Exhibit E

Environmental Impact Statement

FERC/EIS-0282

FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR HYDROPOWER LICENSE

Swan Lake North Pumped Storage Project—FERC Project No. 13318-003

Oregon

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, D.C. 20426

January 2019

FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Final Environmental Impact Statement

Attached is the final environmental impact statement (final EIS) for the proposed Swan Lake North Pumped Storage Project (No. 13318-003), that would be located about 11 miles northeast of Klamath Falls in Klamath County, Oregon.

This final EIS documents the view of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Federal Energy Regulatory Commission (Commission) staff. It contains staff evaluations of the applicant's proposal and alternatives for licensing the project.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The final EIS will be part of the record from which the Commission will make its decision. The final EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about January 25, 2019.

Copies of the final EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington D.C. 20426. The final EIS also may be viewed on the Internet at www.ferc.gov/docs-filing/elibrary.asp. Please call (202) 502-8222 for assistance.

Attachment: Final Environmental Impact Statement

COVER SHEET

a.	Title:	Licensing the Swan Lake North Pumped Storage Project, FERC Project No. 13318-003.
b.	Subject:	Final Environmental Impact Statement
c.	Lead Agency:	Federal Energy Regulatory Commission
d.	Abstract:	The proposed 393.3-megawatt Swan Lake North Pumped Storage Project (FERC No. 13318) would be located about 11 miles northeast of the city of Klamath Falls, Klamath County, Oregon. The project would occupy 730 acres of federal land administered by the U.S. Bureau of Land Management and the U.S. Bureau of Reclamation, state lands, and private lands. The project would be a closed-loop system, meaning it would not be connected to or use any existing surface body of water for project operations. Initial fill water and long-term refill due to evaporative losses would come from groundwater which would be supplied by the local groundwater agricultural pumping system and delivered to the lower reservoir via an existing underground agricultural irrigation network. Swan Lake North Hydro LLC (applicant) proposes to develop or finalize plans to protect and mitigate the environmental effects of project construction and operation on the following: soils, water quality, wildlife and wildlife habitat, public safety, traffic, aesthetics, and cultural resources. Staff's recommendation is to license the project as proposed, with certain modifications and additional measures recommended by the agencies.
e.	Contact:	Dianne Rodman Federal Energy Regulatory Commission Office of Energy Projects 888 First Street, N.E. Washington, D.C. 20426 (202) 502-6077

f.	Transmittal:	This final environmental impact statement on an application to construct and operate the Swan Lake North Pumped Storage Project is being made available for public comment on or about January 25, 2019, as required by the National Environmental Policy Act of 1969[1] and the Commission's Regulations Implementing the National Environmental Policy Act (18 CFR Part 380).

[1] National Environmental Policy Act of 1969, amended (Pub. L. 91-190, 42 U.S.C. 4321–4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act[3] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

That the project adopted…shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e)…[4]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[5] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[6]

[2] 16 U.S.C. §791(a)-825r (2012), as amended by the Electric Consumers Protection Act of 1986, Pub. L. 99-495 (1986), the Energy Policy Act of 1992, Pub. L. 102-486 (1992), and the Energy Policy Act of 2005, Pub. L. 109-58 (2005).

[3] Pub. L. 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. § 803(a) (2012).

[5] 16 U.S.C. § 803(g) (2012).

[6] 18 C.F.R. §385.206 (2018).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

APE	area of potential effects
AKWA	area of known wolf activity
BLM	U.S. Bureau of Land Management
BMP	best management practice
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
COTP	California-Oregon Transmission Project
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dBA	A-weighted decibel
DO	dissolved oxygen
EIS	environmental impact statement
ELF	extremely low frequency
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FWS	U.S. Department of the Interior, Fish and Wildlife Service
gpm	gallons per minute
GWh	gigawatt-hour
HPMP	Historic Properties Management Plan
HRA	Historical Research Associates
HUC	hydrologic unit code
Hz	Hertz
IPaC	Information for Planning and Consultation
KCPW	Klamath County Public Works
KOP	key observation point
kV	kilovolt
kW	kilowatt
mG	milligauss
mg/L	milligrams per liter
mph	miles per hour
msl	mean sea level
MW	megawatt
MWh	megawatt-hour

NAAQS	National Ambient Air Quality Standards
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act of 1966
NIEHS	National Institute of Environmental Health Sciences
NRCS	Natural Resources Conservation Service
NSA	noise sensitive area
NWI	National Wetland Inventory
NWPP	Northwest Power Pool
OAR	Oregon Administrative Rules
OC&E Trail	Oregon, California and Eastern Woods Line State Trail
OHV	off-highway vehicle
Oregon DEQ	Oregon Department of Environmental Quality
Oregon DFW	Oregon Department of Fish and Wildlife
Oregon PRD	Oregon Parks and Recreation Department
ORS	Oregon Revised Statutes
PA	Programmatic Agreement
REA	ready for environmental analysis
Reclamation	U.S. Bureau of Reclamation
RMP	Resource Management Plan
ROW	right-of-way
SD1	Scoping document 1
SD2	Scoping document 2
SHPO	State Historic Preservation Officer
SWAP	(Oregon) State Wildlife Action Plan
TCP	Traditional Cultural Property
TDS	total dissolved solid
TMDL	total maximum daily load
U.S.C.	United States Code
VRM	visual resource management
WHREP	Wildlife Habitat Restoration and Enhancement Plan

EXECUTIVE SUMMARY

Proposed Action

On October 28, 2015, Swan Lake North Hydro LLC (Swan Lake North Hydro) filed an application for a license with the Federal Energy Regulatory Commission (Commission or FERC) to construct and operate its proposed 393.3-megawatt (MW) Swan Lake North Pumped Storage Hydroelectric Project (project). The project would be located about 11 miles northeast of the city of Klamath Falls, Klamath County, Oregon. The project would occupy 730 acres of federal land administered by the U.S. Bureau of Land Management (BLM) and the U.S. Bureau of Reclamation (Reclamation), and 1,310 acres of state, county, and private lands. The project would generate an average of about 1.187 gigawatt-hours (GWh) of energy annually.

The project would be a closed-loop system, meaning it would not be connected to or use any existing surface body of water for project operations. Water to initially fill the reservoirs and to replace water lost to evaporation and seepage would come from groundwater supplied by the local groundwater agricultural pumping system and delivered to the lower reservoir via an existing underground agricultural irrigation network.

Proposed Project Facilities

The proposed project would consist of a new upper and lower reservoir, a high-pressure steel penstock between the upper reservoir and the powerhouse, a powerhouse with generating/pumping facilities, three low-pressure steel penstocks from the powerhouse to the lower reservoir, a transmission line and substation, access roads to the lower and upper reservoirs, and accompanying facilities (see figure 2-1).

The asphalt, concrete and geomembrane-lined upper reservoir would be created by a 7,972-foot-long, 58-foot-high earthen embankment and would have a surface area of 64.21 acres and a storage capacity of 2,568 acre-feet at a maximum surface elevation of 6,128 feet above mean sea level (msl). A bell mouth intake fitted with a 38.6-foot-wide by 29.8-foot-long inclined screen and head gate would withdraw water from the upper reservoir and deliver it to the powerhouse through a 13.8-foot-diameter, 9,655-foot-long, high-pressure steel penstock that would be predominantly aboveground with a 14-foot-long buried segment.

A partially buried powerhouse would be constructed adjacent to the lower reservoir and contain three 131.1-MW variable speed reversible pump-turbine units for a total installed capacity of 393.3 MW. Upon entering the powerhouse, the steel penstock would trifurcate to distribute flow to each pump-turbine unit, with flow distribution controlled by a spherical valve located at the intake of the pump-turbine units. Maximum hydraulic capacity of each turbine would be 3,230 cfs. Each turbine would discharge into the lower reservoir through a separate 9.8-foot-diameter, 1,430-foot-long steel

low-pressure penstock that would be predominantly aboveground with a 78-foot-long buried segment.

The asphalt, concrete and geomembrane-lined lower reservoir[7] would be created by a 8,003-foot-long, 65-foot-high earthen embankment and would have a surface area of 60.14 acres and a storage capacity of 2,581 acre-feet at a maximum surface elevation of 4,457 feet msl. Each reservoir would be fitted with a drainage system designed to detect, collect, and monitor water leakage from the reservoirs. A 500-foot-long, riprap lined trapezoidal spillway would be built into the crest of the upper and lower reservoir embankment at an elevation of approximately 6,135 feet msl and 4,464 feet msl, respectively.[8]

The 2,581 acre-feet of groundwater needed to initially fill the reservoirs and 357-acre-feet needed annually to make-up for evaporative and any seepage losses would be supplied by the local groundwater agricultural pumping system and delivered to the lower reservoir via an existing agricultural irrigation network.

The applicant would improve approximately 10.7 miles of existing roads and construct 3.4 miles of new permanent road to access the lower reservoir, upper reservoir, laydown areas, powerhouse, substation and some of the project transmission towers. The applicant would also construct approximately 8.3 miles of temporary project access road to construct portions of the transmission line.

Power generated by the project would be transmitted from the powerhouse through an adjacent fenced substation and then through a 32.8-mile-long, 230-kilovolt (kV) aboveground transmission line to interconnect with the existing non-project Malin Substation.

Proposed Project Operation

The proposed project would use off-peak energy (i.e., energy available during periods of low electrical demand) to pump water from the lower reservoir to the upper reservoir and generate energy by passing the water from the upper to the lower reservoir through generating units during periods of high electrical demand. Generation timing

---

[7] The lower reservoir would include a 25-inch-diameter bottom outlet with a manual valve for gravitational dewatering of the lower reservoir. Discharge from the bottom outlet would be released along Grizzly Butte and into Swan Lake Valley. Full dewatering of the reservoir should take approximately 21 days.

[8] The spillways would be located on the northern edge of the upper reservoir embankment and the southeastern edge of the lower reservoir embankment. The spillways would be designed to release 3,230 cubic feet per second (cfs), the maximum flow through the turbines. Flow over the spillways would only be expected during very large and exceedingly rare rainfall events or during emergency circumstances to maintain reservoir levels.

would be based on on-peak/off-peak power considerations, the need to augment the production of renewable wind and solar power generation, or to provide ancillary power services.[9]

The project is designed to pump approximately 2,110 acre-feet of water from the lower reservoir to the upper reservoir in approximately 11.5 hours; it would provide a maximum of 9.5 hours of generation per day at maximum generating output. Under typical operations, a full pumping/generation cycle would take 30 hours (1.2 days) or more than a day to complete. The maximum water level fluctuation in the upper reservoir would be 44 feet, and in the lower reservoir, it would be 50 feet.

Proposed Environmental Measures

The applicant proposes the following environmental measures to protect or enhance environmental resources at the project:

Geology and Soils

- Develop a soil erosion control plan that includes site-specific best management practices (BMPs) to control erosion during project construction.
- Construct the portions of the upper reservoir access road that cross intermittent waterbodies in the dry season to minimize erosion and sediment deposition.

Water Resources

- Construct berms around the project reservoirs to minimize the capture of surface water runoff by the project reservoirs and to minimize changes to the surface hydrology associated with the Swan Lake drainage area.
- Line the reservoirs to prevent seepage of project water into groundwater.
- Develop a hazardous substances spill prevention and cleanup plan that includes BMPs to prevent and contain the release of contaminants during all phases of construction and operation.
- Develop an adaptive water quality monitoring and management program to ensure levels of dissolved solids, nutrients, and heavy metals in the proposed reservoirs do not rise to levels that impair project operation or affect wildlife that may incidentally come in contact with project waters.

[9] Ancillary services help balance the transmission system as electricity is moved from generating sources to ultimate consumers and are necessary for proper grid operation. Ancillary services include: load following, reactive power-voltage regulation, system protective services, loss compensation service, system control, load dispatch services, and energy imbalance services.

Terrestrial Resources

- Finalize the Revegetation and Noxious Weed Management Plan filed with the license application that outlines the procedures for revegetation and control of noxious weeds and invasive plants in areas disturbed by construction.
- Conduct preconstruction surveys for sensitive plants, including slender Orcutt grass and Greene's tuctoria, and if found, enact protection measures (e.g., flagging and fencing or translocating individual plants) after consultation with the appropriate federal agency.
- Finalize the Wildlife Habitat Restoration and Enhancement Plan (WHREP) filed on July 26, 2016, to mitigate for lost and long-term disturbance of wildlife habitat that includes: installing/repairing two water guzzlers for big game; retaining a private road access easement and making improvements to a temporary access road to ensure BLM retains access to its lands for habitat improvements; acquiring or obtaining a long-term lease of 585 acres of land for big game and other wildlife habitat conservation, and funding BLM to thin 232 acres of western juniper and mixed conifer forest to improve the value of sagebrush habitat on Bryant Mountain.
- Develop an eagle conservation plan that includes: conducting two preconstruction surveys between May 1 and July 31 for two breeding seasons; prohibiting blasting and helicopter use within 0.5 mile of an active eagle nest between January 1 and August 15 and consulting with resource agencies before conducting other high-decibel activities; protecting the historic bald eagle nest tree near the lower reservoir on Grizzly Butte; constructing transmission structures to prevent eagle electrocution and collision to the extent practicable; and developing project- and transmission line-specific risk assessment models to determine if an eagle take permit is necessary.
- Develop an avian protection plan that includes: conducting two preconstruction surveys between May 1 and July 31 for raptors (two breeding seasons) and birds of conservation concern (one breeding season); prohibiting blasting and helicopter use within 0.5 mile of an active raptor nest between January 1 and August 15 and consulting with resource agencies before conducting other high-decibel activities; prohibiting ground-disturbing and vegetation-clearing activities in the reservoir areas between April 1 and July 15 to protect nesting songbirds; constructing transmission structures to prevent avian electrocution and collision to the extent practicable; installing flight diverters in five areas with a high risk of avian collisions; adjusting lighting systems to minimize disruption of nighttime foraging; avoiding the removal of shrubs, native grasses, and forbs along the transmission line; marking the project reservoir fencing

with vinyl strips and/or reflective tape to prevent avian collisions; and monitoring of the transmission line and reservoir fencing for bird collisions.

- Develop an ungulate protection plan that includes: fencing the project reservoirs to prevent drownings; daily monitoring of reservoir fencing; applying dust palliatives to ungraded or new roads to reduce dust clouds and minimize degrading the quality of adjacent habitats; decommissioning access roads that are unnecessary for long-term project operation and maintenance to reduce disturbance to wildlife and their habitats; covering trenches to reduce potential entrapment hazards to wildlife; creating wildlife crossings under the penstock to minimize impediments to wildlife movement; avoiding construction within the transmission corridor during wildlife winter range use to minimize disturbance; enforcing vehicle speed limits on all access roads to reduce collisions; and managing portions of the transmission line right-of-way (ROW) for wildlife benefits.

Recreation

- Develop an interpretive facility in consultation with stakeholders that includes educational and historical signage and a staging area for periodic guided tours of the hydroelectric facility to enhance recreational opportunities in the project area.
- Develop a public safety plan, in coordination with state, federal and county agencies that includes measures to protect the public during project construction and operation (e.g., safe operation of reservoirs, emergency vehicle access, preventing and monitoring access to reservoirs, working with Oregon Parks and Recreation Department (Oregon PRD) to ensure safety of those using the Oregon, California, and Eastern Woods Line State trail [OC&E Trail] during construction.
- Cooperate with BLM to support future efforts to design and construct BLM's proposed Swan Lake Rim Trail.

Aesthetics Resources

- Use locally quarried rock, preferably dark basalt, for the outer berm faces of the proposed reservoirs to match the colors of the surrounding landscape and plant vegetation to minimize visibility of the reservoirs. Paint the powerhouse, maintenance structures, and appurtenant facilities with colors that match the surrounding landscape, and dull the surfaces that cannot be painted; use BLM-approved paint colors; screen project facilities with vegetation; and keep facility yards clean of debris and unused materials to minimize the appearance of these structures.
- Use special lamps, covers, timers, and motion sensors on outdoor lighting to minimize light pollution.

- Install mono-pole-type transmission line structures instead of lattice-type structures; use weathering COR-TEN-type steel that would form a stable, rust-like appearance over time; and use conductors with non-specular materials where possible to minimize visibility and contrast of transmission line with the surrounding landscape.
- Reduce the prominence of land scarring and vegetation changes from the construction or modification of access and service roads to the extent possible by: using low-impact construction techniques such as helicopters to place and maintain transmission poles in sensitive or difficult to access locations; using locally quarried aggregate to match colors of the surrounding landscape; modifying road surface color to match the surrounding landscape; minimizing the widening and grading of roads; employing dust-suppression measures during construction; and replanting all disturbed areas with permanent vegetation consistent with the Revegetation and Noxious Weed Management Plan.

Cultural Resources

- Revise the Historic Properties Management Plan (HPMP) filed with the license application to mitigate, minimize, or avoid project-related adverse effects on those cultural resources eligible to be placed on the National Register of Historic Places (National Register).

Socioeconomics

- Develop a comprehensive traffic safety plan in cooperation with federal, state, and county agencies that includes measures for traffic control, directing the public around traffic pattern changes, public safety, and control of recreational off-highway vehicle access to public lands from the project's transmission line ROW during construction.

Public Involvement

Before filing its license application, the applicant conducted pre-filing consultation under the traditional licensing process. The intent of the Commission's prefiling process is to initiate public involvement early in the project planning process and encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to an application being formally filed with the Commission. After the application was filed, we conducted scoping to determine what issues and alternatives should be addressed. We distributed an initial scoping document to interested parties on July 8, 2016. Scoping meetings were held in Klamath Falls, Oregon, on August 9 and 10, 2016. On December 20, 2017, we requested conditions and recommendations in response to a notice that the application was ready for environmental analysis. We issued the draft EIS on August 22, 2018, and held a public meeting to receive comments on the draft EIS in Klamath Falls, Oregon, on September 26, 2018.

Alternatives Considered

This final environmental impact statement (EIS) analyzes the effects of the proposed project's construction and operation, and recommends conditions for any license that may be issued for the project. In addition to the applicant's proposal, we consider two alternatives: (1) no action, whereby the project would not be licensed and constructed; and (2) the staff alternative.

Staff Alternative

Under the staff alternative the project would include the applicant's proposed measures, with the following modifications and additions.

Water Resources

- Modify the proposed operational adaptive water quality monitoring plan to include: (1) specific methods to be used to monitor water quality in the project reservoirs; (2) threshold criteria and measures that would be taken if water quality in the project reservoirs deteriorates to below the threshold criteria; and (3) reporting procedures.

Terrestrial Resources

- Modify the Revegetation and Noxious Weed Management Plan to specify the seed mixes and plant species to be used, including wild celery and other plants important in tribal customs if practicable (i.e., seeds are available and site conditions would support their use); planting densities and methods, fertilization and irrigation requirements, monitoring protocols, and criteria for measuring the success of revegetation efforts, and expand the plan to cover vegetation management during project operation.
- Modify the proposed avian protection plan as follows: (1) include conduct an additional preconstruction survey in February to ensure that early nesting raptors are identified; (2) expand the preconstruction survey area from 0.25 mile to 0.5 mile around project features where no blasting would occur; (3) adjust the proposed spatial and temporal restrictions for construction activities as needed based on site-specific environmental conditions and nesting status; (4) install flight diverters on the section of transmission line between Hopper Hill and the temporary access road in Swan Lake Valley; (5) include quantifiable thresholds for determining when additional measures would be needed to address high-mortality areas based on the proposed transmission line monitoring; and (6) include procedures for documenting and reporting bird fatalities and injuries.
- Include in the proposed eagle conservation plan the following additional provisions: (1) conduct two preconstruction winter roost surveys for two winter seasons; and (2) include helicopter flight paths in preconstruction surveys for eagle nests and winter roosts.

- Modify the proposed WHREP to include: (1) a maintenance program for the proposed big game water guzzlers; (2) a management plan for conservation lands that identifies the parcels to be acquired, the criteria used to select the parcels, and habitat improvements that would be implemented on each parcel; (3) replacing the applicant's proposed road access easement mitigation measure with 50 acres of additional juniper removal to improve wildlife habitat; (4) an implementation schedule; and (5) a provision to bring the acquired lands into the project boundary.
- Modify the ungulate protection plan to include: (1) a big game water guzzler near the upper reservoir and one near the lower reservoir; and (2) a schedule for inspecting and making any necessary fence repairs that is developed in consultation with Oregon DFW.
- In the case of emergencies or unanticipated circumstances in which large numbers of wildlife are being endangered, harmed, or killed by the project or its operation, notify Oregon DFW within 24 hours (six hours for state or federal listed species); comply with restorative measures required by the agencies to the extent the measures don't conflict with license requirements; and inform the Commission within 10 days after each occurrence and specify the nature of the occurrence and restorative measures taken.
- Develop a fire prevention plan that describes the measures and protocols the licensee would follow to prevent wildfires during construction and operation, including the removal of slash by means other than burning within 1 year of its creation.

Recreation Resources

- File for Commission approval, conceptual drawings of the proposed interpretive facility, a map showing the location of facility features, and revised Exhibit G drawings, if revision of the project boundary is necessary to include the facility.
- Include in the proposed public safety plan specific measures to protect hikers and minimize disrupting use of the OC&E Trail during construction, including notification procedures, signage, and establishing a temporary alternate route around the construction area.

Land Use

- Develop a Harpold Dam and quarry coordination plan, in consultation with the Klamath Irrigation District and Horsefly Irrigation District, to coordinate the timing of installation and placement of the proposed transmission line to avoid or minimize disrupting their operations.

- Develop an agricultural operations coordination plan, in consultation with owners of agricultural lands that would be crossed by the transmission line, which considers pole spacing and installation timing in such a way that minimizes adverse effects on area farming practices.

Cultural Resources

- Revise the HPMP to include: (1) a culture-historic background section to give context to National Register eligibility determinations; (2) a revised map showing the direct and indirect area of potential effects (APE) established in consultation with the Oregon SHPO, BLM, Reclamation, and the Klamath Tribes; (3) National Register eligibility determinations (assessing for Criteria A, B, C, and D) on all cultural resources located within the project's direct APE, including a determination of the eligibility of Horton Rim, Harpold Dam, and Bryant Mountain Traditional Areas as TCPs or archaeological districts and any new sites discovered on lands that could not be surveyed because of access limitations; (4) procedures to evaluate project-related effects on cultural resources, and for consideration and treatment of adverse effects, as appropriate, in consultation with the SHPO, BLM, Reclamation, and the Klamath Tribes; (5) specific proposed measures for avoiding, reducing, or mitigating project-related adverse effects on the individual National Register-eligible cultural resources within the project's direct and indirect APE, including site-specific data recovery plans (including schedules to complete the work) for those pre-contact archaeological sites where direct project-related adverse effects cannot be avoided and scheduling construction to avoid traditional cultural practices as practicable (6) a description of future construction and operation activities that would be subject to review by the Oregon SHPO, BLM, and the Klamath Tribes (i.e., exempt, little effect, and case-by-case) and how the review would be conducted and adverse effects resolved; (7) detailed monitoring procedures during construction; and (8) detailed provisions for addressing any newly discovered cultural resources.

Socioeconomics

- Include in the traffic safety plan, details on how: work shifts would be scheduled; traffic and access would be controlled; the public notified of traffic pattern changes; disruption of Klamath County Public Works (KCPW) roadway and drainage facility maintenance and operations would be minimized; and bridge weight restrictions followed.

Air Quality

- Develop an air quality control plan to control fugitive dust and vehicle emissions during construction.

The staff alternative does not include the applicant's proposal to retain a private road access easement and make improvements to a temporary access road for BLM to access its lands. It also does not include a requirement to enforce vehicle speed limits on all access roads to reduce vehicle collisions with wildlife.

Environmental Impacts and Measures of the Staff Alternative

The primary issues associated with constructing and operating the project are: (1) soil erosion and fugitive dust caused by ground disturbance during construction; (2) increased concentrations of dissolved solids, nutrients, and heavy metals in the reservoirs over time; (3) permanent loss of 211 acres of wildlife habitat and temporary loss/disturbance of an additional 267 acres of habitat; (4) disruption of recreational use of the OC&E Trail and local traffic during project construction and disruption of the operation of the existing Harpold Dam and rock quarry during project operation; (5) visual impacts from the construction of 32.8 miles of overhead transmission line; and (6) significant unavoidable adverse effects on the Swan Lake Rim Traditional Cultural Property (TCP).

The environmental effects of the staff alternative are described in the following section.

Geology and Soils

Ground-disturbing activities during the construction of the upper and lower reservoirs, penstocks, powerhouse, substation, access roads, and transmission line would be likely to cause some soil erosion. Developing a site-specific comprehensive soil erosion control plan would control erosion and limit adverse effects on surrounding wildlife habitat by limiting the amount of disturbed ground to the extent possible, and preventing sediment transport.

Water Resources

Existing agricultural wells and water rights would be used to obtain water to initially fill the reservoirs and periodically make up for evaporative losses. Because the project would not need any additional water allocations, there would be no long-term effect on groundwater levels. Effects on surface water in the project area would be negligible and limited to precipitation captured within the reservoirs.

As water is exchanged between the reservoirs during project operation, dissolved solids, nutrients, and heavy metals could become concentrated. The applicant proposes to develop an adaptive water quality monitoring and management plan to monitor any changes in reservoir concentrations of dissolved solids, nutrients, and heavy metals over time. Implementing this plan as modified by staff would ensure that any deterioration in water quality would be detected and steps identified to protect operations and wildlife that may incidentally come in contact with project waters. Sealing the reservoirs with an

impervious geomembrane and lining them with concrete would prevent seepage into the groundwater that may adversely affect groundwater quality.

Fisheries Resources

No fish-bearing streams are located on land that would be directly affected by the project. The sites of the northernmost project facilities, including about 12 miles of the proposed transmission line, drain to Swan Lake, a closed-basin body of water that occasionally dries completely in late summer. The southern part of the project, which consists of about 21 miles of transmission line, would include a crossing of the Lost River, but no power poles would be installed within the river channel and no effects on the river's aquatic habitat or fisheries resources are expected.

Terrestrial Resources

Wildlife Habitat Mitigation

Constructing the project would result in the permanent or long-term (more than 5 years to recover) disturbance of 305.7 acres of big game wintering habitat. This habitat loss would be offset through the proposed habitat protection and improvements on 917 acres as outlined in the applicant's WHREP. The protection and habitat improvements include installing two water guzzlers for big game, acquiring or obtaining a long-term lease of 585 acres of land for wildlife habitat conservation, and funding BLM to thin 232 acres of western juniper and mixed conifer forest to improve the value of sagebrush habitat for mule deer and other wildlife. Revising the WHREP to include a maintenance program for the water guzzlers, management plans for all acquired conservation lands, and implementing juniper and mixed conifer thinning (as opposed to funding BLM to conduct the thinning) would mitigate for the lost wildlife habitat.

The applicant also proposes to seek to secure and transfer to BLM administrative access rights to an existing road across private lands, and retain and convert a 0.9-mile-long segment of new transmission line construction access road into a permanent road for exclusive use by BLM personnel and the applicant. BLM would use this 0.9-mile segment to access BLM lands and implement habitat improvement projects. The staff alternative does not include this measure because: (1) it is unclear what habitat improvements would be made by BLM on their lands; (2) how such improvements would mitigate project effects on wildlife; and (3) if and when the habitat improvements would take place. This measure was intended to provide 50 acres of mitigation value. To achieve the intended goal, the staff alternative includes direct habitat improvements, such as juniper and conifer thinning, on an additional 50 acres of land.

Vegetation Management

Disturbance of soils could cause soil erosion and introduce or spread various weed species that occur in the project area. Revising the proposed Revegetation and Noxious Weed Management Plan would reduce these adverse effects by ensuring that temporarily disturbed areas are quickly revegetated using native species, including species that may

be important to tribal practices like wild celery. The revised plan would include a better defined monitoring program to enhance the likelihood of successful growth and reestablishment. Under the staff alternative, the plan would be implemented throughout project operation to ensure that periodic vegetation maintenance practices do not degrade wildlife habitats and continue to promote native vegetation establishment.

Avian Protection

A diversity of raptors and other avian species can be found on Swan Lake Rim, Grizzly Butte, and in nearby valleys and agricultural fields, and numerous waterfowl and waterbirds use the Lost River and larger Klamath River Basin wetland system. Noise and human activity associated with project construction could disrupt breeding birds, and the project's 32.8-mile-long transmission line could pose a collision or electrocution hazard to migrating birds. The proposed avian protection plan and associated bald eagle conservation plan contain several measures that would protect avian species throughout the construction and operation periods, including conducting preconstruction surveys for nesting raptors, restricting construction activities around active nests, and installing bird flight diverters on segments of the transmission line to reduce collision hazards. Under the staff alternative, disturbance of nesting bald eagles, other raptors and sensitive birds would be further reduced by conducting a preconstruction survey in February (in addition to the two proposed between May 1 and July 31) to capture early nesting raptors, expanding the preconstruction survey area from 0.25 mile to 0.5 mile and including helicopter flight paths in the survey area, and adjusting spatial and temporal construction restrictions based on site-specific environmental (e.g., elevation) or biological (e.g., nesting status) conditions determined during the preconstruction surveys. Potential disturbance to eagles at winter roost sites would be minimized by conducting preconstruction winter roost surveys and adjusting spatial and temporal construction restrictions based on the survey results. Installing additional bird flight diverters on approximately two miles of transmission line north of Hopper Hill, and developing quantifiable thresholds for when additional protection measures might be needed based on the proposed transmission line monitoring data would further minimize the potential for bird collision and electrocution.

Emergency Notifications

Under the staff alternative, we also recommend that the applicant establish procedures for notifying Oregon DFW and the Commission when emergencies result in significant wildlife injury or mortality. Notification procedures would allow for a rapid response and assessment of emergency situations by experts that could provide recommendations to remedy the situation.

Ungulate Protection

Mule deer are an important resource in the project area and populations are currently below management goals. Construction and operation of the project could create stress and mortality to the local deer subpopulation through vehicle collisions,

entrapment within construction trenches, alteration of migratory pathways, and disturbance of deer during sensitive periods. However, the measures to be included the applicant's proposed ungulate protection plan would minimize these effects. Under the staff alternative, we recommend providing additional drinking water sources (one water guzzler near the upper reservoir and one near the lower) as an alternative to the reservoirs. This would minimize the amount of time and energy wildlife might expend in attempting to access and drink from the reservoirs. We also recommend that the plan be developed in consultation with Oregon DFW, and include a schedule for inspecting and making any necessary repairs to the reservoir fencing.

Wildfire Prevention

The climate in the project area is semi-arid and subject to wildfires. Vegetation clearing to construct the project and to periodically maintain the transmission line corridor would create slash that could build up concentrations of combustibles that could fuel wildfires. Developing protocols for preventing wildfires including promptly removing slash would help to avoid fires.

Threatened and Endangered Species

Eight federally listed species have the potential to occur in the project area: the Lost River sucker, shortnose sucker, Applegate's milk-vetch, Greene's tuctoria, slender Orcutt grass, yellow-billed cuckoo, northern spotted owl, and gray wolf. The proposed threatened North American wolverine and the candidate species whitebark pine also have the potential to be in the project area. There is no designated critical habitat in the project area.

Project construction and operation would not affect the Lost River sucker, shortnose sucker, Applegate's milk-vetch, Greene's tuctoria, slender Orcutt grass, yellow-billed cuckoo, North American wolverine, or whitebark pine because they are not known to occur within the project vicinity and no suitable habitat for these species occurs in the project area.

Project construction and operation would not affect northern spotted owls because they are not likely to use the recently disturbed forested area surrounding the project, and designated home ranges within the Fremont-Winema National Forest are located far enough away (i.e., over 2 miles) that they would not be disturbed.

Gray wolves are unlikely to permanently reside in the project area because of the marginal habitat it provides, but transient wolves may use proposed project lands temporarily during dispersal periods, as in 2016, when a lone male was documented within a few miles of the proposed project. Project construction could discourage wolves and their prey from entering the area, but such effects would be localized and short-term given the wolves' transitory and very limited use of the project area. Actions during project operation, such as occasional infrastructure monitoring or vegetation maintenance activities, would be similarly localized and short-term in nature, and thus would be unlikely to adversely affect wolves that may pass through the area in the future. Habitat

improvements achieved from implementing the WHREP may improve prey availability. Therefore, constructing and operating the project may affect, but is not likely to adversely affect the gray wolf.

Recreation

Recreational use in the immediate project area is relatively light, consisting primarily of dispersed uses such as hunting, hiking, and wildlife viewing. The OC&E Trail, however, receives significant use and would be crossed by the project transmission line at two locations. Construction activities in these locations would be expected to temporarily interrupt use of the OC&E Trail. Including measures in the applicant's proposed public safety plan that address how users of the OC&E Trail would be informed of construction activities and alternative routes would help to mitigate disruptions to trail use. Developing these measures in consultation with BLM, Oregon PRD, and the Oregon DFW would ensure that agency concerns and recommendations regarding trail safety are adequately addressed in the plan. Developing the applicant's proposed interpretive facility and establishing an area to meet for guided tours of the hydroelectric facility would enhance the public's knowledge of the project and the surrounding environment. However, additional detail describing the location, content, and design of the facility and meeting area would be needed before the installation's construction could be initiated. Filing conceptual drawings of the facility for Commission approval within one year of license issuance and including the facility within the project boundary would help to ensure that the facility is built to appropriate standards and maintained over the term of any license that may be issued.

Land Use

Land use, other than recreation, in the project area is mostly agricultural with some rural residences, commercial forestry, open space, wildlife habitat management, and small rock quarry operations. The project would occupy federal, state, and private lands. Part of the upper reservoir and penstock, some access roads, and about half of the 32.8-mile-long transmission line would be located on BLM land along Swan Lake Rim, Horton Rim, and Bryant Mountain. A small portion of transmission line would cross Reclamation land at the Lost River. In total, the project would occupy 711 acres of BLM land and 19 acres of Reclamation land. In order to occupy these federal lands, the applicant would be required to obtain a right of way authorization from BLM and a use authorization from Reclamation. The lower reservoir, powerhouse, and part of the penstock would be on private agricultural lands as would most of the remaining length of transmission line.

Agriculture

Inundation by the project's two reservoirs would permanently remove some agricultural land currently used for grazing and growing crops, although use of adjacent lands would not change. The proposed lay down and staging areas for the two reservoirs would temporarily remove lands from agricultural production as would temporary access

roads built to access the transmission line corridor. The transmission line poles would displace small portions of land from their current uses and could, in certain areas, interfere with farm operations. Identifying the construction timing, and placement of the transmission poles in consultation with landowners of agricultural land crossed by the transmission line would minimize any adverse effects on agricultural operations. The applicant's proposal to fully restore temporarily disturbed areas to their original uses and to compensate landowners for both temporary and permanent loss of land would further minimize or offset such impacts.

Operation of Harpold Dam and Rock Quarry

The project transmission line would cross directly over an existing rock quarry operated by the KCPW and Klamath Irrigation District, and immediately upstream of Harpold Dam which is operated by the Horsefly Irrigation District. The presence of the transmission line towers, if not properly placed, could interfere with quarry operations, and construction traffic and activities could temporarily impede access to the quarry and dam. Developing a plan to identify the design and installation of the transmission line in consultation with KCPW, the Klamath Irrigation District, and the Horsefly Irrigation District would help to minimize interference and disruption of each entity's respective operations.

Electromagnetic Fields and Electrical Interference

Because the proposed transmission line is high voltage (230 kV), it would create electromagnetic fields (EMFs) and possibly electrical interference within and adjacent to the corridor. Recreationists using the OC&E Trail, those travelling on roads, and livestock that cross the corridor would be temporarily exposed to EMF radiation while within or immediately adjacent to the corridor. These exposures would likely be intermittent and brief, so significant exposure to EMFs is not expected. Any EMF exposure to residents living near the proposed transmission line ROW is expected to be minor given that exposure levels drop by 99 percent within 300 feet from the source and the closest residences to the transmission line are located well beyond this distance. Electrical interference from the transmission line with high frequency electrical devices, such as digital TVs, cellphones, and computers, is unlikely because high voltage transmission lines operate at very low frequencies.

Aesthetics Resources

Despite its rural character, the landscape in the project area contains many human modifications, including residences and communities, farm structures, highways and other roads, substations, transmission lines, and natural gas pipelines. Project facilities would add to the existing infrastructure in the project area and would therefore contribute to cumulative visual effects within the Lost River Basin.

Visual simulations indicate that the applicant's proposed mitigation measures would reduce the contrast of project facilities with the surrounding landscape to the extent practicable. Those measures include designing and aligning project features to be

as unobtrusive as possible, using paint or non-reflective materials that blend with the environment, using vegetation and natural features to screen facilities, employing various light pollution reduction measures, and quickly restoring and revegetating disturbed areas. Implementing these measures would ensure that visual impacts from project development are mitigated to the extent practicable.

Cultural Resources

Cultural resource investigations define the Swan Lake Rim as a traditional cultural landscape or traditional cultural property (hereafter Swan Lake Rim TCP). The TCP contains a high density of individually recorded pre-contact archaeological sites and natural landscape features (Swan Lake Rim, Grizzly Butte, and Swan Lake) that ethnographically represent various traditional functions (mostly religious and ceremonial) that were prominent in the oral histories of the Klamath Tribes. Land ownership within the TCP is a combination of private and public lands. Grizzly Butte, the site of the lower reservoir, powerhouse, and part of the penstock and transmission line is privately owned (Edgewood Range Inc.), while the upper reservoir and penstock cross BLM lands. Where the transmission line crosses Horton Rim, Harpold Dam, and Bryant Mountain, the lands primarily belong to BLM and Reclamation.

The project reservoirs and laydown areas would be located within the northern half of the Swan Lake Rim TCP. Sixty-three related pre-contact archaeological sites that are contributing elements to the TCP and considered eligible for the National Register have been found in these construction areas. Of the 63 sites, 16 would be destroyed during site construction, and another 47 would be indirectly adversely affected by the proposed project.

An additional 22 National Register-eligible pre-contact stacked rock sites located in the Horton Rim, Harpold Dam, and Bryant Mountain portions of the proposed project area could be directly adversely affected by siting and placement of powerlines and poles, removal of vegetation, and with the construction of access roads.

The proposed draft HPMP does not incorporate the results of several studies completed since the filing of the license application and lacks a detailed approach to resolving these site-specific adverse effects to significant cultural resources. Adverse effects to the archaeological sites could be mitigated through the development of a more detailed HPMP that includes: completing National Register eligibility determinations on all cultural resources located within the project's direct APE; a detailed set of measures to avoid, reduce, or mitigate project-related adverse effects, including site-specific data recovery plans (including schedules to complete the work) for those pre-contact archaeological sites where direct project-related adverse effects cannot be avoided; and measures for addressing any undiscovered sites during construction. To fulfill its section 106 responsibilities, Commission staff intend to execute a Programmatic Agreement (PA) that stipulates the development of a more detailed HPMP and defines consultation procedures for resolving conflicts.

Nevertheless, the project would be a permanent feature on the landscape and would adversely affect the Klamath Tribes cultural use and practices within the Swan Lake TCP, and other places of cultural significance within the Horton, Harpold Dam, and Bryant Mountain Traditional Areas. The Klamath Tribes state that the proposed project would have significant irreversible adverse effects on the Swan Lake Rim TCP and other sacred areas south of the TCP that cannot be resolved and would cause irretrievable harm to their cultural identity and their traditional and religious well-being as a people. The applicant has not proposed and staff have not identified any measures that would mitigate this effect. While it is not known how the Klamath Tribes currently access Grizzly Butte to conduct its cultural practices, future use of Grizzly Butte by the Klamath Tribes would not necessarily be guaranteed in the absence of the proposed project because of its private ownership. Swan Lake Rim, Horton Rim, Harpold Dam, and Bryant Mountain traditional use areas would continue to be accessible to the Klamath Tribes across public lands managed by BLM and Reclamation, but their cultural practices would be adversely affected by the addition of the project features on the landscape.

Socioeconomics

Project construction would result in an influx of 300 construction-related workers to the area over a 3- to 5-year construction period, with a peak of 200 to 250 employees during year 2 or 3. This increase in population would be spread out over multiple communities and would not be expected to overburden law enforcement, fire protection, emergency services, health care facilities, housing, or schools in the area. Job opportunities from constructing the project as well as increased local spending from project personnel would result in a positive effect on the local economy. No existing businesses would be displaced although some farm land would be temporarily taken out of production; however, the applicant proposes to compensate landowners for this loss.

During project operation, the permanent influx of 40 to 60 families would benefit the local economy from salaries, income taxes, property taxes, and the purchase of real estate and goods and services.

The project would generate construction traffic on local roads, possibly creating delays, changes in traffic patterns, and safety issues. Developing a comprehensive traffic safety plan that includes staggering work shifts, defining necessary traffic control measures and traffic pattern changes, and coordinating with KCPW to minimize interference with its roadway and drainage facilities maintenance and operation, would minimize traffic-related effects on the community.

The proposed project transmission line would parallel the private Loveness Landing Airstrip. However, operation of the airstrip would not be affected because the transmission line would be located between 800 and 900 feet from the airstrip, which meets Federal Aviation Administration safety standards.

Air Quality and Noise

Construction activities would result in emissions of air pollutants through fugitive dust and vehicle exhaust. To minimize air quality impacts during construction, staff recommends that the applicant develop and implement an air quality control plan with specific measures to reduce fugitive dust and vehicle exhaust during construction, such as covering or maintaining at least 2 feet of freeboard space on haul trucks transporting soil, sand, or other loose material; adding soil palliatives to disturbed areas; and incorporating dust collectors into the temporary concrete batch plant. Long-term operational effects on air quality would be negligible.

Project construction- and operation-related noise could increase ambient sounds and disturb residents, visitors, and wildlife. Noise that could be attributed to the project would primarily consist of short-term construction noise produced during heavy earthwork. Because of the short duration and temporary nature of elevated noise levels during project construction, intervening vegetation and topography, and distances between noise sources and receptors, effects should be minor. The applicant's proposed WHREP, eagle conservation plan, and avian protection plan would include timing restrictions to minimize or avoid disturbance to wildlife during sensitive periods such as nesting. Noise from project operation, including from the powerhouse, would not be noticeable at any noise-sensitive area.

Conclusions

Based on our analysis, we recommend licensing the project as proposed by Swan Lake North Hydro with some staff modifications and additional measures.

In section 4.2 of the EIS, we estimate the likely cost of alternative power for each of the two alternatives identified above. Our analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $13,346,600, or $11.24/megawatt-hour (MWh) less than the likely alternative cost of power. Under the staff alternative, project power would cost $13,329,300, or $11.23/MWh less than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (1.187 GWh annually); and (2) the recommended environmental measures proposed by Swan Lake North Hydro, as modified by staff, would adequately protect and enhance environmental resources affected by the project. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

FINAL ENVIRONMENTAL IMPACT STATEMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Swan Lake North Pumped Storage Hydroelectric Project
FERC Project No. 13318-003—Oregon

1.0 INTRODUCTION

1.1 APPLICATION

On October 28, 2015, Swan Lake North Hydro LLC (applicant or Swan Lake North Hydro) filed an application for an original license for the Swan Lake North Pumped Storage Hydroelectric Project (project) with the Federal Energy Regulatory Commission (Commission or FERC). The 393.3-megawatt (MW) project would be located about 11 miles northeast of the city of Klamath Falls, Klamath County, Oregon (figure 1-1). The project would occupy 730 acres of federal lands administered by the U.S. Bureau of Land Management (BLM) and the U.S. Bureau of Reclamation (Reclamation), and 1,310 acres of state, county, and private lands The project would generate an average of about 1.187 gigawatt-hours (GWh) of energy annually.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed project is to provide a new source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a license to Swan Lake North Hydro for the project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

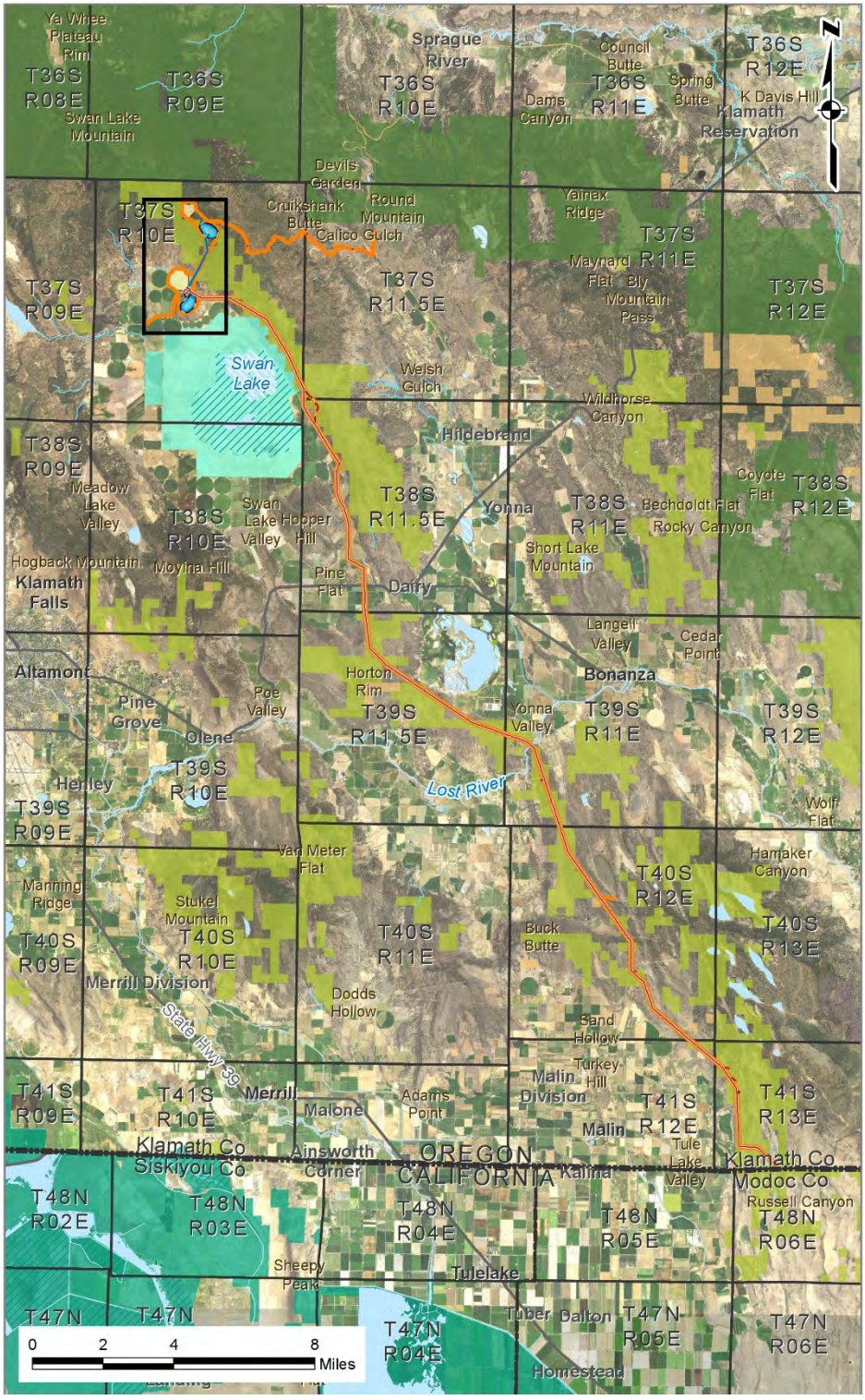

Figure 1-1. Location of Swan Lake North Pumped Storage Hydroelectric Project (Source: Swan Lake North Hydro, as modified by staff).

Issuing an original license for the project would allow the applicant to generate electricity at the project for the term of a license, making electrical power from a renewable resource available to its customers.

This environmental impact statement (EIS) assesses the effects associated with construction, operation, and maintenance of the project and alternatives to the proposed project. It also includes recommendations to the Commission on whether to issue a license, and if so, includes the recommended terms and conditions to become a part of any license issued.

In this EIS, we assess the environmental and economic effects of constructing, operating, and maintaining the project: (1) as proposed by the applicant and (2) with our recommended measures. We also consider the effects of the no-action alternative, which is denying the license. Important issues that are addressed include: (1) soil erosion and fugitive dust caused by ground disturbance during construction; (2) increased concentrations of dissolved solids, nutrients, and heavy metals in the reservoirs over time; (3) permanent loss of 211 acres of wildlife habitat and temporary loss/disturbance of an additional 267 acres of habitat; (4) disruption of recreational use of the OC&E Trail and local traffic and the operation of the existing Harpold Dam and rock quarry during project construction; (5) visual impacts from the construction of the 32.8-mile-long transmission line; and (6) significant irreversible adverse effects on the Swan Lake Rim Traditional Cultural Property (TCP).

1.2.2 Need for Power

The project would provide hydroelectric generation to meet part of Oregon's power requirements, resource diversity, and capacity needs. The project would use surplus renewable power to pump water from the lower-elevation reservoir to the higher reservoir during low demand periods, and generate power for up to 10 hours when grid operators need more energy to meet demand or to balance sudden drop-offs in solar or wind production. The project would have an installed capacity of 393.3 MW and generate approximately 1,187 GWh per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Swan Lake North Project is located within the jurisdiction of the Northwest Power Pool, United States area (NWPP), a sub-region of the Western Electricity Coordinating Council, a region of the NERC. According to NERC's 2017 forecast, average annual demand requirements for the NWPP sub-region are projected to grow at a rate of 0.6 percent from 2018 through 2027. NERC projects resource capacity margins (generating capacity in excess of demand) will range between 22.1 percent and 28.5 percent of firm peak demand during the 10-year forecast period, including estimated new capacity additions. Over the next 10 years, NERC estimates that about 4,500 MW of additional capacity will be brought on line.

Power from the Swan Lake North Project would help meet a need for power in the NWPP sub-region in both the short and long term. The project would provide power that would displace non-renewable, fossil-fired generation and contribute to a diversified generation mix. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Swan Lake North Project would be subject to numerous requirements under the FPA and other applicable statutes, as summarized below.

1.3.1 Federal Power Act

1.3.1.1 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation will be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. Neither BLM, which manages 711 acres of land that would be occupied by the project, nor Reclamation, which manages 19 acres, filed section 4(e) conditions.

1.3.1.2 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Oregon Department of Fish and Wildlife (Oregon DFW) timely filed,[10] on February 20, 2018, recommendations under section 10(j), as summarized in table 5-1, in section 5.3.1, *Recommendations of Fish and Wildlife Agencies*. In section 5.3, we also discuss how we address the agency recommendations and comply with section 10(j).

[10] The Commission's Rules of Practice and Procedure provide that if a filing deadline falls on a Saturday, Sunday, holiday, or other day when the Commission is closed for business, the filing deadline does not end until the close of business on the next business day. 18 C.F.R. § 385.2007(a)(2) (2018). Because the 60-day filing deadline fell on a holiday (i.e., February 19, 2018), the filing deadline was extended until the close of business on Tuesday, February 20, 2018.

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. In its license application, Swan Lake North Hydro states that a 401 water quality certification for the project is not required because as a closed loop project it would not withdraw from or discharge into surface waters. On April 10, 2018, Swan Lake North Hydro requested Oregon Department of Environmental Quality (Oregon DEQ) concurrence with this determination. On June 19, 2018, Swan Lake North Hydro filed Oregon DEQ's June 19, 2018, concurrence, stating that, for reasons cited by Swan Lake North Hydro, a water quality certification is not needed for the project.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Several federally listed species have the potential to occur in the project area. Species with endangered status include the gray wolf (*Canis lupus*), Lost River sucker (*Deltistes luxatus*), shortnose sucker (*Chasmistes brevirostris*), Applegate's milk-vetch (*Astragalus applegatei*), and Greene's tuctoria (*Tuctoria greenei*). Three other species are listed as threatened: northern spotted owl (*Strix occidentalis caurina*), yellow-billed cuckoo (*Coccyzus americanus*), and slender Orcutt grass (*Orcuttia tenuis*). The proposed threatened North American wolverine (*Gulo luscus*) and the candidate species whitebark pine (*Pinus albicaulis*) may also be present in the project area. There are no critical habitats in the project area. Our analyses of project impacts on threatened and endangered species are presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

We conclude that licensing of the project, as proposed with staff-recommended measures, would have no effect on the Lost River sucker or the Shortnose sucker because neither species is found in the project vicinity. Additionally, measures proposed by applicant would ensure that surface water hydrology in the Lost River Basin would be unaltered.

Based on Swan Lake North Hydro's field surveys, we also conclude that the project would not affect the Applegate's milk-vetch, Greene's tuctoria, slender Orcutt grass, yellow-billed cuckoo, North American wolverine, or whitebark pine because these species are not known to occur within the project vicinity and/or suitable habitat does not exist in the project area. Additionally, the applicant proposes to consult with resource agencies regarding special-status plant species protection measures and take appropriate measures to avoid or minimize effects if they are found during preconstruction surveys.

Northern spotted owls occur north of the project within the old growth forested habitat of the Fremont-Winema National Forest. Designated home range territories are

more than 2 miles from the project boundary and would not be affected by noise from project construction or operation activities. In addition, northern spotted owls are unlikely to use the early to mid-seral stage forested areas on Swan Lake Rim plateau. Therefore, we conclude that the project would not affect this species.

There are no known gray wolves currently using the project area. However, the project is at the border of potential wolf range habitat, and at least one wolf is known to have been within the project vicinity in recent years. During project construction, noise and human activity may cause wolves and their prey base to avoid the area, but we expect effects to wolves would be localized and short-term given their transient use of the proposed project's marginal habitat. Similarly, project operation activities (e.g., monitoring the reservoir fencing and transmission line infrastructure, occasional vegetation maintenance activities along the transmission line right-of-way (ROW), would be localized and short-term, and thus would be unlikely to adversely affect any wolves that may occasionally be traveling through or hunting near the project area. Mitigation projects to benefit big game winter range habitat may positively benefit the wolf's prey base and influence the occurrence of wolves in the area. We conclude that the project may affect, but would not likely have a significant adverse effect, on transient wolves. On October 9, 2018, FWS filed its concurrence with staff's findings. No further consultation pursuant to the ESA is required.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 United States Code (U.S.C.) §1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The project would be not located within the state-designated coastal management zone, which extends inland to the crest of the Cascade Mountain Range, and along river basins, including the Klamath River Basin, that bisect the Cascade Range. The project would be located east of the Cascade Mountain Range, at least 10 miles northeast of the Klamath River and would be a closed-loop system using only groundwater taken from an existing irrigation network; therefore, the project would not affect Oregon's coastal resources. Because the project would have no effect on coastal resources, it is not subject to Oregon's coastal zone program review, and no consistency certification is needed for the action.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering,

and culture that are eligible for inclusion in the National Register of Historic Places (National Register). To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the construction, operation, and maintenance of the Swan Lake North Project. The terms of the PA would ensure that Swan Lake North Hydro addresses and treats all historic properties identified within the project's direct area of potential effects (APE) through the finalization of a Historic Properties Management Plan (HPMP). On September 21, 2018, we provided the Oregon SHPO with a draft PA and HPMP for review. The Oregon SHPO filed detailed comments on the draft PA and HPMP on October 25, 2018, which we discuss in section 3.3.8.2, *Cultural Resources, Environmental Effects*. Following the issuance of the FEIS, staff will issue the final PA and seek to execute the PA with the Oregon SHPO, BLM, Reclamation, the Klamath Tribe, and the Advisory Council if it chooses to be involved.

1.3.6 Pacific Northwest Power Planning and Conservation Act

As part of its Columbia River Basin Fish and Wildlife Program (Program), the Northwest Power Planning Council has designated over 40,000 miles of river in the Pacific Northwest region as not being suitable for hydroelectric development ("protected area"). Because the project would be a closed-looped system that would not be hydraulically connected to any surface waters, the project would not be located on or develop a protected area. However, the project transmission line would cross the Lost River (figure 3-2), which is a protected reach designated for wildlife. Our recommendations to minimize avian collisions, reduce disturbance effects on mule deer, revegetate disturbed areas with native vegetation, and manage the transmission line corridor to benefit wildlife would minimize effects of the transmission line on the resources for which the Lost River reach was designated and thus would not be inconsistent with the protected area provisions of the program.

1.3.7 Wild and Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to make a determination as to whether the operation of the project under a license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. Public Law 99-552 (October 27, 1986) designated the Klamath River as a Wild and Scenic River, which extends from J.C. Boyle powerhouse downstream for a distance of 11 miles. BLM manages the Klamath Wild and Scenic River to protect and enhance the free-flowing condition, water quality, and outstanding remarkable values for which the river was designated while providing for public recreation and resource uses that do not adversely affect or degrade those values. The project is not located on, nor would it directly affect, the Klamath River; therefore, it would have no effect on the values for which the river segment is designated.

1.3.8 Federal Land Policy and Management Act

Title V of the Federal Land Policy and Management Act of 1976 authorizes the BLM to grant, issue, or renew ROWs over, upon, under, or through BLM lands for the generation, transmission, and distribution of electric energy. BLM's authority to issue a ROW is limited to those hydropower projects that were proposed after October 24, 1992, or that would expand onto BLM-managed lands after October 24, 1992. A ROW application was filed with BLM on July 21, 2017, that would cover the upper reservoir, part of the penstock, access roads, and about half of the transmission line. A ROW permit has not yet been issued. A BLM-issued ROW will contain the terms and conditions that the BLM deems necessary for the protection of BLM-managed lands and resources.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], section 4.38) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, ESA, the NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

On November 9, 2015, the Commission issued a public notice that, among other things, solicited requests from federal, state, local, and tribal agencies with jurisdiction and/or special expertise with respect to environmental issues to cooperate in preparing the environmental document. There are no cooperating agencies.

Before preparing this EIS, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) was distributed to interested agencies and others on July 8, 2016. It was noticed in the Federal Register on July 14, 2016. Two scoping meetings, both advertised in the Klamath Falls Herald and News, were held on August 9 and 10, 2016, in Klamath Falls, Oregon, to request oral comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
Jon Flegel	August 17, 2016
William K. Tamplen	August 22, 2016
Pat Lunde	August 24, 2016
Marganne Oxley	August 24, 2016

Commenting Entity	Date Filed
Dave Wirth	August 31, 2016
National Park Service	September 6, 2016
Rod Neterer	September 6, 2016
Klamath Tribes	September 7, 2016
Oregon Water Resources Department	September 8, 2016
Oregon Department of Fish and Wildlife	September 9, 2016
Matthew Iversen	September 9, 2016
Mary Hunnicutt	September 9, 2016
Jesperson Swan Lake Inc.	September 12, 2016
U.S. Bureau of Reclamation	September 12, 2016
Dan R. Cohan	September 12, 2016
Klamath Tribes Tribal Council	September 12, 2016
Klamath Tribes	October 25, 2016

A revised scoping document (SD2), addressing these comments, was issued on September 30, 2016.

1.4.2 Interventions

On December 18, 2015, the Commission issued a notice that Swan Lake North Hydro had filed an application for an original license for the Swan Lake North Pumped Storage Project. This notice set February 16, 2016, as the deadline for filing motions to intervene and protest. In response to the notice, the following entities filed motions to intervene:

Intervenor	Date Filed
Oregon Water Resources Department	February 3, 2016
Lester R. Sturm Trust	February 4, 2016
Oregon Department of Environmental Quality	February 5, 2016
PacifiCorp	February 11, 2016
U.S. Department of the Interior	February 12, 2016
Oregon Department of Fish and Wildlife	February 16, 2016
Jespersen Swan Lake Inc.	February 16, 2016

1.4.3 Comments on the Application

A notice requesting conditions and recommendations was issued on December 20, 2017. The following entities commented:

Commenting Agency and Other Entity	Date Filed
Michael S. Bandfield	December 29, 2017
Klamath Tribes	January 9, 2018
Duane Flackus	January 10, 2018
Dave B. Wirth	January 12, 2018
John and Lori Venable	February 6, 2018
Oregon Department of Environmental Quality	February 16, 2018
U.S. Department of the Interior	February 16, 2018
Oregon Water Resources Department	February 16, 2018
Oregon Department of Fish and Wildlife	February 20, 2018
Julie Jespersen	February 21, 2018
Natural Resources Conservation Service	February 21, 2018
U.S. Bureau of Land Management	February 22, 2018

The applicant did not file reply comments.

1.4.4 Comments on the Draft Environmental Impact Statement

The draft EIS was sent to the U.S. Environmental Protection Agency (EPA) and made available to the public on August 22, 2018. Written comments on the draft EIS were due October 30, 2018. In addition, oral testimony on the draft EIS was received during a public meeting held in Klamath Falls, Oregon, on September 26, 2018. Appendix A summarizes the substantive comments, includes staff responses to those comments, and indicates where we made modifications to this final EIS, as appropriate.

1.5 TRIBAL CONSULTATION

By letter dated October 26, 2010, Commission staff notified the Klamath Tribes and the Modoc Tribe of Oklahoma that Swan Lake North Hydro was preparing a license application for the project, and offered to meet with them to discuss their roles in the licensing process and ensure that issues of concern to the Tribes were addressed in the prefiling phase of the process. The Klamath Tribes provided comments on the project on March 8, 2011, but did not request a meeting. The Modoc Tribe of Oklahoma did not respond.

After the license application was filed, Commission staff met with Klamath Tribes' members on August 11, 2016, and March 30, 2017, at tribal headquarters in Chiloquin, Oregon, to review the licensing process and hear the Tribes' concerns. Since filing of the application, the Klamath Tribes have filed 8 letters commenting on the project. Commission staff have considered those comments in the development of the final EIS.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is license denial. Under the no-action alternative, the project would not be built, and the environmental resources in the project area would not be affected.

2.2 APPLICANT'S PROPOSAL

2.2.1 Project Facilities

The proposed pumped storage project would consist of a new upper and lower reservoir created by two earthen embankments, high-pressure steel pipes between the upper reservoir and the powerhouse, a powerhouse with generating/pumping facilities, steel low-pressure penstocks from the powerhouse to the lower reservoir, a transmission line and one substation, access roads to the lower and upper reservoirs, and accompanying facilities (figure 2-1). The asphalt, concrete, and geomembrane-lined upper reservoir would be created by a 7,972–foot-long, 58-foot-high earthen embankment and would have a surface area of 64.21 acres and a storage capacity of 2,568 acre-feet at a maximum surface elevation of 6,128 feet above mean sea level (msl). An intake located in the upper reservoir, consisting of a bell mouth, 38.6-foot-wide by 29.8-foot-long inclined screen, head gate, and 13.8-foot-diameter foundational steel pipe, would connect to the powerhouse through a 13.8-foot-diameter, 9,655-foot-long, steel high-pressure penstock that would be predominantly aboveground with a 14-foot-long buried segment. A partially buried powerhouse would be constructed adjacent to the lower reservoir and contain three 131.1-MW variable speed reversible pump-turbine units for a total installed capacity of 393.3 MW. Upon entering the powerhouse, the steel penstock would trifurcate to distribute flow to each pump-turbine unit, with flow distribution controlled by a spherical valve located at the intake of the pump-turbine units. Each turbine would discharge into the lower reservoir through three 9.8-foot-diameter, 1,430-foot-long steel low-pressure penstocks that would be predominantly aboveground with a 78-foot-long buried segment. The asphalt, concrete and geomembrane-lined lower reservoir[11] would be created by a 8,003-foot-long, 65-foot-high earthen embankment and would have a surface area of 60.14 acres and a storage capacity of 2,581 acre-feet at a maximum surface elevation of 4,457 feet msl. Each reservoir would be fitted with a drainage system designed to detect, collect, and monitor water leakage from the

[11] The lower reservoir would include a 25-inch-diameter bottom outlet with manual valve for gravitational dewatering of the lower reservoir. Discharge from the bottom outlet would be released along Grizzly Butte and into Swan Lake Valley. Full dewatering of the reservoir should take approximately 21 days.

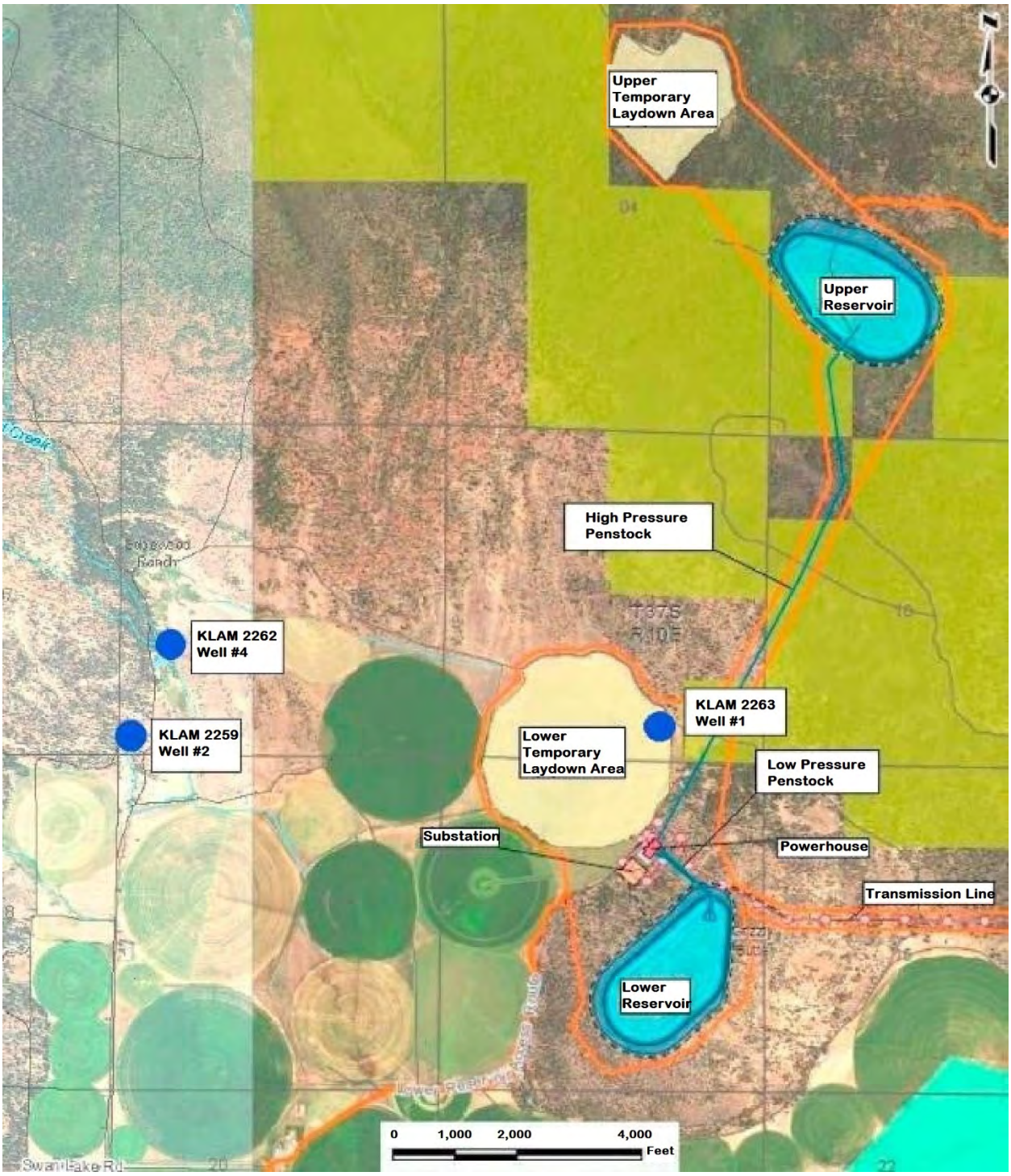

Figure 2-1. Configuration of proposed project facilities for the Swan Lake North Pumped Storage Hydroelectric Project (Source: Swan Lake North Hydro, as modified by staff).

reservoirs and a 500-foot-long, riprap lined trapezoidal spillway built into the crest of the upper and lower embankment at an elevation of approximately 6,135 feet msl and 4,464 feet msl.[12]

The 2,581 acre-feet of groundwater needed to initially fill the reservoirs and 357 acre-feet needed annually to make up for evaporative losses would be supplied by the local groundwater agricultural pumping system and delivered to the lower reservoir via an existing agricultural irrigation network.

The applicant would improve approximately 10.7 miles of existing roads and construct 3.4 miles of new permanent road to access the lower reservoir, upper reservoir, laydown areas, powerhouse, substation, and some of the project transmission towers. The applicant would also construct approximately 8.3 miles of temporary project access road to construct portions of the transmission line corridor.

Power generated by the project would be transmitted from the powerhouse through an adjacent fenced substation and then through a 32.8-mile-long, 230-kilovolt (kV) aboveground transmission line to interconnect with the existing non-project Malin Substation. The project is estimated to generate 1,187 GWh annually.

2.2.2 Project Safety

As part of the licensing process, the Commission would review the adequacy of the proposed project facilities. Special articles would be included in any license issued, as appropriate. Commission staff would inspect the licensed project both during and after construction. Inspection during construction would concentrate on adherence to Commission-approved plans and specifications, special license articles relating to construction, and accepted engineering practices and procedures. Operational inspections would focus on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, any license issued would require an inspection and evaluation every 5 years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.2.3 Project Operation

The project would operate as a closed-loop pumped storage system. The project would pump water from the lower reservoir to the upper reservoir at times when energy

[12] The spillways would be located on the northern edge of the upper reservoir embankment and the southeastern edge of the lower reservoir embankment. The spillways would be designed to release 3,230 cubic feet per second (cfs), the maximum flow through the turbines. These flows would only be expected during very large and exceedingly rare rainfall events or during emergency circumstances to maintain reservoir levels.

is in excess or in low demand. When energy is needed, water would be released from the upper reservoir through the high-pressure penstock to the powerhouse to generate electricity. This would occur based on on-peak/off-peak power considerations, the need to augment the production of renewable wind and solar power generation, or to provide ancillary power services.[13]

The project is designed to pump approximately 2,110 acre-feet of water from the lower reservoir to the upper reservoir in approximately 11.5 hours but would be limited to a maximum of 9.5 hours of generation per day at maximum generating output. Under typical operations, a full pumping/generation cycle would take 30 hours (1.2 days) or more than a day to complete, but at maximum speed a full cycle could be accomplished in 21 hours. Maximum water level fluctuation in the upper reservoir would be 44 feet, and in the lower reservoir, it would be 50 feet. Maximum hydraulic capacity of each turbine would be 3,230 cfs and would be operated with variable speed technology in order to fluctuate capacity when the project is in pumping mode.

2.2.4 Environmental Measures

The applicant proposes several measures, including the following:

Geology and Soils

- Develop a soil erosion control plan that includes site-specific best management practices (BMPs) to control erosion during project construction.
- Construct the portions of the upper reservoir access road that cross intermittent waterbodies in the dry season to minimize erosion and sediment deposition.

Water Resources

- Construct berms around the project reservoirs to minimize the capture of surface water runoff by the project reservoirs and to minimize changes to the surface hydrology associated with the Swan Lake drainage area.
- Line the reservoirs to prevent seepage of project water into groundwater.
- Develop a hazardous substances spill prevention and cleanup plan that includes BMPs to prevent and contain the release of contaminants during all phases of construction and operation.

---

[13] Ancillary services help balance the transmission system as electricity is moved from generating sources to ultimate consumers and are necessary for proper grid operation. Ancillary services include: load following, reactive power-voltage regulation, system protective services, loss compensation service, system control, load dispatch services, and energy imbalance services.

- Develop an adaptive water quality monitoring and management program to ensure levels of dissolved solids, nutrients, and heavy metals in the proposed reservoirs do not rise to levels that impair project operations or affect wildlife that may incidentally come in contact with project waters.

Terrestrial Resources

- Finalize the Revegetation and Noxious Weed Management Plan filed with the license application that outlines the procedures for revegetation and control of noxious weeds and invasive plants disturbed by construction.
- Conduct preconstruction surveys for sensitive plants, including slender Orcutt grass and Greene's tuctoria, and if found, enact protection measures (e.g., flagging and fencing or translocating individual plants) after consulting with the appropriate federal agency.
- Finalize the Wildlife Habitat Restoration and Enhancement Plan (WHREP) filed on July 26, 2016, to mitigate for lost and long-term disturbance of wildlife habitat by: installing/repairing two water guzzlers for big game; retaining a private road access easement and making improvements to a temporary access road to ensure BLM retains access to that agency's lands; acquiring or obtaining a long-term lease of 585 acres of land for big game and other wildlife habitat conservation; and funding BLM to thin 232 acres of western juniper and mixed conifer forest to improve the value of sagebrush habitat on Bryant Mountain.
- Develop an eagle conservation plan that includes: conducting two preconstruction surveys between May 1 and July 31 for two breeding seasons; prohibiting blasting and helicopter use within 0.5 mile of an active eagle nest between January 1 and August 15 and consulting with resource agencies before conducting other high-decibel activities; protecting the historic bald eagle nest tree near the lower reservoir on Grizzly Butte; constructing transmission structures to prevent eagle electrocution and collision to the extent practicable; and developing project- and transmission line-specific risk assessment models to determine if an eagle take permit is necessary.
- Develop an avian protection plan that includes: conducting two preconstruction surveys between May 1 and July 31 for raptors (two breeding seasons) and birds of conservation concern (one breeding season); prohibiting blasting and helicopter use within 0.5 mile of an active eagle nest between January 1 and August 15 and consulting with resource agencies before conducting other high-decibel activities; prohibiting ground-disturbing and vegetation-clearing activities in the reservoir areas between April 1 and July 15 to protect nesting songbirds; constructing transmission structures to prevent avian electrocution and collision to the

extent practicable; installing flight diverters in five areas with a high risk of avian collisions; adjusting lighting systems to minimize disruption of nighttime foraging; avoiding the removal of shrubs, native grasses, and forbs along the transmission line; marking the project reservoir fencing with vinyl strips and/or reflective tape to prevent avian collisions; and monitoring of the transmission line and reservoir fencing for bird collisions.

- Develop an ungulate protection plan that includes: fencing the project reservoirs to prevent drownings; daily monitoring of reservoir fencing; applying dust palliatives to ungraded or new roads to reduce dust clouds and minimize degrading the quality of adjacent habitats; decommissioning access roads that are unnecessary for long-term project operation and maintenance to reduce disturbance to wildlife and their habitats; designing trenches to reduce potential entrapment hazards to wildlife; creating wildlife crossings under the penstock to minimize impediments to wildlife movement; avoiding construction within the transmission corridor during wildlife winter range use to minimize disturbance; enforcing vehicle speed limits on all access roads to reduce collisions; and managing portions of the transmission line ROW for wildlife benefits.

Recreation

- Develop an interpretive facility in consultation with stakeholders that includes educational and historical signage and a staging area for periodic guided tours of the hydroelectric facility to enhance recreational opportunities in the project area.
- Develop a public safety plan, in coordination with state, federal, and county agencies, which would include measures to protect the public during construction and operation of project facilities (e.g., safe operation of reservoirs, emergency vehicle access, preventing and monitoring access to reservoirs, and working with Oregon PRD to ensure safety of those using the Oregon, California, and Eastern Woods Line State Trail [OC&E Trail] during construction).
- Cooperate with BLM to support future efforts to design and construct BLM's proposed Swan Lake Rim Trail.

Aesthetics

- Use locally quarried rock, preferably dark basalt, for the outer berm faces of the proposed reservoirs, to match the colors of the surrounding landscape and plant vegetation to minimize visibility of the reservoirs. Paint the powerhouse, maintenance structures, and appurtenant facilities with colors that match the surrounding landscape and dull the surfaces that cannot be painted; use BLM-approved paint colors; screen project facilities with

vegetation; and keep facility yards clean of debris and unused materials to minimize the appearance of these structures.

- Use special lamps, covers, timers, or motion sensors, and use fully shielded lighting on outdoor fixtures to minimize light pollution to the extent possible.
- Install mono-pole-type transmission line structures instead of lattice-type structures; use weathering COR-TEN-type steel that would form a stable, rust-like appearance over time; and use conductors with non-specular materials, where possible, to minimize the contrast of transmission line structures with the surrounding landscape.
- Reduce the prominence of land scarring and vegetation changes from the construction or modification of access and service roads, to the extent possible by: (1) using low-impact construction techniques such as helicopters to place and maintain transmission poles in sensitive or difficult to access locations to avoid the need for new road construction; (2) using locally quarried aggregate to match colors of the surrounding landscape; (3) modifying road surface color to match the surrounding landscape and reduce contrast; (4) minimizing the widening and grading of roads; (5) employing dust-suppression measures during construction; and (6) replanting all disturbed areas with permanent vegetation consistent with the Revegetation and Noxious Weed Management Plan.

Cultural Resources

- Revise the HPMP filed with the license application to minimize or avoid project-related adverse effects on those cultural resources eligible to be placed on the National Register.

Socioeconomics

- Develop a comprehensive traffic safety plan in cooperation with federal, state, and county agencies that includes measures for traffic control, notifying and directing the public around traffic pattern changes, public safety, and control of recreational off-highway vehicle (OHV) use of public lands within the project's ROW during construction.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would include most of the applicant's measures as outlined above, with some modifications. The staff alternative does not include the applicant's proposal to retain a private road access easement and make improvements to a temporary access road for BLM's perpetual access to its lands. It also does not include a requirement to enforce vehicle speed limits on all access roads to reduce vehicle collisions with wildlife. The staff alternative would include the following additional measures and/or modifications to the applicant's proposed measures.

Water Resources

- Modify the proposed operational adaptive water quality monitoring plan to include: (1) specific methods to be used to monitor water quality in the project reservoirs; (2) threshold criteria and measures that would be taken if water quality in the project reservoirs deteriorates to below the threshold criteria; and (3) reporting procedures.

Terrestrial Resources

- Modify the Revegetation and Noxious Weed Management Plan to specify the seed mixes and plant species to be used, including wild celery and other plants important in tribal customs if practicable (i.e., seeds are available and site conditions would support their use); planting densities and methods; fertilization and irrigation requirements; monitoring protocols; and criteria for measuring the success of revegetation efforts; and expand the plan to cover vegetation management during project operation.
- Modify the proposed avian protection plan as follows: (1) include an additional preconstruction survey in February to ensure that early nesting raptors are identified; (2) expand the preconstruction survey area from 0.25 mile to 0.5 mile around project features where no blasting would occur; (3) adjust the proposed spatial and temporal restrictions for construction activities as needed based on site-specific environmental conditions and nesting status; (4) install flight diverters on the section of transmission line between Hopper Hill and the temporary access road in Swan Lake Valley; (5) include quantifiable thresholds for determining when additional measures would be needed to address high-mortality areas based on the proposed transmission line monitoring; and (6) include procedures for documenting and reporting bird fatalities and injuries.
- Include in the proposed eagle conservation plan the following additional measures: (1) conduct two, preconstruction winter roost surveys for two winter seasons; and (2) include helicopter flight paths in preconstruction surveys for eagle nests and winter roosts.
- Modify the proposed WHREP to include: (1) a maintenance program for the proposed big game water guzzlers; (2) a management plan for conservation lands that identifies the parcels to be acquired, the criteria used to select the parcels, and habitat improvements that would be implemented on each parcel; (3) replacing the applicant's proposed road access easement mitigation measures with 50 acres of additional juniper removal to improve wildlife habitat; (4) an implementation schedule; and (-5) a provision to bring the acquired lands into the project boundary.

- Modify the ungulate protection plan to include: (1) a big game water guzzler near the upper reservoir and one near the lower reservoir; and (2) a schedule for inspecting and making any necessary fence repairs that is developed in consultation with Oregon DFW.
- In the event of emergencies or unanticipated circumstances in which large numbers of wildlife are being endangered, harmed, or killed by the project or its operation, notify Oregon DFW within 24 hours (six hours for state or federal listed species); comply with restorative measures required by the agencies to the extent the measures don't conflict with license requirements; and inform the Commission within 10 days after each occurrence and specify the nature of the occurrence and restorative measures taken.
- Develop a fire prevention plan that describes the measures and protocols the licensee would follow to prevent wildfires during construction and operation, including the removal of slash by means other than burning within 1 year of its creation.

Recreation Resources

- File for Commission approval conceptual drawings of the proposed interpretive facility, a map showing the location of facility features, and revised Exhibit G drawings, if revision of the project boundary is necessary to include the facility.
- Include in the proposed public safety plan specific measures to protect hikers and minimize disrupting use of the OC&E Trail during construction, including notification procedures, signage, and establishing a temporary alternative route around the construction area.

Land Use

- Develop a Harpold Dam and quarry coordination plan, in consultation with the Klamath Irrigation District and Horsefly Irrigation District, to coordinate the timing of installation and placement of the proposed transmission line to avoid or minimize disrupting their operations.
- Develop an agricultural operations coordination plan, in consultation with owners of agricultural lands that would be crossed by the transmission line, which considers pole spacing and installation timing in such a way that minimizes adverse effects on area farming practice.

Cultural Resources

- Revise the HPMP to include: (1) a culture-historic background section to give context to National Register eligibility determinations; (2) a revised

map showing the direct and indirect APE established in consultation with the Oregon SHPO, BLM, Reclamation, and the Klamath Tribes; (3) National Register eligibility determinations (assessing for Criteria A, B, C, and D) on all cultural resources located within the project's direct APE, including a determination of the eligibility of Horton Rim, Harpold Dam, and Bryant Mountain Traditional Areas as TCPs or archaeological districts and any new sites discovered on lands that could not be surveyed because of access limitations; (4) procedures to evaluate project-related effects on cultural resources, and for consideration and treatment of adverse effects, as appropriate, in consultation with the SHPO, BLM, Reclamation, and the Klamath Tribes; (5) specific proposed measures for avoiding, reducing, or mitigating project-related adverse effects on the individual National Register-eligible cultural resources within the project's direct and indirect APE, including site-specific data recovery plans (including schedules to complete the work) for those pre-contact archaeological sites where direct project-related adverse effects cannot be avoided and scheduling construction to avoid traditional cultural practices as practicable (6) a description of future construction and operation activities that would be subject to review by the Oregon SHPO, BLM, and the Klamath Tribes (i.e., exempt, little effect, and case-by-case) and how the review would be conducted and adverse effects resolved; (7) detailed monitoring procedures during construction; and (8) detailed provisions for addressing any newly discovered cultural resources.

Socioeconomics

- Include in the traffic safety plan details on how work shifts would be scheduled; traffic and access would be controlled; the public notified of traffic pattern changes; disruption of KCPW roadway and drainage facility maintenance and operations would be minimized; and bridge weight restrictions followed.

Air Quality

- Develop an air quality control plan to control fugitive dust and vehicle emissions during construction.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

A number of alternative designs and locations were considered for project features, including the size and location of the upper and lower reservoirs, the size and type of penstock leading from the upper reservoir to the powerhouse, the size of the powerhouse and the turbines, and five different transmission line corridor alternatives. However, based on a review of energy needs and environmental concerns, the applicant proposes to develop the project as described in this EIS. Ultimately, the other design

alternatives were deemed to be impractical, as they were too costly from a financial and environmental resource perspective. Below we summarize the basis for those findings.

2.4.1 Alternative Project Feature Design

Swan Lake North Hydro initially considered constructing a 1,144-MW pumped storage project with a powerhouse containing ten 110-MW generating units, a 215-acre lower reservoir constructed in NRCS-managed lands just south of Grizzly Butte, and a 260-acre upper reservoir located on the western edge of Swan Lake Rim. Following further feasibility assessments, Swan Lake North Hydro downsized the project to 1,000 MW and moved the lower reservoir to the north of NRCS managed lands, but south of Grizzly Butte. The 215-acre upper reservoir would be contained by two dams and would be located on western edge of Swan Lake Rim. The 193-acre lower reservoir would have been located northwest of Swan Lake, on Grizzly Butte and southwest of the Swan Lake Rim, approximately 1.25 miles west of the upper reservoir. Water would have been conveyed from the upper reservoir to the lower reservoir through a 30-foot diameter, 3,565 foot long underground tunnel. The powerhouse would contain four 250-MW pump-turbine generating units. Site investigations and analysis of the 1,000 MW project was described in the draft license application filed in 2011.

Subsequently, Swan Lake North Hydro completed additional geotechnical explorations in the project area, which identified two geological faults that would have been crossed by the tunnel and a significant likelihood of liquefaction of the lower reservoir dam constructed on the sedimentary soils that could have led to a breach of the retaining dam during a seismic event. Further, the large size of the 1,000-MW project limited the locations available to economically construct the reservoirs and connect them in an efficient manner.

Following additional study of the local energy grid and amid increased awareness of environmental concerns, the project was redesigned in late 2014 with a smaller optimal generating capacity of 393.3 MW. The smaller generating capacity allowed Swan Lake North Hydro to reduce the size and footprint of the reservoirs and move them to take advantage of natural hollows or bowls in the topography of the rim and Grizzly Butte. The new sites as proposed in the license application allows construction to occur on more solid basalt rock avoiding the liquefaction risk. Swan Lake North Hydro also relocated the tunnel and powerhouse to aboveground structures. The penstock now only crosses one fault and avoids poor sub-surface soil conditions that could have posed a significant construction hazard to the project and laborers.

2.4.2 Alternative Transmission Line Configuration

As part of its pre-filing studies Swan Lake North Hydro conducted a transmission line corridor alternatives analysis. Six preliminary transmission routes for a new 500-kV transmission line corridor from the project to the Captain Jack Substation were presented to the public in May 2011. Large scale maps were mailed directly to landowners and reviewed as part of a public presentation in Klamath Falls on May 30, 2011. Based on

written and verbal comments on the preliminary routes, including numerous negative comments about routes or portions of routes that would impact residences and/or agricultural properties in Poe Valley and along Swan Lake Road, as well as the results of other environmental, cultural, and engineering studies, Swan Lake North Hydro refined the six preliminary routes into five revised alternatives for further study. Swan Lake North Hydro chose the five route alternatives based on these considerations: using existing ROWs, natural divisions, and agricultural boundaries where feasible; limiting the length of the line and avoiding geographic constraints that limit line constructability; avoiding populated areas, or other conflicting land uses where possible; avoiding major environmental features, including Swan Lake, Alkali Lake, and other important wildlife habitat; avoiding known historic and culturally significant resources areas; avoiding or minimizing conflicts with agriculture, including center pivot irrigation features and other agricultural facilities; avoiding or minimizing impacts to groundwater resources; avoiding or minimizing impacts on federal lands; avoiding private lands; avoiding or minimizing impacts to residences; and avoiding airports.

The five revised transmission line route alternatives were made available to the public in October 2011 and considered during the pre-application phase of the licensing process. The applicant mailed information to potentially affected stakeholders and property owners on October 11, 2011, and held a public meeting to discuss the alternatives on November 7, 2011. The transmission line alternatives are outlined in figure 2-2.

The applicant created a grading system to compare the relative impacts of the five route alternatives, with a grade of 1 to 4 assigned for each alternative's resource impacts. Grades were awarded based on existing information, which included public comments and the results of the applicant's environmental, cultural, and engineering studies. The grades were defined as:

- Grade 1: No impacts are anticipated.
- Grade 2: Impacts are unlikely to occur.
- Grade 3: Direct and/or indirect impacts would likely occur.
- Grade 4: Direct and indirect impacts would occur.

Table 2-1 shows the applicant's comparison of transmission line alternatives.

Table 2-1. Comparison of transmission line route alternatives (Source: Swan Lake North Hydro, 2015).

Resources	Route 1	Route 2	Route 3	Route 4	Route 5
Geology and Soils	3	3	3	2	2
Water Resources	2	2	2	1	1
Fish and Aquatic Resources	2	2	2	1	1
Botanical Resources	3	3	3	3	3
Wildlife Resources	4	4	4	3	4
Wetland and Riparian Resources	2	2	2	1	1
Federally Listed Species	1	1	1	1	1
Recreation and Land Use	2	2	2	1	3
Aesthetic Resources	4	4	4	3	4
Socioeconomic Resources	4	4	4	2	2
Cultural and Tribal Resources	2	2	3	3	4
Total	26	26	27	18	23

Based on the analysis, Swan Lake North Hydro chose Route 4 as its preferred alternative for the reasons listed below:

- Route 4 would have the fewest number of transmission poles on agricultural lands.
- Route 4 would affect fewer residences than routes 1, 2, and 3.
- Route 4 would have fewer aesthetic impacts to residents in Swan Lake Valley compared to routes 1, 2, 3, and 5.
- Route 4 would have fewer aesthetic impacts to residents in Poe Valley than routes 1, 2, and 3.
- All five routes would affect public and private lands, but Route 4 would have fewer impacts to public lands compared to Route 5 and fewer impacts to private lands compared to routes 1, 2, and 3.
- Route 4 would have less potential to negatively impact wildlife and waters of the United States than routes 1, 2, 3, and 5.

- Route 4 would best address concerns raised at public meetings (to the extent possible) by minimizing impacts to agriculture, private landowners, and wildlife.

- Route 4 would be the shortest in length, reducing the number of impacts to a variety of resources as well as project costs.

Several alterations were later made to Route 4 based on agency and public comments raised between completion of the study and filing of the license application. These revisions included eliminating a section of Route 4 that crossed private lands in the northeastern portion of Poe Valley and altering a portion of the southern alignment close to the Loveness Rural Airstrip to meet Federal Aviation Administration regulations; straightening the route along the northeast side of Hopper Hill where the transmission route exits Swan Lake Valley to reduce impacts to existing ponderosa pines; straightening the alignment in Pine Flats north of Highway 140 to accommodate private landowner preferences; moving a portion of the route south along Horton Rim (south of Highway 140) to reduce visual impacts to the community of Dairy and exclude known deer bedding area; and moving 2.6 miles of the transmission line up in elevation toward Swan Lake Rim near Swan Lake to avoid impacts to NRCS lands. The route modifications and a reduction in the size of the line (230 KV) needed to serve the smaller 393.3-MW project resulted in further changes: at Hopper Hill, the route now travels to the west, rather than the east, of the small hill to the east of Hopper Hill; the route around Dairy Hill now travels to the west and south of the hill, between Horton Rim and Dairy Hill, reducing visual impacts of the line; and the line now terminates north of the state line, at the Malin Substation.

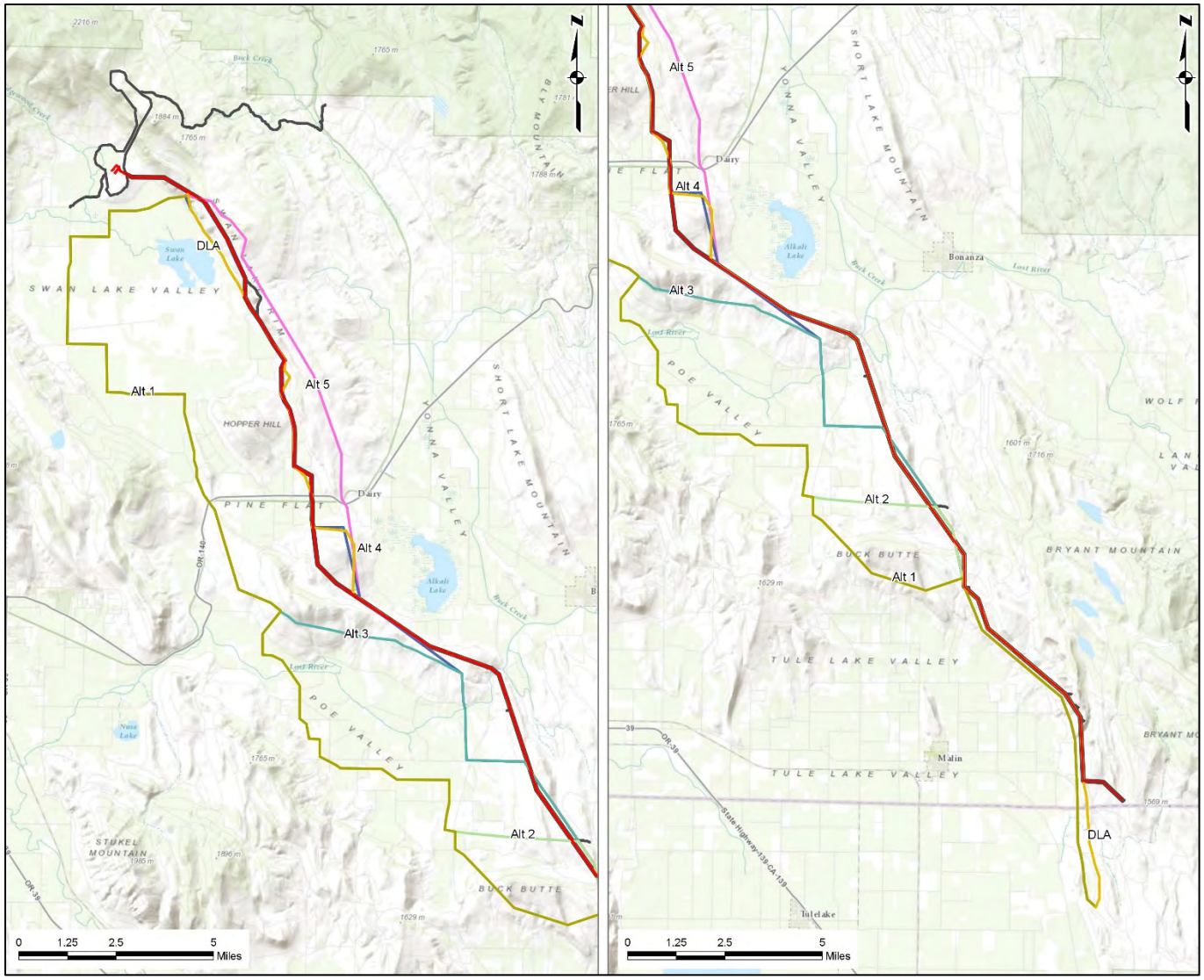

Figure 2-2. Configuration of proposed transmission line route alternatives (Source: Swan Lake North Hydro, as modified by staff).

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historic and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[14]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The proposed project would be located within the northern portion of the 1,650-square-mile Lost River Basin. The Lost River, which is about 60 miles long, originates in California at Clear Lake Reservoir, part of Reclamation's Klamath Project, flows into Oregon, and returns to California to terminate in Tule Lake. Historically the Lost River Basin had no outlet, but Reclamation's Klamath Project allows controlled water exchanges between the Lost and Klamath Rivers for irrigation. Seven existing dams in the basin include five on the Lost River and two on the tributary Miller Creek. All the existing dams were constructed for irrigation and flood control and have no power generation facilities. The proposed transmission line would cross the Lost River at the existing Harpold Dam (figure 3-2), located at RM 41, which is operated by the Horsefly Irrigation District.

Swan Lake (figure 2-1) would be the nearest surface water feature to the proposed project's reservoirs and generating facilities. The lake is shallow, with large seasonal fluctuations in surface area. A remnant of ancient Lake Modoc, the Swan Lake inflows from Anderson Creek are reduced by irrigation diversions and seepage. Swan Lake supports wetlands that provide important habitat for migratory waterfowl and other wildlife. However, the lake often dries completely in late summer during low-rainfall years.

Lands within and near the proposed project boundary are used for timber and irrigated crop production, livestock grazing, and wildlife habitat.

The climate of the project area is semi-arid, with the wettest months being November through January and the driest months being July and August. Average total annual precipitation in the uplands averages around 20 inches and precipitation on the

[14] Unless otherwise indicated, our information is taken from the application for license for this project (Swan Lake North, 2015) and additional information filed by Swan Lake North on March 16, 2016; March 24, 2016; April 18, 2016; May 24, 2016; July 25, 2016; February 27, 2017; and October 31, 2017.

valley floor is estimated at 14 inches. The average high temperature is 60 degrees Fahrenheit (°F), with summer highs in excess of 100°F; the average low temperature is 32°F, with winter lows below 10°F.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing National Environmental Policy Act (40 CFR, section 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we identified fisheries resources, aesthetic resources, cultural resources, and mule deer as resources as having potential to be cumulatively affected by the proposed project in combination with other past, present, and foreseeable future activities.

Fisheries resources were selected for analysis because the presence and operation of the Swan Lake North Project, in combination with other diversions and consumptive water uses in the basin, may reduce streamflows in the Lost River Basin due to evaporative losses and capture of surface run-off. Reduced streamflows could lead to effects on fisheries resources through the loss of suitable stream habitat.

We chose aesthetic resources because the project's new 230-kV transmission line, in combination with existing large non-project transmission lines, could have a cumulative effect on aesthetic resources in the vicinity of the 32.8-mile-long ROW.

We chose cultural resources because the addition of the project infrastructure would add to modifications to the landscape created by past agricultural and logging practices, further affecting tribal vision quests on Swan Lake Rim, as well as other areas to the south along the proposed transmission line corridor.

We identified mule deer because the potential effects of construction and operation of the proposed project, in combination with other developmental projects or factors such as hunting, vehicle collisions, and disease, could cumulatively affect mule deer populations.

3.2.1 Geographic Scope

The geographic scope of analysis defines the physical limits or boundaries the proposed action's effects on the resources. Because the proposed action would affect resources differently, the geographic scope for each resource may vary.

We have identified the Lost River Basin as the geographic scope of analysis for fisheries and aesthetic resources. We identified the viewshed from Swan Lake Rim for

cultural resources. For mule deer, our geographic scope of analysis is Oregon DFW's Klamath Falls Wildlife Management Unit. The entire project and nearby winter range habitat for the mule deer falls within the Klamath Falls Wildlife Management Unit, and, as a big game hunting unit, it has specific mule deer winter population and buck ratio management objectives.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and reasonable foreseeable future actions and their effects on water quality and fisheries resources. Based on the term of a license, we will look 30 to 50 years into the future. The historical discussion is limited, by necessity, to the amount of available information. We identified the present resource conditions based on the license application, agency comments, and comprehensive plans.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific cumulative and site-specific environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EIS. Based on this, we have determined that water quality and quantity, aquatic, terrestrial, threatened and endangered species, recreation, cultural, socioeconomics, and aesthetic resources may be affected by the proposed action and action alternatives. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geologic and Soil Resources

3.3.1.1 Affected Environment

The proposed project would be located on the eastern side of the Swan Lake Basin, a mountain and basin structure within the northern Modoc Plateau that contains interlayered volcanic lava flows, volcaniclastic sedimentary rocks,[15] and continental sediments.[16] Volcanism and sedimentation generally coincided with faulting and basin formation starting in the late Miocene epoch and continuing into the Pleistocene epoch. This resulted in a sequence of layered basalt to basaltic andesite lava flows alternating with flows of fragments of volcanic origin and volcanic and continental sedimentary

[15] Rocks and grains derived from the breakdown of larger sedimentary rocks caused by volcanic activity.

[16] Sedimentary deposits laid down on land or in bodies of water not directly connected with an ocean.

deposits. The lower reservoir would be located on an outcrop of andesite at the top of Grizzly Butte, and the upper reservoir would be located on basalt above the Swan Lake Rim. Volcanic deposits make up the majority of the geological units of the project area, so the underground geological conditions are highly unpredictable.

The Swan Lake escarpment appears to have formed from middle Miocene to Quaternary age normal faulting, creating the Swan Lake Valley. Geologic mapping and field reconnaissance performed for the applicant identified a fault along the base of the Swan Lake escarpment (informally known as the Jesperson-Edgewood Fault) that may be active and a fault along the mid-slope of the escarpment. The mid-slope fault is located roughly parallel to the Jespersen-Edgewood Fault.

The transmission line route would follow or cross several local geological features, as shown in figure 3-1. The line would begin at the powerhouse switchyard at the base of Grizzly Butte and proceed along the base of the Swan Lake Rim escarpment in the Swan Lake Valley. The line would then cross over Hopper Hill and then between Hopper Hill and the base of the Swan Lake Rim escarpment. The line would then cross Pine Flats, proceed between Dairy Hill and the base of the Horton Rim escarpment, extend along the base of the Horton Rim escarpment, and then cross Horton Rim and drop into the Poe Valley. The line would span the Lost River in the Poe Valley at Harpold Dam and continue along the center of the Harpold Ridge on the east side of the Poe Valley. Finally, the line would cross uplands to the main substation near the Oregon border with California.

Numerous soil types exist in the project area. Soils in the location of the proposed upper reservoir, penstock, and powerhouse are Woodcock association and Woodcock-Rock outcrop complex derived from a parent material of extremely gravelly colluvium from andesite, basalt, and a small amount of cinders and ash. Slopes in these areas range from 5 to 60 percent, and depth to the restrictive layer is more than 60 inches. The natural drainage class is well drained with relatively high water movement in the most restrictive layer.

The lower reservoir would sit atop Grizzly Butte, on Lorella and Lorella-Calimus association soils. Lorella soils are of a parent material consisting of very cobbly and gravelly colluvium and residuum derived from basalt and tuff,[17] and the parent material for Calimus soils is a loamy lacustrine sediment. Depth to a root restrictive layer is 10 to 20 inches on the south side of the reservoir and greater than 60 inches on the north side. The natural drainage class is well drained, and water movement in the most restrictive layer is moderately low on the south side but relatively high on the north side. Slopes range from 15 to 35 percent.

[17] Tuff is a volcanic rock formed when ash, rock, or mineral fragments fall from the air into a mixed deposit, following a volcanic eruption.

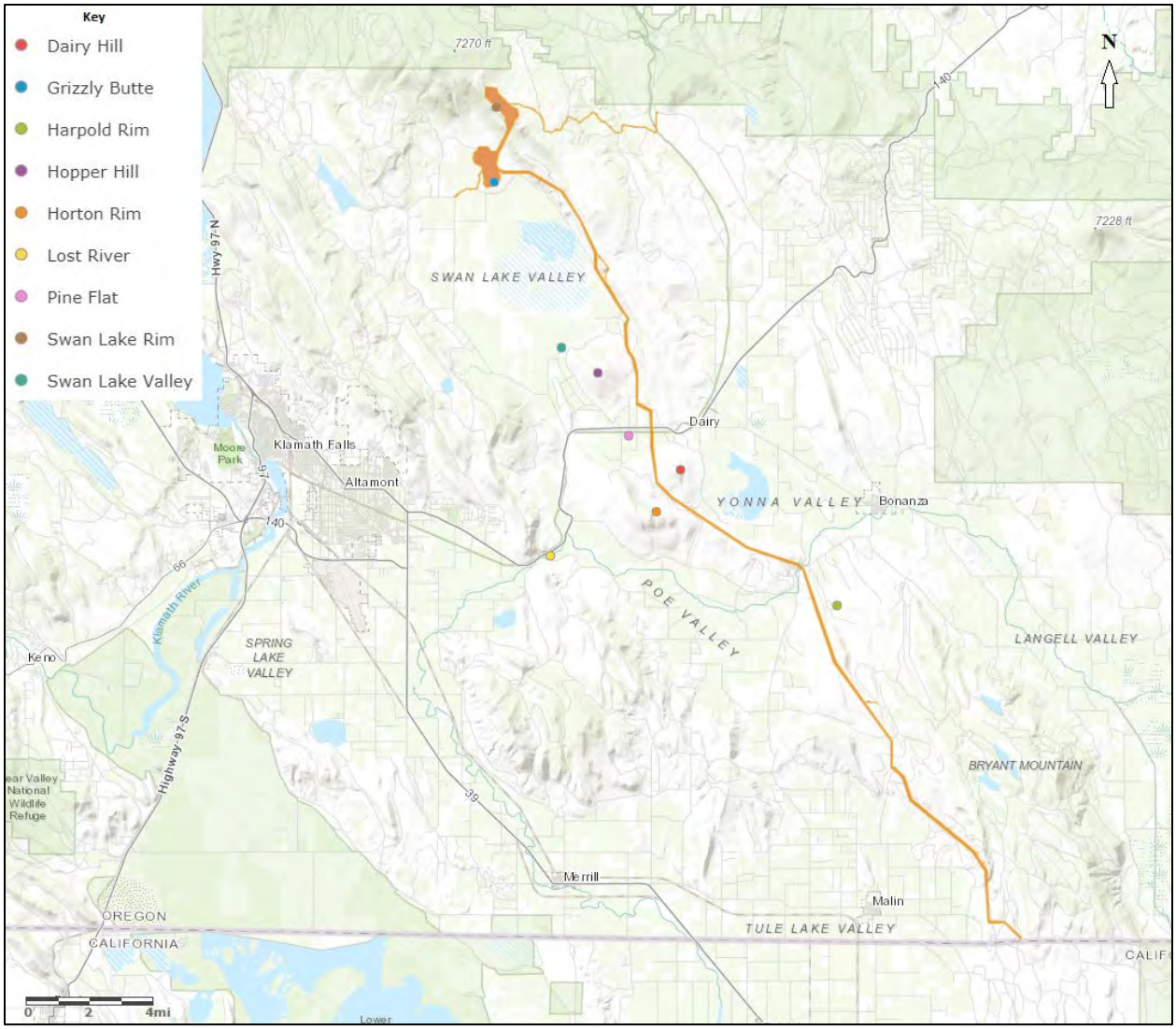

Figure 3-1. Important geologic features in the project vicinity (Source: staff).

The proposed transmission line ROW would traverse a variety of soil types between the powerhouse and the terminus of the transmission line at the Malin Substation. Erosion hazards along the transmission line corridor are generally low, with some areas categorized as moderate to severe.

Throughout Klamath County, there are active claims for pumice, diatomite, mercury, gold, and titanium; however, none of these sites are located within, or adjacent to, the proposed project boundary (The Diggings, 2018). The Klamath Irrigation District has a licensed rock pit on BLM lands that would be located under the transmission line just northwest of where the line would cross over Harpold Dam. The locations of Harpold Dam and the quarry are shown in figure 3-2.

Figure 3-2. Locations of Harpold Dam and quarry (Source: staff).

Geologic Hazards

The applicant commissioned a geotechnical study in 2015 (Barr Engineering, 2016), which included borings of the proposed upper and lower reservoir sites, powerhouse, and base of the penstock. The investigation confirmed information gathered for the general project area and provided supplemental information pertaining to the current proposed project configuration.

Seismicity

The applicant commissioned a seismic analysis of the project area, which included research into past seismic activity in the area as well as ground motion analyses. Crustal seismic sources within about 50 miles of the project site were evaluated, and review of seismic hazard data for the area indicated that crustal sources of more than about 50 miles from the site do not contribute significantly to the overall seismic hazard. The investigation concluded that the Jesperson-Edgewood Fault at the base of the Swan Lake Rim escarpment is active.

Seismic instrument monitoring records are limited in the proposed project vicinity because of the sparse population and the lack of dedicated seismometer installations in the area. The instrument record is relatively limited, with only a few recorded

earthquakes exceeding a local magnitude (M_l)[18] of 4 in Klamath County. However, after a series of moderate earthquakes near Klamath Falls, seismometers were installed in the area in September 1993. Two main earthquake shocks occurred on September 20, 1993, (M_l5.9 and M_l6.0) and a strong aftershock (M_l=5.1) on December 4, 1993. Studies of these earthquakes show that most of the crustal earthquake activity was occurring at relatively shallow depths of 3.0 to 7.5 miles on normal fault structures. This type of earthquake is typical of basin and range extensional settings.

The 1993 earthquakes caused damage to multiple Klamath County public facilities. Landslides and rock falls were observed up to 18 miles away from the epicenter and caused damage to several state highways and roads and a bridge on Oregon Highway 140.

The applicant estimates that the Jesperson-Edgewood Fault is capable of ground surface rupture ranging from about 5.5 to 9.5 feet of displacement during a seismic event and further concludes that the average return interval for the fault would be approximately 42,000 years. While the Jesperson-Edgewood Fault was determined to be active, the fault at mid-slope of the Swan Lake escarpment was interpreted as not active.

Landslides

A complex of large landslides, which likely failed during the late Pleistocene or Holocene, are located on the western slope of the Swan Lake escarpment. Similar large landslides located in the Klamath Falls area to the west and in the Summer Lake Basin to the east are thought to be seismically induced. The applicant commissioned a landslide investigation that identified a large slide adjacent to, and partially including, the western side of the proposed penstock route from the powerhouse to the upper reservoir. Other smaller landslides were noted to the east of the proposed route. The slopes are covered by colluvium derived from long-term erosion and mass wasting along the edges of uplifted basalt flows along the fault escarpment. The colluvium is likely underlain by basalt flows offset by normal faulting.

Field reconnaissance of the large slide concluded that the slide is an ancient feature containing a subdued curved area where the failure surface ruptures the ground surface on the steep slope, bowl, and rounded toe and was considered to represent a rock slide. The cause of the rockslide is not known, but investigators concluded that it may have been initiated by past earthquake activity that displaced a portion of the steep slope.

[18] Earthquake magnitude (M) is measured on a scale of 0 (motion not detected and no damage) to 10 (significant motion and damage).

3.3.1.2 Environmental Effects

Construction Effects on Soil Resources

Construction of the various project facilities laydown and staging areas, and access roads would result in ground disturbance that could lead to erosion and subsequent sediment deposition in sensitive areas if not controlled. In addition, materials excavated and temporarily stored for use later during construction would be susceptible to erosion.

The project is expected to use all excavated rock material to construct the reservoir embankments. The expected quantity of excavated material is 1,585 acre-feet and the expected quantity of required fill material is 1,603 acre-feet for the upper reservoir. For the lower reservoir, the expected quantity of excavated material is 1,274 acre-feet and the expected quantity of fill material is 1,254 acre-feet. Any excess excavation material would be utilized as aggregate for concrete mixed onsite during project construction. Storage for excavated material would be located in the temporary laydown areas at each reservoir construction site.

To minimize erosion, the applicant proposes to close, regrade, and revegetate all roads used strictly for construction access. To further minimize land disturbance and the potential for erosion, the applicant proposes to use the following design criteria for constructing the temporary transmission line roads:

- 15 percent maximum grade (10 percent preferred)
- 40-foot centerline radius minimum on any proposed road curves
- Use existing access roads where possible
- Minimize access road length
- Minimize the elevation difference between existing access and tower location to take advantage of existing topography where appropriate
- No retaining wall designs
- No significant cuts on steep slopes
- No switchback arrangements; if a switchback is required up a steep slope, the site would be designated for helicopter construction methods
- Avoid creeks and sensitive areas (including wetlands near Swan Lake)
- Minimize impact on existing agricultural fields and structures

The applicant also proposes to prepare a comprehensive soil erosion control plan that incorporates site-specific BMPs endorsed by the state of Oregon as project design is finalized. Erosion control BMPs recommended by the state of Oregon include dust control, mulching, and geotextiles for non-vegetative soils; temporary or permanent seeding for vegetative soils; conveyance, diversion, control, and outlet stabilization for runoff; and sediment barriers for additional sediment control.

Our Analysis

The proposed project design would reduce potential adverse effects on geologic and soil resources from construction and erosion. Nonetheless, the potential for erosion is still possible if not controlled.

The applicant's proposed erosion and sediment control plan would limit the potential for impacts from soil erosion and sedimentation during construction. The proposed erosion prevention and control measures would be based on state BMPs (e.g., BMPs that have been shown to prevent erosion and sediment transport, if properly implemented, monitored and maintained) until the sites can be permanently stabilized. The proposed plan would limit the amount of disturbed ground to the extent possible, and include measures to avoid or minimize sediment transport (e.g., hay bales, silt fences) that could enter waterways (i.e., irrigation ditches).

The design criteria for temporary transmission line roadways would avoid ground disturbance by using existing roadways where possible and would reduce the amount of ground disturbance by minimizing road length, minimizing elevation differences by taking into account existing topography, and eliminating significant cuts on steep slopes. The potential for sediment transport into creeks and sensitive areas and wetlands would be minimized by avoiding those features during road design and placement. The road grade limitations would minimize the velocity of surface runoff that could cause soil erosion.

Overall, the proposed project would incorporate reasonable, appropriate, and sufficient measures to reduce the amount of ground disturbance and to reduce or eliminate the potential for soil erosion. However, additional details would be needed based on site-specific conditions during the final design to ensure that the necessary measures fit the on-the-ground conditions and would be effective in controlling erosion.

Effects of Burying the Transmission Line on Soil Resources

Several members of the public recommend burying various segments of the transmission line to avoid or minimize electromagnetic fields (EMF), interruption of agricultural operations, avian collisions, and adverse aesthetic effects. The proposals range from burying the entire line to burying 0.25 mile.

Burial of a portion or all of the transmission line would result in excavation and ground disturbance that could lead to erosion and subsequent sediment deposition in sensitive areas if not controlled. In addition, materials excavated and temporarily stored for use as backfill in the excavated burial trench would be susceptible to erosion. The potential quantity of impacted soil resources and excavated material could be quite extensive, depending on the length of transmission line that is to be buried.

Our Analysis

The feasibility of burying the transmission line is unknown because of the lack of detailed geotechnical studies along the corridor. However, the corridor crosses steep

topography and areas where there may not be sufficient soil depth to practically bury the transmission line.

Swan Lake North Hydro has not proposed any measures to address burying the transmission line. Nonetheless, development of an erosion control plan containing the BMPs proposed by the applicant would also reduce potential adverse effects on geologic and soil resources from construction and erosion if the transmission line is buried. The potential for erosion is still possible if not controlled. Along the steeper slopes, the potential for erosion would be greater and would likely require more extensive control measures.

Effects of Reservoir Spills and Emergency Dewatering on Soils

Although the project reservoirs would not be located on any stream or use surface waters, each reservoir would be constructed with a 500-foot-long, emergency overflow spillway. The spillways would be designed to safely pass water to prevent overfilling the reservoirs and threatening the integrity of the embankments. In the event that the crest of the spillways are overtopped, water would flow down the concrete riprap apron on the face of the dam embankment and continue overland, away from the reservoir.

The lower reservoir would be constructed with a bottom outlet to allow the lower reservoir to be gravitationally dewatered. Dewatering would only occur in case of emergency, defined in the application as a rare event where potential failure is developing on the lower reservoir and, at the same time, the transfer of the water from lower to upper reservoir is not possible (no power available, pumps out of order, or upper reservoir damaged). A bottom outlet is not proposed for the upper reservoir because dewatering of the upper reservoir into the lower reservoir would be possible at any time through the penstock. The outlet on the lower reservoir would consist of a 25-inch-diameter pipe with a hollow jet valve located at the exterior base of the reservoir embankment on the southwest corner of the reservoir. The valve would dissipate the jet energy and would be directed up at a 45-degree angle, reducing erosive forces of the discharged water. The water would naturally flow overland away from the reservoir.

Although they did not recommend any measures to address erosion, the Oregon DEQ and NRCS expressed concern with the effects of the above discharges on the resources of the Swan Lake Valley.

Our Analysis

Discharges through the spillway and evacuation of the lower reservoir are expected to be a very rare occurrence. The project reservoirs have a combined storage capacity of 5,149 acre-feet at 6,128 feet msl and 4,457 feet msl for the upper and lower reservoirs, respectively. This exceeds the probably maximum flood, which is estimated to total 683 acre-feet, or 170 acre-feet and 513 acre-feet for the upper and lower reservoirs, respectively. Thus overtopping of the reservoir from a high rainfall event is unlikely.

The only plausible scenario where there would be overtopping in one of the reservoirs is "runaway" pumping or generating; in that case, the excess flow would be discharged through the respective upper or lower reservoir spillway depending on the cycle (i.e., generation or pumping). In that case, the maximum flow that would be discharged through either spillway would be 3,230 cfs, or the equivalent to the maximum flow that could be passed by the powerhouse (3,230 cfs). Based on a review of topographic maps of the area, any flow through the lower reservoir spillway would flow down the southeast portion of Grizzly Butte and would likely extend into Swan Lake Valley. Flow from the proposed upper reservoir spillway would flow overland generally to the north or northeast along the butte and away from the valley. Discharge through the spillways would occur until action is taken to stop discharge to the lower reservoir or pumping to the upper reservoir, which should occur quickly given the automated monitoring systems proposed by the applicant.

The portion of Swan Lake Valley that abuts Grizzly Butte where the lower reservoir would be located is a broad, relatively flat agricultural plain of about 18,000 acres. The maximum volume of the lower reservoir would be 3,300 acre-feet. In the unlikely event that the lower reservoir would need to be drained, dewatering this volume over 21 days (as designed) would equate to an average flow of 79 cfs. The flow would extend in the valley, with some of the flow soaking into the ground, and perhaps a small amount evaporating over the 21 days. If the entire maximum volume of the lower reservoir covered the valley at one time, the water would be 2.2 inches deep.

Given the configuration and sizing of project facilities, the potential for such outflows and associated flooding should be minimal. Under worst case conditions, if outflows were to occur, the effects in terms of potential flooding would be temporary, most damaging close to the spillways, and would diminish with distance from the spillway. Crops in the agricultural fields of the Swan Lake Valley could be damaged or lost; others may just be temporarily inundated until the water infiltrates the soils.

Effects of a Penstock or Embankment Failure on Soils

Concerns of seismic events causing penstock and embankment failure on natural resources were raised during scoping. However the applicant has included a number of design features to reduce the potential for such failures.

First, the above-ground portions of the penstock would be supported by concrete piers and concrete anchor blocks. The anchor blocks would be installed at bends in the penstock to (1) resist hydrostatic loads during operation; (2) prevent displacement of the penstock during construction; and (3) resist vibrational forces, which could cause displacement in the penstock. Where the penstocks would cross known fault lines, the applicant proposes to install compensating joints on each end of the penstock section spanning the faults. The joints would allow lateral movement to occur without breaching the penstock. Expansion joints would be installed immediately downstream of the anchor blocks to eliminate temperature load and longitudinal stresses.

The applicant also proposes to install ground motion sensors close to the head gates at each reservoir intake structure to prevent draining the reservoirs if a seismic event were to result in a penstock failure. The sensors would detect a primary wave (P-wave) and initiate the closure of the head gates prior to a destructive secondary wave (S-wave) reaching the site.

The applicant also proposes to install overflow sensors in the penstock to detect an increase in water discharge through the penstock in the event of a non-earthquake penstock failure. The sensor would initiate automatic closure of the head gates.

Based on the results of various slope stability and seismic loading analyses, the applicant considers the design of the reservoir embankments to be conservative and sufficient to withstand anticipated forces of a seismic event. The applicant also proposes to install a leak detection system that would collect and monitor any leakage through the watertight membranes in the reservoirs. If repairs to the watertight liners were required, the reservoir would be dewatered prior to initiating repairs.

Our Analysis

The seismic detection equipment, penstock and reservoir leak detection equipment and sensors, and the use of automated head gates would help reduce the potential of a penstock or reservoir breach. Design parameters are also proposed to address potential adverse effects on project structures that may result from normal fault activities and potential seismic activity.

With adequate detection of seismic activity, the applicant would be able take proactive steps to avoid a breach of the reservoir embankments or penstock by ceasing project operations, and if necessary by drawing down one or both reservoirs and/or closing the penstock headgates to stop flow from the upper reservoir to the lower reservoir. In the unlikely event of a penstock failure, the amount of water released would be limited to the volume of water in the penstock until the head gates are closed and flow is shut off. The resulting release would likely cause erosion to areas closest to, and downstream of, the breach. In such circumstances, the Commission would require the license to take appropriate steps to mitigate and correct the problems leading to the failure. Notification procedures recommended by Oregon DFW would also inform those measures.

The proposed design, equipment, and operating systems represent reasonable and sufficient methods to avoid, and/or minimize potential effects on soils in the vicinity of project structures.

Further, if a license was issued for the project, the Commission's Division of Dam Safety and Inspections would evaluate the stability of the reservoir embankment dams under all probable loading conditions, including seismic loading. The Division of Dam Safety and Inspections would review geotechnical studies provided in support of the project's final design to ensure that project features are designed to safely withstand all credible loading conditions and ensure safe operating conditions. Furthermore, an

independent Board of Consultants would perform a peer-review of the final project design. The Board of Consultants would consist of qualified professionals with expertise in the design and construction of dams of commensurate size. The Board of Consultants would review the geology of the project site and surroundings, the project design, and the plans and specifications and would oversee construction of the project. The Commission would not allow construction to begin until the project facilities satisfactorily meet the criteria of the Commission's Engineering Guidelines and the designs are shown to be safe and adequate.

3.3.2 Water Resources

3.3.2.1 Affected Environment

Water Quantity

Surface Water

The proposed project area is located in the northern portion of the Lost River Basin (see figure 1-1). Project features would be located within the following subbasins:

- The upper reservoir and upper temporary staging area are located on the divide between the Swan Lake subbasin (hydrologic unit code [HUC]; HUC 180102040804) and Upper Buck Creek subbasin (HUC 180102040701).
- The lower reservoir, lower temporary staging area, and associated power production infrastructure, as well as about 12 miles of the transmission ROW traverses two subbasins that drain to the Swan Lake: Grizzly Butte subbasin (HUC 180102040802) and Swan Lake sub-basin.
- About 10 miles of the transmission ROW traverses three sub-basins that drain to the Lost River: Upper Buck Creek (HUC 180102040701), Alkali Lake – Lost River (HUC 180102040705), and Poe Valley – Lost River (HUC 180102040706).
- The southern end of the transmission ROW, about 8.5 miles, traverses two Oregon sub-basins that drain to Tule Lake in California, a closed subbasin: Mills Creek – Tule Lake Valley (HUC 180102040906) and Russell Canyon (HUC 180102040905).

Swan Lake is the nearest surface water feature to the project reservoirs and power generation infrastructure. Swan Lake is a closed, inward draining basin located about 1.4 miles southeast of the project's lower reservoir (see figure 2-1). A remnant of ancient Lake Modoc, Swan Lake is relatively shallow with dramatic seasonal fluctuations in size and depth. Swan Lake often dries completely in late summer during low rainfall years. Swan Lake is fed by Anderson Creek; however, this perennial stream has been modified

and flows only when water is released from the Whiteline Reservoir[19] for irrigation purposes, although some seepage through the dam does occur. When water is released for irrigation, it is largely intercepted by irrigation systems used for agriculture or lost to seepage. As a result, very little discharge reaches Swan Lake. Even historically, water from Anderson Creek reached Swan Lake only in periods of its greatest flow. Additional surface water inputs to Swan Lake are from overland flow and many small, intermittent springs on the ridges surrounding the valley.

Groundwater

Groundwater is an important resource in the project area and surrounding Lost River Basin and would be used for both the initial fill of project reservoirs, as well as periodic re-fills to the lower reservoir to account for evaporative losses and water leakages. The underlying volcanic lithologies support large aquifers that supply sizeable quantities of drinking and agricultural irrigation water. The geology of the basin largely controls the occurrence and movement of groundwater.

The two main sources of groundwater recharge in Swan Lake Valley are underflow from the unconfined system of the adjacent volcanic basalt rocks; and less significantly, infiltration of surface water through sedimentary deposits that overlay the basin. Although the surface layer of fine-grain unconsolidated deposits yield little water, the underlying volcanic basalt and sedimentary rock aquifers yield large quantities of water to wells. Maximum well yields[20] are 4,750 gallons per minute at depths between 180 and 860 feet (table 3-1). The general pattern of groundwater movement is from north to south. Groundwater in the Swan Lake Valley tends to flow toward the Lost River to the south, with a gradient of less than 10 feet per mile, with the exception of the southern part of the valley, where the gradient slopes steeply to the southwest. Swan Lake Valley groundwater appears to discharge from the basalt aquifer at springs adjacent to the Lost River in western Poe Valley.

[19] Whiteline Reservoir is located on Anderson Creek about 4.5 miles west of the lower reservoir site.

[20] Maximum well yield is, how much water can continue to be pumped from the well for a set amount of time. Maximum safe yield is measured by pumping the well for an extended time and also measuring the groundwater level in the well.

Table 3-1. Groundwater well characteristics from well reports for 205 eastern Lost River subbasin wells developed in basalt (Source: Swan Lake North Hydro, 2015).

Area		Reported Water Temperature (°F)	Reported Well Yield (gallons/minute)	Calculated Specific Capacity (gallons/minute/feet)
Swan Lake Valley to Pine Flat	Minimum	48	30	10
	Average	58	2,222	541
	Median	58	2,283	210
	Maximum	68	4,750	3,970

Four distinct groundwater subareas (the south Langell Valley, Lorella, Bonanza, and Swan Lake Valley to Poe Valley subareas) exist in the eastern Lost River subbasin. The proposed project would use groundwater withdrawn from the Swan Lake Valley to Poe Valley subarea. The general pattern of groundwater movements in the Swan Lake Valley to Poe Valley subarea is from north to south. Groundwater interference tests to assess the effect of project-related withdrawals on existing water rights conducted by the applicant utilized pumping wells located in the northern and southern groundwater compartments of the Swan Lake Valley to Poe Valley subarea. Although the bounding conditions of the compartments are poorly defined, they appear to create some resistance to groundwater flow and help categorize compartment and subarea response to seasonal stress. The north Swan Lake Valley compartment roughly coincides with the approximate northern one-third of the Swan Lake Valley, with a southern boundary of the compartment consisting of an east- to west-trending line at the approximate latitude of Swan Lake.

The applicant identified seasonal groundwater level fluctuations of 2 to 4 feet in the northern groundwater compartment and 4 to 7 feet in the southern groundwater compartment of the Swan Lake Valley to Poe Valley subarea. These seasonal groundwater fluctuations help distinguish groundwater compartments in the project area. The applicant identified 39 irrigation wells between the northern limit of Swan Lake Valley and Pine Flat (generally coinciding with the project area) from a review of water right records. Nearly all of these wells are developed within the basalt unit, and total associated groundwater appropriation is about 35,000 acre-feet per year. Since 2001, there has been a marked increase in groundwater pumping in the Upper Klamath Basin in response to changes in surface-water management and a series of consecutive dryer-than-average years.

Water Quality

The project would be located in the northern portion of the Lost River Basin, which is part of the Klamath River Basin. Oregon Administrative Rules (OAR) Chapter 340, Division 041 of the *Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon* (OAR 340-041) for the Klamath River Basin, applies to project-area waters. Oregon DEQ designates existing beneficial uses for water bodies in the basin as public and private domestic water supply, power, industrial water supply, irrigation, livestock watering, aquatic habitat, wildlife habitat, water contact recreation and canoeing and rafting, other non-contact water recreation, and commercial navigation and transportation. Table 3-2 outlines water quality standards applicable to surface waters in the project area defined by OAR 340-041.

Table 3-2. Water quality criteria for surface waters in the project area (Source: Oregon DEQ, 2018a).

Parameter	Water Quality Objectives
Temperature	Natural water temperatures shall not be altered, and applicable criteria are the same criteria as is applicable to the nearest downstream water body depicted on the applicable map. Natural lakes may not be warmed by more than 0.5°F above the ambient condition unless a greater increase would not reasonably be expected to adversely affect fish or other aquatic life.
Dissolved oxygen (DO)	DO concentration shall not fall below 11.0 milligrams per liter (mg/L), unless the spatial median of intergravel DO is 8.0 mg/l or greater, then the DO criterion is 9.0 mg/L. The spatial median intergravel DO concentration shall not fall below 8.0 mg/L. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 11.0 to 9.0 mg/L criteria, DO levels shall not fall below 95 percent of saturation.
pH	The pH shall not be depressed below 6.5 nor raised above 9.0.
Fecal coliform	Based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 126/100 ml, nor shall a single sample exceed 406/100 ml.
Total dissolved solids (TDS)	TDS concentration shall not exceed 100 mg/L in all fresh water streams and tributaries.
Toxics	Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combination that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect

Parameter	Water Quality Objectives
	public health, safety, or welfare or aquatic life, wildlife, or other designated beneficial uses.
Turbidity	Increases in turbidity attributable to controllable water quality factors shall not exceed a 10 percent cumulative increase in natural stream turbidities, as measured relative to a control point immediately upstream of the turbidity causing activity.

Notes: °F = degrees Fahrenheit; DO = dissolved oxygen; mg/L = milligrams per liter; ml = milliliters.

Water quality standards applicable to groundwater sources in the project area are outlined in the Oregon Groundwater Quality Protection Act of 1989 (ORS 468B.150–468B.190) and the background water quality monitoring guidelines presented in Oregon DEQ's Oregon Administrative Rules Chapter 340, Division 040, *Monitoring Background Groundwater Quality* (OAR 340-040). The Oregon Groundwater Quality Protection Act sets a broad goal for groundwater resources in the project area to prevent contamination of the groundwater resource, conserve and restore this resource, and maintain the high quality of Oregon's groundwater resource for present and future uses. Oregon DEQ's OAR 340-040 establishes guidelines to protect all groundwater from pollution that could impair the existing or potential beneficial uses for which the natural water quality of the groundwater is adequate.

Within the project area, rangeland is the predominant land use, followed by agricultural and industrial uses. The majority of water use in the project area is for irrigation and livestock watering. Table 3-3 summarizes existing total maximum daily loads (TMDLs)[21] for surface waters in the project area. Swan Lake is the nearest surface water feature to the proposed project's reservoirs and power production infrastructure. Swan Lake often dries completely in late summer during low rainfall years. Oregon DEQ lists two streams in project area sub-basins, Buck Creek and the Lost River, that periodically violate state water quality standards. Buck Creek is included on the 303(d) list of water-quality-limited[22] water bodies for 2012 for temperature and is considered water quality limited for habitat modification. The Lost River is on the 303(d) list for ammonia, dissolved oxygen (DO), pH, and chlorophyll-a; is considered water quality limited for habitat modification and flow modification; and has potential concerns for arsenic and beryllium.

[21] A TMDL is a regulatory term in the CWA describing a plan for restoring impaired waters that identifies the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.

[22] Term applied to streams, lakes, and estuaries that do not meet water quality standards for protection of designated beneficial uses.

Table 3-3. Existing total maximum daily loads in project area (Source: Oregon DEQ, 2018b).

Parameter	Geographic Areas
Dissolved oxygen	Lost River Drainage, Lost River Diversion Channel, Klamath Straits Drain, Keno Reservoir
pH	JC Boyle Reservoir, Keno Reservoir, Lost River Drainage, Lost River Diversion Channel, Klamath Straits Drain
Ammonia toxicity	Lost River Drainage, Lost River Diversion Channel, Klamath Straits Drain, Keno Reservoir
Chlorophyll-a	Lost River Drainage, Lost River Diversion Channel, Klamath Straits Drain

No point sources for pollutants upstream of the proposed project are known. Potential nonpoint sources include surface water runoff from roads, exposed dirt surfaces, and cattle grazing pastures, which are most active during spring and summer. The applicant did not collect surface water quality samples in the project area.

GeoDesign Inc. collected measurements of total dissolved solids (TDS) on September 28, 2011, from potential groundwater supply wells for the proposed project. Testing results indicated that local groundwater sources had TDS levels with an average concentration of 95 mg/L. Table 3-4 provides TDS measurements for the wells that could be used as water sources for the proposed project. See figure 2-1 for location of wells in proximity to the project.

Table 3-4. TDS measurements for water source wells (Source: Swan Lake North Hydro, 2015).

Well	TDS (mg/L)
KLAM 2259 (Well #2; "100-Horse")	80.4
KLAM 2262 (Well #4; "Aspen")	128.4
KLAM 2263 (Well #1; "Cove")	76.4
Average	95.1

Notes: mg/L = milligrams per liter

3.3.2.2 Environmental Effects

Water Quantity Effects on Surface Water

Surface water runoff is an important source of water for Swan Lake and neighboring wetlands. During scoping some commenters expressed concerns with how

the project might affect instream flow into Swan Lake and the resources that depend on the lake (e.g., waterfowl). To minimize effects on the hydrology of Swan Lake, the applicant proposes to construct berms around the project reservoirs to route runoff from precipitation around the reservoir, thus only capturing the precipitation that falls on the reservoirs.

Our Analysis

The berms proposed by the applicant would effectively route all overland flow around the reservoirs. All runoff from the slopes of the Swan Lake escarpment and Grizzly Butte into the Swan Lake sink would occur generally as it does now. Normal project operation and maintenance would not require draining the reservoirs, and spillage from the reservoirs would be unlikely because of the system's closed-loop nature and designed reservoir capacity.

Because the project reservoirs would not be covered, they would capture all precipitation that falls directly upon the surface of the reservoirs. The upper reservoir would have a surface area of 64.21 acres and would sit on a part of the landscape that averages 20 inches of precipitation annually. The lower reservoir would have a surface area of 60.14 acres and would receive an average of 14 inches of precipitation annually. We estimate that the upper reservoir would capture approximately 107 acre-feet of water annually that would normally flow into the Buck Creek and Lost River subbasins. We estimate that the lower reservoir would capture approximately 70 acre-feet of water annually that would normally flow into Swan Lake subbasin. Combined, this would represent a loss of about 177 acre-feet of water annually that would normally contribute to aquatic habitat in the subbasins. The amount of water captured within the reservoirs is negligible relative to the large drainage area for Swan Lake.

Water Quantity Effects on Groundwater

To initially fill the project reservoirs, the applicant would withdraw 3,001 acre-feet of ground water from three existing, permitted groundwater wells. The 3,001 acre-feet would consist of 2,581 acre-feet that would be used as the operating volume of the reservoir and extra 420 acre-feet to account for evaporation and leakage over the first year. Thereafter, the applicant estimates it would need 420 acre-feet annually to make up for evaporation (357 acre-feet) and leakage (63 acre-feet). These withdrawals could place additional demand on groundwater resources.

To minimize effects on groundwater supply, the applicant would use existing permitted irrigation groundwater wells under a transfer of water-right certificate 29530 and a transfer of water-right permit G-10952. The initial fill of the reservoirs would be completed within 4 months to a year. The water would be delivered to the lower reservoir via an existing underground agricultural irrigation network connecting the existing pumping wells (table 3-5).

Table 3-5. Proposed pumping wells for initial reservoir filling and annual maintenance flow input (Source: Swan Lake North Hydro, 2015).

Pumping Well	Installation Date	Total Depth (feet BGS)	Cased Depth (feet BGS)	Source Aquifer	Allowable Appropriation Rate (gpm)	Allowable Annual Duty (acre-feet)
KLAM 2259 (Well #2; "100-Horse")	1952	281	170	Basalt	2,033	1,944.0
KLAM 2262 (Well #4; "Aspen")	1979	187	81	Basalt	2,567	1,371.6
KLAM 2263 (Well #1; "Cove")	1951	142	19	Basalt	2,800	1,503.3

Notes: BGS = below ground surface; gpm = gallons per minute

Water deliveries would be constrained by the conditions of the existing groundwater well network and established, permitted pumping rates and volumes. The proposed reservoirs would be lined to prevent or minimize seepage of project water into groundwater.

Based on the groundwater interference pumping tests conducted by the applicant, Oregon WRD determined that project-related water withdrawals would not interfere with existing water rights or adversely affect existing groundwater and surface water conditions in the project area. Oregon WRD based its conclusion on the conditions that the proposed project would:

- use existing, permitted groundwater only (i.e., no new groundwater use),
- use existing, permitted pumping rates,
- use existing, permitted annual extraction volumes, and
- forego use of groundwater wells for irrigation purposes during initial filling of reservoirs.

Oregon WRD states that it does not expect that any water right requirements it would establish would conflict with other FERC conditions for the proposed project.[23]

Our Analysis

Because a geologic boundary largely separates groundwater in the northern portion of the Swan Lake Valley from groundwater in the southern portion of the valley, the applicant performed two separate pumping tests to assess the effects of project-related withdrawals on existing water uses (see final license application, appendix E-1). The first consisted of a single-well drawdown and recovery test by pumping KLAM 2259 (Well #2; "100-Horse") to assess drawdown in the northern groundwater compartment. The second test was a multiple-well drawdown using wells within the northern and southern groundwater compartments. The single-well pumping test involved pumping about 26.5 acre-feet of water over the course of 48 hours. This test showed that the northern Swan Lake Valley aquifer compartment is highly transmissive,[24] with estimated values ranging between 300,000 and 900,000 square feet per day. Drawdown ranged from 0 inch in an observation well 1.64 miles from the test well, to 1.8 inches in a well located 0.37 mile from the test well. The multiple-well test involved pumping about 480 acre-feet of water from five wells over a 9-day period. Water levels in the southern portion of Swan Lake Valley did not drop during the multiple-well test, confirming the hydrologic separation of groundwater in north and south Swan Lake Valley.

Actual drawdowns (if observed or measurable) caused by the proposed reservoir filling are minimal based on the single and multiple-well tests, particularly for wells located south of the apparent flow boundary between the North Swan Lake and Central Swan Lake to Poe Valley subareas. Further the estimated pumping rates for the project would extend the pumping period from 4 months to a year as opposed to the typical

---

[23] Rather than providing licensing recommendations, Oregon WRD's letter filed February 16, 2018, indicates it would likely place the following conditions on the project's water right: requirements for recording and reporting monthly water use for the initial fill and maintenance filling of the reservoirs; requirements for measuring and monitoring static water levels in March of each year to evaluate potential long-term water-level declines; establishment of an observation well at a location designated by Oregon WRD staff to determine the magnitude and timing of groundwater-level response during the initial fill of the reservoirs and to monitor potential impacts on neighboring wells and water right holders; and adjustments to the rate and timing of the initial fill if data from the observation well indicate the initial fill is having a negative effect on existing neighboring wells within the project area. Because these anticipated conditions relate to compliance and administration of the water right, they are not considered and analyzed in the draft EIS as potential license conditions.

[24] Aquifer determination is based primarily on the transmissivity of the impacted hydrogeological unit. Transmissivity is a function of hydraulic conductivity and saturated unit thickness.

irrigation season. This distribution of pumping would reduce the potential for interferences with other irrigation wells during peak demand periods (i.e., late summer).

Based on the groundwater pumping tests, the project is not expected to affect existing water uses outside the northern Swan Lake Valley compartment because water withdrawals for reservoir filling and maintenance would only use wells located in the highly transmissive northern portion of Swan Lake Valley and groundwater in the northern and southern portions of Swan Lake Valley are hydrologically separated. Because water deliveries to the project would be constrained by the conditions of the existing groundwater well network and established, permitted pumping rates and volumes, there would be no change from existing conditions and thus the project would not create additional or excessive stress on groundwater resources. Groundwater conditions in the project area are not expected to change because the proposed groundwater wells have been operated at their permitted rates and volumes during the recent historical period.

Effects on Construction on Surface Water Quality

As discussed in section 3.3.1.2, construction of the proposed reservoirs, penstock, powerhouse, substations, access roads, transmission line, and staging and stockpiling areas would involve soil disturbing actions that could create dust and soil runoff that could migrate to waterbodies in the project vicinity. In response to the REA notice, Oregon DEQ expressed concern that the construction of access roads for the upper reservoir would involve crossing of intermittent waterbodies and require in-water work, but did not recommend any measures to address this concern.

Swan Lake North Hydro proposes to address any erosion associated with project construction through a comprehensive site-specific soil erosion control plan. The plan would describe erosion control measures (i.e., BMPs) to minimize water quality impacts on existing surface water resources. As construction of the proposed project moves forward, Swan Lake North Hydro would work with Oregon DEQ and other resource agencies to develop the comprehensive soil erosion control plan. Swan Lake North Hydro would schedule the construction of access roads across intermittent waterbodies to occur only during the dry season when water is normally not present in these waterbodies.

Construction projects of this size commonly store several hundred to several thousand gallons of fuel, motor oil, and hydraulic fluid onsite to service heavy equipment. Similarly, some hazardous materials would likely be kept and handled onsite during project operation (e.g., transformers). Spills of hazardous substances could adversely affect wildlife and aquatic resources if they migrated to surface waters. Swan Lake North Hydro proposes to develop a hazardous substances spill prevention and cleanup plan to address potential water quality impacts on surface water and groundwater resources from spills of hazardous substances during construction, operation, or maintenance activities at the proposed project. The hazardous substances spill prevention

and cleanup plan would specify material handling procedures and storage requirements and identify spill cleanup procedures. The plan would standardize operational procedures and employee training to minimize the potential for accidental pollutant releases that could contaminate surface, groundwater, or stormwater runoff. At a minimum, the proposed hazardous substances spill prevention and cleanup plan would include the following preliminary BMPs: (1) establish fueling areas at locations that would avoid or minimize potential spills into nearby waterbodies, (2) inspect vehicles and equipment for leaks, (3) store hazardous materials in protective containers, (4) stop and clean up spills immediately, and (5) provide employee training to prevent and respond to spills.

Our Analysis

Soil Erosion

As discussed in section 3.3.1.2, use of BMPs to control soil erosion and runoff would be expected to minimize the potential soil erosion and eventual sediment deposition in waterbodies that could adversely affect their water quality and the aquatic resources they support. Further, the potential for soil to eventually enter waterbodies is limited by distance of proposed construction activities from surface waters.

All of the proposed project facilities, including the upper and lower reservoirs, penstock, powerhouse, and transmission line, would be located well away from existing surface waters, including Swan Lake, which is 1.4 miles southeast of the proposed lower reservoir. It is expected that placement of the transmission line towers would occur well outside the riparian area where it crosses the Lost River and would not involve soil disturbance in this area. Scheduling construction of the transmission line across intermittent waterbodies during the dry season would minimize the potential for degrading surface waters further downstream.

Because the proposed project would be a closed system, project operations would have very little ability to affect nearby surface waters. Any spillage from the proposed upper reservoir would flow overland generally to the north or northeast and possibly enter small, intermittent stream channels near the proposed project. Spillage from the proposed lower reservoir would flow overland in a southeast direction into the closed Swan Lake Basin. Spillage from either reservoir would be a rare event and would likely have little to no effect on existing natural water bodies in the project area.

Hazardous Materials

Although the proposed project features would not be constructed near existing surface waters, any hazardous material spills could allow contaminants to migrate into nearby groundwater or surface water resources. A hazardous substances spill prevention and cleanup plan that includes procedures for handling and storing hazardous substances and containing and responding to unintentional spills would minimize the potential for hazardous substances to enter any existing water bodies, the proposed project reservoirs, or groundwater during project construction and operation.

Water Quality in the Project Reservoirs

As water is exchanged between the project reservoirs, various water quality constituents of concern (e.g., TDS, nutrients, and heavy metals) could become concentrated within the proposed project's closed loop reservoir system. Leakage of such water could degrade groundwater quality. Wildlife, such as waterfowl attracted to the reservoirs, could also be exposed to unhealthy concentrations of heavy metals and nutrients.

To prevent the seepage of project water into the underlying groundwater, Swan Lake North Hydro proposes to seal the reservoirs with an impervious geomembrane and to line them with concrete. Swan Lake North Hydro also proposes to develop an operational adaptive water quality monitoring and management plan to monitor the gradual progress of concentrations of dissolved solids, nutrients, and heavy metals in the reservoirs and if needed, it would develop measures to address the potential impacts (e.g., wildlife interactions with project waters) of increased water constituent concentration.

Oregon DFW recommends that the applicant prepare a reservoir water quality monitoring plan that includes a requirement to prepare an annual report summarizing annual reservoir water quality conditions.

Our Analysis

The yearly cycles of evaporation and water re-fill over the term of any license issued could alter water quality conditions in the project reservoirs by concentrating water quality constituent levels over time. Table 3-4 in section 3.3.2.1, *Affected Environment, Water Quality*, lists TDS concentration measurements for the groundwater wells that could serve as water supply sources for the proposed project. TDS concentrations for the wells averaged 95.1 mg/L and ranged from a minimum of 76.4 mg/L to a maximum of 128.4 mg/L. Table 3-6 shows the estimated increase of TDS concentration[25] in the proposed project reservoirs over a 50-year period.

Table 3-6. Estimated increase of TDS concentration in the proposed project reservoirs (Source: staff).

Year	TDS Concentration (mg/L)		
	76.4 (Minimum)	**95.1 (Average)**	**128.4 (Maximum)**
1	76.4	95.1	128.4
5	118.7	147.7	199.4

[25] Multiplying TDS concentration (mg/L) by the annual reservoir re-fill in liters (L) and dividing by the initial reservoir fill volume (L), yields the annual TDS concentration (mg/L). Increasing trend in TDS concentration is a result of adding the previous year's TDS contribution (mg) to the subsequent year.

Year	TDS Concentration (mg/L)		
	76.4 (Minimum)	95.1 (Average)	128.4 (Maximum)
10	171.5	213.5	306.0
15	224.3	279.3	377.0
20	277.2	345.0	465.8
25	330.0	410.8	554.6
30	382.9	476.6	643.4
35	435.7	542.3	732.2
40	488.5	608.1	821.0
45	541.4	673.9	909.8
50	594.2	739.7	998.6

As table 3-6 shows, the TDS concentrations in the reservoirs are expected to increase steadily over the lifetime of the proposed project, but are not expected to rise to a level that would negatively impact wildlife since concentrations are estimated to remain below the 1,000 mg/L threshold used by the U.S. Geological Survey to classify fresh water. Similar information on nutrient, heavy metals, and other water quality constituent concentrations in the groundwater are not available. However, we would expect similar trends, if they were present in the groundwater resources used by the proposed project. The degree that such concentrations might become harmful would depend on the constituent.

The use of the geomembrane would minimize seepage from the reservoirs into the groundwater, thus it is unlikely that groundwater water quality would become degraded.

Swan Lake North Hydro's proposed operational adaptive water quality monitoring and management plan would serve as a mechanism to monitor the gradual progress of concentrations of dissolved solids, nutrients, and heavy metals in the proposed reservoirs. To be effective, the plan must describe in detail the methodology to be used to monitor water quality in the project reservoirs, measures that would be taken in case water quality in the project reservoirs deteriorates to specified action levels agreed upon by the applicant and resource agencies, and reporting requirements.

3.3.3 Fisheries Resources

3.3.3.1 Affected Environment

The project area is located entirely within the Lost River watershed, which is further divided into a number of basins and subbasins. Although no fish-bearing streams

are located within the lands directly affected by the project, other portions of the Lost River watershed support fish communities.

The upper reservoir and upper staging area would be located between the Buck Creek and Lost River subbasins. These project features are located at a high elevation, where streams do not support fish populations. The land that would be occupied by the lower reservoir, associated power production infrastructure, and 12 miles of the transmission ROW are located in the Swan Lake subbasin. The subbasin has one perennial stream (Anderson Creek) and two perennial waterbodies (Whiteline Reservoir and Swan Lake).

Very little fish survey work has been done in the Swan Lake subbasin. The Oregon DFW surveyed Anderson Creek in 1994 and found blue chub, a native fish, and flathead minnow, a nonnative. Blue chub are found throughout the Klamath River Basin and Lost River Basin. They are common in this geographic area, although poor water quality and competition from nonnative minnows, such as the flathead minnow, have caused their populations to decline. The Whiteline Reservoir, located on Anderson Creek upstream of Swan Lake, may contain warm water fish species, but no surveys have been completed.

An additional 10 miles of the transmission line ROW traverses three subbasins that drain to the Lost River. The Lost River is generally poor habitat for fishes due to the large diversion of irrigation water and a history of human alterations. In general, the fish assemblage of the Lost River is dominated by tolerant, exotic species that have proliferated since the 1970s. The main exotic species present are brown bullhead, flathead minnow, pumpkinseed, and Sacramento perch. The native Lost River sucker was historically abundant, but has been almost completely extirpated from the basin. A small breeding population remains in Clear Lake. Native shortnose suckers were also once prevalent in the basin, but now breed only in Clear Lake, Gerber Reservoir, and Miller Creek. Other indigenous species in the basin include redband trout, marbled sculpin, tui chub, and blue chub, although all populations are small.

The southern end of the transmission line ROW (8.5 miles) traverses two Oregon subbasins that drain to Tule Lake in California. The area surrounding these subbasins is heavily modified due to agricultural processes. Fourteen species are listed as occurring within these subbasins: black crappie, bluegill, coastal rainbow trout, golden shiner, goldfish, green sunfish, Klamath speckled dace, largemouth bass, Lost River sucker, Pacific lamprey, Sacramento perch, shortnose sucker, Western mosquitofish, and white crappie. Some species may no longer be present upstream due to dams and diking.

3.3.3.2 Environmental Effects

Because the project reservoirs would not be located on any stream, the effects of project construction and operation on fish and aquatic habitats are limited to potential erosion and sedimentation during construction, which have already been discussed, and the capture of precipitation by the project reservoirs. Capture of precipitation could

compound the effects of irrigation withdrawals, further reducing the quality and availability of aquatic habitats.

The applicant proposes to construct berms that would encircle the reservoirs to minimize the capture of surface water runoff by the project reservoirs and to minimize changes to the surface hydrology associated with the Swan Lake drainage area.

Our Analysis

The project reservoirs would capture rainfall and other precipitation that would naturally become a part of the basin's hydrology through either over-ground runoff to nearby streams or through infiltration through the soil to the underlying groundwater aquifer. The reservoirs would be lined to prevent seepage of project water to the underlying aquifer, so any precipitation that would enter the reservoirs would be effectively lost for other uses in the basin. The lost precipitation would result in reduction of natural water available to provide aquatic habitat for fishes inhabiting streams in the area.

The applicant's use of berms encircling the reservoirs would minimize the capture of surface water by shunting runoff precipitation away from the reservoirs, and forcing the water to remain a part of the natural basin hydrology. This would allow for that water to contribute to aquatic habitat in basin-area streams through the same natural pathways as it would do in an unaltered landscape.

The reservoirs would capture all precipitation that falls on their surfaces. As discussed in section 3.3.2.2, we estimate that presence of the upper reservoir would capture approximately 107 acre-feet of water annually that would normally flow into the Lost River Basin. We estimate that the lower reservoir would capture approximately 70 acre-feet of water annually that would normally flow into the Lost River Basin. Combined, this would represent a loss of about 177 acre-feet of water annually that would normally contribute to aquatic habitat in the subbasins.

All three of these subbasins are large relative to the sizes of the proposed reservoirs. For example, the Lost River Basin consists of over 3,000 square miles of land. The annual loss of 107 acre-feet and 70 acre-feet, respectively, would represent a very small fraction of the annual water budget of these subbasins that is contributed by precipitation. Any effects on fisheries in basin-area streams would likely be negligible and impossible to detect.

3.3.3.3 Cumulative Effects

South-central Oregon is characterized by a semi-arid landscape. Much of the surface water in the region is appropriated for agricultural use and storage. As discussed above, the presence of the project would lead to an annual loss of 177 acre-feet of water per year in the Lost River Basin. While this projected loss is miniscule when compared to the total precipitation that falls on the entire basin, it would incrementally contribute to a basin-wide reduction in the quantity of aquatic habitat.

Streams that suffer from a lack of water are also characterized by reductions of water quality. Water temperatures in these streams are often elevated because they have less water to buffer the natural heating caused by solar radiation. In response, higher stream temperatures result in lower levels of dissolved oxygen because warmer water has less ability to retain dissolved oxygen.

If this project is constructed, it would contribute slightly to any ongoing degradation in the quantity and quality of aquatic habitat in streams of the Lost River Basin. Accordingly, fish in these streams may be subject to negative effects resulting from these changes. However, the amount of water lost due to the project's existence would be such a small percentage of the annual natural water budget, that is would be impossible to detect project effects on any specific fisheries.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

Botanical Resources

The project is located within the East Cascades ecoregion and spans three sub-regions: Klamath/Goose Lake Basins, Klamath Juniper Woodland, and Fremont Pine/Fir Forest. The East Cascades ecoregion stretches the entire length of the state from north to south and is bordered by the Cascade Mountains to the west and high desert to the east (Oregon DFW, 2016a). Historically, ponderosa pine stands dominated the broader region, and extensive wetland and grassland complexes covered much of the lowlands. Over the past century, most of the wetlands were drained for agriculture, and forest practices and fire suppression have converted the largest ponderosa pines stands into young, dense mixed-species stands. The current vegetated landscape exists under a prevailing dry, continental climate with wide temperature variations.

Swan Lake North Hydro used data from 2011 and 2015 vegetation surveys, literature reviews, and geographic information system data to characterize the vegetation within the project boundary. The dominant plant community is juniper woodland, followed by mixed shrubland, and agricultural land (table 3-7).

Table 3-7. Plant communities in the project area (Source: Swan Lake North Hydro, 2015, as modified by staff).

Plant Community	Acres
Agricultural land (pasture and irrigated)	340.7
Big sagebrush, bunchgrass	13.8
Juniper woodland	853.3
Low sagebrush, bluegrass scabland	22.8
Mixed shrubland	355.8

Plant Community	Acres
Ponderosa pine forest	11.7
Ponderosa pine, bitterbrush, Idaho fescue	43.5
Ponderosa pine, incense cedar, mahala mat	25.6
White fir, grand fir, mahala mat (natural and thinned)	339.7
Developed (no plant community)	30.3
Total	**2037.2**

Agricultural Land

Agricultural lands include center-pivot irrigated cropland, pasture, and associated roads and structures (e.g., hay storage facilities). They are located within the proposed lower reservoir and lower reservoir laydown area, along the temporary access roads to the lower reservoir area, and along the proposed transmission line corridor. Most cropland in the Swan Lake Valley is hay or alfalfa but cereal grains, potatoes, onions, and a few specialty crops are also commonly planted throughout the Klamath Basin. Pastures in and near the project boundary are a mix of native and nonnative grasses and a few forbs. Basin wild rye, cereal rye, and bluebunch wheatgrass are abundant along existing roads in the project area.

Big Sagebrush, Bunchgrass

Scattered big sagebrush-steppe communities are scattered along the east side of Swan Lake Valley up the escarpment, and along Horton Rim and Harpold Rim. The proposed transmission corridor runs through a small patch of big sagebrush-steppe as it traverses the escarpment alongside Swan Lake. Patches of big sagebrush are generally small, isolated, and degraded. This plant community type includes dominant shrubs such as basin big sagebrush and rubber rabbitbrush. Green rabbitbrush and granite gilia are abundant in the flatter, lower elevation portions of big sagebrush communities. Sagebrush habitats are considered a strategy habitat[26] in Oregon's State Wildlife Action Plan (SWAP) for the East Cascades ecoregion (Oregon DFW, 2016a).

Juniper Woodland

Juniper woodlands include areas where juniper cover is over 10 percent or where cover is over 5 percent with multiple age classes represented. This vegetation type

[26] Strategy habitats are habitats of conservation concern within Oregon that provide important benefits to strategy species. Strategy species are defined as having small or declining populations, are at-risk, and/or are of management concern (Oregon DFW, 2016a).

occupies the greatest proportion of land within the project boundary, dominating the lower slope of the Swan Lake Rim escarpment along the proposed penstock corridor and most of Grizzly Butte (i.e., proposed location of the lower reservoir). Western juniper is the dominant tree/shrub, with occasional individuals and small pockets of ponderosa pine also present. The shrub layer is light to sparse, consisting mostly of low sagebrush, big sagebrush, rubber rabbitbrush, and bitterbrush. Forb and grass cover is generally high and fairly diverse, with Sandberg bluegrass, bottlebrush squirreltail, silvery lupine, and tower butterweed being common.

Low Sagebrush, Bluegrass Scabland

Low sagebrush-steppe communities occur within the project boundary on Grizzly Butte, along the penstock and transmission line corridors. Shrubs species existing in these locations include goldenweed and rock buckwheat. Other shrubs, such as desert gooseberry, rubber rabbitbrush, and curl-leaf mountain mahogany occurred only at the edges of this community type. Grasses and forbs found included Sandberg bluegrass, carpet phlox, and sulphur buckwheat.

Mixed Shrubland

Mixed shrublands include those areas where tree cover is less than 10 percent, shrubs are dominant, and low sagebrush is absent or greatly reduced in cover and importance. The escarpment and plateau of Swan Lake Rim contain large areas that are dominated by mixed shrublands. This habitat type occurs along the proposed penstock corridor and is also well-distributed throughout the proposed transmission corridor. Mixed shrubland has mountain mahogany and Klamath plum as dominant shrubs, with areas of curl-leaf mountain mahogany and widely scattered ponderosa pine. A wide variety of forbs and grasses exist, with cheatgrass, wild celery, Sandberg bluegrass, and smooth hawksbeard all being common.

Ponderosa Pine Forest

Open, old-growth stands of ponderosa pine are increasingly rare due to the long-term effects of timber harvest and fire suppression and are considered a strategy habitat in the East Cascades ecoregion (Oregon DFW, 2016a). Ponderosa pine forests were defined as those areas where pine cover was greater than 10 percent and no white fir was present. A few patches of this plant community are present along the proposed transmission line corridor south of Swan Lake close to Hopper Hill.

Ponderosa Pine, Bitterbrush, Idaho Fescue

The Ponderosa Pine/Bitterbrush/Idaho Fescue vegetation type is a community subtype of the ponderosa pine forest. This plant community exists within the proposed substation area and powerhouse area on the north side of Grizzly Butte. The nearly pure stands of ponderosa pine have little shrub or forb cover, whereas the mixed stands have similar shrub, forb, and grass composition to the surrounding Juniper Woodland areas,

though big sagebrush tends to be the dominant shrub. Idaho fescue and western needlegrass were each more than twice as abundant as other grass species.

Ponderosa Pine, Incense Cedar, Mahala Mat

Ponderosa Pine - Incense Cedar/Mahala Mat is another community subtype of the ponderosa pine forest and is characterized as having ponderosa pine as the dominant tree, with lesser amounts of incense cedar, and a variable density shrub layer of variable composition. Forb and grass cover is generally light in this forest. This community exists in a few small patches on Swan Lake Rim within the proposed penstock and transmission line corridors.

White Fir, Grand Fir, Mahala Mat

White Fir - Grand Fir/Mahala Mat is the dominant vegetation type on the Swan Lake Rim plateau (i.e., proposed location for the upper reservoir and upper reservoir staging area, access road to the upper reservoir, and upper portion of the penstock corridor). Dominant trees in this vegetation type are white fir and ponderosa pine, with pockets of quaking aspen. The shrub layer is generally dense throughout much of this area, consisting mostly of greenleaf manzanita and snowbrush, with oceanspray, Oregon cherry, chokecherry, and mahala mat also common. The forb layer is generally light, likely due to competition with the often dense shrub layer.

Developed

Within the project boundary, there are a few areas of disturbed/developed land, including a rock quarry just north of Harpold Dam.

Noxious Weeds

Swan Lake North Hydro queried the Oregon Department of Agriculture's WeedMapper database for known noxious weed locations within a 5-mile radius of the project. No noxious weeds were found within the project boundary, but 94 populations made up of 7 species (Canada thistle, Dalmatian toadflax, nodding plumeless thistle, Scotch thistle, Mediterranean sage, St. John's wort, and leafy spurge) were found within the 5-mile radius.

Swan Lake North Hydro also surveyed for noxious weeds in conjunction with special-status plant surveys in the summers of 2011 and 2015. All areas within the project boundary where ground disturbance may occur were searched for weeds, including: (1) areas where construction equipment may operate; (2) areas where vegetation would be removed for project features; and (3) travel and transmission corridors. Surveyors recorded all species present on the Klamath County list of noxious weeds of concern identified by the County Board of Commissioners, Oregon Department of Agriculture, and BLM. In addition, the invasive species ox-eye daisy, Russian thistle, and North Africa grass were also surveyed because they are invasives of concern with the Lakeview District BLM. The vast majority of weed locations were found in irrigated

cropland, pastures, along roads, and on the lower slopes of Grizzly Butte. Weeds were most abundant at or near the lower laydown area, with species found in this area including bull thistle, Canada thistle, medusahead, nodding plumeless thistle, North Africa grass, and reed canarygrass. Medusahead covered the greatest amount of acreage within the project boundary (35.6 acres), with several infestations along the middle and southern ends of the transmission line corridor.

Special-status Botanical Species

Swan Lake North Hydro conducted an initial review of available information to determine which special-status plants occurred in the vicinity of the project. The applicant examined distribution records, species lists, and documents from BLM, the Oregon Biodiversity Information Center and FWS, and queried BLM's Geographic Biotic Observations database and the Oregon Flora Project Atlas for known site locations of target species within a 5-mile radius of the study area. Target species included those with federal and/or State of Oregon threatened, endangered, species of concern, and candidate status as well as BLM Sensitive and Strategic species.[27] The results showed that no special-status species had high likelihood for occurring in the project boundary but several have been documented within 2 miles of the proposed project. They include nodding melicgrass, Columbia cress, Howell's thelypody, short-podded thelypody, Rafinesque's pondweed, and American pillwort.

Surveys for sensitive plants were conducted in 2011 and 2015. The project area was surveyed multiple times over the growing season to ensure that surveys occurred during the appropriate phenological stage for each species. No special-status plant species were detected in the surveyed areas during either 2011 or 2015.

Culturally Important Plants

Cultural resources investigations conducted in 2015 and 2017 identified several plant species of cultural importance because of their use for food, medicine, fuel, tools, handicrafts, and shelter (Davis et al., 2015; 2017). In interviews with Klamath tribal members, individuals report gathering plants in the Swan Lake Rim area. They indicate that plants, such as lilies, have been gathered for ornamental purposes and that mushrooms (e.g., morels, boletes) and wild celery have been gathered as a food source in recent years along Swan Lake Rim. Gathering areas mentioned included the proposed penstock route and along the northernmost portion of the proposed transmission line corridor. The applicant's botanical surveys documented wild celery in mixed shrubland

[27] Sensitive and strategic species are two categories of BLM's special-status species. Sensitive species require special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA (BLM, 2008b), whereas strategic species require only that information for species sites located during survey efforts shall be entered into the BLM's Geographic Biotic Observations database (BLM, 2008a).

and in ponderosa pine forests where it dominates certain microsites, such as talus slopes, on the Swan Lake Rim escarpment. One lily species, the chocolate lily, was found on Swan Lake Rim. The botanical survey plant list did not include fungi, but a variety of edible wild mushrooms can be found in Oregon's fir or pine forests.

Plant gathering areas also occurred near lakes, wet meadows, and riparian meadows. Emergent aquatic plants such as hardstem bulrush (or tule) and cattails could be used as food or for construction of baskets and mats. Although many wetland and wet meadow sites have disappeared due to changes in groundwater levels and the construction of roads and impoundment features in these areas, hardstem bulrush and cattails are abundant in low-lying areas south of the project area, including irrigation laterals, ditches, and the margins of Swan Lake and Alkali Lake.

Macrobotanical analysis of archaeological sites within the project area identified several plant species traditionally gathered as food or for medicinal purposes (Davis et al., 2017). The applicant's botanical survey identified several of those plants in the proposed upper and lower reservoir areas, including wild rye (*Elymus* sp.), miner's lettuce, arrowleaf balsamroot, biscuitroot (*Lomatium sp.*), currant, Klamath plum, and Oregon yampah. Oregon yampah (known as *ipos*), is still traditionally collected in the spring by modern Klamath tribal members.

Other culturally significant trees and shrubs such as mountain mahogany, ponderosa pine, sagebrush, and juniper are present throughout the project area. Tribes used mountain mahogany and ponderosa pine as a construction material for building or carving canoes, paddles, bulb and root digging sticks, arrow shafts, clubs, and shelter structures. Ponderosa pine and sagebrush were used as fuel. Some members used the inner bark and seeds of ponderosa pine as food, and they ingested or chewed the leaves, berries, or bark of mountain mahogany, sagebrush, ponderosa pine, and juniper for medicinal purposes. Tribal members also used ponderosa pine pitch as an adhesive.

Wetlands

Wetlands, as well as flowing water and riparian habitats, are considered strategy habitats in Oregon's SWAP (Oregon DFW, 2016a). Large lakes, rivers and wetlands in the project vicinity include Swan Lake, Alkali Lake, and the Lost River. Swan Lake is a freshwater emergent and open water wetland complex that is protected under the NRCS's Wetland Reserve Program through a 4,580-acre conservation easement. It is located south of the proposed reservoirs within Swan Lake Valley, a 10-mile-long historical lake basin that has largely been converted to irrigated cropland and pasture. Alkali Lake, an approximately 2,200-acre freshwater emergent and open water wetland complex, is located in Yonna Valley east of the proposed transmission line corridor. The Lost River is a low gradient, 60-mile-long river that originates at the outlet of Clear Lake, California, and flows northward into Oregon's Klamath and Lake Counties, before returning to Tule Lake in California. It is listed in Oregon's SWAP as a "conservation opportunity area" or a place where targeted funding efforts are likely to obtain broad fish and wildlife

conservation goals (Oregon DFW, 2016a). It is highlighted for providing habitat for the endangered Lost River sucker and shortnose sucker and for its heavy use by migrating and wintering waterfowl (Oregon DFW, 2016a). The proposed transmission line corridor crosses the Lost River at Harpold Dam, southeast of Alkali Lake.

Swan Lake North Hydro used FWS's National Wetlands Inventory (NWI) to map wetlands within the project boundary. The majority of the project's features would be constructed in upland areas, but small wetlands and intermittent stream channels occur within the project boundary along the upper reservoir access road and along the transmission line route.[28] The access road to the upper reservoir traverses westward from Bliss Road and crosses Buck Creek, a seasonally flooded stream, and two intermittent tributaries. A small, 1.4-acre freshwater emergent/forested-shrub wetland is also present along the access road pathway. Along the project's proposed transmission line, there are a number of intermittent streams, small freshwater emergent wetlands, small impounded ponds, and one area of open water habitat (the Lost River at Harpold Dam).

Wildlife

The region contains several habitat types that support a diverse assemblage of wildlife. The applicant recorded wildlife observations during field surveys (i.e., species of conservation concern habitat surveys, sensitive plant surveys, weed surveys, etc.) and gathered specific information on raptors through targeted roadside surveys or surveys for nests and winter roosts during the 2011 summer and 2011-2012 winter. Eighty-two wildlife species (67 birds, 11 mammals, 3 reptiles, and 1 amphibian) were observed in the vicinity of the proposed project from March 2011 to March 2012.

Numerous bird species were observed in croplands and pastures in and near the project boundary, with raptors such as bald eagles and ferruginous hawks using overhead transmission line poles and irrigation structures as perches. Other species likely to be found in agricultural areas include black-billed magpie, western kingbird, California quail, mourning dove, western meadowlark, and horned lark. In the low sagebrush-steppe communities, the applicant observed species such as sharp-shinned hawks, turkey vultures, chipping sparrows, dark-eyed juncos, western bluebirds, and common nighthawks. Species observed in juniper woodlands within the project boundary included

[28] The NWI map also shows two small freshwater emergent wetlands (0.65 and 0.49 acre, respectively) and one 0.52-acre freshwater pond at the northern end of the lower staging area and a 1.22-acre freshwater emergent wetland at the southern end of the lower staging area. According to the applicant, the wetlands at the northern end no longer exist, and were part of a previous agricultural irrigation system that has since been placed underground (see the May 18, 2018, telephone memorandum to the project file). In April 2015, the applicant conducted an onsite investigation of a 1.22-acre freshwater emergent wetland at the southern end of the lower staging area but found that it did not have wetland hydrology, plants, or soils, and thus concluded there was an error in the NWI data.

black-billed magpies, Stellar's jays, and Townsend's solitaires, while those detected in ponderosa pine and white fir forest stands included hermit warblers, mountain chickadees, Clark's nutcrackers, western tanagers, Cassin's vireos, red-breasted sapsuckers, western wood-pewees, and red-tailed hawks.

Within the surrounding Swan Lake, Poe, and Yonna Valleys, raptor surveys documented several species (i.e., bald eagles, golden eagles, ferruginous hawks, rough-legged hawks, northern harrier, red-tailed hawks, and American kestrels) either nesting or overwintering. The Lost River and associated wetlands and reservoirs within Poe and Yonna Valleys provide important foraging and migratory stopover areas for waterfowl, shorebirds, songbirds, and raptors. In January 2012, the applicant observed several geese using the Lost River when Swan and Alkali Lakes were iced-over. Swan Lake, Poe, and Yonna Valleys are included in the Lower Klamath Bird Habitat Conservation Area for eastern Oregon (Oregon Habitat Joint Venture, 2005), and are a part of the larger Klamath River Basin wetland system that supports tens of thousands of waterfowl and waterbirds during spring staging, summer nesting, and autumn migration periods (Gilmer et al., 2004; Shuford et al., 2006). Nongame waterbird surveys conducted in May, June, and August in 2003 and 2004 at Klamath River Basin wetlands and lakes showed bird totals ranging from 145 to 12,416 in the Swan Lake area and 285 to 2,236 in the Yonna Valley area (Shuford et al., 2006). Swan Lake, in particular, provided 14 to 19 percent of the basinwide total during the May surveys, primarily due to the high numbers of nesting gulls species (Shuford et al., 2006). During visits to Swan and Alkali Lakes in 2011–2012, the applicant noted high bird numbers (estimated in the hundreds to tens of thousands, depending on the season), with a diversity of ducks, geese, cranes, gulls, pelicans, and swans.

Several mammal species are likely to use or were observed using habitats within the project boundary. The applicant commonly observed mule deer and pronghorn antelope throughout the valleys and hills associated with the proposed project, with mule deer fawns and does routinely observed on Grizzly Butte in summer. These ungulates rely on the forb and grass cover in the project's low sagebrush habitats during migration periods and late summer, and utilize the big sagebrush-steppe areas, mixed shrublands, and juniper woodlands for thermal cover and food resources during winter months when grasses and forbs are scarce or under snow. Juniper woodlands and shrub-steppe communities support a number of small mammals such as yellow pine chipmunks, golden-mantled and California ground squirrels, mice, voles, and shrews. Bushy-tailed woodrats and their nests were observed in western junipers on Grizzly Butte, Swan Lake Rim, Hopper Hill, Horton Rim, and Harpold Rim during field surveys, and cottontail rabbit pellets were found within the large patch of big sagebrush steppe along the east side of Swan Lake. Several bat species likely use large ponderosa pines and outcrops on the Swan Lake escarpment for roosting as well as other available habitats, including juniper woodlands and low sagebrush-steppe areas. Large mammals such as elk, mountain lions, or black bears may traverse and forage through habitats that occur within the project boundary, with predators such as coyotes seeking prey in agricultural fields.

Numerous lizards and snakes, including the sagebrush lizard and western rattlesnake, are found in sagebrush habitats, while fence lizards, and other reptiles are likely present in talus areas among juniper woodlands on the Swan Lake Rim escarpment.

Wildlife Species of Conservation Concern

The applicant observed nine wildlife species at or near the project that have special-status under federal and/or state agencies (table 3-8) (BLM, 2015; FWS, 2016; Oregon DFW, 2016a,b). Animal species federally or state-listed as threatened or endangered are discussed in section 3.3.4. Several other special-status species are also likely to use habitats found at the project or within the vicinity (approximately 2 miles) of the project boundary (Oregon State University, 2007).

Table 3-8. Special-status wildlife species likely to be at or within the vicinity of the project (Source: staff).

Common Name (Scientific Name)	Observed within Project Boundary or Vicinity	Status		
		FWS List[a]	Oregon DFW East Cascades Ecoregion List[b]	BLM OR Special-status Species List[c]
Birds				
American white pelican (*Pelecanus erythrorhynchos*)	X		S, SS	SEN, KF-d
Bald Eagle[d] (*Haliaeetus leucocephalus*)	X			SEN, KF-d
Black-backed woodpecker (*Picoides arcticus*)			S, SS	
Black tern (*Chlidonias niger*)		SOC		
Bufflehead (*Bucephala albeola*)	X			SEN, KF-d
Ferruginous hawk (*Buteo regalis*)	X	SOC		
Flammulated owl (*Psiloscops flammeolus*)			S, SS	
Golden eagle[d] (*Aquila chrysaetos*)	X			

Common Name (Scientific Name)	Observed within Project Boundary or Vicinity	Status		
		FWS List[a]	Oregon DFW East Cascades Ecoregion List[b]	BLM OR Special-status Species List[c]
Great gray owl (*Strix nebulosa*)			S, SS	
Greater sandhill crane (*Grus canadensis tabida*)	X		S, SS	
Horned grebe (*Podiceps auritus*)				SEN, KF-s
Lewis's woodpecker (*Melanerpes lewis*)		SOC	S-C, SS	SEN, KF-d
Long-billed curlew (*Numenius americanus*)			S, SS	
Mountain quail (*Oreortyx pictus*)		SOC		
Northern goshawk (*Accipiter gentilis*)		SOC	S	
Olive-sided flycatcher (*Contopus cooperi*)	X	SOC	S-C, SS	
Purple martin (*Progne subis*)		SOC		SEN
Snowy egret (*Egretta thula*)				SEN, KF-d
Swainson's hawk (*Buteo swainsoni*)	X		S, SS	
Tricolored blackbird (*Agelaius tricolor*)		SOC		SEN, KF-d
White-faced ibis (*Plegadis chihi*)		SOC		
White-headed woodpecker (*Picoides albolarvatus*)	X	SOC	S-C, SS	SEN, KF-d
Willow flycatcher (*Empidonax traillii adastus*)		SOC		

Common Name (Scientific Name)	Observed within Project Boundary or Vicinity	Status		
		FWS List[a]	Oregon DFW East Cascades Ecoregion List[b]	BLM OR Special-status Species List[c]
Yellow rail (*Coturnicops noveboracensis*)		SOC	S-C, SS	SEN, KF-d
Mammals				
America pika (*Ochotona princeps*)			S, SS	
California myotis (*Myotis californicus*)			S, SS	
Gray wolf (*Canis lupus*)		FE	SS	SEN, KF-d
Hoary bat (*Lasiurus cinereus*)		SOC	S, SS	
Long-eared myotis (*Myotis evotis*)		SOC		
Long-legged myotis (*Myotis volans)*		SOC	S,SS	
Pallid bat (*Antrozous pallidus*)		SOC	S, SS	SEN, KF-d
Pygmy rabbit (*Brachylagus idahoensis*)		SOC		SEN, KF-s
Silver-haired bat *(Lasionycteris noctivagans)*		SOC	S, SS	
Yuma myotis *(Myotis yumanensis*)		SOC		
Reptiles				
Northern sagebrush lizard (*Sceloporus graciosus graciosus*)		SOC		

Common Name (Scientific Name)	Observed within Project Boundary or Vicinity	Status		
		FWS List[a]	Oregon DFW East Cascades Ecoregion List[b]	BLM OR Special-status Species List[c]
Western pond turtle (*Actinemys marmorata marmorata*)		SOC	S-C, SS	SEN, KF-d
Amphibians				
Western toad (*Anaxyrus boreas*)			S, SS	

[a] FWS categories are: FE = Federally Endangered, SOC = Species of Concern.

[b] Oregon East Cascades Ecoregion List categories are: S = Sensitive, S-C = Sensitive Critical, SS = Strategy Species.

[c] BLM Sensitive Status Species categories are: KF-d = documented occurrence in Klamath Falls Resource Area, KF-s = suspected occurrence in Klamath Falls Resource Area, SEN = Sensitive in OR.

[d] Receive additional federal protection under the Bald and Golden Eagle Protection Act.

Special-status bird species were identified near the proposed upper and lower reservoir areas. At the proposed upper reservoir location, a male olive-sided flycatcher was heard singing in late June 2011. At the proposed lower reservoir location, on the north side of Grizzly Butte, the applicant observed a male and female white-headed woodpecker foraging in the ponderosa pine stands during the 2011 summer and 2011–2012 winter months. Although no nestlings were observed, this area likely comprises part of the pair's breeding territory. At this same location near the lower reservoir, there are two bald eagle nests; one nest has been active since 2004 and the other nest is considered inactive. During the 2011 breeding season, the occupying bald eagle pair successfully hatched at least one eaglet.

Along the proposed transmission line corridor, there are four other bald eagle nests within 2 miles of the proposed transmission line route; all nests are presumed to be active except for one near the Captain Jack Substation[29] that was last occupied in 2007. Golden eagles also have active nests within 2 miles of the proposed project. One nest is on the east side of Swan Lake Rim and less than 2 miles from the proposed transmission

[29] This existing substation is located approximately 5 miles northeast of Malin, Oregon. It would not be part of the proposed project and the project transmission line would not interconnect with it.

corridor near Hopper Hill. Another nest site is at the end of the proposed transmission corridor, approximately 0.25 mile west in Mills Creek Canyon.

Along with bald and golden eagles, other special-status raptors have also been seen foraging and overwintering within Swan Lake, Poe, and Yonna Valleys. The applicant observed a Swainson's hawk in Yonna Valley in November 2011, and ferruginous hawks were observed in Swan Lake, Poe, and Yonna Valleys through the 2011–2012 winter season.

The applicant observed special-status waterfowl species (i.e., white pelicans, buffleheads, greater sandhill cranes) at nearby Swan and Alkali Lakes and the Lost River. The presence of other FWS species of concern (i.e., white-faced ibis (*Plegadis chihi*), black tern (*Chlidonias niger*)) has been documented in the area of Swan Lake and Yonna Valley by past surveys, and these species are likely to be present considering the numbers of birds that utilize these areas during migration and nesting periods. In addition, although not observed by the applicant during the 2011–2012 surveys, western pond turtles (*Actinemys marmorata*) have been documented on the Lost River near the town of Bonanza and in the vicinity of Harpold Dam according to Oregon Biodiversity Information Center records. This species is currently undergoing federal review for possible listing under the ESA (FWS, 2015a).

The greater sage-grouse (*Centrocercus urophasianus*) was removed from the ESA candidate species list in October 2015 (FWS, 2015b) but remains a FWS species of concern and a BLM sensitive species (BLM, 2015; FWS, 2016). The proposed project lies within the Western Association of Fish and Wildlife Agencies' Management Zone V (Northern Great Basin) for the greater sage-grouse, and the route for the proposed project transmission line passes through the Klamath population boundary, as defined by the 2012 Sage-Grouse Conservation Objectives Team (FWS, 2013a). However, the Klamath population, which once extended from northern California through southern Oregon, is considered extirpated in Oregon because there have been no confirmed sightings of individuals from this population in the state since 1993 (FWS, 2013a). Recent Oregon conservation plans for the sage-grouse (State of Oregon's 2015 Sage-grouse Action Plan, BLM's 2015 Oregon Greater Sage Grouse Plan Amendment, and BLM's 2018 Oregon Draft Resource Management Plan Amendment) focus on lands outside of the project boundary (planning and decision areas are over 15 miles east of the project). Therefore, the proposed project would not affect these conservation areas or conflict with these land use plans.

3.3.4.2 Environmental Effects

Effects of Project Construction and Operation on Vegetation

Construction of the project would require vegetation clearing and ground disturbance, resulting in permanent and temporary loss of vegetation on proposed project lands. Construction activities could affect microsite environmental conditions through soil compaction, soil excavation, and altered sunlight levels, which could change species

composition or survival of existing vegetation. Additionally, construction vehicles could transport invasive weed species to recently disturbed areas, potentially leading to increased competition with existing plant communities.

The applicant estimates that construction of the project would result in a permanent loss of 210.5 acres of vegetation and temporary disturbance of an additional 266.9 acres (table 3-9). Permanent loss to vegetation would occur as a result of the construction of the upper and lower reservoirs, powerhouse, substation, power poles, penstock, and permanent access roads. Temporary disturbances to vegetation would occur from temporary access road construction and the establishment of temporary laydown areas.

Some tree clearing would be required along the transmission line corridor to ensure sufficient clearance between the transmission line conductors and surrounding vegetation. Such clearing would convert about 685 acres of forested habitat (mainly juniper woodlands) to herbaceous or shrub habitats, and such habitats would need to be maintained in those early successional stages. Other habitat types (e.g., mixed shrubland, agricultural lands) within the transmission line corridor would not change.

Table 3-9. Permanent and temporary impacts on vegetation on proposed project lands (Source: Swan Lake North Hydro, 2015).

Vegetation Type	Permanent Disturbance (acres)	Temporary Disturbance (acres)	Total Disturbance (acres)
Agricultural land	2.2	171.7	173.9
Juniper woodland	97.6	11.7	109.3
Sagebrush	0.6	1.1	1.7
Mixed shrubland	2.1	6.7	8.8
Pine and fir forests	108	75.7	183.7
Total	**210.5**	**266.9**	**477.4**

Once construction is completed, some operation and maintenance activities would continue to affect vegetation in the project area. These activities would primarily include regular vegetation management (e.g., tree removal every 10 years), primarily along the transmission line ROW, and periodic vegetation disturbance during maintenance and repair of project facilities.

To minimize effects on botanical resources, the applicant proposes to finalize the details of the Revegetation and Noxious Weed Management Plan filed with the license application. The applicant's proposed plan includes: (1) guidance for minimizing ground disturbance and soil preparation; (2) temporarily planting disturbed areas to

reduce erosion and establishment of weeds; (3) reseeding disturbed areas as soon as possible following construction activities using only BLM-approved and Oregon Department of Agriculture-certified weed-free seed and other materials (e.g., straw, fill); (4) reestablishing native plants from genetically local sources to the extent practicable; (5) implementing a monitoring program using survey sampling plots to evaluate the efficacy of revegetation efforts; and (6) applying additional soil amendments, plantings, and weed management strategies if revegetation is not achieved within 3 to 5 years of target cover levels for individual species.

To minimize the potential introduction and spread of noxious weeds during project construction the Revegetation and Noxious Weed Management Plan includes measures for preconstruction, construction, and post-construction periods including: (1) onsite personnel training to implement protocols; (2) cleaning of equipment prior to entering and leaving the construction site; (3) guidance for treatment of stockpiled soils that may contain weeds; (4) safety guidelines for herbicide use and potential spills; (5) use of weed-free materials (e.g., seed stock, fill materials, and materials used in erosion control); (6) noxious weed surveys and treatment prior to ground-disturbing activity; (7) temporarily planting certain areas to reduce weed establishment; (8) monthly inspection and treatment of areas within the project boundary during construction; and (9) monitoring and post-construction treatment of weeds identified within the project boundary.

The applicant also proposes four specific mitigation projects for the permanent and temporary but long-term (e.g., more than 5 years to recovery) losses to wildlife habitat. As these proposed mitigation projects are more focused toward benefits to wildlife, analyses of these measures are discussed later in this section (see *Permanent and Long-Term Loss or Change of Wildlife Habitat*).

Oregon DFW recommends (10(j) recommendation 3(H)) that the applicant develop, in consultation with resource agencies, a vegetation management plan for managing native vegetation and control of invasive weed species throughout the license term. Oregon DFW states that within its recommended plan, there should be a separate revegetation management plan for restoring native vegetation in temporarily disturbed areas.

In its comments on the draft EIS, KCPW recommends that the Revegetation and Noxious Weed Management Plan include a warranty condition that no noxious weeds should be allowed to produce seed after the first year of construction activity. KCPW also recommends that the following requirements of state statutes be incorporated in the plan: (a) noxious weed control will be required during and after project completion as required under (Oregon Revised Statute [ORS] 569.390); (b) continuous control of noxious weeds under transmission lines (ORS 569.395); and (c) Klamath County Weed Control Supervisor will inspect the site for any noxious weeds after project completion (ORS 569.380). In its comments on the draft EIS, Interior recommends that the following measures be implemented during project construction and operation: (1) all

fire restrictions must be followed in accordance with the jurisdictional land management agency; and (2) any vegetation slash created on BLM lands must be removed by means other than burning to avoid concentrations of hazardous fuels within the project area and that this removal should be completed within one year of creating slash.

Our Analysis

The measures proposed in the applicant's Revegetation and Noxious Weed Management Plan would minimize the limits of vegetation disturbance and ensure that temporarily disturbed areas are revegetated as soon as possible upon completion of construction activities. Establishing cover on disturbed areas as quickly as possible would preserve soils and minimize the introduction of weeds. Establishment of native plants that would provide more permanent and valuable wildlife habitat would take time; however, in our experience, successful reestablishment of native vegetation can be accomplished within 5 years as long as there are no extreme weather conditions. The applicant's proposed monitoring program would provide a means to track and verify re-establishment of vegetation. If annual monitoring indicates that successful revegetation has not been achieved within 3 to 5 years, the implementation of additional soil amendments, plantings, and weed management strategies would help to ensure timely recovery of disturbed areas. Use of genetically local sources of native plants would enhance the likelihood of successful growth and reestablishment, and consultation with resource agencies to define appropriate seed mixtures and plant species would ensure that the revegetated areas provide habitat of value (e.g., forage, cover) for wildlife resources.

The measures included in the Revegetation and Noxious Weed Management Plan would also prevent the spread of noxious weeds during project construction. Temporarily planting certain areas (e.g., areas left exposed longer than 8 weeks) and long-term revegetation of disturbed areas as soon as possible upon completion of construction activities as proposed would limit openings for potential noxious weed colonization. The applicant's preventative measures such as cleaning of construction equipment, treatment of weed infestations prior to ground disturbance, and use of weed-free materials would reduce potential for transfer of invasive weed propagules to disturbed sites. Proposed monthly treatment of weeds during construction and implementing protocols for treating of stockpiled soils that may contain weeds would minimize further propagation of weed species during construction activities.

KCPW's recommendation that the plan include a warranty condition that no noxious weeds should be allowed to produce seed after the first year of construction activity is unenforceable and impracticable, as there can be no reasonable way to guarantee that there would not be any weed persistence and germination of weeds after the first year of construction, particularly over such a large area. The BMPs in the applicant's draft Revegetation and Noxious Weed Control Plan are commonly used measures designed to minimize, but not prevent with certainty, the introduction or spread of noxious and invasive weeds. Nonetheless, the proposed measures in the plan would

ensure that Swan Lake North Hydro monitors for weed establishment and takes the necessary steps to control the spread of weeds as needed.

KCPW also recommends that several State of Oregon statutes regarding noxious weed control should also be incorporated into the plan. While the Commission expects its licensee's to obtain and follow all necessary state and local permits, the Commission does not typically require its licensees to adhere to state statutes because it cannot abrogate its responsibilities to other authorities. Nonetheless, Swan Lake North Hydro already proposes to implement weed control measures during and after construction, which should address KCPW's concerns. Also, the Commission cannot require inspections by Klamath County Weed Control Supervisor because the Commission only has authority over the licensee. Requiring the noxious weed control plan to be developed in consultation with KCPW would provide a means to include periodic inspections and other actions the county may consider necessary to prevent the spread of weeds.

The applicant does not provide any specifics regarding the methods of cutting and disposal of vegetation. However, as noted by Interior, accumulation of slash could increase fuel loads and susceptibility of wildfires, particularly given the area's dry climate. Promptly removing cleared vegetation would help prevent build-up of fuels that feed wildfires. Development of a fire prevention plan would ensure that there are specific measures in place to minimize the potential for a wildfire.

As noted above regarding weed control, the Commission typically does not require adherence to other agency broad regulatory requirements. However, developing the fire prevention plan in consultation with BLM and the Klamath County Emergency Management Department would ensure that those entities' concerns are fully considered in any plan approved by the Commission.

The proposed Revegetation and Noxious Weed Management Plan needs further refinement. Details that still need to be finalized in consultation with resource agencies include seed mixes and plant species to be used for revegetation, planting densities and methods, fertilization and irrigation requirements, specific monitoring protocols, criteria for measuring the success of revegetation efforts, and specific procedures to be followed if revegetation is not successful. In addition, the plan focuses on revegetation and control of noxious weeds during and immediately following construction of the project. It does not describe what protocols and measures would be followed for conducting routine vegetation management during project operation. Applying the measures described in the plan throughout project operation would help ensure that periodic vegetation practices continue to promote native vegetation establishment, but do not degrade wildlife habitats by the spreading of noxious weeds.

Effects of Project Construction on Special-status Plants

Project construction and operation could affect special-status plants by removal or disturbance of individual plants, habitat loss or degradation, and introduction and spread of non-native invasive plants, including noxious weeds. The applicant did not detect any

special-status plants during 2011 and 2015 surveys, but proposes to complete additional sensitive plant surveys prior to any ground disturbing activities associated with construction of the proposed project because plants can often recolonize areas over time or may have been missed during site surveys. If individuals are detected, the applicant would consult with FWS, NRCS, or BLM, and measures would be taken to protect the species. If possible, individual plants that are located in areas that may be temporarily disturbed would be flagged and fenced to avoid damage or displacement. If displacement cannot be avoided, they could be translocated or seeds collected and incorporated into the planting scheme for revegetation efforts.

No one commented on the applicant's proposed measures.

Our Analysis

Although special status plants are not likely to be present in the construction area, conducting preconstruction surveys for special-status plant species would allow the applicant to identify the occurrence of these populations before construction begins and to take appropriate measures to minimize adverse effects on special-status plants. The applicant does not specify when surveys would be conducted, but the applicant's 2011 and 2015 special-status plant surveys were conducted multiple times throughout the summer months (May through August) to account for differing phenological stages among species. Conducting preconstruction surveys during this same time of year would help to identify (if present) two species that were not included in prior survey lists, Greene's tuctoria and slender Orcutt grass, as this would be during these species' inflorescence period. Should a special-status plant be detected measures could be undertaken to minimize effects on or avoid these populations (e.g., marking and protecting the area, transplanting individual plants). Consulting with the resource agencies would enable these agencies to advise Swan Lake North Hydro and make recommendations for appropriate protective solutions. The results of the preconstruction survey should be reported to the Commission, FWS, NRCS, and BLM at least three months prior to beginning construction. Swan Lake North Hydro's proposed measures to reduce the spread of noxious weeds would also limit potential effects on special-status plant species.

Effects on Culturally Important Plants

Project construction and operation would result in the removal or disturbance of some plants, trees, and shrubs that are considered culturally important to Native Americans. Degradation of habitat for culturally important plants could also occur due to the introduction and spread of non-native invasive plants, and soil compaction or erosion.

In their September 9, 2016, comment letter, the Klamath Tribes state that the proposed project would disturb habitat for certain plants (e.g., mushrooms, wild celery) that are used as both food and for ceremonial use. The Klamath Tribes also indicate that other plants gathered for ornamental purposes would also be adversely affected. The

Klamath Tribes do not recommend any measures to mitigate for these effects, nor does the applicant.

Our Analysis

Project construction and operation would permanently remove 210.5 acres of vegetation and temporarily disturb 266.9 acres, primarily at the construction site for the upper and lower reservoirs/laydown areas. The project location, particularly the upper reservoir/laydown area on Swan Lake Rim, would likely cause the removal of some culturally important plants, and some temporary and permanent displacement of plant gathering activities that have historically and currently occur in this area. Emergent aquatic plants are not likely to be affected by project construction, as the majority of the construction of project features would be in upland areas.

The applicant's Revegetation and Noxious Weed Management Plan contains measures to reseed disturbed areas as soon as possible following construction activities, and to replant using native species. A final plant list has not been developed, but several of the recommended plant species include those that are considered culturally important species: ponderosa pine, mountain mahogany, Klamath plum, currant, and wild rye. Consultation with the Klamath Tribes during finalization of the Revegetation and Noxious Weed Management Plan could help to ensure that culturally important plants, such as wild celery, are included in the species list for replanting. Additionally, consultation with the Klamath Tribes for management of conservation lands acquired as mitigation for habitat losses (discussed later in this section under *Permanent and Long-Term Loss or Change of Wildlife Habitat*), could also consider promoting the growth and collection of culturally important plants, and thus enhance the development of new areas for traditional plant gathering activities.

Effects of Project Construction on Wetlands

Although the majority of the project's features would be constructed in upland areas, small wetlands and stream channels occur along the upper reservoir access road and along the transmission line route. Construction activities within or adjacent to those features could cause soil erosion or compaction and adversely affect wetlands through diminished water quality or altered hydrology. After construction, the surface water runoff patterns in Swan Lake Valley would be changed by the project features. The reservoirs would capture some rainwater that is currently available for nearby wetlands such as Swan Lake, and new surface runoff channels would form to reroute water around the reservoirs.

The applicant proposes to construct the access road for the upper reservoir during the dry season when water would not be present. Impacts to jurisdictional wetlands along the transmission line ROW (including the Lost River) would be prevented by ensuring that project features (e.g., transmission line poles) and soil disturbance areas are outside the boundaries of wetlands or riparian areas. The applicant also proposes to develop and implement a comprehensive soil erosion control plan to protect intermittent waterbodies.

Our Analysis

The applicant's proposed project design would limit impacts to wetlands or riparian areas. Implementing a soil erosion control plan and conducting construction during the dry season would also help to minimize potential reduction of water quality for intermittent streams.

The upper and lower reservoirs, with surface areas of approximately 64 and 60 acres, respectively, would capture and remove some rainwater. However, this loss of rainwater is not expected to significantly affect surface water runoff to wetland habitat types as there are no known wetlands, streams, or vernal pools within a mile of either proposed reservoir.

Permanent and Long-term Loss or Change of Wildlife Habitat

As stated above, project construction would permanently remove 210.5 acres of vegetation and temporarily disturb an additional 266.9 acres (see table 3-9). Because the some of the temporary habitat disturbances (95.2 acres) would take longer than 5 years to recover, the applicant proposes to mitigate for those effects as a permanent loss to wildlife habitats.

To mitigate and compensate for the permanent and long-term habitat disturbances, the applicant proposes to finalize and implement the WHREP in consultation with FWS, Oregon DFW, and BLM.[30]

The applicant considers the entire project boundary as big game winter range essential habitat. Although available browse and cover at the upper reservoir area may be under snow and/or sparse during winter, the applicant still considers this area as big game winter range habitat given its likely use in mild winters, and the importance of Swan Lake Rim as a migration route. Similarly, cropland and pasture within the project boundary are not native habitats, but they provide both summer range and crucial winter range for big game in the project vicinity. Big game winter range is classified as Category 2 habitat under Oregon DFW's Habitat Mitigation Policy.[31] Because of the

[30] The applicant's draft WHREP also includes resource-specific sub-plans for revegetation and noxious weed management, and the protection of ungulates, eagles, and general avian/bat species. In this document, we evaluate those sub-plans as individual, stand-alone plans, as recommended by Oregon DFW in its May 22, 2018, filing.

[31] Under Oregon DFW's Habitat Mitigation Policy, Category 2 habitat is defined as 'essential and limited.' 'Essential habitat' is defined as 'any habitat condition or set of habitat conditions which, if diminished in quality or quantity, would result in depletion of a fish or wildlife species.' 'Limited habitat' is defined as 'an amount insufficient or barely sufficient to sustain fish and wildlife populations over time.' The mitigation goal for proposed actions that could displace Category 2 habitat is no net loss in habitat quantity or quality and a net benefit of habitat quantity or quality.

importance of the affected area to big game as winter range, the proposed plan focuses on improving habitat for ungulates.

The plan includes a combination of specific habitat measures and funding to offset the adverse effects to 305.7 acres by improving and protecting 917 acres (305.7 acres at a mitigation ratio of 3:1) of big game habitat. Specifically, the applicant would: (1) install/repair two wildlife water guzzlers (a mitigation value of 50 acres); (2) retain a private road access easement and make improvements to a temporary access road for BLM's perpetual access so that it could implement wildlife habitat projects on its lands on Swan Lake Rim (a mitigation value of 50 acres), (3) acquire or obtain a long-term lease of 585 acres of land for big game and other wildlife habitat conservation, and (4) fund BLM to thin 232 acres of juniper and mixed conifer forest to improve the value of sagebrush habitat on Bryant Mountain.

Oregon DFW recommends (10(j) recommendations 3(B)) that the applicant finalize a comprehensive WHREP for the project area and related mitigation lands, in consultation with agencies and tribes, within 1 year of license issuance.

Our Analysis

Swan Lake North Hydro developed a draft WHREP in consultation with FWS, Oregon DFW, and BLM, and included it in its final license application. In response to the Commission's additional information requests on December 18, 2015, and June 23, 2016, Swan Lake North Hydro filed revised WHREP drafts on April 18, 2016, and July 25, 2016. The current WHREP, however, still lacks specificity, and an implementation schedule for some measures (i.e., installing/repairing water guzzlers, Bryant Mountain juniper and mixed conifer thinning) would be determined by BLM. In some cases, the measures conflict with Commission policy. We discuss specific measures below.

Big Game Water Developments

The applicant would install/repair water guzzlers (structures that collect and store rainwater for wildlife use) to enhance water availability for big game in the vicinity of the project, but not on project lands (i.e., lands proposed to be included in the project boundary). One water guzzler would be installed on Horton Rim, on the hill southwest of the town of Dairy (figure 3-3). Another water guzzler that currently exists on Windy Ridge, southwest of Harpold Dam, would be repaired or rebuilt. The schedule for implementing this mitigation project would be determined by BLM.

Availability of free-standing water for wildlife, particularly big game, is likely a limiting factor in the project area. The project would lie within the East Cascades ecoregion, which is in the rain shadow of the Cascade Range and is characterized by a generally dry climate. Most of the wet meadows and wetlands that historically occurred in the greater Klamath River Basin have been reduced or diverted by agricultural and urban activities.

Providing reliable, supplemental sources of water, such as guzzlers, would benefit wildlife if conditions are such that food and cover are available, but water quantity, quality, or distribution are inadequate or not optimized (NRCS, 2010). According to Oregon's Elk Management Plan (2003a), livestock water improvements in arid areas have clearly benefited elk, with increased water distribution contributing to increased populations and expanded herd ranges. Also, water developments established for deer and elk could benefit other wildlife species, such as birds, bats, and small mammals (Oregon DFW, 2016a). Therefore, the proposed installation and repair of the guzzlers would likely benefit mule deer and other wildlife that use habitats affected by construction and operation of the project.

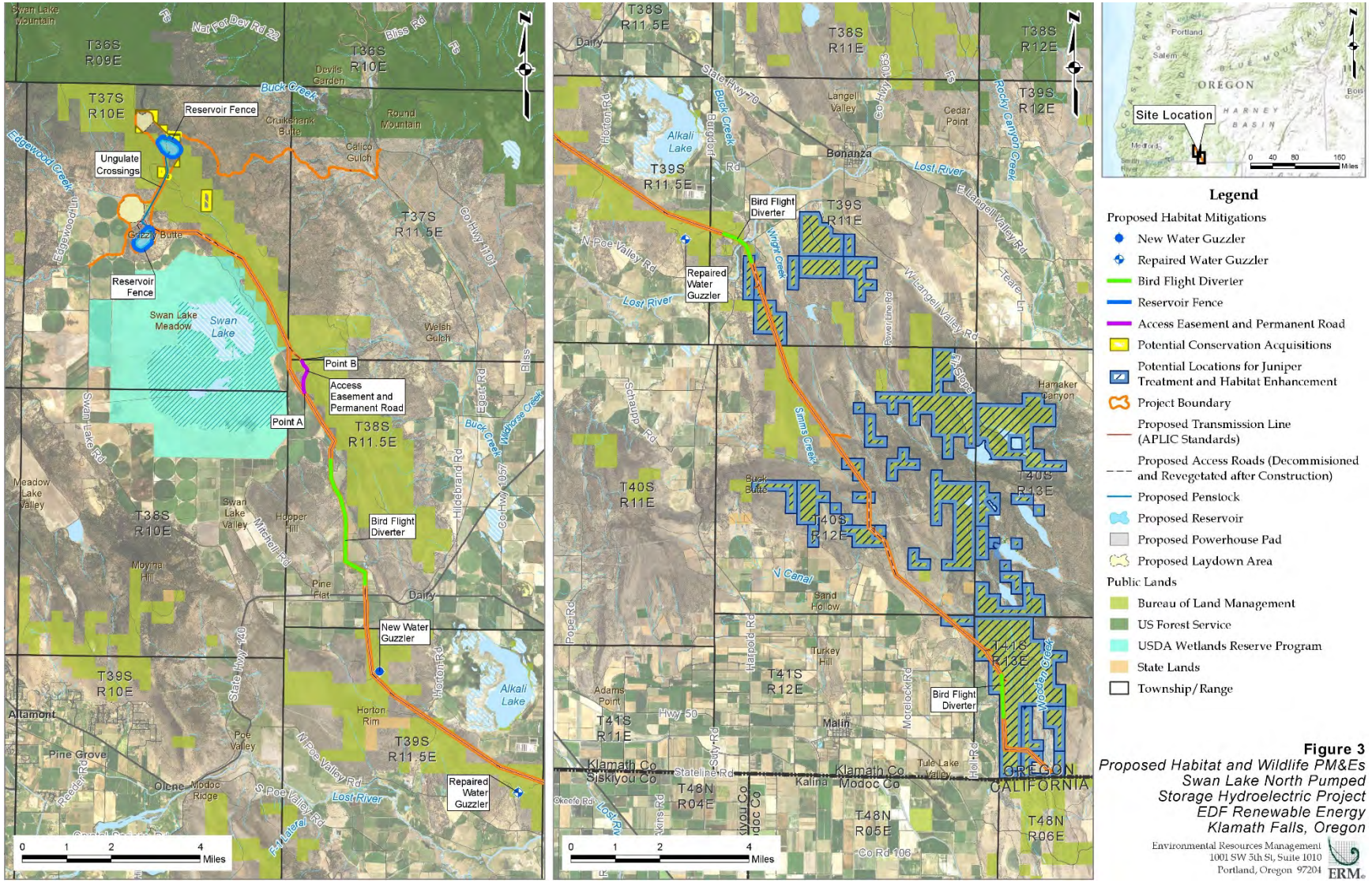

Figure 3
Proposed Habitat and Wildlife PM&Es
Swan Lake North Pumped Storage Hydroelectric Project
EDF Renewable Energy
Klamath Falls, Oregon

Environmental Resources Management
1001 SW 5th St, Suite 1010
Portland, Oregon 97204

Figure 3-3. Location of the proposed WHREP measures (Source: Swan Lake North Hydro, 2015).

However, installing wildlife watering facilities might have unintended drawbacks, such as concentrating animals, making them more susceptible to predation, diseases, and hunting (NRCS, 2010). Some types of water facilities have design features that present a hazard to wildlife such as over-hanging wires that act as trip lines for bats, steep side walls that act as entrapments under low water conditions, or unstable perches that cause animals to fall into the water and drown (Oregon DFW, 2016a). Also, water facilities can develop maintenance problems over time as they age in open, unprotected environments (e.g., plumbing issues, damage to collection aprons).

Designing the guzzlers in consultation with Oregon DFW, FWS, and BLM would allow the resource agencies to advice on the best design alternatives. Annually inspecting the guzzlers would be needed to identify any potential problems that may occur after installation, such as adverse effects on wildlife or maintenance issues. Implementing a maintenance program, with routine inspection and follow-up maintenance as needed, would ensure that the guzzlers provide the intended benefits throughout any license term.

Administrative Access and Road Improvements for BLM Habitat Improvement Projects

This is a two-part mitigation measure. The first part involves securing and transferring to BLM administrative access rights to an existing road across private lands. The road is located between highway 140 and the proposed power line temporary access road just southeast of Swan Lake. The road access easement would be initially acquired for transmission line construction, but the applicant intends to negotiate to maintain this easement for BLM's land management purposes through the license term. These access rights for BLM would be for administrative access only, not public access. Any use of these roads for access to BLM lands after construction is complete would be limited to use by BLM or the applicant.

The second part of this mitigation project would involve retaining and converting a portion of the temporary power line access road (mentioned above) into a permanent road for exclusive use by BLM personnel and the applicant. BLM would use this 0.9-mile segment to access their lands and implement habitat improvement projects. A steel gate and lock box would be installed at the southern end (point A in figure 3-4) to block public access, and a 50-foot-wide and 50-foot-long parking lot and turn around spot would be constructed at the northern end (point B in figure 3-4). The improved road would be turned over to BLM after construction, and any maintenance costs associated with the road or future improvements would be borne by BLM.

The temporary access road, and the administrative access rights to the existing road across private lands (joining the temporary access road and highway 140), would only be needed for project construction – not for operation or maintenance of the project. Typically, lands or features that are only needed for project construction would not need to be made part of the project lands.

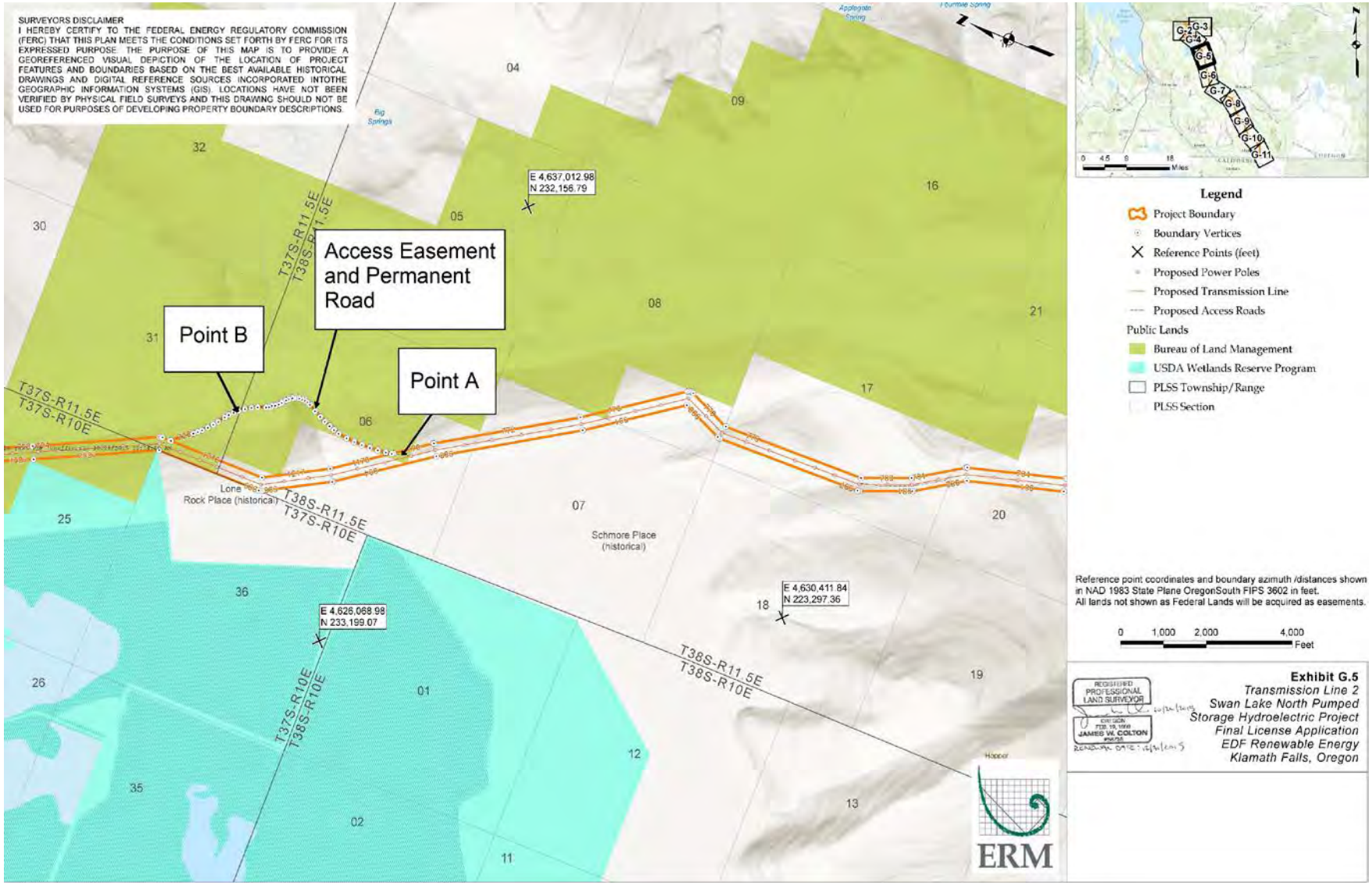

Figure 3-4. Location of proposed administrative access and road improvements (Source: Swan Lake North Hydro, 2015, as modified by staff).

In the draft EIS, staff did not recommend this measure because it was unclear: (1) what habitat improvements would be taken on these lands; (2) how such improvements would mitigate project effects on wildlife; and (3) if and when the habitat improvements would take place. Instead, staff recommended that the 50 acres of mitigation value for this measure could be replaced by direct habitat improvements (e.g., juniper and mixed conifer forest thinning) because the benefits to wildlife would be more assured through direct habitat improvements (e.g., juniper and conifer thinning) and there were ample opportunities for achieving the 50 acres of benefits sought by this measure.

Staff discussed this measure with the applicant and resource agencies in a section 10(j) meeting on December 6, 2018.[32] During that meeting, BLM stated that it can no longer require this measure due to its current policy direction on compensatory mitigation (BLM Permanent Instruction Memorandum (IM) 2018-093, July 2018). Oregon DFW stated that it would prefer that the 50 acres of mitigation value for this measure be replaced by 50 acres of conservation land acquisition but agreed that it could also be replaced by 50 acres of direct habitat improvements as recommended by staff.

Land Acquisition for Conservation

The applicant would acquire ownership or long-term lease of a total of 585 acres of land for conservation. The lands would be retained by the applicant throughout the license term and protected to maintain habitat values, particularly for big game species. Management and conservation of these lands would be conducted in consultation with Oregon DFW, BLM, and FWS.

To date, the applicant has identified 127 acres, located mainly near the proposed upper reservoir, upper reservoir laydown area, and penstock (figure 3-3). The remaining 458 acres have yet to be identified, but the applicant proposes to secure land parcels with similar habitat values as those lost to construction of the project, with a focus on conserving ungulate winter range. It is unclear from the project record if such lands are available from willing sellers close to the project.

While acquisition of the lands would not replace lost habitat (i.e., wildlife species would not be gaining access to new habitat), it would prevent the future development of lands currently used by wildlife. However, part of the consideration for valuing this type of measure would depend on the development threat. We are not aware of any potential future development plans for this particular area. Consequently, acquisition of lands for conservation purposes alone would not achieve the intended wildlife benefits. Oregon DFW reached a similar conclusion and states that the acquired lands would need to be managed by the project operator for wildlife habitat values through the duration of the license. The Commission has typically required that all lands that are needed for project purposes be brought into the project boundary and managed by the licensee to ensure the intended benefits are achieved.

[32] *See* the section 10(j) meeting summary filed on December 12, 2018.

The lands currently identified for conservation are located on the escarpment, which is important ungulate winter range habitat. The mitigation lands are also near the project, which is preferred by the Commission and by Oregon DFW according to its mitigation strategy for loss of Category 2 habitat. Over half of the parcels are contiguous with BLM lands, which would provide an additional benefit by providing a buffer to, or joining, forested land tracts already managed for wildlife benefits. An intermittent stream runs through the southern end of the easternmost parcel. Providing and protecting free-standing surface water would be of value to big game and other wildlife species in this dry climate, as noted above in our discussion of the proposed big game water developments.

The applicant proposes to consult with Oregon DFW, BLM, and FWS for management and conservation of the lands. This would enhance the conservation effort by having advice from local land management experts on how to best achieve the maximum benefits to wildlife over any license term. However, the habitat improvements needed to fully mitigate for project effects would depend on the selected lands, their current condition, and management objectives. While acquiring and implementing habitat improvements on 585 acres should be sufficient to achieve the proposed mitigation benefits, a detailed management plan would need to be developed for each parcel. The plan would need to identify the parcels to be acquired, the criteria used for selecting the parcels, and habitat improvements that would be implemented on each parcel.

Bryant Mountain Juniper Removal

In general, when funds are proposed to be paid to a non-licensee entity for a measure, staff analyzes the actual measure itself to determine whether the measure addresses an identified project effect or would enhance a resource affected by the project. Here, the applicant would fund BLM's thinning of 232 acres of western juniper and mixed conifer habitat and the subsequent planting of bitterbrush and mountain mahogany on public lands. Some land parcels are within the project boundary; however, most would be offsite and located on lands to the east of the project transmission line at its southern end (figure 3-3). Funding for this measure would be available from the applicant at the start of project construction, but BLM would determine the schedule for implementing the juniper thinning and subsequent plantings.

The measure would be conducted under BLM's Bryant Mountain Vegetation Treatments program – a program to improve the condition of sagebrush steppe and forested habitats at Harpold Ridge, Buck Butte, and Bryant Mountain (BLM, 2016a). BLM developed the Bryant Mountain Vegetation Treatments program to implement some of the resource objectives listed in the Commission-approved comprehensive plan, Klamath Falls Resource Area's Resource Management Plan (BLM, 1995). One of the plan's wildlife habitat management actions is the thinning of encroaching juniper to protect and improve forage for big game. Over time, juniper densities on Harpold Ridge, Buck Butte and Bryant Mountain have increased in areas to a point that has caused a

reduction in the abundance of native shrubs, forbs, and grasses (BLM, 2016a). BLM plans to thin 2,135 acres of encroaching western juniper and 1,500 acres of mixed conifer forest through the Bryant Mountain Vegetation Program. The applicant's proposal would help achieve habitat benefits on about six percent of the area subject to the program.

Project construction would permanently or temporarily remove big game essential winter range habitat. This type of habitat, at lower elevations with less snow cover in the winter, is critically important to deer, as they can more easily access the shrub/forb type of forage that sustains them through the winter months. Thinning 232 acres of western juniper and mixed conifer stands via BLM's Bryant Mountain Vegetation Treatments program would improve the forage quality and quantity for big game that may use project lands and would be affected by project construction. Replanting with mountain mahogany and bitterbrush shrub species would also prevent the establishment of invasive weeds that degrade wildlife habitat quality, and help to reestablish a more suitable and biologically diverse habitat for other wildlife species that are affected by the project's construction.

Effects of Project Construction and Operation on Ungulates and Other Wildlife

In addition to habitat loss and modification discussed above, project construction activities would result in increased human activity that could displace and disturb wildlife, fragment habitat and create potential barriers to movement, and expose deer and other wildlife to potential hazards (e.g., falling into trenches or pits, drowning in the project reservoirs). Noise associated with project construction activities and equipment, including blasting, could temporarily displace individuals and disturb wildlife during sensitive or critical periods (e.g., fawning, migration, extreme winters). Injury or mortality of individuals might occur from collisions with construction vehicles or equipment and/or inadvertent crushing of inhabited dens, burrows, or snags.

To minimize the potential effects of project construction and operation on deer and other wildlife, the applicant proposes to develop and implement an ungulate protection plan, which would include the following provisions:

- Create wildlife crossings underneath the penstock.
- Prevent wildlife entrapment at construction trenches by covering trenches at night, creating exit ramps in trenches, and spacing trenches to allow for wildlife passage.
- Implement vehicle speed restrictions to reduce dust, disturbance, and collision risks.
- Decommission newly constructed transmission line access roads that would be unnecessary for long-term operation and maintenance, and restore disturbed vegetation using seed mixes and plantings appropriate to the soil conditions and pre-existing vegetation.

- Apply dust palliatives to all ungraded and new access roads to minimize dust clouds.
- Install fencing (at least 8 feet high) around reservoirs and monitor daily for animal entry or injury.
- Avoid, if possible, conducting construction activities in the transmission line corridor during ungulate winter range use period (December 1 to March 31).
- Manage the transmission line ROW to benefit wildlife by leaving cut trees as snags when possible; avoiding removal of shrubs, native grasses, and forbs; removing dense juniper with subsequent reseeding and replanting using native species of benefit to wildlife; and controlling weeds to maintain native forage and browse species. Vegetation maintenance activities would be scheduled from August 15 through November 15 when practicable, to avoid disturbing wintering big game.
- Avoid ground-disturbing and vegetation-clearing activities in the reservoir areas from April 1 through July 15 to protect ungulates during migration and fawning season.

Oregon DFW recommends that the applicant prepare an ungulate protection plan (10(j) recommendation 3(F)), that includes the following: (1) providing alternative drinking water sources close to the reservoirs to attract wildlife away from the reservoirs; (2) designing the reservoir security fences to exclude reptiles, amphibians, and small mammals; and (3) and developing an operation and maintenance program for the exclusion fencing that includes inspecting the fencing monthly and during/following all major rainfall events, and making temporary repairs immediately after observed damage and permanent repair within one week. Additionally, if reservoir monitoring shows evidence of small animal mortality through drowning or other reasons, then the applicant should provide escape ramps or other methods so that animals can get out of the reservoirs.

In its December 26, 2018, filing, Oregon DFW clarified that the lower two to three feet of fencing should be of a sufficient mesh size (one quarter to one half inch) to exclude smaller animals and should extend underground and outward a couple of feet to discourage burrowing animals such as badgers from accessing the reservoir area. Oregon DFW further clarified that the intent of the fencing was to prevent large and small animals (e.g., amphibians) from having access to "a water quality compromised water source," and a potential entrapment and drowning site. Oregon DFW acknowledges in its filing that there are few examples of such fencing being considered or required at other pumped storage projects but still recommends the measure. Oregon DFW states that the only example it could find where such fencing measures were to be provided was at the

Eagle Mountain Pumped Storage Project No. 13123,[33] where the fencing was recommended to protect the threatened desert tortoise.

Our Analysis

The applicant's proposed ungulate protection plan contains measures that would minimize disturbance and prevent injuries/mortalities to ungulates and other wildlife. The penstock between the upper reservoir and the powerhouse was designed in consultation with Oregon DFW and BLM, and provides adequate spacing for ungulates and other mammals to cross underneath as they pass through the project area. Along this 9,655-foot-long, 13.8-foot-diameter penstock, there are four areas (the sum length of these being 1,348 feet[34]) that are greater than 12 feet above natural ground surface. Animals of all size classes would be able to cross underneath the penstock at these locations, as the height and width clearance of each meets the recommended dimensions for designing an underneath crossing structures (i.e., culvert) for large animals such as deer and black bear (10-foot-high by 20-foot-width), and elk and wolf (12-foot-high by 32-foot-width) (Ruediger and DiGiorgio, 2007). Other sections of the penstock are between 8 to 12 feet above ground surface elevation, and could be used by deer, elk, and small to mid-size mammals such as bobcats and coyotes. The proposed crossings would allow for continued wildlife movement through the project area and minimize the potential for alteration of ungulate migration routes or other wildlife travel patterns.

Covering trenches at night and imposing vehicle speed restrictions along project access roads as proposed would help to prevent wildlife injuries or mortalities. However, while speed limits may be a part of the proposed plan, the Commission would not be able to enforce this measure because enforcement of speed limits falls within the jurisdiction of state and local authorities.

Measures such as road decommissioning, applying dust palliatives, and managing the transmission corridor for wildlife benefits would help to lessen the disturbances to ungulate habitat from project construction. Seasonal restrictions on construction activities would minimize disturbance to ungulates during sensitive periods. In the reservoir areas, there would be no blasting or helicopter use (within 0.5 mile of an active raptor nest) from January 1 to August 15, and ground-disturbing and vegetation-clearing activities would be prohibited from April 1 through July 15. This would protect ungulates during their spring migration and fawning season, and lessen the disturbance, and potential displacement of herds or individual animals, through most of their critical wintering period (December 1 through March 31). Similar benefits would ensue for deer

[33] Construction of the Eagle Mountain Pumped Storage Project has not yet begun.

[34] This total length was calculated by summing the lengths of the four sections (389.2, 353.6, 82.1, and 522.7 feet) that are greater than 12 feet above ground surface as shown in figure 4.4 in Exhibit E of the license application; however, this total length differs from the 1,470-foot length provided in figure 6 of the WHREP filed July 25, 2016.

and other wildlife using habitats adjacent to the transmission line, which traverses a long stretch of big game winter range. The applicant would avoid construction within the transmission line corridor during the entire big game winter restriction period, and the same blasting and helicopter use restrictions, as mentioned above, would apply from January 1 to August 15. During project operations, the applicant would conduct routine vegetation maintenance along the transmission corridor during the fall season (August 15 to November 15) when feasible, thereby avoiding the winter range use period and spring migration and fawning seasons.

In the draft EIS, staff did not recommend adding alternative sources of drinking water near the reservoirs to attract wildlife away from the reservoirs because: (1) the applicant's proposed fencing (at a minimum height of 8 feet) around the reservoirs would be a sufficient barrier to keep large animals from entering the reservoirs, and (2) it was unclear whether they would draw wildlife away from the reservoirs as intended. During discussions with Oregon DFW, BLM, and the applicant at the section 10(j) meeting on December 6, 2018, Oregon DFW explained that the additional guzzlers were intended to help minimize the amount of time and energy expended by wildlife in attempting to access the reservoirs for water, particularly if the guzzlers were strategically located along a migratory route where ungulates are more likely to encounter and use the guzzlers. During the meeting, Swan Lake North Hydro agreed to install two additional guzzlers that are easy to maintain, one near the upper and one near the lower reservoir. Placement and type of guzzler would be determined in consultation with the Oregon DFW and BLM. Based on the new information, staff concluded that the guzzlers would benefit ungulates for the reasons stated by Oregon DFW.

As to Oregon DFW's recommended reservoir fencing to exclude entry of amphibians, reptiles and small mammals, there is little evidence that reservoirs represent a significant wildlife drowning hazard at other pumped-storage projects or that it would represent a significant drowning hazard here. Unlike the federally threatened desert tortoise at the Eagle Mountain Pumped Storage Project, there are no threatened or endangered or sensitive species in the area that are particularly vulnerable or in need of protection. The interior slope of the proposed reservoirs would not be very steep (3 horizontal units to 1 vertical unit) and the interior surface material of the reservoirs would be rip-rap (stone sieve size ranging from 0.2 to 15 inches in diameter). So even if small mammals or herptiles were to pass through a fence and enter the reservoirs, they should be able to climb back out without difficulty using the rocky interior surface.

Further, it is not known for sure that the water quality of the project reservoirs will degrade to point that could be harmful to wildlife as discussed earlier in the water quality section. The proposed water quality monitoring program would determine if additional measures, such as small animal fencing, might be needed to prevent wildlife access to the reservoir. Therefore, there would be no need for the reservoir fencing to purposefully exclude small wildlife or to provide escape ramps.

The applicant proposes to visually monitor the fencing daily, either in-person or remotely, and repair damage immediately as practical. This would help to identify and address damage that has occurred; however, if the fencing is monitored remotely using cameras, it is likely that not all areas of the fence could be seen. Oregon DFW's recommendation for an inspection on a monthly basis and during/following all major rainfall events would provide additional assurance that potential damages or breaches do not remain unnoticed for long periods and are addressed in a timely manner.

In the draft EIS, staff did not recommend Oregon DFW's fencing repair schedule (i.e., immediate temporary repair followed by a permanent repair within one week) because staff believed it would be too inflexible to accommodate unforeseen emergency situations (e.g., inclement weather). During the December 6, 2018, section 10(j) teleconference, Oregon DFW explained that it understood staff's concerns, but did not want repairs to languish for long periods. During the teleconference, Oregon DFW and Swan Lake North Hydro agreed that they would work together to develop a more reasonable and flexible inspection and repair schedule, which would address staff's concerns.

Effects of Project Construction and Operation on Avian Species

The project would be located in an area that receives high use by waterfowl and other migrating birds and within areas known to support nesting raptors, such as bald eagles. The new transmission lines might cause bird injuries or mortalities due to collisions or electrocutions. The new transmission lines and utility poles would also likely provide new perch sites for raptors, increasing the predation risk to small mammals and other wildlife. Noise and human activity associated with construction of the transmission line could disrupt normal nesting behaviors or abandonment of nests of bald eagles and raptors.

To minimize the potential effects of project construction and operation on birds, the applicant proposes to develop and implement an avian protection plan. This plan would include the following measures:

- Conduct two preconstruction surveys for raptors between May 1 and July 31 for two breeding seasons. The study area would encompass all areas within 1 mile of locations where blasting may occur and within 0.25 mile of all other proposed project features.
- Conduct two preconstruction surveys for birds of conservation concern between May 1 and July 31 for one breeding season in the year prior to construction.
- Based on survey results, prohibit on- and near-surface blasting and helicopter use within 0.5 mile of an active raptor nest during the breeding season of January 1 through August 15.

- Enact BLM-established spatial and temporal buffers for surface disturbing activities near active raptor nests.
- Seek consent from FWS and Oregon DFW before conducting high decibel-producing activities.
- Avoid cutting ponderosa pines and other trees along the transmission line.
- Design all transmission infrastructure in accordance with Avian Power Line Interaction Committee guidelines to the extent practicable (e.g., removing guide wires when feasible).
- Monitor transmission lines quarterly for the first year of operation, with a subsequent monitoring schedule established through consultation with resource agencies. Any observed or suspected bird collisions with fences, transmission lines, or other project-related structures would be documented and immediately reported to the FWS Law Enforcement Division.
- Install at up to five locations, bird flight diverters in high-risk collision areas along the transmission line, for a total of 9 miles.
- Install motion or heat activated security lighting to minimize disruption of nighttime foraging activities.
- Mark reservoir fencing with vinyl strips and/or reflective tape to prevent avian collisions.
- Manage portions of the transmission line ROW for wildlife benefits (e.g., avoiding removal of shrubs, native grasses, and forbs along the transmission line, leaving cut trees as snags when possible), with activities scheduled from August 15 through November 15 when practicable to avoid disturbing nesting birds.
- Conduct ground-disturbing and vegetation-clearing activities in the reservoir areas outside April 1 through July 15 to protect nesting songbirds.
- Conduct ongoing consultation with resource agencies during preconstruction and construction periods.

The applicant also proposes to develop an eagle conservation plan, which would contain some similar measures as in the avian protection plan, with additional provisions for protecting bald and golden eagles:

- Conduct two preconstruction surveys for eagles between May 1 and July 31 for two breeding seasons.
- Based on survey results, establish spatial and temporal restrictions for construction activities as needed to minimize disturbance to nesting eagles, including prohibiting on- and near-surface blasting and helicopter use within

0.5 mile of an active eagle nest during the breeding season of January 1 through August 15.

- Protect the historic bald eagle nest tree near the lower reservoir on Grizzly Butte.
- Construct transmission structures to prevent eagle electrocution and collision to the extent practicable.
- Develop project- and transmission line-specific risk assessment models to determine if an eagle take permit is necessary.

Oregon DFW recommends that the applicant develop an eagle conservation plan (10(j) recommendation 3(D)) and an avian protection plan (10(j) recommendation 3(E)) to protect birds. Regarding the preconstruction bird surveys proposed by the applicant, Oregon DFW recommends that: (1) the study area distance in respect to proposed project features should be 0.5 mile instead of 0.25 mile; (2) surveys should begin February 15th of each year instead of May 1st, to cover early nesting raptors; and (3) conduct a minimum, one survey in February and one survey in June/July, with a third, mid-season survey strongly recommended. Regarding surface blasting and helicopter use, Oregon DFW recommends that: (1) the 0.5 mile buffer should be used as a starting point and be adjusted based on site topography; and (2) these activities should be prohibited from January 1 through August 15, or until nests are documented to have failed or fledged. Oregon DFW, without elaboration, also recommends further consultation on what construction activities would be allowed within 0.5 mile of an active raptor nest during the January 1 through August 15 nesting period. In its comments on the draft EIS, FWS recommends that the preconstruction survey area for eagles include the helicopter flight paths, and references the 2007 National Bald Eagle Management Guidelines that state that helicopters should avoid being within 1,000 feet of a nest during the breeding season

Regarding the transmission line, Oregon DFW recommends (10(j) recommendation 4(B)) that Swan Lake North Hydro, FWS, and Oregon DFW enter into an Agreement for Management of Birds on Power Lines to promote cooperation between the applicant and the signatory resource agencies for dealing with bird mortality and problem nests. Oregon DFW states that the WHREP (filed on July 25, 2016) does not reflect Oregon DFW's prior recommendation for installing flight diverters on three

additional sections of transmission line,[35] and that, during project operation, the applicant should provide additional flight diverters as needed. Lastly, Oregon's DFW recommends (10(j) recommendation 3(I)) the applicant analyze the transmission line monitoring data to: (1) determine bird and bat fatality rates for the project; (2) determine fatality rates for species of concern; (3) compare estimated fatality rates to predicted fatality rates; and (4) determine the composition of fatalities in relation to migrating and resident birds and bats at the site.

In comments on the draft EIS, some commenters indicated that Swan Lake North Hydro's proposal to install flight diverters on certain sections of the transmission line would not be effective enough to protect birds, and several recommended that all or parts of the transmission line be buried. In particular, members of the public were concerned about the transmission line crossing the Lost River, and state that large numbers of migratory birds are attracted to the Lost River in the winter and early spring due partly to available open water habitats provided by warm water springs that keep the water from freezing. Commenters state that large-bodied waterfowl, such as geese, have difficulty flying in the strong winds and fog that can occur in this area, and they state that flight diverters, in their view, would be unlikely to be effective in those types of weather conditions or when birds are migrating at nighttime. [36]

In its comments on the draft EIS, Interior/OEPC recommends that the eagle conservation plan incorporate BLM's management direction for bald and golden eagles from the Southwestern Oregon Record of Decision/Resource Management Plan (2016) for activities on BLM administered lands. This management direction includes the following measures to minimize disturbing eagles during breeding and winter roost

---

[35] In its February 20, 2018, filing, Oregon DFW states that it had recommended the following 3 additional sections of the proposed transmission line to be equipped with flight diverters: (1) the section immediately east and south of the Grizzly Butte until the line reaches mid-slope; (2) north of the Hopper Hill area (to the beginning of the temporary transmission line access road); and (3) the area along Horton Rim/Windy Ridge. In an April 12, 2018, email correspondence, the applicant stated that Figure 3 from the draft WHREP filed on July 25, 2016, was in error, and that the draft version filed on April 18, 2016, shows the additional flight diverter locations recommended by Oregon DFW (see the April 12, 2018, email memorandum to the project file). However, neither draft versions of the WHREP (filed on April 18, 2016, or July 25, 2016) shows bird flight diverters at the section of transmission line north of the Hopper Hill area. Commission staff confirmed this with the applicant on May 14, 2018 (see the May 18, 2018, telephone memorandum to the project file).

[36] Matt Iverson, who resides in the Harpold Gap area along the Lost River, states that he has observed several bird injuries/mortalities that he alleges are due to collisions with existing power lines over the Lost River that already have line markers. To support his assertion, Mr. Iverson provided pictures showing flocks of geese flying over the distribution lines with line markers in his September 9, 2016 filing.

periods: (1) continue routine use and maintenance of existing roads and other facilities; (2) prohibit the removal of overstory trees within 330 feet of bald eagle or golden eagle nests, except for hazard trees, (3) prohibit timber harvest operations during the breeding season within 660 feet of an active nest or within 330 feet of an alternate nest, (4) prohibit operation of OHVs during the breeding season within 330 feet of nest or within 660 feet of a nest if forest cover or topographic relief provide visual and auditory screening, and (5) prohibit activities that will disrupt roosting bald eagles or golden eagles at communal winter roosts. The applicant does propose any measures to protect eagle winter roosts.

Our Analysis

Preconstruction Surveys

Preconstruction surveys for raptors and birds of conservation concern would assist in identifying what bird species are nesting in the project area and how close their nesting territories are to the project construction site. That information could then be used to prevent inadvertent destruction of nests and to establish appropriate spatial and temporal boundaries for construction activities in order to minimize noise disturbances. The applicant proposes conducting at least two surveys between May 1 and July 31, which is consistent with Oregon DFW's recommendations. However, scheduling one survey in February, as suggested by Oregon DFW, would likely provide a better assessment of the presence/absence of early nesting birds in the area, such as great horned owls and bald eagles which can begin nesting activities as early as January in Oregon (FWS, 2007; Isaacs and Anthony, 2011; Jackman and Jenkins, 2004; Johnson, 1993). In addition to a survey in February, two surveys later in the breeding season, as proposed by the applicant, would be appropriate for locating other nesting raptors and special-status species that may be present. For example, the recommended breeding survey schedule for the white-headed woodpecker is for two surveys between May 1 and June 30, with at least one survey conducted between May 15 and June 15 (Mellen-McLean et al., 2015).

The applicant's proposed preconstruction survey area encompasses all areas within 1 mile of locations where blasting would occur, and within 0.25 mile of other proposed project features. Oregon DFW states that the study area distance in respect to proposed project features should be 0.5 mile instead of 0.25 mile,[37] but it does not provide any rationale for why it is suggesting this change. Increasing the survey distance from 0.25 to 0.5 mile along the transmission line would likely ensure that the prior documented red-tailed hawk and owl (presumably great horned owl) nests or nesting territories on Swan Lake Rim are within the survey range. In addition, the median distance of recommended buffer zones for protecting nesting raptors from human disturbance are generally between 0.25 and 0.5 mile (Richardson and Miller, 1997). Therefore, Oregon DFW's recommended increased survey distance is reasonable because

[37] We assume that Oregon DFW agrees with the applicant's proposed survey distance of 1 mile from areas where blasting may occur.

it would ensure that the survey includes known nesting territories and search habitat within a typical buffer zone radius.

Spatial and Timing Restrictions for Construction

During construction, the applicant proposes to restrict blasting and helicopter use within 0.5 mile of an active raptor nest; however, Oregon DFW believes this distance should be a starting point and that adjustments may need to be made based on site topography. Oregon DFW also expressed concerns with certain construction activities (e.g., grading, heavy equipment use) being allowed within 0.5 mile of an active raptor nest site during the nest season. The applicant's proposed spatial restriction distance of 0.5 mile for blasting is the same as what is recommended by the National Bald Eagle Guidelines (FWS, 2007), which state that blasting and other activities that produce extremely loud noises should be avoided within 0.5 mile of an active nest. In addition, shorter buffer distances may be permitted for other types of construction activities, depending on habitat conditions and species. For example, for the northern spotted owl, 0.25 mile has been used as a protective distance threshold for heavy equipment operation (including chainsaws) during the nesting season (Washington DOT, 2018). However, local site conditions such as vegetation, topography, and atmospheric conditions affects whether visual cues can be seen at a distance and how well sound carries. For example, a ridge can serve as a buffer to noise and visual disturbance, whereas a canyon can contain and amplify noise disturbance. Therefore, consulting with Oregon DFW once the preconstruction surveys are complete and nesting sites for raptors and special-status species have been identified, would allow the applicant and Oregon DFW to consider site-specific conditions when establishing spatial and timing restrictions for blasting and construction activities.

Regarding temporal restrictions for blasting activity and helicopter use from January 1 through August 15, Oregon DFW recommends that these activities be prohibited until nests are known to have failed or fledged. Since the fledging period for some raptor species (e.g., bald eagles) may not end until after August 15 (Isaacs and Anthony, 2001), temporal restrictions may need to be extended to some date later in the year based on site-specific nest data to minimize potential effects on fledging success.

Avian and Bat Collisions with the Proposed Transmission Line

A variety of factors influence the potential for avian collisions with power lines including species-specific physiology, morphology, and ecology; site topography; habitat features; weather and light conditions; and power line-specific factors (e.g.,, number of vertical wires, wire height, and wire diameter) (Bernardino et al., 2018, APLIC, 2012). Ducks, geese, and swans are among the species most frequently associated with power line collisions, particularly where transmission lines cross rivers, topographical depressions, mountain passes and ridges, which can tend to channel and concentrate flight paths (Bernardino et al., 2018). Such conditions exist where the project transmission line crosses the Lost River, and members of the public have reported large

congregations of birds flying through this area during migration and using the ice-free waters of the Lost River during the winter season.

Marking transmission lines is a widely accepted practice for reducing avian collisions. A variety of markers have been used to increase visibility, including spirals, suspended devices (e.g., swinging, flapping, and fixed), and large aviation balls (APLIC, 2012). From recent studies, marking lines have been shown to decrease bird collisions by 50 to 80 percent (APLIC, 2012; Barrientos et al., 2011; Jenkins et al., 2010), although in some studies, effectiveness was lower than 50 percent (Barrientos et al., 2012; Sporer et al., 2013). Comparing the effectiveness of different marker types across studies, however, is difficult due to variations in study design (e.g., differences in species, habitats, weather conditions, or line configurations) as well as differences in carcass persistence rates and observer detection.

The applicant proposes to mark the transmission line by installing bird flight diverters at up to five locations (figure 3-3). However, this proposal does not incorporate Oregon DFW's recommendation for placement of flight diverters along the transmission line to the north of the Hopper Hill area. This area is characterized by a sharp transition in topography moving from west to east, from the low elevation of Swan Lake meadow to the high elevations of Swan Lake Rim. Raptors that have been documented in this area, such as prairie falcons, may be at risk of collision as they fly back-and-forth from foraging to nesting habitat. Bird flight diverters placed along this section of the transmission line would reduce this collision risk.

Oregon DFW also states that the applicant should provide additional flight diverters if a need becomes apparent during project operation. The applicant and resource agencies have identified areas that pose the greatest risk of bird collisions, but other areas may become apparent once the transmission line infrastructure is in-place. As stated above, members of the public have reported that bird collisions already occur at the Lost River, despite the fact that some distribution lines in this area are marked with suspended fixed tags. There is no information on exactly how many bird collisions are occurring at the Lost River crossing and it is unclear if, or how often, those line markers are being maintained. Regardless, if the proposed transmission line is constructed, it may increase the number of bird collisions in this area to some degree. While the applicant's proposed monitoring efforts would help to estimate bird collision rates and detect those areas with high numbers of bird mortalities, having an avian protection plan that contains a strategy for addressing these high-collision areas with corrective measures would allow for a quicker and more effective response to situations as they arise during project operation. Such strategies could include triggers that consider when fatality rates for raptors and sensitive species become excessive. Thus, deriving basic fatality rates from the transmission line monitoring data, as recommended by Oregon DFW, could be useful in identifying problem areas and establishing criteria for when to implement corrective measures. However, Oregon DFW's recommendation for agencies to enter into an agreement for managing bird-transmission line issues would be unenforceable, as the Commission only has jurisdiction over the actions of the licensee and not any other

agency. Developing the avian protection plan in consultation with the Oregon DFW, BLM, and FWS would ensure that the agencies concerns and issues are identified and addressed prior to the Commission approving the plan.

Burying the transmission line, as recommended by some members of the public, would eliminate the avian collision risk for the length of the buried line, which would vary from 0.25 mile to 32.8 miles if all or a portion of the line were buried. Construction and maintenance disturbances to vegetation and wildlife within the transmission line corridor would be different than described above for an above-ground line, and would instead involve temporary vegetation clearing with trenching and back-filling of soils along the buried portions of the transmission line route.

Although both the applicant and Oregon DFW recommend monitoring bat interactions and fatalities with the transmission line as part of the avian protection plan, we are not aware of any documented problems of bats colliding with transmission lines (Manville, 2016), or any mechanism for addressing these effects. Bats' echolocation abilities are likely sufficient to detect and avoid transmission line conductors and guide wires. Further, animals with their small size and agility would be extremely difficult and expensive to monitor over a length of 32.8 miles (e.g., could require the use of radar).

Eagle Conservation Plan

Interior recommends that the following measures to minimize disturbing eagles during breeding and winter roost periods be incorporated into the eagle conservation plan: (1) continue routine use and maintenance of existing roads and other facilities; (2) prohibit the removal of overstory trees within 330 feet of bald eagle or golden eagle nests, except for hazard trees, (3) prohibit timber harvest operations during the breeding season within 660 feet of an active nest or within 330 feet of an alternate nest, (4) prohibit operation of OHVs during the breeding season within 330 feet of nest or within 660 feet of a nest if forest cover or topographic relief provide visual and auditory screening, and (5) prohibit activities that will disrupt roosting bald eagles or golden eagles at communal winter roosts.

However, measures regarding the continued routine use and maintenance of existing roads and facilities (item #1), and restricting timber harvest (item #3) are not applicable and/or would not serve as protective measures for this project. Restricting the cutting of overstory trees within 330 feet of an eagle nest (item #2), is already incorporated in the avian protection plan through the construction buffer restrictions, but only during the breeding season. Implementing this measure year-round would ensure that overstory trees, which take many years to mature and reach full height, would remain to provide protective screening from auditory and visual disturbances that could affect nesting territories. Restricting OHV use near eagle nests during the breeding season (item #4) would add additional protection for nesting eagles, and would be consistent with the applicant's proposal to control OHV use in the project area through its traffic safety plan.

Swan Lake North's proposed eagle conservation plan does not include any measures to protect eagle winter roosts (item #5). The applicant searched for roosts during the 2011-2012 winter raptor surveys. While no eagles were observed at roosts, no observations were done at night when eagles might have been present, and in one case, the view of the known roost area was obstructed According to National Eagle Roost Registry data (Center for Conservation Biology, 2018), there may be five communal roosts on BLM land in proximity to the proposed transmission line (ranging from about 0.3 to 5.5 miles away). Preconstruction surveys for winter roosts, in addition to nests, would help to identify those areas, if present, that are important for eagle survival through the winter months (e.g., provide hiding cover and thermal protection), and allow for the incorporation of any additional protective measures that might be needed to protect these areas in the finalizing of the avian protection and eagle conservation plans,

FWS recommends incorporating the helicopter flight paths into the search area for preconstruction eagle nest surveys. Because the applicant proposes to restrict helicopter use within 0.5 mile of an active raptor nest during construction, including the helicopter flight paths in the area to be surveyed would help to identify any nests that may be within that 0.5 mile radius, and allow for re-routing of flight paths to avoid disturbing nests. Similarly, helicopter flight paths could be re-routed if winter roosts are identified within a 0.5 mile radius. However, the survey area should not include the flight path from the airstrip to the project construction site because these might change daily due to unforeseen factors.

Additional Resource Management Plans

Oregon DFW recommends (10(j) recommendation 1(B)) that the applicant develop the following resource management plans: (1) project operations; (2) wildlife protection, mitigation, and enhancement; (3) avian protection; (4) fish and wildlife habitat restoration; and (5) vegetation and noxious weed management. All plans would be developed in consultation with resource agencies and filed with the Commission within 1 year of license issuance. The plans would be updated every 5 years to reflect new information and new management needs or implementation strategies.

Our Analysis

Oregon DFW does not describe the resource management plans or the basis for the plans. For conventional hydroelectric projects, an operating plan is often requested to establish procedures to document compliance with certain aspects of operations, such as minimum instream flow releases, fish passage, limits on reservoir fluctuations, etc. Here, there is no need for a project operation plan because as a closed-looped pumped storage project there would be no need for similar environmental limits on its operations. We expect that any operational issues (aside from mechanical) would be generally straightforward, given the closed-loop pumped storage design of the proposed project. The other plans appear to be duplicative with the development of proposed plans already proposed by the applicant and recommended by Oregon DFW (e.g., WHREP,

Revegetation and Noxious Weed Management Plan, and avian protection plan); therefore they would serve no purpose.

Consultation on Draft Plans

Oregon DFW recommends (10(j) recommendation 2(A)) that the applicant provide a minimum 60-day notice, and opportunity for Oregon DFW and other state, federal, and tribal stakeholders to provide comments on draft plans before they are finalized.

Our Analysis

Allowing relevant stakeholders a sufficient amount of time to review and comment on draft plans before they become finalized would help to ensure that all interested parties have an opportunity to assess the plan's adequacy to establish measurable goals and objectives. This would be beneficial for producing more thoroughly developed final plans. However, our view is that 30 days should be sufficient time for agencies to review and comment on agency-recommended plans.

Terrestrial Resources Working Group

Oregon DFW recommends (10(j) recommendation 4(A1)[38]) that the applicant establish a Terrestrial Resources Working Group consisting of the applicant's environmental coordinator/consultants, and to the extent of their interest in participating, Oregon DFW, FWS, NRCS, and BLM, to help with drafting and finalizing resource protection plans and annual reports.

Our Analysis

The creation of a technical working group could be beneficial for facilitating the collective input of resource agencies during the resource plan development process and establishing a mechanism for long-term communication with local natural resource experts. However, the Commission typically does not require the establishment of such working groups because we cannot require entity participation. Oregon DFW recognizes this limitation and states that agency participation is not required; however, if agency participation is not required, we see little value in making it a license requirement to establish the working group. Regardless, the applicant proposes and the Commission often requires that the various plans be developed in consultation with interested resource agencies and tribes. Those consultation requirements, including Oregon DFW's recommended comment period on draft plans mentioned above, should be sufficient to ensure that the interests of the agencies are considered in developing and implementing the resource plans.

[38] Because there were two separate recommendations that were both labeled "4(A)," we denote the first as "4(A1)" and the second as "4(A2)."

WHREP Funding

Oregon DFW recommends (10(j) recommendations 3(B)) that the applicant establish a habitat fund to accomplish the purposes of the WHREP. Oregon DFW does not specify what funding level should be established but states that the fund amount should be developed in consultation with Oregon DFW, FWS, and BLM.

Our Analysis

Creating a fund for implementing the WHREP, with an annual deposit, would ensure that funds are readily available each year as needed, and thus minimize the potential for implementation delays. This would be particularly true if the funds are being provided to another entity for their implementation as proposed by the applicant. However, as discussed above, the Commission looks to its licensees to ensure that its proposed environmental measures and mitigation projects are implemented as scheduled. The funding mechanism by which the applicant would chose to fulfill those obligations is not a matter of Commission concern.

Annual Reports

The applicant proposes to file reports for the WHREP and the Revegetation and Noxious Weed Plan. For the WHREP, the reports would be filed with the Commission and resource agencies during the preconstruction and construction periods to report on the progress of implementation of the WHREP. The report would include a summary of any monitoring work completed that year, implementation progress, and any adaptive management measures taken or recommended. During the first 5 years of operations, annual reports would be filed if needed, to address potential wildlife issues. The operational reports would discuss the identified issue, the adaptive management measures implemented to resolve the problem, and any future changes or concerns. For the Revegetation and Noxious Weed Management Plan, the applicant proposes the filing of annual progress reports to resource agencies that would summarize: site management activities, regrowth of vegetation, current status of noxious weeds in the project area and weed control activities implemented that year, and an outline of projected activities for the next year. Although not specifically stated, we assume that the applicant only proposes to file progress reports during the five-year vegetation regrowth monitoring period.

Oregon DFW recommends (10(j) recommendation 1(A)) that the applicant prepare annual reports for the WHREP and other required resource reports.[39] Oregon DFW states that the reports should: (1) commence upon the first anniversary of license issuance and continue throughout the license term, (2) be done in consultation with the members of the

[39] In Oregon DFW's May 22, 2018, filing, it states that this 10(j) recommendation is for an annual WHREP report, vegetation and noxious weed management report, reservoir water quality report, eagle conservation report, avian protection report, and an ungulate protection report.

Terrestrial Resources Working Group, (3) provide Terrestrial Resources Working Group members with at least 30 days to comment on a draft report, and (4) file annual reports by March 31 of each year to the Commission and the Terrestrial Resources Working Group. Reports should include a description of the planned activities underway or to be implemented in the current year, activities planned for the following year, and a consultation summary documenting annual consultation with the Terrestrial Resources Working Group.

In other 10(j) recommendations (specifically 1(C), 1(D), and 1(E)), Oregon DFW again recommends annual reports for the WHREP, vegetation and noxious weed management, and reservoir water quality monitoring, respectively (see section 3.3.2.2. under *Water Quality Effects in the Project Reservoirs* for our discussion of the reservoir water quality annual report). For the WHREP, Oregon DFW recommends that annual reports: (1) document the implementation of measures as scheduled in the WHREP; (2) describe the coming year's proposals for implementing scheduled management actions pursuant to the WHREP; (3) document consultation activities related to the WHREP; and (4) document the results of monitoring of completed actions (to the extent monitoring is required for any particular action) to ensure proper implementation and effectiveness. For vegetation and noxious weed management, Oregon DFW recommends that the report compile information, data, and graphs summarizing progress toward implementation of strategies for managing native vegetation to optimize habitat for wildlife species and control of invasive weed species.

Our Analysis

As discussed above, implementing the proposed mitigation projects, and managing native vegetation and controlling noxious weeds on project lands would occur over several years. Filing annual WHREP reports would provide information to stakeholders regarding the timing of mitigation project implementation and updates in achieving established mitigation goals. Providing annual reports describing the status of measures for managing native vegetation and controlling invasive weeds would also help to inform resource agencies of current and future project operation activities that could impact wildlife habitat.

As to other resource areas encompassed under this 10(j) recommendation, routine reporting of the ungulate, eagle, and avian protection plans could increase awareness of project-related adverse effects on wildlife species. Reports summarizing the reservoir fencing and transmission line monitoring data, and any other wildlife injuries/mortalities that occur, would allow the licensee and resource agencies to review particular hazardous situations and assess whether additional guidance or action is needed.

Specific conditions under this 1(A) recommendation (e.g., prepare reports in consultation with the members of the Terrestrial Resources Working Group, provide a 30-day comment on draft reports, file annual reports by March 31 to the Commission and the Terrestrial Resources Working Group) are reasonable and would likely result in more informative and timely reports. However, as mentioned above, the Commission typically

requires that the various plans be developed in consultation with interested resource agencies and tribes, and there would be no need for a separate Terrestrial Resources Working Group.

Monitoring Elements

Oregon DFW recommends (10(j) recommendation 3(I)) that the WHREP and specific resource management plans provide a description of monitoring implementation strategies, methods, and protocols. The plans should also provide the geographic scope, species, monitoring frequencies, and duration.

Our Analysis

Providing specificity in final plans regarding the implementation of monitoring would help to minimize potential ambiguity regarding how monitoring should be conducted. It would also be beneficial for ensuring that the type of data being collected could be used to assess whether the plan's goals and objectives are being met.

Facilities and Records Inspections

Oregon DFW recommends (10(j) recommendation 5(A)) that the applicant allow state and federal regulatory agencies, including Oregon DFW, access to and across project lands and works for the purpose of inspecting facilities and records, including monitoring data, to monitor compliance with the license. The applicant should allow such inspections upon the entity requesting the inspection providing the applicant with reasonable notice of such inspections and agreeing to follow the applicant's standard safety and security procedures when engaged in such inspections.

Our Analysis

If the Commission were to issue a license, it would include a standard license condition that already grants federal agency access to project lands in the performance of their employment duties, therefore, granting similar access for state officials with sufficient notice as suggested by Oregon DFW is reasonable. It would also assist the Commission in monitoring compliance with the various resource plans recommended by staff (e.g., WHREP, revegetation and noxious weed management, avian protection, etc.).

Emergency Situations

Oregon DFW recommends (10(j) recommendation 4(A2)) that in an emergency situation where wildlife are being killed, harmed, or endangered by any of the project facilities or as a result of project operation, the applicant should immediately take appropriate action to prevent further loss. Oregon DFW also recommends that the applicant notify the nearest Oregon DFW office within 24 hours (6 hours for state or federal ESA listed species) of an occurrence, and comply with any restorative measures required by the agency to the extent such measures do not conflict with the conditions of any license. Lastly, the applicant should notify the Commission as soon as possible but

no later than 10 days after each occurrence and inform the Commission as to the nature of the occurrence and restorative measures taken.

Our Analysis

Unexpected operation or maintenance emergencies at the project (e.g., damage to fencing, hazardous substances spill into or out of the reservoirs, fires, equipment failures) could occur at any time during the term of a license and cause harm to wildlife. Notifying the agencies within 24 hours of any hazardous substance spill or emergency situation associated with the project would give the agencies the opportunity to visit the site quickly and assess the effects and the effectiveness of the implemented mitigation measures during any of these situations. Such quick assessment would be beneficial because the agencies could provide Swan Lake North Hydro and the Commission with recommendations for ways to prevent future accidents or emergencies from occurring. However, because there are no specific measures or restorative actions recommended at this time, it would be impossible to analyze or assess the environmental effects of any future potential restorative measures that could be recommended by the agencies in the event of an emergency situation at the project.

3.3.4.3 Cumulative Effects

In the past few decades, Oregon's mule deer population has declined. This decline is thought to be due to, at least partially, diminishing forage availability and quality (BLM, 2016a; Peek et al., 2002). Data from recent years show that estimated population numbers have been below Oregon DFW's management objectives,[40] ranging from 210,637 in 2012 to 231,241 in 2014. For the Klamath Falls Wildlife Management Unit, the average estimated number of mule deer from 2012 to 2017 is 3,668, which is well below the management objective of 6,200.

Several actions, during the past 50 years as well as currently, are affecting mule deer habitat in south-central Oregon (Oregon DFW, 2003b; USDA, 2018a). Fire suppression has increased hiding and thermal cover, but in some areas, decreased the abundance of forage in the summer range. Timber harvest may have improved foraging conditions by gradually increasing shrub densities on all seasonal ranges and creating openings and increasing edge habitat in the forest landscape. Livestock grazing, while increasing shrub densities, may have increased competition for forage and decreased habitat quality by increasing the spread of invasive weeds and creating poor riparian conditions.

Human activities and infrastructure have adversely affected mule deer populations. Collisions with vehicle and livestock fences can cause injuries and mortalities, and the placement of fencing or road infrastructure can create travel barriers or alter migration routes (Coe et al., 2015). Hunting is a major influence on population numbers.

[40] Oregon DFW's total population management objective for all Wildlife Management Units was 317,400 in 1990, and was later updated to 346,200 in 2016.

Mulligan's (2015) study of radio-collared deer in south-central Oregon found that legal harvest was the leading cause of mortality for male mule deer, and illegal harvest was the second leading cause. Illegal hunting was also the third leading cause of mortality for female deer, behind predation and vehicle or fence collisions. Other studies have indicated that hunting and off-road recreational activities may influence deer behavior by causing them to hide in dense cover (Johnson et al., 2005; Wisdom et al., 2005), thereby reducing opportunities for foraging and putting on fat reserves needed for winter survival.

Natural factors, such as predation, disease, and weather can also influence populations. Predators of mule deer, such as coyotes and cougars, have increased during the past few decades (Oregon DFW, 2003b; 2017b), and shown to be a leading cause of mortality during a study of Oregon mule deer (Mulligan, 2015). Several diseases and parasites that present management concern or significant or recurring health risk to mule deer in Oregon include cervid adenoviral hemorrhagic disease, epizootic hemorrhagic disease, meningeal worm, and biting lice (Oregon DFW, 2016a). Extreme weather can produce drought conditions leading to reduced forage and cover values, while severe winter weather conditions can result in large losses of deer (Oregon DFW, 2003b).

Projects that are currently occurring, or are likely to occur in the reasonably foreseeable future, within the Klamath Falls Wildlife Management Unit that would affect mule deer habitat are BLM's Bryant Mountain Vegetation Treatments program and the U.S. Department of Agriculture, Forest Service (Forest Service) Lobert Restoration Project in the Fremont-Winema National Forest. The Bryant Mountain Vegetation Treatments project area is within summer range and critical winter range for mule deer and would affect over 7,000 acres of habitat through mixed conifer and western juniper thinning, weed treatments, seeding and planting of native grasses and shrubs, road construction and prescribed under burns. The Lobert Restoration Project has been proposed for the purpose of restoring the resiliency of forested lands to natural disturbances (USDA, 2018a). It would authorize a variety of activities, including vegetation restoration treatments and prescribed burning, within mule deer summer and winter range. Approximately 2,701 acres of winter range and 68,195 acres of summer range are expected to be affected by the Lobert Restoration Project.[41] Treatment activities could negatively impact mule deer by disturbing deer during winter and fawning season, introduction of noxious weeds, and reducing cover for deer through the construction of temporary roads, but overall, the projects are anticipated to result in improved foraging habitat (BLM, 2016a; USDA, 2018a). Both projects are projected to occur during the same time period for constructing the proposed Swan Lake North Hydroelectric Project.

[41] This is based on implementation, without modification, of Alternative 2 from the Forest Service's April 2018 Final Environmental Impact Statement for the Lobert Restoration Project, as recommended in its April 2018 Record of Decision (USDA, 2018b).

The Swan Lake North Hydroelectric Project would contribute to the past and ongoing adverse effects to mule deer habitat cited above by the permanent loss in an estimated 210.5 acres and the temporary disturbance of 266.9 acres (see table 3-9) of big game winter range essential habitat. In addition to the habitat losses/changes, project construction could reduce forage quality through the introduction or spread of noxious weeds or through the coating of road dust. Project construction and operation could impose additional stress and mortality on the local mule deer population through vehicle collisions, entrapment within construction trenches, alteration of migratory pathways, and disturbance of deer during sensitive periods. For example, construction activities at the reservoir areas would displace does and fawns during the summer, and could disturb or displace deer during harsh winter conditions when they are attempting to maintain energy reserves and seeking thermal cover from snow and low air temperatures.

However, these effects would be offset through the various proposed and recommended protection measures (i.e., temporal construction limits and habitat acquisition and improvements). Further the area that would be affected by the project is small relative to the amount of the available big game winter range essential habitat within the Klamath Falls Wildlife Management Unit. Also, the applicant's proposed measures would complement the positive effects of nearby projects to improve ungulate habitat (i.e., Bryant Mountain Vegetation Treatments program, Lobert Restoration Project). In summary, the project would likely have a localized cumulative adverse effect that would be offset by proposed protective measures and habitat improvement projects.

3.3.5 Threatened and Endangered Species

3.3.5.1 Affected Environment

On December 13, 2018, we accessed FWS's Information for Planning and Consultation (IPaC) database to determine which federally listed species, if any, could occur in the project vicinity.[42] According to the IPaC database, species with endangered status include the gray wolf, Lost River sucker, shortnose sucker, Applegate's milk-vetch, and Greene's tuctoria. Three other species are listed as threatened: northern spotted owl, yellow-billed cuckoo, and slender Orcutt grass. The proposed threatened North American wolverine (and the candidate species whitebark pine) may also be present in the project area. The project area contains no critical habitats.

[42] *See* FWS's official list of threatened and endangered species, accessed by staff using the IPaC database (https://ecos.fws.gov/ipac/) on February 14, 2018, and updated on December 13, 2018. The updated list identified no new listed species from the original list.

Aquatic Species

Lost River Sucker

The Lost River sucker is a large, long-lived fish that grows up to 1 meter in length. It was listed as federally endangered in 1988. This fish is endemic to the Upper Klamath River Basin of Oregon and California. These fish prefer deep water in lakes and spawn in gravel substrate of springs or tributary streams upstream from their home lake. The present distribution of Lost River suckers includes Upper Klamath Lake and its tributaries, Clear Lake Reservoir and its tributaries, Tule Lake, the Lost River up to Anderson-Rose Dam, and the Klamath River downstream to Copco Reservoir. FWS developed a revised recovery plan for the Lost River sucker in April 2013, and designated critical habitat in December 2012 (FWS, 2012).

Shortnose Sucker

The shortnose sucker is a large, long-lived fish endemic to the Upper Klamath River Basin of Oregon and California. It was listed as federally endangered in 1988, and critical habitat has been designated, including the Lost River (FWS, 2012). These fish prefer deep water in lakes and spawn in gravel substrate of springs or tributary streams upstream from their home lake. Currently, the shortnose sucker occupies only a fraction of its former range and is restricted to a few areas in the Upper Klamath River Basin, such as the Upper Klamath Lake, Tule Lake, and Clear Lake drainages. In the project area, they occur in the Lost River (ORBIC, 2015). The major threat to the shortnose sucker is the loss of suitable spawning habitat due to dam construction, draining of wetlands, and flow alteration. Other threats include reduced water quality and interactions with nonnative fishes (FWS, 1993). A recovery plan was developed for the shortnose sucker in 1993.

Terrestrial Species

Gray Wolf

The gray wolf is a large canid that formerly inhabited nearly all habitat types across the United States, from prairies to mountains, until predator-control programs and loss of habitat resulted in its elimination throughout most of its range. Currently, gray wolves are found in the mostly forested lands of mid- and northwestern states that allow establishment of large territories and provide a sufficient prey base, primarily deer and elk. In Oregon, wolves west of Oregon Highways 395/78/95 are federally protected as endangered under the ESA. No critical habitat for this population has been designated. Those to the east of those same highways are considered part of the Northern Rocky Mountain distinct population segment and were delisted from the ESA in 2011. On November 9, 2015, the Oregon Fish and Wildlife Commission removed wolves from Oregon's List of Endangered Species, but they are still protected under Oregon statute and managed under the Oregon Wolf Conservation and Management Plan (Oregon DFW,

2010; 2017a). They are also listed as a conservation strategy species for the East Cascades ecoregion. Potential future conservation threats to gray wolf populations include reduced habitat and prey, human-caused mortalities including poaching and vehicle collisions, hybridization with other canid species, and disease (Oregon DFW, 2017a).

According to Oregon DFW's gray wolf webpage,[43] several wolves (as individuals, breeding pairs, groups, or packs)[44] have been documented roaming and establishing territories in the southwestern part of Oregon in recent years, within 40 miles of the project boundary. In 2014, signs of wolves were documented southwest of Klamath Falls, between Klamath and Jackson Counties. Evidence from early 2017 indicates that this area is inhabited by three wolves, known as the Keno wolves. The most eastern border of their established area of known wolf activity (AKWA)[45] is about 30 miles west of the proposed transmission line route. However, this wolf activity area was discontinued after wolves were not confirmed for over 1 year (Oregon DFW, 2018). According to Oregon DFW's 2017 annual wolf report, reproduction was never confirmed in the Keno area and may simply be a corridor for wolves moving between Oregon and California (Oregon DFW, 2018).

The Rogue pack has established an AKWA whose border is located approximately 20 miles north of that of the Keno wolves and approximately 30 miles northwest of the proposed lower reservoir. It includes a portion of the southern Cascades south of Crater Lake National Park. The adult male and female from this pack produced three pups in 2014, and subsequent litters in 2015, 2016, and 2017. Two of the pups from the 2014 litter have since been detected in California.[46] By the end of 2017, the number of individual wolves in this pack was seven (Oregon DFW, 2018).

In 2016, the forming of a male and female pair (the Silver Lake pair) was confirmed, and their established AKWA primarily spanned the Silver Lake Wildlife Management Unit of Lake County. The western border of the activity area is approximately 40 miles northeast of the proposed project. The pair produced at least one pup in 2016, but the adult female was found dead later that year.

---

[43] http://www.dfw.state.or.us/wolves/.

[44] A breeding pair is a male and a female that have produced at least two pups surviving to the end of a calendar year. A group of wolves is designated a pack when there is evidence of a minimum of four wolves traveling together in winter.

[45] To address wolf-livestock conflict, Oregon DFW designates AKWAs when resident wolf use of an area is determined, the boundary of which may be adjusted as new data or information become available (Oregon DFW, 2017a).

[46] The only wolves currently known in California are part of the Lassen Pack, which use an area across southwestern Lassen County into northern Plumas County.

Two lone male wolves, OR25 and OR33, dispersed from the Imnaha Pack in northeastern Oregon and traveled across the state to eventually establish localized activity areas within parts of Klamath County. OR25's AKWA spanned central Klamath County to western Silver Lake County. He was found dead in October 2017 near Fort Klamath in Sun Pass State Forest in west-central Klamath County. OR33 traveled throughout Klamath, Jackson, and a small portion of Douglas and Lake Counties before eventually establishing an activity area that overlapped that of the Keno wolves in southeastern Jackson and southwestern Klamath Counties. An incident of depredation, attributed to OR33, occurred on February 22, 2016, in a 90-acre open land winter feeding pasture in Swan Lake Valley near Swan Lake Road, approximately 4 miles west of the proposed project transmission line route. OR33 was found dead in October 2017 in the Fremont-Winema National Forest, about 20 miles northwest of Klamath Falls.

North American Wolverine

The North American wolverine is the largest terrestrial member of the weasel family and has wide feet for traveling across deep snow and semi-retractile claws for digging and climbing. They are primarily carnivorous scavengers but will opportunistically feed on a variety of foods, including small mammals, birds, fruits, and insects. Within the United States, they generally live in the Pacific Northwest and Northern Rocky Mountains and are restricted to high mountain environments near the treeline, where conditions are cold year-round and snow cover persists well into May (FWS, 2013b). In Oregon, the wolverine is state-listed as threatened, and FWS proposed to list the distinct population segment occurring in the contiguous United States as a federally threatened species in February 2013. The major threat to the species is loss of suitable habitat through increased summer temperatures and reduced incidence of persistent spring snowpack (FWS, 2013b).

Yellow-billed Cuckoo

The yellow-billed cuckoo is a neotropical migrant bird that has a slightly down-curved bill and a long tail with conspicuous white and black spots on the underside. It is an insect specialist but also consumes fruit, seeds, and small vertebrates such as tree frogs and lizards. For nesting, yellow-billed cuckoos typically use large (greater than 50 acres), contiguous tracts of multi-layered riparian habitat along low-gradient rivers and streams. Willows are preferred as nest trees, although other riparian tree species can be used such as cottonwood, alder, box elder, and mesquite (Daw, 2014; FWS, 2014a). The population of yellow-billed cuckoos occurring in northwestern Mexico, southwestern Canada, and west of the U.S. Continental Divide was classified as a distinct population segment and listed as federally threatened on October 3, 2014. The decline of the western yellow-billed cuckoo is primarily the result of riparian habitat loss and degradation due to factors such as drought, nonnative invasive vegetation, wildfires, and alteration of hydrology, including the conversion of floodplains for agricultural uses (FWS, 2014b).

Critical habitat for this species was proposed in August 2014 (FWS 2014a). None of the proposed habitat units are in Oregon or near the Oregon-California border.

Northern Spotted Owl

Northern spotted owls are medium-sized owls, averaging 18 inches tall with a wingspan about 48 inches wide, and are dark brown in coloration with barred tails and white spots on the head and breast. This species is typically found in mature or old growth forests of northern California and the Pacific Northwest of the United States and in southern parts of British Columbia, Canada. Nesting, roosting, and foraging habitat generally consists of moderate to high tree canopy closure (60 to 90 percent), a high incidence of trees with deformities such as large cavities, large accumulations of woody debris on the ground, and sufficient open space below the canopy for owls to fly. During the breeding season, most activity is centered within a core area surrounding the nest tree. Their primary prey are nocturnal mammals, with northern flying squirrels dominating their diet. FWS listed this species as federally threatened in 1990 because of widespread loss of habitat and forest fragmentation across its range. Current threats to this species include continued habitat loss in addition to competition from barred owls (*Strix varia*) for habitat and resources for breeding, feeding, and sheltering (FWS, 2012). FWS published a recovery plan for the northern spotted owl in 2008 and a revised version in 2011 (FWS, 2011). The plan outlines the following four steps to address threats to the northern spotted owl: (1) completion of a range-wide habitat modeling tool; (2) habitat conservation and active forest restoration; (3) barred owl management; and (4) research and monitoring. In Oregon, the northern spotted owl is state-listed as threatened, and is listed as a strategy species for several ecoregions, including the East Cascades, under Oregon's SWAP (Oregon DFW, 2016a).

FWS designated critical habitat for this species in Washington, Oregon, and California in 1992, with additional revisions to the final rule in 2008 and 2012 (FWS, 2012). The closest designated critical habitat to the proposed project area is along the western boarder of Klamath County, more than 20 miles to the west.

Applegate's Milk-vetch

Applegate's milk-vetch is a herbaceous, perennial legume with numerous tufted or trailing stems, ascending leaves containing 7 to 11 leaflets, lavender-tipped white flowers, and oblong fruit pods. The species is endemic to Oregon's Lower Klamath Basin and grows in flat, open, seasonally moist grasslands with alkaline soils belonging to the Henley, Laki, and Poe series with inclusions in the Calimus series (FWS, 2009). Known populations are restricted to an elevation of 4,100 feet. FWS listed Applegate's milk-vetch as federally endangered in July 1993, but has not designated critical habitat. The reasons for its listing and current threats include competition with invasive weeds, herbivory by caterpillars, and habitat loss and modification due to intensive agricultural and urban development of the Klamath River floodplain (FWS, 1998). FWS published a recovery plan for this species in 1998 and identified the following actions for recovery:

(1) conserve natural and introduced Applegate's milk-vetch populations; (2) long-term, off-site seed storage; and (3) research particular areas of management concern (e.g., population sustainability, population establishment and augmentation techniques, efficacy of habitat management strategies, and the plant's edaphic and hydrologic requirements) (FWS, 1998). In Oregon, this plant is state-listed as endangered and is listed as a strategy species for the East Cascades ecoregion under Oregon's SWAP (Oregon DFW, 2016a).

There are only six, currently known, occupied sites and all are located within five miles of the City of Klamath Falls (FWS, 2009). During the applicant's sensitive plant surveys in 2011 and 2015, no specimens of Applegate's milk-vetch were detected.

Greene's Tuctoria

Greene's tuctoria is a small, hairy, annual grass whose florets are protected by veiny specialized leaves edged with numerous tiny teeth. It typically occurs in vernal pools, swales, and other ephemeral wetlands surrounded by open grassland or pine forest, and can be found at elevations ranging from near 100 feet to near 3,500 feet (FWS, 2003). FWS listed it as federally endangered in 1997 (FWS, 1997). Threats leading to loss or destruction of its habitat include agriculture, urbanization, overgrazing and trampling by livestock, alterations in hydrology, and invasive species. In 2005, FWS published a recovery plan addressing this species along with 32 other species of plants and animals that occur exclusively or primarily within a vernal pool ecosystem in California and southern Oregon (FWS, 2005). In general, the identified actions needed for recovery are: (1) protect habitat within core areas, vernal pool regions, and all other recovery areas; (2) refine areas for vernal pool conservation; (3) restore and adaptively manage vernal pool conservation areas; (4) develop and implement standardized survey and monitoring protocols; (5) research refinements to management techniques and recovery criteria; (6) establish regional recovery implementation working groups; and (7) public outreach and education.

In 2003, FWS designated critical habitat for Greene's tuctoria and several other vernal pool species (FWS, 2003); all habitat units are in California and not close to Oregon's state border.

This plant was not included in the applicant's target species list for the special-status vascular plant surveys, and thus was not searched for presence within or near the project boundary.

Slender Orcutt Grass

Slender Orcutt grass is a small 5 to 15 centimeters tall, loosely tufted, blue-green annual grass that is sparsely hairy and branch only from the upper half of the stem. Slender Orcutt grass is endemic to vernal pools and occurs primarily on substrates of volcanic origin, but can occur at other natural and artificially created seasonal wetlands such as creek floodplains, stock ponds, and borrow pits (FWS, 2005). FWS listed slender

Orcutt grass as federally threatened in 1997 (FWS, 1997), and included it in the same recovery plan as mentioned above for the Greene's tuctoria because they face similar habitat threats. FWS designated critical habitat for slender Orcutt grass in 2003, and all habitat units are in California (FWS, 2003).

Like Greene's tuctoria, this plant was not included in the applicant's target species list for the special-status vascular plant surveys, and thus was not searched for presence within or near the project boundary.

Whitebark Pine

Whitebark pine is a federal candidate species, meaning that there is sufficient information on its biological status and threats to propose it as endangered or threatened under the ESA; however, higher priority actions preclude immediate listing. Whitebark pines are found on rocky, well-drained sites with steep slopes and windy exposures in subalpine and alpine elevations in western North America. The location of certain project features (i.e., upper reservoir and penstock, transmission line) would be within the potential elevation range for the whitebark pine (4,300 to 12,100 feet) (Fryer, 2002); however, no occurrences were noted during botanical surveys. The closest known locations of whitebark pine to the project boundary are approximately 15 to 20 miles away (WPEF, 2014) and at generally higher elevations (greater than 6,500 feet) than those found at the project.

3.3.5.2 Environment Effects

Lost River and Shortnose Sucker

Swan Lake North Hydro proposes to use groundwater that is already appropriated for other uses for the initial filing of the reservoirs, as well as for any additional water needed to make up for evaporative losses. Additionally, the applicant proposes to construct berms around the reservoirs to minimize the capture of surface water runoff by the project reservoirs and to minimize changes to the surface hydrology associated with the Lost River Basin.

Our Analysis

Neither the Lost River sucker nor the shortnose sucker are found within the immediate project vicinity. The closest possible individuals would be found in the Lost River, over 15 miles from the site of the proposed reservoirs. Neither species would be directly affected by project construction or operation; however, the project could alter the natural hydrology of the Lost River Basin, resulting in indirect effects on the species.

As discussed in section 3.3.3.2, *Environmental Effects*, the applicant would use groundwater for both the initial fill of the reservoirs and for any replacement water lost to evaporation. To initially fill the project reservoirs, the applicant would withdraw 3,001 acre-feet of ground water from three existing, permitted groundwater wells. To minimize effects on groundwater supply, the applicant would use existing permitted irrigation

groundwater wells under a transfer of water-right certificate 29530 and a transfer of water-right permit G-10952. Based on the groundwater interference pumping tests conducted by the applicant, Oregon WRD determined that project-related water withdrawals would not interfere with existing water rights or adversely affect existing groundwater and surface water conditions in the project area. The amount of groundwater available to provide aquatic habitat in the Lost River would remain the same whether groundwater in the basin is used for project purposes or for agricultural purposes to which it is already appropriated and used annually. Since aquatic habitat in the Lost River would not be affected by project filling, we find that project construction and operation would consequently not affect the Lost River nor shortnose sucker.

As also discussed in section 3.3.3.2, the proposed project, if constructed, would act as a sink capturing rainfall and other precipitation that would naturally become a part of the basin's hydrology through either over-ground runoff to nearby streams or through infiltration through the soil to the underlying groundwater aquifer. This rainfall could contribute to the availability of aquatic habitat in basin-area streams. The use of groundwater for project fill would ensure that no fish species are affected during the initial fill phase of project construction. The use of berms around both reservoirs to stop run-off from entering the reservoirs would minimize changes to natural surface water hydrology.

The reservoirs would capture approximately 177 acre-feet of precipitation annually, effectively removing this water from the Lost River Basin. The Lost River Basin, in its entirety, consists of over 3,000 square miles of land. The annual loss of 177 acre-feet of precipitation would represent a very small fraction of the annual water budget of the basin that is contributed by precipitation. Any effects on fisheries in basin-area streams would likely be negligible and impossible to detect, even when considered cumulatively with all existing and future water uses. Therefore, we conclude that construction and operation of the Swan Lake North Project would have no effect on the Lost River and shortnose sucker.

Gray Wolf

The north end of the project boundary (e.g., near the proposed upper and lower reservoirs) would be at the margin of potential wolf range habitat (Oregon DFW, 2015). Construction and operation of the project could affect gray wolves through loss of habitat or avoidance of the area by individual wolves or their prey. Currently, there are no established AKWAs within the project vicinity and there are no known wolves using this area.

Our Analysis

As there are no established AKWAs within the project vicinity and no known wolves currently using proposed project lands. However, if wolf populations continue to increase and expand throughout southwestern Oregon over the long-term, it is possible that transient use of the project area could occur over the license term. Wolves could use

the area during dispersal periods, as they are capable of covering large areas while traveling in search of prey and other wolves. The 2016 depredation event documented within four miles of the proposed transmission line suggests that wolves may temporarily use project lands for hunting prey. Noise and human activity from project construction may have some local, adverse effects on the wolves or their prey base, but these effects are expected to be temporary and short-term. Similarly, disturbance from project operation activities (e.g., project infrastructure monitoring, vegetation maintenance along the transmission line ROW) would be localized and short-term. Project mitigation measures implemented through the WHREP, such as protection of conservation lands, enhancement of big game winter habitat, and installation of water guzzlers, would benefit ungulate habitat. Changes in elk and mule deer population numbers as a result of the project could, in turn, affect wolf presence in the area.

Wolves would be unlikely to reside in the immediate project vicinity or consistently occur at the site, however, because of human presence and the commercial logging and agricultural land practices at or near the project. Human-caused mortality is the primary factor that influences dynamics of most wolf populations (Oregon DFW, 2018), and chronic conflict would likely preclude wolves from occupying project lands. Therefore, project operation may affect, but would not likely adversely affect wolves over the long term.

North American Wolverine

No known occurrences of wolverines near the project have been reported. In Oregon, wolverines occupy habitat in the Walla Range of the Rocky Mountains in the northeastern part of the state. The closest available habitat, which is currently unoccupied but which could be used by dispersing individuals, is found west and north of Upper Klamath Lake (FWS, 2013b), and over 20 miles from the project area.

Our Analysis

Because there is no suitable habitat within the project area, wolverines are not expected to occur on proposed project lands. Therefore, project construction and operation would not affect wolverines.

Yellow-billed Cuckoo

The western yellow-billed cuckoo has experienced a major decline in its breeding range since the 1800s, and breeding no longer occurs in Oregon (Washington Department of Fish and Wildlife, 2012). Additionally, the potential range map for this species in Oregon shows that only the northern half of the state contains potential habitat (FWS, 2018).

Our Analysis

This species is not expected to occur on proposed project lands because of the lack of well-developed riparian habitat in the area; therefore, project construction and operations would not affect this species.

Northern Spotted Owl

No northern spotted owls were detected during the applicant's field surveys for the project, and no suitable habitat is available for this species within the project boundary; however, they have been documented north of the proposed project, within the Fremont-Winema National Forest (USDA, 2017). Eight designated home range sites were identified approximately 3 to 10 miles north-northwest of the proposed upper reservoir laydown area.[47] Owl surveys conducted in this area between 2014 and 2016 detected 23 individuals, although none were determined to be nesting or in pairs (USDA, 2017).

Our Analysis

Project construction would not affect potential nesting spotted owls within the Fremont-Winema National Forest. The closest known home range sites and potential nesting-roosting habitat to the project are approximately 3 and 2.5 miles, respectively (USDA, 2018a). Previous noise disturbance analyses for the spotted owl have cited one mile as the disruption distance threshold for blasting activities (larger than 2 pounds), with shorter distances for other construction activities (FWS, 2006; Washington DOT, 2018). Using this one-mile threshold, known home ranges and nesting-roosting habitat would not be affected as they would be a sufficient distance away from any noise-producing activities at the proposed project.

Applegate's Milk-vetch, Whitebark Pine, Greene's Tuctoria, and Slender Orcutt Grass

Project construction and operations would disturb over 450 acres of habitat. Although no special-status plants were documented during 2011 and 2015 botanical surveys, Swan Lake North Hydro proposes to conduct additional surveys for special-status plant species prior to construction. The surveys would target Greene's tuctoria and slender Orcutt grass, among other species, because the applicant's prior plant surveys did not include these two species. The applicant would implement protective measures should any special-status plants be found (e.g., flagging and fencing or translocating individual plants).

---

[47] The distances were estimated by measuring the distance from the project boundary (upper reservoir laydown area) to the closest point on the outer circular boundary of the designated home range (1.3 miles from the home range center). A spotted owl's home range is considered to be the area within which an owl conducts its activities during a year and that provides important habitat elements for nesting, roosting, and foraging (FWS, 2011).

Our Analysis

Project construction and operations would have no effect on Applegate's milk-vetch or whitebark pine because these species are not known and unlikely to occur within proposed project lands. The project boundary does not contain suitable habitat for whitebark pine, which is found on windswept ridges and peaks in subalpine and alpine habitats at elevations generally above those at the project area. The project boundary does contain soils found in typical Applegate's milk-vetch habitats (e.g., Henley, Laki, and Calimus loams); however, those areas have been converted to cropland or are at elevations higher than the 4,100 feet of current populations. The project would have no effect on Greene's tuctoria or slender Orcutt grass since they are exclusively associated with vernal pool habitat and Swan Lake North Hydro did not document any vernal pool habitat on proposed project lands during the 2011 or 2015 field surveys. However, Swan Lake North Hydro proposed survey and protective measures would prevent any adverse effects should any of these four species be found prior to construction.

3.3.6 Recreation and Land Use

3.3.6.1 Affected Environment

Recreation

The proposed project would be located on federal and private lands within the Upper Klamath River Basin and Lost River Watershed in Klamath County, Oregon. Most project facilities would be developed north of Swan Lake, except the transmission line, which would extend to the southeast about 33 miles to the Malin Substation at the California border. The city of Klamath Falls is located about 10 miles southwest of Grizzly Butte, the proposed site of the lower reservoir. Several much smaller communities, including Dairy, Bonanza, and Malin, lie within 2 to 4 miles of the transmission line.

Regional Recreation Resources

Recreation resources in the project vicinity include dispersed-use areas and developed sites and facilities throughout the Upper Klamath River Basin. The basin is renowned for lakes, streams, and freshwater marshes that attract millions of migrating waterfowl in fall and winter seasons, making this a prime area for both wildlife viewing and waterfowl hunting. The Klamath Basin National Wildlife Refuge Complex, which extends over a large area and protects much of this habitat, includes the Klamath Marsh Refuge, Upper Klamath Refuge, Bear Valley Refuge, Lower Klamath Refuge, Tule Lake Refuge, Clear Lake Refuge, and Hanks Marsh. Many of these areas provide opportunities for wildlife viewing and photography, waterfowl hunting, fishing, canoeing/kayaking, hiking, cycling, picnicking, camping, and sightseeing. However, most of the refuges are 10 to 20 miles or more to the south and west of the proposed project. The nearest refuge is Hanks Marsh, 10 miles west at Klamath Lake.

About 35 miles northwest of the project is Crater Lake National Park, which supports camping, lodging, hiking, boat tours, cycling, and in winter, cross-country skiing and snow shoeing. The Fremont-Winema National Forest occupies much of the area between the project and the national park. The national forest boundary is approximately 1 mile north of the proposed project boundary; however, the national forest cannot be accessed by road or trail from the project area. The national forest offers fishing, hunting, backpacking, hiking, camping, boating, sightseeing, and in winter, snowmobiling, cross-country skiing, and downhill skiing. The Mountain Lakes Wilderness Area is in the Cascade Range, 20 miles to the west. No other wilderness areas or designated wild and scenic rivers are in the vicinity of the project.

East of the project are BLM-managed federal lands, including Swan Lake Rim and Bryant Mountain, rising 1,000 to 1,500 feet above the adjacent lowlands. BLM lands are interspersed with private lands and often lack public roads or trails, which makes access difficult in some areas, including Swan Lake Rim. This effectively limits recreational use. However, some areas support hiking, horseback riding, fishing, hunting, wildlife observation, picnicking, sightseeing, camping, mountain biking, and off-road vehicle use (limited to roads and trails). Klamath County is a popular destination for hunters of waterfowl, upland game birds, and big game. Commonly hunted species include ring-necked pheasant, mountain quail, blue grouse, mule deer, elk, pronghorn, cougar, and black bear. Figure 3-5 shows recreation sites near the project area.

A few developed recreation sites and facilities are also present in the vicinity of the project. These include the OC&E Trail (described below); Stevenson Park, a small county park managed for day-use only (e.g., picnicking and fishing) and located between Highway 140 and the Lost River (4 miles west of the transmission line); a wayside on Highway 140 called Klamath Falls Lakeview Forest State Park that is otherwise undeveloped and located 8 miles east of the transmission line; water access areas along the Lost River, including Harpold Dam, and Wilson Reservoir southeast of Klamath Falls; plus a number of parks, trails, and water access areas in the city of Klamath Falls. Some areas support cross-country skiing, snowshoeing, and snow machining in winter.

No other developed parks or trails are located in the project vicinity. For clarification, the "California Trail" near the Malin Substation is not a developed recreation facility, but rather a system of historic routes that were heavily used during westward migration across the United States in the mid-1800s. The California Trail is further discussed under cultural resources in section 3.3.8.

Future development of parks, trails, or other recreation sites and facilities could occur during the license term, based on the goals and objectives of various local, state, and federal plans for the region. The 2013–2017 Oregon Statewide Comprehensive Outdoor Recreation Plan (Oregon PRD, 2012) identifies a rapidly aging and increasingly sedentary population, as well as fewer youths learning outdoor skills, as key recreation issues for Oregon. According to the plan, developing new recreation facilities, including trails, day-use facilities, camping areas, and sports fields near and within urban areas will be important to addressing recreation needs.

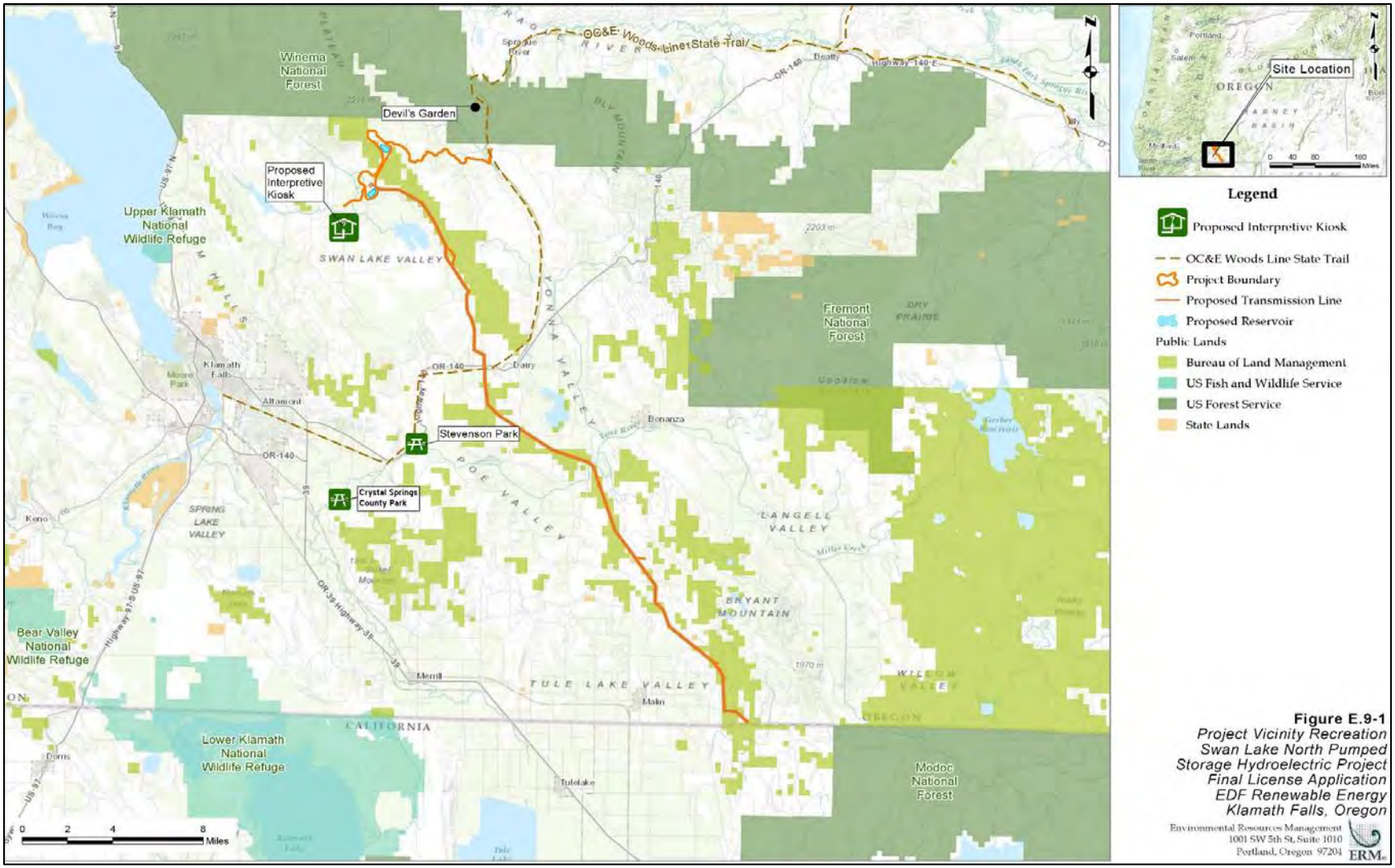

Figure E.9-1
Project Vicinity Recreation
Swan Lake North Pumped Storage Hydroelectric Project
Final License Application
EDF Renewable Energy
Klamath Falls, Oregon

Environmental Resources Management
1001 SW 5th St, Suite 1010
Portland, Oregon 97204

Figure 3-5. Project vicinity recreation (Source: Swan Lake North Hydro, 2015).

Recreation Resources in the Project Area

Recreation resources in the more immediate project area include some of the public lands noted above that are available for dispersed recreational use. Immediately south of the lower reservoir area, Swan Lake and nearby wetlands provide waterfowl habitat for tens of thousands of breeding and migrating waterfowl,[48] which complement similar habitats and wildlife viewing and hunting opportunities found in the Klamath Basin's national wildlife refuges. However, Swan Lake is located on private land and has no developed public access. NRCS holds a Wetland Reserve Program conservation easement on 4,580 acres that protects habitat for waterfowl and other wildlife, but the easement does not specifically include public access.

Project features would cross the OC&E Trail at two locations: (1) the proposed transmission line crosses it approximately 1.3 miles east of Dairy, and (2) the east end of the upper reservoir access road crosses it just south of the Fremont-Winema National Forest boundary. The trail receives significant use and is open to walking, hiking, running, cycling, skating, and in winter, cross-country skiing, and snowshoeing.

The OC&E Trail corridor is managed as state park land, although it is not held in fee simple ownership. The trail was formerly a railroad corridor of the OC&E Railroad. The track was abandoned in 1990 and acquired by the state in July 1992 for conversion to a trail, subject to a rail-banking agreement.[49] Today, the partially paved trail is nearly 110 miles long, beginning in Klamath Falls and heading east and north to the Sprague River, then generally east to a terminus at Bly.

A recent study (Forest Service, 2018) of economic activity associated with Oregon state parks estimated that the OC&E Trail received 37,331 visits in 2016, generating approximately $845,000 in local spending associated with use of the trail.

In the Klamath Falls Resource Area Management Plan (1995), BLM lists several proposed improvements to recreation sites in the project area, including the Alkali Springs Day Use Area, Hogback Mountain Day Use Area, and the Swan Lake Rim Trail and trail access area. However, their future development is uncertain. The Swan Lake Rim Trail would follow the western edge of Swan Lake Rim, possibly near the proposed site of the upper reservoir. BLM conducted layout, design, and survey work for the Swan Lake Rim Trail in 2011 (BLM, 2011), although there is no plan or schedule for its development in BLM's 2016 Southwestern Oregon Resource Management Plan (RMP), which only calls for pursuing legal access for a non-motorized trail along Swan Lake Rim (BLM, 2016c).

The proposed upper reservoir, penstock, and portions of the transmission line and new access roads would be located within the Swan Lake Rim Extensive Recreation

---

[48] Oregon DFW comment letter dated February 17, 2018.

[49] The railroad ROW was acquired by the state under the rail-banking provisions of section 8(d) of the National Trails System Act.

Management Area (ERMA), established in 2016 for its important recreation values including its potential for development of a non-motorized trail system on a long scarp-rim feature that provides a panoramic view of the surrounding high desert scenery. About 4 miles of the transmission line would be located within the Bryant Mountain ERMA, also established in 2016 for its recreation values that include OHV use, dispersed camping, fishing, hunting, and scenic views, as well as its potential to expand its OHV trail system. Both ERMAs are managed by BLM to "support and sustain the principal recreation activities" associated with the area (BLM, 2016b). The Swan Lake Rim ERMA is managed for non-motorized recreational use while the Bryant Mountain ERMA is managed for semi-primitive motorized and non-motorized recreation opportunities. The Southwestern Oregon RMP calls for limiting OHV use to existing roads and trails in the Bryant Mountain ERMA but to provide enhancements to these trails. The RMP also limits OHV use in the Bryant Mountain ERMA from November 1 to April 15 (BLM, 2016c). Rights-of-way in ERMAs are granted only when "compatible with the protection of the values for which the land use was designated, or when no feasible alternative route or designated right-of-way corridor is available" (BLM 2016c).

Land Use

The proposed project would be located within a rural and agricultural area approximately 11 miles northeast of Klamath Falls in Klamath County, Oregon. The area also supports rural residential uses, commercial forestry, open space, recreation, and wildlife habitat. The nearest town is Dairy, with a population of about 300, located 10 miles southeast of the lower reservoir. Two other small communities, Bonanza and Malin, lie farther south and within 4 miles of the proposed transmission line. Klamath Falls is the county seat, with a population of about 22,000.

The proposed reservoirs and generation facilities would occupy upland areas adjacent to Swan Lake Valley and Swan Lake Rim, while the transmission line would extend across the uplands between Poe Valley and Yonna Valley and above the east side of Tule Lake Valley. The valleys contain open water, wetlands, and extensive farmlands used for sheep and cattle ranching and irrigated agriculture, both of which are predominant land uses in the vicinity of the project. Major crops typically include alfalfa, grass hay, potatoes, beets, and strawberries. The Lost River generally flows west through parts of Yonna and Poe Valleys to the Wilson Reservoir near Klamath Falls. The river is an important source of irrigation water in the region. A portion of Swan Lake Valley's wetlands is protected under NRCS's Wetland Reserve Program, which provides financial assistance to landowners for protecting wetlands.

The uplands that would be traversed by the proposed transmission line and occupied by the upper reservoir are composed of BLM land and private land generally managed for livestock grazing, wildlife habitat, and to a lesser extent, timber harvest. BLM lands are part of the agency's Eastside Forest Management Area and are managed for grazing, wildlife habitat, and recreation. The nearest residences to the proposed transmission line would be approximately 600 feet away.

Near Harpold Dam on the Lost River, the transmission line would cross two 40-acre parcels managed by Reclamation,[50] one of which is used by the Klamath Irrigation District to quarry rock for rip rap and fill materials to be used in the repair and rehabilitation of Reclamation's irrigation and drainage facilities (see figure 3-2). The other is Harpold Dam which is operated by the Horsefly Irrigation District to control flows on the Lost River. KCPW also owns two parcels of land at the Harpold quarry that it operates under an aggregate production permit.

Based on Klamath County land use zoning data, the applicant states that adjacent lands within 200 feet of the project area include primarily forestry/range lands (about half of the adjacent lands), forestry (about a third of the adjacent lands), and the balance in exclusive farm use for cropland or grazing (figure 3-6).

Lands and resources in the project area are also used for spiritual and cultural purposes, as explained by the Klamath Tribes in comments filed on January 9, 2018. The Tribes state that "The area known as the Swan Lake Rim in its entirety is sacred to the Klamath Tribes and has been used for spiritual ceremonies for thousands of years." Cultural use of the area is discussed in section 3.3.8.

3.3.6.2 Environmental Effects

Effects of Project Construction and Operation on Recreation

The project could affect recreational use of the OC&E Trail and public use of BLM land within the project boundary during construction by disrupting use of the OC&E Trail and introducing infrastructure and human activity in a rural recreational setting. The existing road, located off of Bliss Road, which the applicant proposes to improve for access to the upper reservoir, crosses the OC&E Trail, and construction activity in this area could disrupt trail use, perhaps requiring recreationists to find a detour. In addition, the proposed transmission line route would cross the OC&E Trail near where the trail parallels Highway 140, possibly disturbing recreational use of the trail in this area while the transmission line is being strung. This disturbance, however, would likely be limited to less than one week. Recreational opportunities such as hunting may be temporarily disrupted or diminished in the immediate project area due to noise and increased traffic.

[50] The two parcels are located in the southeast quarter of Section 19, Township 39 South, Range 11 East of the Willamette Meridian. An authorization from Reclamation would be required to use these properties.

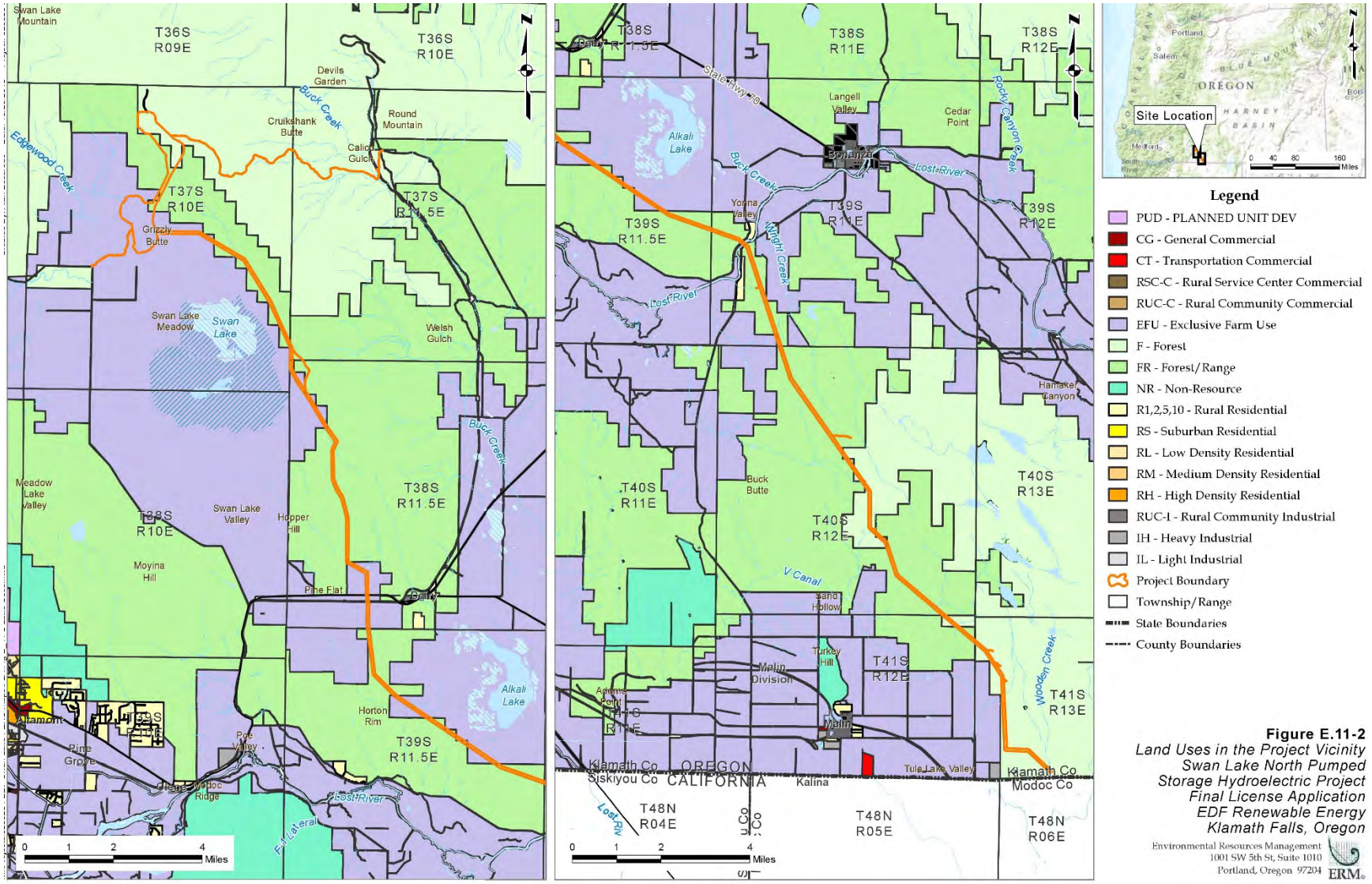

Figure 3-6. Land use designations in the vicinity of the project (Source: Swan Lake North Hydro, 2015, Figure E.11-2).

To minimize disruption to recreation users and ensure public safety during project construction, the applicant proposes to coordinate with BLM and the Oregon PRD to develop a public safety plan. The plan would contain measures for the safe operation of the reservoirs, emergency vehicle access, preventing and monitoring access to reservoirs, and maintaining safety of OC&E Trail users during construction. If BLM moves forward with its efforts to design and construct the Swan Lake Rim Trail, the applicant proposes to support those efforts. The applicant also proposes to develop a small, interpretive facility at the lower reservoir that would include signage with educational and historical information and would provide a staging area for periodic guided tours of the project facility. The applicant proposes to develop site drawings and designs of this facility in consultation with stakeholders.

Because the upper reservoir, penstock, and portions of the transmission line and new access roads would be located within the Swan Lake ERMA and portions of the transmission line within the Bryant Mountain ERMA, BLM must consider the following before authorizing a right of way across these lands: the existing conditions of, and accessibility to, recreational resources, land ownership and use on adjacent lands; project-induced recreational impacts or opportunities; and the compatibility of the project with the protection of values for which the Swan Lake and Bryant Mountain ERMAs were designated. If the project is not compatible with these resources or values, then BLM considers whether any alternative sites for these project facilities are feasible before determining whether or not to authorize a ROW. Consequently, BLM recommends that the applicant consult with the Klamath Falls Resource Area, Lakeview District, prior to any ground-disturbing activities in an ERMA. However, BLM did not recommend any measures in response to the Commission's ready for environmental analysis notice.

Our Analysis

OC&E Trail Use

Recreational use is generally dispersed and light throughout the project area except along the OC&E Trail, which receives significant use. Although long-term impacts from the project on trail use are not anticipated, recreational use of the trail could be temporarily disrupted during construction of the upper reservoir access road and the transmission line where they cross the trail. Disruption would be less than a week and confined to the locations where the transmission line and access road cross the OC&E trail. During these construction activities, recreationists would likely need to be directed around the construction area to ensure they are kept at a safe distance. Where they cannot be safely rerouted, use of the trail may not be feasible. Although the applicant intends to ensure public safety and minimize disruption of recreation, it does not explain how it would do so through the public safety plan. To be effective, the plan would need to include measures such as, notification and signage of construction activities, and temporary closures or alternative routes. Developing these measures in consultation with BLM, Oregon PRD, and Oregon DFW would ensure that the plan takes into consideration agency concerns.

Swan Lake ERMA

The transmission line would traverse about 2.25 miles along the western edge of the upper half of the Swan Lake Rim ERMA. The ERMA in the vicinity of the project does not receive significant recreational use because access is limited. Such access would not change once the project is constructed nor would any recreational opportunities that presently exist in the area, other than possible visual effects from the presence of project facilities. Swan Lake North Hydro's proposed closing of temporary access roads used to install the transmission line would help prevent increased OHV use which would be consistent with the land management objectives of the ERMA. Because the project would not change the condition of, or accessibility to, existing recreational resources it would be compatible with existing recreational uses of the ERMA.

At this point, we have no information on the precise location of the Swan Lake Rim Trail or if or when the trail might be built; therefore we cannot assess with certainty how the project might affect its use or development. If BLM chooses to develop the trail, many of the project structures likely would be visible to its users and this could adversely affect the semi-primitive backcountry experience trail users would likely be seeking. The most visible feature to these recreationists would be the above-ground penstock. The lower reservoir would also be visible from the ERMA. Whether or not the Swan Lake Rim Trail is built in the ERMA, the applicant's proposal to cooperate with BLM to support future efforts to design and construct the trail may help to minimize these impacts and would be consistent with a licensee's general obligations under section 2.7 of the Commission's regulations to meet recreation needs in the project area.[51] The applicant's proposed visual mitigation measures would help to lessen any impacts project facilities may have on users of the proposed Swan Lake Rim Trail. As discussed in our analysis in section 3.3.7, any visual changes to the landscape resulting from the project would be consistent with the visual objectives for the Swan Lake ERMA and therefore compatible with recreational objectives for the area.

Bryant Mountain ERMA

About 4 miles of the proposed transmission line would cross the Bryant Mountain ERMA and be visible to area recreationists. The line could also traverse areas that are currently used for OHV recreation and, depending on where the poles are placed, block an existing OHV trail. However, the relative open-space of the area would allow OHV users to easily navigate around the transmission line poles. As noted above, the closing of temporary construction access roads following the installation of the transmission line would prevent unintended creation of OHV trails in the ERMA. Therefore, any impacts to recreational use in the area would be minor and short term and would not interfere with BLM's recreational objectives for the ERMA. The applicant's proposal to co-locate about 1.6 miles of the line within an existing transmission line corridor within the Bryant Mountain ERMA and then parallel, at a distance of about 500 feet, another mile of this

[51] 18 C.F.R. section 2.7(e).

same existing transmission line corridor would lessen any visual effects on recreationists. The presence of the project's transmission line would be consistent with visual objectives for the Bryant Mountain ERMA and therefore compatible with recreational objectives. An analysis of the visual impacts of the line, including the possible cumulative visual effect from being built in an area with several other existing lines within the ERMA, is included in the *Aesthetic Resources* section later in this EIS.

Recreation at the Project

As a pumped storage project, project operations (i.e., frequent reservoir fluctuations) would not be compatible with typical recreation activities found at most hydroelectric projects (e.g., swimming, fishing, boating). However, the applicant's proposed development of an interpretive facility in the vicinity of the lower reservoir with a staging area for guided tours of the project would create a new recreational opportunity in the Swan Lake area by providing information to the public on the history of the surrounding area and the functions of a pumped storage hydroelectric project. No details, however, have been provided on the design, location or content of the interpretive facility or what stakeholders would be consulted in the design of the facility. Such details are needed to facilitate Commission administration of the license. Filing conceptual design drawings of the facility, along with a map showing the location of facility features, for Commission approval prior to construction of the facility, as well as documentation of consultation with Oregon PRD, BLM, and Oregon DFW in the development of the facility, would ensure that it is built to appropriate standards and has taken into account comments of agencies that are involved in the management of recreation resources at, or in proximity to, the project site. Including the facility in the project boundary would ensure that it is effectively managed as a project facility.

Effects of Project Construction and Operation on Land Use

Project construction would convert existing agricultural, forest, and recreation lands to industrial land or mixed land uses. Construction and operation of project structures could also affect the operation of a quarry and irrigation dam. We discuss each of these issues below.

Land Use Changes

Project construction would convert some existing land use from forest and grazing to industrial uses. The most significant change in land use would be from the inundation of public and private lands to create the two proposed project reservoirs. The upper reservoir, including its berm and ring access road, would convert a total of 97 acres of forest lands of which 74 acres are zoned as "forest" and 23 acres are zoned "forest/rangeland" to industrial uses. Similarly, the proposed lower reservoir, including its berm and ring access road, would convert a total of 92 acres of grazing land on Grizzly Butte to industrial uses.

Project construction would require the use of two temporary laydown and staging areas, one near each proposed reservoir site. The laydown and staging area near the upper reservoir would temporarily encumber 76 acres of forest lands; the area near the lower reservoir would temporarily encumber up to 171 acres of irrigated agricultural land. At the start of construction, agricultural lands would be taken out of production for up to 5 years until construction is completed. The applicant proposes to compensate landowners for the temporary use of their lands, and restore the lands to their previous use after construction.

The proposed transmission line corridor would cross a number of land use types and traverse both public and private land. Although an easement would be required for the 300-foot-wide ROW, disturbance or displacement of existing uses would be limited to the footprint of the towers. Some forest land within the ROW would be cleared and maintained in low herbaceous and shrub habitat to prevent vegetation contact with the transmission line that could create a fire hazard and threaten operation of the line. Land under the transmission line would continue to be available for grazing, recreation and wildlife habitat. The footprint of individual transmission line towers would be small (2.31 acres) with the total amount of acreage displaced from the placement of all towers being 6 acres of land. A total of 21 acres of land would be disturbed to construct the temporary access roads used to construct the transmission line. Following construction of the line, lands within the corridor in agricultural use should return to their previous level of use. Lands adjacent to the transmission line corridor are expected to maintain their current uses. The applicant proposes to restore all temporarily disturbed areas within the transmission line corridor to their original and previous levels of use.

Julie Jespersen, owner of Jespersen Swan Lake, Inc., a farming and ranching operation on Highway 140 east of Dairy, states that soil mixing, erosion, rutting and compaction related to transmission line construction could greatly affect vegetation and crop yields. The proposed transmission line would cross her ranch; therefore, it would directly affect her lands. She recommends that the transmission line be rerouted along the existing public ROW of Swan Lake Road and Highway 140 to avoid impacts of agricultural lands along the eastern side of Swan Lake.

Julie Jespersen is also concerned that the placement of transmission line towers would interfere with operation of irrigation equipment and other farm practices such as planting and harvesting. David McLin, owner of the 3MC Ranch and lessee of farmland owned by Patrick Colahan and Alta Cochran, also indicates that the placement of the transmission line towers would interfere with his farm operations. He states that placing the transmission line towers over a buried irrigation mainline and six wheel lines that are moved twice a day would destroy his ability to raise Timothy and orchard grass on the Colahan and Cochran property. He further points out that placing the towers down the center of a north-south access road on his 3MC Ranch property would destroy improvements that are necessary for operation of his farm, including roads, tail ditches, and crops. He explains that, south of this area, the transmission towers would "come within feet of" one of his farm's irrigation pivots on the east side of the road, and even

farther south, a tower would be directly above another buried mainline and wheel lines that he changes daily. He recommends burying the "two or so miles" of the transmission line that runs through his farming grounds.

Lyle Smith, a landowner in the Harpold Gap area, recommends burying the transmission line for an approximate 7 miles between the project powerhouse and the Lost River crossing, in order to avoid impacts on agricultural lands in this area. This 7-mile-long stretch would encompass the Jespersen, McLin, and Colahan and Cochran properties.

Our Analysis

Project construction would take 189 acres of land out of agricultural, forest, wildlife and recreation uses; 268 acres would be temporarily removed from the uses during construction. Land uses adjacent to project land would not change. Temporary changes in land use would continue until revegetated/restored to their original uses. Revegetation of forested and rangeland areas may take longer than 5 years as discussed under the terrestrial resources section. However, restoration of agricultural land uses should be completed quickly following construction. The applicant's revegetation and noxious weed control plan includes proposals to reestablish natural contours, stockpile and redistribute topsoil, re-seed areas with non-invasive annual grasses and forbs, and control the spread of noxious weeds in areas disturbed during construction. Employing these practices would assist in preserving the soils' beneficial attributes and ensure that agricultural lands are quickly returned to production.

The applicant explored six different transmission line routes, in consultation with agencies, landowners, and other stakeholders.[52] While it was not feasible to avoid all agricultural lands, the proposed route has significantly fewer impacts on agricultural land, wildlife, and visual and cultural resources because it is the shortest route, affects the least amount of land, and affects fewer residences.

Staff examined the transmission line route in relation to farmland, using Google Earth and GIS technology. The transmission line crosses a 6.9-mile-long stretch of irrigated agricultural land that would either border or cross through farms owned by 3MC Ranches, Colahan and Cochran, Jespersen Swan Lake, Inc, Edgewood Ranch, Inc, and Delbert Fox. Within this stretch, the transmission line would cross or abut at least 18 irrigation pivots; although it appears that the applicant has sited the transmission line to mostly abut, rather than cross, these pivots to minimize impacts on farm operations. Because we do not know the types of irrigations systems being used on the farms or the specific location of transmission line poles, we cannot determine exactly how farm operations might be impacted. However, for circular systems that pivot around a center point, which is the water source, the 360-degree rotation would be disrupted when an

[52] *See* the discussion of project alternatives in Exhibit B of the license application (Swan Lake North Hydro, 2015) and section 3.4.2 of the EIS.

obstruction such as a transmission line pole intersects the pattern. Bonneville Power Administration's (BPA 2002) guidelines for installing and operating irrigation systems near high voltage transmission lines recommends that all metal pipelines, pivots, electrical power cables, and communication cables, above or below ground, be kept 50 feet (15 m) from any part of the transmission line structure and 15 feet (5 m) from any grounding system; that the center point or pivot point of the irrigation system be located 20 feet (6.5 m) laterally outside the outermost conductor; and that nozzles be positioned so that they do not spray water on the transmission line conductors. When this is not practical, distances which range from 43 feet for a ¼-inch nozzle to 150 feet for a 1-15/16-inch nozzle, are recommended to be used between nozzle and centerline of a 230-kV transmission line (BPA, 2002). BPA (2002) also recommends that all nozzle risers, which pass under a transmission line, be equipped with spoilers or automatic shut-offs in case a nozzle breaks or drops off. This will insure that that a solid stream of water is not projected into the transmission line. BPA (2002) recommends similar installation and operation conditions for wheel-type systems.

Thus, while irrigation operations may need to be modified where the proposed Swan Lake North transmission crosses irrigated fields, farming operations may not necessarily be prevented. Other agricultural operations, such as cattle grazing would be able to continue. Access to pastures for installation of the towers would be required, but normal operations would be able to proceed following installation and restoration of the pastures.

Swan Lake North indicates that there is some flexibility in where to place poles within the proposed transmission line ROW and that final placement of transmission line poles might require adjusting the location of some farm facilities. Consulting with local agricultural landowners during final design and placement of the transmission line would allow Swan Lake North to consider pole spacing, placement and installation timing to minimize adverse effects on agricultural operations.

Ms. Jespersen's recommended alternative alignment to follow existing roads on the east side of Swan Lake is similar to the applicant's proposed "alternative route 1." This route was rejected because it would have a greater impact on residences and agricultural properties in the Poe Valley and along Swan Lake Road, as well as on wetlands and cultural resources. It would also increase the cost of the line by adding 6 miles to its length.

Burying the 6.9 miles of the transmission line that affects the five above-mentioned farms would eliminate any permanent impacts of the transmission line on farm operations on these properties.

Operations of Harpold Dam and the Rock Quarry

The proposed transmission line would run directly overhead of the rock quarry where the Klamath Irrigation District and KCPW conduct operations, and cross the Lost River immediately downstream of Harpold Dam. Interior states that constructing a

power line so close to these facilities could interfere with their operation by obstructing access to these facilities during the construction period or being placed in areas that would not allow sufficient clearance for operation or maintenance activities at these facilities.[53] Therefore, Interior recommends that the applicant coordinate with the Klamath Irrigation District and the Horsefly Irrigation District to prevent any such interference. KCPW recommends that the applicant coordinate with it to ensure that the placement of the transmission line does not interfere with its aggregate operations

Our Analysis

It is not clear from the project drawings exactly where the transmission towers and conductors would be constructed relative to the quarry and dam. Stringing the conductors and installing the towers could temporally impede access to the quarry and dam (see figure 3-2). The delay effects would be short-term (less than a day) and are not likely to totally prevent access. If tower placement within the quarry were needed, it could impede normal operations. These operations should be considered in the final design of the project transmission line. Coordinating construction timing and tower placement with the Klamath Irrigation District, KCPW, and Horsefly Irrigation District during final design of the transmission line would minimize potential disruptions of quarry and dam operation and avoid any interference with operations of these facilities following construction. Developing a plan in consultation with KCPW, the Horsefly Irrigation District, and the Klamath Irrigation District, to coordinate transmission line construction with the operation of the dam and quarry, and filing it for Commission approval, would ensure that the line is placed and maintained with minimal disturbance to operations of these facilities.

Electromagnetic Fields and Electrical Interference from the Transmission Line

EMFs are ubiquitous fields of force created by electric voltage and current. They are produced naturally by the local build-up of electric charges in the atmosphere associated with thunderstorms and are also associated with the production, transmission, and use of electricity in modern society. High-voltage transmission lines, such as the proposed 230-kV project transmission line, create EMFs in areas within and adjacent to the transmission line ROW.

Mary Hunnicutt, Amanda Cory, Ken Masten, Matt Iversen, and Windy Ridge Farm, Bonanza residents and businesses residing near the proposed transmission line corridor, Jon Hobbs, Klamath Falls resident, and Richard and Terry Sacchi, Malin residents, raise concerns about the adverse effects of exposure to EMFs on the health of people and livestock. Mary Hunnicutt is also concerned with the effect of possible interference from the proposed transmission line on television, radio, and cell phone

[53] *See* record of July 3, 2018, phone conversation between Suzanne Novak, Outdoor Recreation Planner, FERC, and Kurt Young, Bureau of Reclamation, filed with the Commission on July 6, 2018.

reception. Richard and Terry Sacchi recommend placing the proposed power line on the other side of existing lines in the Malin area that run close to their home. Mary Hunnicutt recommends burying the proposed transmission line for all or portions of the route.

To address concerns about EMF radiation, the applicant has aligned the proposed transmission route to avoid residents as much as possible. The applicant states that electrical interference will be minimal because appropriate grounding would ensure that electrical discharges are less than 5 milli-amperes within the immediate vicinity of the transmission line corridor.

Our Analysis

Transmission lines in the United States transmit electricity at an extremely low frequency (ELF) of 60 Hertz (Hz), with a wavelength of 3,100 miles. According to the National Institute of Environmental Health Sciences (NIEHS), a 230-kV line is expected to generate on average an electromagnetic field of 57.5 milligauss (mG) 3.3 feet above ground at the source. This level is reduced by about 63 percent at 50 feet from the source (19.5 mG), 88 percent at 100 feet (7.1d mG), 97 percent at 200 feet (1.8 mG), and 99 percent at 300 feet (0.8 mG) (NIEHS, 2002). In comparison, table 3-10 provides the strength of magnetic fields generated by objects commonly found around the home.

Table 3-10. Common sources and strength of magnetic fields (Source: NIEHS, 2002).

Electric Appliance	6 Inches Distance (mG)	1 Foot Distance (mG)	4 Foot Distance (mG)
Vacuum cleaner	100 – 700	20 – 200	0 – 10
Hair dryer	1 – 700	0 – 70	0 – 1
Electric shaver	4 – 600	0 – 100	0 – 1
Microwave oven	100 – 300	1 – 200	0 – 20
Electric range	20 – 200	0 – 30	0 – 6
Electric oven	4 – 20	1 – 5	0
Washing machine	0.8 – 50	0.15 – 3	0.01 – 0.15
Electric can opener	500 – 1,500	40 – 300	0 – 4
Drills	100 – 200	20 – 40	0
Computer	7 – 20	2 – 6	0
Mixers	30 – 600	5 – 100	0
Color TV	0 – 20	0 – 8	0 – 4

Note: 0 indicates the magnetic field is indistinguishable from the background level.

The Federal Office for Radiation Safety in Germany recently measured the daily exposure to magnetic fields of about 2,000 individuals equipped with personal dosimeters across a range of occupations and public exposures (WHO, 2002). Although the measured exposure varied widely, it gave an average daily exposure of 1 mG. This value is 1,000 times lower than the standard limit of 1,000 mG for the public and 5,000 times lower than the 5,000 mG exposure limit for workers adopted by the European Union; there are currently no specific Occupational Safety and Health Administration standards that address ELF fields in the United States. Furthermore, the exposure of people living in the centers of cities showed that there are no drastic differences in exposure between life in rural areas and life in the city. Even the exposure of people living in the vicinity of high voltage transmission lines differs very little from the average exposure in the population.

EMF and Human Health

Much research has been carried out to determine whether ELF magnetic fields might be a potential cause of cancer. This work has involved laboratory experiments with cell cultures and animals, and epidemiological studies of people who, because of where they live or work, may have higher exposures to magnetic fields than other people. Overall, there is a wide consensus that there is a weak, but relatively consistent, association (correlation) between prolonged exposure to relatively strong magnetic fields and childhood leukemia. For example, a pooled analysis of the results from several studies, published in 2000, found that there was an increased incidence of childhood leukemia associated with exposure to time-averaged magnetic fields greater than 4 mG (National Research Laboratory, 2008). However, the fact that there is a correlation does not necessarily mean that there is a cause and effect relationship. The authors of the pooled analysis commented that the explanation for the elevated risk estimates is unknown, but selection bias[54] may have accounted for some of the increase.

Research findings have been reviewed by several panels of experts around the world, including the World Health Organization. Overall, these groups doubt that long-term exposure to EMF causes cancer. Although the relationship between childhood leukemia and EMF exposure suggests that there may be a link, laboratory research does not indicate any effect of magnetic fields on cancer, which includes several studies on animals exposed over their lifetimes. There are also considerable doubts that ELF magnetic fields, at the levels found around transmission lines and electrical appliances, could produce any effect at all. The National Research Laboratory (2008) concluded that there is no consistent evidence of a relationship between adult exposure to relatively high levels of ELF magnetic fields at home or in the course of their work and cancer risk.

A review of residential and occupational EMF studies on brain cancer and of experimental studies as they relate both to the biological plausibility of an EMF-brain

[54] Selection bias is an artifact arising from the way studies are carried out.

cancer relation was published in 1999 by Neuro-Oncology, a peer-reviewed medical journal covering cancer of the nervous system. The report concludes that no recent research, either epidemiologic or experimental, has emerged to provide reasonable support for a causal role of EMF on brain cancer (Gurney and Van Wijngaarden, 1999).

In 1989, the Institute of Electrical and Electronics Engineers (IEEE) issued an "Entity Position Statement" which stated that "there is not enough relevant scientific data to establish whether common exposure to electric and magnetic fields at extremely low frequencies, particularly those associated with the distribution and utilization of electric power, should be considered a health hazard" and that "there is general agreement that more research is needed to define safe limits of human exposure to power-frequency fields." After examination of relevant research reports published during the last 10 years, the Committee on Man and Radiation (COMAR), a technical committee of the Engineering in Medicine and Biology Society of the IEEE, concluded that it is highly unlikely that health problems can be associated with average 24-hour field exposure to power frequency magnetic fields of less than 10 mG (COMAR, 2000). Good laboratory evidence shows that magnetic fields 100 to 10,000 times higher than this level, either ELF sinusoidal or pulsed, can induce a variety of biological effects, including beneficial health effects such as bone or tissue healing. However, the means of interaction of low-level ELF fields with cells, tissues, or laboratory animals is not fully understood; therefore, the health impacts of such weak fields on intact animals and humans, if any, cannot be predicted or explained. Further research is needed to confirm or negate reports of effects of weak fields, and to determine mechanisms and relevance of these effects to actual health hazards (COMAR, 2000).

Effects of EMF on Animal Health

In the 1980s, field studies investigating estrous cycle, fertility, and growth performance in cattle near transmission lines revealed no effects for any of the examined parameters. Two published studies about effects of ELF exposure for several weeks did not identify any adverse health effects on growth behavior in calves or bovine reproduction. However, they reported a decreased milk yield and shorter calving intervals after exposure to EMF ranging from 194 mG to 421 mG, which are much greater than the expected ELF fields associated with 230 kV lines. In hematological and immunological investigations, higher counts of T lymphocytes were identified after exposure of cows to field strengths of about 20 to 33 mG from 380-kV transmission lines, but group sizes were quite small (n=5) (Fedrowitz, 2014).

From 1996 to 2007, at least 13 papers were published regarding experimental studies on effects of ELF electric and magnetic fields in dairy cows. In 2005, the authors described the development of an exposure chamber for cows. In most of their studies, the animals were exposed to 60 Hz, 10 kV/m, 300 mG for several 28-day-periods (except in some studies with a shorter exposure, e.g., 16-day periods). Body weight, feed intake, milk production and composition, as well as many other parameters were examined,

mostly in plasma samples, sometimes in cerebrospinal fluid of pregnant or non-pregnant cows or heifers.

Alterations in milk production and milk fat, which were correlated within a week of exposure, were noticed, and the data suggested an adaption response of the animals. Almost no ELF or EMF effects on progesterone were observed (Fedrowitz, 2014).

A long-term series of controlled studies was conducted at McGill University (2002, 2003, and 2004) regarding the possible effects of strong and continuous EMF exposure on the health, behavior, and productivity of dairy cattle. The broad goal of this research program was to assess whether EMF exposure could mimic the effect of days with long periods of light and increase milk production and feed intake through a hormonal pathway involving melatonin. In previous studies, some differences were reported between EMF-exposed and unexposed cows; however, they were not reported consistently between studies, the changes were still within the range of what is considered normal, and it did not appear that the changes were adverse in nature.

The studies conducted at McGill University differed from previous studies in that the exposure was restricted to magnetic fields; the outcomes evaluated included measurement of the hormones progesterone, melatonin, prolactin, and insulin-like growth factor 1 (IGF-1), as well as feed consumption. No significant differences in melatonin levels, progesterone levels, or feed intake were reported. Significant decreases in prolactin and IGF-1 levels were reported. Thus, similar to the previous studies by this group of investigators, the University studies did not report findings that suggest magnetic fields cause changes in the melatonin pathway that could result in effects on reproduction or milk production (BPA, 2011).

Summary

Although some studies and controlled experiments indicate a possible link between prolonged exposure to strong EMF and health effects in humans and animals, the levels of exposure studied were considerably higher than levels expected from electrical transmission from the proposed Swan Lake North Project. Although recreationists, those travelling on roads, and livestock would likely be exposed to EMFs close to the project transmission line, especially in areas that cross directly beneath the lines, this exposure would likely be intermittent and/or brief; therefore, significant exposure to EMFs is not expected.

Staff examined the proposed transmission line route in relation to residences using GIS and found that the closest residents would be in the Harpold Dam area, where some would be located as close as 600 feet from the transmission lines, and in Malin, where the closest resident would be about 1,000 feet away from the line. At these distances, the strength of EMF caused by the power line would be below the background levels found in those residences. Recreationists and others using the OC&E Trail would experience magnetic field flux densities of up to 57.5 mG while passing under the transmission line, but this exposure would be brief, and would approach zero after a few hundred feet.

Given that exposure levels drop by about 99 percent within 300 feet of the source, it is unlikely that residents would be exposed to significant amounts of EMF radiation from the proposed transmission line. Similarly, animals grazing or passing in the vicinity of the power transmission lines would not experience prolonged exposure at levels suspected of causing health effects or altering milk production.

Effect of Extremely Low Frequency EMF on Communication and Data Transmission Technology

Although it is possible for high voltage transmission lines to occasionally create static interference on AM radio or analog TV, it is unlikely to interfere with cell phone use, cable or digital TV, FM radio, or WiFi because these devices operate on a high frequency, unlike transmission lines that operate at very low frequencies (ATCO Electric, 2014). Further, the chance of any interference decreases with distance from the line. Given that no residences are located closer than 600 feet from the proposed transmission line, it is unlikely that electrical interference with household electronics or cell phones would occur.

Burying the transmission line in areas where it would run adjacent to residences would reduce or eliminate any chance of EMF radiation or electrical interference but would significantly raise costs and could create additional adverse effects on other resources from land-disturbing activities associated with burying the line. The benefit would be small given the relatively small risk of EMF exposure and electrical interference associated with the current alignment.

3.3.7 Aesthetic Resources

3.3.7.1 Affected Environment

The project area is characterized by its agricultural and undeveloped sage-steppe and ponderosa pine landscape. Topography is steep, and the Swan Lake Valley and escarpment are the most visually prominent features. Agricultural uses dominate the lands adjacent to the project, with cattle and sheep ranching in the uplands and irrigated crop production in the valleys. The deep-water wetland areas of Swan Lake and Alkali Lake are in undeveloped areas of the valley surrounding the project.

The project would be located on uplands that comprise both private and BLM land managed for timber harvest, grazing, wildlife habitat conservation, and agriculture. The proposed upper reservoir site is situated at about 6,000 feet msl along Swan Lake Rim, and the lower reservoir site at about 4,000 feet msl on Grizzly Butte. The proposed transmission line ROW would traverse the Swan Lake, Poe, Yonna, and Tule Lake Valleys along ridgelines until it reaches the existing substation in Malin. To the southeast of the proposed project powerhouse, the proposed transmission line ROW would be in mostly undeveloped sage-steppe uplands.

Public access to the Swan Lake Rim area, where the upper reservoir would be located, is limited because private land abuts both BLM land and the project site on both

the east and west sides, and the BLM lands offer no public access for motorized vehicles in this area. Non-motorized access is available on the south end of Swan Lake Rim from Highway 140, approximately 1 mile east of Dairy, Oregon. This route requires a hike of about 8 miles to reach the upper reservoir. The only other public access would be from the north through a combination of Forest Service and BLM lands from Forest Service Road 9718. This route requires a rugged hike of more than 5 miles from Swan Lake Point to the upper reservoir location.

While the project area is primarily characterized by its undeveloped and agricultural landscape, it does contain many human modifications, including rural residences and communities, farm structures, highways and other roads, substations, transmission lines, and liquefied natural gas pipeline corridors.

BLM's Klamath Falls Resource Management Plan establishes visual resource management (VRM) classes for most areas within the Klamath Falls District in which the proposed project site is located. The plan establishes these VRM classes for both public and private land; however, classification of non-BLM land is used for planning purposes only, and landowners are not required to meet the standards for these classes. BLM lands near the proposed reservoirs and the north end of the proposed transmission line ROW, including portions of the project that would be within the Swan Lake Rim ERMA, are classified as VRM Class IV, which allows for modifications of the character of the landscape that dominate the view and are the focus of attention with attempts to minimize visual impacts. Some small portions of the project area south of Horton Rim are also classified as VRM Class IV. South of Swan Lake, along the proposed transmission line route, BLM lands from Horton Rim south along Bryant Mountain to the line's interconnection with the substation near Malin, including the Bryant Mountain ERMA, are primarily classified as VRM Class III, which calls for the partial retention of the existing character of the landscape. In Class III areas, moderate levels of change to the landscape are permitted, and may attract attention, but these changes should not dominate the view of a casual observer. Any changes to the landscape in Class III areas should repeat predominant features of the landscape.

In 2011, the applicant conducted a visual resource study using BLM's VRM methodology and photographs of the project site from 21 key observation points (KOPs) (figure 3-7). In 2015, the applicant added five more KOPs to reflect changes in the proposed project design.[55] Figures 3-8 through 3-12 show the type of terrain (mountain, foothills, valley, waterbody/wetland, or developed) that is characteristic of what can be seen from the various KOPs.

[55] KOPs 3 and 21 were removed from the visual resources study in 2015 because they were no longer relevant due to project design changes.

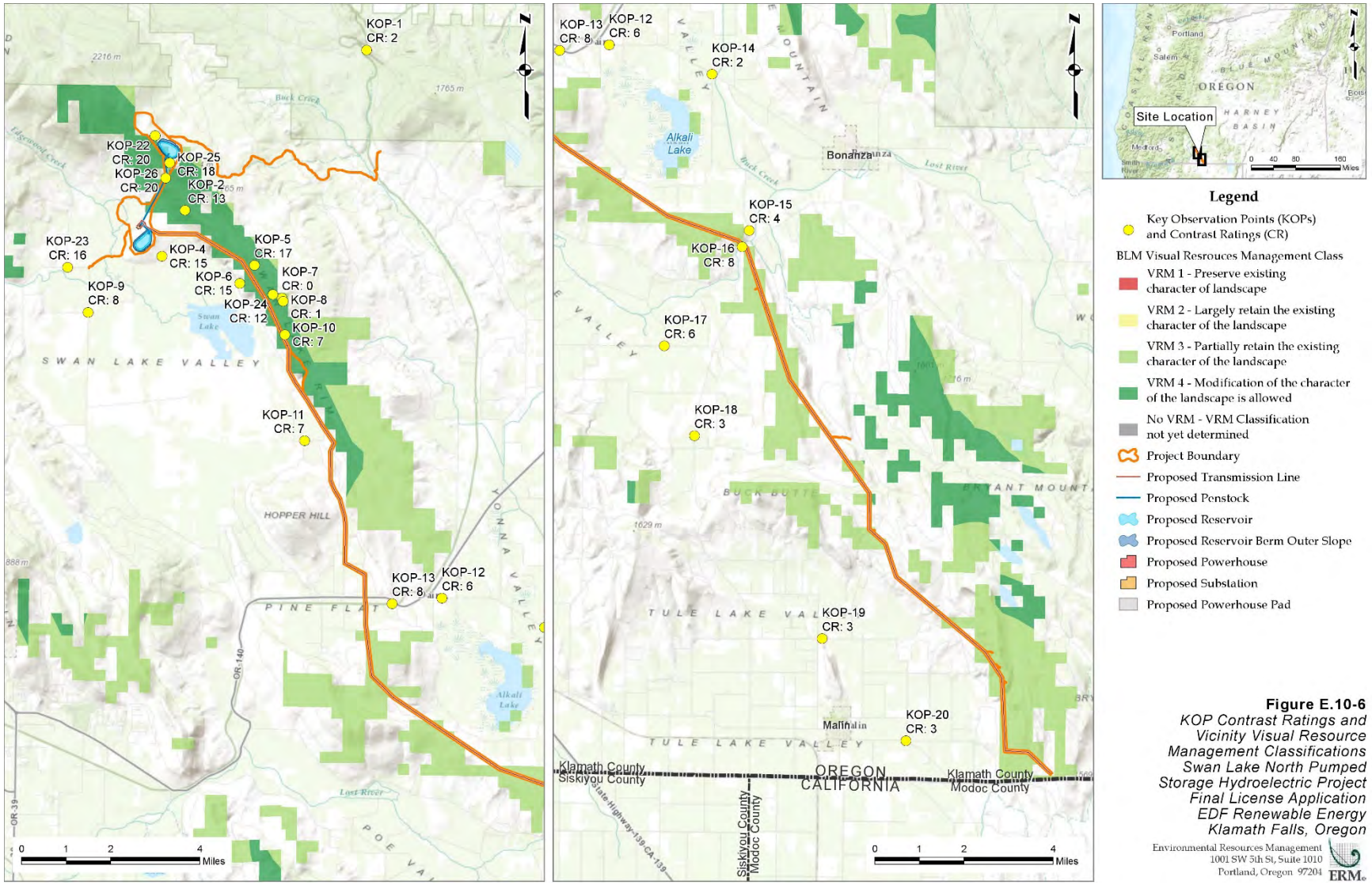

Figure 3-7. Key Observation Points for the Swan Lake North Pumped Storage Project (Source: Swan Lake North Hydro, 2015, Figure E.10-6).

Figure 3-8. Mountain views characteristic of what can be seen from KOPs 2, 3, 5, 7, 22, 24, 25, and 26 (Source: Swan Lake North Hydro, 2015, Figure 10.1).

Figure 3-9. Foothill Views of what can be seen from KOPs 1, 6, 8, and 21 (Source: Swan Lake North Hydro, 2015, Figure 10.2).

Figure 3-10. Valley views characteristic of what can be seen from KOPs 4, 9, 11, 12, 13, 14, 17, 18, 20, and 22 (Source: Swan Lake North Hydro, 2015, Figure 10.3).

Figure 3-11. Waterbody/wetland views characteristic of what can be seen from KOPs 10 and 16 (Source: Swan Lake North Hydro, 2015, Figure 10.4).

Figure 3-12. Views of developed areas characteristic of what can be seen from KOPs 15 and 19 (Source: Swan Lake North Hydro, 2015, Figure 10.5).

The applicant scored and ranked the scenic quality of each KOP using BLM's VRM system and then determined the level of visual contrast created by project features and project compatibility with VRM classes by creating and analyzing photo-simulations of project features. The text below describes, and table 3-11 summarizes, each KOP, including its VRM Class designation and scenic quality score and ranking.

KOP 1

KOP 1 is located at the abandoned railcar on the OC&E Trail switchback trailhead parking area. The trailhead is accessed from Bliss Road (National Forest Development Road 11), a paved two-lane road that connects Sprague River and Dairy, Oregon. KOP 1 was selected because it represents one of the few recreation areas in the vicinity of the project. A nearby geological feature, Devil's Garden, also draws people to the area. The landscape consists of a broad valley, backed by rolling hills and rounded buttes that lead to a broad flat escarpment, the Swan Lake Rim. The viewshed includes a mix of public and privately owned forest lands managed for timber production. In addition to Bliss Road and the OC&E Trail, several off-road vehicle roads are visible from this location. The only existing structures visible from KOP 1 are power line poles along Bliss Road. The proposed upper reservoir site is in the distant view. The VRM Class for KOP 1 is III.

The scenic quality score is 12 with a B ranking, meaning that the landscape has above-average diversity of interest.

KOP 2

KOP 2 is located along the Swan Lake escarpment about 1,000 feet above the Swan Lake Valley floor. The viewpoint is in an area on BLM land where the potential Swan Lake Rim Trail, if built, could cross and is currently accessed either by a lengthy hike on public land or via a private four-wheel-drive road. KOP 2 was selected because it represents an area along a potential recreational trail route that provides a scenic overlook of the Swan Lake Valley with Mount Shasta in the background and Grizzly Butte, the proposed lower reservoir site. The landscape consists of a broad round valley backed by rolling hills with rugged mountains in the distance. Within the viewshed, the environmental setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. Several roads, power lines, canals, barns, and residences are within view. The VRM Class for this KOP is IV. The scenic quality score is 16 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 3

KOP 3 was removed from the study in 2015.

KOP 4

KOP 4 is located in the Swan Lake Valley. The viewpoint is located on private land accessed from a gravel road running alongside Grizzly Butte. This point provides a view of the proposed transmission line route along Swan Lake Rim. The landscape consists of a flat valley backed by rugged mountains in the distance. Within the viewshed, the setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. A road, fence line, and several barns are within view in Swan Lake Valley. The VRM Class for this KOP is IV. The scenic quality score is 12 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 5

KOP 5 is located on Swan Lake Rim about 0.2 mile east of and facing the proposed transmission line route. The KOP is on BLM land near a possible alignment of the potential Swan Lake Rim Trail and can currently only be accessed on foot. KOP 5 was selected because it represents an area along a potential recreation route that provides a scenic overlook of the Swan Lake Valley with Mount Shasta in the background and overlooks Grizzly Butte and the proposed lower reservoir location. The landscape consists of a broad round valley backed by rolling hills with rugged mountains in the distance. Within the viewshed, the setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. Several roads,

power lines, canals, barns, and residences are within view. The VRM Class for this KOP is IV. The scenic quality score is 18 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 6

KOP 6 is located on private land along an access road to an active gravel pit on the Swan Lake escarpment, approximately 200 feet above the valley floor. This KOP was selected because it represents an excellent vantage point near the project site and overlooks Grizzly Butte and the proposed lower reservoir location. The landscape consists of a broad round valley backed by rolling hills with Swan Lake Point in the distance. Within the viewshed, the environmental setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. Several roads, power lines, canals, barns, and residences are within the view. The VRM Class for the KOP is IV. The scenic quality score is 15 with a B ranking, meaning that the landscape is above-average interest of diversity.

KOP 7

KOP 7 is located on a knoll along Swan Lake Rim, approximately 3 miles southeast of the proposed lower reservoir. The viewpoint is on BLM land near a potential alignment of the Swan Lake Rim Trail and is currently only accessible by foot. This KOP was selected because it is at the highest point along a potential recreation trail route (elevation 5,717 feet msl). The landscape consists of a rounded dome that is heavily forested. Within the viewshed, the setting includes a mixture of publicly owned forested lands managed for timber production and wildlife. The VRM Class for this KOP is IV. The scenic quality score is 12 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 8

KOP 8 is located on the Swan Lake Rim near the knoll where KOP 7 is located, approximately 3.2 miles southeast of the proposed lower reservoir. The viewpoint is on BLM land approximately 150 meters away from a potential alignment of the potential Swan Lake Rim Trail and is currently only accessible by foot. This KOP was selected because it provides a scenic overlook of the Swan Lake Valley with Mount Shasta in the background and is an excellent vantage point for viewing Hopper Hill and the proposed transmission line route. The landscape consists of a broad round valley backed by rolling hills with rugged mountains in the distance. Within the viewshed, the setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. Several roads, power lines, canals, barns, and residences are within view. The VRM Class for KOP 8 is IV. The scenic quality score is 15 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 9

KOP 9 is located in the Swan Lake Valley, 1.8 miles southwest of the proposed lower reservoir site. The viewpoint is at the intersection of Swan Lake and Coleman Roads. This KOP was selected because it provides a representative vantage point of the project from Swan Lake Road and the middle of the valley. The landscape consists of a wide, flat valley backed by rugged mountains in the distance. Within the viewshed, the setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. The VRM Class of KOP 9 is IV. The scenic quality score is 11 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 10

KOP 10 is located on Swan Lake Rim about 250 feet east of the proposed transmission line and 3.6 miles southeast of the proposed lower reservoir site, facing west toward Swan Lake Valley. The viewpoint is on BLM land, 150 meters from a portion of the potential Swan Lake Rim Trail, and is currently accessed only on foot. KOP 10 was selected because it represents an area along the potential recreation trail route that provides a scenic overlook of the Swan Lake Valley with Mount Shasta and Mount McLoughlin in the background and provides a good mid-distance vantage point of Grizzly Butte and the proposed lower reservoir site. The landscape consists of a broad round valley backed by rolling hills with rugged mountains in the distance. Within the viewshed, the setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. Several roads, power lines, canals, barns, and residences are within view. The VRM Class for KOP 10 is IV. The scenic quality score is 17 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 11

KOP 11 is located on private land along a farm access road near the base of Hopper Hill in Swan Lake Valley, approximately 5.5 miles southeast of the proposed lower reservoir location. This KOP was selected because it represents an excellent vantage point of the transmission line route running along the base of the escarpment from the valley floor near the primary access road to the project. The landscape consists of a broad round valley backed by rolling hills with Swan Lake Point in the distance. Within the viewshed, the setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. Several roads, power lines, canals, and barns are within view. The VRM Class for KOP 11 is IV. The scenic quality score is 10 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 12

KOP 12 is located along the Dairy-Bonanza Highway just east of Dairy, Oregon. This KOP was selected because it represents an excellent vantage point of the transmission line running along the northeast side of Horton Rim from the Yonna Valley floor. The landscape consists of a broad valley and lake backed by rolling hills and rounded buttes leading to Horton Rim, a broad flat escarpment. Within the viewshed, the environmental setting includes an agricultural valley and a mixture of public and privately owned forested lands managed for timber production and wildlife. Many existing structures are visible from the location, including transmission lines, fence lines, homes, and barns. The VRM Class for this KOP is III. The scenic quality score is 11 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 13

KOP 13 is located in Pine Flat along the OC&E Trail, near Dairy, Oregon. The viewpoint represents the experience of a traveler on the OC&E Trail and Highway 140, the Klamath-Lakeview Highway, just west of Dairy where the highway bridge crosses the OC&E Trail. The landscape consists of a broad valley backed by rolling hills and rounded buttes, leading to the broad flat Swan Lake Rim escarpment. Within the viewshed, the setting includes an agricultural valley and privately owned forested lands managed for timber production. Highway 140 is visible from this location. Many existing structures are also visible, including transmission lines, fence lines, homes, and barns. The VRM Class for this KOP is III. The scenic quality score is 12 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 14

KOP 14 is located at the intersection of the Dairy-Bonanza Highway and Burgdorf Road, approximately 2.75 miles east of Dairy, Oregon. This KOP was selected because it represents a good vantage point to view the proposed transmission line corridor running along the southeast side of Horton Rim from the intersection of two major roads on the Yonna Valley floor. The landscape consists of a broad valley and lake, backed by rolling hills and rounded buttes, and leading to the broad flat Horton Rim escarpment. Within the viewshed, the environmental setting includes an agricultural valley and a mixture of public and privately owned forested land managed for timber production and wildlife. Many existing structures are visible from the location, including the TransCanada pipeline, transmission lines, fence lines, homes, and barns. The VRM for this KOP is Class III. The scenic quality score is 19 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 15

KOP 15 is located along a residential section of Burgdorf Road near the Lost River. This KOP was selected because it represents a good vantage point to see the proposed transmission line corridor from one of the few residential areas near the route as it crosses the Lost River near Harpold Dam. The landscape consists of a broad valley backed by rolling hills and rounded buttes. Within the viewshed, the environmental setting includes an agricultural valley and a mixture of public and privately owned forested lands managed for timber production and wildlife. Many existing structures are visible from the location, including transmission lines, fence lines, homes, and barns. The area of the proposed transmission line route is visible approximately 0.4 mile west-southwest from the viewpoint. The VRM Class for KOP 15 is III. The scenic quality rating is 11 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 16

KOP 16 is located at the intersection of Burgdorf Road and Harpold Road near Harpold Dam on the Lost River. This KOP was selected because it represents a good vantage point to view the area of the proposed transmission line route from a heavily used intersection near the route as it crosses Lost River near Harpold Dam. The landscape consists of a broad valley backed by rolling hills and rounded buttes. Within the viewshed, the environmental setting includes an agricultural valley and a mixture of public and privately owned forested lands managed for timber production and wildlife. Several existing structures are visible form the location, including transmission lines, fence lines, homes, and barns. An existing distribution line crosses the river at an angle just south of the bridge at this intersection. The VRM Class for KOP 16 is III. The scenic quality score is 16 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 17

KOP 17 is located along South Poe Valley Road near the entrance to the Lost River Ranch. This KOP was selected because it represents a good vantage point to view the proposed transmission line from a major road on the Poe Valley floor. The landscape consists of a broad valley backed by rolling hills and rounded buttes. Within the viewshed, the environmental setting includes an agricultural valley and a mixture of public and privately owned forested lands managed for timber production and wildlife. Many existing structures are visible from the location, including transmission lines, fence lines, homes, and barns. The VRM Class for KOP 17 is IV. The scenic quality score is 8 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 18

KOP 18 is located along Harpold Road in the southern Poe Valley. This KOP was selected because it represents a good vantage point of the transmission line corridor from a major road on the Poe Valley floor. The landscape consists of a broad valley backed by rolling hills and rounded Buck Butte. Within the viewshed, the setting includes an agricultural valley and a mixture of public and privately owned forested lands managed for timber production and wildlife. Many existing structures are visible from the location, including transmission lines, fence lines, homes, and barns. The VRM Class for this KOP is IV. The scenic quality score is 9 with a C ranking, meaning the landscape is primarily common to the region and offers minimum diversity and distinguishing characteristics.

KOP 19

KOP 19 is located along Transformer Road on Turkey Hill, north of Malin, Oregon. This KOP was selected because it represents a good vantage point to view the transmission line from a major road on the Tule Lake Valley floor. The landscape consists of a broad valley backed by rolling hills and rounded buttes. Within the viewshed, the setting includes an agricultural valley and a mixture of public and privately owned forested lands managed for timber production and wildlife. Many existing structures are visible from this location, including several major transmission lines leaving the Captain Jack Substation (3 miles to the northeast), fence lines, homes, and barns. The VRM Class for this KOP is III. The scenic quality score is 9 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 20

KOP 20 is located east of Malin, Oregon, at the intersections of Highway 50, Stastny Road, and Morelock Road. This KOP was selected because it represents a good vantage point to see the transmission line from a major intersection on the Tule Lake Valley floor. The landscape consists of a broad valley backed by rolling hills and rounded buttes. Within the viewshed, the environmental setting includes an agricultural valley and a mixture of public and privately owned forested lands managed for timber production and wildlife. Many existing structures are visible from the location, including several major transmission lines leaving Malin Substation (3 miles to the east), fence lines, homes, and barns. The VRM Class for this KOP is III. The scenic quality score is 7 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 21

KOP 21 was removed in 2015, after the project design was modified, because it did not provide a viewpoint of the proposed transmission line.

KOP 22

KOP 22 is located about 0.2 mile northwest of the proposed upper reservoir. Similar to other sites on the Swan Lake Rim, public access through developed trails or roads is not available. Non-motorized access is available on the south end of Swan Lake Rim from Highway 140 approximately 1 mile east of Dairy, Oregon. This route requires a hike of approximately 12 miles. The only other public access route is from the north through a mixture of Forest Service and BLM land from Forest Service Road 9718. This route requires a rugged hike of about 2 miles from Swan Lake Point. This KOP was selected because it represents a good vantage point to view the upper reservoir from BLM lands. The landscape consists of a broad saddle at the top of Swan Lake Rim, with vegetation predominantly in early seral stages of regrowth from logging operations. Within the viewshed, the setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. The VRM Class for KOP 22 is IV. The scenic quality score is 16 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 23

KOP 23 is located in the Swan Lake Valley, about 1.8 miles southwest of the proposed lower reservoir site. The viewpoint is at the point where Swan Lake Road makes a 90-degree turn. This KOP was added in 2015 because it is the closest location from which the project can be viewed from a public road. The location is representative of Swan Lake Road and the middle of the valley. The landscape consists of a wide, flat valley backed by rugged mountains in the distance. Within the viewshed, the environmental setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. The VRM Class for KOP 23 is IV. The scenic quality score is 10 with a C ranking, meaning that the landscape is primarily common to the region and offers minimal diversity and distinguishing characteristics.

KOP 24

KOP 24 is located on the Swan Lake escarpment about 3 miles southeast of Grizzly Butte and the proposed lower reservoir site. The proposed transmission line would run 0.2 mile to the west of the location. Similar to other sites on Swan Lake Rim, public access through developed trails or roads is not available. Non-motorized access via a hike is available on the south end of Swan Lake Rim from Highway 140, approximately 1 mile east of Dairy, Oregon. This KOP was selected because it represents a good vantage of Grizzly Butte with good potential to view the lower reservoir and the proposed project's transmission line ROW. The landscape consists of a broad, round valley backed by rolling hills with Swan Lake Point in the distance. Within the viewshed, the setting includes agricultural lands and a mixture of public and privately owned forested lands managed for timber production. Several roads, power lines, canals, barns, and residences are within view. The VRM Class for this KOP is IV. The scenic

quality score is 17 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 25

KOP 25 is located about 0.2 mile north of the proposed lower reservoir, about 500 feet east of the penstock alignment. Similar to other sites on the Swan Lake Rim, public access is not available by developed trails or roads. Non-motorized access is available on the south end of Swan Lake Rim from Highway 140, approximately 1 mile east of Dairy, Oregon. This route requires a hike of approximately 12 miles. The only other public access route is from the north through a mixture of Forest Service and BLM lands from Forest Service Road 9718. This route requires a rugged hike of about 2 miles from Swan Lake Point. This KOP was added in 2015 because it represents an excellent vantage point to view the project from BLM lands. The landscape consists of the Swan Lake Rim and Grizzly Butte, the broad agricultural Swan Lake Valley, and high-mountain peaks to the west in the distance. Within the viewshed, the setting includes a mixture of public and privately owned lands with land uses that include agriculture, grazing, and forestry. The VRM Class for this KOP is IV. The scenic quality score is 19 with a B ranking, meaning that the landscape is of above-average diversity of interest.

KOP 26

KOP 26 is located about 0.2 mile northwest of the proposed lower reservoir and only about 10 feet from the proposed penstock alignment. Similar to other sites on Swan Lake Rim, public access is not available through developed trails or roads. Non-motorized access is available on the south end of Swan Lake Rim from Highway 140, approximately 1 mile east of Dairy, Oregon. This route requires a hike of approximately 12 miles. The only other public access route is from the north, through a mixture of Forest Service and BLM land from Forest Service Road 9718. This route requires a rugged 2-mile-long hike form Swan Lake Point. This KOP was selected because it represents a lower point of elevation on Swan Lake Rim than KOP 25 and an excellent view of Grizzly Butte and the location of the proposed lower reservoir and penstock. Because the elevation is lower than KOP 25, the view is slightly more limited; however, it provides the same sweeping landscape views as KOP 25, which consist of the Swan Lake Rim and Grizzly Butte, the broad agricultural Swan Lake Valley, and high mountain peaks to the west in the distance. Within the viewshed, the setting includes a mixture of public and privately owned lands with lands uses that include agriculture, grazing, and forestry. The VRM Class for this KOP is IV. The scenic quality score is 17 with a B ranking, meaning that the landscape is of above-average diversity of interest.

Table 3-11. Summary of KOP sites established for the Swan Lake North Pumped Storage Project Visual Resources Study, FERC No. 13318 (Source: Swan Lake North Hydro, 2015, as modified by staff).

KOP	VRM Class	Scenic Quality Score	Scenic Quality Rank
1	III	12	B
2	IV	16	B
4	IV	12	B
5	IV	18	B
6	IV	15	B
7	IV	12	B
8	IV	8	B
9	IV	11	C
10	IV	17	B
11	IV	10	C
12	III	11	C
13	III	12	B
14	III	19	C
15	III	11	C
16	III	16	B
17	IV	8	C
18	IV	9	C
19	III	9	C
20	III	7	C
22	IV	16	B
23	IV	10	C
24	IV	17	B
25	IV	19	B
26	IV	17	B

3.3.7.2 Environmental Effects

Results from the applicant's visual resource study show that project construction and operation would introduce both temporary and permanent changes to the landscape in the proposed project area. Changes would be visible to varying degrees from communities and individual residences, recreation areas, preservation areas, parks, culturally significant sites, and transportation corridors.

Project construction would introduce new, human-made elements into the landscape, including staging areas and the presence of heavy construction equipment such as large trucks and cranes. Clearing, grading, use of temporary staging areas associated with reservoir and transmission line construction; use of temporary roads, helicopter landing pads, and pulling and tensioning areas associated with transmission line construction; and artificial lighting from trailers and equipment would create unnatural but temporary visual contrasts with the surrounding landscape. Once constructed, the reservoirs, transmission lines, and powerhouse and associated features would be visible from certain viewpoints. The following section examines the visual impacts of the proposed project from each of the KOPs analyzed in the applicant's visual resource study, including a description of visible project features and the visual impact rating (visual contrast) for each KOP. Based on the scenic quality score for each KOP, a visual contrast rating was determined of either weak (0 to 7), moderate (8 to 16), or strong (17 to 20). The following text and table 3-12 summarize visual impacts at each KOP.

KOP 1

The upper reservoir berm would appear as a short and wide, gray-brown mass along the Swan Lake rim ridge top, creating a horizon line that blends with other ridge tops nearby. Because of the distance from the viewpoint and the subtle form of the reservoir wall, the contrast rating score for this site was 2 (weak contrast). The proposed development would be consistent with VRM Class III, which allows moderate levels of change to the landscape and changes to be visible to the casual observer as long as they do not dominate the view.

KOP 2

The project's lower reservoir would be visible approximately 0.8 mile southwest of this viewpoint. A small portion of the transmission line would also be visible between Grizzly Butte and the Swan Lake escarpment at a distance of 0.4 to 0.7 mile south of the viewer. Because of the prevalence and proximity of the lower reservoir from the KOP, the contrast rating score for this site was 13 (moderate contrast). The proposed development would be consistent with VRM Class IV because high levels of change to the landscape are permitted. According to BLM's management plan, changes may dominate the view and be the focus of attention; however, the plan recommends that attempts be made to minimize visual effects.

KOP 4

The project's transmission line along the Swan Lake escarpment would be distinguishable from the landscape at this viewpoint. The contrast rating score for this site was 15 (moderate contrast). The proposed development would be consistent with the VRM Class IV because high levels of change to the landscape, even those that would dominate the view, are permitted.

Table 3-12. Summary of KOP site impacts for the Swan Lake North Pumped Storage Project, Visual Resources Study, FERC No. 13318 (Source: Swan Lake North Hydro, 2015, as modified by staff).

KOP	Visual Contrast Score	VRM Class	VRM-Consistent?
1	2 (weak)	III	Yes
2	13 (moderate)	IV	Yes
4	15 (moderate)	IV	Yes
5	17 (Strong)	IV	Yes
6	15 (moderate)	IV	Yes
7	0 (no contrast)	IV	Yes
8	1 (weak)	IV	Yes
9	8 (moderate)	IV	Yes
10	7 (weak)	IV	Yes
11	7 (weak)	IV	Yes
12	6 (weak)	III	Yes
13	8 (moderate)	III	Yes
14	2 (weak)	II	Yes
15	4 (weak)	III	Yes
16	8 (moderate)	III	Yes
17	6 (weak)	IV	Yes
18	3 (weak)	IV	Yes
19	3 (weak)	III	Yes
20	3 (weak)	III	Yes
22	20 (strong)	IV	Yes
23	16 (moderate)	IV	Yes
24	12 (moderate)	IV	Yes
25	18 (strong)	IV	Yes
26	20 (strong)	IV	Yes

KOP 5

The project's proposed lower reservoir would be in view approximately 2.3 miles northwest from the viewpoint (figure 3-13). The transmission line would also be within view between Grizzly Butte and Swan Lake escarpment, west to south from the viewer. Due to the visibility of prominent project features from this KOP, the contrast rating score for this site was 17 (strong). Despite the strong contrast, the proposed development would be consistent with VRM Class IV because high levels of change to the landscape are permitted and may dominate the view, although attempts to minimize visual effects are recommended.

Figure 3-13. Photo-simulation of the lower reservoir on Grizzly Butte as seen from KOP 5 (Source: Swan Lake North Hydro, 2015, Appendix E-18.4).

KOP 6

The project's lower reservoir berm would be visible in the distance approximately 2.1 miles northwest from this KOP. The reservoir's water surface, however, would not

be visible. A portion of the transmission line would also be seen between Grizzly Butte and the base of Swan Lake escarpment, northwest to southeast from the viewer. Because of the viewing distance and the lack of color and texture contrast with the surroundings, the contrast rating score for this site was 15 (moderate contrast). The proposed development would be consistent with VRM Class IV because high levels of change to the landscape are permitted and may dominate the view as long as attempts have been made to minimize visual effects.

KOP 7

Because of high tree density at this site, no project features would be visible from this viewpoint, resulting a contrast rating score of 0 (no contrast). The proposed development would be consistent with the VRM Class IV designation for this area because high levels of change are permitted and may dominate the landscape, as long as attempts are made to minimize impacts.

KOP 8

Neither of the project reservoirs would be seen from this location, but several miles of the proposed transmission line could be visible in the distance along the base of the Swan Lake escarpment and Hopper Hill. However, at a distance of over 5 miles and intervening topography blocking the view in most places, the contrast rating score for this site was 1 (weak contrast). The proposed development would be consistent with the VRM Class IV designation.

KOP 9

The proposed project's lower reservoir berm, penstock, and several miles of the proposed transmission line would be distinguishable from the viewpoint. Due to the prevalence and proximity (middle ground) of the project features from this KOP, the contrast rating score for this site was 8 (moderate contrast). The proposed development would be consistent with VRM Class IV because it allows high levels of change to the landscape as long as attempts are made to minimize visual impacts.

KOP 10

The proposed project's lower reservoir and berm and one mile of the transmission line running northwest to southeast between Grizzly Butte and the Swan Lake escarpment would be in the distant peripheral view of the observer. The penstock, powerhouse, and other project features would not be visible from this location. Due to the remoteness and distance (distant view) of these two project features from this KOP, the contrast rating score for this site was 7 (weak contrast). The proposed development would be consistent with the VRM Class IV designation for this view because high levels of change are permitted as long as attempts are made to minimize visual effects.

KOP 11

Several miles of the transmission line would be seen along the base of the Swan Lake escarpment. The contrast rating score for this site was 7 (weak contrast). The

proposed development would be consistent with VRM Class IV because high levels of change to the landscape are permitted as long as attempts are made to minimize visual contrasts.

KOP 12

The project's transmission line would be seen along the side of Horton Rim approximately 2 miles southwest from the viewpoint (figure 3-14). Because of the landform behind the poles and moderate distance from the viewer, the contrast score for this KOP was 6 (weak contrast). The proposed development would be consistent with the VRM Class III for this area because moderate levels of change to the landscape are permitted.

Figure 3-14. Photo-simulation of the transmission line along Horton Rim as seen from the Dairy-Bonanza Highway from KOP 12 (Source: Swan Lake North Hydro, 2015, Appendix E-18.11).

KOP 13

The project's transmission line would be seen approximately 0.6 mile west from this viewpoint. Because of the proximity to the viewers and because the KOP is on an existing recreation trail, the contrast rating for this site was 8 (moderate). The proposed development would be consistent with VRM Class III because moderate levels of change in the landscape are permitted.

KOP 14

The project's transmission line would be seen approximately 3 miles west-southwest from the viewpoint. Due to the distance from the transmission line, the position of the transmission line mid-slope, and the fact that many other existing

structures are visible from this location, the contrast rating for the site was 2 (weak contrast). The proposed development would be consistent with VRM Class III because moderate levels of change to the landscape are permitted.

KOP 15

The project's proposed transmission line would be seen approximately 0.4 mile west-southwest from the viewpoint. Because the transmission line would be hidden from view by topography from a large portion of this viewpoint, the contrast score was 4 (weak contrast). The proposed development visible from this site would be consistent with VRM Class III because moderate levels of change to the landscape are permitted.

KOP 16

The transmission line and towers would be visible from this location where it traverses the Lost River (figure 3-15). Due to the proximity of the transmission line to this viewpoint, the contrast score was 8 (moderate). The proposed development visible from this site would be consistent with VRM Class III, in which moderate levels of change to the landscape are permitted.

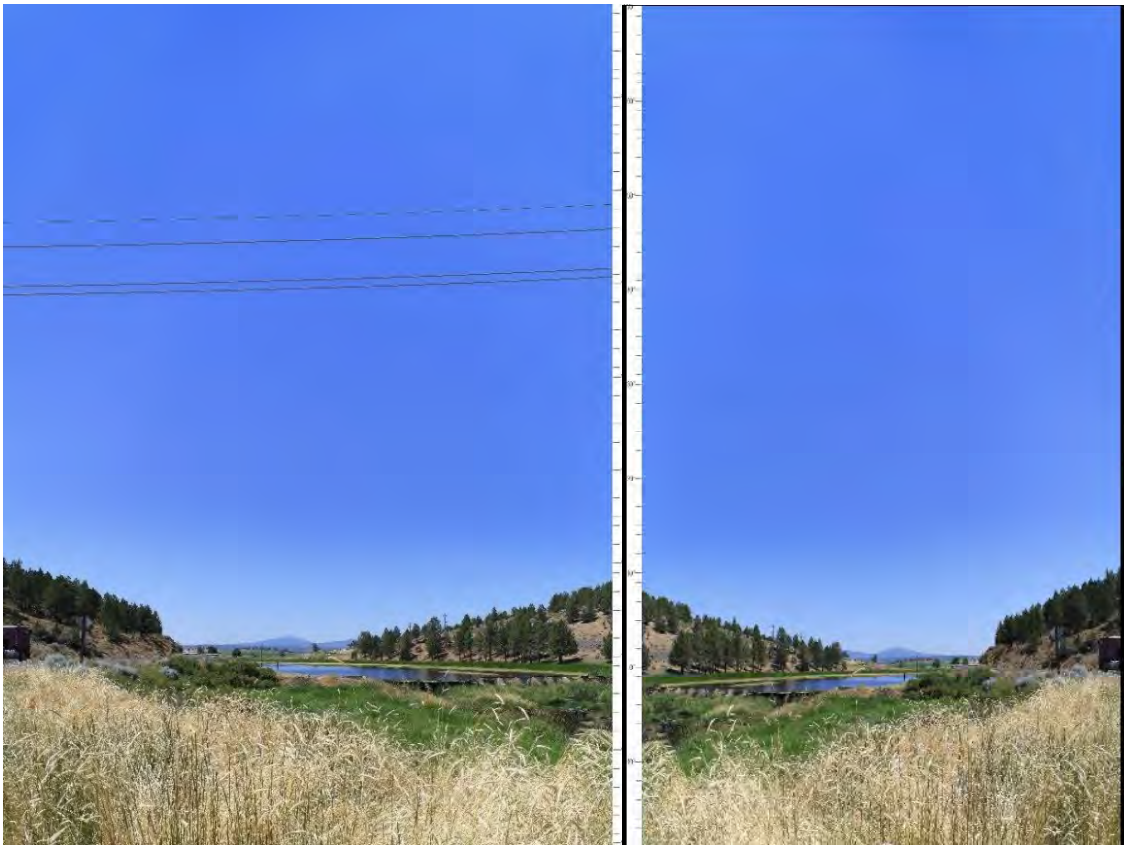

Figure 3-15. Photo-simulation of the transmission line crossing the Lost River at Harpold Dam as seen from KOP 16 (Source: Swan Lake North Hydro, 2015, Appendix E-18.15).

KOP 17

The project's transmission line would be seen approximately 2.5 miles east from the viewpoint, running north to south along the west side of the ridgeline. Due to the distance of this site from the transmission line and the fact that many existing structures are visible from the viewpoint, the contrast rating for the site was 6 (weak contrast). The proposed development would be consistent with VRM Class IV because high levels of change to the landscape are permitted and may dominate the view, as long as attempts are made to minimize visual impacts.

KOP 18

The project's proposed transmission line would be seen approximately 2.5 miles east from this viewpoint, running north to south along the west side of the ridgeline. Due to the distance from the transmission line and the fact that many existing structures are visible from the location, the contrast rating for the site was 3 (weak contrast). The proposed development would be consistent with VRM Class IV.

KOP 19

The proposed project's transmission line would be in view approximately 2.25 miles east from this viewpoint, running north to south along the west side of the ridgeline and paralleling the California-Oregon Transmission Project (COTP) line. Due to the distance from the transmission line and the fact that many existing structures are visible from this location, the contrast rating for this site was 3 (weak contrast). The proposed development would be consistent with VRM Class III.

KOP 20

The project's transmission line would be seen approximately 2.25 miles east from the viewpoint, running north to south along the west side of the ridgeline and paralleling the COTP line. Due to the distance from the transmission line and the fact that may existing structures are visible from the location, the contrast rating for the site was 3 (weak contrast). The proposed project visible from this site would be consistent with VRM Class III.

KOP 22

The proposed project's upper reservoir would dominate the view from this vantage point because it would be located only 0.1 mile to the southeast of the viewer (figure 3-16). Because the KOP is located at a higher elevation than the reservoir, glare on the surface of the reservoir would also be visible. The project's transmission line, penstock, and other features would not be visible from this location. Due to the proximity to the upper reservoir and viewing angle, the contrast rating for this site is 20 (strong contrast). Despite the strong contrast, the project would be consistent with the VRM Class IV because it allows high levels of change that may dominate the view as long as attempts are made to minimize visual effects.

Figure 3-16. Photo-simulation of the upper reservoir as seen from KOP 22 (Source: Swan Lake North Hydro, 2015, Appendix E-18.20).

KOP 23

The project's proposed powerhouse and substation would be visible from a distance at the base of Grizzly Butte, and a portion of the penstock would be visible traversing up the Swan Lake escarpment. The reservoir berm would be visible above the tree line of Grizzly Butte, however, the water surface of the reservoir would not be visible. The transmission line would be visible in the distance traveling across the middle elevations of the Swan Lake escarpment. The upper reservoir would not be visible from this location. Due to the number of project features that would be visible from this location, the contrast rating for this site is 16 (moderate contrast). The project would be consistent with the VRM Class IV designation.

KOP 24

The project's lower reservoir would be visible in the distance in the peripheral right vision of the observer at this vantage point. Because the KOP is located at a higher elevation than the reservoir, glare on the surface of the reservoir would also be visible, however, the glare from the reservoir would be less pronounced than, and blends with, the glare from the Swan Lake wetland. A small portion of the project's transmission line would be visible from this location as it traverses from Grizzly Butte to the Swan Lake escarpment. Due to the distance from, and viewing angle of, the lower reservoir, as well as the reservoir's compatibility with the existing waterbody visible from this location, the contrast rating for this site is 12 (moderate contrast). The project facilities visible from this site would be consistent with the VRM Class IV.

KOP 25

The project's lower reservoir, powerhouse, substation, and transmission line across Grizzly Butte would be visible in the distance from this location (figure 3-17). Because the KOP is located at a higher elevation than the reservoir, glare on the surface of the reservoir would be visible and would be more pronounced than the glare from the Swan Lake wetlands in the distance. Due to the proximity to, and high visibility of, the lower reservoir from this location, the contrast rating for this site is 18 (strong contrast). These project features would be consistent with the VRM Class IV because it allows for a high degree of development that may dominate the landscape as long as attempts are made to reduce visual effects.

Figure 3-17. Photo-simulation of the lower reservoir as seen from KOP 25 (Source: Swan Lake North Hydro, 2015, Appendix E-18.23).

KOP 26

The project penstock would dominate the view from this vantage point, as the penstock would be located only 10 feet to the west of the viewer (figure 3-18). The project powerhouse, substation, and transmission line across Grizzly Butte would also be visible in the distance from this location. Because the KOP is located at a higher elevation than the reservoir, glare on the surface of the reservoir would also be visible, with the glare being somewhat more pronounced than the glare from the Swan Lake wetlands in the distance. Due to the proximity to the penstock and the viewing angle of the lower reservoir, the contrast rating for this site is 20 (strong contrast). The project would be consistent with the VRM Class IV designation.

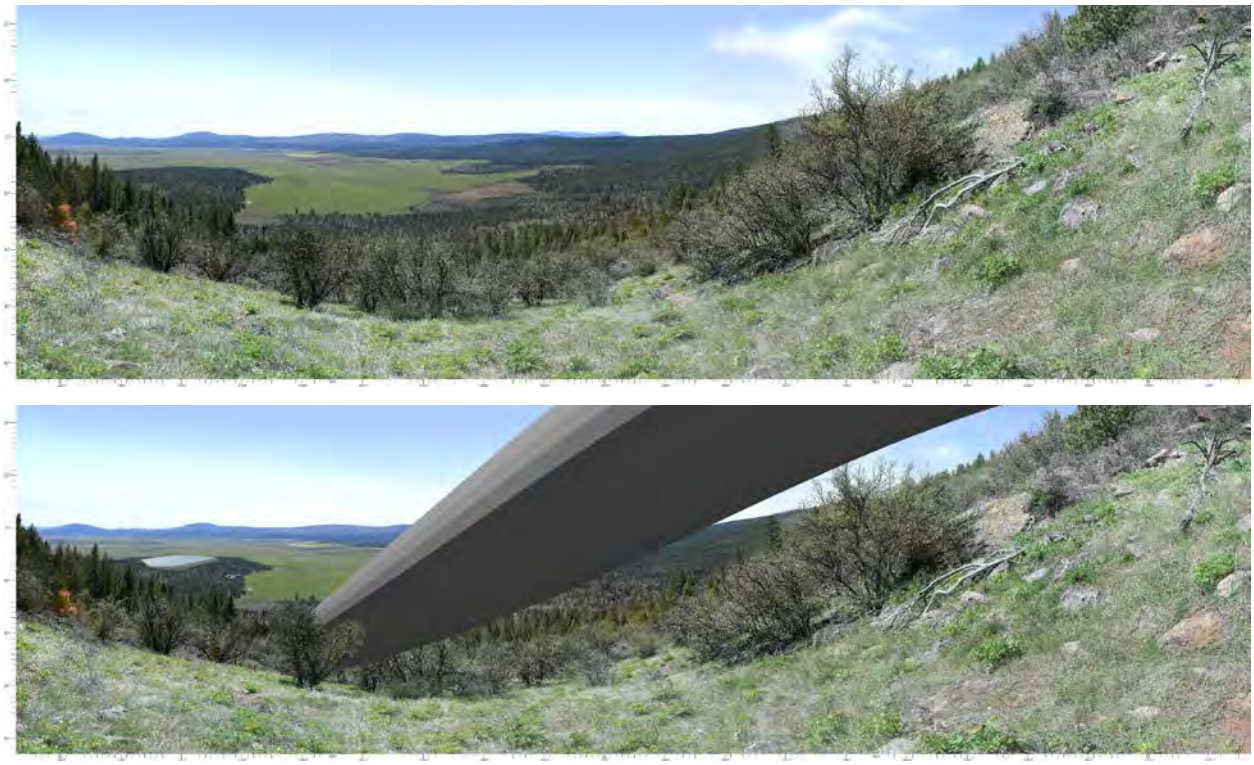

Figure 3-18. Photo-simulation of the penstock and lower reservoir as seen from KOP 26 (Source: Swan Lake North Hydro, 2015, Appendix E-18.24).

To minimize visual contrast of the proposed upper and lower reservoirs with the surrounding landscape, the applicant proposes to use locally quarried rock, such as dark basalt for the outer berm faces of the reservoir, and vegetation wherever possible to soften the reservoirs' edges. To blend the powerhouse and maintenance facilities with the surrounding environment, the applicant proposes to screen these facilities with vegetation and paint or dull the surfaces to match the landscape. Only BLM-approved paint colors would be used for structures on BLM lands, and the applicant would organize and keep facility yards clean of debris and unused material to further reduce contrast. To minimize the visual impacts of the transmission line, the applicant proposes to use COR-TEN-type steel that would weather to form a less-contrasting rust-like appearance, use non-reflective materials for transmission line conductors, install mono-poles instead of lattice-type structures, and replant all areas disturbed by the transmission line according to its proposed Revegetation and Noxious Weed Management Plan.

To reduce the appearance of land-scarring and vegetative changes from construction or modification of project access and service roads, the applicant proposes to (1) revegetate and restore unnatural appearances in the landscape caused by clearing and maintenance; (2) use low-impact construction techniques such as helicopter placement and maintenance of transmission poles to avoid scarring in visible, sensitive, or difficult to access locations; (3) use locally colored aggregate for roads to match surrounding landscape; (4) minimize the widening and grading of roads; (5) employ dust-suppression

measures during construction; and (6) revegetate all disturbed areas according to the proposed Revegetation and Noxious Weed Management Plan.

Because construction of the powerhouse and reservoirs would occur throughout a 24-hour period, lighting of the construction area and construction equipment likely would be visible from a distance at night to residences and those using surrounding roads. In addition, lighting used for safety and maintenance purposes during project operation would also be visible, although to a lesser extent than lighting during construction. The applicant proposes to use special lamps, light covers, timers, or motion sensors to minimize light pollution from on-site lighting.

Dan Cohan, Mary Hunnicutt, and Rod Neterer, all Bonanza residents, and Terri and Richard Sacchi, residents of Malin, live near the proposed transmission line route and are concerned with aesthetic effects of the proposed transmission line. Rod Neterer points out that the area that would be traversed by the proposed transmission line is rural and scenic, especially at the crossing of the Lost River and that the line would be unsightly to those travelling along Harpold Road, Burgdorf Road, and the North and South Poe Valley Roads. Terri and Richard Sacchi recommend that the line be placed on the other side of any existing lines that run close to their home. Mary Hunnicutt and Dan Cohan point out that the applicant's viewshed analysis only takes into consideration views from roads and highways and does not address the view of the transmission line by residents adjacent to its route. Dan Cohan recommends an additional viewshed analysis that uses GIS and digital elevation model data to determine visual impacts on residents.

Our Analysis

Project features would contrast to varying extents with the surrounding landscape with the transmission line having the farthest-reaching visual impact because of its linear nature and proximity to more residences, roads and recreation trails. Because of the remoteness and lack of public access, the reservoirs and power house would have limited effects on the viewshed. The applicant's proposed screening, painting, and lighting measures would minimize adverse effects of constructing and operating the powerhouse and reservoirs to extent practicable. The applicant's proposal to install mono-poles, instead of lattice-type structures for the transmission line would reduce the visual contrast of the line with the surrounding landscape. Figure 3-19 shows photographs of similar poles recently installed in another location in the western United States.

Figure 3-19. Photograph of an existing single circuit steel mono-pole transmission line similar to the one proposed for the Swan Lake North Hydroelectric Project (Source: Electrical Consultants Inc. 2019)

As discussed on section 3.3.6.2, there would be some visual effects on recreationists visiting the western edge of the Swan Lake Rim ERMA because the lower

reservoir, the powerhouse, parts of the transmission line, and the above-ground penstock would be visible from certain locations along the rim. The degree of intrusion on the viewshed would depend on the location of the viewer. For example, the penstock would dominate views and obscure the landscape from KOP 26, which is, a possible location along BLM's anticipated Swan Lake Rim Trail (see figure 3-18). The penstock could not be screened sufficiently to fully mitigate this visual impact; however the applicant's proposal to paint the penstock with earth-tone colors would reduce the contrast. While the sight of the penstock in this area would detract from the scenic quality of the view, the Class IV VRM designation for this area of the ERMA allows for landscape modifications to dominate the view. From other KOP sites along the western edge of the rim, however, project facilities would not be as obvious to recreationists in the Swan Lake ERMA. For example, while the lower reservoir and portions of the transmission line would be visible from KOPs 2, 5, 8, 10, 24, and 25, these facilities would not dominate the scenery because they would either be partially screened by terrain or vegetation or visible at a distance. The view of the upper reservoir from KOP 22 from the northeastern edge of the Swan Lake ERMA, however, would dominate the scenery even with the applicant's proposed visual mitigation measures in place but would still be consistent with BLM's Class IV designation for the area.

The applicant's revegetation efforts, use of use COR-TEN-type steel and non-reflective materials for transmission line conductors, and installation of mono-poles would minimize the contrast of the new line with the surrounding landscape to the extent practicable. However, the transmission line would still represent a moderate contrast with the landscape where it travels through open terrain from the perspective of those viewing it from residences and roads in the Swan Lake Valley, along the OC&E Trail (especially where it crosses the transmission line in the Pine Flat area), at the Lost River Crossing, from residences on either side of the route through the Poe Valley southeast of the Lost River crossing, and from recreationists within the Bryant Mountain ERMA.

As recommended by Dan Cohen, staff used Google maps and GIS technology to superimpose the transmission line route on satellite images of the terrain. We then estimated the distance between residences and the proposed route and the visibility of the transmission line taking into account land features and elevation. By combining this information with results of the applicant's visual resources study, staff determined that the closest residents to the transmission lines would be located just south of the Lost River crossing and would be within 600 feet of the line. The transmission line would be particularly visible here because it travels in open terrain as it crosses the river and the poles, which would stand on higher ground on either side of the river, would not be screened by vegetation or geographic features. As the transmission line continues along the ridge between residences on Harpold Road and Philpott Lane, the upper 50 to 90 feet of the poles would be visible above the western juniper trees that grow in this area. The next closest residents are located in the surrounding farmland outside of Malin, where the closest one would be located about 1,000 feet west of the power line route and at a point where the line would turn east to connect with the Malin substation. The line would be

visible in this area because it would travel in open terrain, although the elevated terrain behind the line would reduce the visibility to a certain extent.

The proposed transmission line would contrast less with the surrounding environment where it would parallel the existing TransCanada natural gas pipeline about 1 mile north of the Captain Jack Substation (located about 5 miles northeast of Malin) and where it follows existing transmission lines coming out of the substation before it crosses about a mile of empty BLM land to connect with the substation at Malin. Part of this lower route of the transmission line would pass through the Bryant Mountain ERMA. The line would be co-located with, or run parallel to, existing transmission lines in this area, which would reduce its contrast with the surrounding environment. Because it would not dominate the landscape, it would be compatible with BLM's Class III VRM designation for the ERMA. However, because this area already has three major transmission lines running through it, the proposed transmission line would add another unnatural linear element to the scenery in the ERMA.

Installing flight diverters on the transmission line in certain areas to prevent bird collisions, as proposed by the applicant and recommended by Oregon DFW (see section 3.3.5.2), would make the presence of the line even more obvious in these areas, especially in open areas such as the ROW adjacent to residences near the Lost River crossing.

Several members of the public recommended burying the transmission line for a variety of reasons and distances, ranging from the entire line to the 0.25-mile portion that crosses the Lost River. Burying the transmission line would remove the poles and conductors from sight for that portion of the line that is buried, eliminating any long term visual impacts on the viewshed. Burying the line across the Lost River would also preserve existing views in this area, although, depending on where the line would re-emerge to transition to above-ground towers, a 80- to 120-foot-high pole would likely be visible on the high ground on either side of the river. While the area looking downstream of the bridge crossing the Lost River below Harpold Dam has a view of a distribution line crossing, there are no such line crossings visible upstream of the dam and, except for a distribution line that runs along a road on the right bank of the river, the upstream view is relatively unobstructed by linear features.

3.3.7.3 Cumulative Effects

Several high voltage transmission lines cross the Lost River Basin and connect to two major substations: the Captain Jack Substation, located about 5 miles northeast of Malin, Oregon, and the Malin Substation located about 3.5 miles east of the town. At the Captain Jack Substation, multiple lines come in from the north and west and continue south to the Malin Substation. The TransCanada pipeline also traverses parts of the basin in a north-south direction with several east-west feeder lines joining it. The Pacific Connector Gas Pipeline Project, a 235-mile-long, 36-inch-diameter natural gas pipeline, is in the proposal stage and, if constructed, would carry gas from Malin, Oregon,

northeast to the Jordan Cove liquefied natural gas terminal in Coos Bay, Oregon, and would cross the Lost River Basin.

The proposed project transmission line would introduce another linear element of development in an area that already has numerous linear, human-built disturbances to the landscape, including other transmission lines, natural gas pipelines, and irrigation canals. The proposed transmission line would be seen in addition to other lines throughout areas in the basin but would present less of an adverse cumulative impact in areas where it parallels existing lines because it would create less of a contrast with the surrounding environment. This would be the case along the southernmost portion of the route from just north of the Captain Jack Substation where it begins to parallel the existing TransCanada gas pipeline and then parallels two existing high-voltage lines (500 kV and 230 kV) coming out of the substation for about 3 miles before it also starts to parallel the existing COTP transmission line until turning east to connect with the Malin Substation.

In areas where the proposed transmission line would run in a divergent path from other lines visible in the viewshed, there would be more of an adverse cumulative visual effect because viewing the transmission line in relation to other lines going in different directions would create a disjointed appearance of lines on the landscape which would be more obvious to the observer. Such cumulative visual impacts would be seen from farms and residential areas in the Poe Valley (especially near the Lost River crossing in Bonanza) and Swan Lake Valley (especially near Dairy), the OC&E Trail near Dairy, roads traversing Swan Lake Valley and Poe Valley, from within the Bryant Mountain ERMA where the transmission line would add to three existing lines, and from some residences east of Malin (where the proposed transmission line would be visible to the east while an existing line is visible to the west). The addition of the new transmission line would further reduce the amount of lands unencumbered by infrastructure and the overall scenic quality of the Lost River Basin.

The measures proposed by the applicant to blend the transmission line facilities with the surrounding environment, such as collocating the facility with other ROWs and using poles instead of lattice structures and non-reflective weathering materials, would reduce the cumulative visual impact of the line. However, even with these measures, the facility would still be visible on the landscape.

3.3.8 Cultural Resources

3.3.8.1 Affected Environment

Section 106 of the NHPA requires that the Commission evaluate the potential effects on properties listed or eligible for listing in the National Register. Such properties listed or eligible for listing in the National Register are called historic properties. In this document, we also use the term "cultural resources" for properties that have not been evaluated for eligibility for listing in the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered

historic. Section 106 also requires that the Commission seek concurrence with the State Historic Preservation Office (SHPO) on any finding involving effects or no effects on historic properties and allow the Advisory Council on Historic Preservation (Advisory Council) an opportunity to comment on any finding of effects on historic properties. If Native American (i.e., aboriginal) properties have been identified, section 106 also requires that the Commission consult with interested Indian tribes that might attach religious or cultural significance to such properties.

Area of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by the issuance of a proposed license within a project's APE. The APE is determined in consultation with the SHPO and is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.

The direct APE covers areas that could be subject to ground-disturbing activities. The direct APE is approximately 2,030 acres and consists of a 300-foot-wide ROW along the 32.8-mile-long corridor of the transmission line (approximately, 1,178 acres); project reservoirs, powerhouse, penstock and laydown areas (approximately 831 acres); and associated access roadways for construction of transmission line (approximately 21 acres). The indirect APE is the area that would be indirectly affected through visual effects. The indirect APE consists of a 1-mile buffer on each side of the centerline around the 32.8-mile-long transmission line corridor and other project structures. The Oregon SHPO concurred with the APE in a letter dated April 26, 2016 (see appendix A in Bowden and Deur, 2017).

Culture Historic Context[56]

Aboriginal Settlement

The first aboriginal settlements in the region would have been related to small, highly mobile hunter-gatherer groups of the Paleoindian period (prior to 10,000 years BP) who occupied much of the northwestern United States at the end of the Pleistocene Era. At the close of the Pleistocene, these early Paleoindian groups had crossed the unglaciated land-bridge from Eurasia to Alaska and southward into the Pacific Northwest. These first-Americans were associated with the Clovis culture, who manufactured distinctive fluted spear points used in the dispatching of large Pleistocene mega fauna, such as mammoth and mastodon. No Paleoindian settlements have been recorded within the project area; however, fluted spear points have been found about 20 miles southwest of the project area in California, and another 40 miles northeast near Ashland, Oregon.

[56] The culture historic context is taken and generalized from Davis et al., 2015; Bowden and Deur, 2017; Davis et al., 2017.

The earliest documented settlements in the local area occurs at the beginning of the Holocene period (after 10,000 BP) when climatic conditions became warmer and more stable and where people could exploit more reliable food resources including modern species of smaller mammals, tubers, and other plant resources. Less than a mile southeast of the project area, two archaeological sites have components dating from about 10,000 to 8000 BP. Another related archaeological site dating to the same period near Keno, about 20 miles southwest of the project area, shows a more intensive occupation where people hunted a significant number of different animal species on a seasonal basis. The more dense cultural deposits at this particular site also indicate that populations were returning to the same places over generations demonstrating a more stable, predictable environment and settlement pattern at this time.

At around 7600 BP, however, the stability of the entire region changed dramatically with the eruption of Mount Mazama (present-day Crater Lake). Some archaeological evidence shows occupation within a short period of time after the eruption, but sites dating to this period are rare. From the middle Holocene (ca. 7500 to 4500 BP) onwards, populations regained a footing in the region and shifted more towards a sedentary life-style where people congregated in large villages and continued to intensively exploit particular local food resources, especially along the riverine and marsh environments which were becoming widespread throughout the area. Beginning in the late Holocene (ca. 4500 to 2500 BP), there is also an increase of ground stone artifacts that were used in the processing of root and seasonal plant resources. At this time, the presence of round house pits appear, demonstrating a more sophisticated and residential lifestyle within the larger village sites. The size of house pits also vary, indicating that there was some kind social ranking occurring in the villages. The complexities of settlements also show a pattern of larger winter villages and more seasonal special use camps for fishing, hunting, and collecting of particular plant resources.

By around 2500 BP, the settlement pattern and lifestyle of aboriginal groups living in the area basically begin to reflect the ethnographic patterns associated with populations who were indigenous to the area at the time of Euro-American contact. At 2000 BP, there is also a significant shift towards a more heavy reliance on fishing, as noted by the presence of stone net sinkers, barbed points, and harpoons found in settlements at the time. People also develop the use of the bow and arrow as indicated by the presence of smaller stone arrow points.

Aboriginal Occupation

The Swan Lake area lies within the traditional lands of the Klamath and Modoc peoples who are speakers of the Plateau Penutian language group. These two aboriginal groups were probably indigenous to the area for at least several thousand years, and their ancestral and continuous past is well documented in the archaeological record both around and within the project area. The Klamath and Modoc are closely related, sharing many cultural traits.

The Klamath generally occupied the northern portion of the Upper Klamath Basin as far north as the southern boundary of the Deschutes River, while the Modoc inhabited the southern portion of the Upper Klamath Basin extending down to Lower Klamath Lake, Tule Lake, and Lost River. Both the Klamath and Modoc followed an annual round of exploiting seasonal food resources, living in semi-permanent winter villages along streams or lakes, and then successively traveling outside the village during the warmer months to gather roots and berries, spending time at fish camps, and participate in hunting parties. In the winter villages, the Klamath built circular earth lodges over a house pit which had wood plank and mat-covered roofs, ranging in size from 12 to 30 feet in diameter. These earth lodges were often spaced close together. Other less substantial structures (such as mat-covered houses and huts) would also be built in the winter villages, or more frequently in the temporary season camps.

The Modoc constructed similar earth lodges in their winter villages, but they tended to have shallower pits and be spaced farther apart from one another, often hundreds of feet apart. They also built less substantial domed-shaped mat houses and huts. The Klamath groups heavily exploited the riverine, lacustrine, and marsh environments (particularly for fish and water lily seeds), while the Modoc tended to be more engaged with hunting and collecting of plant resources. Both groups relied heavily on fish resources for their diet, but the Klamath fished year-round, while the Modoc only fished seasonally.

As discussed in greater detail below, both the Klamath and Modoc considered the geographic landscape within and around Swan Lake Rim, Swan Lake, Bryant Mountain, Olene Pass, Horton Rim, and the Harpold Dam area sacred, and frequented these places for ceremonial use over the millennia. The Klamath and Modoc would also band together to fight and defend against common enemies outside their territories, including the Shasta, the Upland Takelma, and the Northern Paiute to the south and east. They were more friendly and traded with other groups such as the Southern Molalla of the Cascade Mountains, the Warm Springs of the Deschutes River, and Wishram-Wasco of the Dalles along the Columbia River. The Klamath and Modoc would exchange obsidian, dried venison, and fish in exchange for maritime resources such as Olivella (olive shell) and clamshell beads.

Lifestyles and practices of the Klamath and Modoc continued unaffected up into the initial contacts with Euro-Americans. Not too long afterwards, however, easy access to hunt, fish, and collect plants within their traditional lands became increasingly more difficult. This difficulty was caused by an ever-expanding stream of explorers, trappers, and settlers arriving from the eastern United States, as early as 1825, and continuing after the Civil War. With an increased presence of Euro-American settlers and establishment of the Oregon Territory in 1846, treaties were formed between the United States and the Klamath and Modoc. The United States Government established the Klamath Treaty of 1864, which combined the Klamath, Modoc, and the Yahooskin Band of Snake Indians into a single entity called the Klamath Tribes. Geographically, the Klamath reservation included Upper Klamath Lake and Agency Lakes and the Williamson and Sprague River

drainages and extended south near the northern boundary of the project area. Under the leadership of the charismatic tribal leader, known as Captain Jack, or Kintpuach, a group of Modoc Indians left the Klamath reservation in 1872 and for the following year were engaged in an armed conflict with the U.S. Government known at the Modoc War. Captain Jack and his group were defeated by the U.S. Army about 50 miles south of the project area in what is now known as the Lava Beds National Monument in California, and survivors were moved to Indian Territory (Oklahoma) where they were held as prisoners of war until 1909. Afterwards, some of the remaining Modoc were allowed to return to the Klamath reservation, while the remaining group formed and gained federal recognition in 1978 as the Modoc Tribe of Oklahoma. In 1954, under the Klamath Termination Act, the Klamath Tribes in Oregon were terminated from federal recognition and their reservation was dissolved. In 1986, the Klamath Tribes regained their federal recognition, but their former reservation lands were never reestablished.

Euro-American Settlement and Occupation

The first Euro-American to enter the region in and around the project area was probably a fur trapper from the Hudson Bay Company named Peter Skene, who was hunting beaver in the Klamath marshlands in 1825. With his initial success, he returned with his companion, Thomas McKay, to the area in 1826 and 1827. Lt. Charles Wilkes of the U.S. Navy entered the region in 1841 and provided the first land and topographic maps that were later used by John Fremont on his second expedition out to California where he arrived at Klamath Lake in December 1843.

In 1846, Jesse and Lindsey Applegate led a party through the area looking for suitable trails for settlers to use as routes to the newly established Oregon Territory. They blazed the Applegate Trail which traced across the north side of Tule Lake, looped around Lower Klamath Lake, crossing the Klamath River near present-day Keno, and then over the southern flank of the Cascade Mountains and down into the Rough River Valley. During the 1848 California Gold Rush, prospectors were also using the Applegate Trail to reach the gold fields. The Applegate Trail is also considered a spur of the California National Historic Trail, which is administered by the National Park Service. These same trails were also used for additional prospectors and some settlers in search of good farmlands in the project area.

The first settlers in what was later to become Klamath County were the Applegate family, the head of which was Captain Oliver Cromwell Applegate, being the son of one of the original Applegate trailblazers, Lindsay Applegate. Captain Applegate settled at Lake of the Woods in 1860. In 1875, he purchased from the U.S. Government a 160-acre land grant approximately 0.5-mile west of the project area, and an additional 160-acre land grant in 1881. Another son of Lindsay Applegate, Major Lucien Applegate, also purchased 160-acre land grants and established a large ranch called Brookside Ranch in the Swan Lake Valley about 2 miles southwest of Grizzly Butte. He resided there until his death in 1926. As early as 1866, Captain Applegate had also established the "Ax and Rifle Company" that consisted of a group of 50 Native Americans who cleared a wagon

trail through the dense forests (called the Trail to Yanax) that was used to transport beef cattle from the Dalles on the Columbia River to the Klamath Indian agency that was established on the Klamath reservation in the same year. The trail also appears on a historic 1873 General Land Office map leading directly from Swan Lake where the Applegate brothers were ranching. Three years earlier, in 1863, Fort Klamath was established by the U.S. military to monitor the Klamath reservation and served as a base of operations for troops pursuing Captain Jack and his followers during the Modoc Wars of 1872–1873. The town of Linkville was established around the same time.

Klamath County was established in 1882, and the name of Linkville was formally changed to Klamath Falls in 1893. Settlements were sparse in the region until large-scale irrigation came in around the close of the century, allowing for significant cultivation of the surrounding area as a result of the irrigation canals draining many of the marshlands. The town of Malin, which lies just to the south of the project area, was founded in 1909 by a group of Czech decedents who were attracted to the region by the supply of irrigated water and tillable lands. In the same year, the Southern Pacific Railroad came to Klamath Falls extending a rail line south to Alturas, California, where it connected to the Nevada-California-Oregon Railroad. With a growing lumber industry, establishment of flour mills from the local farming communities, and the railroad, settlements and populations rapidly increased in the area, providing a greater need for electricity which came in as early as 1905 with the establishment of a hydroelectric plant along the Keno Canal in Klamath Falls. At the same time, portions of the Klamath River below Upper Klamath Lake were also dammed for generating electricity, resulting in the Klamath Hydroelectric Project (FERC Project No. 2082). The Weyerhaeuser Company Mill began operating at Klamath Falls in 1929 and was considered the largest pine mill in the West at the time. In the late 1930s, public rangelands were also established in the area and originally managed through the U.S. Grazing Service and General Land Office, until these agencies were merged into BLM in 1946.

Archaeological, Traditional-Ethnographic, Historic, and Architectural Investigations

Cultural resources investigations within the proposed project's APE were completed in 2015, 2017, and 2018 (Davis et al., 2015; Bowden and Deur, 2017; Davis et al., 2017; Davis et al., 2018). Cultural investigations consisted of archival and ethnographic research in both the direct and indirect APE and systematic pedestrian surveys (accompanied with shovel probes) within the direct APE, except for those portions on private lands where access was denied. The inaccessible areas totaled 297 acres and were all within the transmission corridor portion of the direct APE. A total of 1,968 acres was systematically surveyed in the direct APE.

Archaeological Resources

Archaeological resources found during the surveys involve both sites and isolated finds. The archaeological sites consist of scatters and concentrations of artifacts

(sometimes with cultural deposits that extend below the surface) that are either pre-contact or historic in nature. Pre-contact archaeological sites found within the APE are composed of chipped stone debris scatters (lithic scatters) often associated with stacked rock features, which involve one or more stones being placed on top of one another. A single stacked rock feature without a lithic scatter is also considered an archaeological site. Historic archaeological sites consist of a scatter of historic debris, such as cans, scrap metal, and bits of glass, but can also be defined as a feature, such as rock wall. Isolated finds consist of a single artifact or group of artifacts isolated in one area. Most isolated finds in the APE consist of one or more stone artifacts associated with pre-contact occupations.

The surveys conducted in 2015, 2017, and 2018 within the proposed project's APE identified a total of 161 archaeological resources,[57] of which 129 were archaeological sites and 32 where isolated finds. Of the 129 archaeological sites, 113 where pre-contact in age and associated with Klamath/Modoc occupations.[58] Of the remaining 16 archaeological sites, 9 were scatters of historic refuse, two were historic rock walls, two were historic telephone/transmission lines, one was a historic irrigation feature, one was a historic small earthen berm or dam, and one was a segment of the OC&E Railroad grade. Based on the initial 2015 cultural resources investigations, recommendations were made by the applicant's cultural resources contractor, Historical Research Associates (HRA), for further National Register eligibility evaluations, especially on those archaeological sites containing pre-contact stacked rock features and associated lithic materials.

In 2017, HRA evaluated 12 of the archaeological sites within the direct APE for National Register eligibility (Davis et al., 2017). Of these sites, nine were pre-contact in age; four were located within the lower reservoir portion of the APE (Grizzly Butte), three were located along the Lost River portion of the transmission line corridor, and the remaining two were along the Bryant Mountain portion of the transmission line corridor. Of these nine pre-contact sites, six were considered eligible for the National Register. These particular sites had significant cultural deposits and/or features, including one site (in the Harpold Dam portion of the APE) that contained a house pit feature that may be associated with a village site. Three historic period archaeological sites were also investigated. One consisted of a segment of the OC&E Railroad grade located along the transmission line corridor just south of Highway 140, and two consisted of rock walls features located along a portion of the transmission line corridor south of Grizzly Butte and flanking the western edge of the Swan Lake Rim. Of the three historic archaeological sites investigated, only the OC&E Railroad grade was considered eligible for the National Register.

---

[57] See summary of the 2018 HRA cultural resources report below which added additional locations of archaeological resources not previously recorded.

[58] One of these sites also contained a scatter of historic refuse.

At BLM's request, Swan Lake North had HRA survey 62.9 acres of BLM lands within the transmission line corridor in 2018 (Davis et al., 2018). These investigations included: (1) completing a pedestrian survey of three segments of un-surveyed portions of the direct APE within the transmission line corridor; (2) investigating 51 archaeological sites identified by BLM as being missed during earlier investigations or where site boundaries needed to be modified; and (3) completing formal evaluations of three stacked rock features previously presumed eligible for the National Register (35KL3986, 35KL3987, and 35KL3982). HRA recorded 11 archaeological resources on the newly surveyed BLM lands, comprising 8 sites and 3 isolates. Of the 51 sites identified by BLM, HRA evaluated and recorded 38, including 35 newly identified resources and 3 previously recorded sites where the site boundaries changed. Due to the site boundary change at one site (35KL3983), additional shovel probes were conducted in order to verify the new site boundaries, and no cultural material was found. Of all the sites evaluated during the 2018 study, 35 were verified as newly identified archaeological sites (stacked rock features), while four were previously recorded archaeological sites and their boundaries either expanded or decreased in size. Sites 35KL3986, 35KL3987, and 35KL3982 were confirmed to be eligible for the National Register under Criterion A, but further work is needed to evaluate them under other criteria.

BLM also requested that Swan Lake North revisit and individually evaluate approximately 35 stacked rock features within the indirect effects APE that were presumed to be eligible for listing in the National Register as part of a not yet defined traditional landscape or were recommended as contributing (i.e., eligible) to a defined traditional landscape by Bowden and Deur (2017). HRA determined that no additional work to determine National Register eligibility was needed because these sites were already recommended eligible for the National Register or treated as eligible, all are considered as contributing elements to the Swan Lake Rim TCP, and mitigation recommendations for these sites would not change if revisited. Therefore, no further work was conducted at these sites.

Of the 50 archaeological resources studied in 2018, HRA recommended that 34 staked rock features as eligible for the National Register, that one be treated as eligible, and that 15 be considered not eligible for the National Register. Of the 15 stacked rock features that were considered to be either natural or modern in manufacture by HRA, 6 of them were questioned by the BLM as being of native significance.

Traditional Cultural Resources

In 2017, HRA, in cooperation with members of the Klamath Tribes, conducted an ethnographic assessment of traditional cultural resources within the Swan Lake Rim, Horton Rim and Harpold Dam area, and the Bryant Mountain area.

Swan Lake Rim Traditional Cultural Property

Based on the cultural resources investigations, HRA identified the entirety of the Swan Lake Rim, including Grizzly Butte, as a traditional cultural landscape or TCP

because it contains a high density of individually recorded pre-contact archaeological sites that ethnographically represent various traditional functions (mostly religious and ceremonial) along with natural landscape features (Swan Lake Rim, Grizzly Butte, and Swan Lake) that were prominent in the oral histories of the Klamath Tribes. HRA concluded it is a significant TCP because peoples associated with the Klamath Tribes (but also including others associated with the Modoc and Yahooskin cultures) have journeyed up and along the Swan Lake Rim for at least the last several thousand years (as evidenced by the archaeological record in the area), practicing various spiritual activities and other cultural experiences.

The stacked rock features which predominate most of the archaeological sites associated with the TCP, were positioned in special places along the Swan Lake Rim where individuals would have a good view (often used for vision questing) of the surrounding landscape, including distant views of predominant mountain peaks, such as Mount Shasta, Mount McLaughlin, Pelican Butte, and Mount Scott (figure 3-20).

Figure 3-20. View of Swan Lake Valley from Swan Lake Rim directly above Grizzly Butte (Source: Bowen and Deur 2017, Figure 3-6).

During a particular ceremony, practitioners would make simple stack rock offerings to the various creation forces that governed and permeated through the religion and traditional lifeways of the Klamath peoples. It is important to note that in the ethnographic literature, modern native practitioners often revisit the earlier stacked rock features and perform the same ceremonial activities as their ancestors.

Along with the spiritual aspects, Klamath and Modoc peoples also used the prominence of the rim as a traditional vantage point for tracking and hunting, as evidenced by presence of lithic artifact scatters, associated projectile points, and isolated finds. Indeed, members of the Klamath Tribes have noted that some of the Swan Lake Rim ritual areas were also linked to hunting sites. There is also a rock ring (representing an archaeological site) that sits on a discrete bench formation about halfway up the rim near the exact middle of the TCP. Some tribal members surmised that the rock ring may have been used as a dance circle involving group ceremonies.

Geographically, the Swan Lake Rim TCP boundary is defined by the Swan Lake Rim uplift, which is approximately 12.5 miles long and encompasses 9,804 acres. The majority of lands associated with the TCP are privately owned (6,091 acres), while 3,160 acres are on BLM lands, and another 553 acres are on Forest Service lands.[59] The northern half of the proposed project's direct and indirect APE (i.e., upper and lower reservoir and a portion of the transmission line corridor) essentially contains all of the Swan Lake Rim TCP. Based on HRA assessments, staff determined that the Swan Lake Rim TCP is eligible for the National Register as a historic district, and the SHPO has concurred.[60] The TCP contains a number of contributing elements, all of which are pre-contact archaeological sites. Some of these archaeological sites were originally documented in the 2015 HRA cultural resources report associated with the Grizzly Butte portion of the APE. Several additional pre-contact archaeological sites located on BLM land were subsequently identified from other surveys, which are also considered to be contributing elements. These sites are located in the indirect APE. In total, there are 63 pre-contact archaeological sites[61] in either the direct or indirect APE, which are considered contributing elements to the Swan Lake Rim TCP.[62] Of these 63 sites, 47

[59] Lands managed by the Forest Service within the TCP are located outside the proposed project boundary. No Forest Service lands would be located inside the proposed project boundary.

[60] See Commission letter to Oregon SHPO, issued December 20, 2017, and Oregon SHPO's response, filed January 24, 2018.

[61] Six additional pre-contact sites were added to the Swan Lake Rim TCP as a result of the 2018 HRA cultural resources report.

[62] Two additional contributing elements (stacked rock features) associated with the Swan Lake Rim TCP were located outside the APE. A total of 33 isolated finds, all non-contributing elements, were also associated with the Swan Lake Rim TCP.

contain stacked rock features. Another 13 are lithic scatters only, and two are a combination of a stacked rock feature and lithic scatter. There is also another site consisting of a boulder that has pecked and painted petroglyphic designs which is also considered a contributing element of the TCP.

An additional six pre-contact archaeological sites that appear to be associated with similar features contributing to the TCP are located within 1 mile of the project area, but these sites are considered too far to fall within boundary of the Swan Lake Rim TCP.

Horton Rim and Harpold Dam Traditional Area

The Horton Rim and Harpold Dam area were not assessed as to whether they meet the criteria to be a TCP pursuant to section 106, but the ethnographic assessment did identify traditional uses by the Klamath and Modoc peoples. The area potentially affected by project construction (i.e., direct APE) begins at Highway 140 on the north end and ends about a mile south of Lost River. These boundaries are somewhat arbitrary, but this area had been a center of cultural, subsistence, and spiritual activities associated with the Modoc Tribe prior to their removal in the 1870s. Klamath Tribes members also mention a number of historically and culturally important places at or near Harpold Dam. There were also reports of a pre-Modoc War settlement site near Harpold Dam, and this locality was considered as a key fishing station along the Lost River where the waters became shallower as the river ran through Olene Gap. Historic Modoc trails running along the river also passed through this gap. Vision quests and other ceremonial activities along Horton Rim, and along the prominences on either side of Olene Gap, were also reported to have occurred among the Modoc peoples residing there. Even in more recent times, tribal peoples have used the Lost River Basin in this area for rounding up feral horses and to hunt and fish. During the 2015, 2017, and 2018 HRA investigations, 15 pre-contact sites were documented in the Horton Rim and Harpold Dam Area. Of these sites, eight consisted of stacked rock features, four consisted of stacked rock features and lithic scatters, two were lithic scatters, and the other was a lithic scatter with a house pit feature. This latter site may have been a village occupation, and perhaps in some way affiliated with the reported pre-Modoc War settlement. HRA recommended 10 of the sites with stacked rock features as eligible for the National Register.

Bryant Mountain Traditional Area

Similarly, the Bryant Mountain area was not determined to be a TCP, but the ethnographic assessment identified significant uses and cultural importance to the tribes. The portion of the Bryant Mountain traditional use area that could be affected by project construction begins where the Horton Rim and Harpold Dam area ends and extends to where the transmission line ties into the grid. The traditional area outside the APE is dominated by Bryant Mountain (considered the highest peak within Modoc traditional lands) and the Tule Lake Valley to the south. Considerable settlements of Modoc peoples occurred in the Tule Lake Basin, including the locality around present-day Malin.

This locality would include village sites, cremation areas, and other areas of cultural activities. In the Bryant Mountain area, there are 34 pre-contact archaeological sites that were documented within the direct APE. Thirty-one consist of stacked rock features, another two consist of lithic scatters, and one consists of both a stacked rock feature and lithic scatter. HRA recommended that all of the sites containing stacked rock features be considered eligible for the National Register.

Architectural Resources

In 2015 and 2017, HRA also recorded and evaluated nine above-ground, architectural resources (Harpold Dam and eight residences) and one historic trail within the proposed project's direct APE. All were located within the proposed transmission line corridor. Other than Harpold Dam, which is located on Reclamation lands, all of the residences were located on inaccessible private lands and could only be observed from a distance. Of the eight residences and associated outbuildings, three were assumed to be eligible for the National Register because of their construction techniques and styles, or their association with early to mid-20th century development of the agricultural and dairy industry.

Harpold Dam, located on the Lost River, is a concrete structure consisting of a series of abutment and buttress walls with a group of related bays. The dam was constructed in 1904 and predates the Klamath Project irrigation complex that was built by Reclamation in 1905, and is thought to be one of the earliest irrigation structures in the area. Harpold Dam has been previously determined eligible for the National Register.

The California National Historic Trail extends approximately 5,700 miles across the United States from Missouri and Iowa to parts of Oregon and California. The trail was used extensively by immigrants of the mid-1800s to reach the gold fields during the California Gold Rush and to settle in the states of California and Oregon afterwards. Segments of the California National Historic Trail, which are associated with Applegate Trail in the region, would be crossed by the southern portions of the proposed transmission line corridor. The California National Historic Trail has been previously determined eligible for the National Register, and it has significance for the initial historic development of the region.

3.3.8.2 Environmental Effects

Project construction would require blasting, soil excavation, and use of heavy equipment. These actions would adversely affect, through removal and destruction, 16 of the 63 (25 percent) pre-contact archaeological sites associated with the Swan Lake Rim TCP. These sites are located within the upper and lower reservoirs, penstock corridor, new access roads, and the connecting portion of the transmission line corridor. All of these sites are considered eligible for the National Register and are contributing elements to the Swan Lake Rim TCP, which is also eligible for listing on the National Register as a historic district. The remaining 47 (75 percent) pre-contact archaeological sites within the Swan Lake Rim TCP found eligible, or considered eligible, would be indirectly

adversely affected by the presence of project infrastructure by being within the view of these sites.

Because the majority of the project features would lie within the Swan Lake Rim TCP, tribal practitioners' experiences would also be significantly altered or permanently damaged by the visual effects of the proposed project. Although much of the land immediately below the TCP has been altered by deforestation and modern agricultural practices, and can be considered significantly changed from pre-contact times, tribal oral histories indicate that tribal practitioners still spend periods of fasting, praying, and meditation within the TCP, experiencing the overall landscape outside the TCP in a more transcendent frame of mind—also known as vision questing. The proposed project infrastructure would add to adverse effects of deforestation and modern agricultural practices on the overall setting and tranquility of the Native practitioners' vision quest experiences associated with the Swan Lake Rim TCP, but as discussed further below, would not completely eliminate the use of the TCP for vision quest experiences.

Along the 32.8-mile transmission line corridor, 22 of the 49 (45 percent) pre-contact archaeological sites outside the Swan Lake Rim TCP (8 in the Horton Rim/Harpold Dam area and 14 in the Bryant Mountain area) could be directly affected through vegetation clearing, erecting power poles, and stringing the transmission line conductors.[63] All of the 22 pre-contact archaeological sites that could be directly affected by the proposed project are considered eligible for the National Register. The remaining 27 (55 percent) pre-contact archaeological sites would be indirectly adversely affected because the transmission line would be in direct view. All of these pre-contact archaeological sites also have traditional and cultural values to native peoples associated with the Klamath and Modoc, and they still come to these areas for traditional and religious purposes. None of the architectural resources would be directly adversely affected because these structures would remain intact as they are and would not be in the way of any construction activities involving the proposed project.

To mitigate adverse effects on cultural resources, the applicant proposes to finalize the draft HPMP filed with the license application. In the draft HPMP, the applicant proposes to complete all remaining National Register evaluations and to ultimately address and resolve any potential project-related adverse effects on National Register-eligible cultural resources prior to project construction. The draft HPMP is general in scope and provides: (1) a basic summary of cultural resources found within the APE as of 2015; (2) steps to designate a cultural resources coordinator; (3) review levels to assess and address project-related effects on specific cultural resources; (4) procedures to address unanticipated discoveries of archaeological sites and human remains; and (5)

[63] The section of the California National Historic Trail that crosses the proposed project area does not contribute to the significance of the trail because the original trail in this area has been largely destroyed by agricultural development. Thus, the proposed project would have no adverse effect on the California National Historic Trail.

steps and procedures to resolve any project-related adverse effects on National Register-eligible cultural resources.

In its response to our REA notice, the Klamath Tribes continue to express significant concerns with the proposed project. The Klamath Tribes contend that the project would destroy the religious and cultural aspects of an area they have used for thousands of years and no measures can be developed to mitigate the irreparable adverse effects to their traditional and cultural well-being.[64] The affected area that the Klamath Tribes refer to is the Swan Lake Rim TCP. The Klamath Tribes state that tribal members still travel on the rim for ceremonies.[65] They state that in addition to permanently destroying the many stacked rock features that are present within the construction area, the upper and lower reservoirs would also impair their vision questing experience along with other ritual, cultural, hunting, and collecting activities that still occur on the rim. During tribal consultation meetings, they added that the permanent destruction and loss of important cultural and natural resources to the Klamath Tribes as a result of the proposed project would be irreplaceable. The Klamath Tribes add that the APE for the proposed project should be widened to include a number of other stacked rock features that are presently not part of the Swan Lake Rim TCP.

The Klamath Tribes also expressed concern that in addition to deer, elk, and antelope, other species of cultural importance to them would be adversely affected or displaced by the proposed project, including bald eagles, white-headed woodpeckers, sandhill cranes, ferruginous hawks, northern goshawks, black bear, bobcat, and mountain lions. The Klamath Tribes also access the rim area to collect culturally important plants such as mushrooms and wild celery they use for both food and medicinal purposes, and these plant resources could be directly adversely affected by the proposed project. We address potential effects on wildlife and culturally important plants in section 3.3.4.2.

In response to both issuance of our draft EIS and associated draft PA, in letters filed on October 15, October 22, and October 30, 2018, the Klamath Tribes state that they oppose the project because it, in their view, would destroy and adversely affect many cultural and sacred resources in the Swan Lake Rim area (especially Grizzly Butte) that still have great spiritual value to tribal members. They repeat their view that placement and construction of the proposed project would also disrupt the habitat and migration routes of animals and plants that are traditionally hunted and gathered by tribal members. They add that the proposed project would not only physically destroy many spiritual

[64] See Klamath Tribes filings on November 23, 2015, December 14, 2015, September 12, 2016, October 25, 2016, January 3, 2018, and January 9, 2018.

[65] The Klamath Tribes also state that the religious significance of the Swan Lake Rim TCP is also applicable under the tenets of the Native American Religious Freedom Act, and that building the proposed project would infringe upon their rights to practice their religion at this place.

sites, but in their view, would negatively affect the area as a whole by degrading visual and aesthetic values important to them, and that retaining such values involving Swan Lake Rim is ultimately protected under the American Indian Religious Freedom Act.

The Klamath Tribes add that data recovery as a means for mitigating some of the proposed project-related adverse effects on pre-contact archaeological sites is not adequate, as these sites possess special, spiritual significance to them, and is counter to guidance recommendations provided by the Advisory Council on such sites being slated for data recovery.[66] The Klamath Tribes also comment on the inadequacy of the draft HPMP and state that the draft document does not meet the joint FERC and Advisory Council guidelines for crafting HPMPs involving FERC hydropower projects. They further point out that the draft HPMP associated with the draft PA does not provide, in their view: (1) a basic description of the importance of the Swan Lake Rim as a significant cultural resource; (2) a complete breakdown of archaeological and tribal resources within the project's APE, of which there remains missing and inadequate information involving such sites; (3) integration of the various archaeological sites and traditional areas into a larger more comprehensive understanding of the whole area of significance; and (4) a strategy of preservation and mitigation through implementation of specific management measures.

In the letter filed on February 16, 2018, BLM reiterates that the Klamath Tribes have important cultural, traditional, and religious ties to the Swan Lake Rim area where the proposed project would be constructed.[67] BLM states that tribal members continue to access and use lands (both public and private) within the proposed project's APE for such purposes, and that care must be taken to ensure that their use and access to such lands are protected under the American Indian Religious Freedom Act.[68] BLM adds that the applicant must provide adequate documentation to meet the requirements of section 106 including a synthesis of existing archaeological information supplemented by field surveys on both BLM and private lands, including additional test excavations for determining National Register eligibilities of pre-contact archaeological sites, and to provide any additional studies requested by the Klamath Tribes. BLM further clarifies that all archaeological sites on its lands must be individually evaluated for National Register eligibility according to BLM's Resource Management Plan and that there are known sites on its land that were not evaluated for National Register eligibility.[69] In a

---

[66] We also pointed this out in the draft EIS.

[67] See Interior's Comments, Recommendation, Terms, and Conditions letter, filed February 16, 2018.

[68] The Klamath Tribes also stress their rights to access religious places under the American Indian Religious Freedom Act.

[69] See BLM's follow-up comments on Comments, Recommendations, Terms and Conditions and Prescriptions, filed February 22, 2018.

letter filed on April 12, 2018, the applicant explained some aspects of the incompleteness of the archaeological investigations, and added it has cooperated, and plans to continue to cooperate, with BLM to address the outstanding issues after a license has been issued for the proposed project.

In response to our draft EIS and associated PA, Interior and BLM filed additional comments involving cultural resources on October 10 and October 23, 2018, respectively. Like the Klamath Tribes, the BLM has multiple concerns with the draft HPMP including that the document is, in their view: (1) years out of date, (2) lacks the full range of resolutions and mitigation measures involving a wide spectrum of potential project-related adverse effects (including indirect effects) on historic properties; (3) does not account for all the remaining National Register evaluations and determinations of effects that need to be accomplished; and (4) needs to incorporate the 2018 HRA cultural resources report.

Reclamation also commented on our draft PA in a letter filed on October 22, 2018. Reclamation recommends that the draft HPMP be revised to include: (1) their role and participation within the HPMP, especially concerning the three historic properties in the Harpold Dam area of the APE that are located on their lands; (2) maps delineating areas within the APE that have or have not been surveyed[70]; (3) a narrative on when and how un-surveyed lands would be surveyed; (4) a statement that the designated HPMP cultural resource coordinator for carrying out responsibilities involving Reclamation lands must be professionally qualified and that such work on Reclamation lands must meet professional standards; (5) acknowledgement that the National Register status of Harpold Dam remains unclear (i.e., what existing or earlier features of the structure were determined eligible) and that the property needs to be re-evaluated [71]; (6) the final National Register status of the Klamath/Modoc Village site near Harpold Dam; (7) the results of the 2018 HRA cultural resources report; and (8) a process for carrying out possible project-related actions outside the established APE and potentially modifying the APE.

In letters filed on January 24, 2018, and May 10, 2018, the Oregon SHPO concurred with staff's determination of eligibility for the 40 pre-contact archaeological

[70] Reclamation notes that the gravel quarry on the north side of the Lost River has not been documented. However this area was documented in the direct APE by HRA as being an area that was disturbed.

[71] Reclamation also points out that Harpold Dam is on and surrounded by lands managed by Reclamation, but the dam itself is owned and operated by Horsefly Irrigation District, and this needs to be pointed out in the HPMP.

sites[72] associated with the Swan Lake Rim TCP under Criterion A.[73] The Oregon SHPO also agreed that none of the architectural resources would be adversely affected by the proposed project. However, it could not concur with staff's eligibility determinations for nearly all of the pre-contact archaeological sites based on Criterion D. The Oregon SHPO states that for it to concur with the eligibility determinations under Criterion D, the applicant needs to conduct additional field studies (i.e., test excavations) to evaluate the individual sites' research and scientific value in furthering understanding of the pre-contact past in this region and in some cases determine their existing condition as they have not been re-visited in more than 20 years. The Oregon SHPO also states that other National Register Criteria (for example, Criterion C, which demonstrates special construction techniques involving the stacked rock features in terms of workmanship) could apply to many of these contributing elements.

In response to our draft EIS and draft PA, the Oregon SHPO (in a letter filed October 25, 2018) states that, in their view, there are many problems with the draft HPMP, including their view that it is outdated. They recommend revising the HPMP to include: (1) National Register eligibility determinations (including what specific National Register criteria were used) on many of the archaeological resources located within the APE; (2) clarification on how project-related indirect effects could occur on historic properties, and how the indirect APE was defined, or needs to be modified, accordingly; (3) incorporate the HRA reports filed after 2015 and National Register eligibility determinations submitted by the Commission to the Oregon SHPO; (4) a detailed description of activities exempt from SHPO review; (5) a detailed description of the various review processes involving the Oregon SHPO; (6) a description of what steps will be taken to gather updated information within those areas of the APE that have not been surveyed in over 20 years (either through new surveys or site re-visitations); (7) a detailed description of monitoring procedures during project construction; (8) detailed procedures and protocols for handling unanticipated discoveries of archaeological resources and human remains consistent with Oregon law, including photography and reporting requirements; (9) consultation procedures for involving Indian tribes when resolving project-related adverse effects to historic properties (including TCPs); (10) specifics regarding the contents of annual reports; and (11) detailed topographic maps

[72] The Oregon SHPO had agreed previously with Commission staff that two other contributing elements (pre-contact archaeological sites) were eligible for the National Register under Criterion A, see letters from the Commission and Oregon SHPO, issued December 20, 2017, and filed January 24, 2018, respectively. Thus, there are a total of 63 contributing elements associated with the Swan Lake Rim TCP, of which the Oregon SHPO concurs with Commission staff that 40 are eligible for the National Register under Criterion A.

[73] See Oregon SHPO letter filed on May 10, 2018. Cultural resources considered eligible under Criterion A demonstrate that such sites must contribute to the major pattern of American history, and in this case to the culture of the Klamath Tribes.

showing what lands have and have not been surveyed, and which lands need to be re-surveyed.

In a letter filed on December 6, 2018, the Oregon SHPO concurred with our finding that 34 stacked rock features were eligible for the National Register (the same 34 sites HRA had recommended as eligible in their 2018 report). However, Oregon SHPO disagreed with our finding that the six stacked rock features considered by HRA to be natural or modern in manufacture were not eligible for the National Register, based on concerns raised by BLM. The Oregon SHPO recommends that the sites be reevaluated in consultation with the Klamath Tribes. The Oregon SHPO also points out that along with these six sites, there remain a number of other sites located within the proposed project APE that require additional investigations to ascertain whether they are eligible for the National Register, and what specific National Register criteria would apply to them.[74]

In a letter filed with the Commission on October 29, 2018, Swan Lake North Hydro agrees that the draft HPMP needs to be revised, but questions the need for further assessment of National Register eligibilities and potential project-related effects to those cultural resources located in the indirect APE. Swan Lake Hydro states that, in its opinion, determining eligibility and project effects for resources in the indirect APE would require further field investigations (i.e., subsurface testing) in areas outside of the project boundary where it would have little ability to obtain access to private lands. Swan Lake Hydro suggests that this type of analysis, while routine within the project boundary and direct APE, would be highly unusual and unnecessary in the indirect APE, particularly with regard to conducting subsurface investigations at resources that will experience only viewshed changes from the project.

Our Analysis

Construction of the proposed project would destroy 16 of the 63 (25 percent) contributing elements associated with the TCP and indirectly adversely affect the remaining 47 sites (75 percent). Grizzly Butte contains 30 pre-contact archaeological resources, of which 18 are contributing elements to the TCP, attesting that the butte was a central place of continuous religious activity among tribal practitioners for two millennia. The entire top of Grizzly Butte would be replaced with the lower reservoir, resulting in the loss of seven of the contributing elements found there (mostly stacked rock features). While it is not clear how tribal practitioners currently access Grizzly Butte considering it is located on private lands, tribal practitioners would no longer be able to effectively use Grizzly Butte for vision questing and other cultural practices once the project was

[74] Commission staff had concluded that many of the pre-contact archaeological sites were also eligible under Criterion D. For a site to be considered eligible under Criterion D, it must contain information that is of scientific value and that the site can be excavated to retrieve such information. Oregon SHPO argues that more investigations (i.e., archaeological testing) are needed before concluding that these sites were eligible under Criterion D.

constructed. Future access to Grizzly Butte in the absence of the project also cannot be guaranteed given that the lands are in private ownership.

The construction of the upper reservoir and part of the transmission line would result in the loss of five of the contributing elements associated with the TCP. Tribal practitioners would no longer have access to the 64 acres occupied by the upper reservoir, but they could still access most of the rim for cultural and religious practices, including vision quests. The TCP is estimated to be about 9,804 acres. Project structures (reservoirs, transmission line, penstock, access roads) would occupy about 912.8 acres of the TCP or about 10 percent of the TCP. Nearby, Horton Rim, Harpold Dam, and Bryant Mountain Traditional Areas would continue to be accessible for traditional and cultural practices, as these areas also played a significant role in tribal cultural practices and use.

However, because the project infrastructure would be visible from much of the rim, their presence would further degrade the vision questing experience that has already been degraded by deforestation and agricultural practices. The degree of adverse effect would depend where on the rim the infrastructure is viewed. Figures 3-16 through 3-18 are examples of views within the TCP. The closer the practitioner is to the project feature, the more prominent it becomes, potentially obstructing views or completely eliminating the vision questing experience. For example, figure 3-16 is a view of the upper reservoir from about 0.2 mile away from the viewer on the rim. The reservoir and exposed berms are prominent features on the landscape. As shown on figure 3-18, the project penstock would obstruct views of the valley and distant mountains. As the practitioner moves further south, project features become less prominent, and continuing southward, to being not all that different from current views (figure 3-17). No one has recommended and staff could not identify any measures to completely mitigate for these indirect adverse effects.

In addition to the project-related adverse effects to the Swan Lake Rim TCP and associated pre-contact archaeological sites, construction of the transmission line towers (including vegetation clearing, erecting the towers, stringing the conductors and constructing access roads) could directly affect 22 stacked rock features associated with the Horton Rim, Harpold Dam, and Bryant Mountain Traditional Areas. Each of these features were determined to be eligible for listing on the National Register. To comply with the NHPA, more information is needed to determine whether the Horton Rim, Harpold Dam, and Bryant Mountain Traditional Areas would constitute a TCP or archaeological district as recommended by Bowden and Deur 2017, the Klamath Tribes, and BLM. If defined as a TCP (or joined to the Swan Lake Rim TCP), similar indirect adverse effects as those described above for Swan Lake Rim TCP would likely occur.

Several members of the public recommended burying all or portions of the transmission line for a variety reasons. If burial were possible, trenching would subject lands to greater potential for ground disturbance along Swan Lake Rim; the crossing at Lost River; and in the Horton Rim, Harpold Dam and Bryant Mountain Traditional Areas. Among the National Register-eligible pre-contact sites that could be directly

affected by burying the transmission line is the Klamath/Modoc Village site in the Harpold Dam area. Once buried, however, indirect effects of the transmission line on the viewshed and tribal practices would be less than an above-ground transmission line.

Overall, unavoidable adverse effects on the individual pre-contact archaeological sites could be partially mitigated through data recovery and recordation. As part of this effort, in order to comply with the National Historic Preservation Act, each site would need to be evaluated for National Register eligibility under Criterion D and possibly C and B,[75] as recommended by the Oregon SHPO. Data recovery at an archaeological site would require systematic excavations and evaluation to fully document the site's importance and significance in a regional context. It is important to note, however, that the Advisory Council advises that archaeological sites destined for data recovery should not possess special significance, or have long-term preservation value, such as traditional cultural and religious importance to an Indian tribe, of which these sites do with the Klamath Tribes.[76] Thus, further review and analysis would be needed to develop suitable mitigation measures, if possible, as part of the HPMP.

Such data recovery and recordation efforts are typically defined and completed as part of an HPMP and implemented through a PA. The applicant's draft HPMP does not reflect the results of the various studies completed to date, and is too general to implement at this point. In such circumstances, the Commission typically recommends that the HPMP be revised in consultation with the SHPO and affected tribes and land managers, which in this case would include the Oregon SHPO, Klamath Tribes, BLM, and Reclamation. The HPMP would need to be completed, approved by the

[75] For a site to be considered under Criterion C it must embody a distinctive characteristic of a type, period, or method of construction. In the 2018 HRA cultural resources, four stacked rock features were considered eligible (concurred with by the Oregon SHPO) under this criterion (along with Criterion A). These particular features were found eligible under Criterion C because they possessed voids (spaces in between the rocks) where a prominent feature of the landscape (like a distant mountain) could be viewed. For a site to be considered under Criterion B, it must be associated with a significant people of the American past.

[76] See Advisory Council on Historic Preservation's "Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites," dated May 7, 1999, updated September 30, 2010. The guidance specifically states: the archaeological site should not have long-term preservation value, such as traditional cultural and religious importance to an Indian tribe or a Native Hawaiian organization." It also states that "the archaeological site [slated for data recovery] should not possess special significance to another ethnic group or community that historically ascribes cultural or symbolic value to the site and would object to the site's excavation and removal of its contents."

Commission, and implemented prior to any ground-disturbing actions that would adversely affect archaeological sites determined to be eligible for the National Register.

To meet the objectives within the Commission's and Advisory Council's guidelines for the development of HPMPs,[77] any revised HPMP would need to include the following :

- a culture-historic background to give context to National Register eligibility determinations;
- a revised map showing the direct and indirect APE established in consultation with the Oregon SHPO, BLM, Reclamation, and the Klamath Tribes;
- National Register eligibility determinations (assessing for Criteria A, B, C, and D) on all cultural resources located within the project's direct APE, including a determination of the eligibility of the Horton Rim, Harpold Dam, and Bryant Mountain Traditional Areas as TCPs or archaeological districts and any new sites discovered on lands that could not be surveyed because of access limitations;
- procedures to evaluate project-related effects on historic properties, and for consideration and treatment of adverse effects, as appropriate, in consultation with the SHPO, BLM, Reclamation, and the Klamath Tribes;
- specific proposed measures for avoiding, reducing, or mitigating project-related adverse effects on the individual National Register-eligible cultural resources within the project's direct and indirect APE, including site-specific data recovery plans (including schedules to complete the work) for those pre-contact archaeological sites where direct project-related adverse effects cannot be avoided and scheduling construction to avoid traditional cultural practices as practicable;
- a description of future construction and operation activities that would be subject to review by the Oregon SHPO, BLM, Bureau of Reclamation, and the Klamath Tribes (i.e., exempt, little effect, and case-by-case) and how the review would be conducted and adverse effects resolved;
- detailed monitoring procedures during construction; and
- detailed provisions for addressing any newly discovered cultural resources.

Commission staff would execute a PA with the Oregon SHPO (along with the Advisory Council, if they choose to participate in the PA), that would stipulate the

[77] See Commission and Advisory Council on Historic Preservation's "Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects," dated May 20, 2002.

applicant file the revised final HPMP for Commission approval within 1 year after issuance of any license for the project.

3.3.8.3 Cumulative Effects

The addition of the project infrastructure would further affect the natural landscape, already modified by past agricultural and logging practices, which in turn, would further diminish the vision quest experiences by tribal practitioners on Swan Lake Rim.

3.3.9 Socioeconomics

3.3.9.1 Affected Environment

Population Characteristics

The population in Klamath County in 2016 was 66,443 (U.S. Census Bureau, 2016). Communities within a few miles of the project site include Dairy (population 207), Bonanza (population 533), Poe Valley (population 1,470), and Malin (population 785). According to U.S. Census Bureau demographic data, most of the population in Klamath County is white (88.6 percent). Other races/ethnicities in Klamath County include Hispanic or Latino (13.1 percent), American Indian or Alaska Native (4.9 percent), Asian (1.2 percent), African American (1.0 percent), Native Hawaiian or other Pacific Islander (.2 percent), and those identifying with two or more races (4.2 percent). These demographics generally reflect those of the entire state of Oregon with a few exceptions. African Americans and Asian Americans comprise a larger percentage of the population statewide (2.2 percent and 4.7 percent, respectively) and American Indians or Native Alaskans comprise a smaller percentage statewide (1.8 percent) (U.S. Census Bureau, 2018).

Although Klamath County's economy has traditionally been based on the timber and agricultural industries, it has expanded to include recreation, tourism, and technology industries. The county's largest public employer is Oregon state government, and the largest private employer is JELD-WEN, a window and door manufacturer. The Sky Lake Medical Center, the local government, and Kingsley Field Air Defense are also major employers.

The U.S. Census Bureau reports that there were 27,171 households in Klamath County, with 2.39 persons per household between 2013 and 2017. During this same time period, the median household income for Klamath County was $42,531 while median income for the state of Oregon was $56,119 (U.S. Census Bureau, 2018). The poverty rate between 2013 and 2017 was 19.2 percent for Klamath County, higher than the state rate of 13.2 percent (U.S. Census Bureau, 2018). The State of Oregon Employment Department reports that the unemployment rate for Klamath County in 2018 was 6.3 percent and 3.9 percent for the state of Oregon (State of Oregon Employment Department, 2018).

Total school enrollment in Klamath County was 16,067 in 2010. Nursery school, preschool, and kindergarten enrollment was at 1,717 with elementary enrollment at 6,856 and high school at 3,566. College or graduate school enrollment was 3,928.

In 2010, the leading industries were education, health, and social services (21 percent); retail trade (13 percent); arts entertainment, recreation, and accommodation and food services (10 percent); and manufacturing (10 percent). In 2010, the most common occupations were management business, science, and arts (28 percent); sales and office occupations (23 percent); service occupations (21 percent); and natural resources, construction, and maintenance (14 percent). Census figures show that 75 percent of Klamath County workers drove to work alone in 2010, while 12 percent carpooled, 4 percent walked, and 6 percent worked from home. The average commute time was 17.2 minutes.

Ground Transportation Routes

As shown in figure 1-1, the proposed project area is traversed by a number of rural county roads and Oregon state highways, including Route 140, also known as the Klamath Falls-Lakeview Highway, which is a principal east-west travel corridor; Route 70 between Diary and Bonanza; and Route 39, a major corridor, also known as the Klamath Falls-Malin Highway, that runs in a north-south direction before it partially coincides with Route 50 that trends east-west towards Malin. Major county roads in the vicinity of the project include Swan Lake Road, which would be used to access the lower reservoir area from Route 140; Bliss Road, which would provide access to the upper reservoir area; and North Poe Valley Road, Harpold Road, and State Line Road, which cross or are close to the transmission line corridor. Many other minor or secondary roads pass near or through the project area and are often used by residents and for agricultural operations.

In total, about 11 miles of existing roads would be improved to provide permanent access to the project site, of which about 2 miles would be on BLM land (table 3-13). Most of these 11 miles would consist of a private road off of Swan Lake Road which would provide access to the lower reservoir and another existing private road which would access the upper reservoir from Bliss Road. In addition, about 3.4 miles of new permanent access road would be built to access the lower and upper reservoirs, laydown areas, powerhouse, substation, and some of the transmission line towers. Approximately one mile of new permanent access road would be on BLM land. Construction access for the transmission towers would use both existing roads and 8.3 miles of newly constructed temporary roads. About 6.1 miles of temporary roads would be located inside the transmission line ROW, and 2.2 miles would lie outside the ROW. About 5 miles of the temporary access roads for transmission line construction would be on BLM land (see table 3-13).

Table 3-13. Total mileage of existing, new permanent, and new temporary access roads to be improved or built for the proposed Swan Lake North Hydroelectric Project including those on BLM land (Source: Swan Lake North Hydro, 2015; 2018).

Roads	Total Miles	BLM Land (miles)
Improved existing	10.71	1.85
New permanent	3.38	1.15
New temporary access	8.29	5.12

Annual average daily traffic volumes for major routes are provided in table 3-14. In addition, the applicant monitored vehicle traffic on Swan Lake Road from April through September 2011 to obtain baseline traffic volumes in the vicinity of the project. Traffic was estimated to average 151 vehicles per day on Swan Lake Road during the period of study.

Table 3-14. Annual average daily traffic at Oregon DOT established locations in the vicinity of the project (2006–2010) (Source: Swan Lake North Hydro, 2015).

Location	Annual Average Daily Traffic								
	2006	2007	2008	2009	2010	2006 to 2010 Average	STDEV	SE[a]	Notes
0.02 mile west of S. Poe Valley Road on Klamath Falls-Lakeview Highway	3,400	3,500	3,100	3,200	3,800	3,400	245	110	0.01 mile west in 2006–2008
0.02 mile east of S. Poe Valley Road on Klamath Falls-Lakeview Highway	2,800	3,100	2,800	2,900	3,500	3,020	264	118	0.01 mile east in 2006–2008
0.02 mile west of Dairy-Bonanza Highway on Klamath Falls-Lakeview Highway	2,300	2,400	2,200	2,300	2,100	2,260	102	46	0.01 mile west in 2006–2008
0.02 mile east of Dairy-Bonanza Highway on Klamath Falls-Lakeview Highway	1,800	1,900	1,700	1,800	1,800	1,800	63	28	0.06 mile east in 2006–2008

Location	Annual Average Daily Traffic								
	2006	2007	2008	2009	2010	2006 to 2010 Average	STDEV	SE[a]	Notes
0.10 mile east of Klamath Falls-Lakeview Highway on Dairy-Bonanza Highway	660	610	540	560	610	596	42	19	
0.02 mile east of Burgdorf Road on Dairy-Bonanza Highway	640	540	480	500	600	552	60	27	0.01 mile east in 2006–2008
0.02 mile west of Statsny Road on Klamath Falls-Malin Highway	180	350	330	340	320	304	63	28	
0.02 mile north of Oregon-California state line on Klamath Falls-Malin Highway	No data	170	160	170	170	168	4	2	

[a] +/- 2 SE = approximately 95% confidence intervals

Air Traffic

Seven airstrips are located within 15 miles of the project boundary. Crater Lake-Klamath Falls Regional Airport (also known as Klamath Falls International Airport) serves general and military aviation, including a wing of the Air National Guard. Passenger service from the regional airport ceased in August 2017. Small public airports also exist at Malin and Tule Lake. Loveness Landing Strip is a privately owned 6,000-foot-long, 60-foot-wide airstrip located on the Bar S Bar Ranch that is used for emergency purposes to serve the surrounding area.[78] Sky Wagon Ranch and Flying T Ranch airports and the Sky Lakes Medical Center Heliport are also private and located at least several miles from the proposed project. Table 3-15 lists other regional airstrips.

[78] *See* Motion to Intervene for Lester R. Sturm Trust filed with the Commission on February 4, 2016.

Table 3-15. Air traffic information within 15 miles of the project boundary (Source: Swan Lake North Hydro, 2015).

Airport	Location	Distance from the Project (miles)	Use	Average Flights/Month
Loveness Landing Strip	3 miles east of Malin	0.2	Private	n/a
Malin	1 mile southeast of Malin	3	Public	58
Sky Wagon Ranch	10 miles east of Klamath Falls	5	Private	n/a
Tule Lake Municipal	7 miles southeast of Tule Lake	6	Public	36
Sky Lakes Medical Center Heliport	2 miles northwest of Klamath Falls	10	Private	n/a
Klamath Falls International	4 miles southeast of Klamath Falls	10	Public	90
Flying T Ranch	8 miles east of Sprague River	13	Private	n/a

3.3.9.2 Environmental Effects

Construction and operation of the proposed project has the potential to impact socioeconomic resources in the project vicinity. Generally these impacts would be related to construction and operation expenditures and changes in demands on public infrastructure and services. Generally, project construction and operation is expected to stimulate the local economy through increased tax payments and salaries associated with temporary construction jobs and permanent operation and maintenance positions. Some added demands on public infrastructure, services and traffic patterns would be created by bringing more people and construction traffic into the area.

Construction and Operation Expenditures and Demands on Local Services

Project construction would require between 200 and 300 personnel over the 3- to-5-year construction period, the peak of which would occur during years 2 or 3. Capital expenditures during construction would occur unevenly over the construction period. According to an economic analysis completed by ECONorthwest in 2015, during the construction period, $1.1 billion would be spent. Klamath County would directly benefit from approximately $22.1 million in construction spending, $20.5 million of that on labor. Approximately $245 million would be spent on wages and benefits for the construction workforce commuting from outside of Klamath County but inside Oregon State. ECONorthwest estimated another $599 million would be spent on equipment

produced out of state and on the wages for those out-of-state workers. Oregon State would benefit from approximately $15 million, attributed to taxes, fees, licenses, and permits.

Annual operations at the project would generate an estimated $6.2 million in goods and services, $1.7 million in labor income, and 35 jobs, including 11 direct and 24 indirect jobs within the state. The majority (96 percent) of direct benefits from operations would fall within Klamath County totaling approximately $4.2 million, of which $3.4 million would be from goods and services generated by the project. The remaining benefit would occur within the whole state of Oregon. Using Oregon's Strategic Investment Program, the applicant estimated that the project could generate approximately $31.5 million from property taxes for Klamath County over a 15-year Strategic Investment Program exemption period, amounting to $2.1 million per year. Additionally, spending and income from annual tax and fee revenues for operations totaling $200,000 would go to state and local taxing jurisdictions.

Our Analysis

Project construction would require a range of 200 to 300 personnel over the 3- to-5-year construction period, the peak of which would occur during years 2 or 3. This would represent less than 1-percent increase in population in Klamath County. At a 15-percent housing vacancy rate, there should be enough available housing to accommodate these workers and their families. This small overall increase in population would be spread out over multiple communities, such as Klamath Falls, Dairy, Bonanza, Poe Valley, and Malin, and should not overburden law enforcement, fire protection, emergency services, health care facilities, or schools within these communities.

Job opportunities from constructing the project as well as increased local spending from project personnel would result in a positive effect on the local economy. No existing businesses would be displaced as a result of the project, although some farm land would be temporarily taken out of production during the construction period. The applicant's proposal to compensate landowners for lost production and to fully restore areas disturbed during construction would minimize this impact.

During the operation phase of the project, we expect that most long-term project personnel would relocate permanently to Klamath County, resulting in an estimated influx of up to 40 to 60 families in the local communities. This small long-term population increase would not be expected to adversely affect local government facilities or services because it would not exceed the capacity of existing infrastructure, available housing, schools, or medical facilities or overburden law enforcement, or fire protection and emergency services. The long-term employees' salaries, income taxes, property taxes, and other miscellaneous taxes, and the purchase of real estate, goods, and services, would provide a positive effect on the state and local economies.

Private and Agricultural Property Value

The project transmission line would be visible to varying degrees from about 72 residences along its route. Although the line would not run directly overhead of any residences, it would cross the property of about 22 landowners along its route, including both rural residential land and agricultural land. At Harpold Gap and Philpott Lane, some residences would be as close as about 600 feet from the transmission line, and the line would be distinctly visible from these properties.

Dan Cohan, Mary Hunnicutt, John and Lori Venable, and Rod Neterer are concerned about the effects of the proposed transmission line on property values of homes in the Dairy area and in the Harpold Gap and Bonanza area, especially near the Lost River Crossing. Dan Cohan and Mary Hunnicutt are particularly concerned about home resale values in the Harpold Gap and Philpott Lane area where they state that the proposed transmission line would go directly over and behind some houses. Julie Jespersen and Mary Hunnicutt are concerned that the proposed transmission line would negatively affect the value of agricultural property. Ms. Jespersen cites a study (Kielisch, 2006) that found that a high-voltage transmission line resulted in a loss in agricultural values of land affected by the line from 15 to 34 percent.

Our Analysis

We do not attempt to speculate on how the visibility and presence of a transmission line might affect property values because in our experience, and as found in other studies, a property's value is influenced by a multitude of factors such as location, the size of the lot or house, improvements, and neighborhood characteristics, rather than the presence of a transmission line (Cowger et al., 1996; PSC, 2000). However, some studies have shown that agricultural property values are negatively affected by transmission lines that interfere with farm operations (Kielisch, 2006; PSC, 2000; EEI, 1992) and that smaller rural residential property values can decrease depending on the proximity of the line, whether substitute properties exist nearby, and the initial value of the house (Chalmers, 2012; Des Rosiers, 2002). Concern about the effects of EMF radiation from transmission lines can also be a factor (Jackson and Pitts, 2010) (see our discussion of EMFs in section 3.3.6.1 and 3.3.6.2).

Kielisch (2006) found that a transmission line bisecting agricultural property could reduce property value by as much as 34 percent and that lines running adjacent to farm property could reduce values up to 15 percent. Reduced agricultural land values have been attributed to the decreased efficiency of farm operations and resultant costs associated with modified operations and loss of production (Brown, 1976; Jackson and Pittsm 2010). Chalmers (2012) found that smaller, rural residential properties may be more vulnerable to transmission line effects on their value, possibly as much as 25 to 30 percent, and these properties may stay on the market twice as long as properties not adjacent to power lines. Chalmers (2012) indicates, however, that this effect is more likely to occur for properties where the line would encumber a potential building on the lot, or where potential buyers have more options to choose similar sites not adjacent to

powerlines. Chalmers (2012) also notes that western viewsheds and natural amenities can make properties more vulnerable to negative value effects from transmission lines; however, he indicates that if the properties are "unique" (substitute properties are not easily found), they are less vulnerable to these effects. In most cases, Chalmers (2012) points out, negative impacts on property values from transmission lines tend to be small and generally disappear beyond 500 feet from the line's corridor. Des Rosiers (2002) found that home values on the lower end of the market are affected less by transmission lines (a reduction of about 10 to 15 percent) than those on the upper end (15 to 20 percent); but this is not always the case and that impacts tend to disappear beyond 500 feet from the line.

As discussed in our analysis of project impacts on agricultural lands in section 3.3.6.2, the transmission line, depending on where the poles are placed, could interfere with some agricultural operations and, based on some study findings, negatively affect the value of these properties. Likewise, the value of some of the smaller residential properties that would be crossed by, or adjacent to, the transmission line could decrease because of the presence of the line. However, these smaller properties are spaced widely apart and appear to have the "unique" qualities that would be hard to find elsewhere, which could have a moderating effect on property values as the Chalmers (2012) study suggests.

Burying the entire transmission line would likely eliminate any potential impacts of the project transmission line on property values, by eliminating the interference with farm operations, visual effects, and the concerns about EMF radiation. Similarly, burying a 1-mile-long portion of the line in the Harpold Gap area (at the Lost River crossing and along the span that would abut or cross the properties of residences on Harpold and Philpott Roads south of the river crossing) would lessen long-term visual effects and any subsequent potential effect on property values in an area that has a concentration of residential development and some farms. The applicant's proposal to compensate landowners whose properties would be crossed by the transmission line, as well as measures to make the line less visually intrusive (see section 3.3.7) would reduce possible impacts to property values. Consulting agricultural landowners on construction timing and placement of towers, would help minimize adverse effects on agricultural operations, which could help reduce adverse effects on their property values.

Ground Transportation Routes

During construction, the construction workforce and material deliveries would access the project site from Highway 140 and Swan Lake Road. From these roads, the project site would be accessed via upgraded private roads and newly constructed roads. The lower reservoir and part of the transmission line would be accessed using a private road off of Highway 140 that runs through the Jespersen-Swan Lake, Inc. property. The upper reservoir would be reached through an upgraded private access road via Bliss Road. Traffic volumes are expected to increase along these roads during the 3- to 5-year construction period. Approximately 300 construction workers are expected to be

employed over the course of the 3- to 5-year construction period. However, not all of these workers would be employed at the same time during this period, nor would they all work the same shift. The peak onsite construction workforce is expected to be between 200 and 250 employees. Workforce-related traffic impacts on Swan Lake Road and Highway 140 would be limited given that the workers would work varying shifts and use the private access road when accessing the project site north of Highway 140.

Semi-trailer trucks and other carriers bringing material in for the penstocks, turbines, and other project equipment would total about 800 to 1,000 trips for the entire construction period. This import traffic would primarily use the private roads to access the reservoirs; however, traffic constraints during the peak import periods might require the use of Swan Lake Road as a secondary corridor thereby increasing traffic on this road. Given the current traffic volume on Swan Lake Road, and taking into account its use as a secondary access point, the applicant anticipates less than a 15-percent increase in total traffic volume on the road during peak construction. Traffic volume along Highway 140 is expected to increase about 10 percent during the peak construction phase.

Transmission line construction in the area of North Poe Valley Road, Harpold Road, and Burgdorf Road would result in increased traffic and some traffic delays as the line is strung overhead across the road and across the Lost River just upstream of Harpold Dam. Increases in project-related traffic, including the increased presence of heavy equipment, could interfere with access to Harpold Dam and the quarry, thereby interrupting operation of these facilities.

Traffic related to project operation would increase along Highway 140 and the private access roads and include workforce traffic, equipment- or waste-related import and export traffic, and visitor-related traffic. Operation of the proposed project would require 40 to 60 employees, which would result in 80 to 120 one-way vehicle trips assuming all individuals commuted to the facility separately. The applicant also anticipates two to three import-export trips and four to five visitor-related trips per day over the lifetime of the project.

KCPW is concerned that the increased traffic during construction could accelerate the deterioration of County roads. KCPW recommends that the applicant coordinate with KCPW to minimize disrupting operation and maintenance of county roadway and drainage facilities, including but not limited to, interference with scheduled road preventative and rehabilitation maintenance activities, use of weight restricted bridges, traffic control, winter snow removal, and dust control. The applicant, however, expects workforce-related traffic impacts to be minimal given that employees would not all commute at the same time. To keep traffic at a minimum, the applicant proposes to require employees to work various shifts for 24 hours a day, 365 days a year, during project operation.

The applicant, within 6 months of any license issued for the project, proposes to develop a comprehensive traffic safety plan in cooperation with the appropriate federal,

state, and county agencies. The plan would include a description of measures for traffic control and maintaining public safety, including (1) setting speed limits for wildlife and pedestrian protection, (2) providing information to the public on traffic pattern changes, and (3) controlling OHV traffic on public lands within the project boundary.

Our Analysis

While traffic is expected to increase during project construction, it appears that Highway 140 and Swan Lake Road would be able to handle the 10 to 15 percent increase expected during the peak construction period when as many as 250 personnel would be commuting to the project site and heavy equipment and trucks carrying excavated and building material would be making frequent trips to and from the project site. However, without adequate traffic-management provisions, the smaller, less-travelled county or private roads used to access the project site may not be able to absorb this increase in traffic as effectively. Further, new or upgraded access roads could invite unauthorized traffic into the project site. The applicant's proposal to stagger work shifts both during project construction and operation and develop and implement a traffic safety plan that would control speed and traffic patterns and restrict OHV use would help to ensure that traffic is managed appropriately on all roads used to access the project to minimize delays and maintain public safety. The applicant, however, does not provide the details of its plan, including how work shifts would be scheduled to minimize traffic disruptions; what specific traffic control or safety measures would be employed; how it would minimize disruption of KCPW roadway and drainage facility operation and maintenance activities; how snow removal or dust control would be implemented; how weight restrictions on bridges would be adhered to; or what entities would be consulted in the development of its plan. Developing a traffic safety plan that addresses these measures, in consultation with BLM, Oregon Department of Transportation, KCPW, Klamath Irrigation District, Horsefly Irrigation District, Oregon DFW, and Oregon PRD and filing it for Commission approval prior to the start of project construction would ensure that appropriate traffic safety measures are employed during project construction and operation, traffic delays are minimized, and stakeholder concerns are addressed.

Air Transportation

The Loveness Landing Strip is paralleled on either side by existing high-voltage overhead transmission lines–the COTP line, which is located between 50 to 270 feet to the west of the runway, and a 500-kV line about 1,300 feet to the east which runs along the ridge top of a nearby escarpment. The proposed transmission line would parallel the airstrip, but would be located between 800 and 900 feet to the east of the airstrip and follow the escarpment to the east of the airstrip at an elevation of about 250 feet above the airstrip.

Lester Sturm, the owner of the Bar S Bar Ranch, states in his Motion to Intervene, filed on February 4, 2016, that adding another transmission line that parallels the airstrip would likely make the airstrip "inoperable," resulting in the loss of the existing emergency access service it provides to the public. The proposed transmission line

would narrow the space between transmission lines on either side of the airstrip by 400 to 500 feet. Mr. Sturm indicates that it would not be practicable to relocate the airstrip on his property because he is constrained by mountainous terrain. Malin Airport, located 3 miles from the proposed transmission lines, is the next closest airfield to the transmission line corridor and would not be affected.

Our Analysis

Federal Aviation Administration standards for small plane runways, such as the Loveness Landing Strip, require that the Runway Safety Area[79] be at least 120 feet wide and extend 1,000 feet beyond either end of the runway. The proposed transmission line would be well outside of this safety area since it is located about 800 to 900 feet to the east of the runway and over 1 mile away from the north terminus of the runway. However, the existing COTP line that runs along the west side of the runway does not appear to fully meet this standard safety zone. While the middle portion of the runway is located at a safe 260 feet away from the COTP transmission line, the line appears to gradually travel closer to the runway at either end where it comes within 50 feet at its closest points. While the COTP line reduces leeway for aircraft maneuverability to the west of the runway, the proposed project transmission line would not interfere with the safety zone, even though it would reduce the area between the two existing transmission lines.

3.3.10 Environmental Justice

3.3.10.1 Affected Environment

According to EPA's guidance, environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Meaningful involvement means: people have an opportunity to participate in decisions about activities that may affect their environment and/or health; the public's contribution can influence the regulatory agency's decision; community concerns will be considered in the decision-making process; and decision makers will seek out and facilitate the involvement of those potentially affected. Section 2.4, *Public Review and Comment*, describes the process by which the Commission has afforded the public the opportunity for meaningful involvement in the licensing decision.

Three factors were used to determine if there were a disproportionate number of low-income individuals in the area of analysis: income, poverty, and unemployment. Available data indicates that there are disproportionately more individuals with low

[79] The Federal Aviation Administration (2015) defines a Runway Safety Area as a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of undershoot, overshoot, or excursion from the runway. The area can be envisioned as a rectangular box surrounding the runway of a specific length and width depending on the type of aircraft using the runway.

incomes, living in poverty, or unemployed at a county level relative to the state of Oregon (see section 3.3.9, *Socioeconomics*). The area affected by the project also has a high density of resources important to the Klamath Tribes. Klamath County does have greater percentages of American Indians than Oregon as a whole, such that any impacts from the project could disproportionately affect Indian Tribes and low income and minority residents of Klamath County, Oregon in the area of analysis.

3.3.10.2 Environmental Effects

Project construction activities could affect environmental justice communities, primarily the Klamath Tribes and the rural communities near the project. These communities could experience increased traffic (see section 4.3.9, *Socioeconomics*), noise, and air emissions (see section 4.3.11, *Air Quality and Noise*). Cultural resources important to the Klamath Tribes would also be lost. As such, local residents and tribal people could be disproportionately affected by construction activities.

The Klamath Tribes state that the draft EIS fails to analyze the adverse environmental justice impacts of the project on many cultural resources and sacred sites of long-term traditional importance to the Tribes.

Our Analysis

We describe above the Commission's consultation effort with the Tribes (section 2.5), the efforts to identify cultural resources important to the Tribes, and the adverse effects of constructing the project on those cultural resources. The project area does have a high percentage of cultural resources important to the Klamath Tribes and a number of these sites would be lost by constructing the project.

Project construction would result in jobs over the 3- to 5-year construction period, but 1,440 of those new jobs would be filled by out-of-county residents, while Klamath County residents would fill only 170 new jobs (ECONorthwest, 2015). Klamath County residents would likely find long-term employment in the expected 11 project operation and maintenance jobs, however.

Increased tax revenues from project operation might impact social programs. Quantifying the impact on county social programs, however, is not possible because many of these programs receive state and federal funding as well as county funds. If social program funding is increased, effects would benefit low-income residents and other environmental justice communities.

The proposed traffic safety plan as modified by staff recommendations would minimize disruption of existing roadways and county facilities. Further, use of BMPs would minimize air and noise emissions during construction, limiting effects on local residents and tribal members.

The proposed location of the project was chosen on the basis of its valuable characteristics for pumped storage project operation. Swan Lake Rim, which rises approximately 1,500 feet above Swan Lake Valley, would provide the hydraulic head

necessary for the operation of the pumped storage project. Therefore, we do not find that Swan Lake North Hydro selected the project location due to the economic status of the Klamath Tribes or the surrounding rural community. Swan Lake North Hydro's site selection did not discriminate against the Tribes or the community because of their economic status.

3.3.11 Air Quality and Noise

3.3.11.1 Affected Environment

Air Quality

Air quality can be affected by a number of factors, including local and regional topography and climate (e.g., wind, precipitation), in conjunction with anthropogenic air pollution. Wind can help to disperse air pollution, lowering its concentration, while falling precipitation can remove pollutants from the air through absorption, such as is the case with acid rain (BC, 2016). Sources of air emissions include commercial facility operations, fugitive dust, construction equipment, on-road vehicles and trucks, aircraft, boats, trains, and natural sources such as hydrocarbons and wildfires. The proposed project would be located along valley bottoms and low ridges east of Klamath Falls. The valley bottoms along the alignment are about 4,100 feet msl, and the ridges rise to about 5,500 feet msl. The project is located east of the Klamath County air quality zone boundary. Because of topography, weather and a large number of woodstoves in use, the Klamath Falls area has a long history of problems with particulate pollutions and working to solve them.

Oregon DEQ is responsible for protecting public health and the environment from the harmful effects of air pollution in the state of Oregon. Nationally, the EPA, through the Clean Air Act and its amendments, has established National Ambient Air Quality Standards (NAAQS) for six criteria air pollutants.[80] Oregon has adopted the federal air quality standards. Table 3-16 summarizes the primary and secondary NAAQS for criteria pollutants.

Table 3-16. National ambient air quality standards (Source: EPA, 2014a).

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon monoxide	Primary[a]	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	

[80] Carbon monoxide, sulfur dioxide, ozone, particulate matter (including PM10 and PM2.5), nitrogen dioxide, and lead.

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Lead	Primary and secondary[b]	Rolling 3 month average	0.15 μg/m^3	Not to be exceeded
Nitrogen dioxide	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Primary and secondary	1 year	53 ppb	Annual Mean
Ozone	Primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle pollution (PM2.5)	Primary	1 year	12.0 μg/m^3	annual mean, averaged over 3 years
	Secondary		15.0 μg/m^3	
	Primary and secondary	24 hours	35 μg/m^3	98th percentile, averaged over 3 years
Particle pollution (PM10)	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	Primary	1 hour	75 ppb	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: ppb = parts per billion; ppm = parts per million; μg/m^3 = micrograms per cubic meter of air.

[a] Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly.

[b] Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (EPA, 2014).

Areas that have never been designated nonattainment for a pollutant and NAAQS are considered attainment areas. Areas that do not meet the NAAQS are classified as nonattainment areas for that pollutant. Former nonattainment areas currently meeting the NAAQS are designated maintenance areas.

Since 1994, the Klamath Falls area has been in attainment for larger or coarse (PM10) particulate matter. In 2009, with the adoption of a fine particulate (PM2.5) matter standard, EPA changed the legal status of the Klamath Falls Area from attainment (meeting air quality standards) to nonattainment (not meeting air quality standards) for fine particulate matter (PM2.5). Oregon DEQ has adopted an attainment plan with associated regulations to ensure that the Klamath Falls area meets the current PM2.5 standard. Although the portions of Klamath County within the Klamath Falls urban growth boundary[81] are within the maintenance area for PM10 and the 1971 standard for CO, the proposed project would be located within attainment areas for all criteria pollutants.

Section 176(c) of the Clean Air Act prohibits federal agencies from taking actions that do not conform to the State Implementation Plan for the attainment and maintenance of the NAAQS. The purposes of conformity are to ensure that (1) federal activities do not interfere with the emissions budgets in the State Implementation Plans, (2) actions do not cause or contribute to new violations, and (3) NAAQS are attained and maintained. General conformity applies only in areas that are designated as NAAQS nonattainment areas or maintenance areas. A conformity review is required only for those pollutants designated as nonattainment or maintenance pollutants. Because the proposed project is located in areas that are in attainment for all criteria pollutants, a general conformity analysis is not warranted.

Noise

Noise is defined as unwanted sound resulting from vibrations in the air (EPA, 1978). Most sounds are composed of a composite of frequencies. The normal human ear can usually distinguish frequencies from 20 Hz[82] (low frequency) to about 20,000 Hz (high frequency), although people are most sensitive to frequencies between 500 and 4,000 Hz. The individual frequency bands can be combined into one overall sound pressure level. This sound pressure level is measured in units called decibels (dB). Figure 3-21 lists typical activities and associated noise levels of anticipated noise issues at the project site (i.e., construction activities and machinery operation). Noise levels relate the magnitude of the sound pressure to a standard reference value. Although the

[81] The eastern extent of the Klamath urban growth boundary, which is closest to the proposed project, extends roughly along the ridgeline of Hogback Mountain, more than 6 miles west of the project site.

[82] The frequency of a sound is the "pitch" (high or low), and the unit for frequency is Hz.

noise values of certain activities can approach 135 dB, sounds typically encountered in the environment range from 40 to 120 dB (Flamme et al., 2012). The faintest sound that can be heard by a healthy ear is about 0 dBA, while an uncomfortably loud sound is about 120 dBA.

The proposed facilities would be located in Klamath County, where the county noise ordinance includes the following restrictions for new industrial sources: 7:00 a.m. to 10:00 p.m.: L_{50} of 55 dBA and L_{10} of 60 dBA and 10:00 p.m. to 7:00 a.m.: L_{50} of 50 dBA and L_{10} of 55 dBA.

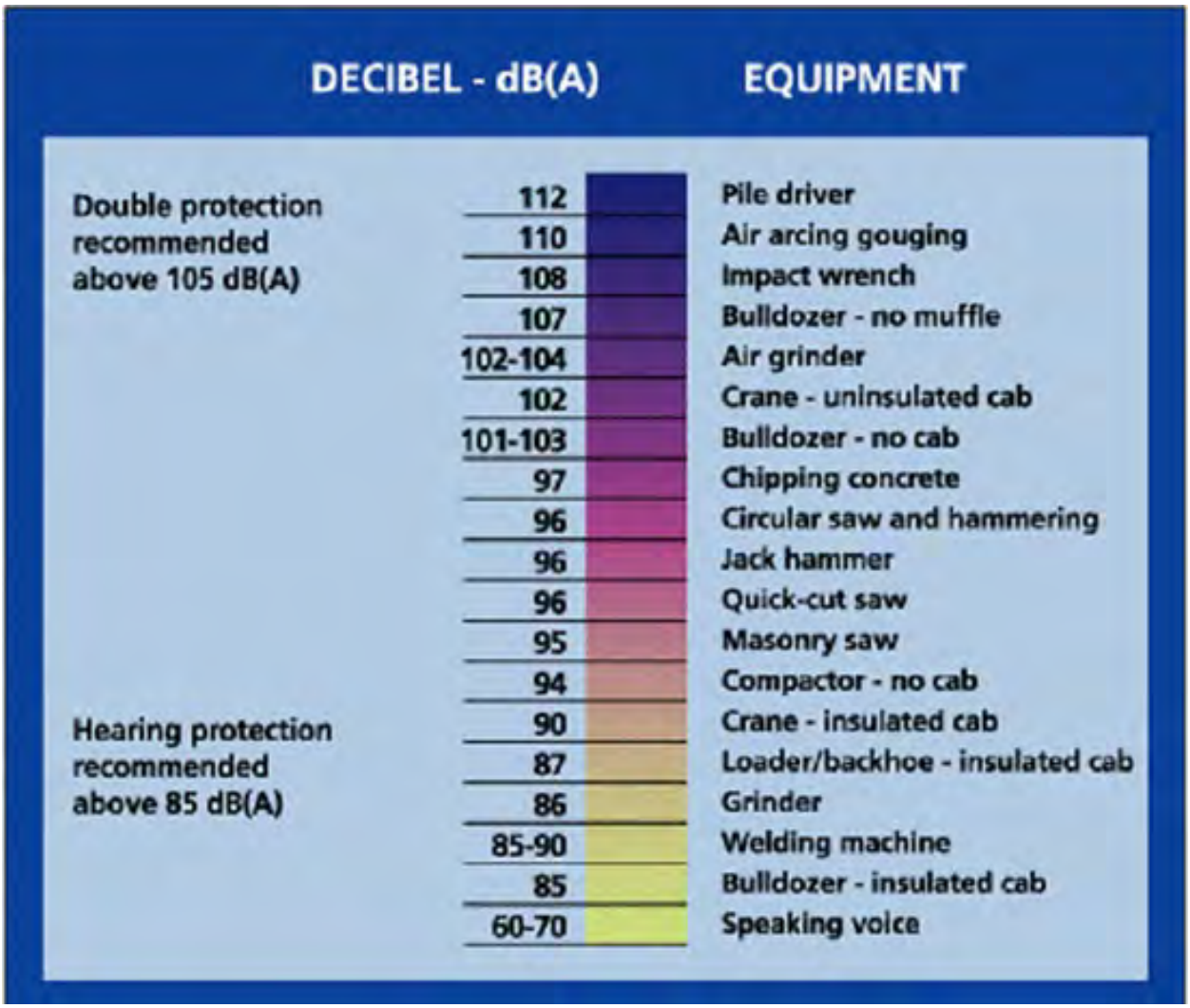

Figure 3-21. Common indoor and outdoor noise levels (Source: Construction Safety Association of Ontario, 2018).

The county noise ordinance restricts noise from blasting and other impulse sounds. In addition, the county ordinance, under section (5) (g), exempts sounds that originate on construction sites. Ambient noise in the project area is created by many elements, including wind, wildlife (primarily insects and birds), vehicles, farm machinery, and air

traffic. The applicant recorded noise levels at KOPs to establish background noise conditions in the project area and vicinity. Figure 3-4 shows the locations of the KOPs, and table 3-17 summarizes the noise levels recorded at these locations. Measurements were taken in dBA at each KOP for a 10-minute period using a pre-calibrated digital sound level meter. Data collected suggest that existing noise is highly variable, especially seasonally, primarily due to changes in numbers and species of birds present, agricultural activities such as planting and harvesting, and vehicular traffic patterns. Background data suggest typically low noise levels, with an average of 43.7 dBA, and collected data vary from a low of 37.8 dBA and a maximum of 62 dBA.

Table 3-17. Noise levels recorded at key observation points (Source: Swan Lake North Hydro, 2015).

				Noise Level (dBA)		
KOP	**Township**	**Range**	**Section**	**Spring**	**Summer**	**Fall**
1	36S	10E	32	--	47 day 40.5 night	41.5
2	37S	10E	10	--	--	44.8
3	37S	10E	14	--	40.7	40.1
4	37S	10E	22	38.0	40.1 day 40.1 night	40.6
5	37S	10E	24	39.8	42.8	40.1
6	37S	10E	23	37.9	62.0	44.5
9	37S	10E	29	--	60 day 46.7 night	37.8
10	38S	11.6E	6	40.6	58.8	40.9
11	38S	11.5E	7	--	43.0 day 40.3 night	47.6
12	38S	11.5E	34	38.7	42.0 day 40.1 night	42.1
13	38S	11.5E	33	40.2	41.5	46.7
15	39S	11E	19	40.1	41.0	47.6
18	40S	11E	12	--	50.0	46.7
19	41S	12E	4	--	40.1	46.8
20	41S	12E	14	--	--	40.5

Ambient sounds were lowest in spring with an average 41.1 dBA, followed by fall at 43.5 dBA, and then summer at 46.2 dBA. Several readings were taken at night and generally showed that ambient noise was the same or reduced slightly compared to readings taken earlier the same day. However, noise levels at KOP 9 were 13 dBA lower at night. KOP 9 is in the middle of a large expanse of farm fields, and the difference is likely due to daytime farming operations. Existing noise levels in the vicinity of the reservoirs and connecting infrastructure (powerhouse, penstocks, etc.) are represented by KOPs 1, 2, 3, 4, and 9, and the remaining KOPs are representative of noise levels along the transmission alignment.

Noise Sensitive Areas (NSAs) within the project vicinity include residences, natural areas used for recreation, and wildlife usage of habitat areas. The closest residential receptors are located about 1,500 feet southwest and 1,600 feet south of the lower reservoir and at various distances from the transmission line. The closest residential receptor to the transmission line is about 600 feet west of the alignment near where the alignment crosses the Lost River.

Other potential receptors include visitors to the public lands in the vicinity of the project (see figure 3-2), including:

- Winema National Forest, located about 0.57 mile north of the upper reservoir and 0.4 mile north of eastern portion of the proposed new access road.
- Fremont National Forest, located about 5 miles northeast of the transmission alignment where it crosses Lost River.
- The Modoc National Forest, located about 3.7 miles southeast of the southern end of the transmission alignment.
- Stevenson Park, located on Route 140 about 3.5 miles west of transmission line.
- Crystal Springs County Park, located on Crystal Springs Road about 7 miles west of the transmission line.
- The Lower Klamath National Wildlife Refuge, located about 10 miles southwest of the southern transmission alignment.
- The OC&E Trail, which crosses the transmission line about 1 mile west of Dairy, Oregon.

3.3.11.2 Environmental Effects

Air Quality

Construction of the proposed project would occur over a 4-year period. Although estimates for type, number, duration, and location of heavy equipment are preliminary, equipment requirements and construction activities can be estimated based on similar construction projects and activities. Construction activities would involve clearing trees,

vegetation, and soils from the areas of the proposed reservoirs, powerhouse, and penstock alignment. Blasting would be used to break bedrock structures to the required depth. Dozers, excavators, dump trucks, and other diesel-powered construction equipment would be used to load and remove excavated material. Additional equipment required for construction of the reservoirs, powerhouse, and penstock would include cranes, loaders, concrete delivery trucks, water trucks for dust suppression, and miscellaneous material delivery by over-the-road semi-tractor trailers. The applicant states that it is likely that a portable concrete batch plant would be erected on-site to produce concrete for the project.

Construction activities would result in emissions of criteria pollutants through fugitive dust and vehicle exhaust. Although the applicant commits to controlling erosion associated with all aspects of project construction through a soil erosion control plan, it does not propose any BMPs to ensure air quality impacts are minimized. No one has recommended any measures.

Our Analysis

Emissions could be minimized by including standard construction dust control BMPs in an air pollution control plan and ensure that contractors abide by BMPs. Elements of such a plan include the following provisions for controlling fugitive dust from the construction site:

- Establish stabilized truck exit areas for washing the wheels of all trucks that enter paved roadways from the construction site and dirt roads leading from the construction site.
- Establish tracking pads at construction exits to prevent dirt from being tracked onto roadways.
- Apply water or dust reducing agents to any truck routes within the construction site as needed (during dry and windy periods) or, in cases where such routes would remain in place for an extended duration, cover the routes with gravel to avoid re-suspension of dust.
- Apply water or dust reducing agents to all exposed surfaces as needed during dry weather. Exposed surfaces include, but are not limited to soil piles, graded areas, unpaved parking areas, staging areas, and access roads.
- Cover or maintain at least 2 feet of free board space on haul trucks transporting soil, sand, or other loose material on the site. Cover any haul trucks that would be traveling along freeways or major roadways.
- Use wet power vacuum street sweepers to remove any visible trackout mud or dirt onto adjacent paved public roads.
- Pave all roadways, driveways, sidewalks, and parking lots as soon as possible. In addition, lay building pads as soon as possible after grading unless seeding or soil binders are used.

- Incorporate dust control measures (e.g., dust collectors and covers limiting pathways for dust) into the temporary concrete batch plant, if used at the construction site.

To control vehicle emissions from diesel-powered equipment working at the construction site the plan could also include:

- Minimize idling time by either shutting equipment off when not in use or reducing idling time to 5 minutes. Provide clear signage regarding this requirement for workers at the entrances to the site.
- Establish protocols for equipment inspection and maintenance programs to ensure work and fuel efficiencies.
- Maintain all construction equipment in proper working condition according to manufacturer's specifications. Ensure that equipment is running in proper condition before it is operated.

Long-term operational effects on air quality would be negligible. A detailed air quality analysis related to stationary or mobile sources is not necessary because project operation would entail minimal stationary or mobile sources of air pollution. Minor mobile source emissions from vehicles would occur as operators travel to and from the facility and during routine maintenance. The proposed project would not involve new stationary sources of air emissions following construction. The proposed project would reduce emissions of criteria pollutants and greenhouse gasses to the extent that it reduces the need for peak-hour generation of electricity.

Noise

Project construction- and operation-related noise could increase ambient sounds and disturb residents, visitors, and wildlife. The proposed project is relatively distant from any potential human receptors; it is located on the east side of Swan Lake Valley and surrounded by undeveloped private and federal land on the remaining three sides. The nearest noise-sensitive land use to the proposed reservoir construction, a residence, is approximately 1,600 feet, and the nearest noise-sensitive land use to the proposed transmission line, the OC&E Trail, is approximately 100 feet (table 3-18). The greatest generation of noise that could be attributed to the project would primarily consist of short-term (8 months) construction noise produced during heavy earthwork. For example, during construction of the reservoirs, blasting has the potential to be an intermittent annoyance to residents.

Table 3-18. Predicted construction noise levels (Source: staff).

Project Component	Receptor	Distance (feet)	Noise Level (dBA L10)
Excavation of Lower Reservoir	Residence (Grizzly Butte)	1,600	53.5
Excavation of Upper Reservoir	Winema National Forest	6,300	49.6
Concrete - Lower Reservoir	Residence (Grizzly Butte)	1,600	56.7
Concrete – Upper Reservoir	Winema National Forest	6,300	50.8
Transmission Line	Residences (south of Lost River)	600	61.3
Transmission Line	OC&E Woods Line State Trail	100	78.0
Access Road	n/a	50	85.2
Access Road	n/a	350	68.3

n/a = not applicable

To minimize the effects of project construction and operation-related noise within proposed project lands, the applicant would utilize several strategies to manage noise associated with construction, including sequencing of the use of noise-producing machinery and siting laydown areas and other construction activities to take advantage of natural buffering of noise from vegetation and topography between noise generation and receptors.

Our Analysis

Reservoirs and Powerhouse

Construction of the proposed project is anticipated to occur over a 4-year period. Estimates for type, number, duration, and location of heavy equipment are preliminary at this time. However, equipment requirements and construction activities can be estimated based on similar construction projects and activities. Projects of this magnitude may be constructed under a two- or three-shift schedule, but construction schedules usually exclude any significant construction over weekends.

Most of the noise-generating project construction would occur at the upper and lower reservoir sites. Sources of construction noise would include chain saws, blasting, operation of the portable concrete batch plant, and use of large excavators, scrapers,

cranes, loaders, dump trucks, concrete mixing trucks, concrete pumping trucks, generators and compressors, water trucks for dust suppression, and miscellaneous material delivery by over-the-road semi-tractor trailers.

The Federal Highway Administration's (FHWA's) roadway construction noise model[83] was used to estimate noise levels at nearby NSAs during the noisiest construction periods. The software predicts construction noise levels for a variety of construction operations based empirical data and acoustical propagation formulas. Predicted construction noise levels are discussed below and are estimated in table 3-18.

Because different equipment would be used during different phases of project construction, not all equipment would be in operation concurrently. For example, the first phase could include tree and overburden removal, with chain saws, backhoes, and dozers; later phases would involve bedrock removal, with blasting, excavators, and dump trucks.

The noisiest conditions are expected during excavation for the reservoirs and concrete pours for the reservoirs and powerhouse. To estimate worst-case construction noise levels, one model run was populated with construction equipment required for excavation and a second run was populated with equipment required for constructing the reservoirs and infrastructure. Equipment was placed throughout the construction site at various distances from the NSA receptors (e.g., residences). To represent a reasonable worst-case condition, shielding from natural buffers—topography, vegetation and other natural features of the area—were not considered in the model.

During excavation of the lower reservoir, noise from blasting, excavating, and hauling excavate was calculated. With these activities occurring in two places within the lower reservoir site, noise levels expected at the closest residences are expected to be approximately 53.5 dBA L10. These levels are above the measured ambient noise levels but below the Klamath County Noise Ordinance.

Concrete would be required for portions of the reservoirs, the powerhouse, and other infrastructure connecting the two reservoirs. Noise near the lower reservoir was estimated assuming the use of a batching plant (located within the laydown area), compactor, compressor, generator, concrete mixer trucks, concrete pumper trucks, a backhoe, and a rebar-bending machine, among other equipment. With some of this equipment operating close to the southwestern edge of the proposed lower reservoir, noise levels expected at the closest residences were approximately 56.7 dBA L10. These levels are above the measured ambient noise levels, but are below the Klamath Noise

[83] FHWA's roadway construction noise model is a computer program that enables the prediction of construction noise levels for a variety of construction operations based on a compilation of empirical data and the application of acoustical propagation formulas. The program enables the calculation of construction noise levels in more detail than manual methods while avoiding the need to collect extensive amounts of project-specific input data.

Ordinance for daytime activities. Noise level estimates did not consider intervening terrain, which consists of trees and other vegetative ground cover over a width of approximately 1,600 feet. The presence of 1,600 feet of trees and other vegetation would lower the noise levels at the residences.

Public land is located close to the project's reservoirs, pump-turbine units, transmission lines, and access roads. The Winema National Forest is located approximately 0.5 mile north of the upper laydown area and 1.2 miles north of the upper reservoir. During excavation of the upper reservoir, noise at the Winema National Forest is estimated to reach 49.6 dBA L10. During concrete work for the upper reservoir, noise levels at the forest could reach 50.8 dBA L10. These levels are above the measured ambient noise levels but below the Klamath Noise Ordinance.

Transmission Line Installation

Construction of the transmission line would also result in short-term and intermittent noise impacts as construction progresses along the ROW. The transmission line would consist of steel mono-pole towers constructed on a reinforced concrete foundation. Construction would involve some excavation, followed by form work and concrete pours. A light-duty crane would be used to erect the mono-pole tower. Construction of one transmission line support tower would take a few days to a week, after which, construction crews would move to a new location.

Noise would result from construction and transportation equipment, including vehicles and helicopters. Noise from truck traffic and increased worker trips along the ROW would temporarily contribute to existing traffic noise on local roads and highways but is not expected to result in a substantial increase in average traffic noise levels. Where helicopters are used for conductor stringing and pole placement, their presence would result in noise levels that may exceed 100 dBA for a brief period.[84] Noise associated with helicopter use would be temporary and intermittent. Because the project would be constructed in rural areas that are located away from noise-sensitive uses and regularly experience machinery noise from agricultural practices, it is unlikely that overall noise levels would change perceptibly. Typical noise levels from farm machinery are provided in table 3-19.

[84] According to IAC Acoustics (2018), Bell J 2A helicopter noise levels are about 100 dBA when operating 100 feet above ground surface. According to the Guam and CNMI Military Relocation EIS (U.S. Navy, 2015), SH-60 helicopter noise levels are about 94 dBA when operating 100 feet from the surface.

Table 3-19. Typical farm machinery noise levels (Source: PennState Extension, n.d., as modified by staff).

Equipment Description	Noise Level Range dBA (at source)
Combine	80–105
Grain dryer	81–102
Crop dusting aircraft	83–116
Orchard sprayer	85–106
Garden tractor	88–94
Grain grinding	93–97
Tractor	74–112

Several residential receptors are located within 0.25 to 0.50 mile of the transmission line alignment north of Klamath Falls Lakeview Highway. South of the Lost River, residences are located within 600 to 775 feet of the alignment. The alignment crosses the OC&E Trail west of Dairy. Elevated noise levels would be minor and short term. Under a construction scenario where work was conducted on two mono-pole sites concurrently using an excavator, dump truck, concrete mixer truck, rebar bender, and a flatbed truck, noise levels at a receptor located 600 feet from the transmission line alignment would reach approximately 61.3 dBA L10.

Mobile Source Noise

Construction materials, equipment, and construction workers would use public roadways, where available, to access the sites for the various components of the project. Where such roadways do not exist, new temporary or permanent access roads would be built. For the lower reservoir, construction traffic would travel along Highway 140 (Klamath Falls-Lakeview Highway) and north on Swan Lake Road. Some increase in noise levels associated with construction traffic along these routes is expected during construction of the project. The increase would be temporary and sporadic, occurring only during the daytime.

Traffic (semi-trailer trucks or other carriers) related to materials deliveries for the penstocks, turbines, and other project equipment is expected to total 800 to 1,000 trips over the 3- to 5-year construction effort.

According to FHWA, a doubling of traffic increases noise levels by approximately 3 dB (FHWA, n.d.), and a 3-dB change in noise levels is barely perceptible. Additionally, the noise generated by one heavy truck (e.g., semi-trailer) traveling at 55

mph is about the same as the noise generated by 28 passenger cars traveling at 55 mph. Between 2006 and 2010, average daily traffic on Highway 140 between South Poe Valley Road and Dairy ranged from 1,800 to 3,400 vehicles. In a worst-case condition where project-related traffic includes 8 truck trips per day and 500 worker trips per day along Highway 140, traffic would not double and noise from the increased traffic would be barely perceptible.

Project Operation

The project includes three 131.1-MW reversible pump-turbine units, enclosed within a partially buried powerhouse. Noise from operation of the proposed project, including the powerhouse, is not expected to be noticeable at any NSA. The facility would employ a small staff who would likely travel to the facility by automobile. No traffic noise increase is anticipated as a result of the small staff.

Summary

Public land is located close to the project's reservoirs, pump-turbine units, transmission lines, and access roads. Noise levels in the forest are expected to be elevated during construction of these components. However, these elevated noise levels would be temporary. Construction of each reservoir and the connecting infrastructure is expected to last approximately 16 months. The transmission ROW would cross the OC&E Trail approximately 1 mile west of Dairy. Depending on the placement of the nearest monopole, construction noise could reach 78.0 dBA L10 or higher at the trail. This would occur for a short time—a few days or a week.

The residence located along the southern edge of Grizzly Butte could experience noise levels above 55 dBA during portions of the construction of the lower reservoir. Daytime noise levels recorded at KOP 9, approximately 1.5 miles southwest of the lower reservoir, indicate ambient noise of approximately 60 dBA during the summer months and approximately 38 dBA in the fall. Daytime noise levels recorded at KOP 4, approximately 0.5 mile southeast of the lower reservoir, indicate ambient noise of approximately 40 dBA during the summer months and approximately 41 dBA in the fall. As such, construction noise levels could exceed the ambient daytime levels, depending on the season and other factors such as farming activity. During installation of the transmission line south of the Lost River, residences located near the ROW could experience temporary and short-term noise levels approaching 65 dBA. Daytime noise levels recorded at KOP 15, approximately 0.5-mile northeast of the transmission line alignment, indicate ambient noise of approximately 41 dBA during the summer months and approximately 48 dBA in the fall. As such, construction noise levels would exceed the ambient daytime levels.

As mentioned above, the mitigating effects of terrain were not considered in the estimate of construction noise impacts for the proposed project. It is likely that during construction, noise levels would be below the estimates provided by the model, but would likely be above some impact criteria levels at times. Because of the short duration

and temporary nature of elevated noise levels, no mitigation for residential and recreational uses (OC&E Trail, National Forest, hunters) are required.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Swan Lake North Project would not be constructed. There would be no changes to the physical, biological, or cultural resources of the area and electrical generation from the project would not occur. The power that would have been developed from a renewable resource would have to be replaced from nonrenewable fuels.