Draft Environmental Assessment

Grand Coulee G1 through G18 Generating Units Modernization and Overhaul

April 2017
U.S. Department of the Interior

The mission of the U.S. Department of the Interior is to protect and provide access to our Nation’s natural and cultural heritage and honor our trust responsibilities to tribes.

Bureau of Reclamation

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.
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## Acronyms and Abbreviations

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<th>Description</th>
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<tr>
<td>°F</td>
<td>degrees Fahrenheit</td>
</tr>
<tr>
<td>ac-ft</td>
<td>acre-foot</td>
</tr>
<tr>
<td>ACHP</td>
<td>Advisory Council on Historic Preservation</td>
</tr>
<tr>
<td>APE</td>
<td>area of potential effect</td>
</tr>
<tr>
<td>BPA</td>
<td>Bonneville Power Administration</td>
</tr>
<tr>
<td>CBP</td>
<td>Columbia Basin Project</td>
</tr>
<tr>
<td>CEQ</td>
<td>Council on Environmental Quality</td>
</tr>
<tr>
<td>CTCR</td>
<td>Confederated Tribes of the Colville Reservation</td>
</tr>
<tr>
<td>cfs</td>
<td>cubic feet per second</td>
</tr>
<tr>
<td>COOP</td>
<td>Cooperative Observer Program</td>
</tr>
<tr>
<td>DGMS</td>
<td>Drum Gate Maintenance Structure</td>
</tr>
<tr>
<td>EA</td>
<td>environmental assessment</td>
</tr>
<tr>
<td>Ecology</td>
<td>Washington State Department of Ecology</td>
</tr>
<tr>
<td>ESA</td>
<td>Endangered Species Act</td>
</tr>
<tr>
<td>FONSI</td>
<td>Finding of No Significant Impact</td>
</tr>
<tr>
<td>FCRPS</td>
<td>Federal Columbia River Power System</td>
</tr>
<tr>
<td>FRM</td>
<td>flood risk management</td>
</tr>
<tr>
<td>FTE</td>
<td>full-time equivalent</td>
</tr>
<tr>
<td>GCPO</td>
<td>Grand Coulee Power Office</td>
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<tr>
<td>GHG</td>
<td>greenhouse gas</td>
</tr>
<tr>
<td>ITA</td>
<td>Indian Trust Assets</td>
</tr>
<tr>
<td>LPH</td>
<td>Left Powerhouse</td>
</tr>
<tr>
<td>MT CO₂e</td>
<td>metric tons of CO₂ equivalent</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
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<tr>
<td>MW</td>
<td>megawatts</td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
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<tr>
<td>NHPA</td>
<td>National Historic Preservation Act of 1966</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NRHP</td>
<td>National Register of Historic Places</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>operations and maintenance</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>PCB</td>
<td>polychlorinated biphenyl</td>
</tr>
<tr>
<td>PDO</td>
<td>property damage only</td>
</tr>
<tr>
<td>PEL</td>
<td>Permissible Exposure Level</td>
</tr>
<tr>
<td>Reclamation</td>
<td>Bureau of Reclamation</td>
</tr>
<tr>
<td>RPH</td>
<td>Right Powerhouse</td>
</tr>
<tr>
<td>SEPA</td>
<td>State Environmental Policy Act (Washington State)</td>
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<tr>
<td>SHPO</td>
<td>State Historic Preservation Office</td>
</tr>
<tr>
<td>SR</td>
<td>State Route</td>
</tr>
<tr>
<td>STOI</td>
<td>Spokane Tribe of Indians</td>
</tr>
<tr>
<td>TERO</td>
<td>Tribal Employment Rights Ordinances</td>
</tr>
<tr>
<td>THPO</td>
<td>Tribal Historic Preservation Officer</td>
</tr>
<tr>
<td>TCP</td>
<td>Traditional Cultural Property</td>
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<tr>
<td>TPP</td>
<td>Third Powerplant</td>
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<tr>
<td>USFWS</td>
<td>U.S. Fish and Wildlife Service</td>
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<tr>
<td>WRCC</td>
<td>Western Regional Climate Center</td>
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<tr>
<td>WSDOT</td>
<td>Washington State Department of Transportation</td>
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Chapter 1. Purpose and Need

1.1 Background

The Columbia Basin Project (CBP) is a multipurpose development on the Upper Columbia River in central Washington. The major facilities of the CBP are Grand Coulee Dam and its impoundment (Lake Roosevelt), the Grand Coulee Powerplant complex that includes the John W. Keys III Pump-Generating Plant, Banks Lake, and Potholes Reservoir. In addition, the CBP includes a well-developed system of canals, dams, reservoirs, drains, wasteways, laterals, and other structures.

The CBP began with fund allocation pursuant to the National Industrial Recovery Act of June 16, 1933. Grand Coulee Dam, located approximately 90 miles west of Spokane, Washington, is the primary storage and diversion structure for the CBP. The dam, one of the largest concrete structures ever constructed, is 550 feet high and 5,223 feet long. The dam was constructed from 1933 to 1941 and was modified from 1967 to 1975 by constructing a 1,170-foot-long and 210-foot-high forebay dam along the right abutment as part of the construction for the Third Powerplant (TPP) powerhouse.

Lake Roosevelt has an elevation of 1208.0 feet at minimum pool and 1290.0 feet at full pool. Lake Roosevelt has a total storage capacity of 9.4 million acre-feet (ac-ft) (5.2 million ac-ft of active space) and extends more than 150 miles upstream to the Canadian border at full pool. The Bureau of Reclamation (Reclamation) operates Grand Coulee Dam in coordination with other projects in the Columbia River basin to provide system flood risk management (FRM) space in Lake Roosevelt to help manage flow of the Columbia River at The Dalles.
The Grand Coulee Powerplant complex consists of three powerhouses—the Left Powerhouse (LPH) and the Right Powerhouse (RPH) located on either side of the spillway looking downstream, and the TPP on the right bank of the dam. The LPH and RPH have a total of 18 units of 125-megawatts (MW) capacity, plus 3 units of 10-MW capacity (a total capacity of 2,280 MW). The TPP contains three units of 690-MW capacity and three units of 805-MW capacity. The three 690-MW units will be upgraded to 770 MW when they are overhauled from 2020 to 2027. This will result in a total capacity for the TPP of 4,725 MW.

The John W. Keys III Pump-Generating Plant on the left bank was designed to accommodate 12 pumping units to pump water from Lake Roosevelt to Banks Lake for irrigation delivery. The first pumping unit (capacity of 1,600 cubic feet per second [cfs]) went into operation in 1951, and five more pumping units with the same capacity were installed between 1951 and 1953; two pump/generators with a pumping capacity of 1,605 cfs each and a generating capacity of 50 MW were installed in 1973; and four pump/generator units with a pumping capacity of 1,700 cfs each and a generating capacity of 53.5 MW were installed between 1983 and 1994. The pumping/generating plant lifts water to the 1.6-mile-long feeder canal that supplies irrigation water to Banks Lake. If Lake Roosevelt is below elevation 1240.0 feet, Reclamation cannot use the pump/generators and therefore may not be able to meet the full pumping demand.

Banks Lake is a re-regulating reservoir and is located in the Grand Coulee, a channel formed during the last ice age. This 27-mile-long reservoir is formed by the North Dam, located approximately 2 miles southwest of Grand Coulee Dam, and the Dry Falls Dam, located approximately 29 miles south of Grand Coulee Dam. Banks Lake has an active storage capacity of 715,000 ac-ft, feeds water to the CBP through the Main Canal at Dry Falls Dam, and provides water to operate the pump/generators in generation mode at the John W. Keys III Pump-Generating Plant. Water from Banks Lake is used to irrigate approximately 670,000 acres of croplands. When the Odessa Subarea is fully developed, the amount of water diverted for irrigation will increase to approximately 2.93 million ac-ft annually and the acreage served will increase to approximately 742,000 acres of land.

The Federal Columbia River Power System (FCRPS) is a unique collaboration among three U.S. government agencies: the Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (USACE), and Reclamation. Collectively, these agencies maximize the use of the Columbia River by generating power, protecting fish and wildlife, providing FRM, providing irrigation and navigation, and sustaining cultural resources. The 31 federally owned multipurpose dams on the Columbia River and its tributaries that comprise the FCRPS provide about 60 percent of the region’s hydroelectric generating capacity and have a maximum capacity of 22,500 MW. Grand Coulee Dam is one of 14 large-scale multipurpose facilities in the FCRPS.
1.2 Purpose and Need for the Action

The purpose of the action is to modernize the power-generating units G1 through G18 in the LPH and RPH at Grand Coulee Dam.

The need for the Grand Coulee G1 through G18 Modernization and Overhaul Project (Project) in the LPH and RPH is to ensure continued operation and to reliably provide electrical power while maintaining hydraulic capacity. Many of the plants’ principle components are being operated far beyond their intended service life, and Reclamation needs to modernize and overhaul aging components. In particular, the G1 through G18 units show problems stemming from age and wear that result in increased hardware failures and forced outages, and increasingly challenging repairs resulting from obsolescence and lack of spare parts. In order to avoid unplanned outages for repair, Reclamation proposes to address the needed overhaul in a planned approach.

1.3 Location and General Description of Affected Area

Grand Coulee Dam and the Left and Right Powerhouses are located in north-central Washington State just south of where the counties of Douglas, Grant, and Okanogan meet on the Columbia River. A portion of the east side of the Grand Coulee Dam and the TPP is located within Okanogan County; its boundary is also a joint boundary for the Colville Indian Reservation. The west side of the dam is located between the communities of Coulee Dam and Grand Coulee in Grant County. There are two other smaller communities in the area with Elmer City just north of Coulee Dam in Okanogan County, and Electric City just west of Grand Coulee in Grant County. Washington State Highway 155 connects all four communities and the site of Grand Coulee Dam. The junction of State Highways 155 and 174 is on the westerly edge of the community of Grand Coulee. Grand Coulee Dam forms the western end of the Lake Roosevelt National Recreation Area.

1.4 Authority

The CBP began with fund allocation for Grand Coulee Dam pursuant to the National Industrial Recovery Act of June 16, 1933. The Project was specifically authorized for construction by the Rivers and Harbors Act approved August 30, 1935. The Columbia Basin Project Act of March 10, 1943 (57 Stat. 14), reauthorized the CBP, bringing it under the provisions of the Reclamation Project Act of 1939.
Congress authorized Reclamation to operate Grand Coulee Dam for the multiple purposes of FRM, navigation, generation of electricity, storage and delivery of water for irrigation, under the 1902 Reclamation Act. Congress has directed that Reclamation enter into contracts with project water users. These contracts set out, among other things, Reclamation’s obligations to store and deliver project water to irrigation districts, municipalities, and other entities. Additionally, the 1902 Reclamation Act requires that Reclamation comply with state law with regard to control, appropriation, use, and distribution of waters. Water can be stored and delivered by a project only for authorized purposes for which Reclamation has asserted or obtained a state water right in accordance with Section 8 of the Reclamation Act of 1902 and applicable federal law. Reclamation must honor senior or prior water rights in storing and diverting project water.

### Table 1. Feature and Authorized Purposes

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<td>Congress allocated funds under National Industrial Recovery Act of June 16, 1933</td>
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<td>Columbia Basin Project</td>
<td>Public Law 74-409 on August 30, 1935</td>
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<tr>
<td></td>
<td>Reauthorized Public Law 78-8 to bring provisions under the Reclamation Project Act of 1939</td>
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<tr>
<td>Units 7, 8, and 9 of RPH</td>
<td>Approved by the Secretary on January 5, 1949</td>
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<td>TPP</td>
<td>Public Law 89-448 on June 14, 1966, and Public Law 89-561 on September 7, 1966</td>
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### 1.5 Scoping and Issues

National Environmental Policy Act (NEPA) provides the opportunity for public involvement and comment during the preparation of an environmental assessment (EA). The initial phase of public involvement is the scoping phase, during which the lead agency requests public input on the scope of the proposal being presented, the range of alternatives, the potential environmental impacts, and any possible mitigation measures. The lead agency notifies the public of the proposal through various media (for example, sending letters, publication notices, and internet postings). This allows the public to comment on the proposal during the scoping period. This section will summarize the public involvement and agency coordination activities that have been conducted to date for this EA.

A 30-day public scoping period was held from October 7, 2016, to November 7, 2016, regarding Reclamation’s intent to prepare an EA and requesting public comment. Letters were sent to the Confederated Tribes of the Colville Reservation (CTCR) and the Spokane Tribe of Indians (STOI) to inform them of the proposed alternatives and to solicit comments or concerns they may have on the alternatives. Similar letters were sent to federal and state agencies, and to local city and county officials (Appendix A). The public comment period was extended until November 27, 2016, at the request of the public (Appendix A).
1.6 Regulatory Compliance

Along with the Secretarial and Congressional authorizations cited above, various laws apply to the Preferred Alternative and are summarized below.

1.6.1 National Environmental Policy Act
NEPA requires that the action agency use a public disclosure process to determine whether there are any environmental impacts associated with proposed federal actions. If there are no significant environmental impacts, a Finding of No Significant Impacts (FONSI) can be signed to complete the NEPA compliance.

1.6.2 Endangered Species Act (1973)
The Endangered Species Act (ESA) requires that federal agency actions do not jeopardize the continued existence of listed species, or destroy or adversely modify their critical habitat. As part of the ESA’s Section 7 process, an agency must request information from the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration’s (NOAA) National Marine Fisheries Service (NOAA Fisheries) on whether any threatened and endangered species occur within or near the Affected Environment. The agency then must evaluate impacts to those species. If the action may affect any listed species, the agency must consult with the USFWS or NOAA Fisheries.

1.6.3 National Historic Preservation Act of 1966
Section 106 of the National Historic Preservation Act (NHPA), as amended, requires that federal agencies consider the effects that their projects have on properties eligible for or on the National Register of Historic Places (NRHP). The 36 CFR 800 regulations provide procedures that federal agencies must follow to comply with the NHPA. For any undertaking, federal agencies must determine if there are properties of National Register quality in the Project area, the effects of the Project on those properties, and the appropriate mitigation for adverse effects. In making these determinations, federal agencies are required to consult with the State Historic Preservation Office (SHPO), Native American tribes with a traditional or culturally significant religious interest in the study area, the interested public and, in certain cases, the Advisory Council on Historic Preservation (ACHP).

1.6.4 Executive Order 13007: Indian Sacred Sites
Executive Order 13007, dated May 24, 1996, instructs federal agencies to promote accommodation of access to and protect the physical integrity of American Indian sacred sites. A sacred site is a specific, discrete, and narrowly delineated location on federal land. An Indian tribe or an Indian individual determined to be an appropriately authoritative representative of an Indian religion must identify a site as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriate authoritative representative of an Indian religion has informed the agency of the existence of such a site [E.O. 13007, Section 1 (b) (iii)].
1.6.5 Secretarial Order 3175: U.S. Department of the Interior Responsibilities for Indian Trust Assets

Indian Trust Assets (ITA) are legal interests in property held in trust by the U.S. (with the Secretary of the U.S. Department of the Interior [Interior] acting as trustee) for Indian tribes or Indian individuals. Examples of ITAs are lands, minerals, hunting and fishing rights, and water rights. In many cases, ITAs are on-reservation; however, they may also be found off-reservation.

The U.S. has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or Indian individuals by treaties, statutes, and executive orders. These rights are sometimes further interpreted through court decisions and regulations. This trust responsibility requires that officials from federal agencies, including Reclamation, take all actions reasonably necessary to protect ITAs when administering programs under their control.

1.6.6 Executive Order 12898: Environmental Justice

Executive Order 12898, dated February 11, 1994, instructs federal agencies, to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by addressing, as appropriate, disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Environmental justice means the fair treatment of people of all races, income, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no person or group of people should shoulder a disproportionate share of negative environmental impacts resulting from the execution of environmental programs.

1.7 Other Related Actions and Activities

The following actions are related but separate because they are being done on various portions of the Grand Coulee Project and serve different purposes and needs. Separate NEPA documents have been completed for the following.

1.7.1 Third Powerplant Overhaul

On April 28, 2010, a FONSI was signed authorizing the TPP overhaul and modernization, which includes work on the six generating units, turbines, shafts, and auxiliary equipment at the Grand Coulee TPP. The main portion of the overhaul work is being completed within the confines of the TPP. Generator units G19, G20, and G21 may be uprated in overall unit capacity, with new generator and turbine components. The overhaul program also includes inspecting and refurbishing or replacing components for generator units G22, G23, and G24. In order to make room to refurbish the existing parts, a new material storage building was erected adjacent to the TPP. The overhaul and modernization is scheduled for completion in 2027. The following link provides documents and information regarding the TPP Project: [http://www.usbr.gov/pn/programs/ea/wash/tpp/index.html](http://www.usbr.gov/pn/programs/ea/wash/tpp/index.html).
1.7.2 John W. Keys III Pump-Generating Plant Modernization Project

On March 12, 2012, a FONSI was signed authorizing the overhaul and modernization of the John W. Keys III Pump-Generating Plant, which includes replacement or work on the 12 pump and pump-generating units, exciters, governors, stators, wicket gates and runners, impellers, penstocks, siphon breakers, suction tubes and gates, unit controls, transformers, circuit breakers, fire protection, and auxiliary equipment. The main portion of the overhaul work will be completed within the confines of the John W. Keys III Pump-Generating Plant. The overhaul and modernization is scheduled for completion in 2034. The following link provides documents and information regarding the Project:


1.7.3 New Fire Station

On November 23, 2015, a FONSI was signed authorizing the construction of a new fire station at the Grand Coulee Dam facility. The Grand Coulee Power Office (GCPO) Fire Department is currently housed and occupies multiple areas within the John W. Keys III Pump-Generating Plant, an industrial facility. The John W. Keys III Pump-Generating Plant space being used for the fire department was originally constructed to support the maintenance of power production and irrigation water pumping units and was never intended to be occupied by a fire department. The new station will be located outside the west Administration/Industrial Area gate, near the intersection of Highway 155 and B Street. The structure will be approximately 21,500 square feet in size and include areas for sleeping, dining, meeting/training, offices, and a public reception area. Access to the new station will be from Industrial Road, off of either B Street or Highway 155. The following link provides documents and information regarding the Fire Station Project:

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Chapter 2. Description of Alternatives

2.1 Introduction

This chapter presents the following alternatives being considered for the Project. Figure 1 shows the location and facilities associated with the Project.

- Alternative A – No Action
- Alternative B – Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time – Preferred Alternative
- Alternative C – Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time

Figure 1. General Overview of Left and Right Powerhouses
2.2 Alternative A – No Action

Under the No Action alternative, Reclamation would continue operating the G1 through G18 generating units with no scheduled component modernization and overhaul. The 18 units would continue generating power until a failure occurs, at which time the generating unit would be taken offline and overhaul would be done. Because none of the modernization and overhaul work would be planned under this Alternative, units may be offline for extended periods. Repair costs and time needed to obtain replacement parts would likely continue to increase based on the aging technology and the scarcity of parts. Age-related wear issues would remain and may become worse over time. Unit components would be modernized and overhauled as failure occurred.

2.3 Alternative B – Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a Time – Preferred Alternative

Under Alternative B, Reclamation would overhaul 18 generating units; G1 through G9 in LPH and G10 through G18 in RPH. The modernization and overhaul work would include work on the generators, windings, stator core, penstocks, and internal and external cranes. The objective would be to repair and restore these machines for reliable operation for an additional 30 years in a timely manner while maintaining hydraulic capacity at Grand Coulee. Work would occur on two of the 18 units at a time (in the LPH and RPH combined). All work would progress in a coordinated manner. Reclamation anticipates the construction portion of the Project to occur from 2018 to 2029, but unforeseen circumstances (for example, equipment breakdown, unexpected outages, or manufacturing delays) could delay completion. The overhaul work would include:

- Replacement on the generator windings and stator cores of the main-unit generators
- Installation of new static digital excitation systems for all 18 main-unit generators
- Digital governor control systems, local unit controls, and generator relay protection systems for all 18 main-unit generators
- Penstock lining repair or replacement for all 18 main-unit generators
- Replacement or modernization of the nine cranes servicing the powerhouses
- Modernization of three station service generators (LS-1 through LS-3) in the LPH
- Replacement or refurbishment of the iso-phase bus and circuit breakers for all 18 main-unit generators

Nine cranes—five inside the powerhouse and four gantry cranes on the powerhouse exteriors and on the top of the dam—will be replaced or modernized as part of this Project. These cranes are aging and provide essential services to the dam and associated facilities. Work on the cranes would proceed in an efficient manner to minimize potential impacts associated with one or more cranes being out of service.

The staging area is shown in Figure 2 on previously disturbed land. Waste material would be recycled and/or taken to an approved disposal facility. Spill prevention and containment would follow the Grand Coulee spill management plan.

Very little parking is available for contractors and workers at Grand Coulee. Therefore, contractors may be required to carpool from the Staging Area to the Project site.

**Figure 2. Location of Staging Area (red) and Parking Area (green)**
2.4 Alternative C – Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time

This alternative would be similar to the above alternative, but rather than completing work on two units at a time, work would only occur on one unit at a time. This would extend the work out an additional 6 or 7 years, depending on speed of completion (Denton 2017c).
Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter provides background information and a description of the study conducted for key resources potentially affected by the Project. It describes the affected environment of various resource areas within the Project area and vicinity, and evaluates the potential effects of constructing and operating the two action alternatives and the No Action Alternative. The action alternatives (including the Preferred Alternative) are based on the purpose and need and the Project description developed by Reclamation.

The affected environment sections describe the existing environment that could be affected by the alternatives. The environmental consequences sections describe the potential environmental consequences of implementing the proposed alternatives on the resources evaluated below. Environmental commitments necessary to reduce any potential impacts to those resources are addressed in the environmental commitments sections. Cumulative impacts, which may result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, also are evaluated. Related actions are discussed in Section 1.7 and are included in the evaluation of cumulative impacts.

Information necessary to develop the affected environment discussion was obtained through a combination of online data review; meetings, discussions, and reports from agencies; field investigations; scoping comments; and a review of available aerial photography.

The Affected Environment referred to in each section, unless specifically mentioned otherwise, is the area potentially affected by the federal action and includes Reclamation’s property at the Grand Coulee Dam site, the staging and laydown areas, and the local/regional transportation system used to construct and supply the Project. Furthermore, the Affected Environment includes other elements of the human and natural environment directly or indirectly impacted by the current and proposed operations of the generating facility.
3.1.1 **Resource Areas Not Discussed in Detail**

Preliminary analysis indicated that the modernization and upgrade of the generating units has no potential to affect certain resource areas or is anticipated to affect certain resources to such a limited extent that a detailed discussion of those areas is not justified. These resource areas are soils and geology, water resources and hydrology, fisheries, vegetation, wildlife, federally protected species, wetlands, land use, visual resources, energy, noise, wild and scenic rivers, air quality, and recreation. Because there is either no affect or very limited potential for affect, these resource areas would not influence the decision to be made regarding the Preferred Alternative and are not discussed in detail. The rationale for eliminating these resource areas from detailed discussion and further consideration is provided in the following sections.

3.1.1.1 **Soils and Geology**

Earth-disturbing activities on soil or geologic resources would not occur under either action alternative; therefore, soils and geology will not be addressed further in this EA.

3.1.1.2 **Water Resources/Hydrology**

No changes to surface or groundwater quality, quantity, or surface flows would occur under either action alternative or cumulatively. No increased spills are predicted with implementation of the Project under either action alternative, inclusive of the Preferred Alternative, and when considered with other projects occurring at Grand Coulee (see Section 1.7); therefore, there would be no cumulative effects. Water resources and hydrology will not be addressed further in this EA due to no effects.

3.1.1.3 **Fisheries**

No changes in the dam operation or water conditions would occur, so no impacts on fisheries resources would occur under either action alternative. There would be no cumulative effects, as no effects to fisheries are expected with implementation of related actions. Therefore, fisheries will not be addressed further in this EA.

3.1.1.4 **Vegetation**

Earth-disturbing activities would not occur. The laydown and staging areas are on previously disturbed sites. Impacts on vegetation resources would not occur under either action alternative. There would be no cumulative effects, as no effects to vegetation are expected with implementation of related actions. Therefore, vegetation will not be addressed further in this EA.

3.1.1.5 **Wildlife**

No disturbance to intact habitat would occur under either action alternative. Only disturbed habitat at the laydown and staging area would be affected. There may be temporary displacement of wildlife that frequent these types of areas, but an abundance of disturbed areas are adjacent to the Project for displaced wildlife to use. Therefore, wildlife impacts are minimal. There are no wildlife impacts.
associated with the related actions; therefore, wildlife will not be addressed further in this EA.

**3.1.1.6 Federally Protected Species**
No potential impacts to federally protected species (migratory birds, marine mammals, and bald and golden eagles) or species listed under the ESA were identified. On March 20, 2017, Reclamation requested from USFWS a list of ESA-listed species that may occur within the Project area. The official species list is derived from a list of species that occur within a county and should be considered in an effects analysis (biological assessment) for the Project. The list of ESA-listed species that occur within the counties include: yellow-billed cuckoo, bull trout, Spalding’s catchfly, and North American wolverine. No critical habitat is designated within the Affected Environment. Reclamation determined that the Project would have no effect on ESA-listed species and they will not be addressed further in this EA.

**3.1.1.7 Wetlands**
There are no wetlands within the areas to be used by the Project under either action alternative and no wetlands are impacted by related actions; therefore, wetlands will not be addressed further in this EA.

**3.1.1.8 Land Use**
Land use would not change under either action alternative or with implementation of the related actions; therefore, land use will not be addressed further in this EA.

**3.1.1.9 Recreation**
River flows and sportsman access will not be affected by the Project. The Visitor Center will remain open during construction. There are no campgrounds in the Project area. The related actions would have no recreation impacts. Therefore, there will be no impact on recreation, and recreation will not be addressed further in this EA.

**3.1.1.10 Visual Resources**
There may be a temporary change to visual resources when the external cranes on top of the dam are upgraded under either action alternative. This impact is considered temporary and minimal. Visual resources are dealt with in more detail as they relate to historical resources in Section 3.3, Cultural Resources. Therefore, visual resources will not be impacted and will not be addressed further in this EA.

**3.1.1.11 Energy**
Under Alternative A, No Action, unplanned maintenance and repair work could potentially affect power generation by resulting in unplanned and unpredictable outages. However, no disruption of power supply would occur under either action alternative. Energy supplies would also not be impacted by the related actions. Therefore, energy will not be addressed further in this EA.
3.2 Hazardous or Toxic Wastes

3.2.1 Affected Environment
The GCPO is identified as a Large Quantity Generator of Hazardous/Dangerous Wastes in 2016 as a result of a lack of a disposal contract (DeWinkler 2017a). The facility’s status will revert to Medium Quantity Generator in 2017 (DeWinkler 2017a). These wastes are generated as part of the facility’s operations and maintenance (O&M) activities and include waste paints, solvents, used oils, lead, and asbestos. The lead and asbestos are accumulated as part of O&M activities associated with generation units.

As identified through sampling and ongoing efforts to dispose of polychlorinated biphenyl (PCB) electrical equipment, the RPH and LPH are generally considered to have a non-PCB operational status. Regardless of this consideration, the RPH and LPH continue to manage, for disposal, oil-filled capacitors as PCB items. Other oil-filled electrical equipment for which sampling cannot be performed or the manufacture date is not discoverable are also managed for disposal as PCB items.
The RPH and LPH have 18 generation units, identified as G1 through G18. All of these units were previously equipped with asbestos-containing brake pads. The brake pads were removed from all the units and all accessible areas were abated of brake dust (DeWinkler 2017b). Other areas are accessible only after the units are dismantled and may contain asbestos contaminated dust. Gaskets to be removed and replaced are known to contain asbestos. Lead contamination is also evidenced in the dust, since many of the metal components were originally coated with lead-based paint. Because of these facts, all LPH and RPH units are managed with the presumption that they contain asbestos and lead dust.

The U.S. Environmental Protection Agency has expressed concerns regarding the potential for PCBs to be included in paints or caulks manufactured prior to 1979 (VERSAR 1979). As a result of these concerns, all painted surfaces scheduled for paint removal as part of any O&M activity would be sampled for both PCBs and lead.

Colville Tribal Law and Order Code, Chapter 4-13 Solid Waste, regulates solid and hazardous waste storage and disposal on CTCR lands. According to Grand Coulee Solid and Hazardous Waste program management, no solid or hazardous wastes are authorized for disposal on Tribal lands.

It has been found through inspection and air monitoring that the asbestos and lead dust is trapped in an oily film that covers virtually all internal surfaces of the units. Personal air monitoring results have not revealed any airborne concentrations of asbestos within an order of magnitude of the Occupational Safety and Health Administration (OSHA) Permissible Exposure Level (PEL) (greater than 0.1 fiber per cubic centimeter of air as an 8-hour time-weighted average). Personal air sampling for airborne concentrations of lead-contaminated dust also revealed concentrations well below the PEL for lead (0.050 milligrams per cubic meter). Health hazards associated with these contaminated dusts are perceived to be minimal (DeWinkler 2017c).

All workers receive annual lead awareness training and asbestos training/certification commensurate with their assigned duties. The Grand Coulee Powerplant Safety Office has established work planning steps to ensure that O&M activities are performed to ensure worker health and safety. Work supervisors are instructed to adhere to the Reclamation Safety and Health Standard, Section 4, to ensure that all known and foreseeable hazards are identified and mitigated prior to beginning work. Past O&M work activities have been preceded by a thorough cleaning of accessible surfaces (DeWinkler 2017c).

### 3.2.2 Environmental Consequences

#### 3.2.2.1 Significance Criteria

Based on a qualitative analysis, a significant impact would occur if human health and the environment are predicted to be negatively impacted from management of hazardous wastes generated during the implementation of the Preferred Alternative or alternatives.
3.2 Hazardous or Toxic Wastes

### Alternative A - No Action Alternative
Reclamation would continue operating the RPH and LPH generating units. Current maintenance and production schedules would be adjusted as necessary to meet operational parameters and contractual obligations for power generation. Hazardous materials and waste would continue to be managed as they are at this present time. Used oils, lead and asbestos-contaminated dusts, and potential PCB and lead-based paints would continue to be analyzed for content and removed and disposed of as determined by the O&M schedule.

### Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time
The internal parts of generating units within the RPH and LPH are coated with a thin film of oil that has encased dust particles potentially containing lead, asbestos, and PCBs. Potential exists for the exposure of GCPO employees and contractor employees working in the RPH and LPH during the dismantling and refurbishing of the generating units via inhalation and ingestion of contaminated dusts.

Regulated hazardous wastes would be generated as part of the Preferred Alternative in quantities greater than those generated during regular O&M activities. Modernization of the generator unit components would generate additional quantities of used oils, solvents, and detergent-based wastes that may contain lead, asbestos, and PCB-contaminated dust. Generation of sandblast media containing lead-based paint chips, waste paints, PCBs, and solvents may result from the removal of paint. Removed paint would be replaced with non-lead based paints. The elevated amount of waste generation has the potential to increase worker exposure through inhalation, ingestion, and dermal absorption.

There will be a small increase in solid and hazardous wastes transportation as the increased waste generated as part of the Preferred Alternative is sent to recycling or disposal locations. Hazardous and dangerous waste management is tightly regulated through Federal Resource Conservation and Recovery Act and state of Washington Dangerous Waste Regulations. There are strict controls regulating its generation, transportation, and disposal or recycling, commonly referred to as cradle-to-grave management. Contingency and emergency response planning is required throughout all phases of the management process. In addition, the quantities potentially generated would not impact the available hazardous/dangerous waste disposal capacity in the region.

Contract specifications will protect contractors and GCPO workers from exposure to hazardous/dangerous waste through criteria that ensures worker health and safety and the proper treatment, temporary storage, and disposal of hazardous/dangerous wastes. Contract specifications require either a Negative Initial Exposure Assessment or the implementation of appropriate engineering controls for any contracted work area where the potential exists for airborne concentrations of lead or asbestos. OSHA PELs for worker exposure to hazardous substances are not to be exceeded.
Further safeguards are provided through Reclamation Manual Policy (ENV P01) and Directives and Standards (ENV 02-02; ENV 05-01) requiring that Reclamation must ensure that hazardous/dangerous wastes generated on Reclamation property through its own or contracted activities are properly treated, stored, and disposed of in accordance with applicable environmental rules, regulations and standards, and that hazardous/dangerous wastes are recycled whenever possible.

Implementation of established worker safety standards and contract specifications will protect workers from potential exposure to hazardous/dangerous wastes. Release of hazardous/dangerous wastes to the environment would be prevented by implementation of waste management standard operation procedures, contract specifications, and federal, state, and local environmental regulations. The Preferred Alternative represents a minimal increased potential for human or environmental exposure to hazardous/dangerous wastes. However, the measures discussed above will prevent exposure that would result in a significant impact.

3.2.2.4 Alternative C - Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time

Environmental consequences would be the same as for Alternative B, but would extend over a longer period of time.

3.2.3 Mitigation

3.2.3.1 Alternative A – No Action

No mitigation is proposed.

3.2.3.2 Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time

Established worker safety standards and contract specifications adequately address the potential worker exposure to generated hazardous/dangerous wastes. Waste management standard operation procedures, contract specifications, and federal, state, and local environmental regulations ensure that a minimal potential exists for the release of hazardous/dangerous wastes to the environment. It is anticipated that the Preferred Alternative represents a minimally elevated potential for impact to human health or the environment, as contaminants may be airborne that wouldn’t be without the Project. Apparent or alleged impacts to human health or the environment are currently being adequately addressed through administrative and engineering controls. The slightly elevated potential for impact to human health or the environment does not require additional controls or mitigation.

3.2.3.3 Alternative C - Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time

Mitigation for Alternative C is the same as for Alternative B.
3.3 Cultural Resources

3.2.4 Cumulative Impacts

The TPP Overhaul has hazardous waste impacts similar to impacts associated with Alternatives B and C of this EA. However, those activities would occur in a separate and isolated location and would not interact with activities associated with Alternatives B and C. The small amount of waste generated with the TPP Overhaul project will not prevent the hazardous waste recycling or disposal activities associated with this Project. Therefore, there will be no cumulative impacts as a result of implementation of Alternatives B or C.

3.3 Cultural Resources

This section addresses the affected environment and environmental consequences of the Project on cultural resources. Cultural resources include cultural landscapes, ethnographic resources, historic places, properties of traditional and cultural importance, artifacts and documents, buildings, structures, archaeological sites, districts, and objects. The Project is being reviewed following the Section 106 of the NHPA process, which encourages close coordination with NEPA and requires federal agencies to take into account the effects of their actions on properties listed or eligible for listing on the NRHP.

Chapter 3.5 (Indian Sacred Sites) provides additional information about the existing conditions and potential environmental consequences to properties of traditional and cultural importance to Native American tribes. As part of the Section 106 process, Reclamation consulted with the Washington SHPO and Tribal Historic Preservation Officer (THPO) for the CTCR regarding the Project and archaeological and built environment areas of potential effects (APE). Appendix B contains copies of this correspondence and other Section 106 correspondence with the responsible historic preservation officers.

Regulations implementing Section 106 of NHPA, 36 CFR Part 800.8, encourage the coordination of two processes: (1) the review of possible impacts on the environment under NEPA, and (2) the assessment of effects of undertakings required under NHPA. Reclamation will provide opportunities to comment on the impacts the Project may have on cultural resources to the Washington SHPO, Native American tribes, and other interested parties.

Reclamation, as the lead agency responsible for compliance with Section 106 of the NHPA, is responsible for ensuring that the appropriate cultural resource studies have been conducted, including Class I literature reviews and Class III pedestrian inventories. These literature reviews and pedestrian inventories have been completed, sites have been recorded, and draft reports have been submitted to Reclamation. These surveys provided the location of cultural resource sites within the Project area.
Avoidance of cultural resources through project design remains the preferred method for mitigating impacts on cultural resources. Cultural resource impacts would be avoided, and best management practices would be implemented, including completion of Section 106 consultation, continuation of Native American consultation, and development of an avoidance strategy.

### 3.3.1 Affected Environment

Reclamation has identified historic properties that could be impacted by the Project. To be eligible for inclusion in the NRHP a property must meet the requirements of at least one of the four primary NRHP criteria (National Park Service 1991).

The quality of significance in American history, architecture, archaeology, engineering and culture is present in districts, sites, buildings, structures, and objects and:

A. That are associated with events that have made a significant contribution to the broad patterns of our history; or

B. That are associated with the lives of persons significant in our past; or

C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. That have yielded or may be likely to yield, information important in prehistory or history.

Properties must retain enough integrity to demonstrate their significance under the criteria. The NRHP recognizes seven aspects of integrity: setting, feeling, association, location, materials, design, and workmanship. Even if a property meets the eligibility criteria, it must retain integrity to be eligible for listing in the NRHP. Properties generally must be at least 50 years of age to be eligible for the NRHP, unless they are proven to have exceptional importance (National Park Service 1991).

#### 3.3.1.1 Archeological

The chronology used here draws on a chronology developed for the Kettle Falls area, located about 100 miles upstream from Grand Coulee Dam (Berryman et al. 2011; Galm 1998). Pouley (2010b) has created a new chronology for the Kettle Falls site and surrounding areas based on re-analysis and interpretation of the data, and a comparison to other regional chronologies (Chance et al. 1986). Terminology for his chronology is based on major figures in local oral history and includes data from radiocarbon dates from new and curated samples. Pouley’s (2010a) revised Kettle Falls Chronology Periods include Coyote (8,000 to 4,800 B.P.), Salmon (4,800 to 3,500 B.P.), Eagle (3,500 to 2,200 B.P.), and Turtle (2,200 to 200 B.P.).
3.3 Cultural Resources

As with other culture history models, Pouley argues for a gradual shift on the Plateau from foraging, to optimal foraging, to collector-based societies.

The following cultural chronology is also synthesized from the investigation for the John W. Keys III Pump-Generating Plant Modernization Project at Grand Coulee Dam (Berryman et al. 2011), and developed from the investigations for Chief Joseph Dam (also known as Lake Rufus Woods) (Ames et al. 1998; Andrefsky 2004; Campbell 1985; CTCR 2006). Chief Joseph Dam lies approximately 20 miles downstream on the Columbia River from the Grand Coulee Dam area. The following cultural chronology incorporates the tripartite period divisions advocated by Galm (1998) and other scholars: Early Period (11,250 to 6,000/4,000 B.P.), Middle Period (4,000 B.P. to 2,500/2,000 B.P.), and Late Period (2,500/2,000 B.P. to 500 B.P.).

**Paleoindian Period (circa 12,000 B.P. to 7,000 B.P.)**
Clovis projectile points have been found approximately 70 miles southwest of the Project area in association with volcanic ash dated to 11,250 B.P. Fluted and large-stemmed Paleoindian projectile points have been found throughout north-central Washington, with finds concentrated along permanent lakes and rivers. Sites in the region have produced little evidence of extensive exploitation of Pleistocene megafauna as seen on the northwest Plains, with the population apparently following a more generalized subsistence strategy focusing on root crops and salmon (Galm 1998).

**Kartar Phase (7,000 B.P. to 4,000 B.P.)**
The Kartar phase is comparable to Pouley’s (2010a) Coyote Period (8,000 to 4,800 B.P.) and spans the Early Archaic and part of the Middle Archaic or Middle periods. During this phase, there was a greater variety of ground stone tools than the preceding Paleoindian period, including mortars and edge-ground cobbles used for food processing (Pouley 2010a). Small groups of three to four semi-subterranean pithouses were common in the later part of the phase. Sites associated with the Kartar phase are concentrated on tributaries of the Columbia River (Berryman et al. 2011).

**Hudnut Phase (4,000 B.P. to 2,000 B.P.)**
The Hudnut phase occupies the later part of the Middle Archaic or Middle period. The material culture of the Hudnut phase generally resembles that seen in the preceding Kartar phase, with a wide variety of ground-stone tool forms; however, projectile points shifted to smaller side- and corner-notched dart points. Sites along the Columbia and its major tributaries are generally larger than those found in other locations (Berryman et al. 2011). The Eagle Period (3,500 B.P. to 2,200 B.P.) also overlaps with the Hudnut Phase and includes the adoption of a collector strategy, evidenced by a further increase in the use of pithouse and storage features, as well as a 60 percent increase in salmon in the archaeological record (Pouley 2010a).
Cultural Resources

Coyote Creek Phase (2,000 to 250 B.P.)
The Coyote Creek phase spans the entirety of the Late Period and is comparable to Pouley’s (2010a) Turtle Period (2,200-200 B.P.) Most of the elements of material culture observed by ethnographers is present by the start of this phase. Although no sites of this phase have been identified in the Project area, it is possible that some of the sites with talus pits, pictographs, and other stone features found in the general Grand Coulee Dam area may date to this period (Berryman et al. 2011).

Euro-American Period (250 B.P. to Present)
Although European exploration did not enter the Grand Coulee Dam area until the early nineteenth century, word of the Russian and Spanish exploratory expeditions along the Pacific Coast spread to the area in the 1600s, with trade goods following shortly thereafter. Horses appear to have been introduced to the area in the 1740s and had a significant effect on tribal organization. The first Christian missionaries arrived in areas occupied by local tribes as early as the late 1830s (Bouchard and Kennedy 1984; Ray 1977). The Indian Appropriations Act of August 19, 1890, opened any unassigned lands to white settlers for settlement. Shortly afterwards, the north half of the Colville Reservation was ceded to the U.S. by an act of Congress in 1892 (27 Stat. 62). This resulted in the opening of 1.5 million acres of the Northern half of the Colville Reservation—which at the time extended all the way north to the Canadian border—to non-Indian settlement in 1892 (Hess 2010). In 1898 reservation lands were opened to miners and prospectors, resulting in destructive environmental effects that can still be seen along the Columbia River (Bouchard and Kennedy 1984). The CTCR formally united 12 Indian tribes with diverse political traditions and distinct linguistic roots with ties to the lands of the Colville Reservation (Ray 1974; 1977). This confederation comprises the Salishan-speaking Sanpoil (or Snpuː̃ ′lʊx), Nespelem (Snspi·̌ləm), Southern Okanagan (or Isankuafli), Colville (or Shwoyelpi or Skoyelpi), Lakes (or Sinixt), Columbia (or Moses-Columbian, or Sinkaiuse), Methow, Chelan, Entiat, and Wentachi (or P’squosa) tribes, the Nez Perce speaking Wallowa-Imnaha band, and Sahaptin-speaking Palus (or Palouse) tribe. Except for the Wallowa Nez Perce, whose ancestral lands were in northeastern Oregon, and the Palus, who migrated from southeastern Washington, all of the Confederated Tribes have had a “long, continuous, and stable occupation” (Ray 1977) of the Columbia River Basin area spanning anywhere from 10,000 (Ray 1977) to 14,000 years or more (Hess 2010).

By 1900, up to 75 percent of the lowlands in the valley bottom had been planted in orchards, with small communities like Peach, Plum, Daisy, Gifford, Kettle Falls, and Marcus forming to supply local farmers (Roulette et al. 2001). The desire to expand farming beyond the fertile valley onto the adjacent arid uplands created a push for large irrigation projects starting in the late nineteenth century. These demands eventually helped spur creation of Grand Coulee Dam (Berryman et al. 2011).
### 3.3.1.2 Archaeological Resources within the Project Area

Although most of the work for the proposed upgrade is occurring inside the generating units, staging and laydown will be required to facilitate construction. The affected area for the proposed staging and laydown encompasses nine staging areas, as shown in Figure 2. These locations would be used temporarily for storage supplies and equipment during construction. Use of these areas would have no impact on built environment resources and have been evaluated for archaeological effects.

Much of the Project area is designated as very high risk/probability for archaeological materials by the Washington Statewide Predictive Model with a recommendation to survey; however, the resolution of the model does not account for many site-specific, on-the-ground variables.

A records search for archaeological resources within 1 mile (1609.34 meters) of the archaeological APE identified 15 archaeological sites. The only cultural resource or historic property identified within the archaeological APE was the Grand Coulee Dam historic district. Of the 15 resources within the study area, nine are pre-contact sites and six are historic sites. There are two NRHP-eligible historic properties within the study areas: 45GR146, a pre-contact site, and 45GR662, a historic site. The other 13 archaeological sites within 1 mile of the APE remain unevaluated for NRHP eligibility at this time.

Investigation of proposed staging areas, including archaeological survey, was conducted as part of compliance with NHPA section 106 (Mcfarland and Ferry 2016). Pedestrian survey confirmed extensive ground disturbance from construction and following demolition and removal of materials. Open areas that at first appeared undeveloped were in fact heavily disturbed. No pre-contact resources were identified during investigation, but non-contributing historic debris and post-demolition fragmentary infrastructure associated with the dam and construction of the TPP were noted.

### 3.3.1.3 Traditional Cultural Properties

According to ethnographic research and additional information provided by the CTCR THPO, there are numerous named landforms with Salish place-names in and near the Grand Coulee area. While the majority of traditional places are present outside Grand Coulee Dam, one named place overlaps with the Project area. The CTCR THPO has, in correspondence for the Project, indicated that “Grand Coulee Dam, and therefore, in a sense, both of the powerhouses under discussion, are located within sk̓ał̓ ʕəcín, a place associated with a trail passing by the mouth of Grand Coulee and an adjacent camp and fishing area. Recently, Reclamation partially mitigated impacts to sk̓ał̓ ʕəcín by establishing a tribal fishing site below Grand Coulee Dam. For cultural resources, we consider the fishery created below the Grand Coulee Dam as adequate treatment for this specific undertaking for the traditional site” (Moura 2016). In the same correspondence, the CTCR THPO indicated the CTCR had no traditional concerns with areas previously disturbed by dam construction.
The Grand Coulee Dam project area has undergone extensive construction-related disturbance over the past 70 plus years (see the Cultural Resources section above, 3.3.1.2). As such, the physical integrity of any TCPs other properties of traditional religious and cultural importance to tribes in this area would have been severely compromised by the transformation of the landform into Grand Coulee Dam. Additionally, as a part of its security procedures, Reclamation has been obligated to limit access to lands within the Project area over the past decades. One recent exception to this statement is the separate (but in process) action to upgrade security measures and allow expanded access to the fishery (associated with the named place: skł’əcín) near the north parapet wall of the TPP on the reservation side (right side) of the river below the dam.

A literature review of previous TCP studies was completed as part of the Section 106 investigations. There are five previously documented TCPs and named places within approximately 2 miles of the proposed APE. Some of these are named places, and some are archaeological sites with cultural relevance to the area tribes. The most visible of these locations, from the southernmost location of the APE, is the landform “Set in between” (for more information, see John W. Keys III Pump-Generating Plant Modernization Project, Grand Coulee Dam: Finding of Effect on Traditional Cultural Properties [Moreno and Curti 2011]). Although the Project, including staging locations, is located within the viewshed of several of these places, the Project occupies lands previously heavily disturbed by Grand Coulee Dam construction activities. Because of the industrial use as part of the larger Grand Coulee Dam complex, additional effects to TCPs are not anticipated as part of the Project. At this point there are no plans to add equipment to the exterior of the industrial complex, and use of the potential staging areas does not currently involve plans for any permanent visible construction.

3.3.1.4 Buildings and Structures

In consultation with SHPO and THPO, Reclamation identified the APE for historic-era buildings and structures to include the LPH, RPH, and Dam. The Project will require the replacement of equipment associated with Grand Coulee Dam, which is the largest hydroelectric power producer in the U.S. and is one of the largest concrete structures in the world (Reclamation 2015). In 2006, SHPO concurred with the finding that the Grand Coulee “dam, power plants, pumping plants, industrial area [southwest of dam] and associated facilities” are part of the historic complex eligible for listing in the NRHP (Reclamation 2006). Reclamation is currently working to delineate the boundaries of the historic district and provide supporting historical significance documentation in the form of a NRHP nomination.
The Grand Coulee Dam complex is eligible for the NRHP at the national level as a historic district that meets NRHP criteria A and C. It is eligible under NRHP Criterion A for its expansion of regional power production, flood control and irrigation, and reflected the “aspirations, capabilities and priorities” of the United States beginning in the 1940s (Roise 2015). The Grand Coulee Dam complex is also eligible as a historic district under NRHP Criterion C for its method of construction. The dam is one of the largest concrete structures in the world and reflects Reclamation’s move from creating dams for agricultural and flood control purposes to multipurpose projects that included hydroelectric power production. Although equipment upgrades have occurred to keep pace with changing technology, the complex has retained integrity. Constructed during a period of rising standardization, the mechanical systems have not been identified as particularly innovative. Overall, the concrete dam and powerplant have retained their original organization, materials, and finishes. Located on the downstream (north) side of the dam, the LPH and RPH flank the spillway and are mirror images of one another.

The Project impacts 11 different types of elements associated with the historic dam and powerhouses. The elements of the NRHP-eligible Grand Coulee Dam Historic District that would be replaced or repaired are summarized in Table 2.

Table 2. Grand Coulee Dam Historic District elements located within the APE of the G1-G18 Modernization Project.

<table>
<thead>
<tr>
<th>No.</th>
<th>Element</th>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Windings and Cores (G1-G3, G6, G8-18)</td>
<td>LPH/RPH</td>
<td>Surrounds generator rotor, which generates electricity by moving to induce current in the stator’s copper windings.</td>
</tr>
<tr>
<td>2</td>
<td>Governors (G1-G18)</td>
<td>LPH/RPH</td>
<td>Mechanical regulating equipment controlling the flow of water through the turbines.</td>
</tr>
<tr>
<td>3</td>
<td>Floor-mounted Exciters (G1-G6)</td>
<td>LPH</td>
<td>Motor-generated exciter on floor next to generating unit, which provides necessary direct current needed to energize the generator’s magnetic field.</td>
</tr>
<tr>
<td>4</td>
<td>Top-mounted Exciters (G7-G18)</td>
<td>LPH/RPH</td>
<td>Exciter located on top of generating unit to provide necessary direct current needed to energize the generator’s magnetic field.</td>
</tr>
<tr>
<td>5</td>
<td>Bridge Cranes</td>
<td>LPH/RPH</td>
<td>Located in powerhouse generator halls above units as a means to hoist heavy equipment.</td>
</tr>
<tr>
<td>6</td>
<td>Gantry Cranes</td>
<td>LPH/RPH</td>
<td>Two 150-ton cranes each on top of LPH and RPH used for lifting gates; two 14-ton Cyclops Cranes on concrete ledge below powerhouse windows used to lift draft tube gates.</td>
</tr>
<tr>
<td>7</td>
<td>Penstocks (G1-G18)</td>
<td>LPH/RPH</td>
<td>Enclosed pipes carrying water from upstream side of dam into the turbines.</td>
</tr>
<tr>
<td>8</td>
<td>Station Service Windings and Cores</td>
<td>LPH</td>
<td>Surrounds generator rotor, which generates electricity by moving to induce current in the stator’s windings (location not illustrated).</td>
</tr>
<tr>
<td>9</td>
<td>Iso-phase Bus</td>
<td>LPH/RPH</td>
<td>Conduit used for carrying very large currents between generator and transformer.</td>
</tr>
<tr>
<td>10</td>
<td>Relays (G1-G18)</td>
<td>LPH/RPH</td>
<td>Device that detects the fault and initiates the operation of the circuit breaker to isolate the defective element from the rest of the system.</td>
</tr>
</tbody>
</table>
3.3.2 Environmental Consequences

3.3.2.1 Significance Criteria

Historic properties were analyzed under both NEPA and NHPA for how the Project might impact or affect them. NEPA analysis refers to project impacts, and the NHPA analysis refers to project effects.

Under NEPA, direct impacts to historic properties are those that are caused by the action and occur at the same time and place. They are not limited to physical impacts to the property; they can also include impacts to the setting. The context and intensity of impacts must be considered. The intensity of an impact refers to the degree to which the action may impact or cause loss or destruction to significant cultural resources. This intensity may be categorized as Minor, Not Significant, or Significant. Indirect impacts are caused by the action and are later in time or farther removed in distance but still are reasonably foreseeable, such as changes in land use patterns and related effects on air quality. Cumulative impacts result from the Preferred Alternative’s incremental impact when added to those of other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions.

Direct impacts to archaeological resources may result from ground-disturbing activities such as construction, staging, or laydown associated with upgrading the generating units. Although changes in reservoir level during repair of the generating units could constitute a direct effect on reservoir shoreline sites, this fluctuation will not be in excess of what occurs during normal operation of the dam, and so cannot be considered an impact separate from routine operating procedures.

Indirect impacts may include disturbance, destruction, and/or increased damage to pre-contact and historic archaeological sites because of increased public use or activities in the resource area.

The ACHP regulations implementing Section 106 of the NHPA create a process through which Criteria of Adverse Effect are applied. These criteria are used to determine whether the Project could change the characteristics that qualify a property for inclusion in the NRHP in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association. There are three findings for effects on historic properties: No Historic Properties Affected, No Adverse Effect, or Adverse Effect. Adverse effects include, but are not limited to, the following: Demolition or alteration of the property; introduction of visual, audible, or atmospheric elements that are out of character with the setting of the historic property; and physical encroachment upon an archaeological site. NEPA requires mitigation for significant impacts and may also include mitigation as integral components of the design to avoid or lessen potentially significant effects. In the spirit of both NEPA and Section 106, the alternatives were designed to avoid or minimize impacts on historic properties and other sensitive cultural resources.
### 3.3.2.2 Alternative A - No Action

**Archaeological**
Alternative A, the No Action alternative, would have no adverse effect and no significant impact to NRHP-eligible archaeological resources.

**TCPs**
Alternative A, the No Action alternative, would have no adverse effect and no significant impact to TCPs.

**Buildings and Structures**
Alternative A, as the No Action alternative, would have no adverse effect and no significant impact to historic properties. If no action occurred, Reclamation would find it progressively more difficult and expensive to maintain the equipment identified for replacement under Alternatives B and C.

No historic properties would be affected by Alternative A, No Action.

### 3.3.2.3 Alternative B – Grand Coulee G1-G18 Modernization and Overhaul – Work on 2 Units at a time

**Archaeological**
Alternative B, completing work on both units simultaneously, would have no effect and no impact to NRHP-eligible archaeological resources. No NRHP-eligible archaeological resources were identified within any of the proposed staging and laydown areas that would be used to support Alternative B.

**TCPs**
Alternative B, completing work on both units simultaneously, would have no effect and no impact to TCPs. No TCPs were identified within any of the proposed staging and laydown areas that would be used to support Alternative B.

**Buildings and Structures**
The Project would have an adverse effect on the NRHP-eligible Grand Coulee Dam historic district as a result of the replacement of the G1-G6 floor-mounted exciters, five bridge cranes, and four gantry cranes. When an undertaking is found to have an adverse effect, Section 106 requires consultation with the SHPO and other interested parties regarding appropriate avoidance, minimization, or mitigation measures. The product of consultation would be a Memorandum of Agreement, per 36 CFR 800.6(c), among Reclamation, SHPO, and THPO. Under NEPA, these adverse effects would be identified as minor impacts. No adverse effects or significant impacts to historic properties would occur from generator winding and core replacements, G1-G18 governor replacements, G7-G18 top-mounted exciter replacements, or recoating of the penstocks. Table 3 identifies the proposed changes, lists the location of proposed modifications, describes if the change will be visible or not, and lists the change’s effect to historic properties under Section 106 of NHPA.
### Table 3. G1-G18 Modernization Project Alternative B NHPA Finding of Effects under NHPA

<table>
<thead>
<tr>
<th>Action No.</th>
<th>Proposed Change</th>
<th>Location</th>
<th>Visible (location described) or Not Visible</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Windings, cores, and spare replacement</td>
<td>LPH/RPH</td>
<td>Not visible</td>
<td>No adverse effect</td>
</tr>
<tr>
<td>2</td>
<td>G1-G18 governor replacement</td>
<td>LPH/RPH</td>
<td>Visible (in cabinet within governor gallery)</td>
<td>No adverse effect</td>
</tr>
<tr>
<td>3</td>
<td>G1-G6 floor-mounted exciter replacement</td>
<td>LPH</td>
<td>Visible (from within the generator hall)</td>
<td>Adverse effect</td>
</tr>
<tr>
<td>4</td>
<td>G7-G18 top-mounted exciter replacement</td>
<td>LPH/RPH</td>
<td>Not visible</td>
<td>No adverse effect</td>
</tr>
<tr>
<td>5</td>
<td>LPH (2), RPH (2), and Station Service (1) bridge crane replacements</td>
<td>LPH/RPH</td>
<td>Visible (from within the generator halls)</td>
<td>Adverse effect</td>
</tr>
<tr>
<td>6</td>
<td>Gantry (4) crane replacements&lt;sup&gt;a&lt;/sup&gt;</td>
<td>LPH/RPH</td>
<td>Visible (from exterior of dam and powerhouses)</td>
<td>Adverse effect</td>
</tr>
<tr>
<td>7</td>
<td>G1-G18 penstock recoating</td>
<td>LPH/RPH</td>
<td>Not visible</td>
<td>No adverse effect</td>
</tr>
<tr>
<td>8</td>
<td>Station service generator winding and modernization</td>
<td>LPH</td>
<td>Not visible</td>
<td>No adverse effect</td>
</tr>
<tr>
<td>9</td>
<td>G1-G18 iso-phase bus evaluation</td>
<td>LPH/RPH</td>
<td>Visible (from within transformer bus gallery)</td>
<td>No adverse effect</td>
</tr>
<tr>
<td>10</td>
<td>G1-G18 relay replacement</td>
<td>LPH/RPH</td>
<td>Visible (through glass door of cabinet in governor gallery)</td>
<td>No Adverse Effect</td>
</tr>
</tbody>
</table>

Note:

<sup>a</sup> If Alternative B results in updating rather than replacing cranes, this could result in a *no adverse* effect.

Reclamation identified no adverse effects would occur from the replacement or repair of standard equipment being modified for the continued operation of Grand Coulee Dam. Furthermore, many of the changes determined to have no adverse effect on historic properties are not easily visible as they occur in remote equipment galleries or are buried or underwater when in use, such as the penstocks.

**G1-G6 Floor-mounted Exciter Replacement**

The existing floor-mounted exciters associated with G1-G6 will be replaced with modern floor-mounted exciters. The new excitation equipment will have a slightly larger footprint and be oriented within the same vicinity of the removed exciters. The exciter controls will be located in close proximity to the exciters and generating unit. This is a change from the existing layout, which consists of the exciter cabinets in a separate hall. The floor-mounted exciters are a visible element from within the LPH generator hall. Though public visitation is restricted today, the generator halls were designed as public spaces where tourists could overlook the power generation facilities. Removal of the original exciters and addition of exciter control cabinets on the generator hall floor would alter the original organization of equipment, diminishing the integrity of design, materials, workmanship, and feeling within the LPH.
LPH (Two), RPH (Two), and Station Service (One) Bridge Crane Replacements
The pairs of bridge cranes in the LPH and RPH generator halls, as well as the bridge crane in the Station Service generator hall, will be replaced or refurbished. The five bridge cranes will be replaced or refurbished with custom-built components. The bridge cranes are a character-defining feature of the generator halls visible from all areas within the halls. The onsite work will be conducted in the generator halls, which includes terrazzo floors. The LPH has particularly distinctive floors illustrating the inner workings of the turbine and generator in different shades of terrazzo with metal trim. Construction of the cranes and the storage and movement of heavy equipment in the generator halls could damage the floors, which are character-defining features of the powerhouses. The replacement of the bridge cranes would be a visible change to the generator halls resulting in an adverse effect as a result of loss of materials, workmanship, and feeling.

If Reclamation chooses to rehabilitate the bridge cranes rather than replaces them, this action may avoid adverse effects.

Gantry Crane Replacements (Four)
The exterior of the LPH and RPH includes four gantry cranes that are character-defining features of the powerhouses. On top of the dam, the moveable 150-ton gantry cranes sit on a pair of 170-pound rails separated by 27 feet, and the downstream side of the LPH and RPH includes two smaller “Cyclops” gantry cranes running on rails extending across the ledge below the powerhouse windows. The massive cranes on top of the dam raise and lower the gates that control the water flow into the G1-G18 penstocks and the smaller cranes move the bulkhead gates. The replacement of the cranes with modern equipment would result in the loss of character-defining exterior elements of the dam and powerhouses. The replacement of the gantry cranes would be an adverse effect to historic properties. It is possible that Reclamation would modernize the controls and electrical equipment rather than replace the cranes. This would include modifications to a variety of components:

- Hoist, trolley, and bridge drive motors
- Bridge electrification busses/conductors/collectors
- Trolley electrification (replace with festooned cabling)
- Control panels (replace with variable-frequency drive modules)

If Reclamation chooses to rehabilitate the gantry cranes rather than replace them, this action may avoid adverse effects.
3.3.2.4 Alternative C—Grand Coulee G1-G18 Modernization and Overhaul – Work on One Unit at a time

Archaeological
Alternative C, with work being conducted on one unit at a time, would have no effect and no impact to NRHP-eligible archaeological resources. No NRHP eligible archaeological resources were identified within any of the proposed staging and laydown areas that would be used to support work under Alternative C.

TCPs
Alternative C, with work being conducted on one unit at a time, would have no effect and no impact to TCPs. No TCPs were identified within any of the proposed staging and laydown areas that would be used to support work under Alternative C.

Buildings and Structures
The effects of impacts to historic properties under Alternative C would be the same as Alternative B impacts, which are summarized in Table 3.

3.3.3 Mitigation
3.3.3.1 Alternative A—No Action
If the No Action Alternative is implemented, no mitigation would be necessary. To complete consultation under Section 106 of the NHPA, Reclamation would need to notify the THPO, Washington Department of Archeological and Historic Preservation (DAHP), and the ACHP of Reclamation’s decision not to proceed with the Project.

3.3.3.2 Alternative B (Grand Coulee G1-G18 Modernization and Overhaul – Work on Two Units at a time) and C (Grand Coulee G1-G18 Modernization and Overhaul – Work on One Unit at a time)
Reclamation has determined that Alternatives B or C of the Project would have adverse effects on historic properties. To resolve the adverse effects, Reclamation, as the lead federal agency under Section 106 of the NHPA, will continue consultation with the SHPO, THPO, and other consulting parties. As required, Reclamation will notify the ACHP of the adverse effects and invite them to participate in this resolution process. The ACHP can agree to or decline the request to participate.

To resolve the adverse effects, a Memorandum of Agreement (MOA) or a Programmatic Agreement (PA) will be prepared in consultation with the AHCP, Washington DAHP, and the CTCR THPO to stipulate measures to minimize or mitigate the effects to the NRHP-eligible Grand Coulee Dam Historic District and to identify categories of undertakings that may be exempted from further review under the appropriate provisions of 36 CFR 800. Appendix C will include a copy of the MOA or PA. Resolution of the adverse effect through an MOA, or execution of a PA, would result in no significant or minor impact for NEPA.
3.3.4 Cumulative Impacts

3.3.4.1 Alternative A– No Action
There would be no impacts to cultural resources under the No Action alternative, so there would be no contribution to cumulative effects to cultural resources under Alternative A.

3.3.4.2 Alternative B (Grand Coulee G1-G18 Modernization and Overhaul – Work on Two Units at a time) and C (Grand Coulee G1-G18 Modernization and Overhaul – Work on One Unit at a time)
Because of the adverse effect resulting from replacement of the six G1-G6 floor-mounted exciters, five bridge cranes and four gantry cranes, the build alternatives would contribute to cumulative impacts to cultural resources. Reclamation is completing two other large overhaul projects within the Grand Coulee Dam Historic District: the TPP Overhaul (FONSI issued April 2010) and the John W. Keys III Pump-Generating Plant Modernization Project (FONSI issued March 2012). Both of these projects were reviewed under Section 106 of the NHPA, which culminated in agreements to mitigate for adverse effects to historic properties. The work being completed is primarily replacement of equipment rather than structural modifications that alter the engineering layout of the facility. Heavy use necessitates the eventual replacement of hydroelectric equipment; therefore, when viewed collectively, the multiple overhaul projects would not have a significant cumulative impact.

There will likely be more maintenance and repair required to this property that could contribute to cumulative impacts; the impacts from the repair and maintenance of the property do not constitute a significant cumulative impact. There would be a beneficial impact to the Grand Coulee Dam Historic District because the property will remain in place and the repairs as part of the Project will ensure its continuity of use.

3.4 Environmental Justice

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” dated February 11, 1994, requires agencies to identify and address disproportionately high and adverse human health or environmental effects of their actions on minorities and low-income populations and communities, as well as the equity of the distribution of the benefits and risks. Environmental Justice addresses the fair treatment of people of all races and incomes with respect to actions affecting the environment. Fair treatment implies that no group should bear a disproportionate share of negative impacts.

3.4.1 Affected Environment
The area around Grand Coulee Dam and its reservoir, Lake Roosevelt, is located in Douglas, Ferry, Grant, Lincoln, and Okanogan counties. These counties were selected as the local study area. Table 4 provides the numbers and percentages of population in 2009 for seven racial categories (White, Black or African American,
The proportion of American Indians within the local study area is more than three times greater than the state of Washington, largely as a result of the presence of the CTCR within the study area and the nearby STOI Reservation. Conversely, the proportion of persons who are Asian or Black or African American is substantially less than for the State of Washington. While the Total Racial Minority Population of the five-county study area, at 8.4 percent, also is less than the state’s percentage of 15.6, the Hispanic or Latino representation within the study area is nearly three times greater than the state, at 27.2 percent and 9.6 percent, respectively.

Low-income populations are identified by several socioeconomic characteristics. As categorized by the 2000 Census, specific characteristics include income (median family and per capita), percentage of the population below poverty (families and individuals), unemployment rates, and substandard housing. Table 5 provides income, poverty, unemployment, and housing information for each county and the state for the year 2000 (U.S. Census Bureau 2010b).

Median family income and per capita income for the five counties are less than the state. Compared to the state of Washington, the study area has greater percentages of families and individuals below the poverty level.

Other demographic data, such as unemployment and substandard housing, also serve as indicators of low income in relation to environmental justice. In 2009, unemployment in three of the five counties was greater than the state’s 7.0 percent unemployment rate. Douglas County’s unemployment rate matched the state’s at 7.0 percent, while Lincoln County’s unemployment rate was a relatively low 4.5 percent.

Substandard housing units are typically identified as being overcrowded and/or lacking complete plumbing facilities. The percentage of occupied housing units with 1.01 or more occupants per room was greater in four of the five study area counties than the 2.4 percent for the state; Ferry County’s 1.5 percent was notably less than the state percentage. The percentage of housing units lacking complete plumbing facilities in the study area was less than the state percentage of 0.5 percent in both Douglas and Grant counties.

3.4.2 Environmental Consequences

3.4.2.1 Significance Criteria

Environmental justice analysis evaluates the effects of potential adverse environmental impacts on natural resources (and associated human health impacts) and socioeconomic impacts to identify and describe disproportionate adverse effects to minority and/or low-income populations. Environmental justice impacts would be considered significant if the Project results in disproportionate adverse impacts to minority and/or low-income populations.
3.4.2.2 *Alternative A - No Action Alternative*

No adverse natural resource or socioeconomic impacts adversely affecting minority and low-income populations have been identified for the No Action Alternative; therefore, there are no environmental justice impacts.
Table 4. Race and Ethnicity

<table>
<thead>
<tr>
<th>Category</th>
<th>Douglas County</th>
<th>Ferry County</th>
<th>Grant County</th>
<th>Lincoln County</th>
<th>Okanogan County</th>
<th>Total Study Area</th>
<th>State of Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
</tr>
<tr>
<td>Total Population</td>
<td>37,565</td>
<td>—</td>
<td>7,520</td>
<td>—</td>
<td>88,098</td>
<td>—</td>
<td>10,248</td>
</tr>
<tr>
<td>White</td>
<td>35,446</td>
<td>94.4</td>
<td>5,902</td>
<td>78.5</td>
<td>83,034</td>
<td>94.3</td>
<td>9,735</td>
</tr>
<tr>
<td>Black or African American</td>
<td>382</td>
<td>1.0</td>
<td>17</td>
<td>0.2</td>
<td>1,147</td>
<td>1.3</td>
<td>28</td>
</tr>
<tr>
<td>American Indian and Alaska Native</td>
<td>713</td>
<td>1.9</td>
<td>1,319</td>
<td>17.5</td>
<td>1,482</td>
<td>1.7</td>
<td>262</td>
</tr>
<tr>
<td>Asian</td>
<td>371</td>
<td>1.0</td>
<td>23</td>
<td>0.3</td>
<td>1,079</td>
<td>1.2</td>
<td>30</td>
</tr>
<tr>
<td>Native Hawaiian and Other Pacific Islander</td>
<td>72</td>
<td>0.2</td>
<td>7</td>
<td>0.1</td>
<td>98</td>
<td>0.1</td>
<td>7</td>
</tr>
<tr>
<td>Population of two or more races</td>
<td>581</td>
<td>1.5</td>
<td>252</td>
<td>3.4</td>
<td>1,258</td>
<td>1.4</td>
<td>186</td>
</tr>
<tr>
<td>Total Racial Minority Population</td>
<td>2,119</td>
<td>5.6</td>
<td>1,618</td>
<td>21.5</td>
<td>5,064</td>
<td>5.7</td>
<td>513</td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>27,507</td>
<td>73.2</td>
<td>7,257</td>
<td>96.5</td>
<td>55,694</td>
<td>63.2</td>
<td>9,946</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>10,058</td>
<td>26.8</td>
<td>263</td>
<td>3.5</td>
<td>32,404</td>
<td>36.8</td>
<td>302</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau 2010a

Table 5. Income, Poverty, Unemployment, and Housing

<table>
<thead>
<tr>
<th>Category</th>
<th>Douglas County</th>
<th>Ferry County</th>
<th>Grant County</th>
<th>Lincoln County</th>
<th>Okanogan County</th>
<th>Total Study Area</th>
<th>State of Washington</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median Family Income</td>
<td>$55,363</td>
<td>$43,529</td>
<td>$48,907</td>
<td>$50,899</td>
<td>$48,159</td>
<td>$68,457</td>
<td></td>
</tr>
<tr>
<td>Per Capita Income</td>
<td>$22,622</td>
<td>$26,283</td>
<td>$19,205</td>
<td>$24,127</td>
<td>$19,367</td>
<td>$29,320</td>
<td></td>
</tr>
<tr>
<td>Percent Below Poverty Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Families</td>
<td>12.0</td>
<td>12.0</td>
<td>14.4</td>
<td>8.1</td>
<td>14.2</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>Individuals</td>
<td>14.3</td>
<td>19.1</td>
<td>19.0</td>
<td>12.6</td>
<td>19.6</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td>Percent Unemployed</td>
<td>7.0</td>
<td>15.0</td>
<td>10.2</td>
<td>4.5</td>
<td>8.7</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>Percent of Housing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.01 or More Occupants per Room</td>
<td>5.6</td>
<td>1.5</td>
<td>7.8</td>
<td>2.6</td>
<td>2.9</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>Lacking Complete Plumbing Facilities</td>
<td>0.4</td>
<td>2.3</td>
<td>0.1</td>
<td>1.2</td>
<td>0.8</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau 2010a
3.4.2.3 Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time

Alternative B would likely result in new jobs at any one time during the time period necessary for modernization. Some portion of these jobs likely would be filled by persons coming into the study area from outside, although the number cannot be reliably estimated. While we cannot say for certain, we assume that some of the new persons coming into the area for the Project may rent property, hotel rooms, camp, or stay in nearby RV parks for extended periods of time or for work days.

In terms of available housing in the area, research conducted for previous construction-related projects at Grand Coulee confirmed anecdotal information that there are many factors at the local and regional levels that influence the demand, supply, and cost of rental and owner-occupied housing. The existing demand for rental housing in the Project area is generally considered to be high relative to the currently available supply, and Alternative B would be expected to contribute to that demand; however, it is not reasonably foreseeable that this would result in adverse impacts that could disproportionately affect minority or low-income populations.

3.4.2.4 Alternative C - Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time

Environmental consequences for Alternative C would be the same as Alternative B.

3.4.3 Mitigation

None identified for any of the alternatives.

3.4.4 Cumulative Impacts

The Project and other attractants to persons moving into or remaining within the Project vicinity and study area would contribute to the demand for housing and could influence upward pressure on the cost of housing to some small degree; however, this is not expected to create an environmental justice impact when considered with the other related actions.

3.5 Indian Sacred Sites

Executive Order 13007, signed by President Clinton on May 24, 1996, defines a sacred site as:

Any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site [E.O. 13007, Section 1 (b) (iii)].
3.5 Indian Sacred Sites

3.5.1 Affected Environment
The Grand Coulee Dam sits within the traditional territory of the Nespelem Tribe. The Nespelem are one of 12 federally recognized tribes who are incorporated as the CTCR. The Sanpoil and the Moses-Columbia, also incorporated as part of the CTCR, occupied adjacent traditional territories to the east and south of the Project.

The CTCR have not specifically identified any sacred sites within the immediate vicinity of the proposed project area. A number of locations with traditional Indian place names and traditional cultural value are present in the general area of Grand Coulee Dam, but the CTCR have not specifically identified these sites as having established religious significance or ceremonial use.

Members of the CTCR often generally recognize that many aspects of the natural environment should be considered sacred, including water, land, air, and various plant and animal species. In their Cultural Resources Management Plan (CTCR 2006), the CTCR group sacred sites with traditional cultural properties and properties of traditional religious and cultural importance to tribes.

Local landforms with Salish place-names are associated with stories and legends that remain important to the cultural continuity of the CTCR and other regional tribes. In addition to living near the Columbia River and fishing its waters, tribal members traditionally exploited root crops in the wetlands and traversed the river bottom and the rocky slopes above the river channel for a variety of other resources. Stacked rock cairns and rock art panels present on rocky slopes surrounding the Grand Coulee Dam denote places where tribal members have sought, and still seek, spiritual power (George, 2003).

3.5.1.1 Tribal Consultation and Coordination
The CTCR and STOI were contacted in preparation of this EA. The Chairs of the STOI and the CTCR, as well as appropriate Bureau of Indian Affairs officials, were sent scoping letters (Appendix A) to inform the tribes and solicit comments relative to ITAs and other issues. CTCR and STOI both replied with formal public scoping comment letters (Appendix A).

3.5.2 Environmental Consequences
3.5.2.1 Significance Criteria
Any alternative adversely affecting Indian sacred sites would be considered a significant impact.

3.5.2.2 No Action Alternative
There are no impacts to Indian sacred sites from the No Action Alternative.

3.5.2.3 Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time
Based upon the review of existing information and consultations with the CTCR THPO, implementation of Alternative B would not result in direct or indirect impacts to sacred sites.
3.5.2.4 Alternative C - Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time

Based upon the review of existing information and consultations with the CTCR THPO, implementation of Alternative C would not result in direct or indirect impacts to sacred sites.

3.5.3 Mitigation

There is no mitigation required for implementation of any alternative.

3.5.4 Cumulative Impacts

There are no impacts from implementation of the action alternatives. Therefore, there are no cumulative impacts when considered with the other related actions.

3.6 Indian Trust Assets

ITAs are legal interests in property held in trust by the U.S. for federally recognized Indian Tribes or individual Indians. ITAs may include land, minerals, federally reserved hunting and fishing rights, federally reserved water rights, and instream flows associated with trust land. The General Allotment Act of 1887 allotted land to some Tribes, while others were allotted land through treaty or specific legislation until 1934 when further allotments were prohibited. These allotments are considered ITAs.

3.6.1 Affected Environment

Federally recognized Indian Tribes with trust land are beneficiaries of the Indian trust relationship with the U.S. acting as trustee. No one can sell, lease, or otherwise encumber ITAs without approval of the U.S. Government. While the majority of ITAs are located on-reservation, ITAs can also occur outside reservation boundaries. Consequently, two Tribes have a historical presence or cultural interest in the larger project area. These include the CTCR and the STOI.

As stated in the 1994 memorandum, Government-to-Government Relations with Native American Tribal Governments, Reclamation is responsible for the assessment of project effects on Tribal trust resources and federally recognized Tribal Governments. Reclamation is tasked to actively engage and consult federally recognized Tribal Governments on a Government-to-Government level when its actions affect ITAs.

The Interior Manual Part 512.2 delegates the responsibility for ensuring protection of ITAs to the heads of bureaus and offices (Interior 1995). The Interior is required to “protect and preserve ITAs from loss, damage, unlawful alienation, waste, and depletion” (Interior 2000). Reclamation is responsible for determining if a proposed project has a potential to affect ITAs.
3.6.2 Environmental Consequences

3.6.2.1 Significance Criteria
Any alternative adversely affecting ITAs would be considered a significant impact.

3.6.2.2 No Action Alternative
There are no impacts to ITAs from the No Action Alternative.

3.6.2.3 Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time
No ITAs have been identified in the Project area. Alternative B would not have direct or indirect impacts to ITAs since Project impacts are limited to Coulee Dam and surrounding Project areas. Laydown yards located near the dam are also located within the existing footprint of dam facilities.

3.6.2.4 Alternative C - Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time
No ITAs have been identified in the Project area. Alternative C would not have direct or indirect impacts to ITAs since Project impacts are limited to Coulee Dam and surrounding project areas. Laydown yards located near the dam are also located within the existing footprint of dam facilities.

3.6.3 Mitigation
There is no mitigation required for any alternative.

3.6.4 Cumulative Impacts
There are no impacts from implementation of the action alternatives. Therefore, there are no cumulative impacts when considered with the other related actions.

3.7 Transportation

3.7.1 Affected Environment
3.7.1.1 Access
Grand Coulee Dam is located on the Columbia River north of the City of Grand Coulee and south of the Town of Coulee Dam in Grant and Okanogan counties in north-central Washington State, approximately 90 miles west of Spokane and 230 miles east of Seattle. As shown in Figure 3, access to and from the Grand Coulee Dam area is provided by Interstate Highway 90, US Highway 2 and SRs 17, 21, 174, 283/28, and 155. Direct access to Grand Coulee Dam and the powerhouses is provided by Reclamation roads via SR 155.
In the vicinity of the dam, SR 155 generally provides one travel lane in each direction and is classified by the Washington State Department of Transportation (WSDOT) as a minor arterial. From its intersection with SR 174 in west Grand Coulee, the highway heads northeast, through town, past Grand Coulee Dam and the Grand Coulee Dam Visitor Center. SR 155 provides three travel lanes in the vicinity of the Visitor Center and extending uphill beyond the dam crest, with the added third lane providing for southbound travel through the grade ascent. The road continues through west Coulee Dam, crossing the Columbia River on the Columbia River Bridge about 1/2 mile downstream of the dam to east Coulee Dam, then through Nespelem to its terminus in Omak.

SR 155 crosses the Columbia River Bridge on the downstream side of Grand Coulee Dam, connecting Grant County to the south with Okanagan County to the north. It provides the only Columbia River crossing between SR 17 in Bridgeport, approximately 30 miles to the west, and Keller Ferry, serving SR 21 about 10 miles to the east. It is also used by vehicles to access SR 174 and the local communities of Coulee Dam, Grand Coulee, Elmer City, and Electric City. The main attractions on the east side of the bridge are the Coulee Dam Casino (Cervine 2016) and where the public tours of the Grand Coulee Dam begin at the Tour Building.

Average daily traffic volumes on SR 155 in the vicinity of the dam are shown in Table 6.
Table 6. Average daily two-way traffic - State Route 155, Coulee Dam

<table>
<thead>
<tr>
<th>State Route</th>
<th>Milepost</th>
<th>Location</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>155</td>
<td>25.73</td>
<td>East of Junction SR 174 (after Junction SR 174 Wye Conn)</td>
<td>5,200a</td>
<td>5,300</td>
<td>5,500</td>
<td>5,100a</td>
</tr>
<tr>
<td>155</td>
<td>28.05</td>
<td>Southern entrance to the City of Coulee Dam (after Junction Grant Ave)</td>
<td>5,200</td>
<td>4,800a</td>
<td>4,900</td>
<td>5,000</td>
</tr>
</tbody>
</table>

Note:

*a Based on Actual Count Data

Source: WSDOT 2015

Vehicles crossing the bridge are limited to 20,000 pounds per axle. The bridge provides one lane in each direction and has a restricted height of 14 feet, 3 inches. The road turns 90 degrees at the western approach, which has a yellow flashing signal and a posted 15-mile-per-hour speed limit.

Traffic becomes congested on the east and west approaches to the bridge when large trucks are crossing. The bridge provides access between portions of the Grand Coulee Powerplant complex on the opposite side of the river via Roosevelt Way in east Coulee Dam and SR 155.

Access to the Reclamation road across Grand Coulee Dam is located off SR 155 between the city of Grand Coulee and the town of Coulee Dam. This road, located atop the dam, served as SR 155 prior to 2001 when it was closed for public access as a result of security concerns. This road is still used by Reclamation for local access (Snively 2016).

3.7.1.2 Existing Traffic

The Grand Coulee Dam, Visitor Center, and tours are popular tourist attractions. An average of about 225,000 people in an estimated 64,000 vehicles visited the dam during the 2016 fiscal year. Peak visitation occurs in July each year; in 2016, the daily July peak was 2,356 visitors and 673 vehicles (Snively 2016). The Visitor Center is open daily (except New Year’s Day, Thanksgiving, and Christmas) from 9:00 a.m. to 5:00 p.m., with extended hours between Memorial Day and September 30. A laser light show is presented nightly starting the Saturday of Memorial Day weekend through September 30. The 36-minute show, shown on the face of the dam and the powerhouses, is viewable from many locations in the downstream area and attracts large numbers of viewers each night. The only periods with notable traffic jams are July 4, as a result of the laser light show and fireworks, and possibly Labor Day Weekend. Traffic-generating tourist attractions include dam tours, the Visitor Center, and the laser show (Hall 2016).
Presently, approximately 500 Reclamation employees work at Grand Coulee Dam, associated facilities, offices, and the powerhouses. Numerous contractors also work at these facilities, many of whom stay in local hotels, campgrounds, and rentals. Most Reclamation employees and contractors commute from Coulee Dam, Grand Coulee and Electric City, or from the surrounding communities of Elmer City, Wilbur, Bridgeport, Nespelem, Almira, Hartline, Davenport, and Coulee City (Snavely 2016).

Grant County Transit provides 18-seat commuter transit service via the Route 59 bus between the dam and Moses Lake on SR 155 with one AM and one PM trip daily. Numerous vanpools are used by Reclamation employees to commute between Moses Lake, Spokane, and other communities. The Interior also subsidizes bicycle commuting to entice employees to reduce their carbon footprint (Snavely 2016).

Existing seasonal peak hour traffic volumes are handled adequately during three shift changes without significant congestion. A brief pulse of traffic occurs daily between 4:00 p.m. and 5:00 p.m. when workers depart the powerhouses heading southbound across the river and up the hill. The existing traffic patterns associated with the current operation of Grand Coulee Dam and powerhouses are considered to be the local norm (Hall 2016).

### 3.7.1.3 Parking

Surface parking lots are located at each powerhouse and at the administrative area for Reclamation employees and contractors. Parking at the LPH is constrained by the geography of the site, so there is limited surplus parking capacity in this area.

### 3.7.1.4 Safety

In support of this analysis, WSDOT provided a history of officer-reported crashes that occurred at, or in the vicinity of, the following intersections near the City of Coulee Dam and the counties of Douglas, Grant, and Okanogan for the period of January 1, 2011 through December 31, 2015.

- Federal Reserve Rd (aka SR 155) @ Lincoln Ave
- SR 155 (milepost 28.04 – 28.07) @ Grant Ave
- SR 155 (milepost 28.12 – 28.16) @ Douglas Ave
- SR 155 (milepost 28.23 – 28.27) @ Columbia Ave
- SR 155 (milepost 28.47 – 28.51) @ Roosevelt Way

Review of crash data provided by WSDOT indicates that, during this time period, there are very few crashes at these intersections. Table 7 provides a summary of the reported crashes.
### Table 7. Intersection Crash Data Summary

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Date</th>
<th>Description</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 155 @ Lincoln Ave.</td>
<td>8/12</td>
<td>Hit Fixed Object</td>
<td>Injury</td>
</tr>
<tr>
<td>SR 155 @ Grant Ave.</td>
<td>1/12</td>
<td>Ran Off Road (DUI)</td>
<td>Injury</td>
</tr>
<tr>
<td></td>
<td>8/12</td>
<td>Hit Fixed Object</td>
<td>PDO</td>
</tr>
<tr>
<td></td>
<td>7/14</td>
<td>Hit Bicycle</td>
<td>Injury</td>
</tr>
<tr>
<td>SR 155 @ Roosevelt Way</td>
<td>3/11</td>
<td>Hit Fixed Object</td>
<td>PDO</td>
</tr>
<tr>
<td></td>
<td>1/13</td>
<td>Left Turning, Hit Oncoming Vehicle</td>
<td>Injury</td>
</tr>
<tr>
<td></td>
<td>5/15</td>
<td>Lost Control of Motorcycle</td>
<td>Injury</td>
</tr>
<tr>
<td>SR 155 @ Douglas Ave</td>
<td>No reported crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR 155 @ Douglas Ave</td>
<td>No reported crashes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
PDO = property damage only
Source: WSDOT 2016

As indicated in Table 7, there were a total of seven crashes at these intersections over the 5-year time period. The intersections of SR 155 with Grant Avenue and Roosevelt Way had three each, while the intersection of SR 155 with Lincoln Avenue had one. There were no reported crashes at the intersections of SR 155 with Douglas and Columbia Avenues. Although sufficient traffic data to calculate a crash rate is not available, none of these intersections are anticipated to have a crash rate that would approach a threshold for a high accident location (one crash per million entering vehicles).

### 3.7.2 Environmental Consequences

#### 3.7.2.1 Significance Criteria

Potential adverse transportation impacts could be associated with implementation of the No Action and Action alternatives. A qualitative assessment of traffic impacts was performed, based on the construction procedures and equipment that would be used, review of existing conditions, and traffic levels on key roadways. Transportation impacts would be considered significant if construction or operation of the alternative caused substantial increases in traffic or disruption of existing vehicular traffic.

#### 3.7.2.2 No Action Alternative

Under the No Action alternative, Reclamation would continue operating the G1-G18 generating units with no system improvements. This would likely increase the need for maintenance, resulting in greater repair costs and longer production outages. Repair costs and time needed to obtain replacement parts would continue to increase based on the aging technology and scarcity of replacement parts. The timing and duration of future maintenance periods would depend on the nature of
the problems to be resolved. Maintenance would be performed by existing Reclamation employees or contractors, as necessary.

Parking demand at the LPH may exceed supply during some maintenance tasks, requiring contractors to coordinate with Reclamation regarding alternative access methods such as ride sharing from other parking lots or temporary use of visitor parking during low visitation periods.

It is estimated that the potential onsite contractor workforce would likely range from 20 to 30 workers per day during maintenance activities. Assuming that there is no ride sharing, this increase in workers would likely result in an additional 20 to 30 daily peak hour vehicle trips to and from the site. This would result in an estimated increase of about 0.4 percent to 0.6 percent in the average daily two-way traffic on SR 155 between the entrance to the Town of Coulee Dam (mile marker 28.04) and the junction of SR 155 and SR 174 (mile marker 25.73). No adverse workforce-related traffic impacts have occurred from similar numbers of additional workers in the past, and none would be expected under this alternative.

Routine deliveries of maintenance-related materials and equipment would use existing roadways and be unlikely to cause adverse traffic impacts.

No significant changes to access, traffic, parking, or safety would result from maintenance activities related to this alternative.

3.7.2.3 Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time

Under Alternative B, Reclamation would overhaul and modernize the 18 generating units during a 12-year construction window beginning in 2018 and ending in approximately 2029. During this timeframe, transportation would be minimally impacted by additional vehicular trips generated by construction workers commuting to and from the powerhouses and deliveries of supplies, temporary bridge closures, and an increased demand for parking.

Access
As a whole, site access would not be impacted by the Project. However, the contractor may request that oversize loads be transported across the Columbia River Bridge for deliveries to the powerhouses. If this were to occur, the limited lane width on this bridge could result in the bridge being temporarily closed to general traffic for brief durations. If the contractor were to request a bridge closure, he would be required to provide a traffic control plan, which will need to be submitted to WSDOT for approval.

Except for periods of cold weather when road traction is a concern, the dam could be used as an alternative roadway to transport large, heavy loads that would temporarily close the bridge to general purpose traffic or would exceed the bridge load limits. Because of the limited frequency and duration of temporary bridge closures, the implementation of WSDOT-approved traffic control plans and the use
of the dam as an alternative haul route, Alternative B should result in only negligible access impacts.

Traffic
Reclamation estimates this work would result in 63 additional workers (contractor employees) on the Project site from 6:30 a.m. to 4:30 p.m. Monday through Thursday. Assuming a worst-case scenario, (no ride sharing), this would result in 63 additional daily peak hour vehicle trips to and from the temporary parking lot, an increase of about 1.2 percent in the average daily two-way traffic on SR 155 between the entrance to the town of Coulee Dam (mile marker 28.04) and the junction of SR 155 and SR 174 (mile marker 25.73). In addition, there would also be some shuttle trips transporting workers to and from the LPH. No adverse workforce-related traffic impacts have occurred from similar numbers of additional workers and associated increases in vehicle trips in the past, and none would be expected for this alternative.

Supplies for the Project will be delivered by truck via SR 155 and 174. The nearest rail depot is approximately 28 miles southwest near Coulee City. Delivery truck traffic will increase slightly during the Project, but not enough to generate more than negligible impacts on local traffic.

Parking
Parking is constrained at the LPH as a result of a small surface lot. To address this constraint, Reclamation will provide a temporary parking lot north of the powerhouses (see Figure 2 for location of this Parking Area, shown in green). Contractors will need to arrange shuttles from the temporary parking lot to the LPH. Additional parking could be provided at Reclamation’s construction office location or at the south end of the visitor’s lots. By providing temporary parking for contractors, the Project will not decrease public or employee parking capacity.

Safety
Anticipated minor changes in transportation patterns and minor traffic volume increases resulting from this alternative are not expected to result in increased risk of vehicular collisions in the vicinity of the Project. To prevent temporary restrictions to access by emergency response vehicles by construction or transport of oversized loads, prior arrangements would be made with the fire department as necessary.
### 3.7.2.4 Alternative C - Grand Coulee G1 Through G18 Modernization and Overhaul – Work on One Unit at a time

This alternative would be similar to Alternative B, but with a longer construction timeframe. Rather than completing work on two units at a time, work would only occur on one unit at a time, adding an estimated 6 to 7 years to the Project duration (Denton 2017c). Depending on speed of completion, Reclamation anticipates the construction portion of the Project to occur from 2018 to 2035 or 2036. The impacts on transportation under Alternative C would be slightly less than described under Alternative B, but with a longer duration.

#### Access

As with Alternative B, frequency and duration of bridge closures would depend on factors such as sequencing of contractor deliveries, the capacity of each load, and the amount of each expedited order. However, bridge closures will likely be less frequent than under Alternative B. As indicated in the discussion for Alternative B, WSDOT-approved traffic control plans and potential use of the dam for deliveries will help minimize access impacts.

#### Traffic

Alternative C would require fewer workers (contractor employees) than Alternative B on the Project site from 6:30 a.m. to 4:30 p.m. Monday through Thursday. This relatively minor addition to the local workforce will result in a correspondingly minor increase to local traffic. Deliveries of supplies will be less frequent than under Alternative B but will occur for a longer duration.

#### Parking

Temporary parking for contractor vehicles will be provided in designated locations and contractors will need to arrange shuttles from the provided staging/parking areas to the LPH similar to Alternative B. The temporary parking facilities may not need to be as large as under Alternative B as a result of the anticipated smaller workforce.

#### Safety

As with Alternative B, minor changes in transportation patterns and traffic volume increases resulting from this alternative are not expected to result in increased risk of vehicular collisions in the vicinity of the Project. Prior arrangements would be made with the fire department as necessary in the event of temporary access restrictions resulting from construction or transport of oversized loads.

### 3.7.3 Mitigation

#### 3.7.3.1 Alternative A - No Action

No mitigation is required.
3.7.3.2 Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time

Provision of temporary contractor parking facilities and compliance with the contract specifications and federal and state requirements for transport of oversize loads would ensure there are no significant adverse transportation impacts. Safety would be optimized by advance coordination with emergency service providers during transport of oversize loads. No mitigation would be needed for either of these alternatives.

3.7.3.3 Alternative C - Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time

Mitigation for Alternative C will be the same as for Alternative B.

3.7.4 Cumulative Impacts

Other projects identified in the Grand Coulee area include the TPP Overhaul, John W. Keys III Pump-Generating Plant Modernization Project, and construction of a new fire station. Construction traffic generated by the Preferred Alternative would add to that generated by these three projects. As shown on Table 8, the combined increase as the result of the TPP, John W. Keys III Pump-Generating Plant Modernization Project, and this Project is expected to be about 2.6 percent in the average daily two-way traffic on SR 155.

Table 8. Cumulative Trip Growth

<table>
<thead>
<tr>
<th>Project</th>
<th>Milepost 25.73</th>
<th>Milepost 28.04</th>
<th>Year</th>
<th>Trips</th>
<th>% Trip Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPP</td>
<td>5,100</td>
<td>5,300</td>
<td>2017</td>
<td>40</td>
<td>.8</td>
</tr>
<tr>
<td>John W. Keys III Pump-Generating Plant Modernization Project</td>
<td>5,700</td>
<td>5,400</td>
<td>2010</td>
<td>32</td>
<td>1.2</td>
</tr>
<tr>
<td>Fire Stationa</td>
<td>5,300</td>
<td>No data</td>
<td>2013</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>G1 – G18</td>
<td>5,100</td>
<td>5,000</td>
<td>2015</td>
<td>63</td>
<td>1.2</td>
</tr>
<tr>
<td>Cumulative Trip Growth</td>
<td></td>
<td></td>
<td></td>
<td>135</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Note:

a No data on construction trip estimates are included in the FONSI Final Environmental Assessment New Fire Station

Source: Reclamation 2015

As addressed in Section 3.1.2, the additional contract workers and deliveries associated with either alternative is expected to add a negligible number of vehicles to the cumulative traffic volumes in the vicinity of the dam, and all roadways are expected to operate in an acceptable manner. No cumulative effects related to access, traffic, parking, or safety are anticipated as a result of the Project alternatives.
3.8 Socioeconomics

The study area for potential socioeconomic impacts from the Project consists of the five-county region comprised Douglas, Ferry, Grant, Lincoln, and Okanogan counties in Washington State.

Data from the Washington State Office of Financial Management and the U.S. Census Bureau websites were used to describe the historical and current population in the study area. Data from the Washington State Employment Security Department were used to describe the study area’s historical and current employment and unemployment characteristics, and income by industry.

The IMPLAN model, a regional input-output economic model, was used to estimate the regional economic impacts resulting from changes in construction expenditures for the Project. The regional economic impact analysis considers both the initial or direct impact on the primary affected industries and the secondary impacts resulting from those industries that provide inputs to the directly affected primary industries. This analysis also includes the changes in economic activity stemming from household spending of income earned by those employed in the sectors of the economy affected either directly or indirectly. These secondary impacts are often referred to as multiplier effects.

3.8.1 Affected Environment

3.8.1.1 Population

The estimated population and the changes in the population in the study area, Washington State, and the U.S. are presented in Table 9. The population of the five-county study area has been increasing since 2000, with most of the population increases occurring in Grant and Douglas counties. The population of the study area has increased approximately 18 percent, from 164,000 to 194,000. The study area has experienced average growth rates similar to the state of Washington and slightly higher than the national average.

Table 9. Study Area Population

<table>
<thead>
<tr>
<th>Area</th>
<th>2000</th>
<th>2010</th>
<th>2015</th>
<th>Average Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2000 to 2010</td>
</tr>
<tr>
<td>Study Area</td>
<td></td>
<td></td>
<td></td>
<td>1.7%</td>
</tr>
<tr>
<td>Douglas</td>
<td>32,603</td>
<td>38,431</td>
<td>39,990</td>
<td></td>
</tr>
<tr>
<td>Ferry</td>
<td>7,260</td>
<td>7,551</td>
<td>7,710</td>
<td>0.4%</td>
</tr>
<tr>
<td>Grant</td>
<td>74,698</td>
<td>89,120</td>
<td>93,930</td>
<td>1.8%</td>
</tr>
<tr>
<td>Lincoln</td>
<td>10,184</td>
<td>10,570</td>
<td>10,720</td>
<td>0.4%</td>
</tr>
<tr>
<td>Okanogan</td>
<td>39,564</td>
<td>41,120</td>
<td>41,860</td>
<td>0.4%</td>
</tr>
<tr>
<td>Study Area Total</td>
<td>164,309</td>
<td>186,792</td>
<td>194,210</td>
<td>1.3%</td>
</tr>
<tr>
<td>WA State</td>
<td>5,894,143</td>
<td>6,724,540</td>
<td>7,061,410</td>
<td>1.3%</td>
</tr>
<tr>
<td>United States</td>
<td>282,162,411</td>
<td>309,346,863</td>
<td>321,418,820</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

### 3.8 Socioeconomics

#### 3.8.1.2 Employment

Figure 4 displays average employment by industry for study area. In 2002, an estimated 59,000 people were employed in the five-county study area. By 2015, average annual employment increased approximately 23 percent to nearly 73,000. Employment in the study area is concentrated in the agricultural, forestry, fishing, and hunting sector as well as local, state, and county government. These two sectors account for approximately 51 percent of jobs in the study area. Retail trade, manufacturing, health care, and accommodation and food services are also growing industries, accounting for a combined 31 percent of total employment.

![Figure 4. Study Area Covered Employment, 2002 and 2015](image)


#### 3.8.1.3 Unemployment

Unemployment rate trends for the five-county study area, Washington State, and the U.S. are shown in Figure 5. In general, the study area’s unemployment rate has trended higher than the state’s average, and has experienced greater volatility. From 1990 to 2001, the study area has experienced an unemployment rate between two to three points more than the state. Starting in 2001, the study area’s unemployment rate has been less than 2 points below the state average; it equaled the state average in 2009. With the national economic recession from 2007 to 2009, unemployment rose in the study area, the state, and the nation. Since 2010, the unemployment rate for the study area has declined each year from a high of 10.7 percent in 2010 to 6.9 percent in 2015.
3.8 Socioeconomics

Figure 5. Unemployment Rate for Study Area, Washington State and the U.S., 1990-2015


3.8.1.4 Payroll by Industry

Table 10 presents the taxable wages by industry in the study area. Covered payroll is the total wages and taxable wages from quarterly unemployment tax forms filed by employers in the study area. The government sector generates the largest portion of payroll in the region (32.5 percent of total regional payroll). The next largest sector is related to agriculture, forestry, fish, and hunting (19.1 percent of total payroll). Ranking third is the manufacturing sector (11.8 percent of total payroll).
Table 10. Study Area Covered Payroll by Industry, 2015

<table>
<thead>
<tr>
<th>Industry</th>
<th>Covered Payroll, 2015 (millions)</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, forestry, fishing and hunting</td>
<td>$479.1</td>
<td>19.1%</td>
</tr>
<tr>
<td>Mining</td>
<td>$0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Utilities</td>
<td>$0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Construction</td>
<td>$99.5</td>
<td>4.0%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>$296.3</td>
<td>11.8%</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>$130.6</td>
<td>5.2%</td>
</tr>
<tr>
<td>Retail trade</td>
<td>$185.5</td>
<td>7.4%</td>
</tr>
<tr>
<td>Transportation and warehousing</td>
<td>$57.7</td>
<td>2.3%</td>
</tr>
<tr>
<td>Information</td>
<td>$26.8</td>
<td>1.1%</td>
</tr>
<tr>
<td>Finance and insurance</td>
<td>$38.2</td>
<td>1.5%</td>
</tr>
<tr>
<td>Real estate and rental and leasing</td>
<td>$14.8</td>
<td>0.6%</td>
</tr>
<tr>
<td>Professional and technical services</td>
<td>$58.9</td>
<td>2.3%</td>
</tr>
<tr>
<td>Management of companies and enterprises</td>
<td>$1.3</td>
<td>0.1%</td>
</tr>
<tr>
<td>Administrative and waste services</td>
<td>$40.8</td>
<td>1.6%</td>
</tr>
<tr>
<td>Educational services</td>
<td>$2.1</td>
<td>0.1%</td>
</tr>
<tr>
<td>Health care and social assistance</td>
<td>$163.1</td>
<td>6.5%</td>
</tr>
<tr>
<td>Arts, entertainment, and recreation</td>
<td>$14.9</td>
<td>0.6%</td>
</tr>
<tr>
<td>Accommodation and food services</td>
<td>$66.5</td>
<td>2.6%</td>
</tr>
<tr>
<td>Other services, except public administration</td>
<td>$20.3</td>
<td>0.8%</td>
</tr>
<tr>
<td>Government</td>
<td>$817.7</td>
<td>32.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,514.0</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>


3.8.2 Environmental Consequences

3.8.2.1 Significance Criteria

Changes in the socioeconomic resources resulting from changes in construction and operation were evaluated in terms of their direct impact on population, employment (labor force and unemployment rate), income, and overall economic development. The changes in the socioeconomic resources are a direct result of the changes in employment (number of workers during project construction) and income (measured as expenditures during project construction) in the study area.
In addition to the direct economic effects, the Project will also result in secondary (indirect and induced) economic effects. These economic effects include changes in characteristics such as regional employment and income. Secondary employment effects would include indirect employment resulting from the purchase of goods and services by firms involved with construction, and induced employment because of construction workers spending their income within the study area. In addition to these secondary employment impacts, construction activity will also result in indirect and induced incomes. The magnitudes of these economic effects depend on the initial changes in economic activity within the region (such as construction expenditures), the interactions within the regional economy, and the leakage of economic activity from this regional economy to the larger, surrounding economy. Economic linkages create multiplier effects in a regional economy as money is circulated by trade. Economic leakages reduce the multiplier effects in a regional economy.

The IMPLAN model was used to estimate the regional economic effects of construction-related expenditures for the Project is a widely used economic input-output model. The IMPLAN package includes 1) estimates of final demands and final payments for counties developed from government data; 2) a national average matrix of technical coefficients; 3) mathematical tools that help the user formulate a regional model; and 4) tools that allow the user to input more accurate data or add data refinement, conduct impact analyses, and generate reports.

Indirect and induced economic effects during construction were evaluated using an IMPLAN model of the five-county region and the 2015 IMPLAN county data. The Project construction costs were refined using assumptions on construction duration, construction cost split (between materials/equipment and labor), origin and size of labor force, and origin of construction materials. Because the IMPLAN model is an annual model that evaluates the regional economic effects of changes in local expenditures, it was necessary to identify which of the Project’s costs were on locally sourced material and labor inputs. As with any model, the accuracy of the results depends on the accuracy of the inputs. Cost estimates are preliminary and may change as engineering design is refined.

**Construction Costs**

Table 11 shows the total construction costs associated with the construction of alternatives B and C. The Project’s total design and construction cost is estimated to be $240 million for Alternatives B and C (in 2015 dollars) (Denton 2017a); of this, 30 percent is assumed to be the cost of materials while the remaining 70 percent is assumed to be construction payroll. Of the estimated cost on materials, 10 to 20 percent is assumed to be sourced locally (within the five-county region). The remaining 80 to 90 percent is assumed to be sourced from outside the study area. The Project anticipates that most of the construction workforce will come from outside the five-county region.
Construction of the Project is expected to take 12 years for Alternative B and 18 years for Alternative C. Because economic impacts are typically measured and reported in annual terms, Project costs were converted to average annual expenditures for the duration of the construction period. These annual estimates of the construction phase expenditures were used as input into the regional IMPLAN model to estimate the changes in regional annual employment and income during the construction phase of the Project.

The annual costs used to estimate the regional economic impacts associated with the construction of Alternative B and C are shown in Table 12. The costs in the first column under each alternative represent the average annual expenditures when local costs are assumed to be 10 percent of the total construction costs, and the costs in the second column represent the average annual expenditures when the local costs are assumed to be 20 percent of the total construction costs.

<table>
<thead>
<tr>
<th>Table 12. Average Annual Costs by Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local Costs</strong></td>
</tr>
<tr>
<td>Labor</td>
</tr>
<tr>
<td>Labor</td>
</tr>
<tr>
<td>Non-labor</td>
</tr>
<tr>
<td>Non-labor</td>
</tr>
</tbody>
</table>

Note:
Cost estimates are in 2015 dollars (Denton 2017c)

Source: Druliner 2017; Denton 2017a; Denton 2017b
The regional economic effects on employment and income in the five-county region were evaluated for Project construction for each alternative. Changes are shown relative to Existing Conditions and the No Action alternative. The direct employment estimates were derived using average prevailing wage for construction journeys of $40 an hour (Washington State Department of Labor and Industries 2017).

### 3.8.2.2 No Action Alternative

Under the No Action alternative, Reclamation would continue operating the G1-G18 generating units with no system improvements. This would likely increase the need for maintenance, resulting in greater repair costs and longer production outages. Repair costs and time needed to obtain replacement parts would continue to increase based on the aging technology and scarcity of replacement parts. The timing and duration of future maintenance periods would depend on the nature of the problems to be resolved. Maintenance would be performed by existing Reclamation employees or contractors, as necessary.

### 3.8.2.3 Alternative B– Grand Coulee G1-G18 Modernization and Overhaul – Work on Two Units at a time

#### Construction Impacts
The construction of the Project is expected to create approximately 60 direct employment opportunities. It is expected that a majority of these jobs would be performed by separate contractor workforces that would be onsite and in the community only for the duration of their specific work assignment. Many will use temporary housing in the area including motels, RV parks, and campgrounds. It is not expected that the tradesmen and workers would relocate their families to the temporary job location.

Table 13 demonstrates that in addition to the average annual direct employment of 7 to 14 full-time equivalent jobs (FTE), the construction phase of the Project would result in annual indirect and induced employment within the study area of 13 to 26 FTEs and 4 to 7 FTEs, respectively. The total annual construction employment in the five-county region is estimated to range from 24 to 47 FTEs.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Employment (FTEs)</th>
<th>Labor Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>7 to 14</td>
<td>$2,000,000 to $4,000,000</td>
</tr>
<tr>
<td>Indirect</td>
<td>13 to 26</td>
<td>$620,000 to $1,240,000</td>
</tr>
<tr>
<td>Induced</td>
<td>4 to 7</td>
<td>$138,000 to $275,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24 to 47</strong></td>
<td><strong>$2,758,000 to $5,515,000</strong></td>
</tr>
</tbody>
</table>

Note:
Cost estimates are in 2015 dollars (Denton 2017c)

Source: Druliner 2017; Denton 2017a; IMPLAN
As expected, the increase in regional employment would be accompanied by increased levels of income within the region (Table 13). Construction of the Project is expected to result in $2 to 4 million in annual direct income to the five-county region. The annual indirect income is estimated to range from $600,000 to $1.2 million while annual induced income is approximately $138,000 to $275,000.

The increase in employment and income from Project construction of Alternative B are minor compared to the study area’s total employment and incomes. When compared to the five-county region, construction of Alternative B will represent less than 0.3 percent of total employment and income.

**Tribal Employment Rights Ordinance**
Tribal Employment Rights Ordinances (TERO) extend Indian preference hiring to all construction projects on or near an Indian Reservation. A TERO program monitors and enforces employment and contracting rights of Indians and ensures their rights are protected and exerted. Portions of the work associated with the modernization and overhaul of the G1-G18 generating units would be located on or near the CTCR Reservation. The CTCR have enacted a TERO (Colville Tribal Law and Order Code, Title 10 Employment and Contracting Chapter 10-1 Tribal Employment Rights [CTCR 2009]) and other ordinances that may be applicable to this work. Tribal ordinances would be included among the laws, codes, and regulations covered by the Permits and Responsibilities clause of the Reclamation contract for the work. Reclamation’s contractor would be directed to contact the CTCR Tribal Employment Rights Office for information about these requirements. However, Reclamation’s Contracting Officer is not a party to enforcing Indian preference requirements; it is a matter solely between the Tribe and the contractor.

**Operational Impacts**
The impacts associated with the construction phase are temporary and, as such, different from the long-term effects associated with the operational phase of the Project. It would be expected that Reclamation employees would continue to reside at their current locations and no new jobs would directly result from the Project. No changes in population would be expected within the study area as a result of long-term operations of the Project. Maintenance would be performed by existing Reclamation employees or contractors, as necessary.

Operational impacts would consist of long-term effects and changes in the local economy from secondary expenditures of the Reclamation employees, such as at local eateries and gas stations; and from long-term effects associated with revenue from property taxes, payroll taxes, or income taxes. Either of the action alternatives would be expected to have long-term minor beneficial impacts associated with increased spending from secondary expenditures of Reclamation employees at local businesses. No changes to socioeconomic conditions would be expected within the study area.
3.8.2.4 Alternative C—Grand Coulee G1-G18 Modernization and Overhaul—Work on 1 Unit at a time

**Construction Impacts**

This alternative would be similar to Alternative B, but with a longer construction timeframe. Rather than completing work on two units at a time, work would only occur on one unit at a time, adding an estimated 6 to 7 years to the Project duration (Denton 2017c). Depending on speed of completion, Reclamation anticipates the construction portion of the Project to occur from 2018 to 2035 or 2036. The impacts on socioeconomics under Alternative C would be slightly less than described under Alternative B, but with a longer duration.

Similar to Alternative B, this alternative is expected to create approximately 60 direct employment opportunities. It is expected that a majority of these jobs would be performed by separate contractor workforces that would be onsite and in the community only for the duration of their specific work assignment. Many will use temporary housing in the area, including motels, RV parks, and campgrounds. It is not expected that the tradesmen and workers would relocate their families to the temporary job location.

Table 14 summarizes the annual construction phase employment and income effects of the Project, assuming a construction schedule of 18 years. In addition to the average annual direct employment of 6 to 11 FTEs, the construction phase of the Project would result in annual indirect and induced employment within the study area of 10 to 20 FTEs and 3 to 6 FTEs, respectively. The total annual construction employment in the five-county region is estimated to range from 19 to 37 FTEs.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Employment (FTEs)</th>
<th>Labor Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>6 to 11</td>
<td>$1,592,000 to $3,184,000</td>
</tr>
<tr>
<td>Indirect</td>
<td>10 to 20</td>
<td>$494,000 to $987,000</td>
</tr>
<tr>
<td>Induced</td>
<td>3 to 6</td>
<td>$109,000 to $219,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19 to 37</strong></td>
<td><strong>$2,195,000 to $4,390,000</strong></td>
</tr>
</tbody>
</table>

**Note:**

Cost estimates are in 2015 dollars (Denton 2017c).

**Source:** Druliner 2017; Denton 2017a; IMPLAN

As expected, the increase in regional employment would be accompanied by increased levels of income within the region (Table 14). Construction of the proposed project is expected to result in approximately $1.6 to $3.2 million in annual direct income to the five-county region. The annual indirect income is estimated to range from nearly $500,000 to $1.0 million while induced income is approximately $109,000 to $219,000.
The increase in employment and income from project construction of Alternative C is minor compared to the study area’s total employment and incomes and less than Alternative B. When compared to the five-county region, construction of Alternative C will represent less than 0.2 percent of total employment and income.

**Tribal Employment Rights Ordinance**
TERO information would be the same as Alternative B.

**Operational Impacts**
Economic impacts associated with the operation of Alternative C would be similar to Alternative B. Alternative C would likely have increased maintenance costs and longer production outages when compared to Alternative B as aging equipment would be in use for a longer period of time. The timing and duration of future maintenance periods would depend on the nature of the problems to be resolved. Maintenance would be performed by existing Reclamation employees or contractors, as necessary.

### 3.8.3 Mitigation
There was no mitigation identified for any of the alternatives.

### 3.8.4 Cumulative Impacts
Other projects identified in the Grand Coulee area include the TPP Overhaul, John W. Keys III Pump-Generating Plant Modernization Project, and construction of a new fire station. It is anticipated that the new fire station will be complete before the Project begins. Programmed maintenance, overhauls, and construction of the Project would be concurrent with activities at the TPP and John W. Keys III Pump-Generating Plant and would contribute to cumulative regional economic impacts. While these and other actions in the region would provide an important beneficial contribution to economic activity over a multi-year period, the cumulative regional economic effects of these actions would still be very small relative to the overall regional economy.

### 3.9 Climate Change
This section summarizes the existing climate of the Project area, projected climate changes, impacts of the Project on climate change, and impacts of climate change on the Project.

**Study and Analysis Methodology**
The primary source of information on the existing climate is the *Local Climate Data Summary for Coulee Dam 1 SW* (Cooperative Observer Program [COOP] ID 451767) from August 1, 1934 through June 9, 2016, based on daily NOAA COOP program data, provided by the Western Regional Climate Center (WRCC 2016).

Sources for projected climate changes include the *Columbia River Basin Climate Impact Assessment* (Reclamation 2016), Northwest Chapter of the 2014 *National*
Climate Assessment (Mote et al. 2014) and the report Climate Change in the Northwest (Dalton et al. 2013).

Because climate change is driven by global greenhouse gas (GHG) emissions, impact of the Project on climate change is discussed qualitatively as Project-related GHG net emissions increase and reduce. Guidance on inclusion of GHG emissions and climate change in the NEPA process (CEQ 2014) stress that, with regards to GHG and climate change analysis, the “EA or Environmental Impact Statement (EIS) should be proportionate to the effects of the Project.” The Council on Environmental Quality (CEQ) goes on to recommend a threshold of 25,000 metric tons of equivalent carbon dioxide (MT CO₂e) emissions per year “below which a GHG quantitative analysis is not warranted” (2014). State Environmental Policy Act (SEPA) guidance by Washington State Department of Ecology (Ecology) further breaks this 25,000-metric-ton-threshold down into common project elements for GHG screening (Ecology 2011).

3.9.1 Affected Environment

Temperature
Average daily temperatures at Grand Coulee range from a low of 20 degrees Fahrenheit (°F) and a high of 30°F in December to a low of 60°F and a high of 90°F in July. Extreme high temperatures can reach nearly 110°F in July, and below -10°F in December and January.

Regional mean annual temperatures in the northwest are expected to rise between 3.3°F and 9.7°F by the end of the century, depending on many factors, but especially total global GHG emissions (Mote et al. 2014). Temperature increases are expected to be highest in the summer and lowest in the winter (Dalton et al. 2013). Relative to the northwest region-wide average, the area around Grand Coulee is expected to see approximately average temperature increases. Extreme temperature events are expected to increase, with number of days above 90°F expected to increase by 8 days per year, number of days above 100°F expected to increase by 3 days per year, and the freeze-free period expected to increase by 35 days by the middle of the century.

With atmospheric temperatures rising, water temperatures of the Columbia River and Lake Roosevelt are also expected to rise, although not necessarily to the same extent as atmospheric temperatures. The volume and depth of Lake Roosevelt will buffer some changes, and will generally dampen increased inflow water temperature.

The generally warming climate would shift snow-dominant hydrographic regions to be more rain influenced and would shift summer runoff peaks associated with snowmelt to occur earlier in the year. Mean December-March runoff for the Columbia River above The Dalles is expected to increase 26 percent to 91 percent by the 2080s while mean April-July runoff is expected to change between -17 percent to +10 percent (Reclamation 2016). Because the Columbia River system
is regulated by numerous reservoirs upstream of Grand Coulee Dam, changes in system operation may dampen or exacerbate any changes to the natural hydrology caused by climate change.

**Precipitation**
Most of the facilities being evaluated are inside, and are not affected by precipitation and/or changes to precipitation at Grand Coulee. Outside project elements that are exposed to precipitation include replacement or modernization of four outside cranes. Rain and snow (especially intense precipitation events) may temporarily delay or otherwise impact outside construction activities.

Average total annual precipitation is 10.6 inches, with about 16 inches of snowfall (average over 1981 to 2010). December is generally the wettest month, with 1.4 inches average monthly precipitation; August is the driest month, with 0.4 inches average monthly precipitation.

Over the gage record (1934 to 2012), there are an average of 90 days each year with measurable (greater than 0.01 inches) of precipitation: 31 days in the winter, 24 in spring, 14 in summer, and 21 in fall. Annually there an average of 35 days with more than 0.1 inches of rain, and 3 days with more than 0.5 inches of rain.

While the winter months tend to have the highest occurrence of wet days, the late spring, summer, and early fall tend to have the most extreme precipitation events. The greatest measured one-day total was 2.31 inches measured on June 27, 1996. Extreme events greater than 1 inch in one day have occurred in all but the winter months (December, January, February); June (1996) is the only month with greater than 2 inches in one day.

Changes to precipitation in the Upper Columbia Basin may alter Columbia River hydrology. The changes to flow at The Dalles described in the Temperature section are a composite effect of both changes to basin-wide temperature and precipitation.

**Wind**
Because all of the facilities being evaluated are inside, wind and/or changes to wind at Grand Coulee will not affect the Project.

As a result of system complexity, changes in wind patterns because of climate change are uncertain (Mote et al. 2014) and are not considered in this report.

### 3.9.2 Environmental Consequences

#### 3.9.2.1 Significance Criteria
Impacts of the Project on climate change (GHG emissions) and of the changing climate on the Project were qualitatively evaluated.

Impacts to or from climate change would be considered significant if Project implementation is expected to contribute to damaging levels of GHG emissions or if
the ability of the Project to deliver adequate power supplies was diminished sufficiently to impact overall system operations.

3.9.2.2 No Action Alternative

Future operations through approximately 2060 to 2065 (the end of 30-year design life for Alternatives B and C) of the G1-G18 generating units with no system improvements are anticipated to require extensive and increasing maintenance, including replacing worn parts, and possible unit replacement in the case of unit failure. Units may be offline for extended periods for maintenance or replacement work.

Time offline would result in lost power generation, requiring other sources of power within the overall regional electrical grid. These other sources may have higher GHG emissions than the hydropower that would have been generated by G1-G18. Projected time offline is unknown. SEPA guidance by Ecology (2011) assigns 0.41 MT CO₂e per megawatt-hour, meaning that replacement power generation above 60,749 megawatt-hours per year (equivalent to one of the G1-G18 units being offline for 21 days per year) exceeds the 25,000-MT-CO₂e-per-year threshold for quantitative GHG analysis recommended by CEQ (2014). In addition to GHG impacts of lost power generation resulting from time offline, the maintenance and repairs associated with Alternative A may have additional GHG emissions associated with parts and equipment supply chains and transportation; however, the extent of these emissions is unknown.

As the climate changes, atmospheric temperatures will generally rise. Increased atmospheric temperatures between 3.3ºF and 9.7ºF by the end of the century in conjunction with altered snowmelt patterns will cause an increase in Columbia River water temperatures. Even with the large volumetric buffer provided by Lake Roosevelt, water temperature running through units G1-G18 will likely rise relative to historical temperatures. The increased atmospheric and water temperatures may exacerbate G1-G18 maintenance needs and time offline.

3.9.2.3 Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time

Short-term Impacts

Alternative B would result in short-term (construction-related) GHG emissions related to modernization and overhaul work, including GHG emissions associated with worker transportation to and from the site, and manufacture and transportation of replacement parts.
These emissions would be low to moderate, especially as compared to other large regional and global GHG emissions. Table 15 tabulates projected GHG emissions on an annualized basis for major items that make up the overhaul and modernization for G1-G18. This tabulation shows a total of approximately 1,500 MT CO₂e per year, well below the 25,000-MT-CO₂e-per-year threshold that requires detailed quantitative analysis. The annualized basis assumes GHG emissions for all items are spread evenly over 12 years. It’s possible that some years will see more concentrated work and associated emissions than others, but the large difference between projected annual GHG emissions and the 25,000 MT CO₂e threshold gives plenty of buffer for years with above-average emissions. Assuming 63 additional daily vehicle trips and moderately conservative conversion factors (40 miles per round trip; 15 miles per gallon; 252 work days per year, 0.0088 MT CO₂e per gallon of gasoline [Ecology 2011]), worker transportation would contribute an additional approximately 400 MT CO₂e per year, well below the 25,000 MT CO₂e threshold for more detailed quantitative analysis. GHG emissions associated with the manufacture and transportation of replacement parts is generally unknown, but is likely to fall well below 25,000 MT CO₂e. A list of overhaul items included in Alternative B is included in Section 2.3.

### Table 15. Greenhouse Gas Emissions for Alternative B

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Quantity Units</th>
<th>GHG Rate</th>
<th>GHG Rate Units</th>
<th>Annual GHG Emission (MT CO₂e)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 daily vehicle trips, 40 miles per trip, 15 miles per gallon, 252 work days per year</td>
<td>42,335</td>
<td>Gallons of gas per year</td>
<td>0.0088</td>
<td>MT CO₂e per gallon</td>
<td>373</td>
<td>Ecology 2011</td>
</tr>
<tr>
<td>Windings - Copper (C11000): 50,000 pounds per unit, 15 units, installed over 12-year construction window</td>
<td>62,500</td>
<td>Pounds of copper per year</td>
<td>0.00044</td>
<td>MT CO₂e per pound</td>
<td>28</td>
<td>Ruuska 2013</td>
</tr>
<tr>
<td>Windings - Steel: 280,000 pounds per unit, 15 units, installed over 12-year construction window</td>
<td>350,000</td>
<td>Pounds of steel per year</td>
<td>0.00171</td>
<td>MT CO₂e per pound</td>
<td>598</td>
<td>Ruuska 2013</td>
</tr>
<tr>
<td>Penstock Recoating: 4,685 gallons Enviroline 376F-60LT, installed over 12-year construction window</td>
<td>390</td>
<td>Gallons of recoating per year</td>
<td>0.0132</td>
<td>MT CO₂e per gallon of paint</td>
<td>5</td>
<td>Carbon Footprint 2017</td>
</tr>
</tbody>
</table>
Short-term impacts of climate change to the Project are expected to be minimal because the changes in temperature and precipitation patterns expected from climate change are anticipated to primarily occur beyond 2030.

These temporary impacts would not be significant.

**Long-term Impacts**

Alternative B would result in long-term (design-life) low continued GHG emissions related to continued O&M of G1-G18. Relative to Alternative A, Alternative B results in less time offline and less overall maintenance and repair of the generating units. Less time offline relative to Alternative A means reduced dependence of the regional electric grid on power generation that may have higher GHG emissions produced by G1-G18.

Long-term impacts of climate change on the Project are expected to be small and not significant. Increased atmospheric temperatures between 3.3°F and 9.7°F by the end of the century in conjunction with altered snowmelt patterns will cause an increase in Columbia River water temperatures. Even with the large volumetric buffer provided by Lake Roosevelt, water temperature running through units G1-G18 will likely rise relative to historical temperatures. The increased atmospheric and water temperatures may exacerbate G1-G18 maintenance needs and time offline.
3.9.2.4 **Alternative C - Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time**

This alternative would be similar to Alternative B, but with a longer construction timeframe. Rather than completing work on two units at a time, work would only occur on one unit at a time, adding an estimated 6 to 7 years to the Project duration (Denton 2017c). Depending on speed of completion, Reclamation anticipates the construction portion of the Project to occur from 2018 to 2035 or 2036. The climate change impacts (GHG emissions) under Alternative C would be lower on an annual basis than under Alternative B, but for a longer duration.

**Short-term Impacts**

Short-term (construction-related) climate change impacts (GHG emissions) under Alternative C would be lower on an annual basis than under Alternative B, but for a longer duration. Table 16 tabulates projected GHG emissions on an annualized basis for major items that make up the overhaul and modernization for G1-G18. This tabulation shows a total of approximately 1,100 MT CO$_2$e per year, well below the 25,000-MT-CO$_2$e-per-year threshold that requires detailed quantitative analysis. The annualized basis assumes GHG emissions for all items are spread evenly over 18 years.

These temporary impacts would not be significant.

**Table 16. Greenhouse Gas Emissions for Alternative C**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Quantity Units</th>
<th>GHG Rate</th>
<th>GHG Rate Units</th>
<th>Annual GHG Emission (MT CO$_2$e)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 daily vehicle trips, 40 miles per trip, 15 miles per gallon, 252 work days per year</td>
<td>42,335</td>
<td>Gallons of gas per year 0.0088 MT CO$_2$e per gallon</td>
<td>373</td>
<td>Ecology 2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windings - Copper (C11000): 50,000 pounds per unit, 15 units, installed over 18-year construction window</td>
<td>41,667</td>
<td>Pounds of copper per year 0.00044 MT CO$_2$e per pound</td>
<td>18</td>
<td>Ruuska 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windings - Steel: 280,000 pounds per unit, 15 units, installed over 18-year construction window</td>
<td>233,333</td>
<td>Pounds of steel per year 0.00171 MT CO$_2$e per pound</td>
<td>399</td>
<td>Ruuska 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penstock Recoating: 4,685 gallons Envirole 376F-60LT, installed over 18-year construction window</td>
<td>250</td>
<td>Gallons of recoating per year 0.0132 MT CO$_2$e per gallon of paint</td>
<td>3</td>
<td>Carbon Footprint 2017</td>
<td></td>
<td></td>
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</tbody>
</table>
### Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
<th>Quantity Units</th>
<th>GHG Rate</th>
<th>GHG Rate Units</th>
<th>Annual GHG Emission (MT CO₂e)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoplogs - Steel: 945,000 pounds of steel, installed over 18-year construction window</td>
<td>52,500</td>
<td>Pounds of steel per year</td>
<td>0.00171</td>
<td>MT CO₂e per pound</td>
<td>90</td>
<td>Ruuska 2013</td>
</tr>
<tr>
<td>Stoplogs - Vinyl paint: 2030 gallons, installed over 18-year construction window</td>
<td>113</td>
<td>Gallons of paint per year</td>
<td>0.0132</td>
<td>MT CO₂e per gallon of paint</td>
<td>1</td>
<td>Carbon Footprint 2017</td>
</tr>
<tr>
<td>Cranes - Steel: 1,980,000 pounds, installed over 18 years</td>
<td>100,000</td>
<td>Pounds of steel per year</td>
<td>0.00171</td>
<td>MT CO₂e per pound</td>
<td>188</td>
<td>Ruuska 2013</td>
</tr>
<tr>
<td>Cranes - Paint: 200 gallons, installed over 18-year construction window</td>
<td>11</td>
<td>Gallons of paint per year</td>
<td>0.0132</td>
<td>MT CO₂e per gallon of paint</td>
<td>0</td>
<td>Carbon Footprint 2017</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,072</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Long-term Impacts

Long-term (design-life) impacts of Alternative C are qualitatively similar to those of Alternative B.

#### 3.9.3 Mitigation

##### 3.9.3.1 Alternative A - No Action

No mitigation is required.

##### 3.9.3.2 Alternative B - Grand Coulee G1 through G18 Modernization and Overhaul – Work on Two Units at a time

Construction operations could be used to address short-term GHG emissions:

- Selection of more fuel efficient and alternative fuel vehicles, when practicable
- Anti-idling technology and site rules to limit the amount of time vehicles are idling while stationary
- Selection of construction materials with lower supply chain GHG emissions
- Long-term impacts to climate change, measured as GHG emissions, would result in an overall reduction in GHG (relative to Alternative A), as the G1-G18 generating unit modernization and overhaul would increase the reliable operation of zero emissions power generation an additional 30 years.
3.9.3.3 Alternative C - Grand Coulee G1 through G18 Modernization and Overhaul – Work on One Unit at a time

The mitigation for Alternative C is the same as that for Alternative B.

3.9.4 Cumulative Impacts

Since there would be no significant climate change impacts associated with these action alternatives (B and C) and no significant impacts from the Projects included in the cumulative analysis, there are no cumulative impacts expected with implementation of Alternatives B or C.
Chapter 4. Consultation and Coordination

4.1 Introduction

This chapter summarizes the activities that took place for Reclamation’s public scoping activities for the Project. Activities involved soliciting comments from the general public, state and federal government agencies, and representatives of the CTCR and the STOI.

The primary mechanism used to solicit public comments was advertisements informing the public about Reclamation’s intent to conduct a NEPA analysis.

The 30-day scoping period was scheduled to end on November 7, 2016, however, it was extended until November 27, 2016, at the request of the public. An official federal scoping notice was released on October 7, 2016, to all media outlets and newspapers in the Pacific Northwest (Appendix A). A revised scoping notice extending the public comment period was released on November 4, 2016, to the same media outlets (Appendix A).

Following the scoping period, activities will include ongoing interactions with the public, CTCR, STOI, and agencies during preparation of the EA. The public, CTCR, STOI, and agencies will be given the opportunity to review and comment on the Draft EA during the public comment period. Reclamation will continue to engage all parties through completion of the Final EA and, if warranted, preparation of the FONSI.

4.2 Public Scoping

4.2.1 Agency Consultations

4.2.1.1 National Historic Preservation Act

The NHPA was enacted in 1966 and is used to protect historical properties. The Act required the Federal government to partner with states, local governments, and Indian tribes to identify and protect eligible properties. All Federal actions must be analyzed to assess for possible effects on these properties. The process for implementing the NHPA is defined in Federal regulations (30 CFR 800) and includes consultation with the SHPO, THPO, and ACHP.
In letters dated March 8, 2016, Reclamation notified the Washington SHPO and the CTCR THPO of the Project’s APE (Smith 2016a and 2016b). Copies of agency correspondence relating the Project’s APE is included in Appendix B. The SHPO and THPO concurred with the APE (Whitlam 2016; Moura 2016), and defined the historical resources APE would include the following locations.

- LPH Interior and Transformer Deck
- RPH Interior and Transformer Deck
- Two moveable Gantry Cranes on top of Dam
- Two Cyclops Cranes on south faces below powerhouses

The APE was not expanded to include visual impacts because of minimal exterior modifications to the powerhouses and dam.

Reclamation identified nine staging areas. These locations would be used temporarily for storage of supplies and equipment during construction. Use of these areas would have no impact on built environment resources and have been evaluated for archaeological effects in the *Historic Resources Technical Report* (CH2M 2017).

4.2.2 Comment Solicitation and Informational Activities

Reclamation used several mechanisms to inform the public about the Project and encourage local residents, Tribal members, and agencies to engage with Reclamation during and following the scoping period.

4.2.3 Mailings

Scoping letters explaining the Project, advertising the comment period, and soliciting comments were sent to local elected officials and organizations, federal and state agencies, U.S. Congressional Representatives, and tribal entities. The scoping letter also described the ways available to provide project ideas or comments to Reclamation. A second scoping letter was sent to recipients on the mailing list indicating the extension of the comment period Appendix A contains the scoping letters, as well as a list of all the persons, agencies, and groups on the scoping letter mailing list.

4.2.4 Internet Postings

Several Reclamation websites hold information about the Project.

Links to all news releases are found at [https://www.usbr.gov/newsroom/](https://www.usbr.gov/newsroom/).


The website designed specifically to contain Project-related information is found at [https://www.usbr.gov/pn/programs/ea/wash/gcpowerhouse/index.html](https://www.usbr.gov/pn/programs/ea/wash/gcpowerhouse/index.html). The Draft
4.2 Public Scoping

EA, Final EA and FONSI, as well as other Project-related documents, will be housed on the Project-specific website.

4.2.5 Meetings
There were no formal public scoping meetings, however, Reclamation met informally with the affected Native American Tribes to discuss the Project and hear their concerns. There were no agency scoping meetings.

4.2.6 Outcomes

4.2.6.1 Public Response and Details
All seven public comment responses were received by e-mail. Two of the seven responses were letters attached to e-mails. Appendix D contains the public comment e-mails and letters. Input received from the comments were compiled in a summary, which presents a general overview of the documented comments and represents the main themes and opinions expressed by the public.

4.2.6.2 Summary of Public Comments
Reclamation received 23 individual comments about the Project. Table 17 lists all the comments received by Reclamation and how Reclamation intends to address each comment. This summary presents a general overview of the documented comments and represents the main themes and opinions expressed by the public. The public comments addressed a wide range of topics, with many topics being represented by only one comment. The summary points below only address comments that were repeated in several comment responses. Table 17 shows the comments in their entirety.

Key Findings (in order of most frequently repeated comments)
*Number in parentheses indicates the number of times comment was repeated*

- Reclamation should investigate providing fish passage (6)
- Ensure the protection of tribal resources (4)
- Support for the action alternatives (3)
- Work with local government and organizations to improve the local economy (2)
Request to analyze the direct, indirect, and cumulative effects of the Project on the annual 181-D payments to the Colville Confederated Tribes, including impacts resulting from decreased power generation during work to modernize and overhaul the G1 to G18 generating units, as well as any effects resulting from operation of the modernized units.

Reclamation does not anticipate any such changes during the modernization work. Although we will have multiple units out, the outages will not be different from current operations. Therefore, we do not expect a change in power generation from this Project that would impact the 181-D payments.

Request that Reclamation analyze the direct, indirect, and cumulative effects of construction and operation of the Project on resident fish populations in Lake Roosevelt.

During scoping and alternative development, Reclamation determined the environmental elements would be analyzed in the draft EA based on internal and external scoping, knowledge of the Project, and existing conditions. Because Reclamation is not changing operations of Grand Coulee Dam, we determined that we would not have an impact on resident fish populations in the reservoir or resident and anadromous fish populations downstream of the Project as a result of modernization work. Project activities will occur in the powerhouses and on the dam structure (cranes).

Request that the Bureau analyze whether the Project will have any direct, indirect, or cumulative impacts on cultural resources, anadromous fish, and future anadromous fish passage at Grand Coulee Dam.

Reclamation determined which environmental elements would be analyzed in the draft EA based on scoping of issues and whether impacts would occur. Because Reclamation is not changing operations of Grand Coulee Dam, we determined that we would not have an impact on resident fish populations in the reservoir or downstream of the Project. Project activities will occur in the powerhouses and on the dam structure (cranes) and so therefore would not impact reservoir conditions. Cultural resource effects from the alternatives will be analyzed in the EA.

The Drum Gate Maintenance Structure (DGMS) is part of the overall updating and maintenance projects for Grand Coulee Dam, including this G1 to G18 Modernization and Overhaul Project. Reclamation should consider these planned projects as a whole to avoid any potential segmentation issues that could arise under NEPA.

Reclamation continues to make progress on the DGMS, but has not yet completed a conceptual design. As the DGMS project matures, it will undergo a NEPA evaluation with a review of cumulative effects. Reclamation will keep you informed when we begin the NEPA process for the DGMS.

Given the potential scope of this work and other work planned, Reclamation must ensure that its obligations under 16 U.S.C. Section 839b(h)(I)(A)(i)&(ii) are addressed.

The Project will not preclude our potential to address obligations under 16 U.S.C. Section 839b(h)(I)(A)(i)&(ii) in the future.

All the maintenance and upgrade projects should be combined into one analysis and should include studies and potential modifications and additions that address fish passage and re-establishment measures outlined in the Northwest Power and Conservation Council 2014 Fish and Wildlife Program, and those same reintroduction considerations that will be part of the Columbia River System Operations Environmental Impact Statement process.

Reclamation will not address fish passage and re-establishment at this time for this Project, as those elements are outside the scope. This Project will not preclude or in any way impact our future ability to consider fish passage or re-establishment.
The Grand Coulee Dam should be modernized for a future with anadromous fish occupying the habitats above Grand Coulee Dam.

Fish passage is outside the scope of this Project. We are proposing to modernize the powerhouses' components at this time while not changing operations.

Requests that Reclamation, as part of this process, review the Spokane Tribe’s 2014 Fish and Wildlife Program and develop a list of fish and wildlife actions that could be addressed at the same time as this project to ensure these funds are used in the most efficient manner possible while fulfilling all of Reclamation’s obligations which include the protection, mitigation, and enhancement of fish and wildlife.

The Project will not preclude us from doing future fish and wildlife projects. We do not anticipate affecting fish or wildlife resources by implementing the Project. We are proposing to do the modernization without changing operations to avoid any impacts to fish, wildlife, and water quality/hydrology.

The Preferred Alternative for the Project does not include changes in reservoir operations or drawdowns. We are proposing to complete this Project without changes to operations to avoid any effects to cultural resources as a result of reservoir operations, hydrology, water quality, and fisheries.

Include a review to ensure the safe passage of juvenile fish.

Fish passage is outside the scope of this Project. We are proposing to modernize the power production components at this time while not changing operations.

Reclamation needs to ensure that whatever refurbishment technology and design it utilizes, includes a juvenile fish passage component.

Fish passage is outside the scope of this Project. We are proposing to modernize the power production components at this time while not changing operations.

The Spokane Tribe’s Department of Natural Resources expects Reclamation to honor its trust obligations to protect the Tribe’s resources at every stage of this process and the larger Grand Coulee Dam refurbishment, maintenance and modernization process over the coming years.

Reclamation will continue to honor our trust obligations to STOI.

My concern is the speed the trucks will travel up and down the road (past experience), which caused the dust and ground movement and noise.

Traffic and impacts associated with traffic for the different alternatives are analyzed in the environmental assessment. It should be noted that the powerhouses must be overhauled and modernized, and increased traffic associated with that work cannot be completely avoided.

Concerned about the noise level of the equipment at the third powerhouse.

Concern noted.

I would like to see the Project completed in the least amount of time, prefer option "B".

Support noted.

Any and all modernization of the Left and Right power generators will have an adverse effect on the CBP’s power rate due to both the increased cost of capital investments and decreased generation.

The proposed work has been forecasted and included within the power rate. Reclamation is bundling the planned work and associated outages into this Project to minimize untimed work, subsequent outages, and associated cost impacts.
<table>
<thead>
<tr>
<th>Comment</th>
<th>Reclamation Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some modernizations included in this scope have already been included in the John Keys Pump Generation modernization plan. i.e., iso-phase bus and station service.</td>
<td>The iso-phase bus work and station service generators proposed are related to the LPH and RPH. Decoupling the John W. Keys III Pump-Generating Plant from the LPH was considered as one of the alternatives in the John W. Keys III Pump Generating Plant Modernization NEPA document and as such, the NEPA document did include some proposals for the iso-phase bus and station service generator work described. That alternative was not chosen for implementation within the John W. Keys Pump Generating Plant Modernization NEPA. Therefore, the iso-phase bus work is being analyzed as part of the alternatives for the G1-G18 Project.</td>
</tr>
<tr>
<td>Replacement of the nine overhead cranes is unrealistic, unneeded and uneconomical.</td>
<td>As noted within the request for public comment, the G1-G18 project calls for replacement or refurbishment of the existing nine cranes servicing the powerhouses. Each set of cranes will be individually evaluated and a determination will be made for replacement or refurbishment.</td>
</tr>
<tr>
<td>My suggestion is Alternative B. Alternative B would provide a more even work force into the area.</td>
<td>Support noted.</td>
</tr>
<tr>
<td>The area needs someone in the Reclamation operation to work with the local area city councils, Chamber, Chamber Economic Development Committee, school system and real estate people and more.</td>
<td>Thank you for your comment. Your concern and suggestion have been noted.</td>
</tr>
<tr>
<td>I would like to recommend that Reclamation assign someone to work with the local Economic Development Council to make the economics in this area better for all.</td>
<td>Thank you for your suggestion.</td>
</tr>
<tr>
<td>We would like to join Reclamation in encouraging local living in the area. Perhaps Reclamation could buy up the old houses and fix them up to be decent contract working digs or even be reasonable quality rentals for employees only. I would love to see at least 150 (estimated current commuters) new families living here and patronizing the local businesses.</td>
<td>Thank you for your suggestions regarding housing in the area. We are not proposing at this time to build housing for workers.</td>
</tr>
<tr>
<td>I would like to express my support for the upgrades proposed to the two powerhouses, cranes, and support infrastructure at the Grand Coulee Dam.</td>
<td>Support noted.</td>
</tr>
</tbody>
</table>
4.3 Follow-up Activities

Reclamation will address the public comments received during scoping in the EA as indicated in Table 17. The public, CTCR, STOI, and agencies will continue to be engaged by Reclamation throughout the EA preparation process. The Draft EA will be released to the public for a 30-day comment period at which time any interested individual or group can provide comments on the Draft EA to Reclamation. The public’s comments on the Draft EA will be addressed in the Final EA as appropriate.
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# Chapter 5. Literature Cited

<table>
<thead>
<tr>
<th>Parenthetical Reference</th>
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<tr>
<td>------------------------</td>
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</tr>
<tr>
<td>Denton 2017a</td>
<td>Denton, David, Project Manager, Bureau of Reclamation, 2017a. Personal communication (e-mail) with Marlena Guhlke, CH2M. February 13.</td>
</tr>
<tr>
<td>Denton 2017b</td>
<td>Denton, David, Project Manager, Bureau of Reclamation, 2017b. Personal communication (e-mail) with Marlena Guhlke, CH2M. February 27.</td>
</tr>
<tr>
<td>Denton 2017c</td>
<td>Denton, David, Project Manager, Bureau of Reclamation. 2017c. Personal communication (e-mail) with Fatuma Yusuf, CH2M. March 2.</td>
</tr>
<tr>
<td>DeWinkler 2017a</td>
<td>DeWinkler, Jeff. 2017a. Environmental Protection Specialist, Grand Coulee Power Office. Personal communication (e-mail) with Denny Mengel, CH2M. January 3.</td>
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<td>Bibliographic Citation</td>
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<tr>
<td>DeWinkler 2017b</td>
<td>DeWinkler, Jeff. 2017b. Environmental Protection Specialist, Grand Coulee Power Office. Personal communication (e-mail) with Denny Mengel, CH2M. January 6.</td>
</tr>
<tr>
<td>DeWinkler 2017c</td>
<td>DeWinkler, Jeff. 2017c. Environmental Protection Specialist, Grand Coulee Power Office. Personal communication (e-mail) with Denny Mengel, CH2M. January 5.</td>
</tr>
<tr>
<td>Druliner 2017</td>
<td>Druliner, Pam, Bureau of Reclamation, 2017. Personal communication (e-mail) with Fatuma Yusuf, CH2M. March 1.</td>
</tr>
<tr>
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<td>Bibliographic Citation</td>
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<td>-------------------------</td>
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<tr>
<td>Moura 2016</td>
<td>Moura, Guy, Tribal Historic Preservation Office. 2016. Personal communication (e-mail) with Coleman Smith, Bureau of Reclamation. March 16.</td>
</tr>
<tr>
<td>Parenthetical Reference</td>
<td>Bibliographic Citation</td>
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<tr>
<td>WSDOT 2016</td>
<td>Washington State Department of Transportation. 2016. Officer Reported Crash Data in the Vicinity of Specific Intersections in the City of Coulee Dam &amp; Douglas, Grant and Okanogan Counties 01/01/2011 - 12/31/2015, provided by Julie Brown, WSDOT Crash Data and Reporting Branch. November 16.</td>
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Appendix A. Scoping Notices, Letters, and Mailing Lists
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Subject: Request for Public Comments Regarding the Proposed Grand Coulee G1-18 Modernization and Overhaul Project

Dear Interested Party:

The Bureau of Reclamation (Reclamation) is preparing an Environmental Assessment (EA) for the proposed Grand Coulee G1-G18 Modernization and Overhaul Project and is requesting public comment and agency input to help identify issues to be addressed in the EA. Information obtained during the Oct. 7 through Nov. 7 scoping period will help in the development of the EA. A draft EA is scheduled to be available for review early in 2017, at which time comments on the draft EA will be accepted. The final EA will be completed thereafter.

PURPOSE AND NEED

Reclamation proposes to modernize and overhaul the G1-G18 generating units in the Left and Right Powerhouses (LPH and RPH). The generating units began service between 1941 and 1949 and are starting to have mechanical problems from age-related wear and design on the principle components. In particular, the identified units show problems that require more frequent maintenance, increasingly challenging repairs, and longer down times. Consequently, there has been an increase in forced outages and reduced reliability. Also, the overhead cranes servicing the dam and the powerhouses need to be updated or replaced to ensure they continue to meet the needs and demands of work on the powerhouses.

The project scope includes:

- new generator windings and stator cores for the main unit generators
- new static digital excitation systems
- digital governor control systems
- local unit controls and generator relay protection systems
- penstock lining repair or replacement
- replacement or modernization of the nine cranes servicing the powerhouses
- modernization of three Station Service Generators in the LPH
- replacement or refurbishment of the iso-phase bus and circuit breakers

PROPOSED ALTERNATIVES

Reclamation is currently investigating the potential alternatives identified below.

Alternative A: No Action

Reclamation would continue operating generating units G1-G18 with no system improvements. The 18 units would continue generating power, and Reclamation would
perform maintenance on an as-needed basis. Units would be offline during maintenance or replacement work.

**Alternative B: G1-G18 Modernization and Overhaul – Work on Two Units at a Time**

Reclamation would repair and restore these machines in a timely manner to ensure reliable operation for an additional 30 years. Work is expected to begin in the spring of 2018. Reclamation anticipates the project would be completed by the end of 2029, but unforeseen circumstances (equipment breakdown, unexpected outages, delay in manufacturing, etc.) could delay completion.

**Alternative C: G1-G18 Modernization and Overhaul – Work on One Unit at a Time**

Reclamation would perform the same work as in Alternative B. However, this would extend the work up to 7 years, depending on speed of completion.

**YOUR FEEDBACK IS REQUESTED**

Please submit your comments by Nov. 7, 2016 to:

Pam Druliner, Natural Resource Specialist
Bureau of Reclamation
1150 North Curtis Road
Boise, Idaho 83706
(208) 378-6214
pdruliner@usbr.gov

Sincerely,

Coleman J. Smith, Jr.
Power Manager

Enclosure – Distribution List
Subject: Request for Public Comments Regarding the Proposed Grand Coulee G1-18 Modernization and Overhaul Project - Extended Comment Period

Dear Interested Party:

The Bureau of Reclamation (Reclamation) is extending the public comment period for the proposed multiyear powerplant overhaul project at two Grand Coulee Dam powerhouses. The initial 30-day comment period ended Nov. 7, however, at the public’s request, it has been extended to Nov. 21. Reclamation is requesting public comment and agency input to help identify issues to be addressed in an Environmental Assessment (EA) for the proposed Grand Coulee G1-G18 Modernization and Overhaul Project. Information obtained during the scoping period will help in the development of the EA. A draft EA is scheduled to be available for review early in 2017, at which time comments on the draft EA will be accepted. The final EA will be completed thereafter.

PURPOSE AND NEED

Reclamation proposes to modernize and overhaul the G1-G18 generating units in the Left and Right Powerhouses (LPH and RPH). The generating units began service between 1941 and 1949 and are starting to have mechanical problems from age-related wear and design on the principle components. In particular, the identified units show problems that require more frequent maintenance, increasingly challenging repairs, and longer down times. Consequently, there has been an increase in forced outages and reduced reliability. Also, the overhead cranes servicing the dam and the powerhouses need to be updated or replaced to ensure they continue to meet the needs and demands of work on the powerhouses.

The project scope includes:

- new generator windings and stator cores for the main unit generators
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- digital governor control systems
- local unit controls and generator relay protection systems
- penstock lining repair or replacement
- replacement or modernization of the nine cranes servicing the powerhouses
- modernization of three Station Service Generators in the LPH
- replacement or refurbishment of the iso-phase bus and circuit breakers
PROPOSED ALTERNATIVES

Reclamation is currently investigating the potential alternatives identified below.

**Alternative A: No Action**

Reclamation would continue operating generating units G1-G18 with no system improvements. The 18 units would continue generating power, and Reclamation would perform maintenance on an as-needed basis. Units would be offline during maintenance or replacement work.

**Alternative B: G1-G18 Modernization and Overhaul – Work on Two Units at a Time**

Reclamation would repair and restore these machines in a timely manner to ensure reliable operation for an additional 30 years. Work is expected to begin in the spring of 2018. Reclamation anticipates the project would be completed by the end of 2029, but unforeseen circumstances (equipment breakdown, unexpected outages, delay in manufacturing, etc.) could delay completion.

**Alternative C: G1-G18 Modernization and Overhaul – Work on One Unit at a Time**

Reclamation would perform the same work as in Alternative B. However, this would extend the work up to 7 years, depending on speed of completion.

**YOUR FEEDBACK IS REQUESTED**

Please submit your comments by Nov. 21, 2016 to:

Pam Druliner, Natural Resource Specialist  
Bureau of Reclamation  
1150 North Curtis Road  
Boise, Idaho 83706  
(208) 378-6214  
pdruliner@usbr.gov

Sincerely,

Coleman J. Smith, Jr.  
Power Manager

Enclosure – Distribution List
Reclamation Seeks Comments on Left and Right Powerhouse Modernization at Grand Coulee Dam

GRAND COULEE, Washington — The Bureau of Reclamation invites the public to comment on a proposed multiyear powerplant overhaul project at two Grand Coulee Dam powerhouses. During the 30-day comment period which ends Nov. 7, the public is encouraged to identify issues and concerns to be addressed in an Environmental Assessment on the proposed modernization and overhaul of all the generators in the Left and Right Powerhouses.

The 18 generating units and three station service units have been in operation for over 70 years and are starting to have mechanical problems from age-related wear and design. Reclamation would upgrade components of the generating units, modernize three station service generators, conduct maintenance of the penstocks, and update or replace the overhead cranes.

The Environmental Assessment alternatives are:

- Alternative A – No Action: Reclamation would continue to operate generating Units G1 – G18 with no system improvements. Maintenance would be performed on an as-needed basis.
- Alternative B – Work on Two Units at a Time: Reclamation would repair and restore the generators in a timely manner to ensure reliable operation for an additional 30 years. Work would be expected to begin in the spring of 2018 with project completion anticipated by the end of 2029. Unforeseen circumstances (equipment breakdown, unexpected outages, delay in manufacturing, etc.) could delay completion.
- Alternative C – Work on One Unit at a Time: Reclamation would perform the same work as in Alternative B. However, this alternative would extend the overhaul work up to seven years, depending on the speed of completion.

The Environmental Assessment would evaluate the impacts of each alternative on the human and natural environments. The final Environmental Assessment is expected to be published in the summer of 2017.

To submit comments, or for additional information, contact Pam Druliner, Natural Resource Specialist, Pacific Northwest Regional Office, 1150 North Curtis Road, Boise, ID 83706. Contact can also be made by emailing pdruliner@usbr.gov.
Reclamation is the largest wholesale water supplier and the second largest producer of hydroelectric power in the United States, with operations and facilities in the 17 Western States. Its facilities also provide substantial flood control, recreation, and fish and wildlife benefits. Visit our website at www.usbr.gov.
For Release: Nov. 4, 2016

Reclamation Extends Public Comment Period for Left and Right Powerhouse Modernization at Grand Coulee Dam

GRAND COULEE, Washington - The Bureau of Reclamation is extending the public comment period for the proposed multiyear powerplant overhaul project at two Grand Coulee Dam powerhouses. The initial 30-day comment period ended Nov. 7, however, at the public’s request, it’s been extended to Nov. 21. The public is encouraged to identify issues and concerns to be addressed in an Environmental Assessment on the proposed modernization and overhaul of all the generators in the Left and Right Powerhouses.

The 18 generating units and three station service units have been in operation for over 70 years and are starting to have mechanical problems from age-related wear and design. Reclamation would upgrade components of the generating units, modernize three station service generators, conduct maintenance of the penstocks, and update or replace the overhead cranes.

The Environmental Assessment alternatives are

- **Alternative A – No Action:** Reclamation would continue to operate generating Units G1 – G18 with no system improvements. Maintenance would be performed on an as-needed basis.
- **Alternative B – Work on Two Units at a Time:** Reclamation would repair and restore the generators in a timely manner to ensure reliable operation for an additional 30 years. Work would be expected to begin in the spring of 2018 with project completion anticipated by the end of 2029. Unforeseen circumstances (equipment breakdown, unexpected outages, delay in manufacturing, etc.) could delay completion.
- **Alternative C – Work on One Unit at a Time:** Reclamation would perform the same work as in Alternative B. However, this alternative would extend the overhaul work up to seven years, depending on the speed of completion.

The Environmental Assessment would evaluate the impacts of each alternative on the human and natural environments. The final Environmental Assessment is expected to be published in the summer of 2017.
To submit comments, or for additional information, contact Pam Druliner, Natural Resource Specialist, Pacific Northwest Regional Office, 1150 North Curtis Road, Boise, ID 83706. Contact can also be made by emailing pdruliner@usbr.gov.

# # #

Reclamation is the largest wholesale water supplier and the second largest producer of hydroelectric power in the United States, with operations and facilities in the 17 Western States. Its facilities also provide substantial flood control, recreation, and fish and wildlife benefits. Visit our website at www.usbr.gov.
Honorable Maria Cantwell  
United States Senator  
W. 920 Riverside, #697  
Spokane, WA 99201

Honorable Patty Murray  
United States Senator  
10 North Post Street, Suite 600  
Spokane, WA 99201

Honorable Dan Newhouse  
House of Representatives  
3100 George Washington Way #135  
Richland, WA 99354

Honorable Cathy McMorris Rodgers  
House of Representatives  
555 South Main Street  
Colville, WA 99114

Honorable Brian Dansel  
Washington Senate  
9507 N. Division St., Suite M-3  
Spokane, WA 99218

Honorable Linda Evans Parlette  
Washington Senate  
305 Legislative Building  
P.O. Box 40412  
Olympia, WA 98504

Honorable Judy Warnick  
Washington Senate  
103 Irv Newhouse Building  
PO Box 40413  
Olympia, WA 98504

Honorable Cary Condotta  
Washington House of Representatives  
3024 G.S. Center Rd., Ste. C  
Wenatchee, WA 98801

Honorable Tom Dent  
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Moses Lake, WA 98837

Honorable Joel Kretz  
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Okanogan, WA 98840

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Lincoln County Commissioner, District 2  
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Honorable Gail Morin  
Mayor of the Town of Elmer City  
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Elmer City, WA 99124

Honorable John Nordine  
Mayor of the City of Electric City  
P.O. Box 130  
Electric City, WA 99124
Honorable Paul Townsend  
Mayor of the City of Grand Coulee  
P.O. Box 180  
Grand Coulee, WA 99133-0180

Honorable Greg Wilder  
Mayor of the Town of Coulee Dam  
300 Lincoln Ave.  
Coulee Dam, WA 99116

Honorable Carol Evans  
Chairwoman  
Spokane Tribe of Indians  
P.O. Box 100  
Wellpinit, WA 99040

Honorable Michael Marchand  
Chairman  
Confederated Tribes of the Colville Reservation  
P.O. Box 150  
Nespelem, WA 99155

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Superintendent  
Colville Agency  
Bureau of Indian Affairs  
P.O. Box 11  
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Superintendent  
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1008 Crest Drive  
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Superintendent  
Lake Roosevelt School District Office  
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The Star Newspaper  
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Mrs. Peggy Nevismal  
Director  
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Executive Director  
Lincoln County Economic Development Council  
P.O. Box 1304  
Davenport, WA 99122

Mr. Charles Lee  
Washington Department of Fish and Wildlife  
22315 North Discovery Place  
Spokane Valley, WA 99216-01566
Appendix B.
Section 106 Correspondence
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Dr. Allyson Brooks, Washington State Historic Preservation Officer  
Department of Archaeology & Historic Preservation  
P.O. Box 48343  
Olympia, WA 98504-8343

Subject: G1-18 Modernization Project – Area of Potential Effects (APE)  
(Tracking No. U16-05:16.01)

Dear Dr. Brooks:

Bureau of Reclamation (Reclamation) is proposing to conduct a modernization project at the Left and Right Powerhouses, which are located on either abutment (west and east sides) of Grand Coulee Dam. The purpose of this project is to replace or upgrade existing components of the plant that are exhibiting substantial age-related wear and design deficiencies, and to increase the operational reliability and flexibility of Units G1-18 at Grand Coulee Dam.

We are in the early stages of the planning process, but have sufficient design information to determine the Area of Potential Effects (APE) for this project. As you will see in the enclosure, we are considering two main action alternatives. The APE designated in the enclosed documents includes the effects of both of these options. We have also enclosed our plan for identifying historic properties in the APE. We request that you concur with the APE and the level of effort to be used in identifying historic properties as described in the enclosure. Please note that we are conducting a coordinating effort of consultation with the Confederated Tribes of the Colville (CCT) Reservation Tribal Historic Preservation Officer since the right abutment (Right Powerhouse) is on the CCT Reservation.

If you have questions about this APE or other issues related to the G1-18 Modernization Project, please contact Mr. Derek Beery, the Power Office Archeologist, at (509) 633-9233.

Sincerely,

Coleman W. Smith, Jr.  
Power Manager

Enclosure – 1

cc: please see next page
cc: Continued from previous page

Guy Moura, Tribal Historic Preservation Officer
History/Archaeology Program
Confederated Tribes of the Colville Reservation
P.O. Box 150
Nespelem, WA 99155-0150
Grand Coulee Dam G1-18 Modernization Project

Attachment 1 - Area of Potential Effects and Plans for Identification of Historic Properties

Overview
The United States Bureau of Reclamation (Reclamation) is considering a large overhaul and modernization project in the Left and Right Powerhouses at Grand Coulee Dam. The project seeks to modernize the aging infrastructure on and associated with units G1-18 in the two powerhouses over the next 10 or more years.

The Left and the Right Powerhouses at Grand Coulee Dam harness the hydraulic power of the Columbia River to generate electricity. Both are integral components of original Grand Coulee Dam project begun by the United States government in the 1930s. Construction of the Left Powerhouse was included as part of the initial dam authorization in 1933. The first of the service station generating units in the Left began producing electricity in 1941 and the remaining generators came online during the next several years in an urgently conducted campaign to produce power for vital war-time industries. By April of 1944 the Left Powerhouse was able to produce 952,000 kW an hour, supplying the vast power requirements of aluminum production in the Northwest and also for the secret project at Hanford.

Realization of the need for electricity to supply war production led to accelerated construction of the Right Powerhouse years ahead of the original plan. A week after the attack on Pearl Harbor a change order authorized building of the Right Powerhouse. Construction began January 1, 1942 with a planned completion late that year. Shortages of labor and materials interfered with building progress causing work on the Right Powerhouse to proceed in fits and starts. With the end of the war and a decline in power demand, completion of the powerhouse took on a secondary importance to other project work. The plant was not completed until the late 1940s, with the generating units coming on-line between 1948 and 1950.

The size of the plants and the vast amount of electrical power generated by the two original powerhouses contribute to the significance of the Grand Coulee Dam project as a landmark engineering accomplishment.

Now the power generating infrastructure inside the Left and Right Powerhouses is outdated and beginning to show the problems associated with hydropower units as they near the end of their useful lives. Grand Coulee Dam continues its historical mission of generating massive amounts of hydropower for the region. (Reclamation) needs to upgrade and modernize the Left and Right Powerhouse generators and other associated infrastructure in order to meet the electrical and irrigation needs of the American people.

Purpose and Need
The purpose of the G1-18 Modernization Project project is to replace and/or upgrade existing components of the plant that are exhibiting substantial age-related wear and design deficiencies and to increase the Left and Right Power Houses’ operational reliability and flexibility. The Left
Grand Coulee Dam G1-18 Modernization Project

Powerhouse contains three station service generators rated at 10,000 kW and nine generators rated at 125,000 kW. The Right Powerhouse contains nine generators rated at 125,000 kW. The modernization is being considered because many of the plants' principal components are being operated far beyond their intended service life. In particular, the G-1 thru G-18 units show problems stemming from age and wear that result in increased hardware failures and forced outages, more challenging repairs due to obsolescence and lack of spare parts.

Preliminary Design Options
Reclamation has developed the following preliminary alternatives for implementation of the project.

Alternative A: No Action
If the generating units are not modernized and overhauled, O&M requirements would increase and production and reliability would decrease and the loss of revenue from interrupted public power generation would be substantial. If this decrease in production and reliability occurs, Reclamation may not be able to meet contractual obligations and historical mission for power generation.

Alternative B: G1-18 Modernization
Reclamation is considering a massive effort to modernize and overhaul generator units G-1 thru G-18 and their auxiliary systems within Left and Right Powerhouses (LPH/RPH) of the Grand Coulee Dam. The Grand Coulee G-1 thru G-18 Unit Modernization Program is a group of related projects, managed by Reclamation as a single program to increase coordination, reduce costs and decrease risk. The program scope is to include new generator windings and stator cores for fifteen (15) of the eighteen (18) main unit generators; new static digital excitation systems for all eighteen (18) main unit generators, digital governor control systems, local unit controls, unit breakers and generator relay protection systems for all eighteen (18) main unit generators; transformer replacements for several main generator units; penstock lining repair or replacement for all eighteen (18) units; replacement or modernization of the nine (9) cranes servicing the powerhouses; modernization of three (3) Station Service generators (LS-1 thru LS-3) in the LPH. Potentially during the same unit outages if determined necessary during future condition assessments, the iso-phase bus from each main unit generator to the transformer deck and the unit circuit breakers may be replaced for all eighteen (18) units.

The modernization program would include inspecting and refurbishing or replacing components. Refurbishment and repairs on the units may include, depending on need, but are not limited to replacement or repair of:

**Left Power House (LPH)**

**Cranes**

- **350-t Bridge Crane #1**
  - Replace w/ New

- **350-t Bridge Crane #2**
  - Replace w/ New

- **50-t Bedford Crane**
Grand Coulee Dam G1-18 Modernization Project

Replace or Modernize Control Systems

**LPH Top of Dam Gantry**
Replace or Modernize Control Systems

**Cyclops Gantry**
Replace or Modernize Control Systems

**Main Generator Units**

**G-1**
- Windings & Stator Core - Replacement
- Floor Mounted Exciter - Replace w/ Digital Exciter Cabinets
- Mechanical Governor Controls - Replace w/ Digital Control System
- Generator Protection Relays - Replace w/ Digital Relays
- Unit Circuit Breakers - Replace
- Isophase Bus Unit to Transformer - Replace
- Penstock - Lining System Removed and New Lining Material Applied

**G-2**
- Windings & Stator Core - Replacement
- Floor Mounted Exciter - Replace w/ Digital Exciter Cabinets
- Mechanical Governor Controls - Replace w/ Digital Control System
- Generator Protection Relays - Replace w/ Digital Relays
- Unit Circuit Breakers - Replace
- Isophase Bus Unit to Transformer - Replace
- Penstock - Lining System Removed and New Lining Material Applied

**G-3**
- Windings & Stator Core - Replacement
- Floor Mounted Exciter - Replace w/ Digital Exciter Cabinets
- Mechanical Governor Controls - Replace w/ Digital Control System
- Generator Protection Relays - Replace w/ Digital Relays
- Unit Circuit Breakers - Replace
- Isophase Bus Unit to Transformer - Replace
- Penstock - Lining System Removed and New Lining Material Applied

**G-4**
- Floor Mounted Exciter - Replace w/ Digital Exciter Cabinets
- Mechanical Governor Controls - Replace w/ Digital Control System
- Generator Protection Relays - Replace w/ Digital Relays
- Unit Circuit Breakers - Replace
- Isophase Bus Unit to Transformer - Replace
- Penstock - Lining System Removed and New Lining Material Applied

**G-5**
- Floor Mounted Exciter - Replace w/ Digital Exciter Cabinets
- Mechanical Governor Controls - Replace w/ Digital Control System
- Generator Protection Relays - Replace w/ Digital Relays
- Unit Circuit Breakers - Replace
- Isophase Bus Unit to Transformer - Replace

**G-6**
- Windings & Stator Core - Replacement
- Penstock - Lining System Removed and New Lining Material Applied
## Grand Coulee Dam G1-18 Modernization Project

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<th>Work Description</th>
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| **G-7** | Floor Mounted Exciter - Replace w/ Digital Exciter Cabinets  
Mechanical Governor Controls - Replace w/ Digital Control System  
Generator Protection Relays - Replace w/ Digital Relays  
Unit Circuit Breakers - Replace  
Isophase Bus Unit to Transformer - Replace  
Penstock - Lining System Removed and New Lining Material Applied |
| **G-8** | Top Mounted Rotating Exciter - Replace w/ Digital Exciter Cabinets in Gallery  
Mechanical Governor Controls - Replace w/ Digital Control System  
Generator Protection Relays - Replace w/ Digital Relays  
Unit Circuit Breakers - Replace  
Isophase Bus Unit to Transformer - Replace  
Penstock - Lining System Removed and New Lining Material Applied  
Transformers - Replace |
| **G-9** | Windings & Stator Core - Replacement  
Top Mounted Rotating Exciter - Replace w/ Digital Exciter Cabinets in Gallery  
Mechanical Governor Controls - Replace w/ Digital Control System  
Generator Protection Relays - Replace w/ Digital Relays  
Unit Circuit Breakers - Replace  
Isophase Bus Unit to Transformer - Replace  
Penstock - Lining System Removed and New Lining Material Applied |

## Station Service Units

| LS-1 | Windings & Stator Core - Replacement  
Exciter - Replace w/ Digital Exciter Cabinets  
Mechanical Governor Controls - Replace w/ Digital Control System |
| LS-2 | Windings & Stator Core - Replacement  
Exciter - Replace w/ Digital Exciter Cabinets  
Mechanical Governor Controls - Replace w/ Digital Control System |
| LS-3 | Windings & Stator Core - Replacement  
Exciter - Replace w/ Digital Exciter Cabinets  
Mechanical Governor Controls - Replace w/ Digital Control System |

## Right Power House (RPH)

| RPH Cranes | 350-t Bridge Crane #1 |
Grand Coulee Dam G1-18 Modernization Project

Replace w/ New

**350-t Bridge Crane #2**
- Replace w/ New

**RPH Top of Dam Gantry**
- Replace or Modernize Control Systems

**Cyclops Gantry**
- Replace or Modernize Control Systems

**Main Generator Units**

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<thead>
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<th>G-10</th>
<th>Windings &amp; Stator Core - Replacement</th>
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<th>Windings &amp; Stator Core - Replacement</th>
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### Grand Coulee Dam G1-18 Modernization Project

<table>
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<th>Unit</th>
<th>Work Description</th>
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| G-15  | Windings & Stator Core - Replacement  
Top Mounted Rotating Exciter - Replace w/ Digital Exciter Cabinets in Gallery  
Mechanical Governor Controls - Replace w/ Digital Control System  
Generator Protection Relays - Replace w/ Digital Relays  
Unit Circuit Breakers - Replace  
Isophase Bus Unit to Transformer - Replace  
Penstock - Lining System Removed and New Lining Material Applied  
Transformers - Replace |
| G-16  | Windings & Stator Core - Replacement  
Top Mounted Rotating Exciter - Replace w/ Digital Exciter Cabinets in Gallery  
Mechanical Governor Controls - Replace w/ Digital Control System  
Generator Protection Relays - Replace w/ Digital Relays  
Unit Circuit Breakers - Replace  
Isophase Bus Unit to Transformer - Replace  
Penstock - Lining System Removed and New Lining Material Applied  
Transformers - Replace |
| G-17  | Windings & Stator Core - Replacement  
Top Mounted Rotating Exciter - Replace w/ Digital Exciter Cabinets in Gallery  
Mechanical Governor Controls - Replace w/ Digital Control System  
Generator Protection Relays - Replace w/ Digital Relays  
Unit Circuit Breakers - Replace  
Isophase Bus Unit to Transformer - Replace  
Penstock - Lining System Removed and New Lining Material Applied  
Transformers - Replace |
| G-18  | Windings & Stator Core - Replacement  
Top Mounted Rotating Exciter - Replace w/ Digital Exciter Cabinets in Gallery  
Mechanical Governor Controls - Replace w/ Digital Control System  
Generator Protection Relays - Replace w/ Digital Relays  
Unit Circuit Breakers - Replace  
Isophase Bus Unit to Transformer - Replace  
Penstock - Lining System Removed and New Lining Material Applied  
Transformers - Replace |

Other repairs may need to be performed on the generating units but due to lack of access to the units, all items in need of repair cannot be fully anticipated. The objective is to repair and restore these machines to ensure reliable operation for an additional 30 years.
Grand Coulee Dam G1-18 Modernization Project

Five staging areas are also being considered. Four of the five area already used as staging areas at this time. Another alternate, at North Dam, is also listed. The North Dam location has been heavily disturbed but it does not have the impervious surface and previous use as a storage area compared to the other four. These staging areas are discussed further in the APE section.

**Area of Potential Effects (APE)**

Based on the project description provided above, the project has the potential to result in direct physical effects to the ground surface at the staging areas. The project also has the potential to affect the built environment, especially the interiors of the Left and Right Powerhouses and the associated transformer deck and cranes for each of the two powerhouses. The project does not have the potential to result in visual effects to the surrounding viewshed as no additional equipment would be added to the exterior of the industrial complex. These three kinds of effects provide the basis for determining the APE.

**APE for Ground Surface-Disturbing Activities**

The APE for ground disturbing activities includes 5 potential staging areas. These five areas contain a total of roughly 35 acres in and around the Left and Right Powerhouses and two more alternatives in areas away from the main dam (Crescent Bay and North Dam Park). These areas were selected to allow for the possibility that the areas might be used for laydown areas and staging for other materials used for the project. At this point in time, no sub-surface ground-disturbing activities like grading or drainage improvements are anticipated in the laydown areas as most already contain flat, impervious surfaces suitable for immediate use as storage and staging sites.

The Five Staging Areas:
- Former Wilson Staging Area (8 acres; right bank)
- TPP Entrance Staging Area (1/2 acre; right bank)
- Lower Visitor Center Staging Area (1/2 acre; left bank)
- Crescent Bay Staging Area (6 acres; NPS Recreation Zone)
- North Dam Staging Area (20 acres; North Dam Park)

**APE for Activities that Will Disturb the Built Environment**

The APE for activities that might affect the built environment includes the following locations:
- Left Powerhouse Interior and the Transformer Deck
- Right Powerhouse Interior and the Transformer Deck
- Two moveable Gantry Cranes on Top of Dam
- Two Cyclops Cranes on south faces below Powerhouses-
APE for Visual Effects of the Project
No new exterior additions beyond the scope of equipment replacement on the transformer decks and the replacement or modernization of gantry and cyclops crane controls are expected. As such a visual effects APE is not included for the project.

Level of Effort to be Used to Identify Historic Properties

Archeological Resources
Reclamation has already reviewed the construction records on file at the Grand Coulee Power Office to determine the extent of previous disturbance in the area of direct physical effects, especially the areas at North Dam and the Wilson Staging Area. Archeological fieldwork would determine the extent of historic features in each of the staging areas but all have been heavily disturbed during dam constructions and there is no potential that use of the areas for staging will have the potential to effect prehistoric archeological resources. Because disturbance will be to the ground surface only do to simple use of the areas for staging and storage it is not anticipated that any shovel test pits or shovel scrapes would be needed to identify archeological resources in these heavily disturbed zones. Any archeological fieldwork will be conducted by personnel who meet the Secretary of the Interior standards for a professional archeologist.

Traditional Cultural Properties
The first step in identifying historic properties of traditional religious and cultural importance to tribes or traditional cultural properties (TCPs) would be reviewing previous ethnographic studies, oral histories, and accounts of local history to determine if any such studies have covered the APE. These sources will be reviewed, and if they are sufficient, they will be used as the basis for making a determination regarding project effects. If they are not sufficient, Reclamation will work with the Confederated Tribes of the Colville Reservation to identify TCPs.

Standing Structures
In order to identify standing structures that may be considered historic properties in the APE, Reclamation will review the records of previous assessments of standing structures in the proposed project area. The Grand Coulee Dam HAER document has been recently completed and will be used as the primary reference point for project effects to historically significant character defining features of Grand Coulee Dam. The National Register eligibility of the standing structures in the APE has been determined and both the Left and Right Powerhouses are determined eligible for the National Register through an existing MOA. This consensus determination will serve as the basis for making determinations of project effects to the National Register eligible Dam and Left and Right Powerhouses and their associated infrastructures. A historian who meets the Secretary of the Interior standards will review and approve studies of the built environment to ensure that the reports comply with applicable standards.
Figure 1. Project Location.
March 16, 2016

Mr. Coleman W. Smith Jr.
Grand Coulee Power Office
Bureau of Reclamation
PO Box 620
Grand Coulee, Washington 99133-0620

RE: G1-18 Modernization Project
Log No.: 2016-03-01750-BOR

Dear Mr. Smith:

Thank you for contacting our Department. We have reviewed the information and materials you provided for the proposed G1-18 Modernization Project at Grand Coulee Dam, Grant County, Washington.

We concur with your determination of the Area of Potential Effect (APE) as described and presented in your figures and text.

We look forward to further consultations as you undertake your identification efforts, consult with the concerned tribal governments, and provide the results of cultural resources review, and render your finalized Determination of Effect.

We would appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

These comments are based on the information available at the time of this review and on the behalf of the State Historic Preservation Officer in conformance with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations 36CFR800. Should additional information become available, our assessment may be revised. Thank you for the opportunity to comment and a copy of these comments should be included in subsequent environmental documents.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 890-2615
e-mail: rob.whitlam@dahp.wa.gov
The Section 106 SHPO Concurrence Letter will be inserted here when it is available.
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Appendix C.
Memorandum of Agreement/Programmatic Agreement (placeholder)
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The Memorandum of Agreement and Programmatic Agreement will be inserted here when they are available.
November 21, 2016

Pam Druliner  
Bureau of Reclamation  
1150 North Curtis Road  
Boise, ID 83706  
pdruliner@usbr.gov

Sent by email only

Re: Confederated Tribes of the Colville Reservation’s Scoping Comments on the Proposed Grand Coulee G1-G18 Modernization and Overhaul Project

Dear Ms. Truliner,

The Confederated Tribes of the Colville Reservation (“Colville”) provides the following scoping comments on the proposed Grand Coulee G1-G18 Modernization and Overhaul Project (“Project”).

1. **Background**

   Colville is a federally recognized Indian tribe that occupies the Colville Indian Reservation—1.4 million acres of land and water in north central Washington State. The Reservation is bounded to the west by the Okanogan River, and to the south and east by the Columbia River. Since time immemorial, members of the 12 original tribes that constitute Colville—the Chelan, Colville, Entiat, Lakes, Methow, Moses-Columbia, Nespelem, Nez Perce, Okanogan, Palus, Sanpoil, and Wenatchi—have relied on fisheries in the Columbia River and its tributaries to meet their subsistence and ceremonial needs.

   On August 30, 1935, Congress authorized the construction of Grand Coulee Dam (“GCD”) on a portion of the Columbia River within the Colville Reservation. 49 Stat. 1028. To facilitate construction, in 1940, Congress instructed the Secretary of the Interior to acquire lands along the Columbia River within the Colville Reservation and Spokane Indian Reservation up to an elevation of 1,310 feet above sea level to be used for “reservoir purposes.” 16 U.S.C. §§835d-835h (hereinafter “1940 Act”).

   As a result of construction of GCD and inundation of Colville lands, many Colville tribal members were displaced, whole towns within the Colville Reservation were either abandoned or relocated, and numerous culturally and archaeologically significant sites were lost. In addition, completion of GCD terminated the salmon fisheries on the Columbia River and its tributaries...
upstream of GCD, which had historically been an extremely important source of nourishment and cultural identity for Colville members. See generally NPS Administrative History (2002).  

2. 181-D Payments

Colville was not fully compensated for the loss of lands resulting from the construction of GCD. Accordingly, Colville filed suit against the federal government for violating the “Fair and Honorable Dealings” clause of the Indian Claims Commission Act, 60 Stat. 1049. This claim, numbered 181-D, was ultimately resolved by a settlement agreement between Colville and the Bonneville Power Administration (“BPA”), under which BPA agreed to make a lump sum payment to Colville as well as annual payments to Colville to compensate Colville for the ongoing use of Colville lands for the generation of electric power. Congress ratified the settlement agreement in 1994. P.L. 103-536 (Apr. 16, 1994).

The settlement agreement between Colville and BPA is attached to this letter. Pursuant to the agreement, the annual 181-D payment is primarily based on two factors—the amount of power generated at GCD for the year, and the change in the BPA power price for the year. See Settlement Agreement, § 2.b.1. Accordingly, any change to the operation of GCD that affects power generation or BPA’s power price has the potential to affect Colville’s annual payment, which Colville members rely on as an important party of their annual income.

Colville calls on the Bureau of Reclamation to analyze the direct, indirect, and cumulative effects of the Project on the annual 181-D payment, including impacts resulting from decreased power generation during work to modernize and overhaul the G1-G18 generating units, as well as any effects resulting from operation of the modernized units.

3. Resident Fish

Pursuant to the 1940 Act, Colville maintains paramount fishing, hunting, and boating rights in the portion of Lake Roosevelt within the Colville Reservation. In order to exercise the reserved fishing right, Colville has devoted considerable resources towards establishing rainbow trout and kokanee fisheries in Lake Roosevelt to replace the historic anadromous fisheries that were lost to GCD.

Any change to the operation of GCD has the potential to adversely affect Colville’s resident fish populations in Lake Roosevelt. These rainbow trout and kokanee populations can be impacted in numerous ways, including from lake level changes, changes in water temperature, reductions in available food, deterioration or loss of habitat, and entrainment through Grand Coulee Dam.

Colville requests that the Bureau analyze the direct, indirect, and cumulative effects of construction and operation of the Project on resident fish populations in Lake Roosevelt.

4. Other Concerns

In addition to the issues discussed above, Colville is concerned that the Project could adversely affect cultural resources, including important cultural sites on and near the banks of Lake Roosevelt. Colville is also concerned that the Project could adversely affect anadromous fish in downstream reaches of the Columbia River and impact the outmigration of juvenile

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1 Available at https://www.nps.gov/parkhistory/online_books/laro/adhi/adhit.htm.
salmon if fish passage and reintroduction of anadromous fish above Grand Coulee Dam is implemented as called for by the 2014 Fish and Wildlife Program of the Northwest Power and Conservation Council.

Colville accordingly calls on the Bureau to analyze whether the Project will have any direct, indirect, or cumulative impacts on cultural resources, anadromous fish, and future anadromous fish passage at GCD.

* * *

Thank you for the opportunity to submit scoping comments on the Grand Coulee G1-G18 Modernization and Overhaul Project. If you have any questions regarding this letter, please contact Sheri Sears at (509) 634-2118.

Sincerely,

Dr. Michael E. Marchand, Chairman
Colville Business Council
November 15, 2016

Pam Druliner, Natural Resource Specialist
Bureau of Reclamation
1150 North Curtis Road
Boise, Idaho 83706

**RE: Spokane Tribe Comments regarding the proposed Grand Coulee G-1-18**
*(sent via: pdruliner@usbr.gov)*

Dear Ms. Druliner:

On behalf of the Spokane Tribe’s Natural Resources Department (Department) please accept these comments on the Proposed Grand Coulee G1-18 Modernization and Overhaul Project. The Bureau of Reclamation’s (BOR) letter requested that interested parties submit issues and concerns associated with the proposal. Given the general nature of the letter, the Department is providing BOR with a list of potential issues and concerns that it would like to see addressed in BOR’s National Environmental Policy Act (NEPA) process for this project.

- In November of 2015 the Department submitted comments on the proposed Drum Gate Maintenance Schedule. The Drum Gate Maintenance Structure is part of the overall updating and maintenance projects for Grand Coulee Dam, including this G-1-18 Modernization and Overhaul Project. BOR should consider all of the projects at the same time that will likely be included in this updating and maintenance process to ensure two potential issues are properly addressed. One, BOR should consider these planned projects as a whole to avoid any potential segmentation issues that could arise under NEPA. Two, given the potential scope of this work and other work planned, BOR must ensure that its obligations under 16 U.S.C. Section 839b(h)(11)(A)(i)&(ii) are addressed. These combined projects will modernize Grand Coulee Dam and should include studies and potential modifications and additions that address fish passage and reestablishment measures outlined in the NPCC 2014 Fish and Wildlife Program, and those same reintroduction considerations that will be part of the CRSO EIS process. In short, the Dam should be modernized for a future with anadromous fish occupying the habitats above Grand Coulee Dam.
This project along with other maintenance and modernization projects at Grand Coulee Dam will expend significant funds. Accordingly, BOR must “exercise such responsibilities consistent with the purposes of this chapter [Northwest Power Act] and other applicable laws, to adequately protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, affected by such projects or facilities in a manner that provides equitable treatment for such fish and wildlife with the other purposes for which such system and facilities are managed and operated.” See 16 U.S.C. § 839b(h)(11)(A)(i). The Department requests that BOR, as part of this process, review the 2014 Fish and Wildlife Program and develop a list of fish and wildlife actions that could be addressed at the same time as this project to ensure these funds are used in the most efficient manner possible while fulfilling all of BOR’s obligations which include the protection, mitigation, and enhancement of fish and wildlife.

Finally, this project and the other refurbishment projects at Grand Coulee will affect the Spokane Tribe’s natural, cultural and economic resources. The potential for more or fewer reservoir drawdowns for drum gate maintenance will impact positively or negatively the Tribe’s fishery, Two Rivers Marina, bank stabilization, water quality, and cultural resources to just name a few. Including a review to ensure the safe passage of juvenile fish. The Tribe has documented redband trout that develop signs of anadromy and are then detected down stream of Chief Joseph Dam. BOR needs to ensure that whatever refurbishment technology and design it utilizes, includes a juvenile fish passage component. Accordingly, the Department expects BOR to honor its trust obligations to protect the Tribe’s resources at every stage of this process and the larger Grand Coulee Dam refurbishment, maintenance and modernization process over the coming years.

The Department hopes that these comments help BOR through this decision making process. If you have any questions, please do not hesitate to contact me at (509) 626-4427.

Sincerely,

B.J. Kieffer
Director
Spokane Tribal Natural Resources Department

Cc: Carol Evans, Chairwoman, Spokane Tribe of Indians
Brent Nichols, Fisheries Manager, Spokane Tribe of Indians
Ted Knight, Special Legal Counsel, Spokane Tribe of Indians
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PUBLIC COMMENT - Proposed multi-year power plant overhaul project / 2 Grand Coulee Dam powerhouses

1 message

To: Pam Druliner <pdruliner@usbr.gov>

Wed, Nov 23, 2016 at 12:53 PM

Ms Druliner,

Please accept my public comments as follows:


My Residence is at [blank], WA. Residence physically located near [blank].

My concern is the speed the trucks will travel up and down the road (past experience), which caused the dust and ground movement and noise. And the noise level of the equipment at the third power house.

I would like to see the project completed in the least amount of time, prefer option "B".

Any questions, please contact me at [blank] or by email.

Regards,

[Redacted]
Comments GC G1-18
1 message

Mon, Nov 21, 2016 at 4:10 PM

Pam:

I contacted you prior and asked for an extension on the comment deadline. You graciously extended until today. Thank you. I tried calling you and found that you are out until next week.

After closer review, I do not have any environmental concerns regarding the Proposed Alternatives to accomplish the project scope.

My concern is with the Project Scope itself in the following areas:

1. Any and all modernization of the Left and Right power generators will have an adverse effect on the CBP’s power rate. The effects will come from both the increased cost of capital investments and decreased generation. Both factors are variable in the power rate formula.
2. Some modernizations included in this scope have already been included in the John Keys Pump Generation modernization plan, i.e. iso-phase bus and station service.
3. Replacement of the nine overhead cranes is unrealistic, unneeded and uneconomical. This was found to be the case in the Keys plant study. USBR should use lessons learned from prior out-year plans.

I am uncertain if my comments will be included in the Draft EA, however if they are not I would like to get a written response informing when/how the correct forum to voice our concerns will be offered.

Thank you for your consideration and your assistance in this process.
To whom it may concern

My suggestion is Alternative B. I have been in the Grand Coulee Dam Area 50 years in 2017. I came into the area to work on the Third Powerplant and have seen lots of construction and contractors come and go.

Alternative B would provide a more even work force into the area. This area does not have a lot of available housing at this time and workers are commuting in and out of the area. Work could be done without constructing additional million dollars buildings that the USBR did on the last project.

People just drive into the area and don’t think it would be a place to live but if they got involved they would learn it is a great place to live and raise children. This causes workers not to become involved in the community and does not help businesses in the area. Also with the low tax base because most of the land is not taxed because it belongs to the USBR or the Colville tribe.

I would like to see the top management of the USBR work closer with the local community. They also do not live in the area so have NO interest in being part of the community. The area needs someone in the USBR operation to work with the local area city councils, Chamber, Chamber Economic Development Committee, school system and real estate people and more.

I am involved in many of the community organizations and a volunteer in many such as, and more.

Electric City, Wa
email: yr retiree from the USBR
I realize that the request for public comment seems to be focused on environmental issues, likely thinking about the water and ground effect.

I’d like to bring up the housing and economic issues. I would like to recommend that the USBR assign someone to work with the local Economic Development Council, of which I am one, to make the economics in this area better for all. Having a significant amount of workers commute in, rather than live here, makes it difficult to economically maintain the area. We would like to join the USBR in encouraging local living in the area.

Perhaps USBR could buy up the old houses and fix them up to be decent contract working digs or even be reasonable quality rentals for employees only. The entire area would benefit by having income producing families living in this town. The refurbishment of homes will clean up the area and help everyone feel better about living here. It will provide badly needed housing options for employees. Another idea would be to create a retirement village which would encourage USBR retirees to move into smaller and more manageable homes in their older part of life and free up homes that they can no longer maintain.

There is a new Superintendent at the school who is working hard to change the reputation of the school. So the next thing to work on is day care and other businesses that will help to prop up the economics of this community. I am a shop owner (and a former engineer) and would love to see at least 150 (estimated current commuters) new families living here and patronizing the local businesses.

Who would be the right person to plug into our EDC so that we can continue this dialogue.

Thanks,
To Whom It May Concern:

As a resident of the Northwest and a concerned citizen I would like to express my support for the upgrades proposed to the two powerhouses, cranes, and support infrastructure at the Grand Coulee Dam. This dam generates CLEAN power for a significant portion of the country and is badly in need of upgrades to the older equipment.

Again, I would like to express my complete and wholehearted support for this vital project.

Regards,