Lake Powell Pipeline

Final Study Report 1 - Air Quality

April 2016

Final Study Report 1 - Air Quality

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Final Study Report 1 – Air Quality
Executive Summary

ES.1 Introduction

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

ES.2 Methodology

The analysis of impacts on air quality follows methodology identified and described in the Preliminary Application Document, Scoping Document No. 1 filed with FERC, and in the approved Study Plan and approved Modified Study Plan.

ES.3 Key Results of the Air Quality Impact Analyses

The significance criteria for the LPP project involve impacts on human health and significant impacts on humans and wildlife from the exceedance of the National Ambient Air Quality Standards (NAAQS). Air pollutant levels would be considered to have a significant impact on human and wildlife receptors if they are above NAAQS levels. The following sections summarize the key results of the air quality impact analyses.

ES.3.1 Water Conveyance System

The Water Conveyance System alignment would be routed near several residential and visitor areas and could possibly affect human receptors during construction. Most residential and visitor areas are outside the pollutant dispersion zone and would not be significantly impacted. Residents living within the dispersion zone could be temporarily affected from pollutant levels above NAAQS, but these direct impacts would be mitigated by implementing Best Management Practices (BMPs). Wildlife receptors in the area are expected to temporarily relocate and should not be significantly impacted by LPP Project emissions.

ES.3.2 Hydro System - Existing Highway Alternative

The Hydro System Existing Highway Alternative would be constructed near residential areas from the Grand Staircase-Escalante National Monument west boundary to Fredonia, and in the Pipe Springs area on the Kaibab-Paiute Indian Reservation. Temporary direct air quality impacts on human and wildlife receptors would be similar to the Water Conveyance System impacts. No significant air quality impacts are expected to occur.

ES.3.3 Hydro System – South Alternative / Southeast Corner Alternative

Residential areas were not identified along the eastern portion of the Hydro System South Alternative alignment from the High Point Regulating Tank 2 to the intersection of Yellowstone Road with Highway

389. Therefore, human receptors would not be affected. Wildlife receptors in the area are expected to temporarily relocate and would not be significantly affected.

The proposed pipeline alignment from the Yellowstone Road-Highway 389 intersection to Sand Hollow Reservoir is shared by the Existing Highway and South alternatives. Residents could be temporarily affected from exposure to levels of pollutants above NAAQS, although significant impacts are not expected because BMPs would be implemented to mitigate the direct air quality impacts and most residential areas are outside of the pollutant dispersion zone.

ES.3.4 Transmission Line Alignments

The transmission line alignments would be aligned near several residential areas and direct impacts on human and wildlife receptors would be similar to the Water Conveyance System impacts. No significant impacts are expected to occur.

ES.3.5 Natural Gas Pipeline and Generators Alternative

Natural gas generators operation at the IPS and several of the booster pump stations would exceed the NAAQS for NO_2 with maximum allowed emission stack heights. The IPS would have 75 foot-high emission stacks to disperse the gas generator emissions, and Selective Catalyst Reduction (SCR) systems would be installed to lower the NO_2 concentrations below the NAAQS. Booster Pump Station (BPS) 4 and BPS-4 (Alt.) would have 100 foot-high emission stacks to disperse the gas generator emissions, and SCR systems would be installed to lower the NO_2 concentrations below the NAAQS. BPS-3 would have 100-foot high emission stacks to disperse the gas generator emissions, and SCR systems would be installed to lower the NO2 concentrations below the NAAQS. Natural gas generator emissions at BPS-1, BPS-2 and BPS-3 (Alt.) would be lower than the NAAQS for NO_2 with 100 foot-high emission stacks.

ES.3.6 No Lake Powell Water Alternative

Air quality would be temporarily affected by non-irrigated landscaping construction activities and increased airborne particulate matter generated from increased exposed soil areas resulting from eliminating outdoor residential watering with culinary supplies. The particulate concentrations could exceed NAAQS beyond dispersion zones, resulting in significant indirect air quality impacts. These indirect impacts may be partially mitigated by implementing BMPs.

ES.3.7 No Action Alternative

The No Action Alternative would not result in air quality impacts. No significant impacts are expected to occur.

ES.3.8 Air Quality Impacts Resulting from Additional Power Demand

Preliminary project design and meetings with local and regional power entities indicate that additional power generating facilities would not be needed to supply electricity for the LPP project because there is currently sufficient power available to meet the projected power demands. Therefore, the LPP project would not cause indirect air quality impacts resulting from new power generation emissions.

Chapter 1
Introduction

1.1 Introduction

This chapter presents a summary description of the Lake Powell Pipeline (LPP) Project alignment alternatives, the No Lake Powell Water Alternative, and the No Action Alternative. It introduces the area studied for environmental resources. It provides an overview of the proposed LPP Project, including each alignment alternative and locator maps.

The LPP Project would deliver Utah's Colorado River water from Lake Powell to the service areas of Washington County Water Conservancy District (WCWCD) and Kane County Water Conservancy District (KCWCD). The LPP Project action alternatives studied include various pipeline and penstock system configurations. Each action alternative would deliver 86,249 acre-feet of municipal and industrial (M&I) use water to the following southwest Utah water conservancy district service areas:

- WCWCD would receive 82,249 acre-feet annually.
- KCWCD would receive up to 4,000 acre-feet annually.

One of the LPP systems previously studied included a conveyance system for the Central Iron County Water Conservancy District (CICWCD), which would have delivered approximately 13,249 acre-feet annually to the Cedar Valley area. The various alternatives were under study when the CICWCD decided to withdraw from the LPP Project, and this conveyance system is no longer being considered.

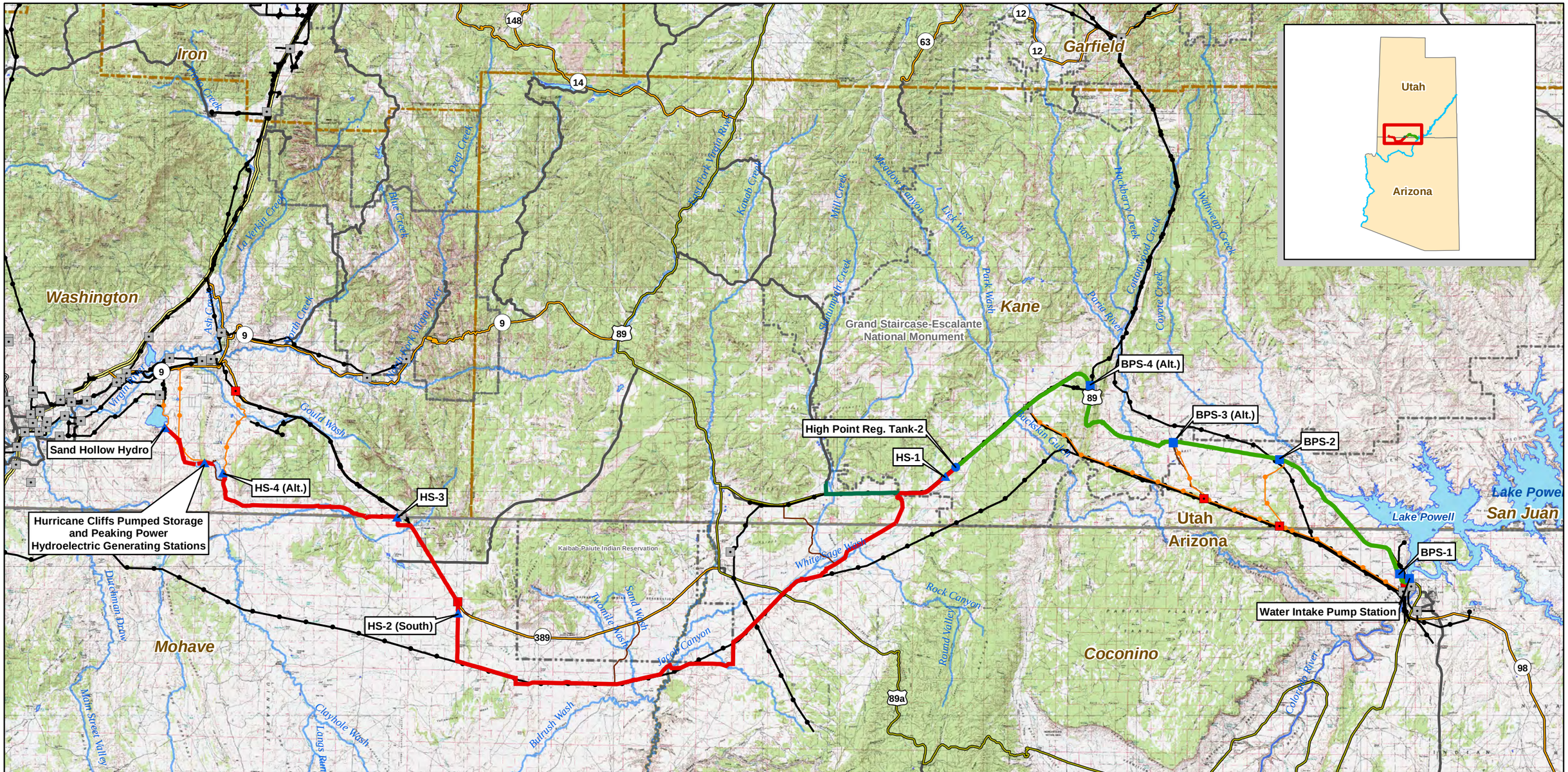
1.2 Summary Description of LPP Project Alignment Alternatives

Three primary pipeline and penstock alignment alternatives are described in this section, along with the electrical power transmission line alignments for providing power to the pump stations and a natural gas supply line alignment alternative. The pipeline and penstock alignment alternatives share common segments between the intake at Lake Powell and delivery at Sand Hollow Reservoir, and they differ spatially in, through and around Kaibab-Paiute Indian Reservation.

The South Alternative (Proposed Action) extends south around Kaibab-Paiute Indian Reservation. The Existing Highway Alternative follows an Arizona state highway through Kaibab-Paiute Indian Reservation. The Southeast Corner Alternative follows the Navajo-McCullough Transmission Line corridor through the southeast corner of Kaibab-Paiute Indian Reservation. The Electric Transmission Line alignments 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. The natural gas pipeline alignment would be coincident to the buried waterline and would not have a different alignment, as compared to transmission line alignments. Figure 1-1 shows the overall proposed project from Lake Powell near Page, Arizona to Sand Hollow Reservoir, Utah.

1.2.1 South Alternative

The South Alternative consists of four systems: **Water Intake, Water Conveyance, Hydro,** and **KCWCD** (see Figure 1-1).



Project Pump Station
Project Regulating Tank
Project Hydro Station
Substation
Proposed Substation

Water Conveyance System
Hydro System - South Alternative (Penstock Segment)
KCWCD System
Project Transmission Lines
Existing Transmission Lines

Interstate
US Highway
ST Highway
Hwy
Major Road
Access Roads

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

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

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

N

0 2.5 5 10 15 20 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-1** MWH

Lake Powell Pipeline Proposed Action

The **Water 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. An enclosed pump station building would house vertical turbine pumps with electric motors, electrical controls, and other equipment at a ground level elevation of 3,745 feet above mean sea level (AMSL).

The **Water Conveyance System** would convey water diverted from Lake Powell at the Intake System through a buried 69-inch diameter pipeline for about 51 miles, parallel with Highway 89 in Coconino County, Arizona and Kane County, Utah, to a buried regulating tank (High Point Regulating Tank-2) along Highway 89 at ground level elevation 5,691 feet AMSL. The pipeline would be a line of connected pipes used for carrying water over a long distance. Figure 1-2 shows the LPP Project Water Intake and Water Conveyance systems. The High Point Regulating Tank-2 would be the LPP Project topographic high point (Figure 1-2). The pipeline would be sited within a utility corridor established by Congress in 1998 that extends 500 feet south and 240 feet north of the Highway 89 centerline on public land administered by Bureau of Land Management (BLM) (U.S. Congress 1998). Figure 1-3 shows the typical 100-foot-wide right-of-way and 20-foot-wide temporary construction easement for the water conveyance system pipeline, adjacent to and away from the highway.

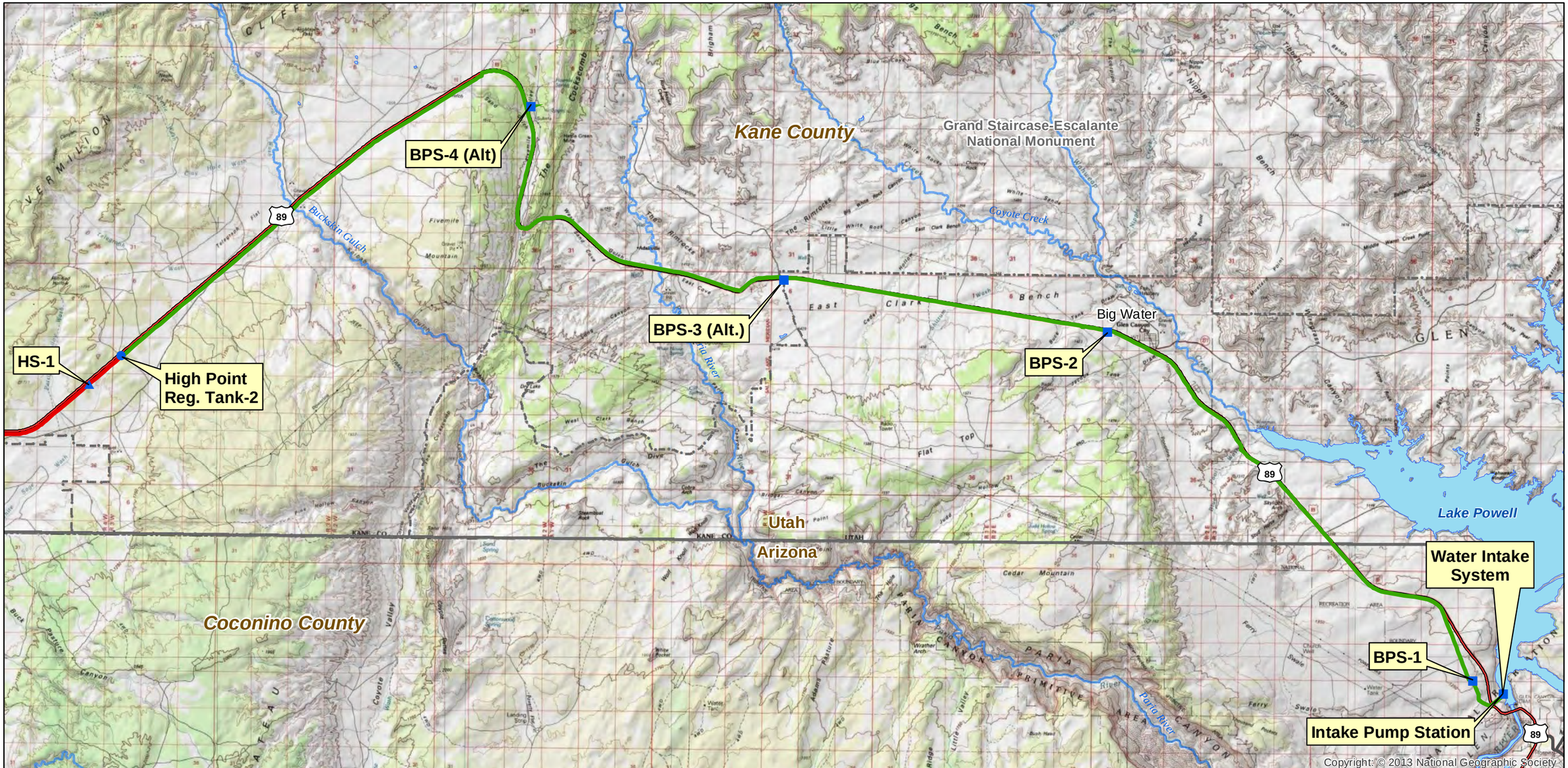
Four booster pump stations (BPS) along the pipeline would pump water to the high point regulating tank. Each BPS would house vertical turbine pumps with electric motors, electrical controls, and other equipment. Additionally, each BPS site would have a buried forebay tank, buried surge tanks, pig retrieval and launching stations, and a surface emergency overflow detention basin. BPS-1 would be located within Glen Canyon National Recreation Area (GCNRA) adjacent to an existing Arizona Department of Transportation maintenance facility, along a segment of abandoned highway, west of Highway 89. The BPS-1 site would cover about six acres and be surrounded by security fencing.

BPS-2 would be on land administered by Utah School and Institutional Trust Lands Administration (SITLA) near Big Water, Utah, on the south side of Highway 89. The BPS-2 site would cover about five acres and be surrounded by security fencing.

BPS-3 (Alt.) would be on land administered by BLM Kanab Field Office, near the east boundary of Grand Staircase-Escalante National Monument (GSENM) on the south side of Highway 89, within the Congressionally-designated utility corridor. The BPS-3 (Alt.) site would cover about five acres and be surrounded by security fencing.

BPS-4 (Alt.) would be located on private land east of Highway 89 and west of the Cockscomb geologic feature (Figure 1-2). The BPS-4 (Alt.) site would cover about six acres and be surrounded by security fencing. The proposed pipeline alignment west of the Cockscomb geologic feature would be situated adjacent to the south boundary of the Congressionally-designated utility corridor.

The proposed pipeline alignment would continue parallel to Highway 89 to the buried High Point Regulating Tank-2 at 5,691 feet AMSL, which would be the topographic high point of the LPP Project (Figure 1-2). The Water Conveyance System would terminate at High Point Regulating Tank-2. The buried High Point Regulating Tank-2 would cover about four acres and be surrounded by security fencing.



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Water Conveyance System
- Hydro System - South Alternative (Penstock Segment)
- KCWCD System
- 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

N

0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-2** MWH

Lake Powell Pipeline Intake and Water Conveyance System

Figure 1-3 shows the typical 100-foot-wide right-of-way and 20-foot-wide temporary construction easement for the hydro system penstock adjacent to, and away from, the highway. Four in-line hydro generating stations (HS-1, HS-2 [South], HS-3, and HS-4 [Alt.]), with substations located along the penstock, would generate electricity and help control water pressure in the penstock. Each in-line hydro station would consist of a building housing the generator units, an afterbay reservoir, retention basin, pig retrieval and launching stations, switchyard, and maintenance parking area, all surrounded by perimeter security fencing.

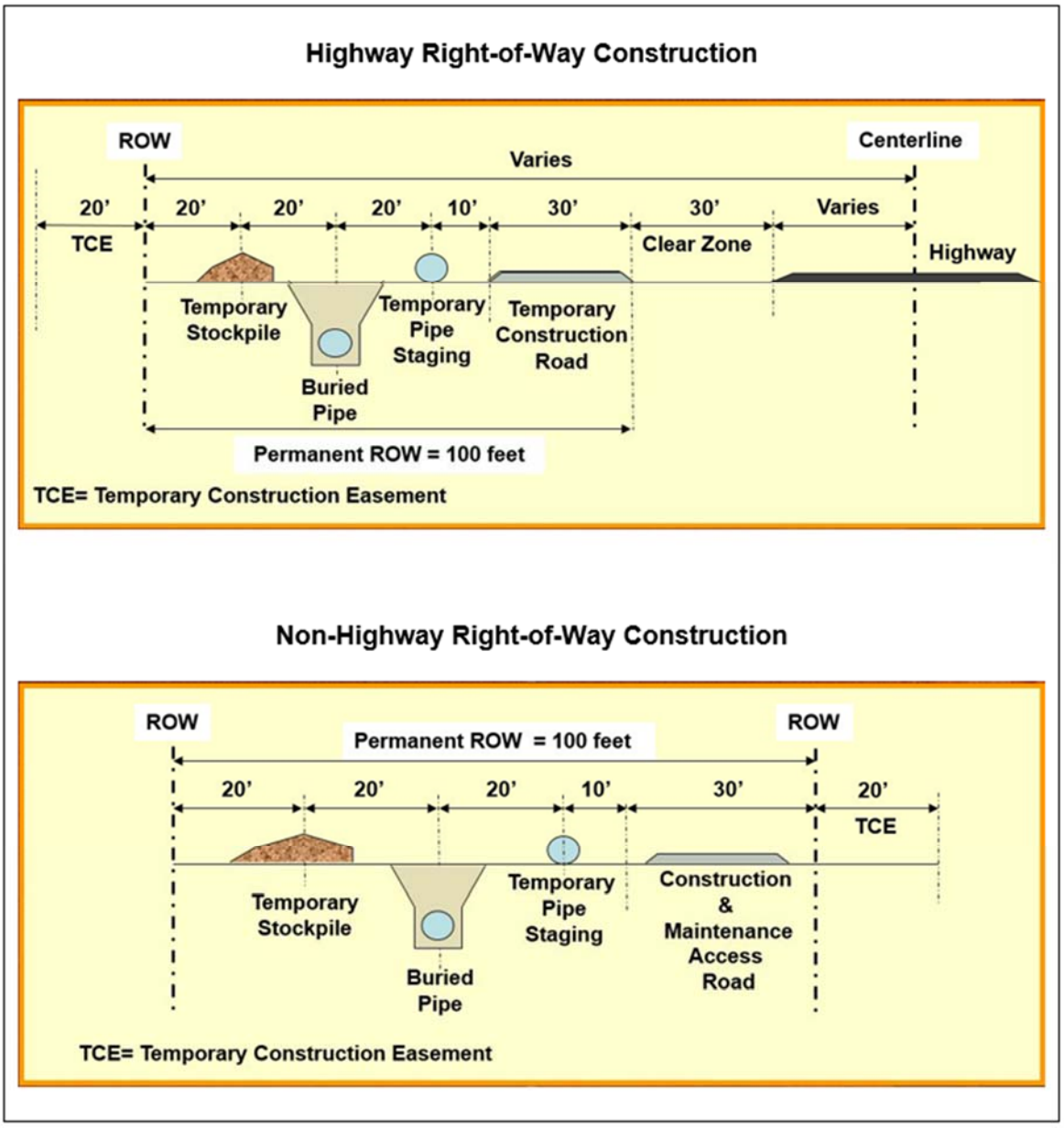


Figure 1-3
Pipeline and Penstock Right-of-Way

The **Hydro System** would convey the water from High Point Regulating Tank-2, at a topographic high point in the LPP Project with ground level elevation 5,691 feet AMSL, 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 1-4). A penstock is an enclosed pipe that delivers water to hydroelectric turbines.

A short penstock segment would convey the water to HS-1. This in-line hydro station would generate up to one megawatt (MW) of electricity at a site along Highway 89 within GSENM, and the penstock would continue west along Highway 89 to the GSENM west boundary. The HS-1 site would cover about five acres.

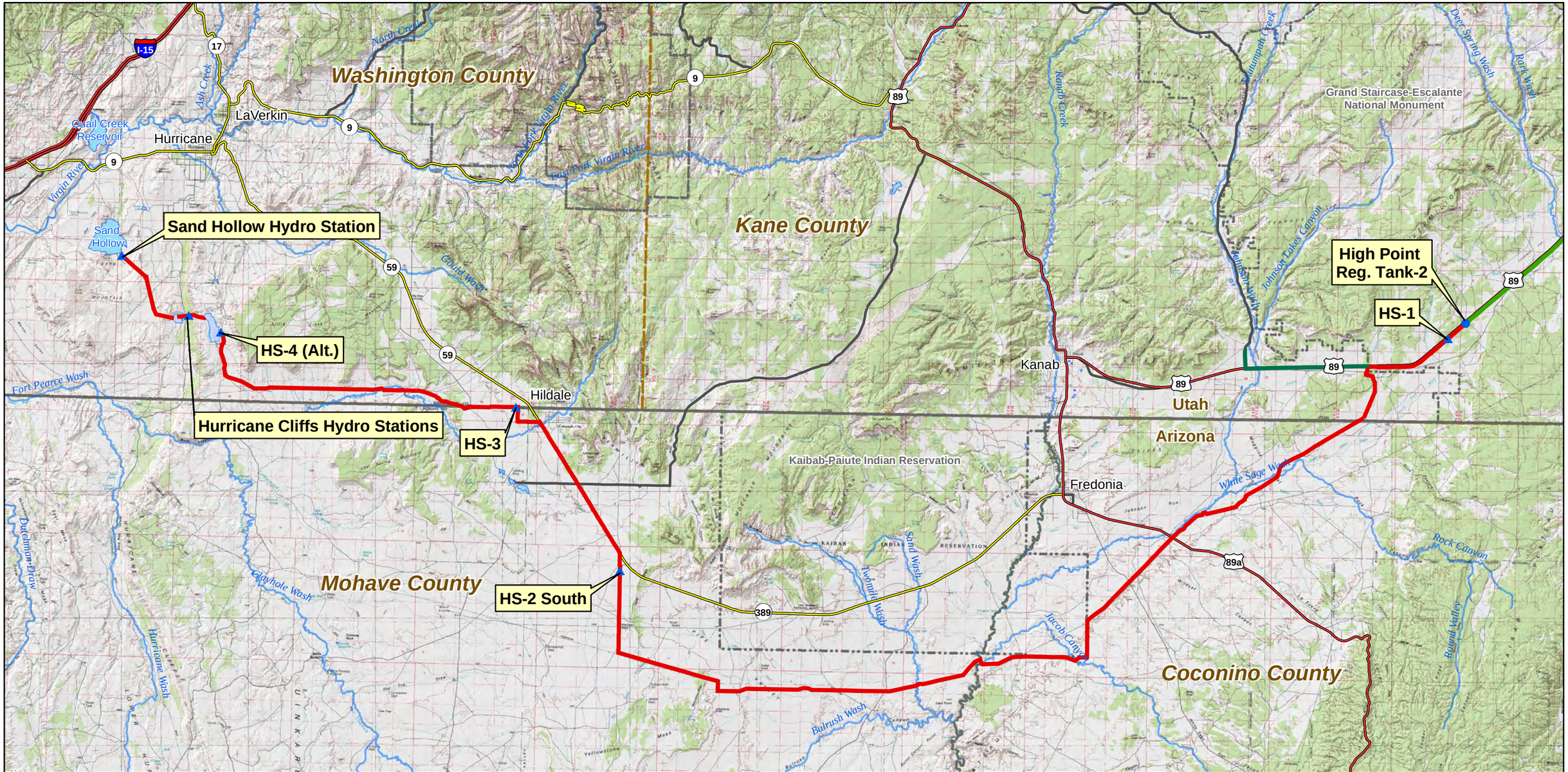
The penstock alignment would turn south from Highway 89 through private land and BLM-administered public lands into White Sage Wash. It would continue across White Sage Wash and then parallel Navajo-McCullough Transmission Line, crossing Highway 89 Alt. and Forest Highway 22 toward the southeast corner of Kaibab-Paiute Indian Reservation. The penstock alignment would run parallel to and south of the Kaibab-Paiute Indian Reservation south boundary, crossing Kanab Creek and Bitter Seeps Wash. It would continue across Moonshine Ridge and Cedar Ridge to Yellowstone Road. At this point, the penstock alignment would run north along Yellowstone Road to Arizona State Route 389 west of Kaibab-Paiute Indian Reservation. HS-2 (South) would be located west of Kaibab-Paiute Indian Reservation on private land east of Yellowstone Road. HS-2 (South) would generate up to one MW of electricity. The HS-2 (South) site would cover about five acres. 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. HS-3 would be located on private land west of Hildale City, Utah, north of and adjacent to Uzona Road. HS-3 would generate up to one MW of electricity. The HS-3 site would cover about five acres. A turnout for future delivery of 13,249 acre-feet of WCWCD's allocation of LPP Project water to Apple Valley would be located immediately west of HS-3.

The penstock alignment would follow Uzona Road west through Canaan Gap and south of Little Creek Mountain, turning north to HS-4 (Alt.) above the proposed Hurricane Cliffs forebay reservoir. HS-4 (Alt.) would be located on about three acres of public land administered by the BLM. HS-4 (Alt.) would generate up to 1.7 MW of electricity and would discharge into the forebay reservoir.

The forebay reservoir would be contained in a valley between two dams (south and north), maintaining active storage of 11,255 acre-feet of water. The forebay reservoir and two dams would cover about 500 acres of public land administered by BLM and would be surrounded by security fencing. 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 35-MW-capacity peaking power hydroelectric generating station and a 300-MW-capacity pumped storage hydroelectric generating station.

The Hurricane Cliffs hydroelectric generating stations and tailrace channel would cover about 50 acres of public land administered by BLM and would be surrounded by security fencing. The tailrace channel would discharge into an afterbay reservoir with 3,551 acre-feet of operating capacity, which is contained by a single dam in the valley below the Hurricane Cliffs. The afterbay reservoir and dam would cover about 200 acres of public land administered by BLM and would be surrounded by security fencing.

Water would be released from the forebay reservoir through the hydro generating system to meet peak power demands. Water would be pumped from the afterbay reservoir into the forebay reservoir during periods of off-peak power demand. The forebay and afterbay reservoirs would not be open to public access because the water levels would fluctuate rapidly during daily operations. A low pressure tunnel would convey the water northwest from the afterbay reservoir to a penstock, continuing to the Sand



Project Pump Station
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs

Water Conveyance System
Hydro System - South Alternative (Penstock Segment)
KCWCD System
Major Rivers & Streams

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 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-4** MWH

Lake Powell Pipeline Hydro System South Alternative

Hollow Hydro Station, which would generate up to 4.2 MW of electricity. The Sand Hollow Hydro Station would be located on land owned by WCWCD and cover about five acres adjacent to Sand Hollow Reservoir. The LPP Project water would discharge from the Sand Hollow Hydro Station into the existing Sand Hollow Reservoir.

The **KCWCD System** would convey water diverted from Lake Powell through the LPP at the west GSENM boundary for about eight miles through a buried 24-inch diameter pipeline in Kane County, Utah, near the mouth of Johnson Canyon. The pipeline would parallel the south side of Highway 89 across Johnson Wash and then run north for 5000 feet to the mouth of Johnson Canyon (Figure 1-4).

1.2.2 Existing Highway Alternative

The Existing Highway Alternative consists of four systems: **Water Intake, Water Conveyance, Hydro,** and **KCWCD**. The **Water Intake** and **Water Conveyance** systems would be the same as described for the South Alternative. The **Hydro System** would convey water diverted at Lake Powell from High Point Regulating Tank 2 at the LPP Project topographical high point (5,691 feet AMSL) 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 alternative alignment parallels Highway 89 to the west and south boundary of GSENM and continues along Highway 89 to Lost Spring Gap. Four in-line hydro generating stations (HS-1, HS-2 [Hwy], HS-3, and HS-4 [Alt.]) located along the penstock would generate electricity and help control water pressure in the penstock. The HS-1, HS-3 and HS-4 (Alt.) hydro stations would be the same as described for the South Alternative.

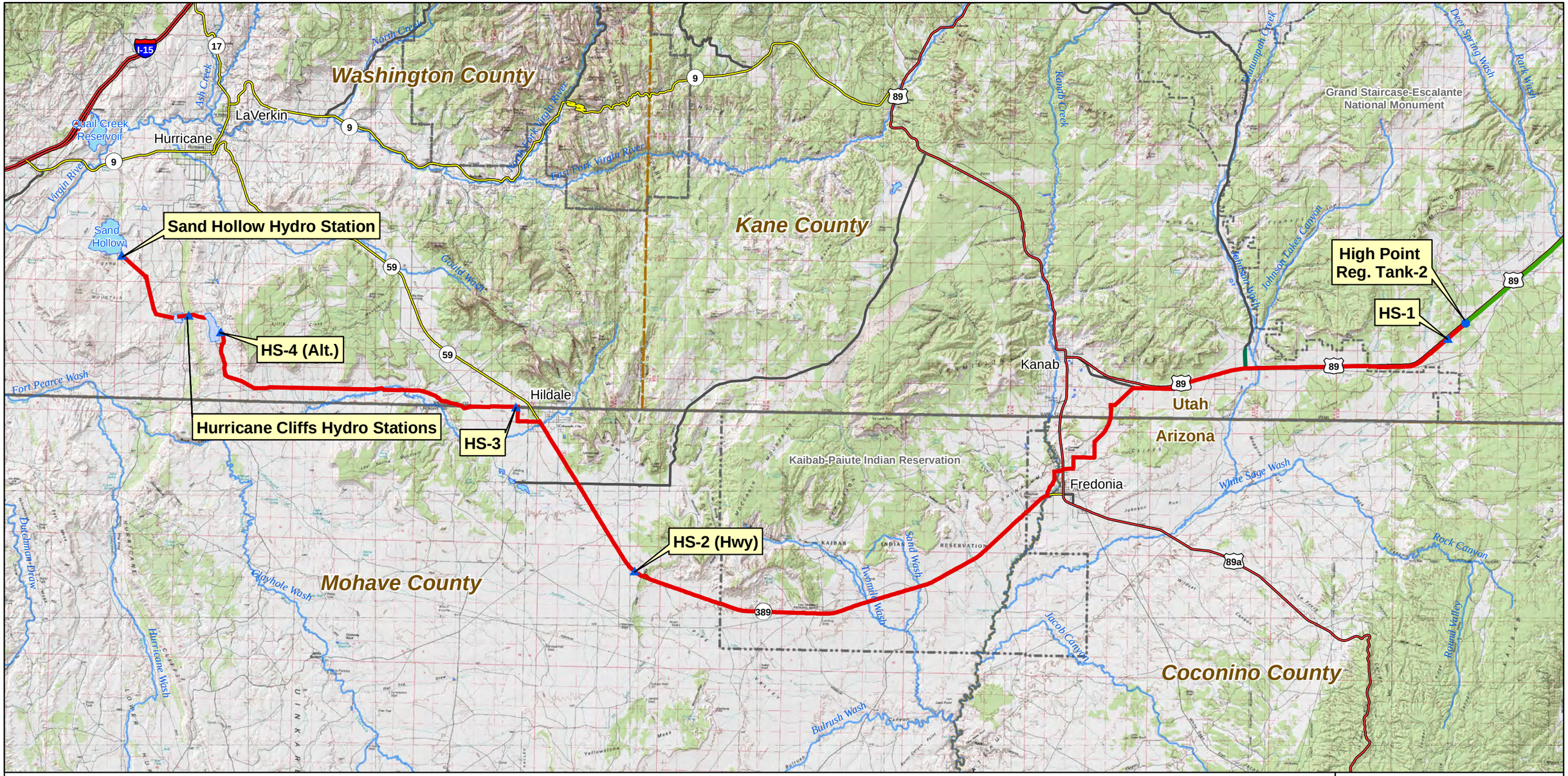
The penstock downstream from the proposed HS-1 would be sited along the south side of Highway 89 within GSENM. The penstock would parallel the south side of Highway 89 west of GSENM, continue past Johnson Wash and follow Lost Spring Gap southwest, crossing Highway 89 Alt. and Kanab Creek in the north end of Fredonia, Arizona. It would continue south, paralleling Kanab Creek to Arizona State Route 389, where it would run west, adjacent to the north side of Route 389 through 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 Kaibab-Paiute Indian Reservation to 1.8 miles west of Cedar Ridge (intersection of Yellowstone Road with Highway 89), where it would then follow the same alignment as the South Alternative to Sand Hollow Reservoir. HS-2 (Hwy) would be sited 0.5 miles west of Cedar Ridge along the north side of Arizona State Route 389. HS-2 (Hwy) would generate approximately 0.8MW of electricity and cover 8.7 acres of private land.

The **KCWCD System** would convey water diverted at Lake Powell from the LPP Project along Highway 89 north along Johnson Canyon Road for 5,000 feet through a buried 24-inch diameter pipeline in Kane County, Utah to the mouth of Johnson Canyon (Figure 1-5).

1.2.3 Southeast Corner Alternative

The Southeast Corner Alternative consists of four systems: **Water Intake, Water Conveyance, Hydro,** and **KCWCD**. The **Water Intake**, **Water Conveyance**, and **KCWCD** systems would be the same as described for the South Alternative.

The **Hydro System** would be the same as described for the South Alternative from High Point Regulating Tank 2 at the LPP Project topographical high point (5,691 feet AMSL) to the east boundary of Kaibab-Paiute Indian Reservation. At the east boundary of Kaibab-Paiute Indian Reservation, the penstock alignment would parallel the north side of the Navajo-McCullough Transmission Line corridor in Coconino County, Arizona, through the southeast corner of the Kaibab-Paiute Indian Reservation for



Project Pump Station
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs

Water Conveyance System
Hydro System - Existing Highway Alternative (Penstock Segment)
KCWCD System
Major Rivers & Streams

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 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-5** MWH

Lake Powell Pipeline Hydro System Existing Highway Alternative

about 3.8 miles. The penstock would 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). The Southeast Corner Alternative would be about 85.7 miles long from High Point Regulating Tank-2 to Sand Hollow Reservoir.

1.2.4 Transmission Line Alignments

Transmission line alignments have been identified to transmit electric power to pump stations in the Water Intake and Water Conveyance systems, and to transmit electric power generated by hydroelectric stations in the Hydro System. The transmission lines that would serve the Water Intake and Water Conveyance systems are located in the east half of the LPP Project. The transmission lines that would serve the Hydro System are located in the west half of the LPP Project.

The proposed new **Water Intake Transmission Line** would begin at Glen Canyon Substation and run parallel to Highway 89 for about 2,500 feet to a new switch station, cross Highway 89 at the Intake access road intersection, and continue northeast to a new electrical substation on the Intake Pump Station site. This 69 kV transmission line would be 0.9 mile 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 Highway 89 and parallel the LPP Project Water Conveyance System alignment to a new electrical substation on the BPS-1 site west of Highway 89. The 69 kV transmission line would be about one mile long in Coconino County, Arizona (Figure 1-7).

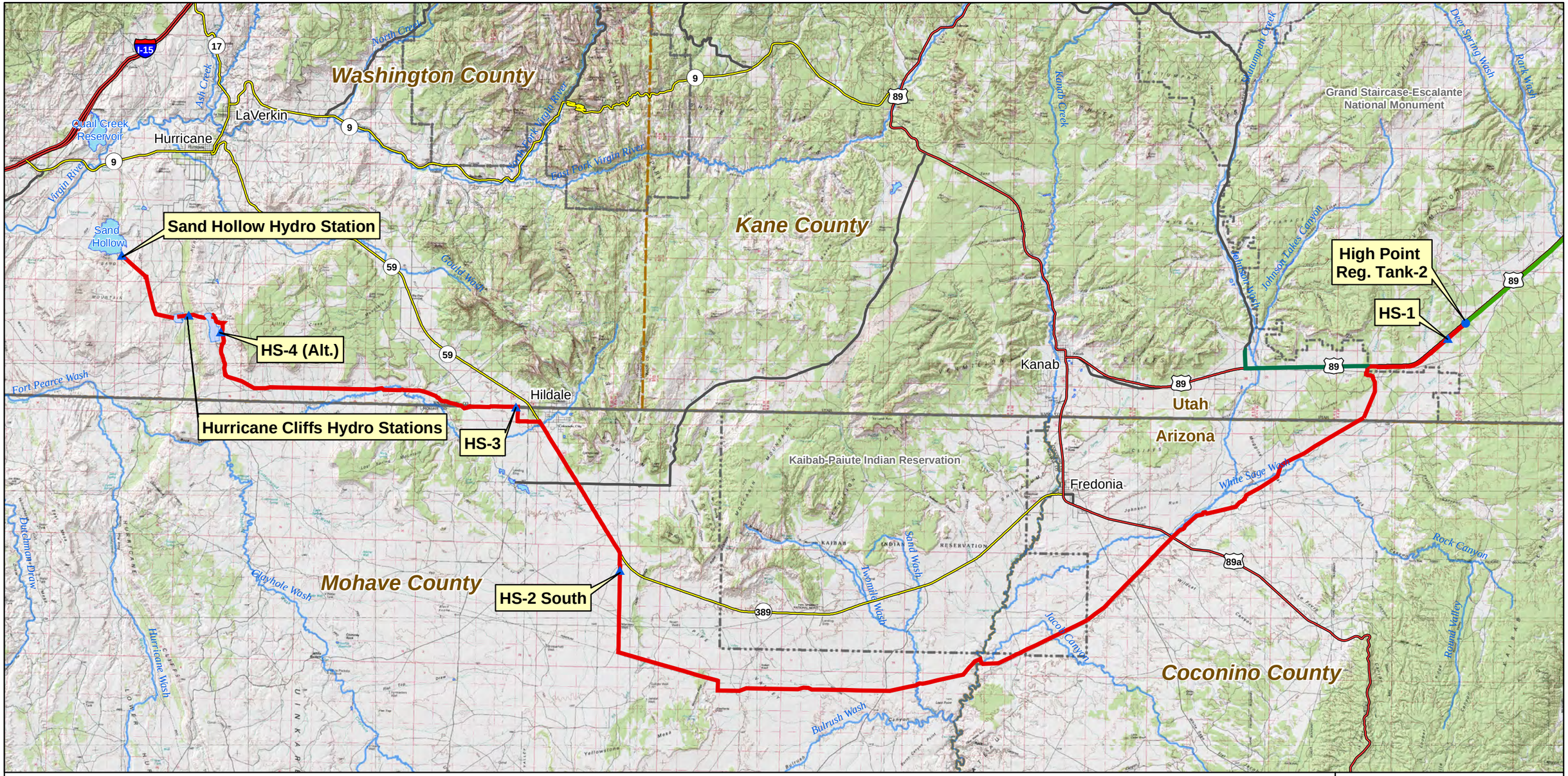
The proposed new **Glen Canyon to Buckskin Transmission Line** would consist of a 230 kV transmission line from the Glen Canyon Substation to the Buckskin Substation, running parallel to the existing 138 kV transmission line. This transmission line upgrade would be about 36 miles long through Coconino 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 five acres of land within 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 (Alt.). The substation upgrade would require an additional two acres of privately-owned land adjacent to the existing substation in Kane County, Utah (Figure 1-7).

The proposed new **BPS-2 Transmission Line** would consist of a new three-ring switch station along the new 230 kV Glen Canyon to Buckskin Transmission Line, a new transmission line from the switch station to a new substation west of Big Water, and a connection to BPS-2 substation in Kane County, Utah. The new transmission line would parallel an existing distribution line that runs northwest, north, and then northeast to Big Water. This new 138 kV transmission line alignment would be about seven 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 proposed new **BPS-3 Alt. Transmission Line South** would consist of a new three-ring switch station along the new 230 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 (Alt.) site near the GSENM east boundary and within the Congressionally-designated utility corridor. This new 138 kV transmission line alignment would be about 5.9 miles long in Kane County, Utah (Figure 1-7).



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Water Conveyance System
- Hydro System - Southeast Corner Alternative (Penstock Segment)
- KCWCD System
- Major Rivers & Streams
- 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

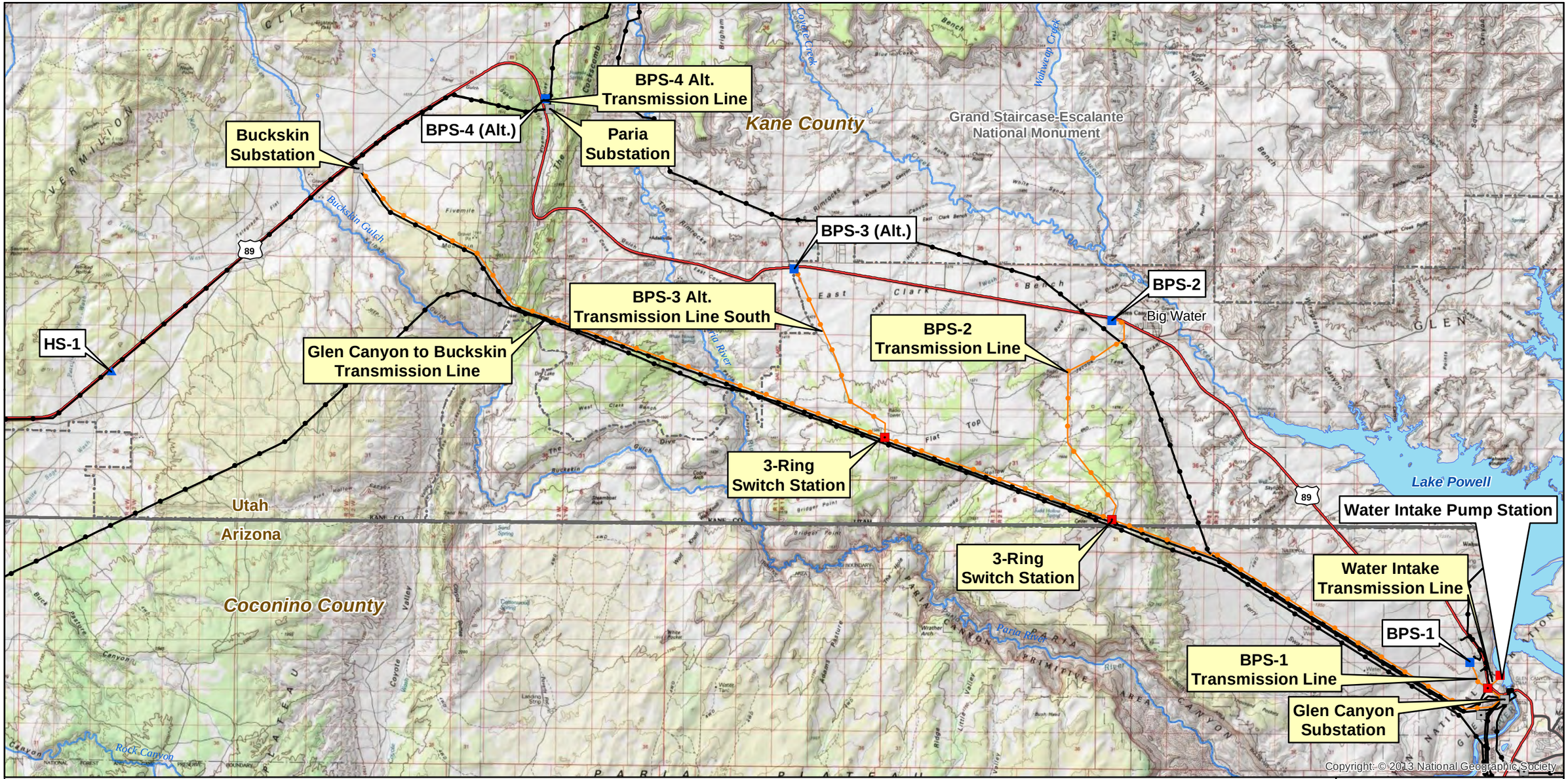
0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-6** MWH

Lake Powell Pipeline
Hydro System
Southeast Corner Alternative



Project Intake Pump Station
Project Pump Station
Project Hydro Station
Substation
Proposed Substation
Project Transmission Lines
Existing Transmission Lines
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

UDWRe **Figure 1-7** MWH

Lake Powell Pipeline Proposed Transmission Lines East

The proposed new **BPS-4 Alt. 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 Transmission Line** would begin at the new HS-1 and tie into the existing 69 kV transmission line along Highway 89 from the Buckskin Substation to the Johnson Substation. The HS-1 69 kV transmission line would be about 400 feet long in Kane County, Utah (Figure 1-8).

The proposed new **HS-2 (South) Transmission Line** 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 new **HS-2 (Highway) Transmission Line** alternative would directly connect the HS-2 hydroelectric station and substation along the Existing Highway Alternative to an existing 138 kV transmission line paralleling Arizona State Route 389. This new 34.5 kV transmission line would be about 200 feet long in Mohave County, Arizona.

The proposed new **HS-3 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 transmission line would be about 0.6 mile long in Washington County, Utah (Figure 1-8).

The proposed new **HS-4 (Alt.) Transmission Line** would connect the HS-4 (Alt.) 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).

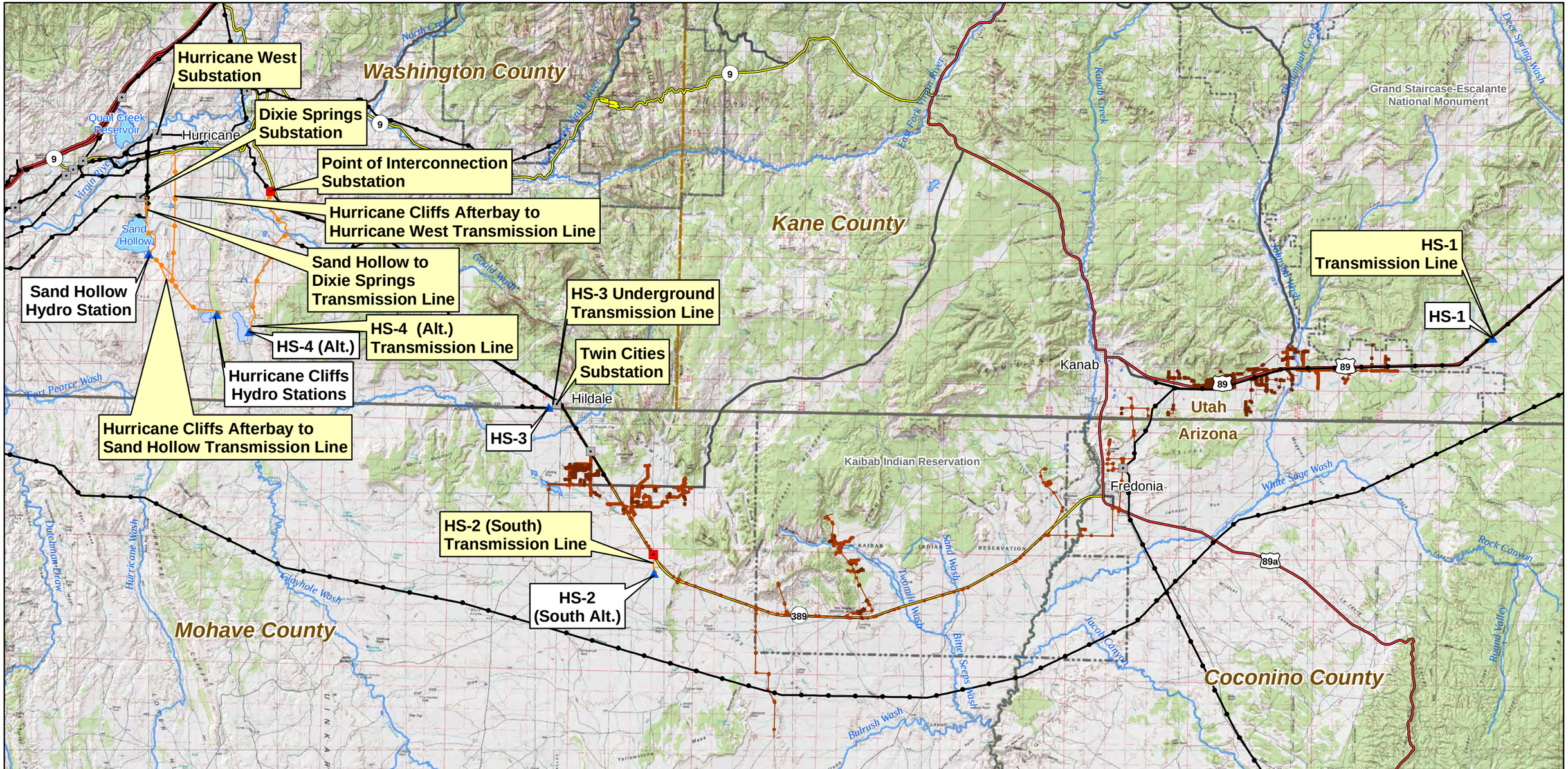
The proposed new **Hurricane Cliffs Afterbay to Sand Hollow Transmission Line** would consist of a new 69 kV transmission line, which would run northwest from the Hurricane Cliffs peaking power plant and substation to the Sand Hollow Hydro substation. This new 69 kV transmission line would be about 4.9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

1.2.5 Natural Gas Pipeline and Generators Alternative

Natural gas engine-driven generation systems to power electric pumps would be an alternative to powering the LPP Project pump stations by electricity via transmission lines. Recent discussions with Questar Gas Company (local natural gas supplier) indicated that capacity would be available in the Kern River natural gas pipeline, which is located west of St. George, Utah, to supply natural gas for this alternative. Questar Gas Company indicated the company has future plans to extend a high pressure natural gas pipeline from the Kern River line to Hurricane, Utah. The Questar Gas pipeline would be



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

FERC Project Number:
12966-001
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N

0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-8** MWH

Lake Powell Pipeline Proposed Transmission Lines West

sized to supply natural gas to the LPP Project 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, the natural gas supply pipeline would be 12 inches in diameter to provide natural gas supply for the LPP Project pump stations. The pipeline would likely be successively reduced in size as it delivers gas to each of the pump stations.

1.2.5.1 Natural Gas Transmission Line Connection

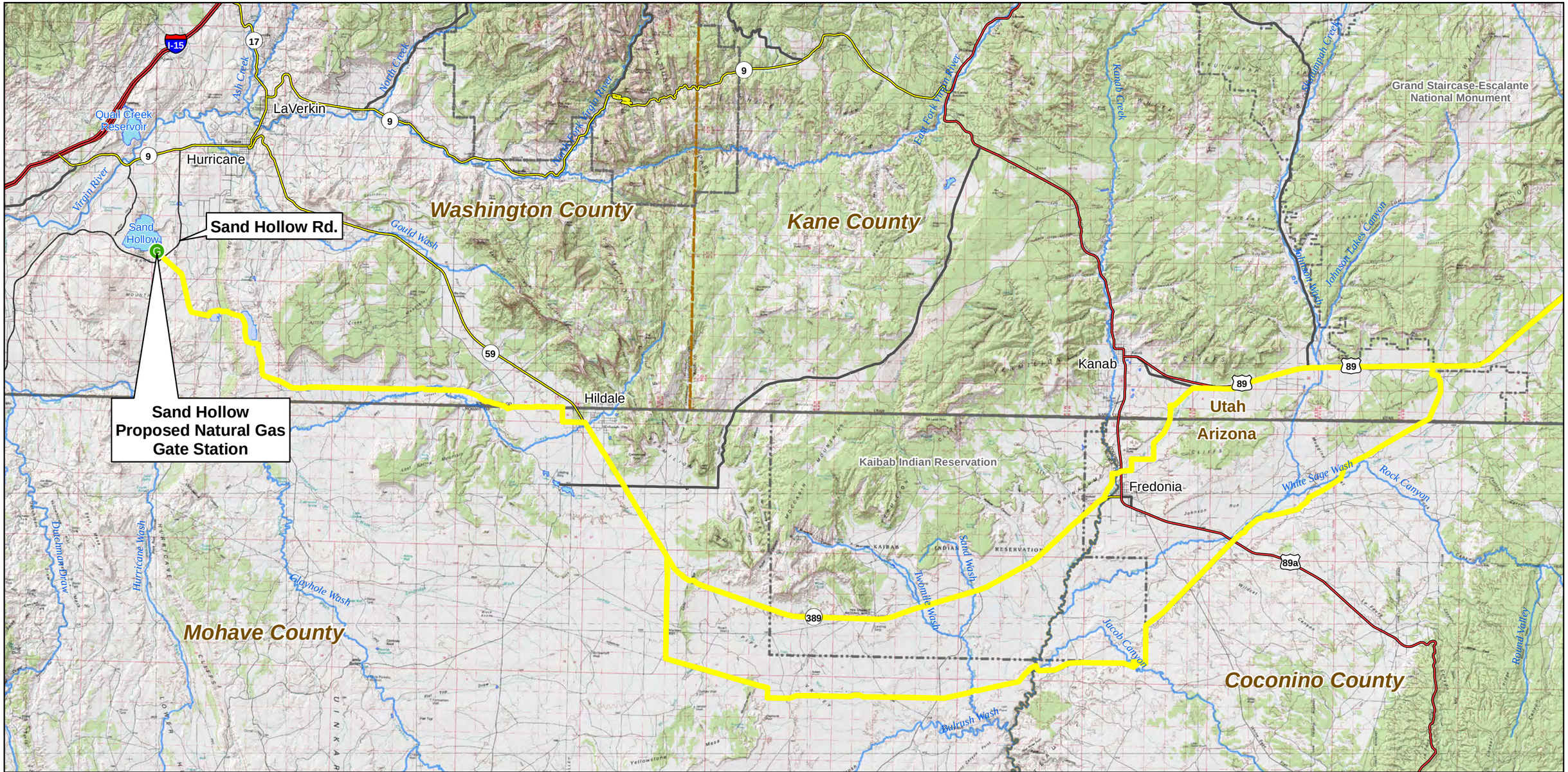
The natural gas supply line alternative would connect to the proposed Questar Gas Transmission Line from the existing Kern River line to Hurricane City. The natural gas supply line would connect to the high pressure gas transmission line at a proposed gate station southeast of Sand Hollow Reservoir. The proposed gate station would be located adjacent to the alignment of the extension of the Southern Corridor Highway, which is the existing alignment of Sand Hollow Road east of Sand Hollow Reservoir (Figure 1-9).

1.2.5.2 Natural Gas Supply Line

The proposed natural gas supply line would be an intermediate high pressure line and would operate between approximately 250 to 300 psi at the gate station connection. Because of pressure losses in the pipeline it is anticipated that 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 four 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 and installed a minimum of 10 feet from the edge of the proposed water pipeline in a separately excavated trench within the LPP ROW. Figure 1-9 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 1-10 shows the east alignment of the natural gas supply line as proposed from the west GSENM boundary to the water intake pump station.

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's 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 and connected to the buried natural gas supply line. Additionally, pig launching or receiving equipment would be installed within the 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. Launching and receiving equipment is connected to the natural gas supply line to enable pigs to be inserted into or removed from the pipeline.



Natural Gas Gate Station
Natural Gas Supply Line Alignment
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
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

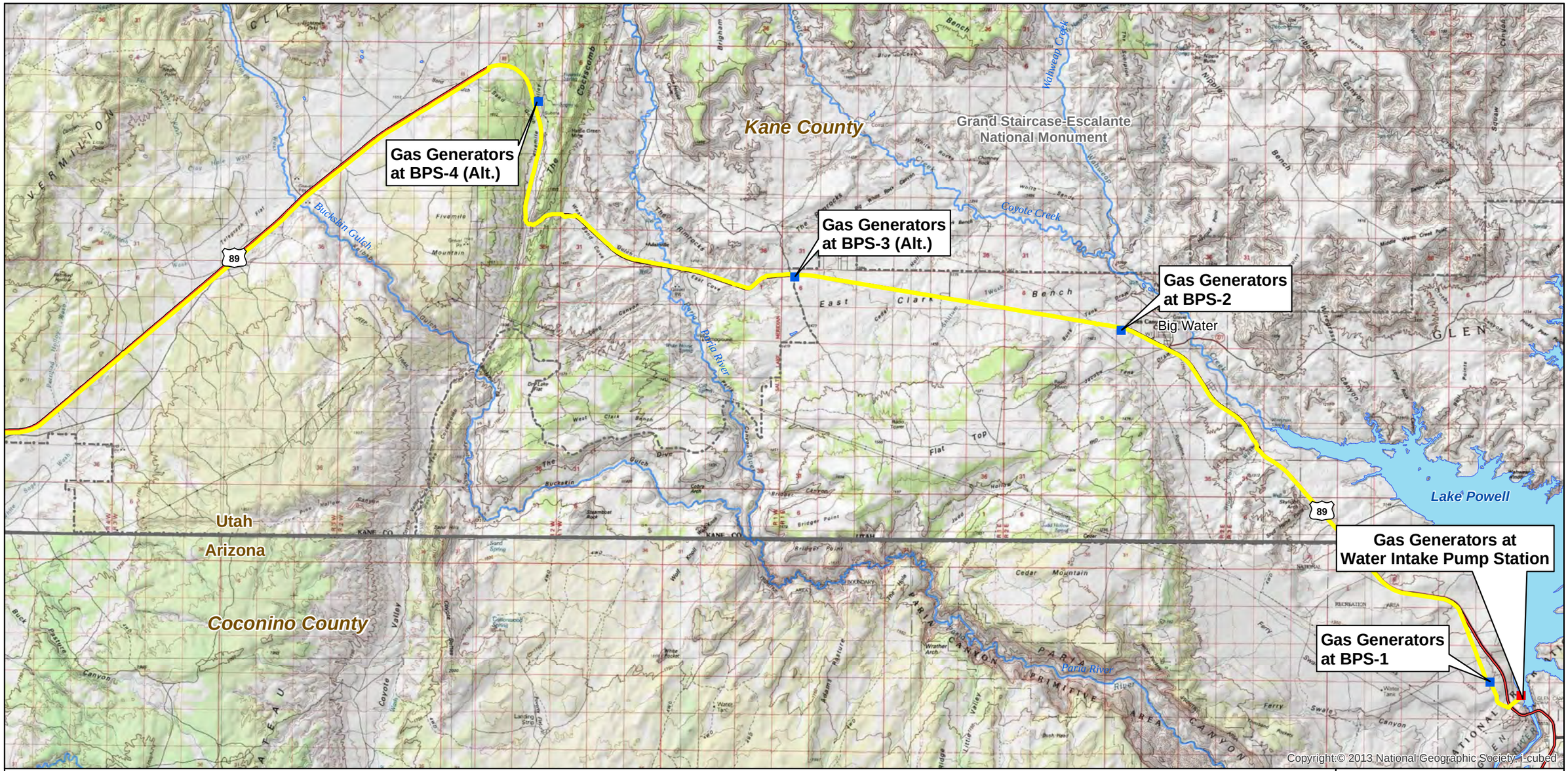
0 2 4 6 8 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-9** MWH

Lake Powell Pipeline
Natural Gas Supply Line and Generators West Alternatives



Project Water Intake Pump Station
Gas Generators 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

N

0 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-10** MWH

Lake Powell Pipeline Natural Gas Supply Line and Generators East Alternative

1.2.5.3 Natural Gas Generators

Natural gas generators would be used to supply power to operate the electric pumps at the LPP pump stations. The size of the electric pumps is approximately 18 feet from center to center when configured. The overall pump station building size would be 14 feet wider and 18 feet longer than the pump stations which are powered by electricity from transmission lines.

The natural gas generators would be approximately 35 feet long by eight feet wide by nine 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, and located adjacent to the pump station electrical room within the five-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 20 feet above the top of the 55-foot tall building. 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.

The natural gas generators alternative 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 1-1
Water Conveyance System 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 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		**25**		**43,830**		**18+5**		**53,089**	**2,855,400**

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 horsepower, 8400 hours/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 eliminating residential outdoor water use in the WCWCD service area. This alternative could provide a total of 86,249 acre-feet of water annually to WCWCD and KCWCD for M&I use without diverting Utah's water from Lake Powell.

1.3.1 WCWCD No Lake Powell Water Alternative

1.3.1.1 Background

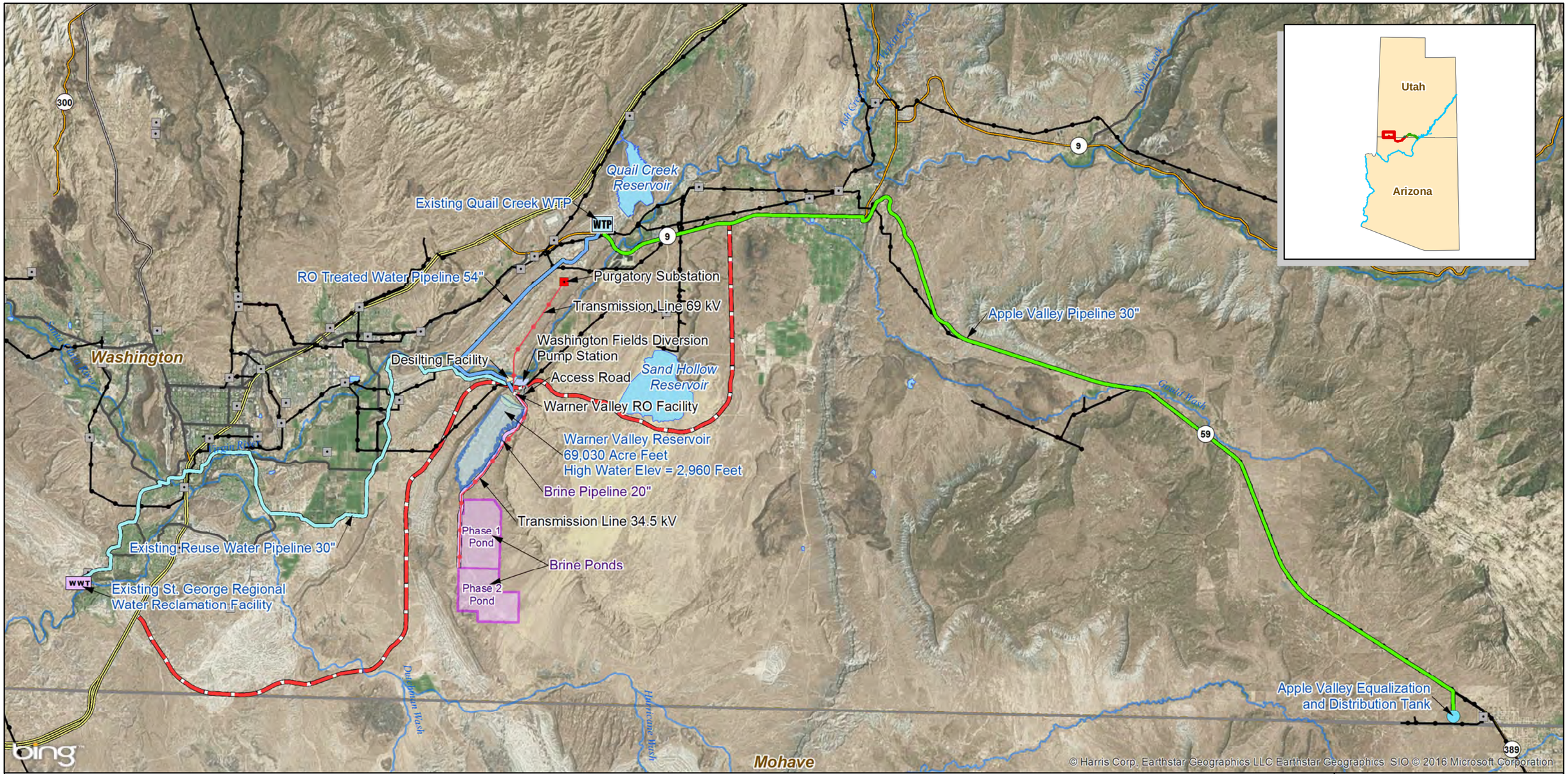
The WCWCD LPP allocation would be 82,249 acre-feet per year, and the WCWCD No Lake Powell Water alternative would need to supply 82,249 acre-feet per year to meet the same future water demands. In addition to the direct supply from Utah's Colorado River water, the water supplied by the LPP Project would provide additional wastewater reuse supply provided that sufficient storage is available.

The No Lake Powell Water Alternative would serve the same population as the LPP Project. WCWCD would implement other future water development projects currently planned by the District, develop additional water reuse/reclamation programs, continue to implement new water conservation measures, and convert additional agricultural water use to M&I use as a result of urban development in agricultural areas through 2028. Remaining planned and future water supply projects include the Ash Creek Pipeline (2,840 acre-feet per year), Sand Hollow recharge/recovery (3,000 acre-feet per year), Westside groundwater wells arsenic treatment (5,000 acre-feet per year), and development/yield increase of existing groundwater wells (2,830 acre-feet per year). Along with existing supplies, these future water supplies would yield an estimated 72,842 acre-feet per year of potable water and 8,505 acre-feet per year secondary water by 2028.

Under the No Lake Powell Water Alternative, actions in addition to the currently planned WCWCD projects would be taken to meet the water demand that would have been supplied by the Lake Powell Pipeline, as described below.

1.3.1.2 WCWCD No Lake Powell Water Alternative Features

Beginning in 2025, Washington County residential outdoor potable water use would be permanently re-purposed to indoor potable water use to help meet increasing indoor potable water demands. 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 50,000 acre-feet per year of diverted Virgin River water, which has a high total dissolved solids (TDS) concentration, mixed with an additional 19,030 acre-feet per year of reuse water. WCWCD would develop the Warner Valley Reservoir to store the reuse water and diverted Virgin River water prior to RO treatment. A water distribution pump station and pipeline would be constructed to convey 13,249 acre-feet of potable water from Quail Creek Water Treatment Plant to the Apple Valley area of Washington County. Figure 1-11 shows the primary conceptual components of the No Lake Powell Water Alternative. Table 1-2 summarizes available supplies and projected demands under the No Lake Powell Water Alternative and the LPP Project alternatives.



WTP Quail Creek WTP (Existing)
WWT St. George Regional Water Reclamation Facility (Existing)
Substation
Substation (Future)
Warner Valley Transmission Line
Existing Transmission Lines
Desilting Facility
RO WTP
Washington Fields Diversion Pump Station
Lakes & Reservoirs
Brine Evaporation Ponds
Access Road
Apple Valley Pipeline 30"
Brine Pipeline 20"
Existing Reuse Water Pipeline 30"
RO Treated Water Pipeline 54"
Major Rivers & Streams
Interstate
US Highway
ST Highway
Hwy
Major Road
Southern Corridor Highway
State Boundaries
County Boundaries

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

N

0 0.75 1.5 3 4.5 6 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-11** MWH

No Lake Powell Water Alternative Primary Infrastructure

Table 1-2 Available Supplies and Projected Demands Under the No Lake Powell Water and Lake Powell Pipeline Project Alternatives		
	No Lake Powell Water Alternative	**Lake Powell Pipeline Project Alternative**
Existing Supplies	67,677	67,677
Planned Projects	13,670	13,670
Lake Powell Pipeline Project	0	82,249
RO Treatment of Virgin River and Reuse Water	57,883	0
Agricultural Conversion	0[1]	10,080
Reuse	17,100[2]	36,130
2060 Total Supply	156,330	209,806
2060 Total Demand	133,119[3]	185,285
Surplus in 2060	**23,211**	**24,521**

Notes:
[1]Agricultural conversion water included in RO treatment.
[2]19,030 acre-feet per year additional reuse included in RO treatment.
[3]Demand reduced 52,166 acre-feet per year from elimination of residential outdoor watering.

1.3.1.2.1 Re-Purposing Potable Water Use. The No Lake Powell Water Alternative would permanently eliminate residential outdoor potable water use in Washington County, re-purposing the portion of potable water used for residential outdoor watering to indoor potable use. Projections of future water use through 2060 account for population growth, climate change (projected 6 percent reduction of Virgin River flows by 2050 [Reclamation 2014]), and water conservation (35 percent reduction in per capita water use from 2000 to 2060). Potable water in Washington County is consumed for residential indoor and outdoor uses, commercial uses, institutional uses, and industrial uses. These potable water uses would total 130,245 acre-feet per year by 2052, the year the LPP Project water is anticipated to be fully utilized (UDWRe 2015). Gradually eliminating residential outdoor potable water use starting in 2025 would provide the growing population with potable water for indoor use through 2045; however, re-purposing residential outdoor potable water use to indoor use would not increase the water supply and would have to be accompanied by adding another water supply to meet the growing demand. Re-purposing residential outdoor potable water use to indoor potable use would require converting traditional residential outdoor landscapes and uses to either landscaping requiring no irrigation or desert landscapes compatible with the local climate. Residential water users would be responsible for converting their traditional outdoor landscapes to non-irrigated or desert landscapes. If no additional water supply was added in Washington County after 2025 and potable water use continued to meet residential indoor and outdoor purposes, then the projected population would completely utilize the potable water supply of 72,842 acre-feet per year by 2028.

1.3.1.2.2 Reverse Osmosis Water Treatment. Washington County's additional future water supply under the No Lake Powell Water Alternative would be dependent on two water sources: 1) Virgin River water diverted at the Washington Fields Diversion; and 2) reuse water from an expanded St. George Regional Water Reclamation Facility. WCWCD would develop a RO advanced water treatment facility near Washington Fields Diversion in Washington County, Utah. The RO facility would be designed to treat 50,000 acre-feet of de-silted water per year diverted from the Virgin River at Washington Fields Diversion. St. George Regional Wastewater Reclamation Facility would provide an additional 19,030 acre-feet of water per year to be treated at the RO facility. The RO facility would be necessary to remove the high concentrations of TDS present in both the Virgin River and the effluent from the St. George Regional Wastewater Reclamation Facility. The reuse facility has a current capacity of approximately 7,800 acre-feet per year, with a future design capacity of 11,760 acre-feet per year. An additional 7,830

acre-feet per year of future wastewater reclamation capacity would need to be added to meet the total reuse water requirement of 19,030 acre-feet per year for RO processing inflow. The RO process would separate the TDS from the water, resulting in two products: 1) a treated water product; and 2) a brine product consisting of highly concentrated salts. A two-stage RO process would be applied to the brine solution to recover additional water and reduce the brine volume for enhanced evaporation. The RO-treated water product would be pH-adjusted to neutral pH, dosed with sodium silicate, mixed with conventionally-treated water from the Quail Creek Water Treatment Plant, and disinfected for distribution throughout the WCWCD service area. The RO advanced water treatment facility would process up to 64,313 acre-feet per year and produce up to 57,883 acre-feet per year of water suitable for M&I potable indoor use. The two-stage RO process would remove 90 percent of the TDS. The remaining 10 percent rejection (6,430 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 RO water treatment plant would process approximately 64,313 acre-feet per year of inflow water from Warner Valley Reservoir storage to meet the 2052 water demand under the No Lake Powell Water Alternative.

The RO water treatment plant processes would consist of pressurized, parallel ultra-filtration units, an influent storage tank with acid added to adjust the pH, pressurized cartridge filtration to remove additional particles from the water, high pressure pumping to pass the water through the parallel RO membrane units, a product water storage tank with saturated lime solution added to adjust the pH of the treated product water prior to disinfection and distribution as potable water, and brine storage tanks in series with the two-stage RO process units for further brine reduction. These water treatment processes would be housed in a water treatment building with electrical, mechanical, chemical storage and metering, heating/air conditioning/ventilation, and SCADA systems. A seven-mile long buried 54-inch diameter pipeline would convey the product water from a pump station at the RO water treatment plant to the Quail Creek Water Treatment Plant. The RO water treatment plant would add RO membrane units in phases as necessary to meet the growing water demand. The RO water treatment plant would be powered by electricity, requiring a 2.8-mile long 69-kV power transmission line from the proposed Purgatory Substation.

The concentrated brine product (6,430 acre-feet per year) would be pumped from the brine tanks through a pipeline to an evaporation apron, spray system and double-lined pond, and then pumped into spray headers over a series of double-lined ponds with leak detection and recovery systems. The enhanced evaporation ponds would be located south of Warner Valley Reservoir and would cover approximately 2,000 acres, developed in two phases. A buried brine conveyance pipeline approximately 4.4 miles long would convey the concentrated brine to the enhanced evaporation ponds. A 4.4-mile long 34.5-kV power transmission line would be extended from the RO water treatment plant to the enhanced evaporation ponds to provide electricity for the pumps spraying the brine solution. The brine solids would be evaporated for approximately 25 years in the Phase 1 ponds, and then dried, collected and disposed in an approved solid waste landfill. The Phase 2 enhanced evaporation ponds would be used during the following 25 years to continue evaporating the brine by-product. Additional infrastructure would be required as part of this alternative, including a de-silting facility, pump stations, pipelines, switch stations and substations, blending and storage tanks, and other associated earthwork.

1.3.1.2.3 Secondary Water Storage in Warner Valley Reservoir. WCWCD would develop the Warner Valley Reservoir to store diverted Virgin River water and reuse water from the St. George Regional Water Reclamation Facility, which would be delivered as inflow to the RO advanced water treatment facility. Warner Valley Reservoir would be located south-southwest of the Washington Fields Diversion. An earth-fill embankment with a clay core and rock-riprap facing would be constructed across the north entrance to the natural valley. The reservoir would have a maximum active storage volume of 69,030 acre-feet and would cover approximately 1,130 acres, including the earth-fill embankment. A large pump station would be constructed at the Washington Fields Diversion to pump the diverted Virgin River water

into the Warner Valley Reservoir. The pump station would be powered by electricity via the 69-kV transmission line from the Purgatory Substation to the RO water treatment plant. The reservoir would store Virgin River water diverted at the Washington Fields Diversion (50,000 acre-feet per year) mixed with St. George Regional Water Reclamation Facility effluent (19,030 acre-feet per year), accounting for annual average evaporation (4,717 acre-feet per year), to produce up to 57,883 acre-feet of RO product water (assuming 90 percent recovery). The brine product from RO treatment would total approximately 6,430 acre-feet per year.

1.3.1.2.4 Water Distribution to Apple Valley. The largest remaining contiguous land area available for development in Washington County would be in Apple Valley. WCWCD would develop a pump station and 28-mile long pipeline to deliver 13,249 acre-feet per year of potable water from the Quail Creek Water Treatment Plant near Hurricane City to the Apple Valley area to meet future residential and commercial water demands.

1.3.2 KCWCD No Lake Powell Water Alternative

The KCWCD No Lake Powell Water Alternative would rely on existing water supplies, water conservation measures resulting in reduced water use, and future water development projects consisting of new groundwater production. Reliable water supplies (projected to be 2,170 acre-feet per year in 2035) for the area served by KCWCD (Kanab City and Johnson Canyon), adjusted for projected stream flow reductions (4.2 percent in 2035) resulting from climate change and a planning reserve (10 percent), would be exceeded by projected M&I water demands by 27 acre-feet per year within the KCWCD service area in 2035. KCWCD projected potable water demand in 2060 would be 3,435 acre-feet per year, with a potable water deficit of 1,334 acre-feet per year. Additional groundwater in the Kanab Creek drainage basin could be developed to provide up to 6,615 acre-feet per year of potable water within the aquifer's estimated safe yield. The quality of this water would likely require advanced water treatment. The developed groundwater from the Kanab Creek drainage basin would be pumped and conveyed through an eight-mile long pipeline to the Johnson Canyon drainage basin. The Johnson Canyon drainage basin comprises the potable water supply service area served by KCWCD in the area that could be served by the LPP Project.

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. FERC would not issue a license for the LPP Project. 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.

1.4.1 WCWCD No Action Alternative

Under the No Action Alternative, WCWCD would complete the Ash Creek Project, planned groundwater development and continue to implement planned conservation programs. Wastewater reuse would be utilized to the maximum extent storage allows. Existing and future water supplies totaling 72,840 acre-feet per year potable and 8,505 acre-feet per year secondary would meet projected M&I water demand within the WCWCD service area through approximately 2028, exhausting all water planning reserves. Each supply source would be phased in to meet the M&I potable and secondary water 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). The No Action Alternative would not provide adequate water supply to meet projected water demands beyond 2028. There would be a projected water shortage of approximately 102,903 acre-feet per year in 2060 within the WCWCD service area under the No Action Alternative.

1.4.2 KCWCD No Action Alternative

KCWCD would use existing water supplies to meet potable water demands through 2035. Reliable water supplies are projected to be 2,101 acre-feet per year in 2060.

The No Action Alternative would not provide KCWCD with any reserve water supply (e.g., water to meet annual shortages because of drought, emergencies, and other losses). The No Action Alternative would not provide adequate water supply to meet projected water demands beyond 2035. There would be a projected water shortage of approximately 1,334 acre-feet per year in 2060 within the KCWCD service area under the No Action Alternative.

1.5 Identified Issues

1.5.1 Purposes of Study

This technical report describes the results and findings of an air quality analysis to evaluate conditions along the proposed alternative pipeline alignments of the LPP Project. The purpose of the analysis, as defined in the 2008 Air Quality Study Plan prepared for the Federal Energy Regulatory Commission (Commission), is to identify potential impacts from LPP Project air emissions during construction and operations, document the potential influence of these emissions on human and wildlife receptors and identify measures to mitigate impacts from the various sources as necessary.

1.5.2 Identified Issues

The issues identified for analyses include the following:

- Potential human and wildlife receptors near the LPP Project
- Current background air quality levels in the region
- Equipment needed for various construction activities and associated emissions
- Combined emissions from the construction equipment for pipeline, facility, and transmission line construction
- Emissions from operations
- Emissions from natural gas generator options
- Distances at which the air pollutants disperse below significant impact levels
- Areas of potential impacts from LPP Project construction and operation air pollution
- Cumulative impacts of air pollution within the LPP Project area from construction and operation emissions

1.6 Impact Topics

The following impact topics are addressed in the Air Quality Study Report:

- Human receptors
- Wildlife receptors

Chapter 2 **Methodology**

2.1 General

This Air Quality Study Report (report) analyzes the air quality impacts resulting from the LPP, herein collectively referred to as the LPP Project. The report also follows the methodology previously identified and described in the Preliminary Application Document (PAD), Scoping Document No. 1, and the Air Quality Study Plan.

Construction of the pipeline and associated facilities will require installation through native soils and rock. These activities are analyzed to characterize and quantify the pollutants and dust resulting from the operation of the required construction equipment. In addition, operational activities including natural gas generation systems are analyzed for emissions to identify possible impacts on air quality.

2.2 Data Used

The following data and information were used for the Study Report (complete references are found at the end of this Study Report):

- United States Federal Register – 40 CFR Part 51 (EPA 2005)
- Southern Utah Air Quality Task Force (SUAQTF) – St. George Air Quality Standards (SUAQTF 2009)
- US Environmental Protection Agency (USEPA) – Region 9 Federal Class 1 Areas – Air Quality Maps (EPA 2009)
- Utah Department of Environmental Quality (UDEQ) – Area Designation Recommendations for the 2006 $PM_{2.5}$ NAAQS (UDAQ 2016)
- National Park Service – National Resource Management Policies 2006 (NPS 2006)
- USEPA – National Ambient Air Quality Standards (NAAQS) (EPA 2016)
- Utah State Division of Air Quality – Dust Control and the Aggregate Industry (UDAQ 2011a)
- USEPA AP-42 Section 13.3-1 and 11.9-2 (EPA 1995)
- Utah State Division of Air Quality – PM_{10} data
- Airmonitoring.Utah.gov – Air quality data (UDAQ 2011b)
- UDEQ – State Implementation Plan – Sulfur Dioxide (UDAQ 2011c)
- USA Dieselnet.com – Non road diesel engines (Dieselnet Undated)
- USEPA – Emission Standards Reference Guide for Heavy Duty and Non road Engines (EPA 1997)
- MWH Field Data – LPP Project wind measurement field data (MWH 2009)
- Western Regional Climate Center (WRCC) – Prevailing wind data (WRCC 2006)
- Arizona Department of Environmental Quality (ADEQ) – LPP Project Scoping Notice (ADEQ 2010)

- Meteorological Solutions Inc. – Isopleths and modeling data (MSI, 2011)
- Utah Division of Air Quality – Background Concentration by County (UDAQ 2011)
- Miratech Corporation – Selective Catalytic Reduction (SCR) Information and Quote (Miratech 2011)
- Jenbacher – Genset Specifications (JEN 2011)
- Kaibab Band of Paiute Indians (Kaibab Tribe 1999) – Comprehensive Cultural Ecology Ordinance of the Kaibab Band of Paiute Indians
- Argonne National Laboratory – Natural Gas Pipeline Overview (ANL 2007)

2.2.1 Agency Resource Management Goals

The Clean Air Act (42 U.S.C. Section 7401) requires that federal standards be set to limit the maximum levels of pollutants in the outdoor air. Each state is responsible for developing plans to achieve and maintain the standards, known as state implementation plans (SIPs). The rules set forth in the plans are enforced by the states; however, the rules are also federally enforceable once the plans have received federal approval. These plans are the framework for each state's program to protect air quality.

Attainment classified areas are where the air quality meets National Ambient Air Quality Standards (NAAQS). Areas that do not meet NAAQS and have been designated as such are classified as Non-Attainment. In areas where the air quality has improved to the point that the National Ambient Air Quality Standards (NAAQS) are no longer exceeded, the implementation plan remains in effect and a maintenance plan is prepared to demonstrate how the air will be kept clean for the next twenty years or longer. These maintenance plans become part of the SIP. Areas that are undetermined as to their classification and still under review are considered Unclassified.

The SIPs in Utah and Arizona are primarily focused on the population centers in each respective state where non-attainment areas exist. Non-attainment areas do not exist in the LPP Project area (UDAQ 2011c) (AAQD 2011).

The Utah SIP has identified parks, including Zion National Park, to be protected from Significant Deterioration of Air Quality. This includes visibility protection in Zion National Park as well. Consideration of impacts on visibility in Zion National Park is included in this Study Report because portions of the park are in the vicinity of the LPP Project. Other national parks that are in the region, but are not likely to be affected include Bryce Canyon, Capitol Reef and Arches.

2.2.1.1 UDEQ – Division of Air Quality

The management of air quality in Utah is addressed through the UDEQ SIP (UDAQ 2011c).

2.2.1.2 ADEQ – Air Quality Division

The management of air quality in Arizona is addressed through the ADEQ SIP (AAQD 2011).

2.2.1.3 EPA

EPA provides input to the agency responsible for the resource management plan.

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 they expect the construction and operations of new facilities to adhere to the goals and requirements established by the State of Utah, State of Arizona, and EPA.

A review of the Comprehensive Cultural Ecology Ordinance of the Kaibab Band of Paiute Indians was performed. The Ecology Ordinance allows for the creation of procedures to protect the quality of air. However, there do not appear to be any specific air resource management goals (Kaibab Tribe 1999).

2.2.1.5 Bureau of Land Management (BLM)

The BLM has an expressed goal to "maintain air quality in accordance with standards prescribed by federal and state laws and regulations." Within the jurisdiction of the Kanab Field Office, the BLM has adopted federal and state requirements through the Kanab Office Management Resource Plan (BLM 2008). The BLM does not maintain regulatory control over air quality. BLM relies on the agency with jurisdiction over air quality to set regulatory standards and criteria to protect the air quality in a particular area. Once these standards are established, BLM references them in its permitting documents and ensures that all permitted activities on public lands refer to the appropriate agency's standard.

2.2.1.6 National Park Service

The National Park Service (NPS) has a responsibility to protect air quality under both the 1916 Organic Act and the Clean Air Act (NPS 2006). Class I areas (parks greater than 6,000 acres) are to be protected from human made visibility impairment. The Clean Air Act recognizes the importance of integral vistas and the NPS strives to protect these vistas through cooperative means.

It is the position of the NPS that external programs need to remedy existing impacts and prevent future impacts from human caused air pollution. NPS will participate in these programs to develop pollution control plans and regulations. NPS will review new sources of pollution and will recommend denial of a construction permit if they are determined to cause an adverse impact (NPS 2006).

2.2.1.7 Bureau of Reclamation

The U.S. Bureau of Reclamation (Reclamation) defers to federal and state air quality requirements for lands and facilities under its jurisdiction. No specific Reclamation goals were identified.

2.2.1.8 Southern Utah Air Quality Task Force

Other than following federal and state requirements, there are no specific resource management goals identified for the region; however, St. George has specific Air Quality Regulations in Chapter 9 of the City Code Book. Chapter 9 primarily pertains to dust creation from construction and other activities and it regulates and further defines requirements of these activities and the standards these activities must uphold (SUAQTF 2009).

2.2.1.9 Five County Association, Counties, and Local Agencies Information

In discussions with representatives from the Five County Association, Washington County, Iron County, Kane County, Coconino County, and Mohave County, no specific requirements, goals or regulations outside of the federal and state air quality requirements were identified.

2.3 Assumptions

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

- Emissions from the LPP Project construction activities are representative of emissions from a typical construction site. This typical construction site analysis was chosen because of the preliminary level of accuracy and detail available at the time the analysis was performed.
- The most conservative emission scenario is used as the standard. Calculations are generally based on these most conservative scenarios.
- Equipment exhaust particulate emissions for the project are assumed to be PM_{10} (particulate matter smaller than 10 micron diameter). This results in a conservative air quality analysis.
- Each piece of construction equipment operates 8 hours per day, 5 days per week.
- Each construction service truck travels 100 miles per day based on previous construction experience.
- Dust emission rate from construction is based on an eight-hour per day period.
- Equipment emissions are calculated assuming all equipment is operating at the same time and in the same general area. This provides for a conservative air quality analysis based on a point source.
- Background pollutant levels are difficult to determine as there is little local monitoring data. Regional park data was used to estimate background levels.
- Fugitive dust emissions for typical LPP Project construction sites are represented by dust emissions from EPA's AP-42 document (EPA 1995).
- EPA's SCREEN3 model was used to determine pollutant concentrations after dispersion from the construction site. This model was chosen because of its EPA approval, the preliminary nature of the data available and uses conservative assumptions.
- SCREEN3 assumptions are listed in the SCREEN3 Modeling results section.
- The impact analysis addresses only the temporary impacts of construction activities of exhaust from heavy equipment and dust produced during construction.
- If air quality modeling projects that Zion National Park would not be affected by the LPP Project, then other more distant national parks would not be affected. The dispersion modeling indicates the NAAQS will be met within a short distance of any construction or operations and would not have a measurable impact on visibility within Zion National Park or other regional parks.
- Non-road (off-road) diesel engine standards (Tiers 1-3) were adopted in 1994 with Tier 3 phased in by 2008. Tier 4 will be phased in by 2015.
- Ultra Low Sulfur Diesel would be used along with regular diesel during construction to reduce SOx emissions to levels that resulted in NAAQS being met at the construction boundary.

- Historical air quality is assumed to be typical of high desert, rural areas.
- Annual averages were the primary tool for modeling analysis as they are more conservative and represent a worst case scenario rather than analyzing a 1-hour concentration (CO, NOx and SO_x).
- Natural Gas Pipeline Power Alternative Modeling Assumptions
  - Generator exhaust is between 75 and 100 ft in elevation depending upon the site and depending upon the Good Engineering Practices (GEP) limits.
  - The GEP formula was defined as H+1.5L where H is the height and L is the length of the nearby structure.
  - One year weather data used
  - Generator NOx emissions were 1.1 g/BHP-hr for Jenbacher 620 F09 generators
  - Multiple generators at a pump station were assumed to be one point source
  - Generator loading was assumed to be 100%
  - Natural gas pipeline construction is assumed to be installed at a rate of approximately 1-mile per day. Daily emissions from the natural gas pipeline construction is as shown in Table 2-2 (ANL 2007). Since these emissions typically occur over a 1-mile construction length, the length was broken down into 100 ft point source segments for modeling purposes.
  - Hourly and Annual Emission Estimates from the generator point sources are shown in Table 2-1 at each pump station

Table 2-1
Hourly and Annual Natural Gas Generator Emissions

Pump Station	Number of Units	Pollutants							
		NO_2		CO		SO_2		$PM_{10}/PM_{2.5}$	
		lb/hr	tn/yr[1]	lb/hr	tn/yr[1]	lb/hr	tn/yr[1]	lb/hr	tn/yr[1]
IPS	5	11.13	243.8	8.071	176.8	0.015	0.33	0.002	0.043
BPS-1	3	11.13	146.3	8.071	106.1	0.015	0.20	0.002	0.026
BPS-2	3	11.13	146.3	8.071	106.1	0.015	0.20	0.002	0.026
BPS-3	5	11.13	243.8	8.071	176.8	0.015	0.33	0.002	0.043
BPS-3 Alt.	4	11.13	195.1	8.071	141.4	0.015	0.26	0.002	0.034
BPS-4	5	11.13	243.8	8.071	176.8	0.015	0.33	0.002	0.043
BPS-4 Alt.	5	11.13	243.8	8.071	176.8	0.015	0.33	0.002	0.043

Note:
[1] Emissions in tons per year based on total number of units

2.3.1 Impact Corridor

The impact corridor is an impact area which is defined by the greatest possible distance NAAQ's exceedance could occur from a source for the air pollutants of concern. For example, if from a certain source, dispersion of NO_x and SO_x below NAAQ's levels occurs at 1,000 and 2,000 ft respectively, the impact corridor would be 2,000 ft at that point.

2.4 Impact Analysis Methodology

The air quality impact analysis was performed by reviewing existing information and data, performing field investigations to determine background pollutant levels, and calculating probable construction, operation and natural gas generator emission air pollution levels using methods consistent with EPA approved methodologies as described in this section.

The analysis included the following elements:

- Determine background levels of pollutants
- Determine if there are any existing areas of non-attainment
- Determine typical construction layout for emissions
- Calculate potential emissions from construction of the LPP Project
- Calculate potential emissions from operation of the LPP Project
- Calculate potential emissions from the Natural Gas Pipeline Power Alternative
- Model dispersion of pollutants from point sources and determine levels of pollutants at various distances from the point sources
- Compare dispersion model results to significance criteria to determine if significant air quality impacts would occur
- Document air quality impacts that are expected to occur

2.4.1 Review Existing Information

Technical reports, internet research, scientific and engineering journal publications, manufacturer specifications, and other literature were reviewed as identified in Section 2.2. The objective of the literature review was to identify and review available technical reports and information to determine known regional air quality conditions at specific locations along the alternative alignments.

2.4.2 Field Investigations

Field investigations within the project area included visual inspections of general air quality in the region (visible pollutants) and measurements to confirm typical wind patterns in the area. Data from field investigations regarding the prevailing wind directions was obtained and used in the modeling of wind directions.

Additionally, Meteorological Solutions Incorporated (MSI) reviewed the emissions volume and dispersion of the natural gas generator emissions based on regional background air quality concentration, geographical characteristics and regional climate data.

2.4.3 Perceived Aesthetic Valuable Areas

The region contains numerous visually valuable areas which could be adversely affected in the event of poor air quality. These areas are generally in the State and National Parks, including Coral Pink Sand

Dunes and Goosenecks State Parks; and the Class I national parks of Zion, Bryce Canyon and Grand Canyon, although aesthetically valuable areas exist throughout the proposed pipeline corridor.

2.4.4 Equipment Estimates and Emissions

It is difficult to determine the exact number of equipment operation hours for each construction activity and which equipment is in operation at any given time. Therefore, the annual emissions estimates were based on the conservative assumption that all equipment would be running 8-hours per day, 5-days per week for the life of the construction.

Pipeline and facility construction activities were identified and the equipment needed for each activity, the length of use, and the typical emissions from the equipment were determined.

Typical construction was assumed and the analysis of emissions was based on the following activities:

- Clearing and Grubbing/Earthwork
- Pipe Installation
- Structure Construction
- Cleaning and Restoring
- Dam Work/Blasting

Each activity was assumed to include the types and quantities of equipment shown in Table 2-2. These assumptions were based upon engineering estimates and previous projects and assessments.

Table 2-2
Construction Equipment[1]

Clearing and Grubbing / Earthwork	Pipelines	Structures[2]	Cleaning and Restoring[3]	Dam Work/ Earthwork
Pickup Truck (4)	Pickup Truck (2)	Pickup Truck (2)	Pickup Truck (2)	Pickup Truck (3)
Dump Truck (2)	Dump Truck	Excavator	Dump Truck	Dump Truck (2)
Loader	Excavator (2)	Grader	Excavator	Loader (2)
Dozer	Pipelayer Crane	Crane	Paver	Excavator (2)
Grader		Compactor	Roller	Dozer (2)
		Welder	Grader	Scraper
		Concrete Trucks (3)		Compactor

Notes:
[1] Numbers of equipment are the expected equipment used at one time.
[2] Concrete trucks for short-term use only and not included for duration of project.
[3] Pipe backfill compaction included in this activity.

Calculations were performed to obtain daily pollution estimates from projected equipment emissions. An example of the calculations is detailed below.

<u>Example Daily Emission Calculation (345 hp excavator)</u>

Horsepower – 345 hp
Daily Usage – 8 hours
NO_2 Emissions (from equipment specifications) – 9.6 grams/hp-hour

NO_2 Emissions = (345 hp) x (8 hours use/day) x (9.6 grams/hp-hour) x (0.0022 lbs/gram) = 58.3 lbs/day

Once each of these individual equipment emissions was calculated, they were summed for each activity. The activity with the largest aggregate emission was used for the modeling to provide conservative emissions results.

Natural gas powered generators were assumed to operate at 8,400 hours/year with loading assumed to be 100 percent. The Jenbacher GE generators were assumed to emit 1.1 grams/hp-hour.

2.4.4.1 Particulate Matter (PM) Calculations

Dust can arise from construction area activities such as travelling over unpaved surfaces, clearing, excavating, blasting, etc. EPA AP-42 provides a general dust emission value of 1.2 tons per acre per month of construction activity (EPA 1995). This is a total suspended particulate (TSP) concentration, which is generally comprised of 30-micron and smaller particle sizes.

Investigations of construction dust particle size distribution have shown that 30 percent of the particulate are in the PM_{10} range at 165 feet downwind of the sources (Grelinger 1988). It was assumed that an additional 50 percent of the dust could be reduced by consistent watering or other dust suppression efforts (EPA 1995).

<u>Example Daily Particulate Matter Emission Calculation</u>

- Area (Booster Pump Station No. 3) = (600 ft) x (300 ft) = 180,000 sf or 4.1 acres
- Dust Emission = (4.1 acres) x (1.2 tons/acre/month) x (1 month/30 days) x (2,000 lbs/ton) x (30% as PM_{10})
- Dust Emission (no dust suppression) = 98 lbs/day
- Dust Emissions (with 50% suppression) = 49 lbs/day

The dust emissions and PM_{10} equipment exhaust emissions were added together for each construction site and the data were converted to grams/second for modeling input. These numbers were used for the SCREEN3 modeling for dispersion and concentration estimates. This was added to background concentrations to compare to NAAQS. A summary of all the major facilities and pipeline dust emissions is shown in Section 3.

Blasting would occur during construction of selected pipeline segments and selected structures. Approximately 75 miles of the LPP Project pipeline alignment would require blasting. The primary LPP Project pipeline segments that would require blasting are near the intake, near the Cockscomb geological feature, and along the South Alignment Alternative south and east of the Kaibab-Paiute Indian Reservation. Fugitive dust emissions from trench and site blasting would be minimal because blasting activities are single, controlled events and PM_{10} levels resulting from blasting are typically low as indicated in AP-42, Compilation of Air Pollutant Emission Factors, Chapter 11. Therefore, the emissions associated with blasting are considered insignificant for purposes of this Study Report.

Under the Natural Gas Pipeline Power Alternative the generators would emit particulate matter which will need to be estimated and modeled.

2.4.5 Review Air Quality Dispersion Models

There are numerous EPA models used to determine air quality, dispersion and concentrations. The SCREEN3 model was used in this Study Report for several reasons, including:

- It is a single source plume model which provides maximum ground-level concentrations for point, area, flare, and volume sources, as well as concentrations, and concentrations caused by inversion break-up.
- It is an EPA-approved model and is available through the EPA website.
- It is a screening model that is used before applying refined air quality modeling and it helps to determine if more refined modeling is necessary.
- It allows a moderate amount of variability which is appropriate for this preliminary level of study.

Under the Natural Gas Supply and Generators alternative, the AERMOD modeling software was used to determine the concentrations of constituents from the generator systems and from natural gas pipeline construction. This near-field model is EPA-approved and is a steady-state plume dispersion model that is used for assessment of pollutant concentrations from various sources. AERMOD uses Gaussian distribution in the vertical and horizontal for stable conditions and in the horizontal for convective conditions. AERMOD's use is approved by UDEQ, ADEQ and EPA for these and similar applications.

2.4.6 Construction Air Quality Calculations

Numerous assumptions were made and models were run to calculate the air quality impacts at specified distances from the construction areas and long term operation of the new facilities to estimate the air quality conditions expected from LPP Project. Data were entered into the SCREEN3 model for analysis of the LPP Project and facility construction. The total emission levels were entered into the model to determine ambient air impacts compared to the National Ambient Air Quality Standards (NAAQS).

2.4.6.1 Particulate Matter (PM_{10})

Particulate matter is from numerous sources including particulates emitted from fueled engines and from disturbance of soils that are picked up by the wind or other disturbances. Assumptions for the fugitive dust modeling include:

- Construction of facilities (pump stations, etc) produces 1.2 tons/acre/month, assuming a 30-day construction month.
- Facilities will be in construction for a 12-month period.
- A maximum of 1,000 feet of pipeline construction could be completed without final dust mitigation efforts being implemented at any one time.
- Twenty pipeline construction operations could be simultaneously performed. Each segment would be approximately ten miles.

2.4.6.2 Nitrogen Dioxide (NO_2)

Nitrogen oxides (NO_2) are regulated in the National Ambient Air Quality Standards (NAAQS). NO_2 is typically produced through the burning of fuels at high temperature, as in a combustion process. The NO_2 standard is shown in Table 3-5. The LPP Project area is an attainment area for NO_2.

2.4.6.3 Carbon Monoxide (CO)

Carbon monoxide is generally the result of incomplete combustion of fuels such as gasoline from automobile engines and other combustion engines. CO standards are set under the NAAQS and are shown in Table 3-5. The LPP Project area is an attainment area for CO.

2.4.6.4 Other Pollutants

Pollutants such as ozone (O_3), sulfur dioxide (SO_2) and lead (Pb) have standards established under the NAAQS. The LPP Project area is an attainment area for these pollutants. Other pollutant NAAQS levels are shown in Table 3-5.

2.4.7 Operations Air Quality Calculations

The impact analysis from operations included exhaust from facility equipment. The facilities are not anticipated to include any combustion equipment, except for possible backup generators; therefore, the analysis is limited to these potential point sources.

The facilities (pump stations and hydro stations) would have little or no pollutant emissions from standard operations. The primary concern is from small stationary sources at each facility. Small stationary sources can be exempted from being required to receive an approval order if it emits (UDAQ 2010a):

- less than 5 tons/year of SO_2, CO, NO_X, PM_{10}, O_3, or VOC's.
- less than 500 lbs/year of any hazardous pollutant and less than 2,000 lbs/year of any combination of hazardous air pollutants.
- less than 500 lbs/year of any air contaminant not listed above and less than 2,000 lbs/year of any combination of air contaminants not listed above.

If the Natural Gas Supply Line and Generators alternative is implemented, the small stationary source exemption would be exceeded and the generators in the alternative would need to be permitted.

Chapter 3
Affected Environment

3.1 Impact Area

This study report encompasses the areas surrounding the LPP Project features shown in Figures 1-1 through 1-10 that could be potentially impacted. The areas that have the potential to exceed NAAQS limits for short periods of time are within the impact corridor. The study involved reviewing air quality impacts on areas of possible cultural sensitivity, tourism, environmental sensitivity, special status species, sensitive wildlife habitats, locations of economic or perceived aesthetic value, relatively dense population areas, or national monuments (wilderness areas, parks, etc.).

3.2 Overview of Baseline Conditions

Since 1970, the Clean Air Act (CAA) and subsequent amendments have provided the authority and framework for EPA regulations of ambient air and pollutant emission sources. The CAA gives federal land managers certain responsibilities and opportunities to participate in decisions being made by regulatory agencies that might affect air quality in federally protected areas.

Airsheds, which are geographical areas which may not coincide with political boundaries, are designated attainment, non-attainment, or unclassified areas for each of the six criteria pollutants covered by the NAAQS (carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO2), particulate matter with a nominal aerodynamic diameter of less than 10 micrometers (PM10), and fine particulates with a nominal aerodynamic diameter of less than 2.5 micrometers (PM2.5)). Areas in which levels of a criteria pollutant measure below the NAAQS are designated “attainment” areas; when a designated air quality area or airshed within a state exceeds the NAAQS, that area may be designated a “non-attainment” area. Typically, non-attainment areas are urban regions and/or areas with higher-density industrial development. The given status of an area is designated separately for each criteria pollutant; one area may have all three classifications. An unclassified designation indicates that the status of attainment has not been verified through data collection.

The existing air quality in the area is expected to be typical of undeveloped regions in the western United States. Data collected in the area of potential effect is limited. Areas with limited ambient air quality data typically indicate that ambient pollution levels are usually near or below detection limits. Locations vulnerable to decreasing air quality include the areas immediately surrounding surface-disturbing activities such as energy and mineral development projects, farm tilling, and local population centers affected by residential emissions. It is assumed the existing air quality conditions in the area of potential effect are typical of high desert, rural areas with low pollutant levels and occasional fugitive dust storms. The following is an analysis of the air quality related baseline conditions and impact topics for the project. Areas potentially impacted by emissions resulting from the LPP Project are identified in this report.

3.2.1 Baseline Conditions

3.2.1.1 Dense Population Areas

Densely populated areas are mainly confined to the St. George metropolitan area (approximate population of 138,530 in 2012) (GOPB 2013). All other areas along the proposed and alternative pipeline alignments are either sparsely populated or run through small rural towns with populations of less than 15,000.

3.2.1.2 Historical Air Quality (Baseline)

Nearly all areas in the region are classified as attainment areas. There are minimal local data and the regional air quality research is focused on St. George and the surrounding area. A recent concern in St. George is particulate matter, specifically $PM_{2.5}$, as levels have increased. Monitoring of $PM_{2.5}$ has been performed in the St. George and Hurricane area; however, no violations of the 24-hour or annual standard have occurred. UDAQ continues to monitor the air quality in St. George and the area is currently described as "unclassifiable" (UDAQ 2007). In addition, with the revised lower ozone NAAQS requirements, ozone has been monitored in recent years at St. George and Zion National Park.

Data for the region are detailed in Table 3-1. The Utah Division of Air Quality provided background concentrations of air contaminants by county. These data represent maximum background levels for the calculations and modeling because they are likely the highest levels in the region.

Table 3-1
Regional Air Quality Data

Location	Pollutant	Averaging Time	Highest Concentration Average*	National Ambient Air Quality Standards
Clark County – NV	CO	8-hour	2,863 μg/m^3	10,000 μg/m^3
		1-hour	4,809 μg/m^3	40,000 μg/m^3
	NO_2	1 hour	120 μg/m^3	188 μg/m^3
		Annual	18.3 μg/m^3	100 μg/m^3
	O_3	1-hour	0.1 ppm	0.12 ppm
		8-hours	0.085 ppm	0.070 ppm
	SO_2	3-hour	5.24 μg/m^3	1,310 μg/m^3
		24 –hours	5.24 μg/m^3	367 μg/m^3
		Annual	2.62 μg/m^3	79 μg/m^3
Coconino County - AZ	PM_{10}	24-hours	45 μg/m^3	150 μg/m^3
	$PM_{2.5}$	Annual	5.92 μg/m^3	12 μg/m^3
		24-hours	13.5 μg/m^3	35 μg/m^3
	O_3	1-hour	0.078 ppm	0.12 ppm
		8-hours	0.073 ppm	0.070 ppm
Grand Junction, CO	CO	8-hours	8,000 μg/m^3	10,000 μg/m^3
		1-hour	14,000 μg/m^3	40,000 μg/m^3
Kanab, UT	NO_2	1 hour		188 μg/m^3
		Annual	0.91 μg/m^3	100 μg/m^3
	O_3	8-hours	0.046 ppm	0.070 ppm
	SO_2	1-hour		196 μg/m^3
		3-hours		1,310 μg/m^3
Iron/Kane County – UT	CO	8-hours	3,206 μg/m^3	10,000 μg/m^3
		1-hour	4,809 μg/m^3	40,000 μg/m^3
	NO_2	1 hour	37 μg/m^3	188 μg/m^3
		Annual	23 μg/m^3	100 μg/m^3
	$PM_{2.5}$	Annual	18.0 μg/m^3	12 μg/m^3
		24-hours		35 μg/m^3
	PM_{10}	24-hours		150 μg/m^3
	SO_2	1-hour		196 μg/m^3
		3-hours		1,310 μg/m^3
St. George, UT	O_3	8-hours	0.070 ppm	0.070 ppm
	$PM_{2.5}$	Annual	<12.0 μg/m^3	12 μg/m^3
		24-hours	<35.0 μg/m^3	35 μg/m^3
	PM_{10}	24-hours	123.0 μg/m^3	150 μg/m^3
Washington County – UT	CO	8-hours	6526.5 μg/m^3	10,000 μg/m^3
		1-hour	22,327.5 μg/m^3	40,000 μg/m^3
	NO_2	1 hour	75.0 μg/m^3	188 μg/m^3
		Annual	47.0 μg/m^3	100 μg/m^3

Table 3-1
Regional Air Quality Data

Page 2 of 2

Washington County - UT	$PM_{2.5}$	Annual	7.0 µg/m^3	12 µg/m^3
		24-hours	19.7 µg/m^3	35 µg/m^3
	PM_{10}	24-hours	47 µg/m^3	150 µg/m^3
	SO_2	1-hour	19 µg/m^3	196 µg/m^3
		3-hours		1,310 µg/m^3
Zion National Park	O_3	8-hours	0.078 ppm	0.070 ppm

Notes:

*Blank 'Highest Concentration Average' fields indicate that no data was found or available.

3.2.1.3 Meteorological Characteristics

Much of the region has an arid to semi-arid climate. Precipitation ranges from less than 10 inches per year near St. George to near 20 inches of precipitation per year south of Cedar City. Inversions, which create stagnant air in valleys and tend to increase air quality issues by confining pollutants, are not common, but can occur in the region from time to time, especially near St. George. Prevailing winds are generally from the west and southwest, although they can vary locally, seasonally and in connection with weather conditions. Temperatures can be extreme in this region with maximum temperatures over 100 degrees Fahrenheit in the summer and minimum temperatures below 0 degrees Fahrenheit in the winter. Local climate data are included in Tables 3-2 and 3-3.

Table 3-2
St. George Climate Data

Month	Average Max. Temperature (F)	Average Min. Temperature (F)	Average Total Precipitation (in.)	Average Total SnowFall (in.)	Average Wind Speed (mph)	Prevailing Wind Direction
January	53.6	25.8	1.07	1.3	3.4	E
February	59.9	30.6	1.02	0.6	4.6	ENE
March	67.9	36.3	0.93	0.2	5.8	ENE
April	76.7	43.1	0.53	0	7.7	W
May	86.1	51.1	0.39	0	8.3	W
June	96.2	59.1	0.19	0	8.5	W
July	101.7	66.5	0.67	0	7.8	W
August	99.5	65.2	0.76	0	7.3	ENE
September	92.6	55.4	0.6	0	6.2	ENE
October	80.2	43.3	0.68	0	4.7	ENE
November	64.8	32	0.64	0.2	3.4	E
December	54	25.9	0.77	0.9	3.2	E
Annual	77.8	44.5	8.25	3.2	5.9	

Table 3-3
Kanab Climate Data

Page 1 of 2

Month	Average Max. Temperature (F)	Average Min. Temperature (F)	Average Total Precipitation (in.)	Average Total SnowFall (in.)	Average Snow Depth (in.)
January	47.3	22	1.53	7.3	1
February	52.1	25.7	1.5	4.2	1
March	59.2	29.8	1.49	2.6	0
April	67.8	35.7	1.01	1.4	0
May	77.5	43	0.62	0	0
June	87.5	50.5	0.35	0	0
July	92.7	58.2	1.04	0	0

Table 3-3
Kanab Climate Data

Page 2 of 2

Month	Average Max. Temperature (F)	Average Min. Temperature (F)	Average Total Precipitation (in.)	Average Total Snowfall (in.)	Average Snow Depth (in.)
August	90.2	57.2	1.42	0	0
September	83.8	50.1	1.18	0	0
October	72.2	39.6	1.07	0.2	0
November	58.8	30.1	1.03	1.5	0
December	48.5	23.3	1.23	5.2	1
Annual	69.8	38.8	13.49	22.5	0

Table 3-4
Meteorological Conditions in Northern Arizona

Monitor Location	Mean Monthly Average	Winter Average	Spring Average	Summer Average	Fall Average	Annual Average/Total
Pipe Springs National Monument	Temperature Max (F)	50.0	69.5	92.0	72.1	**70.9**
	Temperature Min (F)	23.1	35.9	55.8	39.1	**38.5**
	Precipitation (inches)	1.06	0.80	0.88	0.91	**10.94**
	Snowfall (inches)	1.90	0.60	0.00	0.40	**8.60**
Lake Powell	Temperature Max (F)	46.7	70.9	95.1	72.4	**71.3**
	Temperature Min (F)	23.2	40.0	62.8	43.6	**44.2**
	Precipitation (inches)	0.47	0.39	0.59	0.66	**5.07**
	Snowfall (inches)	1.90	0.07	0.00	0.13	**6.30**
Page, AZ	Temperature Max (F)	46.7	70.7	93.7	70	**72.8**
	Temperature Min (F)	28.7	46.0	67.3	48	**47.5**
	Precipitation (inches)	0.57	0.53	0.53	0.73	**7.10**
	Snowfall (inches)	0.50	0.00	0.00	0.00	**0.50**

3.3 Overview of LPP Project Conditions

3.3.1 Air Pollutants of Concern

Following review of existing information and direct contacts with ADEQ and UDEQ staff, tribal and other officials, the primary air quality concerns were identified for the LPP Project (AAQD 2010a; AAQD 2010b; AAQD 2010c; BLM 2009; SGU 2009; FCAOG 2010; ICA 2010; Kaibab Tribe 2009; KCP&Z 2010; MCDPH 2010; NPS 2010; and UDAQ 2010b). The criteria air pollutants includes fugitive dust (PM_{10} and $PM_{2.5}$), NO_2, SO_2, Pb, CO and O_3. However, the primary air quality concern along the LPP Project alternative alignments is fugitive dust emissions during construction, and in particular throughout the St. George metropolitan area. Small emission sources are a concern to the state agencies and the regulations regarding small stationary source emissions would apply if the exemption criteria are exceeded (UDAQ 2010a). In general, the pipeline and associated facilities would be constructed in rural areas that are not likely to affect residents during short periods of NAAQS exceedance at or near the construction sites. Ozone NAAQS limit was revised in October of 2015 and should be also considered an air quality pollutant of concern and should monitored during construction. Additional monitoring for ozone has been performed in both St. George and Zion National Park in recent years.

3.3.1.1 Fugitive Dust and Particulate Matter

Fugitive dust is a type of nonpoint source air pollution with small airborne particulate matter (PM) that does not originate from a specific point such as a gravel quarry or grain mill. Fugitive dust originates in small quantities over large areas. Fugitive dust can originate in large amounts also, although this is usually short-term (except during wind events). The PM in fugitive dust is generally a mixture of dust from various sources (soot is from combustion emissions but is also a PM) and is usually labeled as PM_{10} or $PM_{2.5}$. PM_{10} and $PM_{2.5}$ are defined as matter with diameters of 10 micrometers and less and 2.5 micrometers and less, respectively. Sources include, but are not limited to, unpaved roads, agricultural cropland, desert areas and construction sites.

Recent research indicates that there may be significant health considerations resulting from overexposure to PM (EPA 2011). These particles are so small that they can become imbedded in human lung tissue, causing or exacerbating respiratory diseases and cardiovascular problems. Other negative impacts include reduced visibility and accelerated deterioration of buildings.

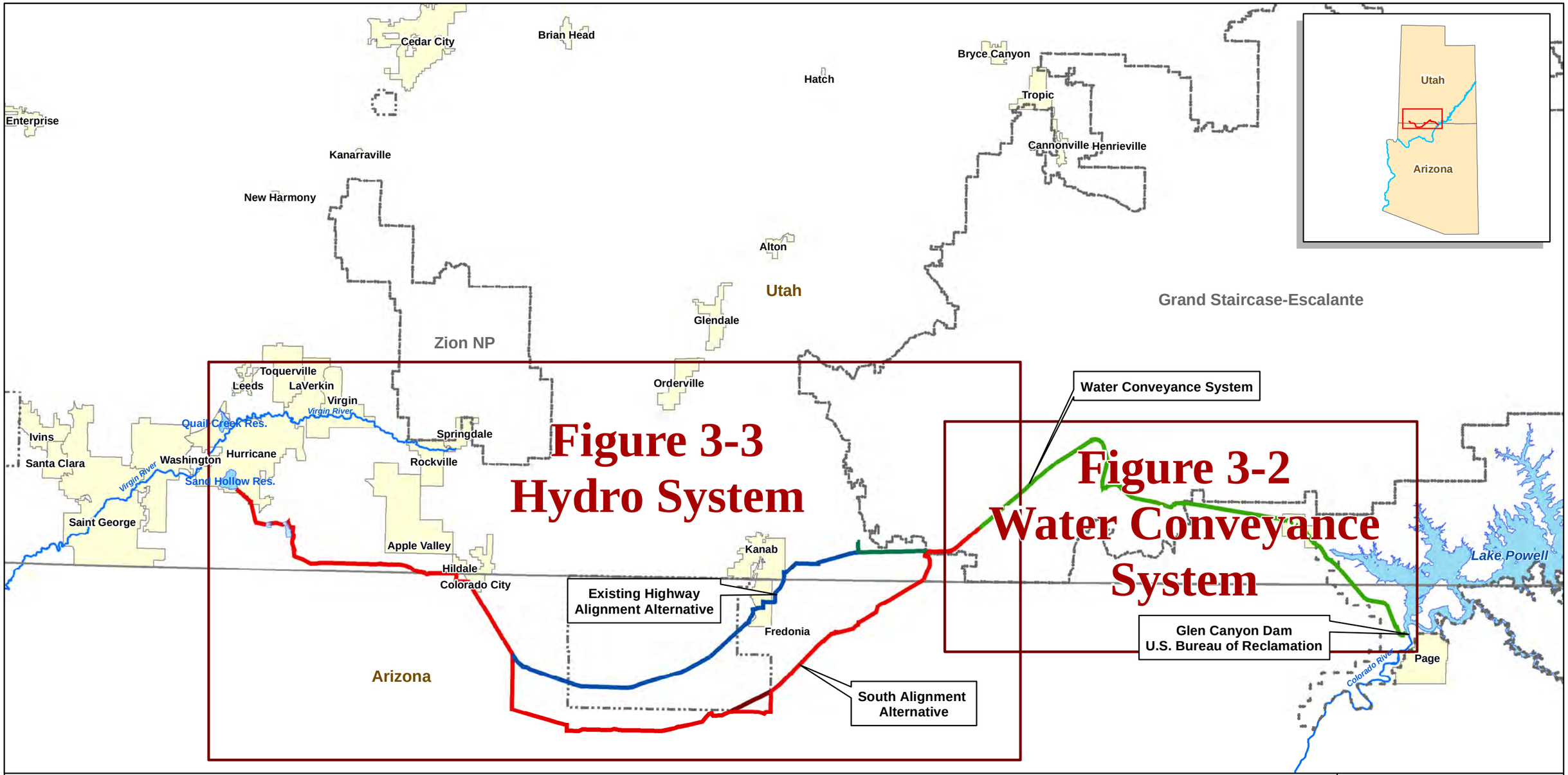
The LPP Project area is designated as an attainment area for all criteria pollutants, including fugitive dust (PM_{10} and $PM_{2.5}$). St. George is currently designated as unclassified and UDEQ is monitoring the St. George air quality further to determine the appropriate designation for PM. Results from past surveys in St. George have indicated there have been no violations of either the 24-hour or annual PM standards. For purposes of this study it is assumed that the St. George area would remain as an unclassified or Attainment area. Kane, Iron, Washington, San Juan and Garfield Counties are designated as unclassified.

Table 3-4 shows the calculated PM emissions from the various construction activities.

Table 3-5 PM_{10} from Facility Construction					
Activity	**Area (acres)**	**TSP (lbs/day)**	**PM_{10} (lbs/day 50% suppression)**	**PM_{10} from Combustion (lbs/day)**	**Total PM_{10} (lbs/day)**
IPS-1 Pump Station	4.6	181	27	0.60	28
BPS1	13.1	515	77	0.60	78
BPS2	5.5	217	33	0.60	33
BPS3	4.1	163	24	0.60	25
BPS4	3.6	143	21	0.60	22
Reg Tank-1	1.8	72	11	0.60	11
HS1	3.1	122	18	0.60	19
HS2	4.6	181	27	0.60	28
HS3	4.0	158	24	0.60	24
HS4	1.7	68	10	0.60	11
Hurricane Cliffs - Forebay S. Dam	32.0	1,368	205	0.90	206
Hurricane Cliffs - Forebay N. Dam	4.7	216	32	0.90	33
Hurricane Cliffs - Forebay Channel	1.5	75	11	0.90	12
Hurricane Cliffs - Afterbay S. Dam	16.4	863	129	0.90	130
Hurricane Cliffs - Afterbay N. Dam	15.8	883	132	0.90	133
Hurricane Cliffs - Powerhouse	7.3	435	65	0.60	66
Hurricane Cliffs Hydro	9.4	371	56	0.60	56
SH Hydro	2.1	82	12	0.60	13
Reg Tank-2	2.0	79	12	0.60	12
Pipeline	2.3	181	27	0.60	28

Table 3-4 indicates that the Hurricane Cliffs Forebay construction would be the area of greatest particulate matter and fugitive dust generation. Results of dispersion calculations show that the particulate matter disperses to concentrations below NAAQS standards at a distance of 339 m (1,111 feet) from the source. Most of the PM would be dispersed before it leaves the construction area because the site is quite large. Figures 3-1 (key sheet for Figures 3-2 to 3-13), 3-2, 3-3, and 3-4 show the extent of the likely PM pollution above NAAQS levels. Smaller sources such as Regulating Tank-1 are projected to produce PM levels that are dispersed to concentrations below NAAQS limits at a distance of 196 m (643 feet) which is largely within the limits of the construction area. These PM levels are very conservative estimates and most of the construction effort would emit significantly less PM and would disperse at shorter distances.

The NAAQS limits are shown in Table 3-5 (EPA 2008).



Hurricane Cliffs Forebay/Afterbay
Water Conveyance System
Hydro System - South Alternative
Hydro System - Southeast Corner Alternative
KCWCD System
Hydro System - Existing Highway Alternative
Key Sheets
National Park/Monument
Tribal Lands
State Boundaries
Major Rivers
Lakes/Reservoirs
Cities

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

N

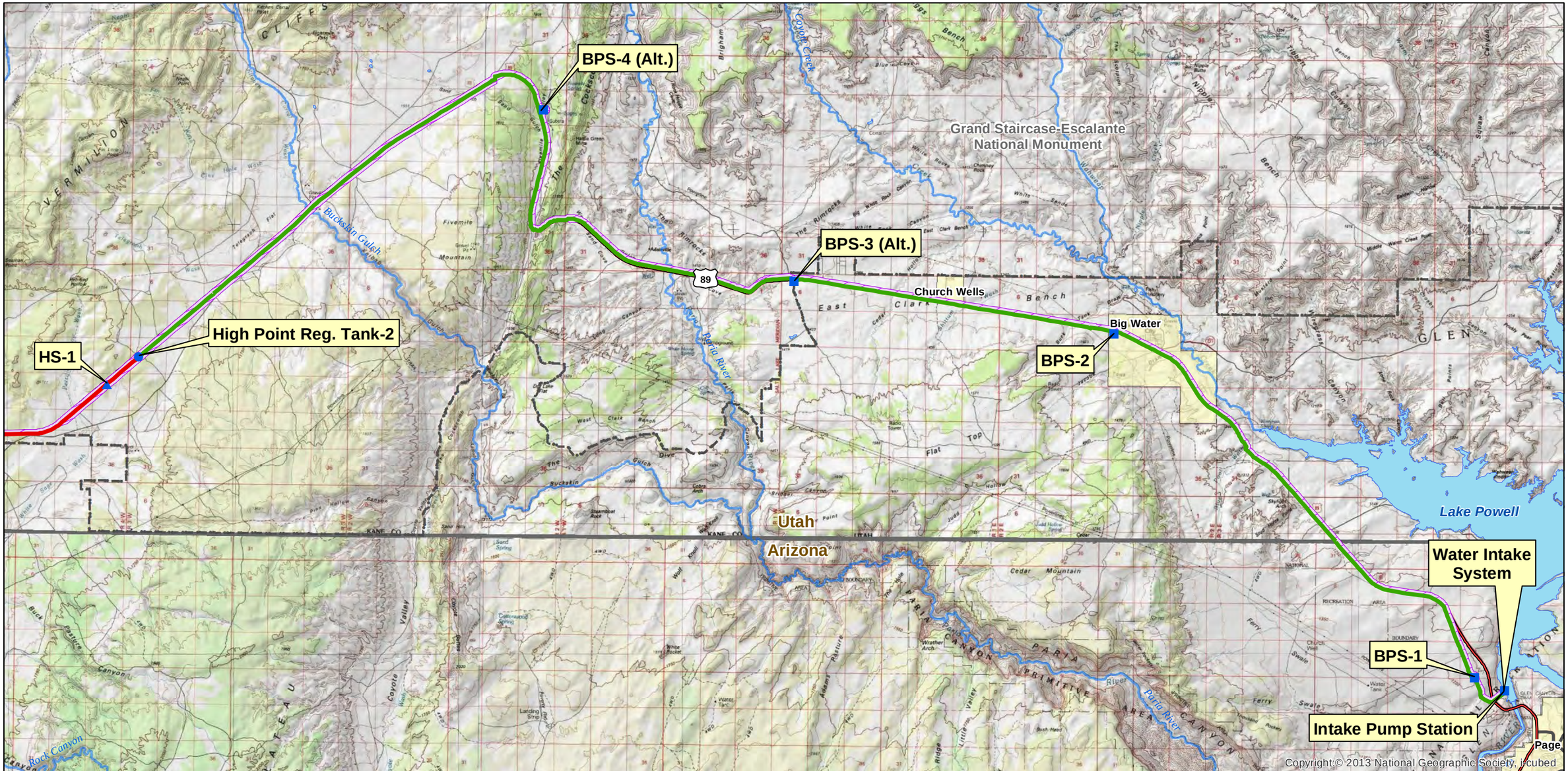
0 2.5 5 10 15 20 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-1** MWH

Lake Powell Pipeline - Key Map
Modeled Dispersion
Below NAAQS Level



Particulate Matter 10 (PM 10) 643 ft Potential Significant Impact Area (above NAAQ's Levels)
Project Pump Station
Project Regulating Tank
Project Hydro Station
Water Conveyance System
Hydro System - Proposed Action

Interstate
US Highway
ST Highway
Hwy
Major Road

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

Notes:

1. The Lake Powell Pipeline Project Area prevailing wind is from the Southwest.
2. Inside the shown potential significant impact area the NAAQ's levels could be exceeded during construction.
3. Outside the potential significant impact area the NAAQ's levels are not expected to be exceeded.

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

N

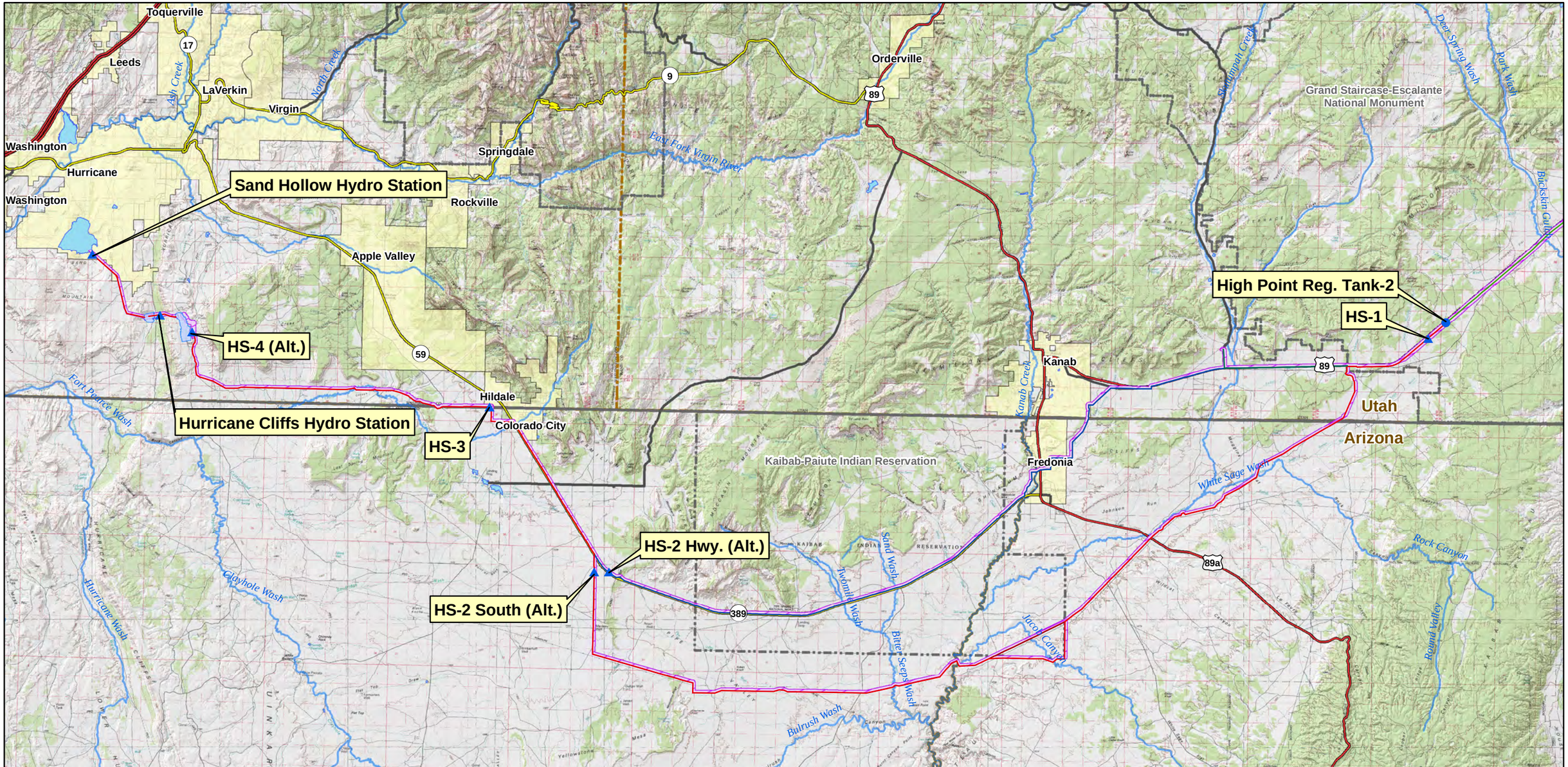
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-2** MWH

Lake Powell Pipeline Water Conveyance System PM 10 - Potential Significant Effects Area



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

Water Conveyance System
Hydro System - Proposed Action
KCWCD System
Hydro System, Existing Highway Alternative
Hydro System, Southeast Corner Alternative

Interstate
US Highway
ST Highway
Hwy
Major Road

National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
Cities
County Boundaries
Particulate Matter 10 (PM 10) 643 ft Potential Significant Impact Area (above NAAQ's levels) Except at Hurricane Cliffs (4,300 ft)

Notes:

1. The Lake Powell Pipeline Project Area prevailing wind is from the Southwest.
2. Inside the shown potential significant impact area the NAAQ's levels could be exceeded during construction.
3. Outside the potential significant impact area the NAAQ's levels are not expected to be exceeded.

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

N

0 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-3** MWH

Lake Powell Pipeline Hydro System PM 10 - Potential Significant Effects Area

Table 3-6
National Ambient Air Quality Standards
Page 1 of 2

Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		Primary	8 hours	9 ppm / 10,000 µg/m^3	Not to be exceeded more than once per year
			1 hour	35 ppm / 40,000 µg/m^3	
Lead (Pb)		Primary and Secondary	Rolling 3 month period	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		Primary	1 hour	100 ppb / 188 µg/m^3	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and Secondary	1 year	53 ppb (2) / 100 µg/m^3	Annual Mean
Ozone (O_3)		Primary and Secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	Primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
		Secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
		Primary and Secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		Primary	1 hour	75 ppb / 196 µg/m^3 (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Notes:

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain

the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect. (2) The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level. (3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards. (4) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)), A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the require NAAQS.	

3.3.1.2 Nitrogen Dioxide (NO_2)

Nitrogen dioxide is the chemical compound formed through fuel combustion and is one of several nitrogen oxides. The U.S. EPA has set safety levels for environmental exposure to NO 2. As of 2015, no areas of the US are out of compliance with these limits and concentrations ranged between 10-20 ppb with annual average ambient NO2 concentrations, as measured at area-wide monitors decreasing by more than 40% since 1980. However, NO2 concentrations in vehicles and near roadways are appreciably higher than those measured at monitors in the current network. Studies show a connection between breathing elevated short-term NO2 concentrations to detrimental health.

Assuming Tier 4 equipment (new equipment with advanced emissions controls) is used at the Hurricane Cliffs forebay construction site, NO_2 levels are projected to disperse to concentrations below NAAQS levels (100 $\mu g/m^3$) at a distance of approximately 170 meters (559 feet). Most of the NO_2 emissions would be dispersed before it leaves the construction area because the site covers a large area. Smaller facility construction, such as Regulating Tank-1, is projected to generate dispersed concentrations below NAAQS at 142 meters (467 feet). Figures 3-5, 3-6, and 3-7 show the extent of the likely NO_2 pollution above NAAQS levels.

3.3.1.3 Carbon Monoxide (CO)

Carbon monoxide is a colorless, odorless, and tasteless gas that is slightly less dense than air which is generated often through fossil fuel combustion. It is toxic to animals (including humans) when encountered in elevated concentrations, although it is also produced in normal animal metabolism in low quantities, and is thought to have some normal biological functions.

The dispersion modeling shows that the CO levels for large facilities would disperse below NAAQS 8-hour limit (40 mg/m^3) in 178 meters (586 feet) and below the 1-hour limit (10 mg/m^3) in less than 300 feet. These distances are generally within the construction boundaries. The CO concentrations would be lower for small facilities and would be dispersed below NAAQS limits within the small facility construction area. Figures 3-8, 3-9 and 3-10 show the extent of the projected CO pollution concentrations above NAAQS levels. The 8-hour results are shown in Tables 3-6 and 3-7 but would be less conservative than the annual averages and are not analyzed further.

3.3.1.4 Sulfur Dioxide (SO_2) and Other Pollutants

Sulfur dioxide is one of a group of highly reactive gases known as "oxides of sulfur." The largest sources of SO_2 emissions nationally are fossil fuel combustion. Sulfur dioxide is an air pollutant which has impacts upon human health. In addition, the concentration of sulfur dioxide in the atmosphere can influence the habitat suitability for plant communities, as well as animal life. Sulfur dioxide emissions are a precursor to acid rain and atmospheric particulates.

SO_2 emissions were modeled to determine the estimated distance from the construction source to achieve dispersion of the concentrations to less than the NAAQS Primary Standard. The model shows that the SO_2 levels would be below NAAQS limits at less than 91 meters (300 feet) for both small and large facility construction. The SO_2 emissions likely would be dispersed prior to leaving the construction sites. Figures 3-11, 3-12, and 3-13 show the extent of the projected SO_2 pollution concentrations above NAAQS levels.

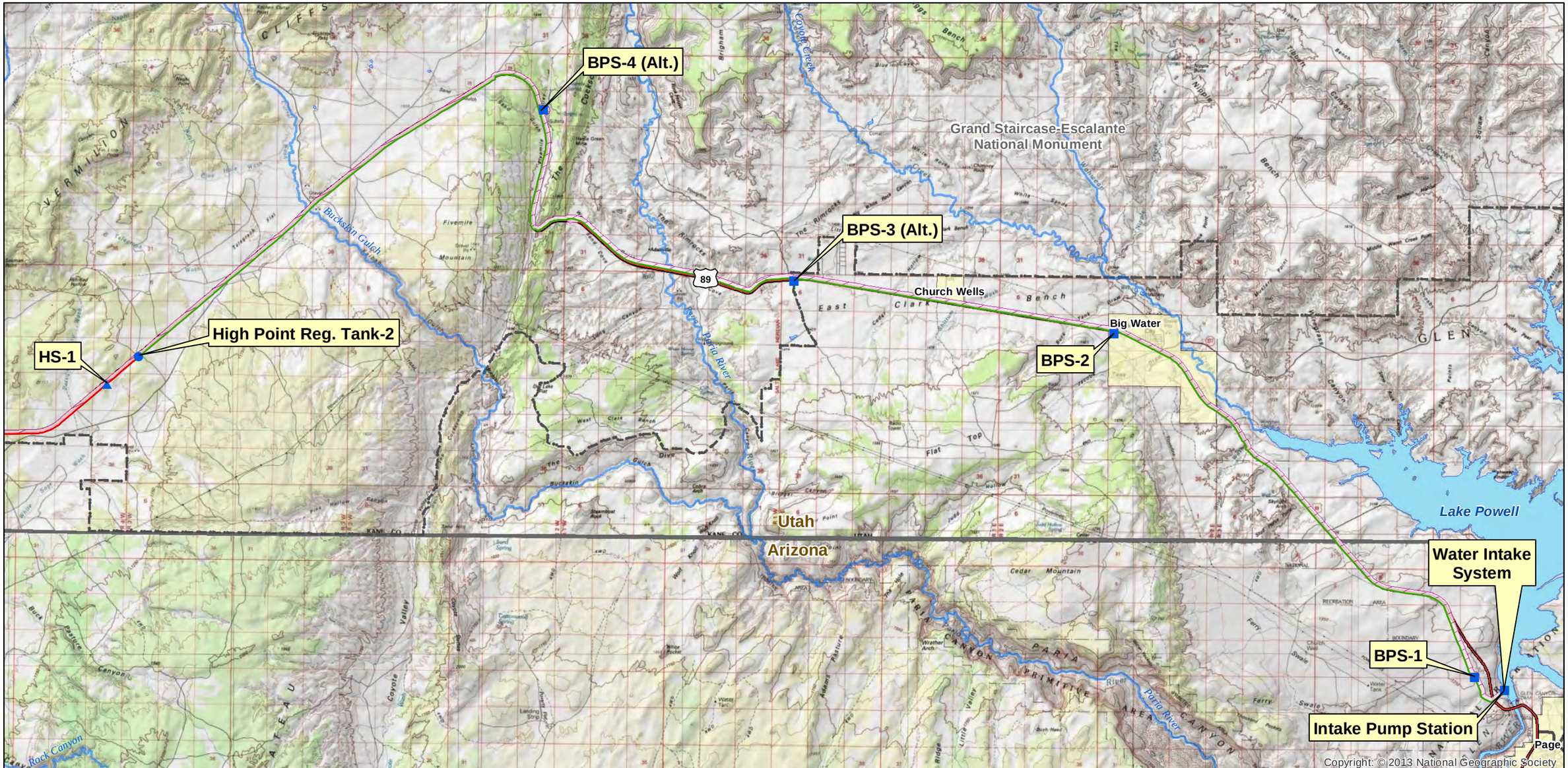
Lead was not modeled because measurable emissions of airborne lead from construction activities are not anticipated.

3.3.2 Nonattainment Areas

The Nonattainment areas in the State of Utah and Arizona are shown in Figure 3-14. All of the Nonattainment areas are outside of the LPP Project area.

3.3.3 Operations Air Quality Calculations

The small stationary sources for the LPP Project may include small backup generators. Small stationary sources are expected to emit a minimal amount of the above mentioned pollutants as the backup generator systems would only be sized to keep the facilities warm and would not be used to keep the facilities operating. In addition, these backup generators would be used very infrequently. Assuming a maximum 25kW diesel generator is installed and operated continuously throughout the year, it would still not produce enough local air pollution to exceed the threshold for Small Source Exemptions.



Project Pump Station
Project Regulating Tank
Project Hydro Station
Water Conveyance System
Hydro System - Proposed Action
Nitrogen Dioxide (NO2) 640 ft Potential Significant Effects Area (above NAAQ's levels)

Interstate
US Highway
ST Highway
Hwy
Major Road

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

Notes:

1. The Lake Powell Pipeline Project Area prevailing wind is from the Southwest.
2. Inside the shown potential significant impact area the NAAQ's levels could be exceeded during construction.
3. Outside the potential significant impact area the NAAQ's levels are not expected to be exceeded.

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

N

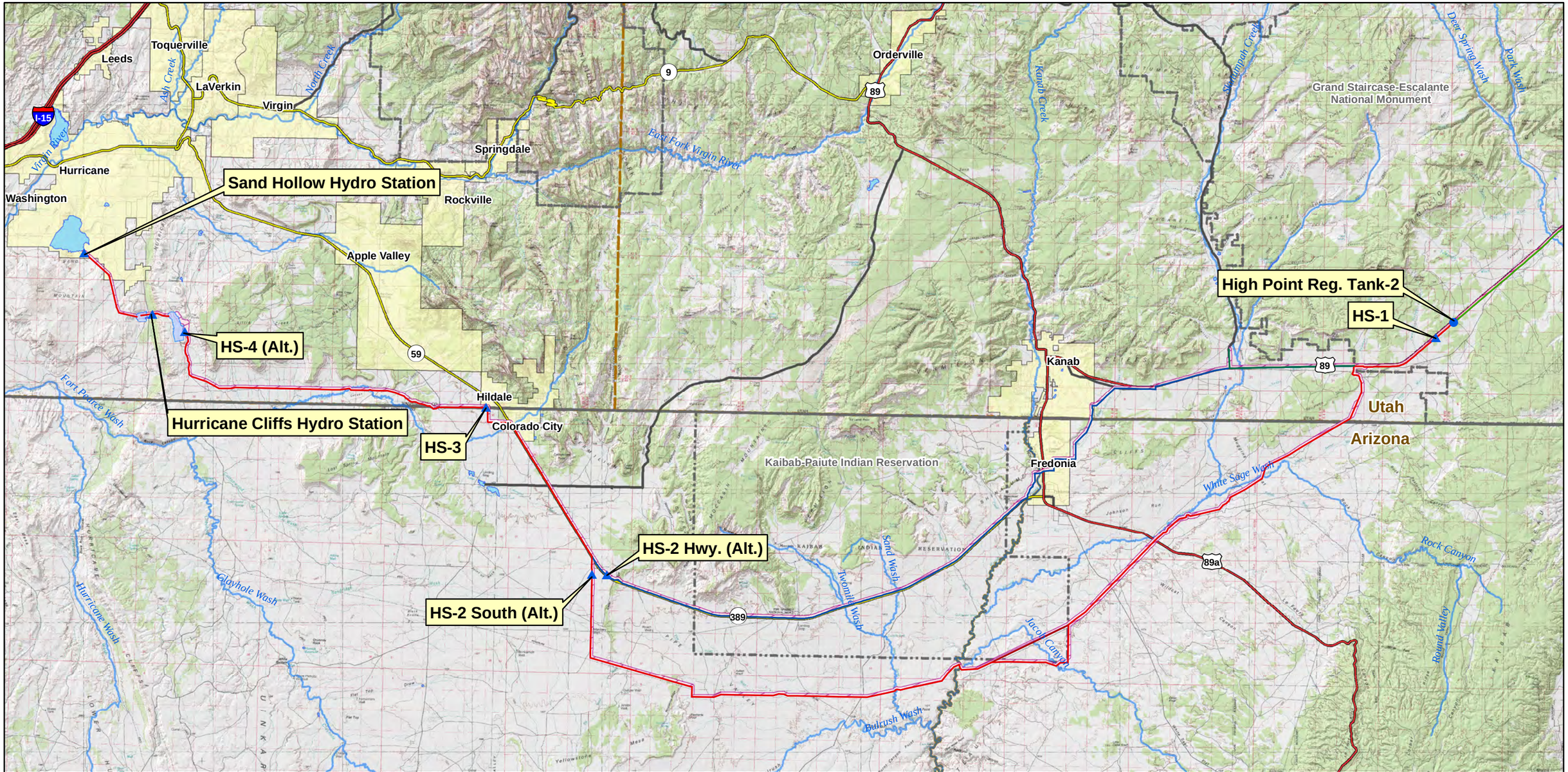
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-5** MWH

Lake Powell Pipeline Water Conveyance System NO2 - Potential Significant Effects Area



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Major Rivers & Streams
- Water Conveyance System
- Hydro System - Proposed Action
- KCWCD System
- Hydro System, Existing Highway Alternative
- Hydro System, Southeast Corner Alternative
- Nitrogen Dioxide (NO2) 640 ft Potential Significant Effects Area (above NAAQ's levels) Except at Hurricane Cliffs (3,500 ft)
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- National Park/Monument
- GSENM Boundary
- Tribal Lands
- State Boundaries
- Cities
- County Boundaries

Notes:

1. The Lake Powell Pipeline Project Area prevailing wind is from the Southwest.
2. Inside the shown potential significant impact area the NAAQ's levels could be exceeded during construction.
3. Outside the potential significant impact area the NAAQ's levels are not expected to be exceeded.

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

N

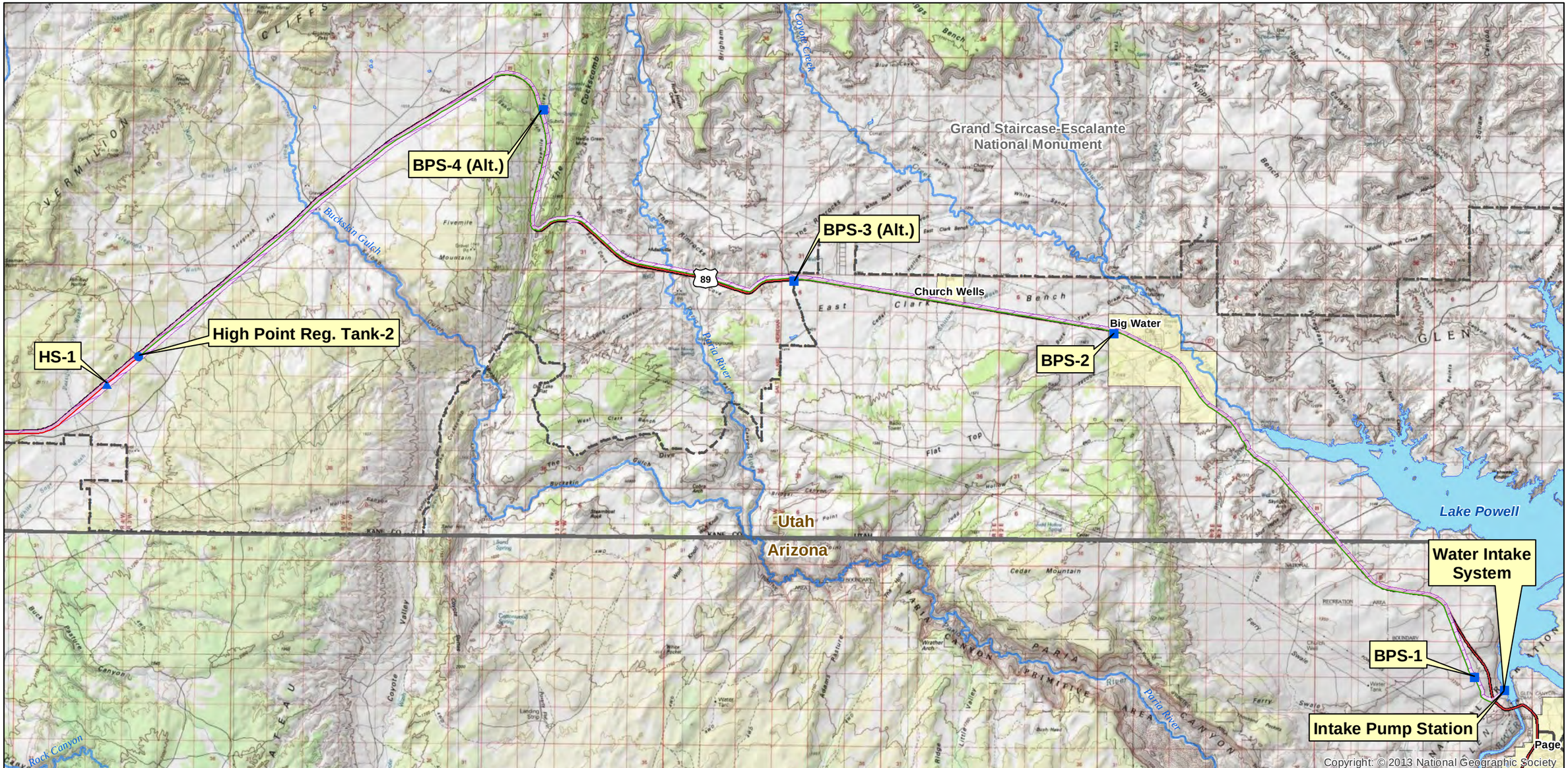
0 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-6** MWH

Lake Powell Pipeline Hydro System NO2 - Potential Significant Effects Area



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Carbon Monoxide (CO) 528 ft Potential Significant Effects Area
- Water Conveyance System
- Hydro System - Proposed Action
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Lakes & Reservoirs
- Major Rivers & Streams
- National Park/Monument
- GSENM Boundary
- State Boundaries
- Cities

Notes:

1. The Lake Powell Pipeline Project Area prevailing wind is from the Southwest.
2. Inside the shown potential significant impact area the NAAQ's levels could be exceeded during construction.
3. Outside the potential significant impact area the NAAQ's levels are not expected to be exceeded.

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

N

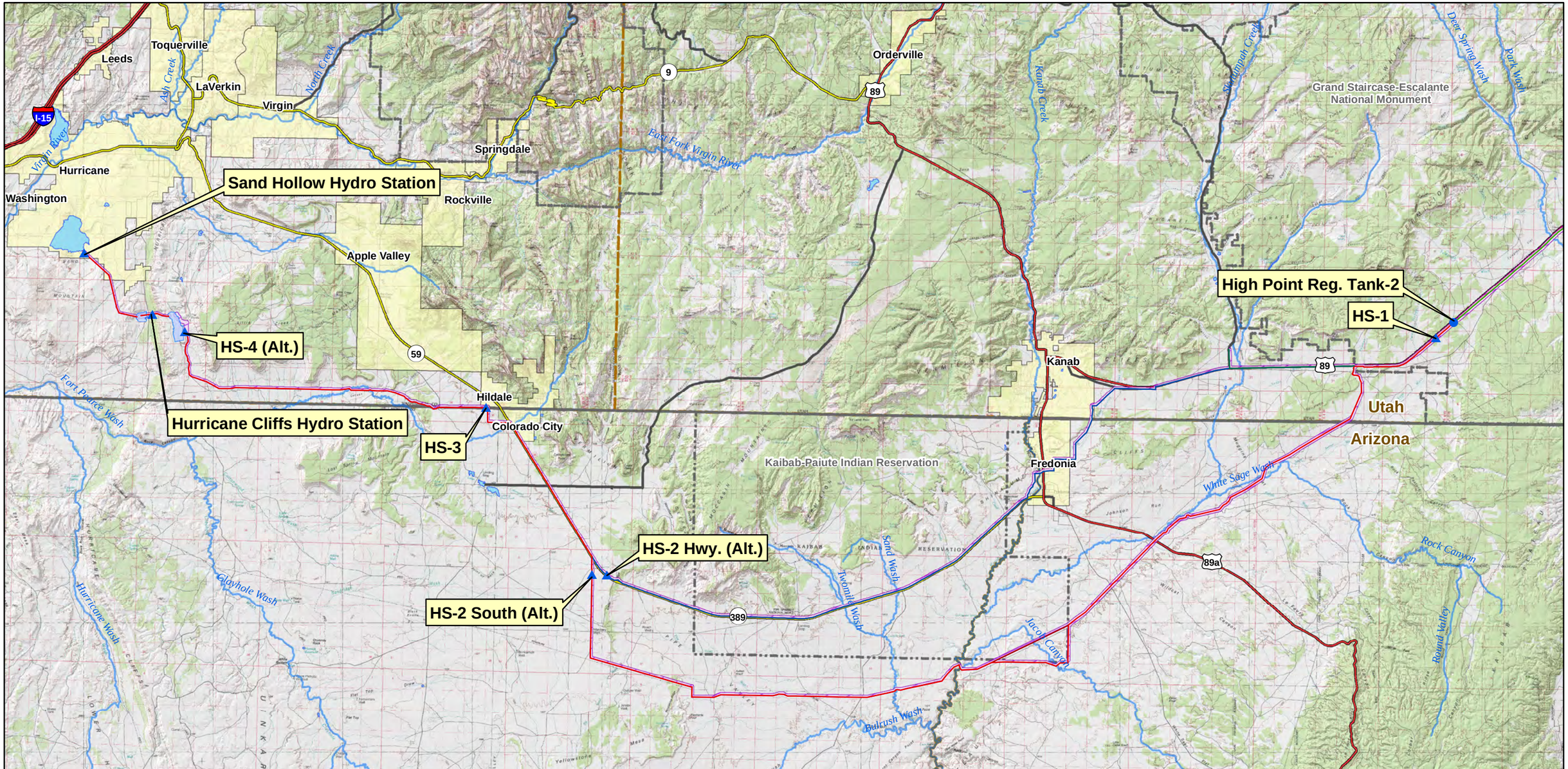
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-8** MWH

Lake Powell Pipeline Water Conveyance System CO - Potential Significant Effects Area



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Carbon Monoxide (CO) 528 ft Potential Significant Impact Area
- Water Conveyance System
- Hydro System - Proposed Action
- KCWCD System
- Hydro System, Existing Highway Alternative
- Hydro System, Southeast Corner Alternative
- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Major Rivers & Streams
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- National Park/Monument
- GSENM Boundary
- Tribal Lands
- State Boundaries
- Cities
- County Boundaries

Notes:

1. The Lake Powell Pipeline Project Area prevailing wind is from the Southwest.
2. Inside the shown potential significant impact area the NAAQ's levels could be exceeded during construction.
3. Outside the potential significant impact area the NAAQ's levels are not expected to be exceeded.

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

N

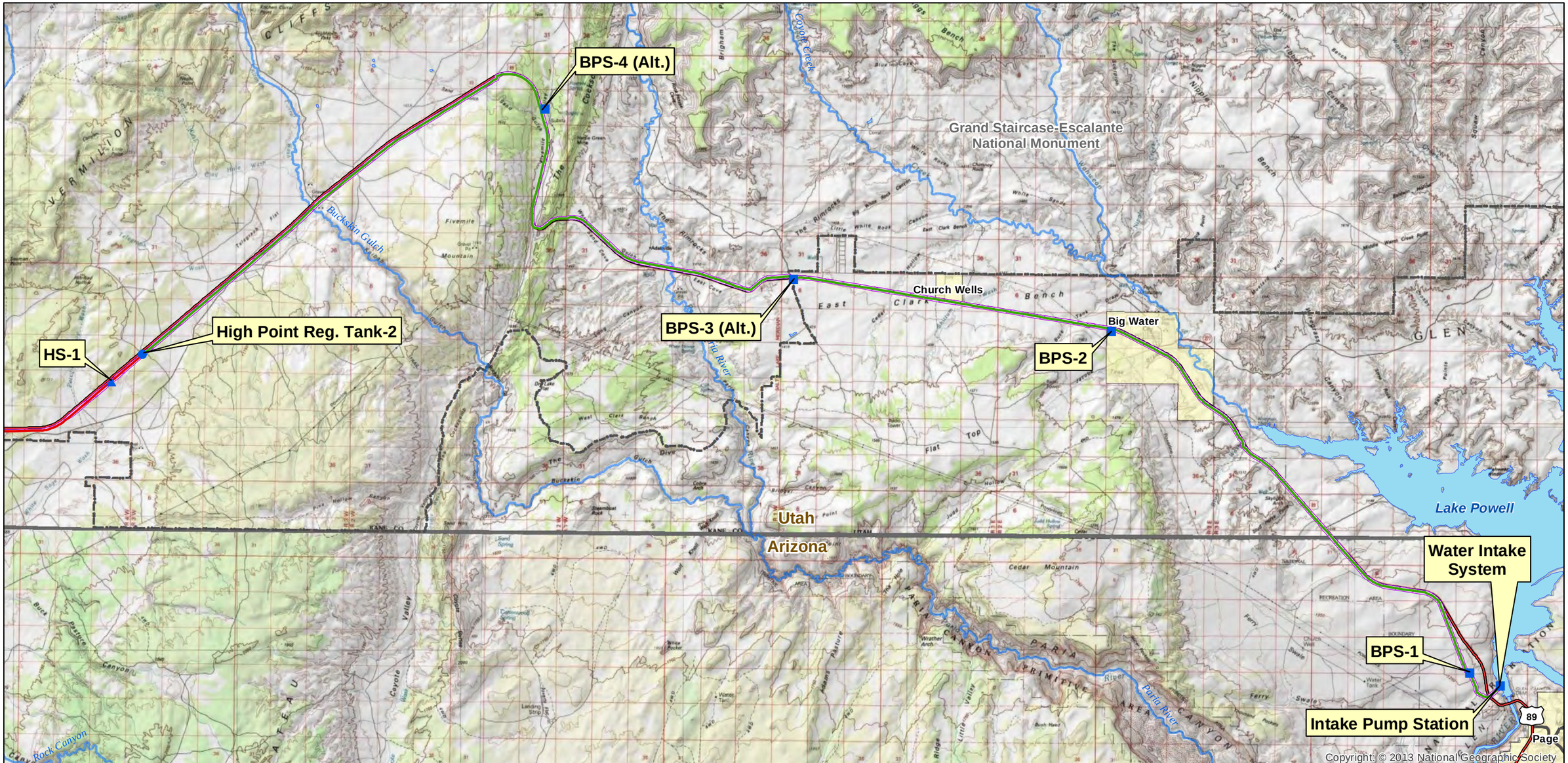
0 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-9** MWH

Lake Powell Pipeline Hydro System CO - Potential Significant Effects Area



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Water Conveyance System
- Hydro System - Proposed Action
- Sulfur Dioxides (SO2) <300 ft Potential Significant Effects Area
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Lakes & Reservoirs
- Major Rivers & Streams
- National Park/Monument
- GSENM Boundary
- State Boundaries
- Cities

Notes:

1. The Lake Powell Pipeline Project Area prevailing wind is from the Southwest.
2. Inside the shown potential significant impact area the NAAQ's levels could be exceeded during construction.
3. Outside the potential significant impact area the NAAQ's levels are not expected to be exceeded.

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

N

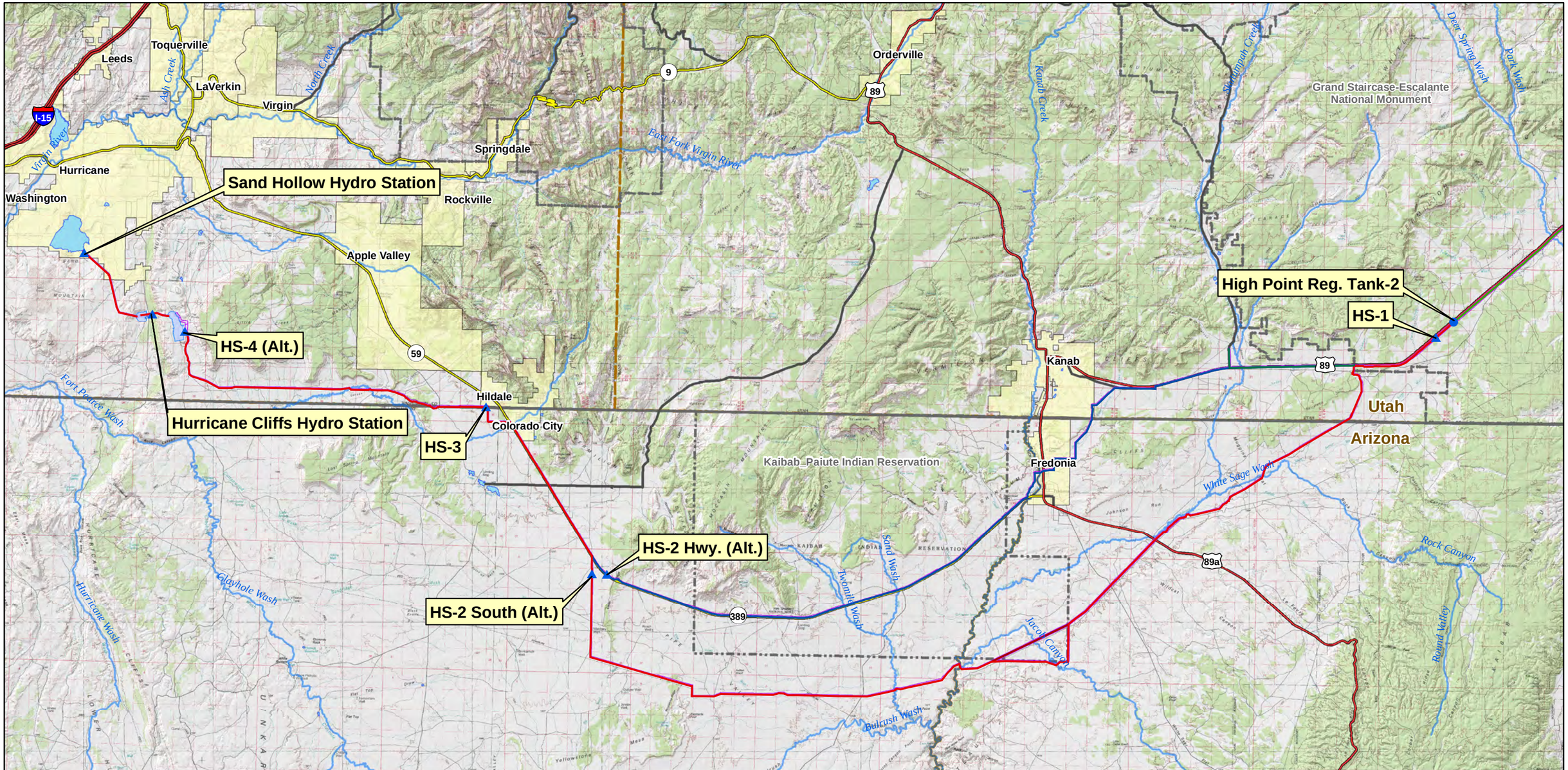
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-11** MWH

Lake Powell Pipeline
Water Conveyance System
SO2 - Potential Significant Effects Area



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Sulfur Dioxides (SO2) <300 ft Potential Significant Effects Area (above NAAQ's levels) Except at Hurricane Cliffs (1,640 ft)
- Water Conveyance System
- Hydro System - Proposed Action
- KCWCD System
- Hydro System, Existing Highway Alternative
- Hydro System, Southeast Corner Alternative
- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Major Rivers & Streams
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- National Park/Monument
- GSENM Boundary
- Tribal Lands
- State Boundaries
- Cities
- County Boundaries

Notes:

1. The Lake Powell Pipeline Project Area prevailing wind is from the Southwest.
2. Inside the shown potential significant impact area the NAAQ's levels could be exceeded during construction.
3. Outside the potential significant impact area the NAAQ's levels are not expected to be exceeded.

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

N

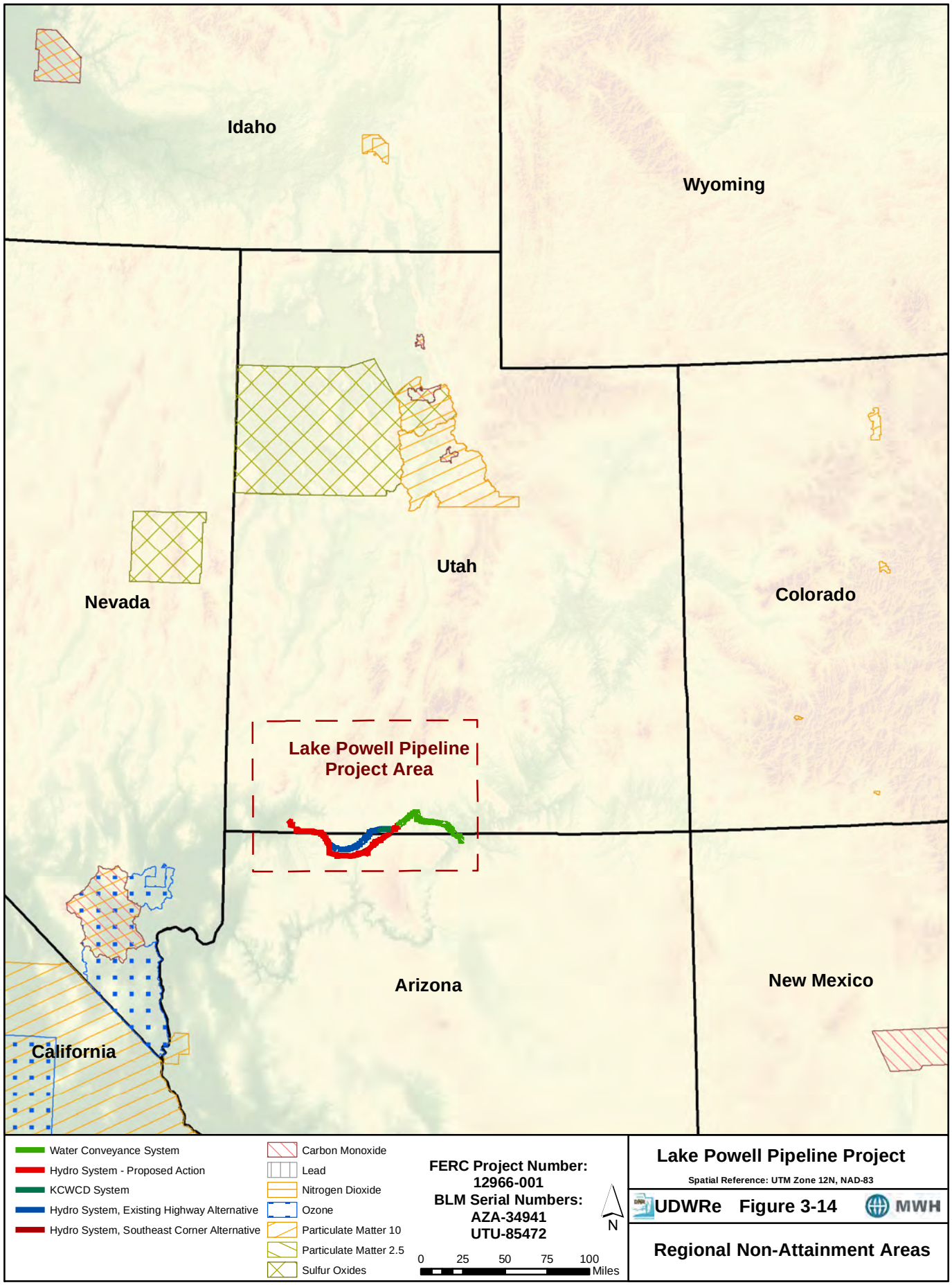
0 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-12** MWH

Lake Powell Pipeline Hydro System SO2 - Potential Significant Effects Area


Idaho
Wyoming
Nevada
Utah
Colorado
Lake Powell Pipeline
Project Area
Arizona
New Mexico
California
Water Conveyance System
Hydro System - Proposed Action
KCWCD System
Hydro System, Existing Highway Alternative
Hydro System, Southeast Corner Alternative
Carbon Monoxide
Lead
Nitrogen Dioxide
Ozone
Particulate Matter 10
Particulate Matter 2.5
Sulfur Oxides
FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472
N
0 25 50 75 100
Miles
Lake Powell Pipeline Project
Spatial Reference: UTM Zone 12N, NAD-83
UDWRe
Figure 3-14
MWH
Regional Non-Attainment Areas

3.3.4 Construction of Pipelines and Facilities

The potential maximum pollutant concentrations were calculated for the construction of pipelines and facilities and the distance at which these pollutants disperse to less than NAAQS levels is detailed in Table 3-6.

Table 3-7
Pipeline and Facility Construction Pollutant Dispersion

Pollutant	Concentration at 300 ft (µg / m³)	NAAQS Concentration (µg / m³)	Distance to NAAQS Concentration (ft)
CO	13,524	10,000 (8-hour)	528
NO_2	191	100 (annual mean)	640
PM_{10}	429	150 (24 hour)	643
Pipeline and Facility Construction Pollutant Dispersion (1-hour)			
Pollutant	**Concentration at 300 ft (µg/m3)**	**NAAQS Concentration (µg/m3)**	**Distance to NAAQS Concentration (ft)**
CO	29,325	40,000	<300
NO_2	191	189	467
PM_{10}	N/A	N/A	N/A
SO_2	97	196	<300

These pollution concentration levels would be temporary but represent a conservative scenario. The extent of the plumes from the pollutants depends upon prevailing wind direction and speed.

3.3.5 Construction of Transmission Lines

Although it is likely the effort to construct transmission lines would not create as many pollutants as the pipeline or facility construction, a conservative scenario is used to estimate pollution from the transmission line construction by using the emissions estimates from pipelines and facilities construction.

3.3.6 Construction of Reservoirs (Afterbay and Forebay)

The construction of reservoirs (forebay and afterbay) would require additional equipment, such as additional trucks, dozers, loaders, dump trucks and excavators, which would emit pollutants. These pollutant levels were calculated and are as detailed in Table 3-7.

Table 3-8 Reservoir Construction Pollutant Dispersion			
Pollutant	**Concentration at 300 ft (µg / m³)**	**NAAQS Concentration (µg / m³)**	**Distance to NAAQS Concentration (ft)**
CO	15,742	10,000 (8-hour)	586
NO_2	315	100 (annual mean)	782
PM_{10}	1079	150 (24 hour)	1,111
Reservoir Construction Pollutant Dispersion (1-hour)			
Pollutant	Concentration at 300 ft (µg/m3)	NAAQS Concentration (µg/m3)	Distance to NAAQS Concentration (ft)
CO	31,543	40,000	<300
NO_2	343	189	559
PM_{10}	N/A	N/A	N/A
SO_2	97	196	<300

3.3.7 Operation of Facilities

The emissions from operating the facilities are expected to be minimal. The equipment would be run via electrical power with virtually no emissions. Traffic to and from each facility would increase with resulting vehicular emissions. As described above, insignificant emissions would result from the infrequent use of small backup generators. The potential air quality pollutants from facilities operation are not analyzed further.

3.3.8 Natural Gas Pipeline and Generators Alternative

The raw emissions from the generator systems at each pump station were modeled and showed NO_2 concentrations in several locations exceeding NAAQS outside of the easement or property boundary assuming exhaust stack heights of 100 feet except for IPS with a stack height of 75 feet. Table 3-8 shows the various natural gas generator emission concentration levels at these boundaries.

Table 3-9
NAAQS Compliance Demonstration for Natural Gas Generators at LPP Pump Stations
Page 1 of 2

Pump Station (Note 2)	Pollutant	Averaging Period	Modeled Conc. ($\mu g/m^3$)	Background Conc. ($\mu g/m^3$)	Total Conc. ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
IPS	CO	1-hour	534.4	4,806.9	5,341.3	40,000
		8-hour	201.7	3,204.6	3,406.3	10,000
	NO_2	**1-hour[1]**	**265.4**	**37.0**	**302.4**	**189**
		Annual	9.7	23.0	32.7	100
	PM_{10}	24-hour	3.3	83.0	86.3	150
	$PM_{2.5}$	24-hour	4.3	18.0	22.3	35
		Annual	0.5	10.0	10.5	12
BPS-1	CO	1-hour	55.9	4,806.9	4862.8	40,000
		8-hour	29.6	3,204.6	3234.2	10,000
	NO_2	1-hour[1]	26.7	37.0	63.7	189
		Annual	1.7	23.0	24.7	100
	PM_{10}	24-hour	0.3	83.0	83.3	150
	$PM_{2.5}$	24-hour	0.4	18.0	18.4	35
		Annual	0.1	10.0	10.1	12
BPS-2	CO	1-hour	181.8	4,806.9	4,988.7	40,000
		8-hour	41.2	3,204.6	3,245.8	10,000
	NO_2	1-hour[1]	63.2	37.0	100.2	189
		Annual	1.8	23.0	24.8	100
	PM_{10}	24-hour	0.4	83.0	83.4	150
	$PM_{2.5}$	24-hour	0.4	18.0	18.4	35
		Annual	0.1	10.0	10.1	12
BPS-3	CO	1-hour	927.0	4,806.9	5733.9	40,000
		8-hour	299.9	3,204.6	3504.5	10,000
	NO_2	**1-hour[1]**	**408.5**	37.0	**445.5**	**189**
		Annual	6.2	23.0	29.2	100
	PM_{10}	24-hour	2.4	83.0	85.4	150
	$PM_{2.5}$	24-hour	3.1	18.0	21.1	35
		Annual	0.3	10.0	10.3	12
BPS-3 Alt.	CO	1-hour	183.8	4,806.9	4990.7	40,000
		8-hour	43.9	3,204.6	3248.5	10,000
	NO_2	1-hour[1]	110.6	37.0	147.6	189
		Annual	2.4	23.0	25.4	100
	PM_{10}	24-hour	0.6	83.0	83.6	150
	$PM_{2.5}$	24-hour	0.8	18.0	18.8	35
		Annual	0.1	10.0	10.1	12

Table 3-8
NAAQS Compliance Demonstration for Natural Gas Generators at LPP Pump Stations
Page 2 of 2

Pump Station (Note 2)	Pollutant	Averaging Period	Modeled Conc. (µg/m³)	Background Conc. (µg/m³)	Total Conc. (µg/m³)	NAAQS (µg/m³)
BPS-4	CO	1-hour	559.3	4,806.9	5366.2	40,000
		8-hour	177.9	3,204.6	3382.5	10,000
	NO_2	**1-hour[1]**	**210.3**	37.0	**247.3**	**189**
		Annual	3.3	23.0	26.3	100
	PM_{10}	24-hour	1.2	83.0	84.2	150
	$PM_{2.5}$	24-hour	1.8	18.0	19.8	35
		Annual	0.2	10.0	10.2	12
BPS-4 Alt.	CO	1-hour	277.1	4,806.9	5084.0	10,000
		8-hour	113.0	3,204.6	3317.6	40,000
	NO_2	**1-hour[1]**	**166.5**	37.0	**203.5**	**189**
		Annual	3.7	23.0	26.7	100
	PM_{10}	24-hour	1.1	83.0	84.1	150
	$PM_{2.5}$	24-hour	1.2	18.0	19.2	35
		Annual	0.2	10.0	10.2	12

Notes:
1. 98th percentile of the daily maximum one-hour average
2. All generator exhaust stacks heights are assumed to be 100 feet except for IPS which is 75 feet.
3. SO2 was below the modeling threshold and was not included in this analysis.
4. Bold text and numbers indicate NAAQS exceedance.
5. Data was taken from the 2011 MSI Modeling Report (MSI 2011)

Data from the generator emissions analysis indicate mitigation would be needed to reduce NO_x below NAAQS levels. The mitigation options to reduce NO_x below the NAAQS limits include increasing the exhaust stack height, reduce emissions through NO_x control units, or implement a combination of both measures. The emission dispersion models were run using 20, 75 and 100 foot stack heights. The maximum stack heights above the ground surface at all booster pump stations would be 100 feet. The maximum stack height above the ground surface at the intake pump station would be 75 feet. These stack heights would effectively disperse NO_x to concentrations within NAAQS levels at some booster pump stations and reduce the scale of NO_x control units at the remaining pump stations. The final configuration of stack height and emission controls to meet the modeled NAAQS levels would be determined during final design if the natural gas generator alternative is implemented.

3.3.9 Natural Gas Pipeline and Generators Construction

The natural gas pipeline and generators construction emissions were analyzed using calculations from the Argonne National Laboratory – Natural Gas Pipeline Technology Overview Report (2007) which estimated pollutant emissions from construction of a new pipeline. Direct emissions result from the

construction of pipeline segments, although these construction impacts are usually temporary and transient and short-term exposure levels are considered minimal (Argonne National Laboratory 2007). The emissions from construction of a natural gas supply line would disperse to NAAQS levels as shown on Table 3-9 below.

Table 3-10
Natural Gas Supply Line Construction Pollutant Dispersion

Pollutant	Concentration at 300 ft ($\mu g/m^3$)	NAAQS Concentration ($\mu g/m^3$)[a]	Distance to NAAQS Concentration (ft)
CO	14,500	10,000 (8 hour)	620
NO_2	550	100 (annual mean)	3,650
PM_{10} [b]	500	150 (24 hour)	950
SO_2	20	196 (1-hour)	<300

Notes:
[a] Used lowest NAAQS limit for conservative analysis
[b] Information from Argonne National Laboratory not available, existing LPP pipeline calculations used.

Chapter 4
Environmental Consequences (Impacts)

4.1 Significance Criteria

The significance criteria for the LPP Project involve impacts on human health and significant impacts on humans and wildlife from the exceedance of air quality standards. The Clean Air Act, as amended in 1990, requires EPA to set National Ambient Air Quality Standards (NAAQS) for air pollutants harmful to the environment and public health. There are two standards applied, Primary Standards and Secondary Standards. Primary Standards are emission limits to protect public health, especially the health of "sensitive" populations (those easily effected by air quality conditions). Secondary Standards set emission limits to protect public welfare (protect visibility, damage to crops, animals, vegetation and buildings). Primary Standards were used for the purpose of this study and air quality impacts from the LPP Project are considered significant if the Primary Standards would be exceeded. Secondary standards were used if these criteria could affect visibility.

4.1.1 Human Receptors

Air pollutant levels would be considered to have a significant impact on human receptors if they are above NAAQS levels. Potential human receptors are defined as persons in the area that could potentially receive or be affected by the air pollutants created by the LPP Project, such as persons working on construction sites, visitors, tourists, and local residents. The locations of potential human receptors are identified in Table 4-1. These receptors primarily include residents and tourists, although there are utilities and some businesses that could be affected.

Table 4-1
Potential Human Receptors

Page 1 of 2

Potential Human Receptor Location	Receptor	Receptor Distance to Pollutant Source (feet)
Pipeline Construction (including Natural Gas)		
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
Paria River	Visitor	<1,000
Adairville (West of Paria River)	Residential	< 1,000
Hydro System - Existing Highway Alternative		
Near S. Johnson Road and SR-89	Residential	< 1,000
Cottonwood Road	Visitor	<1,000
Near Bryce Canyon Road and SR-89	Residential	< 1,000

Near Kaibab Trail and SR-90	Residential	< 1,000
Near Old Highway 89 and SR-89	Residential	< 1,000
Near Fredonia	Residential	< 1,000
Pipe Springs	Residential	< 1,000

Table 4-1
Potential Human Receptors

Page 2 of 2

Potential Human Receptor Location	**Receptor**	**Receptor Distance to Pollutant Source (feet)**
Hydro System - South and Southeast Corner Alternative		
Near School Bound Road South of Colorado City	residential	< 1,000
Clayhole Road	visitor	<1,000
Kanab Creek Crossing	visitor	<1,000
Toroweap (Mt. Trubull) Road	visitor	<1,000
Colorado City	residential	< 1,000
Diamond Ranch Academy	residential	< 1,000
Transmission Line Construction		
Near Hurricane Cliffs/Arizona Strip Road	residential	< 2000
Near SR-9 and West Hurricane	residential	< 1000
Near Hurricane Cliffs Power Station	residential / business / government facilities	< 1000

4.1.2 Wildlife Receptors

Impacts of air quality on wildlife are difficult to quantify as most studies pertain to air pollution impacts on human receptors. Therefore, it is assumed that significant impacts on humans would be significant impacts on wildlife in the region.

It is anticipated that most large wildlife would temporarily abandon the areas near construction sites because of the general disturbance of construction activities and would not be affected by the construction emissions.

The construction is temporary in nature with pipeline construction near most areas being completed within a few weeks and facility construction within a few months, and any wildlife that temporarily relocate are expected to move back into the area and are not expected to be significantly impacted.

4.2 Potential Impacts Eliminated From Further Analysis

Several potential impacts were deleted from further analysis. These items include:

- Facility operations involving electric power supplied from transmission lines were eliminated from further analysis because they would not generate measurable air quality pollutants.

- Pollutants generated by operations vehicles are unlikely to be measurable because of the infrequent nature of facility inspections and maintenance during facility operations. These potential air quality impacts are not analyzed further.
- Impacts from ozone were eliminated because: 1) the impact area is in an attainment area, and 2) ozone is uniquely formed from precursor compounds (volatile organic compounds and nitrogen oxides) that are emitted. A photochemical reaction occurs after an emission creates ozone, often several hours later. Ozone would likely form several miles downwind of the source and it would be dispersed below NAAQS limits by the time it could form.
- Annual impacts from pipeline construction sources were eliminated from further analysis. Temporary direct impacts are considered in the impact analysis because the pipeline and transmission line construction locations would constantly change.
- Particulate matter resulting from blasting was eliminated because each blast is a one-time emission, with substantial time periods between blasts. Most dust generated by blasts settles within or just outside the blast zone. Typically very little PM_{10} remains suspended from bedrock blasting.
- Short-term exposure to construction personnel and persons in the area from construction emissions would not create impacts on human health in the immediate construction area because of the temporary nature of the construction activities and the accomplishment of work in accordance with OSHA guidelines. Most potential human receptors will be indoors and not potentially impacted. Construction activities will include notification for all sensitive persons to take precautions such as particulate masks or avoidance during the period of construction. Exposure of construction workers and to persons in the immediate area to emissions as an air quality impact was eliminated from further consideration.
- The air quality impacts from the construction of a natural gas supply line would be relatively temporary and minor, and were eliminated from further analysis because of the rapid, relatively short duration of construction.
- NAAQS exceedances are possible but if standards are exceeded within the general construction boundary it is not considered a violation but a construction safety issue. If exceedances extend beyond the construction boundary then additional mitigation measures would be needed. After mitigation measures are applied and the air quality still does not meet NAAQS standards, this would be considered an unavoidable impact.
- Impacts on air quality and additional lighting within the project are not significant enough to impact any national parks for starry night observations.

4.3 Air Quality Impacts

The direct and indirect air quality impacts of the alternative alignments and alternatives are described in the following sections.

4.3.1 Water Conveyance System

The Water Conveyance System alignment would be routed near several residential areas and visitor areas which could possibly affect human receptors during construction. Most residential areas are outside the pollutant dispersion zone and would not be significantly impacted. Residents living within the dispersion zone could be temporarily affected from pollutant levels above NAAQS, but these direct impacts would

be mitigated by implementing the Best Management Practices (BMPs) described in Chapter 5. In addition, many of the NAAQS are based on annual mean values or other averaged values, thereby reducing the impact of temporary construction emissions. Wildlife receptors in the area are expected to temporarily relocate and should not be significantly impacted by LPP Project emissions. Wildlife resources are expected to return to the area following construction completion.

4.3.2 Hydro System - Existing Highway Alternative

The Hydro System Existing Highway Alternative would be constructed near residential areas from GSENM west boundary to Fredonia and in the Pipe Springs area on the Kaibab-Paiute Indian Reservation. Temporary direct air quality impacts on human and wildlife receptors would be similar to the Water Conveyance System impacts, and these impacts would be mitigated through the use of the BMPs described in Chapter 5. No significant air quality impacts are expected to occur.

4.3.3 Hydro System - South Alternative

Residential areas were not identified along the eastern portion of the Hydro System South Alternative alignment from the High Point Regulating Tank 2 to the intersection of Yellowstone Road with Highway 389. Therefore, human receptors would not be affected by construction emissions along this alignment other than occasional visitors which are temporary in nature. Wildlife receptors in the area are expected to temporarily relocate and would not be significantly affected by LPP Project emissions. Wildlife resources are expected to return to the area following construction completion.

The proposed pipeline alignment from the Yellowstone Road-Highway 389 intersection to Sand Hollow Reservoir is shared by the Existing Highway and South alternatives. Residential and potential visitor areas were identified along this portion of the alignment. Residents could be temporarily affected from exposure to levels of pollutants above NAAQS, although significant impacts are not expected because BMPs would be implemented to mitigate the direct air quality impacts and most residential and visitor areas are outside of the pollutant dispersion zone. Those within the pollutant dispersion zone could be temporarily affected, but the direct air quality impacts would be mitigated by implementing BMPs. In addition, many of the NAAQS are based on annual mean values or other averaged values, thereby reducing the impact of temporary construction emissions.

4.3.4 Hydro System - Southeast Corner Alternative

Air quality impacts caused by the Hydro System Southeast Corner Alternative would be the same as for the Hydro System South Alternative. No measurable impacts and no significant impacts are expected to occur.

4.3.5 Transmission Lines

The transmission lines would be aligned near several residential areas and direct impacts on human and wildlife receptors would be similar to the Water Conveyance System impacts. Emissions from transmission line construction are not expected to be significant because the temporary construction activities would disturb small land areas such as transmission tower bases, substation sites and access roads. Fugitive dust emissions from these small land areas would be controlled by implementing BMPs as

indicated in Chapter 5 to minimize particulate matter generation similar to dust mitigation from other construction efforts. In addition, most residents or visitors would be far outside of any construction boundary or air pollution impact area. No significant impacts are expected to occur.

4.3.6 Natural Gas Pipeline and Generators Alternative

The operational impacts of the proposed Water Conveyance System with natural gas pipeline and generators would result in NAAQS exceedances from the intake pump station and BPS-4 (Alt.) generator systems for NO_2 at the site right-of-way, easement, or property boundary with stack heights at the GEP limit (between 75 and 100 feet above ground surface). These air quality impacts would be significant because the NO_2 concentrations would exceed the NAAQS. Under the Water Conveyance System Alternative natural gas supply line and generators, the NAAQS would be exceeded at the intake pump station, BPS-3 and BPS-4. These air quality impacts would be significant because the NO_2 concentrations would exceed the NAAQS. Emission control mitigation measures of these significant impacts are discussed in Chapter 5.

4.3.7 No Lake Powell Water Alternative

Air quality could be affected by non-irrigated landscape construction activities resulting from restrictions on outdoor residential watering with culinary supplies as part of the No Lake Powell Water Alternative. Converting traditional residential landscapes to non-irrigated landscapes would increase the disturbed land area within residential communities in the St. George metropolitan area, potentially exposing residents to particulates dispersed by the wind during construction activities. The particulate concentrations could contribute to exceeding NAAQS beyond dispersion zones, resulting in significant indirect air quality impacts. These indirect impacts may be partially mitigated by implementing BMPs; however, water could not be used to control dust because it would not be available for outdoor watering and dust control.

Air quality could be permanently affected by converting traditional residential landscapes to desert landscapes within the St. George metropolitan area, resulting in increased airborne particulate matter generated from increased exposed soil areas. The particulate concentrations could occasionally exceed the NAAQS beyond dispersion zones during windstorms and affect human receptors, resulting in significant indirect air quality impacts. The indirect impacts could be partially mitigated by implementing BMPs, such as placing crushed stone or other natural materials over exposed soils; however, water could not be used to control dust particles because it would not be available for outdoor watering and dust control.

Additional power demand from the KCWCD No Lake Powell Water Alternative is likely negligible since it would be offset from reduced pumping and water treatment from the decreased outdoor culinary water use. However, the WCWCD would include additional power demand from a water treatment facility and reverse osmosis, and the reduced power demand from decreasing outdoor culinary water use would not offset the new treatment power demand. The additional power demand is expected to be approximately 50 million kWh per year. This translates into additional emissions of 150 tons of SO_2, 60 tons of NO_2, 20 tons of CO, and 230 tons of particulate matter annually.

These mitigation measures indicated in Chapter 5 are not expected to control all fugitive dust over the long-term and air quality impacts from fugitive dust would continue to occur. Monitoring would be necessary to determine the effectiveness of dust suppression mitigation measures implemented on residential non-irrigated landscapes.

4.3.8 No Action Alternative

The No Action Alternative would not result in air quality impacts. No measurable impacts and no significant impacts are expected to occur.

4.3.9 Air Quality Impacts Resulting From Additional Power Demand

Preliminary project design and meetings with local and regional power entities indicate that additional power generating facilities would not be needed to supply electricity for the LPP Project because there is currently enough power available to meet the projected power demands. The power required to pump water through the intake and the booster pump stations would be generated at existing power stations in Arizona and transmitted to the pump station sites. The proposed pumped storage hydro generating station at the Hurricane Cliffs would consume available electric power during off-peak hours to pump water into the forebay reservoir for storage and then release during peak demand hours to generate electricity. Therefore, the LPP Project would not cause indirect air quality impacts resulting from new power generation emissions.

Chapter 5
Mitigation and Monitoring

5.1 Introduction

The direct and indirect air quality impacts associated with the alternatives would be caused by fugitive dust generated during construction activities and emissions from construction equipment. BMPs would be implemented to mitigate temporary air quality impacts during construction to control fugitive dust and construction equipment emissions. The BMPs would help avoid or minimize direct and indirect air quality impacts on human receptors. Persons and businesses near temporary construction activities would be notified of the construction efforts and potential short-term minor air quality and particulate matter impacts as part of the BMPs.

5.1.1 LPP Alternative (Intake System, Water Conveyance System, Hydro System, Kane County Pipeline System, Transmission Line Alignments, and Natural Gas Pipeline and Generators Alternative)

Air emissions BMPs would be implemented for all construction activities, including pipeline and penstock construction, site-specific construction for pump stations and hydro stations, helicopter use for transmission line construction, and new and improved access roads. Mitigation of direct and indirect air quality impacts caused by fugitive dust generated from construction activities would be accomplished using dust suppression methods such as physical coverings, spraying with water, or application of other liquid-based dust suppressants. Construction site restoration and revegetation would be performed as soon as feasible after the construction of pipeline, penstock and transmission line segments and site-specific pump stations and hydro stations has been completed. All dust suppression would be performed to meet federal, state and local requirements and according to standard construction practices. Mitigation of potential air quality impacts caused by emitted pollutants would be accomplished by using construction equipment with diesel engines rated as Tier 4 equipment, designed to control diesel combustion emissions. Construction activities on tribal lands must comply with tribal construction requirements.

Air quality monitoring would be performed during construction to make sure BMPs adequately mitigate temporary air quality impacts from fugitive dust and construction equipment emissions. The temporary monitoring would be terminated after completing construction of pipeline and transmission line segments, site-specific pump stations and hydro stations, and construction use of improved access roads and staging areas. Natural gas generators which meet permitting limits will be regulated and permitted by the permitting authority.

5.1.2 No Lake Powell Water Alternative

The indirect air quality impacts resulting from the No Lake Powell Water Alternative could be partially mitigated by implementing BMPs including physical covers and other liquid-based dust suppressants throughout residential landscapes converted to non-irrigated landscapes.

5.1.3 No Action Alternative

The No Action Alternative would not require air quality mitigation or monitoring because there would be no air quality impacts.

Chapter 6
Unavoidable Adverse Impacts

6.1 South Alternative

The South Alignment would have minor short-term unavoidable adverse impacts on air quality when fugitive dust emissions exceed NAAQS particulate matter criteria at the forebay reservoir construction site, particularly during construction and within the construction boundary. Most of the fugitive dust would disperse to concentrations below the NAAQS particulate matter criteria within the construction site boundary. If the NAAQS standards are exceeded, additional mitigation would be needed. If mitigation measures cannot control fugitive dust to concentrations within the NAAQS standards, the short-term air quality impacts would be considered unavoidable adverse impacts. Construction equipment emissions below the NAAQS criteria would have minimal short-term unavoidable adverse impacts on air quality.

6.2 Existing Highway Alternative

The Existing Highway Alternative would have the same unavoidable adverse impacts on air quality as described for the South Alternative in Section 6.1.

6.3 Southeast Corner Alternative

The Southeast Corner Alternative would have the same unavoidable adverse impacts on air quality as described for the South Alternative in Section 6.1.

6.4 Transmission Line Alignments

The Transmission Line Alignments would have the same unavoidable adverse impacts on air quality as described for the South Alternative in Section 6.1.

6.5 Natural Gas Pipeline and Generators Alternative

The Natural Gas Pipeline and Generators Alternative would have the same unavoidable adverse impacts on air quality as described for the South Alternative in Section 6.1.

6.6 No Lake Powell Water Alternative

The No Lake Powell Water Alternative could result in periodic unavoidable adverse impacts on air quality during high wind events. Fugitive dust not controlled by BMPs would be mobilized beyond dispersion zones and occasionally exceed NAAQS. These periodic unavoidable adverse impacts on air quality could be permanent.

6.7 No Action Alternative

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

Chapter 7 Cumulative Impacts

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

7.1 South Alternative

The South Alternative air quality effects would have no measurable cumulative effects when combined with the effects of the following actions:

- Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead EIS and ROD
- Operation of Glen Canyon Dam EIS and ROD
- Interim Surplus Criteria EIS and ROD
- Development and Implementation of a Protocol for High-Flow Experimental Releases from Glen Canyon Dam, Arizona, 2011 through 2020 EA
- Bureau of Reclamation and National Park Service LTEMP EIS

The South Alternative would have short-term direct cumulative effects on air quality with the effects of the Southern Corridor Highway. The South Alternative penstock would cross the Southern Corridor Highway through a carrier pipe already installed under the future intersection of both alignments. The South Alternative would have short-term indirect effects on air quality with the effects of the Southern Corridor Highway. Constructed areas reclaimed and planted for revegetation would be susceptible to wind erosion causing fugitive dust until the vegetation cover is established. The fugitive dust emissions from South Alternative construction areas reclaimed and the Southern Corridor Highway construction areas reclaimed could combine near Sand Hollow Reservoir to cause increased fugitive dust emissions. These short-term cumulative effects could be moderate in the immediate area where the South Alternative and Southern Corridor Highway intersect. Exceedances of the NAAQS particulate matter criteria are not expected.

7.2 Existing Highway Alternative

The Existing Highway Alternative would have the same cumulative impacts on air quality as described for the South Alternative in Section 7.1.

7.3 Southeast Corner Alternative

The Southeast Corner Alternative would have the same cumulative impacts on air quality as described for the South Alternative in Section 7.1.

7.4 Transmission Line Alignments

The Transmission Line Alignments would have the same cumulative impacts on air quality as described for the South Alternative in Section 7.1.

7.5 Natural Gas Pipeline and Generators Alternative

The Natural Gas Pipeline and Generators Alternative would have the same cumulative impacts on air quality as described for the South Alternative in Section 7.1.

7.6 No Lake Powell Water Alternative

The No Lake Powell Water Alternative would have short-term and potential long-term direct cumulative effects on air quality with the effects of the Southern Corridor Highway. These cumulative effects would be most intense near the Washington Fields Diversion where the two actions would intersect at the sites of the No Lake Powell Water Alternative pump station, diversion pipeline, reverse osmosis water treatment facility, and Warner Valley Reservoir embankment dam. Fugitive dust could be generated from exposed soils from both projects that could locally exceed NAAQS particulate matter criteria.

7.7 No Action Alternative

The No Action Alternative would have no cumulative impacts.

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Glossary

Attainment. An area considered to have air quality as good as or better than the national ambient air quality standards as defined in the Clean Air Act.

Fugitive Dust. Particulate matter (PM) consisting of very small liquid and solid particles. Fugitive dust is PM suspended in the air by the wind and human activities. It originates primarily from the soil and is not emitted from vents, chimneys, or stacks.

NAAQS (National Ambient Air Quality Standards). Standards established by the United States Environmental Protection Agency under authority of the Clean Air Act (42 U.S.C. 7401 et seq.) that apply for outdoor air throughout the country. Primary standards are designed to protect human health, with an adequate margin of safety, including sensitive populations such as children, the elderly, and individuals suffering from respiratory disease. Secondary standards are designed to protect public welfare from any known or anticipated adverse impacts of a pollutant (e.g. building facades, visibility, crops, and domestic animals).

PM_x. Particulate matter smaller than x microns.

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

Substation. A subsidiary station in which electric current is transformed to the service voltage level.

Abbreviations and Acronyms

Abbreviation/Acronym	Meaning/Description
AAQD	Arizona Air Quality Division
ADEQ	Arizona Department of Environmental Quality
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
BPS	Booster Pump Station
CFR	Code of Federal Regulations
CICWCD	Central Iron County Water Conservancy District
CO	Carbon Monoxide
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
GSENM	Grand Staircase-Escalante National Monument
HS	Hydro System
KCWCD	Kane County Water Conservancy District
kW	Kilowatt
LPP	Lake Powell Pipeline
M&I	Municipal and Industrial
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NPS	National Park Service
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PAD	Preliminary Application Document
PM	Particulate Matter
ppm	Parts Per Million
SIP	State Implementation Plan
SO2	Sulfur Dioxide
TSP	Total Suspended Pollutants
UDAQ	Utah Division of Air Quality
UDEQ	Utah Department of Environmental Quality
UDWRe	Utah Department of Water Resources
VOC	Volatile Organic Carbon
WCWCD	Washington County Water Conservancy District
WRCC	Western Regional Climate Center

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