Columbia River System Operations Environmental Impact Statement Record of Decision

September 2020

Co-lead Agencies:
U.S. Army Corps of Engineers – Northwestern Division
Bureau of Reclamation – Columbia-Pacific Northwest Region
Bonneville Power Administration (DOE/EIS-0529)

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Acronym List

aMW	Average Megawatt
AEMR	Action Effectiveness Monitoring and Research
APPS	Authorization and Permits for Protected Species reporting system
ARPA	Archaeological Resources Protection Act
BA	Biological Assessment
CAR	Coordination Act Report
CEERP	Columbia Estuary Ecosystem Restoration Program
CEQ	Council on Environmental Quality
COMPASS	Comprehensive Passage Model
CRFM	Columbia River Fish Mitigation
CRITFC	Columbia River Intertribal Fish Commission
CRS	Columbia River System
CRSO EIS	Columbia River System Operations Environmental Impact Statement
CSS	Comparative Survival Study
CWA	Clean Water Act
DOE	Department of Energy
DOJ	United States Department of Justice
DPS	Distinct Population Segment
eDNA	Environmental DNA
EFH	Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act
EIS	Environmental Impact Statement under the National Environmental Policy Act
EPA	U.S. Environmental Protection Agency
ERTG	Expert Regional Technical Group
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
F&W	Bonneville Fish and Wildlife Program
FCRPS	Federal Columbia River Power System
FEIS	Final Environmental Impact Statement
FMO	Foraging, Migrating, and Overwintering
FPIP	Flow Plan Implementation Protocol
FPOM	Fish Passage Operations and Maintenance
FRM	Flood risk management
GHG	Greenhouse Gas
GSI	Genetic stock identification
I&C	Implementation and Compliance Monitoring
IAPMP	Inland Avian Predation Management Plan
IDFG	Idaho Fish and Game
IFP	Improved Fish Passage
ISAB	Northwest Power and Conservation Council's Independent Scientific Advisory Board
ISRP	Northwest Power and Conservation Council's Independent Scientific Review Panel
ITA	Indian Trust Assets
JBS	Juvenile Bypass System

KRWS	Kootenai River white sturgeon
KTOI	Kootenai Tribe of Idaho
kWh	Kilowatt-hour
LCM	Lifecycle model
LCR	Lower Columbia River
LF	LANDFIRE (Landscape Fire and Resource Management Planning Tool)
LOLP	Loss-of-load probability
LPS	Lamprey passage structures
LSRCP	Lower Snake River Compensation Plan
MCR	Mid-Columbia River
MFWP	Montana Fish, Wildlife & Parks
MO	Multiple Objective Alternative or Multiple Objective Action Alternative
MOA	Memorandum of Agreement
MOP	Minimum operating pool
MRLC	Multi-resolution land characteristics
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MW	Megawatt
MWh	Megawatt-hour
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPMP	Northern Pikeminnow Management Program
NWF	National Wildlife Federation
ODFW	Oregon Department of Fish and Wildlife
OMB	Office of Management and Budget
PF	Priority Firm
PIT	Passive Integrated Transponder
PTAGIS	PIT Tag Information System
PTC	Positive Train Control
RM&E	Research, Monitoring, and Evaluation
RPA	Reasonable and Prudent Alternative
SARs	Smolt-to-adult returns
SMP	Smolt Monitoring Program
SNP	Single nucleotide polymorphism
SR	Snake River
SRB	Snake River Basin
SRKW	Southern Resident Killer Whale
SRWG	Studies Review Working Group
TCP	Traditional Cultural Property
TDG	Total Dissolved Gas

THSC	Tributary Habitat Steering Committee
TMDL	Total Maximum Daily Load
UCR	Upper Columbia River
USFWS	United States Fish and Wildlife Service
UWR	Upper Willamette River
VARQ	Variable discharge
VDLs	Variable Draft Limits
WDFW	Washington Department of Fish and Wildlife

Section 1. Introduction

The Columbia River System Operations Environmental Impact Statement (CRSO EIS) dated July 2020 addresses the ongoing operations, maintenance, and configuration of the 14 federal Columbia River System (CRS) projects on the Columbia and Snake rivers. The 14 projects are Libby, Hungry Horse, Albeni Falls, Grand Coulee, Chief Joseph, Dworshak, Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville. The co-lead agencies (the U.S. Army Corps of Engineers [Corps], Bureau of Reclamation [Reclamation], and Bonneville Power Administration [Bonneville]) share responsibility and legal authority for managing the Federal elements of the CRS. These three co-lead agencies coordinate the operation of the CRS and have worked together to develop this EIS. The Corps and Reclamation develop operating requirements for their projects. These are the limits within which a reservoir or dam must be operated. Some requirements are established by Congress when a project is authorized, while others are established by the agencies based on operating experience. Within these operating limits, Bonneville schedules and dispatches power. This process requires continuous communication and coordination among the three agencies. The co-lead agencies have identified the Preferred Alternative, as described in detail in Chapter 7 of the Final EIS, as the Selected Alternative in this Record of Decision (ROD).

This CRSO EIS and ROD represent the detailed work, evaluation, and decision-making of the three co-lead agencies. The CRSO EIS was completed considering the input and assistance of the multiple cooperating agencies with special expertise and authority over the resources evaluated. The co-lead agencies provided for robust public and stakeholder review beginning with scoping and continuing throughout the National Environmental Policy Act (NEPA) process.

As part of the CRSO EIS, the agencies considered six alternatives to Columbia River System operations, maintenance, and configuration. The agencies analyzed the effects of these alternatives on the human environment, including environmental, economic, and social impacts. On February 28, 2020, the co-lead agencies released for public comment the Draft CRSO EIS describing the effects of these alternatives and identifying the agencies' Preferred Alternative. The 45-day public comment period ended on April 13, 2020, and the agencies reviewed and responded to these comments in the Final CRSO EIS. The co-lead agencies released the Final EIS on July 28, 2020, and the agencies issued this joint Record of Decision on September 28, 2020.

All three co-lead agencies recognize selecting an alternative is a complex decision, and have identified the Preferred Alternative as the Selected Alternative to implement. The agencies' expertise, developed over decades of experience operating the projects, allowed for careful, comprehensive consideration of current, high quality technical and scientific information, as well as expert analysis for thorough evaluation of each alternative. The agencies conferred with tribes, public interest groups, the Northwest's Congressional delegation and governors, as well as stakeholder groups, and Federal, state and local public service agencies. The co-lead agencies also closely read, considered, and responded to the public comments which represented diverse voices with numerous perspectives. The agencies considered the effects of making this decision, and sought to provide a balanced approach and the flexibility needed to continue operations and maintenance of the CRS in this dynamic environment.

On March 20, 2018, Office of Management and Budget (OMB) and Council on Environmental Quality (CEQ) issued an OMB/CEQ Memorandum to Heads of Federal Departments and Agencies titled "One Federal Decision Framework for the Environmental Review and Authorization Process for

Major Infrastructure Projects under Executive Order 13807" (OFD Framework), in accordance with Executive Order 13807 (82 Fed. Reg. 40,463 (Aug. 24, 2017)). This "One Federal Decision" policy has increased federal coordination on environmental processes and review, shortened previous timelines, and resulted in the utilization of a joint ROD for federal agencies. This CRSO EIS ROD is consistent with the One Federal Decision policy.

1.1 Decision Summary

1.1.1 Corps' Decision Summary

The information presented in this joint ROD is the Corps' determination of the Selected Alternative for implementation, the agencies' compliance with the NEPA policy and procedures, environmental regulations, and public and agency review. The NEPA process has produced sufficient and accurate assessments of the resources, needs, concerns, and other issues that relate to the evaluated alternatives and has undergone public and agency review as required by 33 C.F.R. Part 230 and 40 C.F.R. parts 1500 through 1508. The conclusions additionally have been reviewed and evaluated by an independent review panel and found to be appropriate. Consultation on the Selected Alternative has been completed per Section 7(a)(2) of the Endangered Species Act (ESA) and incorporated into the Selected Alternative. The Corps has determined, and the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) CRS Biological Opinions demonstrate, based on the best available commercial and scientific information, that the Corps' implementation of the Selected Alternative will not jeopardize listed species or adversely modify or destroy critical habitat.

Based on the analysis contained in the Draft and Final EIS (including review of a reasonable range of alternatives), the reviews by other Federal, State, and local agencies, Tribes, input of the public, and the review by my staff, I, D. Peter Helmlinger, P.E., Brigadier General, U.S. Army, Division Commander, select the alternative identified as the Preferred Alternative in the Final EIS as the Selected Alternative in this ROD. I find the Selected Alternative, along with the incorporation of the identified mitigation, and consistent with the requirements outlined in the Incidental Take Statements contained in the 2020 USFWS and NMFS CRS Biological Opinions, which were also incorporated in this decision, to be technically feasible, meets the Purpose and Need Statement and many of the objectives developed for the EIS, is in accordance with environmental statutes and in the public interest. Additionally, it best balances the human and natural environment in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and to fulfill the social, economic, and other requirements of present and future generations of Americans. I have also considered tribal treaty rights and the United States' trust responsibilities to the tribes in selecting this alternative. Actions that will be implemented by the co-lead agencies will improve salmonid survival, which will benefit tribal fisheries. Therefore, the Corps is deciding to operate its 12 CRS projects, and implement associated mitigation and conservation actions, according to the description of the Preferred Alternative in the Final EIS and the proposed action analyzed in the 2020 USFWS and NMFS CRS Biological Opinions.

1.1.2 Reclamation's Decision Summary

Reclamation is deciding in this ROD to operate its two CRS projects, Grand Coulee and Hungry Horse, and implement associated mitigation and conservation actions, according to the description of the Preferred Alternative in the Final EIS and the proposed action analyzed in the 2020 USFWS and NMFS CRS Biological Opinions. The Final EIS provides Reclamation a reasonable range of

alternatives to implement, identifies key issues and significant effects of alternative actions, and complies with the procedural requirements of NEPA and its implementing regulations. The Final EIS shows that the Selected Alternative is feasible and satisfies Reclamation's statutory obligations. The NMFS and USFWS CRS Biological Opinions demonstrate, based on the best available commercial and scientific information, that Reclamation's implementation of the Selected Alternative will not jeopardize listed species or adversely modify or destroy critical habitat.

This decision improves upon multiple existing measures related to project operations, such as by limiting winter drafting of Reclamation reservoirs to conserve water for spring flow augmentation for migrating salmon and steelhead. Reclamation will also coordinate with the sovereign inter-agency Technical Management Team to solicit, review, comment, and make recommendations for consideration during preparation of the Water Management Plan and during in-season operational adjustments. Additionally, Reclamation's tributary habitat restoration program has improved salmonid and lamprey habitat across the basin since its inception in the early 2000s. It has matured significantly over that period, and this decision implements several advancements resulting from program maturation. In particular, this decision implements improvements in project prioritization, focused research and monitoring efforts to directly support implementation knowledge, and efficiency gains in the design process.

Reclamation's decision implements new measures, including several operations at Grand Coulee. One allows additional maintenance flexibility on generating units and spillways, which the Final EIS shows could result in small increases in spill and thus downstream total dissolved gas (TDG) concentrations. It also updates flood risk management calculations, which Corps and Reclamation will apply in a coordinated and adaptive manner consistent with the Final EIS. Reclamation is also deciding to utilize local water supply forecasts in its operation of Hungry Horse, which will better balance downstream flow augmentation with local resident fish needs.

Before reaching this decision, Reclamation reviewed a reasonable range of alternatives in the EIS; the results of the physical, environmental, economic, and human resources impact analyses; comments submitted by federal, state, and local agencies, tribes, interested parties, and the public; and applicable laws and regulations. The Selected Alternative meets the Purpose and Need of the action, balancing Reclamation's ability to meet its statutory project obligations while also complying with the requirements of the ESA, Clean Water Act (CWA), and other applicable laws.

1.1.3 Bonneville's Decision Summary

Summary of the Decision

Bonneville is deciding to implement its part of the Preferred Alternative identified in the CRSO EIS (DOE/EIS-0529, July 2020), which also constitutes the proposed action reviewed in the 2020 NMFS and USFWS CRS Biological Opinions. Under the Selected Alternative, Bonneville will market and transmit the power generated by the CRS projects as part of coordinated system operations. More specifically, Bonneville will use the CRSO EIS for any operational changes associated with power marketing. These operations will be coordinated with other operational, maintenance or configuration actions for flood risk management, irrigation, fish and wildlife conservation, water quality, navigation and other congressionally authorized purposes. Bonneville's implementation of the Selected Alternative will also comply with all applicable laws and regulations, including the NEPA, the ESA, the Pacific Northwest Electric Power Planning and Conservation Act and the CWA.

As part of the Selected Alternative, Bonneville will continue to mitigate for the effects of its power operational actions. Bonneville will fund non-operational conservation measures as part of implementation of the proposed action consulted upon in the NMFS and USFWS CRS Biological Opinions and mitigation actions associated with the CRSO EIS (see Section 7.6 of the CRSO EIS; Attachment 1, Mitigation Action Plan). These actions will be included in its existing Fish and Wildlife Program and are consistent with the Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program (see Chapters 2, 5, 7 of the CRSO EIS; Attachment 1, Mitigation Action Plan).

In addition to Bonneville's fish and wildlife mitigation commitments described above, there are fish and wildlife mitigation costs associated with fulfilling Bonneville's power share responsibilities that are direct funded by Bonneville to the Corps and Reclamation for mitigation activities, such as hatchery operations, fish stocking, elk habitat maintenance, and others. In addition to the hatchery operations that are funded through the Fish and Wildlife Program, Bonneville will continue to provide USFWS with annual operations and maintenance funding for the Lower Snake River Compensation Plan (LSRCP), in accordance with Bonneville's direct funding agreement with USFWS and any future renewals.

ADDRESS: This Record of Decision will be available to all interested parties and affected persons and agencies and is being sent to all stakeholders who requested a copy. Copies of the Draft and Final CRSO EISs, and additional copies of this document can be obtained from Bonneville's Public Information Center, P.O. Box 3621, Portland, Oregon, 97208-3621. Copies of these documents may also be obtained by calling Bonneville's nationwide toll-free request line at 1-800-622-4520, or by accessing the CRSO EIS project website at https://www.bpa.gov/efw/Analysis/NEPADocuments/Pages/Columbia-River-System-Operations-Project.aspx. Additional information is also available at www.crso.info.

FOR FURTHER INFORMATION, CONTACT: Environmental Planning and Analysis, Bonneville Power Administration –EC-4, P.O. Box 3621, Portland, Oregon, 97208-3621; or toll-free telephone number 1-800-622-4519; or e-mail ECAdmin@bpa.gov.

Section 2. Background

2.1 Purpose and Need

The CRSO EIS evaluated the long-term coordinated operation and management of the CRS projects for the multiple authorized project purposes. An underlying need is to review and update the management of the CRS, including evaluating measures to avoid, offset, or minimize impacts to resources affected by managing the CRS in the context of new information and changed conditions in the Columbia River Basin subsequent to the 1995 System Operation Review EIS, with the RODs in 1997. In addition, the co-lead agencies responded to the Opinion and Order issued by the U.S. District Court for the District of Oregon (District Court), described in more detail in Section 2.3 below. This included evaluating mitigation and non-operational conservation measures to address impacts to ESA-listed species from CRS operations. The CRSO EIS evaluated actions within the current authorities of the co-lead agencies, as well as certain actions that are not within their authorities, based on the District Court's observations about alternatives that should be considered and comments received during the scoping process. The CRSO EIS also provided information and analyses that allowed the co-lead

agencies and the region to evaluate the costs, benefits, and tradeoffs of various alternatives as part of reviewing and updating management of the CRS. The co-lead agencies will use the information garnered through this process to guide future decisions, and allow for a flexible approach to meeting multiple responsibilities including resource and legal and institutional purposes of the action. A full discussion of the Purpose and Need for the CRSO EIS is discussed in Section 1.2 of the Final CRSO EIS.

2.2 Objectives

The eight objectives presented below, along with the CRSO EIS Purpose and Need Statement (Section 1.2 of the Final CRSO EIS), guided the development of a reasonable range of alternatives. The co-lead agencies evaluated the alternatives to determine how effectively they met the objectives as described in Chapter 2. The specific objectives are as follows:

1) Improve ESA-listed anadromous salmonid juvenile fish rearing, passage, and survival within the CRSO project area through actions including but not limited to project configuration, flow management, spill operations, and water quality management.
2) Improve ESA-listed anadromous salmonid adult fish migration within the CRSO project area through actions including but not limited to project configuration, flow management, spill operations, and water quality management.
3) Improve ESA-listed resident fish survival and spawning success at CRSO projects through actions including but not limited to project configuration, flow management, improving connectivity, project operations, and water quality management.
4) Provide an adequate, efficient, economical, and reliable power supply that supports the integrated Columbia River Power System.
5) Minimize greenhouse gas emissions from power production in the Northwest by generating carbon-free power through a combination of hydropower and integration of other renewable energy sources.
6) Maximize operating flexibility by implementing updated, adaptable water management strategies to be responsive to changing conditions, including hydrology, climate, and the environment.
7) Meet existing contractual water supply obligations and provide for authorized additional regional water supply.
8) Improve conditions for lamprey within the CRSO project areas through actions potentially including but not limited to project configurations, flow management, spill operations, and water quality management.

2.3 Recent Litigation History

On May 4, 2016, the District Court issued an opinion invalidating NMFS' biological opinion evaluating the operation of the Columbia River System. The Court held that the 2014 biological opinion violated the ESA and remanded the biological opinion to NMFS and ordered it to complete a new biological opinion. In addition to its findings under the ESA, the District Court found the Corps and Reclamation did not comply with NEPA when they adopted the biological opinion. The District Court ordered

that a new environmental impact statement under NEPA be prepared by March 26, 2021 and that the agencies' respective related Records of Decision be issued on or before September 24, 2021. The District Court further ordered the Corps and Reclamation to continue to implement the biological opinion until a new biological opinion is prepared and filed. On October 18, 2018, the *Presidential Memorandum on Promoting the Reliable Supply and Delivery of Water in the West* directed the co-lead agencies to develop a schedule to complete the CRSO EIS and the associated biological opinions by 2020.

On January 9, 2017, plaintiffs filed motions for injunction with the District Court requesting (1) increased spring spill at eight lower Snake and Columbia River Federal projects beginning with the spring 2017 fish migration season, (2) initiation of bypass operations on March 1, 2017, for smolt monitoring, and (3) a halt to spending by the Corps on certain ongoing and future capital projects at the four lower Snake River projects. On March 27, 2017, the District Court issued an Opinion and Order granting in part and denying in part the motions for injunction with respect to spill, smolt monitoring, and capital project funding.

In its spill ruling, the District Court indicated that it intended to order "increased spill" for the spring 2018 migration season. It ordered the Federal defendants[1] to work with regional experts to develop a plan for increased spill during the spring fish passage season at eight lower Snake and Columbia River projects beginning in the 2018 spring migration season.

In its capital project ruling, the Court concluded that capital spending at the four lower Snake River dams is "likely to cause irreparable harm" under NEPA by creating a significant risk of bias in the CRSO EIS process. The Court declined, however, to enjoin two specific projects at Ice Harbor because their primary benefit is increasing fish survival. On May 16, 2017, the Federal defendants filed a joint proposed notification process to disclose sufficient information to the plaintiffs on future capital spending projects at each dam during the NEPA remand period at appropriate and regular intervals, as directed by the District Court, which it adopted in an order dated May 25, 2017. On June 8, 2017, the Corps and Bonneville provided information to National Wildlife Federation as part of the notification process on 13 capital hydropower improvement projects. Since June 2017, the Corps and Bonneville have continued to provide information on certain capital hydropower improvement projects, Columbia River Fish Mitigation (CRFM) and Other Non-Power capital projects (primarily navigation) at the lower Snake River dams (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor).

On October 30, 2017, the Federal defendants filed a status report with the Court addressing: (1) the appropriateness of the remaining NEPA schedule; and (2) how the agencies intend to integrate and coordinate the NEPA process and the ESA Section 7(a)(2) consultation. The Federal defendants reported they are on target to complete the NEPA process and will integrate the NEPA/ESA processes so the agencies can make informed decisions on the future management of the Federal Columbia River Power System (FCRPS).

On December 8, 2017, the Federal defendants and the plaintiffs filed a joint proposed order and spill implementation plan with the Court. On January 8, 2018, the District Court entered a final spill injunction order governing 2018 spring fish passage spill operations, in which the Court adopted the joint proposed order without modification.

[1] The Federal defendants referred to in Section 2.3 are NMFS, Corps, and Reclamation.

In December 2018 the Federal defendants, the State of Washington (defendant-intervenor), the State of Oregon (plaintiff-intervenor), and the Nez Perce Tribe (amicus curiae) executed an agreement on spring operations (the *2019-2021 Spill Operation Agreement*) in which these parties agreed to certain operations and also agreed not to litigate issues relating to the biological opinion until the CRSO EIS process is complete. On December 18, 2018, the parties filed a joint status report with the District Court[2] notifying the Court of this agreement and that the Federal defendants intended to complete consultation on a new biological opinion before spring operations began in April 2019. NMFS issued a new BiOp on March 29, 2019, incorporating the spring spill operations that were agreed upon in December 2018. The 2019 Columbia River System Biological Opinion went into effect on April 1, 2019.

2.4 Statutory Background

The statutes defining how the agencies operate, maintain, and configure the CRS play a critical role in this decision. Those laws fall primarily into two categories: (1) specific authorizations to construct and operate projects for particular purposes; and (2) general operation and maintenance authorities and responsibilities. Collectively, these statutes define the full extent of the agencies' abilities to operate, maintain, and configure the CRS.

Congress enacted numerous specific statutes authorizing the construction and operation of each CRS project. Congress authorized the first two projects, Bonneville and Grand Coulee, in the Rivers and Harbors Act of 1935, Pub. L. No. 74-409.[3] Congress then authorized Hungry Horse in 1944 under Pub. L. No. 78-329; McNary and the four lower Snake River dams (Ice Harbor, Lower Monumental, Little Goose and Lower Granite) in the River and Harbor Act of 1945, Pub. L. No. 79-14; and Chief Joseph in the Rivers and Harbors Act of 1946, Pub. L. No. 79-525. Congress authorized the remaining CRS projects in the Flood Control Act of 1950, Pub. L. No. 81-516, except for Dworshak, which Congress authorized in the Flood Control Act of 1962, Pub. L. No. 87-874.

Each project's authorizing statute differs, identifying, among other things, the specific purposes for which Reclamation or the Corps must operate a project. Likewise, each project's authorization may vary in defining how that purpose is implemented at each specific project. Every CRS project's authorizing statute includes hydroelectric power generation, and most also include navigation. All of the Corps projects are authorized to support recreation and fish and wildlife conservation.[4] The storage projects—Grand Coulee, Dworshak, Albeni Falls, and Hungry Horse, John Day, and Libby—are authorized for flood risk management. The two Reclamation projects, Grand Coulee and Hungry Horse, as well as the Corps' John Day project, include in their authorizing statutes authority to operate for irrigation purposes. Congress also authorized irrigation as an incidental benefit at the Corps'

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[2] Status Report RE: 2019 -2021 Spill Operation Agreement During the NEPA Remand Period, *Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv.*, No. 3:01-CV-00640-SI (D. Or. Dec. 18, 2018). Footnote 3 stated: "The Confederated Tribes of the Umatilla Reservation, the Confederated Tribes of the Warm Springs, and the State of Idaho indicated that they support the Agreement. The Confederated Salish and Kootenai Tribes, the Kootenai Tribe of Idaho, and the State of Montana collectively do not oppose the Agreement so long as its implementation does not adversely affect or preclude the improvement of the Montana Operations…."

[3] Construction of Bonneville and Grand Coulee commenced under the 1933 National Industry Recovery Act, which authorized the Federal Emergency Administrator of Public Works to develop hydropower, transmit electricity, construct river improvements, and control floods. Pub. L. No. 73-67, § 202 (June 16, 1933). After litigation concerning application of the Act to another project, Congress formally reauthorized both Bonneville and Grand Coulee in the 1935 Rivers and Harbors Act.

[4] Recreation as a Corps' project purpose was generally authorized under the Flood Control Act of 1944, Pub. L. No. 78-534.

projects on the lower Snake River and at The Dalles. Fish and wildlife mitigation at the lower Snake River projects was the result of negotiations under the Fish and Wildlife Coordination Act, Pub. L. No. 85-624.

Overlaying these specific project laws is the Pacific Northwest Electric Power Planning and Conservation Act, Pub. L. No. 96-501. Passed in 1980, the Act seeks to fulfill many objectives, including to provide "an adequate, efficient, economic, and reliable power supply" and "to protect, mitigate and enhance the fish and wildlife . . . of the Columbia River and its tributaries." In support of these goals, the Act requires federal agencies, including the co-lead agencies, to exercise their responsibilities for operating and maintaining CRS projects "to adequately protect, mitigate, and enhance fish and wildlife … affected by such projects or facilities in a manner that provides equitable treatment for such and fish and wildlife with the other purposes" of the projects. It also obligates the co-lead agencies to take into account, at the relevant stages of their decision-making and to the fullest extent practicable, the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power and Conservation Council.

As a backdrop to the foregoing legislation specific to the CRS, general agency statutes also guide the agencies' operation, maintenance, and configuration of the CRS. These include foundational laws, like the Bonneville Project Act of 1937, Pub. L. No. 75-329, which governs aspects of Bonneville's power marketing activities; the Reclamation Project Act of 1939, Pub. L. No. 76-260, which guides Reclamation's operation of its two CRS projects; and the Flood Control Act of 1944, Pub. L. No. 78-534, which authorizes the sale of power from Corps dams, defines the Corps' role in flood risk management at non-Corps dams, and establishes recreation as a purpose of Corps projects.

In addition to these statutes, requirements of the ESA heavily influence CRS operations. Still other laws, including the CWA and National Historic Preservation Act, are important considerations in how the agencies operate and maintain the CRS projects.

Fulfilling these many statutory responsibilities, some of which must be balanced with each other and often pose conflicts, is extremely complex, requiring consideration of multiple factors across an expansive geographic scale. Many additional factors impacting these responsibilities involve matters beyond the reach of the agencies' authorities, including incoming water quality, ocean conditions, and historical environmental degradation.

2.5 Alternatives Considered

The agencies used an iterative process to develop a range of alternatives for the future physical configuration, operation, and maintenance of the 14 projects of the CRS to achieve a reasonable balance of competing resource demands for the available water and for the multiple authorized purposes, including evaluating measures to avoid, offset, or minimize impacts to resources affected by managing the CRS in the context of new information and changed conditions in the Columbia River Basin since the System Operation Review EIS in 1997. This process began by identifying the EIS Purpose and Need Statement and objectives for future management of the CRS. A suite of eight preliminary draft alternatives were developed to focus on individual resources. These Single Objective Alternatives provided information regarding how well measures might perform when combined, and helped identify any conflicts between resources, actions, or locations. These alternatives informed the next iteration of alternatives development, resulting in a reasonable range of Multiple Objective Action

Alternatives (MOs) suitable for analysis. Following analysis and identification of effects for the four MO alternatives, the co-lead agencies used these findings to develop a fifth action alternative, which was described as the agencies' Preferred Alternative.

2.5.1 No Action Alternative

The No Action Alternative includes all operations, maintenance, fish and wildlife programs, and mitigation in effect when the CRSO EIS was initiated in September 2016. Juvenile fish passage spill operations at the eight lower Columbia River and Snake River dams would follow the 2016 Fish Operations Plan developed by the Corps, which used performance standard spill provided under previous NMFS biological opinions. The co-lead agencies would also implement structural measures that were already budgeted and scheduled as of September 2016 that affected CRS operations. The majority of these structural measures are dam modifications to improve conditions for ESA-listed salmon and steelhead. For example, installation of Improved Fish Passage (IFP) turbines planned for Ice Harbor and McNary Dams would occur. Other ongoing habitat and mitigation programs would continue, as was planned at the time the CRSO EIS process started. A detailed description of measures included in the No Action Alternative is included in Section 2.4.2 of the CRSO EIS.

2.5.2 Multiple Objective Alternative 1

Multiple Objective Alternative 1 (MO1) was developed with the goal to avoid unreasonable effects – and if possible, achieve – congressionally authorized project purposes while also benefiting ESA-listed fish species relative to the No Action Alternative. MO1 differs from the other alternatives by carrying out a juvenile fish passage spill operation referred to as a block spill design. The block spill design alternates between two operations: a base operation that releases surface flow, where juvenile fish are most present, over the spillways using different flows at each project based on historical survival tests; and a fixed higher spill target at all projects. For the block that uses the same target at all projects, the operators would release flow through the spillways up to a target of 120 percent TDG in the tailrace of projects and 115 percent TDG in the forebay of those projects. The intent of these two spill operations is to demonstrate the benefit of different spill levels to fish passage. In addition, MO1 sets the duration of juvenile fish passage spill to end based on a fish count trigger, rather than a predetermined date. MO1 proposes to initiate transport operations for juvenile fish approximately two weeks earlier than under the No Action Alternative.

MO1 also incorporates measures to increase hydropower generation flexibility in the lower basin projects and alters the use of stored water at Dworshak for downstream water temperature control in the summer. MO1 includes measures similar to the other action alternatives, which include increased water management flexibility and water supply, and using local forecasts in whole-basin planning. MO1 also includes measures to disrupt predators of ESA-listed fish. A detailed description of the measures in MO1 is in Section 2.4.3 of the CRSO EIS.

2.5.3 Multiple Objective Alternative 2

Multiple Objective Alternative 2 (MO2) was developed with the goal to increase hydropower generation and reduce regional greenhouse gas emissions while avoiding or minimizing adverse effects to other congressionally authorized project purposes. MO2 would slightly relax the No Action Alternative's restrictions on operating ranges and ramping rates to evaluate the potential to increase hydropower generation efficiency and increase operators' flexibility to respond to changes in power

demand and changes in generation of other renewable resources. The measures within MO2 would increase the ability to meet power demand with hydropower generation during the periods when it is most valuable (e.g., winter, summer, and daily peak demands). The upper basin storage projects would be allowed to draft slightly deeper, allowing more hydropower generation in the winter and less during the spring. MO2 also differs from the other alternatives by excluding the water supply measures and evaluating an expanded juvenile fish transportation operation season.

This alternative proposed to transport all collected ESA-listed juvenile fish for release downstream of the Bonneville project, by barge or truck, and to reduce juvenile fish passage spill operations to a target of up to 110 percent TDG. Inclusion of the target up to 110 percent TDG spill operation provided the lowest end of the range of juvenile fish passage spill operations evaluated in the CRSO EIS.

Structural measures of MO2 are aimed at benefits for ESA-listed fish and lamprey. These measures are similar to other alternatives and include making improvements to adult fish ladders, upgrading spillway weirs, adding powerhouse surface passage, and IFP turbine upgrades at John Day Dam. A detailed description of measures included in MO2 is in Section 2.4.4 of the CRSO EIS.

2.5.4 Multiple Objective Alternative 3

Multiple Objective Alternative 3 (MO3) was developed to integrate actions for water management flexibility, hydropower generation at the remaining CRS projects, and water supply with measures that would breach the four lower Snake River dams (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor). In addition to breaching these four projects, MO3 differs from the other alternatives by carrying out a juvenile fish passage spill operation that sets flow through the spillways up to a target of 120 percent TDG in the tailrace of the four lower Columbia River projects (McNary, John Day, The Dalles, and Bonneville). This alternative also proposes an earlier end to summer juvenile fish passage spill operations than the No Action Alternative. Instead, flows would transition to increased hydropower generation when low numbers of juvenile fish are anticipated.

Structural measures in this alternative include breaching the four lower Snake River dams by removing the earthen embankments at each dam location, resulting in a controlled drawdown. A detailed description of measures included in MO3 is in Section 2.4.5 of the CRSO EIS.

2.5.5 Multiple Objective Alternative 4

Multiple Objective Alternative 4 (MO4) was developed to examine a combination of measures to benefit ESA-listed fish, integrated with measures for water management flexibility, hydropower production in certain areas of the basin, and additional water supply. This alternative included the highest fish passage spill level considered in this CRSO EIS, dry-year augmentation of spring flow with water stored in upper basin reservoirs, and annually drawing down the lower Snake River and lower Columbia River reservoirs to their minimum operating pools (MOP). This alternative also included spillway weir notch inserts, changes to the juvenile fish transportation operations, and spill through surface passage structures for kelts, overwintering steelhead and steelhead overshoots. In MO4, the juvenile fish transport program would operate only in the spring and fall, while juvenile fish passage spill is set up to 125 percent TDG during the spring and summer spill season. The alternative contains a measure for restricting winter flows from the Libby project to protect newly established downstream riparian vegetation to improve conditions for ESA-listed resident fish, bull trout, and Kootenai River white sturgeon (KRWS) in the upper Columbia River Basin.

The structural measures in this alternative are primarily focused on improving passage conditions for ESA-listed salmonids and Pacific lamprey. The inclusion of spillway weir notch inserts is the only structural measure unique from the other MO alternatives. A detailed description of measures that are included in MO4 is in Section 2.4.6 of the CRSO EIS.

2.5.6 Preferred Alternative

This alternative was developed using a combination of measures already described in one or more of the four MO alternatives, with some measures slightly refined based upon previous analysis during the EIS process. The Preferred Alternative also drew upon new information obtained from spill operations implemented in 2019 and 2020. The spill regime in this alternative includes a high rate of spill at six of the eight lower Columbia and lower Snake River projects (up to 125% TDG, consistent with the relevant state water quality standards) for up to 16 hours a day, then reduces spill for up to 8 hours, producing benefits for both out-migrating juvenile salmonids and hydropower. The Preferred Alternative also includes measures for lamprey and resident fish, and other measures intended to provide flexibility for water management and water supply operations over the foreseeable future. The Preferred Alternative also improves upon the actions committed to in the past to benefit ESA-listed fish species described in the No Action Alternative, ongoing routine maintenance of the 14 CRS projects, including maintenance of hydropower assets, navigation infrastructure, and fish facilities, continued management of invasive species, and management of avian and pinniped predators of ESA-listed salmonids.[5]

Structural measures in the Preferred Alternative are focused on improving and maintaining hydropower assets, and making changes at the dams to improve passage and conditions for ESA-listed salmonids, resident fish, and lamprey. These include power plant modernization projects at the Hungry Horse, Grand Coulee, and Ice Harbor projects. Fish passage improvement projects are planned at Lower Granite, Little Goose, John Day, and Bonneville. One new structural measure was added to this alternative—closeable floating gate orifices at Bonneville to benefit lamprey.

Operational measures would provide flexible water management across the basin to adjust to local conditions and ensure water availability to benefit resident fish in the upper basin and improve flow conditions for ESA-listed fish in the middle and lower basin. The *Juvenile Fish Passage Spill* measure would be implemented using adaptive management as more information on the effects of increased spill becomes available. The Preferred Alternative also includes a measure to ensure future flexibility for Reclamation to meet authorized water supply obligations.

The Preferred Alternative endeavors to provide the most balanced way to fulfill all of the CRS projects' congressionally authorized purposes, meets a majority of the CRSO EIS objectives, minimizes and avoids adverse impacts to the environment, benefits tribal interests and treaty resources, and provides additional improvements for ESA-listed species. The Preferred Alternative is described in detail in Chapter 7 of the CRSO EIS. The Preferred Alternative is selected in this ROD.

[5] MO3 would provide the highest potential benefit to ESA-listed Snake River salmon and steelhead but would not address the full range of environmental resources to the same degree as the Preferred Alternative.

2.5.7 Environmentally Preferable Alternative

Federal agencies are required to identify the "environmentally preferable alternative" in their Record of Decision consistent with 40 C.F.R. § 1505.2. If the environmentally preferable alternative is not selected as the alternative for implementation, the agencies are to discuss the reasons for not selecting the environmentally preferable alternative. CEQ provided guidance on the "environmentally preferable alternative" in its *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*: "The environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA's Section 101."[6] As stated by CEQ, "Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources."[7]

To identify the environmentally preferable alternative, the co-lead agencies used the policies identified in 42 U.S.C. § 4331(b) (Section 101 of NEPA), to compare the alternatives and determine which meets the environmental intent of the law.[8] Through this evaluation, the agencies determined the Preferred Alternative is the environmentally preferable alternative. Comparatively, it meets each of the policies of NEPA and achieves the widest range of environmental benefits, while minimizing adverse effects to the environment and avoiding hazards to human health and safety.

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[6] 46 Fed. Reg. 18026 (Mar. 23, 1981), as amended (1986), *available at* https://www.energy.gov/nepa/downloads/forty-most-asked-questions-concerning-ceqs-national-environmental-policy-act.

[7] *Id.*

[8] Section 101 of NEPA, 42 U.S.C. § 4331, states the following:

> (a) The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.
>
> (b) In order to carry out the policy set forth in this chapter, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may--
>
> (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
>
> (2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
>
> (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
>
> (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
>
> (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
>
> (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

The Preferred Alternative assures safe, healthful, productive, and esthetically and culturally pleasing surroundings by maintaining current riparian habitat, for example, while providing safe and reliable power generation. The Preferred Alternative supports the widest range of beneficial uses of the environment, without appreciable degradation, risk to health or safety, or other undesirable or unintended consequences by providing flood risk management, power generation and reliability, navigation, and fish and wildlife conservation, including improvements to fish survival, water supply, and irrigation. Commercial and tribal fishing in the lower Columbia and lower Snake rivers would improve over the No Action Alternatives. There would be fewer effects to cultural resources and improvements to tribal fisheries. The Preferred Alternative includes fish passage improvements, creating some job loss and potential higher power rates, as compared to the No Action Alternative. The agencies would monitor for potential shoaling at projects for unintended effects to navigation, resident fish, and anadromous adult fish passage at certain fish passage projects; this is included as mitigation. Effects to cultural resources will continue, but would be mitigated through the FCRPS Cultural Resource Program. Viewed with respect to "the interrelations of all components of the natural environment,"[9] the Preferred Alternative is deemed the environmentally preferable alternative based on its wide benefits to the environment, and the minor adverse effects compared to the other alternatives analyzed.

2.6 Summary of Potential Effects

For all alternatives, the potential effects were evaluated, as appropriate, and discussed in Chapters 3, 4, 6, and 7 of the CRSO EIS. A summary of the potential adverse effects of the Selected Alternative is listed in Table 1, below.

Table 1. Summary of Potential Adverse Effects of Selected Alternative

	Major adverse effect*	Minor or negligible effects due to mitigation**	Minor or negligible effects	Resource unaffected by action
Hydrology and Hydraulics	☐	☒	☐	☐
River Mechanics	☐	☐	☒	☐
Water Quality	☐	☒	☐	☐
Aquatic Habitat, Aquatic Invertebrates, and Fish	☐	☒	☐	☐
Vegetation, Wetlands, Wildlife, and Floodplains	☐	☒	☐	☐
Power Generation and Transmission	☐	☐	☒	☐
Air Quality and Greenhouse Gases	☐	☐	☒	☐
Flood Risk Management	☐	☐	☐	☒
Navigation and Transportation	☐	☒	☐	☒
Recreation	☐	☐	☒	☐
Water Supply	☐	☐	☒	☐
Visual	☐	☐	☒	☐
Noise	☐	☐	☒	☐
Fisheries and Passive Use	☐	☒	☐	☐
Cultural Resources	☐	☒	☐	☐
Indian Trust Assets, Tribal Perspectives and Tribal Interests	☐	☐	☐	☒
Environmental Justice	☐	☐	☒	☐

[9] 43 U.S.C. § 101(a).

Invasive Species	☐	☒	☐	☐
Land Use	☐	☐	☐	☒
Socio-economics	☐	☐	☒	☐

There are some localized moderate hydrological changes at Libby and Dworshak projects, affecting storage reservoir elevations and flows immediately downstream. Mitigation was proposed for habitat and riparian stabilization, as wetlands and aquatic habitat are primarily affected. Lower Snake River and lower Columbia River projects have increases in spill, potentially adversely affecting tailrace conditions, increasing energy dynamics that could cause sediment movement and damage to federal infrastructure. Shoaling and navigation channel effects would be monitored and any adverse effects would be mitigated, including dredging and potential coffer cells. This increased spill operation also creates a moderate impact to water quality because it could increase TDG, especially on the lower Snake River projects, which could adversely affect aquatic life and fish. Additionally, the spill could create eddies and delay migrating juvenile and adult salmon. These adverse effects have associated mitigation components including monitoring, maintenance actions, and fish transport, as well as adaptively managing operations as needed. These actions are described in the Mitigation Measures, Section 2.7, below, Chapter 5 of the CRSO EIS and Appendix R of the CRSO EIS, which includes the description of monitoring and adaptive management.

Modifications of reservoir operations could result in earlier and longer duration drafts of Lake Roosevelt in wet years, resulting in the Inchelium-Gifford Ferry being out of operation for on average four days per year more than under the No Action Alternative. This limits communities, primarily on the Confederated Tribes of the Colville Reservation, from accessing basic services such as medical and education services. Mitigation is proposed to extend the ramp for the Ferry to improve access and allow operation of the ferry under a wider range of reservoir elevations.

The Selected Alternative will negligibly affect cultural resources. The ongoing FCRPS Cultural Resource Program manages and treats cultural resources affected by operations and maintenance in the region, under a Programmatic Agreement between the agencies and consulting parties, and will continue with implementation of the Selected Alternative. There is the additional potential for impacts to built resources, such as modifications of the federal projects themselves, which could affect their historic value.

Under the Selected Alternative, hydropower generation will decrease and the CRS will lose 330 average megawatts (aMW) of firm power during critical water conditions (roughly the amount of power consumed by about 250,000 Northwest homes in a year) and lose an average of 210 aMW across all historical water conditions modeled. The decrease in hydropower generation across the Pacific Northwest (an average decrease of 230 aMW regionally, including Federal and non-Federal projects) results in social welfare costs ranging between $12 million and $17 million. In addition, the Selected Alternative will result in additional costs of compliance with greenhouse gas emission reduction programs in the region of between $16 and $83 million per year. Residential, commercial, and industrial end users will experience slight upward retail rate pressure as a result.

The potential effects to commercial and tribal fisheries relative to the No Action Alternative vary from moderately adverse to majorly beneficial. Migrating juvenile anadromous fish could be affected by the *Juvenile Fish Passage Spill Operations* measure. In addition to the mitigation measures, the Preferred Alternative will be implemented using a robust monitoring plan, which is detailed in the CRSO EIS,

Appendix R, Part 2, *Process for Adaptive Implementation of the Flexible Spill Operational Component of the Columbia River System Operations EIS*.

The EIS included a discussion of practicable mitigation measures to avoid or minimize adverse environmental effects that were analyzed and incorporated into the Selected Alternative. Best management practices will be implemented to minimize impacts during operations of the projects.

2.7 Mitigation Measures

To mitigate for the unavoidable adverse impacts discussed in the previous section, the co-lead agencies will implement the mitigation actions described below. The descriptions also identify which agency is proposing to adopt each action. Each such measure is discussed in detail in Section 7.6 of the CRSO EIS, as well as the *Monitoring and Adaptive Management Plan* and the *Process for Adaptive Implementation of the Flexible Spill Operational Component of the Columbia River System Operations Environmental Impact Statement* in Appendix R of the CRSO EIS. A Mitigation Action Plan, consistent with Department of Energy's NEPA regulations, is included as Attachment 1 to this ROD. This Mitigation Action Plan identifies the mitigation actions Bonneville is adopting as part of this NEPA process.

2.7.1 Plant Cottonwood Trees (up to 100 acres) near Bonners Ferry

The flow regime at Libby makes natural establishment of riparian vegetation downstream of the dam challenging. Higher winter flows make it difficult to sustain young stands of cottonwoods to maturity. The co-lead agencies would plant up to 100 acres of riparian forest along the Braided and Meander reaches of the Kootenai River near Bonners Ferry, using 1- to 2-gallon cottonwood trees, with the expectation that the larger size trees would be better suited to withstand the higher winter flows. This would improve habitat and floodplain connectivity to benefit ESA-listed KRWS, and complement other actions already being taken in the region to benefit their habitat. To the extent possible, this work will be completed through ongoing projects under Bonneville's Fish and Wildlife Program, such as the Kootenai Tribe of Idaho's Kootenai River White Sturgeon Habitat Restoration Program.

2.7.2 Plant native wetland and riparian vegetation (up to 100 acres) on the Kootenai River downstream of Libby

The co-lead agencies would plant up to 100 acres of native forested and scrub-shrub wetland vegetation at a lower river elevation in Region A (see CRSO EIS, Section 3.2.2.1, for descriptions of the regions). This would offset effects to existing wetlands and riparian forests downstream of Libby, which would be caused by the *Modified Draft at Libby* measure, and result in lower water levels on the Kootenai River. To the extent possible, this work will be completed through ongoing projects under Bonneville's Fish and Wildlife Program, such as the Kootenai Tribe of Idaho's Kootenai River White Sturgeon Habitat Restoration Program.

2.7.3 Temporary Extension of Performance Standard Spill Operations

It is expected that higher spill levels and the resultant TDG associated with the *Juvenile Fish Passage Spill* measure could result in delays to adult passage. Eddies created by a high spill operation may confound upstream passage by salmonids. If a delay in adult salmon and steelhead upstream passage is observed, operations would revert to performance standard spill until the adult fish pass the dam, and this would be managed adaptively, through the established Regional Forum process and as described in the CRSO

EIS, Appendix R, Part 2. This work would be carried out by the Corps.

2.7.4 Update and Implement Invasive Species Management Plans

Deeper drafts at Libby would result in lower lake elevations in spring, exposing previously submerged lands during the growing season and potentially allowing establishment of invasive weeds. The Corps would update and implement an invasive species management plan to combat the establishment and proliferation of invasive species, as required by Executive Order 13751.

2.7.5 Spawning Habitat Augmentation at Lake Roosevelt

In Lake Roosevelt, changes in elevation would result in higher rates of kokanee and burbot egg dewatering in winter, and lower reservoir levels in spring would decrease access to tributary spawning habitat for redband rainbow trout. Increased flexibility of refilling Lake Roosevelt through the month of October, depending on the annual water conditions, may affect the spawning success of kokanee, burbot and redband rainbow trout. In 2019, Bonneville funded year one of a three-year study to determine potential effects of modifications in Lake Roosevelt refill to resident fish spawning habitat access. Other evaluations will be conducted to determine potentially affected areas. If study evaluations and other available data indicate resident fish spawning habitat areas are affected by changes in reservoir elevations, the co-lead agencies will work with regional partners to determine where to augment spawning habitat at locations along the reservoir and in the tributaries (up to 100 acres). This mitigation action, when combined with the existing study funded by Bonneville, would evaluate existing effects to reservoir elevation changes from fall operations in Lake Roosevelt and would mitigate for additional effects of the new action. Exact sites and acreage would be determined post-alternative implementation. The Bureau of Reclamation commits to provide staff time and to seek technical assistance and funding to support collaboration with the Confederated Tribes of the Colville Reservation, the Spokane Tribe of Indians, and other interested parties to better understand the effects of Grand Coulee operations on the life history requirements of fish and wildlife resources in the Lake Roosevelt area.

2.7.6 Extension of the boat ramp for the Inchelium-Gifford Ferry in Lake Roosevelt

Earlier and longer drafts at Grand Coulee would affect water levels, making the Inchelium-Gifford Ferry on Lake Roosevelt unavailable on average four days per year more than under the No Action Alternative. Reclamation would work with the Bureau of Indian Affairs to extend the ramp at the Gifford-Inchelium Ferry on Lake Roosevelt so that it would be available at lower water elevations. This work would be subject to available appropriations.

2.7.7 Monitoring at Lower Granite, Lower Monumental, and McNary to evaluate effects of shoaling from increased spill, and if warranted, install coffer cells to dissipate energy

It is expected that higher spill and variable timing of the spill over the course of a day could result in changes to the tailraces at Lower Granite, Lower Monumental and McNary. The Corps would monitor the tailrace at each project to track changes that could affect safe navigation or conditions for ESA-listed fish. If changes to the tailrace warrant action, the Corps would construct coffer cells to dissipate energy.

2.7.8 Increased Dredging at McNary, Ice Harbor, Lower Monumental, and Lower Granite Projects

In Regions C and D, the increased spill operations and lower tailwater would increase shoaling in the navigation channel due to increased spill operations in the lower Snake and Columbia rivers, adversely affecting navigation. In order to maintain the navigation channel and reduce effects to negligible, effects would be mitigated by increasing the frequency and total volume of dredging at McNary, Ice Harbor, Lower Monumental, and Lower Granite at a four- to seven-year interval. As discussed above, shoaling would be monitored to determine if additional installation of coffer cells at Lower Monumental, Little Goose, and McNary could reduce dredging needs and further maintain the channel. Coffer cells would dissipate energy during high spill operations, which would support movement of sediment in the navigation channel, thereby maintaining navigational capacity and river transportation. This would increase overall maintenance costs for the projects, but would reduce the adverse effects to negligible. This work would be carried out by the Corps.

2.7.9 Federal Columbia River Power System Cultural Resource Program and Systemwide Programmatic Agreement

For new effects to archaeological resources, traditional cultural properties, and the built environment at storage projects caused by implementation of the Preferred Alternative relative to the No Action Alternative, the co-lead agencies would use the existing FCRPS Cultural Resource Program and the Systemwide Programmatic Agreement to implement mitigation actions, as warranted and appropriate.

Section 3. Key Considerations for the Decision

3.1 Introduction

The agencies considered several factors when making their decisions in this ROD. These considerations are described in detail below, and are in addition to considering the overall Purpose and Need Statement. The agencies also considered the authorized purposes for which the co-lead agencies operate the Federal projects, including how the purposes complement or conflict with each other, as briefly summarized in Section 2.4 above.

3.1.1 Alternatives Not Fully Meeting the Purpose and Need

The co-lead agencies considered whether an alternative met the Purpose and Need Statement in making their decisions. Initially, eight single objective alternatives were developed to maximize certain project purposes and emphasize specific resources, utilizing the analytical assumption that other purposes did not constrain the actions that could possibly be taken. These single objective alternatives provided the framework for comparing the tradeoffs associated with different objectives throughout the Columbia River Basin. None of the single-objective alternatives were found to fully meet the Purpose and Need, and they were screened from further consideration; however, many of the measures in these alternatives were integrated into the MOs. In comparing the multiple objective alternatives, MO3 and MO4 did not meet, or did not fully meet, the Purpose and Need (see Table 7-1 in the Final EIS).

3.2 Responding to the U.S. District Court for the District of Oregon's Opinion and Order

As outlined in the Purpose and Need Statement, the co-lead agencies responded to the Opinion and Order issued by the District Court[10] by updating the long-term system operating strategy for the CRS projects with updated information, including information on ESA-listed species and their critical habitat and climate change. The co-lead agencies also responded to the Opinion and Order by evaluating actions that ensure CRS operations, maintenance and configuration are not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat. To begin, the co-lead agencies, in coordination with the cooperating agencies, proposed measures as part of the alternatives development process to benefit ESA-listed juvenile and adult anadromous and resident fish species. Through this process, the agencies evaluated actions within their current authorities, as well as certain actions that are not within the co-lead agencies' authorities, based on the District Court's observations about alternatives that could be considered and comments received during the scoping process. This analysis included evaluating breaching the four lower Snake River dams. Based on the proposed alternatives' effects analysis, the agencies then developed additional mitigation measures as part of the CRSO EIS process for affected resources. The analysis from the No Action and Multiple Objective Alternatives, including the mitigation measures, climate effects and cumulative effects analysis informed the development of the Preferred Alternative. The co-lead agencies then proposed non-operational conservation measures through the ESA consultations for the Preferred Alternative that are responsive to uncertainty from the effects of the proposed action and from climate change to ESA-listed species. These same measures were analyzed in Chapter 7 of the EIS to evaluate the direct, indirect and cumulative effects as well as climate change effects and unavoidable adverse effects of the Preferred Alternative. Finally, the co-lead agencies committed to continue funding their ongoing programs that benefit fish and wildlife and other resources affected by the CRS projects (see Chapters, 2, 5 and 7 of the CRSO EIS for more information).

3.3 ESA-listed Species

Based on input received during development of the EIS, and in response to the Order and Opinion issued by the District Court, the agencies focused on developing a Preferred Alternative that maintained and improved on their existing commitments for fish improvements in the region. As reflected in both the Purpose and Need Statement and EIS objectives, a key consideration for the co-lead agencies in their decision-making is how the alternatives could affect ESA-listed and non-listed species. The effects analysis is available in Chapters 3, 4, 6 and 7 of the CRSO EIS.

In addition to routine operations and maintenance of the CRS, the co-lead agencies implement a number of actions and programs to benefit ESA-listed species in the Columbia River Basin. Examples of these actions include habitat measures (e.g., tributary habitat improvements for salmon, steelhead, KRWS, and in consideration of bull trout), operational measures at storage and run-of-river projects (e.g., flow management and fish passage), conservation and safety-net hatcheries (funding, support, design, construction), and predation management (avian, piscivorous, pinnipeds). See Table 7-5 of the CRSO EIS, and, for greater detail, reference the associated Biological Opinions (BiOps) and Chapters 2, 5, and 7 of the CRSO EIS.

[10] *Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv.*, 184 F. Supp. 3d 861 (D. Or. 2016).

3.3.1 Anadromous Adult and Juvenile ESA-listed Species

The Selected Alternative provides a balanced approach between spring and summer flow and spill operations to benefit ESA-listed juvenile and adult salmonids, while also providing benefits to ESA-listed resident fish in the upper Columbia River Basin. It includes measures that benefit adult and juvenile salmonids and continues commitments for ongoing actions to improve conditions for ESA-listed species through habitat improvements. The Selected Alternative is predicted to benefit survival of ESA-listed juvenile salmonids by improving fish passage conditions through reductions in juvenile travel times and instances of powerhouse and juvenile bypass system passage, as detailed in Section 7.7.4 of the CRSO EIS.

The Selected Alternative is also designed to evaluate return rates to the Columbia River Basin of ESA-listed salmonid will increase due to the improvements in the juvenile migration as detailed in Section 7.7.4 of the CRSO EIS. Improved adult abundance is predicted to increase as a result of improved juvenile survival and decreases in latent mortality, (i.e. the delayed death of salmonids), associated with juvenile passage through the CRS projects as discussed in Section 3.5 of the CRSO EIS.

The co-lead agencies will monitor fish passage at the projects and utilize adaptive management principles in implementing the Selected Alternative based on results of biological studies and monitoring information.[11] These results will be discussed and operations modified in collaboration with Federal, state, and tribal sovereigns to ensure expected benefits to salmon and steelhead are being realized based on the best available scientific information. The adaptive implementation plan is discussed in the CRSO EIS, Appendix R, Part 2, *Process for Adaptive Implementation of the Flexible Spill Operational Component of the Columbia River System Operations EIS*.

3.3.2 Resident ESA-listed Species

The Selected Alternative is predicted to benefit ESA-listed bull trout and KRWS, as well as other resident fish through both operational and mitigation measures as detailed in Section 7.7.5 of the CRSO EIS. The Selected Alternative benefits resident fish by improving productivity and food resources in storage reservoirs and by including additional mitigation measures to improve habitat. Structural and operational measures developed for anadromous fish that regulate reservoir levels and remove predators may also provide beneficial effects to resident fish, especially in the lower Columbia River. The co-lead agencies would continue to utilize the Kootenai River Regional Coordination workgroups to guide adaptive management of operations and address technical issues related to KRWS.

3.3.3 Other Considerations under the ESA

In their analysis of the Selected Alternative under Section 7 of the ESA and its implementing regulations, the co-lead agencies conclude that the benefits to ESA-listed species' survival and recovery and to the conservation function of designated critical habitat are sufficient to outweigh and offset the Selective Alternative's adverse effects on ESA-listed species and designated critical habitat. As such, the Selected Alternative as a whole is not likely to contribute to any reductions in reproduction, numbers, or distribution of ESA-listed species that could appreciably reduce their

[11] *Biological Assessment of Effects of the Operations and Maintenance of the Federal Columbia River System* (January 2020) (2020 CRS Biological Assessment), at 2-1 to 2-6.

survival and recovery, nor is the action as a whole likely to diminish the conservation function of designated critical habitat. For these reasons, the Selected Alternative is not an action that is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify their designated critical habitat. Because of this, the co-lead agencies agree with the determinations of the USFWS and NMFS (together referred to as the Services) in the 2020 USFWS and NMFS CRS BiOps (together referred to as the 2020 CRS BiOps) that implementation of the Selected Alternative and the actions described in the Incidental Take Statements are not likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify their designated critical habitat. The jeopardy and destruction or adverse modification analyses in the 2020 CRS BiOps that facilitated the Services' determinations are based on the regulatory definitions for both "jeopardize the continued existence of" and "destruction or adverse modification" of designated critical habitat. The ESA regulations define "to jeopardize the continued existence of" a listed species, which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."[12] Therefore, the analyses considered both survival and recovery of the species. The critical habitat analysis is based upon the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species."[13]

The analysis under these regulatory definitions must always consider whether the effects of the Selected Alternative's effects *cause* appreciable reductions to survival and recovery or *cause* appreciable diminishment of the conservation function of critical habitat. This analysis is separate from the analysis of the environmental baseline[14] or a characterization of the condition of the species prior to implementation of the proposed action[15], even where the proposed action is a continuation of a prior federal action. "Effects of the action" is defined as "all consequences to listed species or designated critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action, and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action."[16] The Services and the co-lead agencies analyzed the Selected Alternative's consistency with the ESA's substantive mandates by using these applicable statutory and regulatory standards.

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[12] 50 C.F.R. § 402.02.

[13] *Id.*

[14] *Id.* ("Environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.").

[15] The ESA utilizes the term "proposed action" in its implementing regulations to describe the agency action that is subject to consultation under Section 7(a)(2) of the ESA. Proposed action is not a term that is used in NEPA. In order to avoid confusion in this ROD, the co-lead agencies have consistently referred to the agency action subject to decision in this ROD as the Selected Alternative.

[16] *See* 50 C.F.R. § 402.17 (the preamble explains that the terms "effect" and "consequences" are generally used interchangeably. 84 Fed. Reg. 44976 (Aug. 27, 2019). The co-lead agencies use these terms in that manner in this document).

By maintaining or improving actions that arose through past consultations, along with significant additional actions through the CRSO EIS process, the co-lead agencies developed the Selected Alternative to, on the whole, benefit ESA-listed species' likelihood of survival and recovery and the conservation function of designated critical habitat. The co-lead agencies worked closely with the Services throughout this development process, as well as cooperating agencies contributing to the CRSO EIS, to ensure that continued operation and maintenance of the CRS and implementation of the non-operational conservation measures, is not likely to jeopardize the continued existence of listed species and is not likely to destroy or adversely modify designated critical habitat.

The co-lead agencies have ensured compliance with the ESA through improvements to system operations and fish passage, with resulting higher dam passage survival rates and faster fish travel times.[17] The co-lead agencies will continue to implement these operations, along with the *Juvenile Fish Passage Spill Operation* measure or Flexible Spill with Adaptive Management with spill levels that are higher than the co-lead agencies have discretionarily implemented prior to 2020. In order to determine the effects of this operation, the Action Agencies and NMFS considered results from lifecycle models created and implemented by state and Federal agencies, the Comparative Survival Study (CSS) managed by the Fish Passage Center, and the Comprehensive Passage Model (COMPASS) and Lifecycle models (LCM) conducted by NMFS' Northwest Fisheries Science Center.

The CSS model predicts substantial juvenile survival increases for Snake River spring-summer Chinook salmon and steelhead, and further predicts that fewer powerhouse passage events (as a result of higher spill levels and higher proportions of juveniles passing the projects via spillbays) will increase adult returns. NMFS LCMs did not predict increases to the levels that the CSS model did, but did qualitatively predict improvements in adult abundance if reductions in latent mortality occurred. The differences resulting from these two models are due to a number of factors, including how latent mortality is addressed in each model. The *Juvenile Fish Passage Spill Operation* measure will be implemented with a robust monitoring plan for salmon and steelhead that will help narrow the uncertainty between these two models and determine how effective additional spill can increase salmon and steelhead returns to the Columbia Basin.[18] Despite the differences in the predictions from these models, the co-lead agencies have determined that implementation of the *Juvenile Fish Passage Spill Operation* measure is anticipated to substantially contribute to offsetting the adverse effects resulting from other measures in the Selected Alternative in a manner that will not reduce appreciably the likelihood of survival and recovery.

In addition, the co-lead agencies have included other operational measures that are intended to offset the adverse effects of the operation and maintenance of the CRS. These measures include *Providing Surface Spill to Reduce Adverse Effects to Overshooting Adult Steelhead* and *John Day Reservoir Spring Operations for Caspian Tern Nesting Dissuasion*. Details of these operational measures can be found in the CRSO EIS. These operational measures, among others, will not appreciably reduce the likelihood of survival and recovery of ESA-listed species.

The Selected Alternative also includes structural improvements for both juvenile and adult fish, as well as maintaining or improving implementation of non-operational conservation measures to help

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[17] U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration. 2017. Federal Columbia River Power System, 2016 Comprehensive Evaluation.

[18] *See* CRSO EIS, Appendix R, Part 2, *Process for Adaptive Implementation of the Flexible Spill Operational Component of the Columbia River System Operations Environmental Impact Statement.*

address uncertainty related to residual adverse effects of system operations and maintenance and the uncertainty related to effects of climate change, including habitat improvement and restoration actions in the tributaries and estuary, nutrient enhancement, continued support for conservation and safety net hatcheries, and predation management. In addition, the Selected Alternative and the Incidental Take Statements in the Services' 2020 CRS BiOps call for the co-lead agencies to submit regular reports to the Services on implementation progress, to conduct ongoing research, monitoring and evaluation (RM&E) of the biological effectiveness of conservation measures, and to manage implementation of the conservation measures adaptively as new information about mitigation action effectiveness emerges. Regular reporting facilitates transparency and co-lead agency accountability for implementing the Selected Alternative and Terms and Conditions. Taken together, the effects of the measures in the Selected Alternative will not appreciably reduce the likelihood of survival and recovery for ESA-listed species.

3.3.4 Southern Resident Killer Whales

The overall health and condition of the Southern Resident Killer Whale (SRKW) depends on the availability of a variety of fish populations throughout their range. SRKW are Chinook specialists, but also consume other available prey populations while they move through various areas of their range in search of prey. There is no evidence that SRKW feed or benefit differentially between wild and hatchery Chinook salmon.[19] Snake River spring/summer Chinook salmon is a small portion of SRKW overall diet, but can be an important forage species during late winter and early spring months near the mouth of the Columbia River.[20]

The co-lead agencies would continue to fund the operations and maintenance of safety-net and conservation hatchery programs with implementation of the Selected Alternative. The agencies would also continue to fund certain independent congressionally-authorized hatchery mitigation responsibilities[21] over the 15-year implementation period of the 2020 NMFS CRS BiOp. This continued funding was an important consideration in the analysis of effects to SRKWs because production from these hatchery programs is expected to offset any adverse effects from the Selected Alternative. For this reason, NMFS concurred with the co-lead agencies' conclusion that the Selected Alternative is not likely to adversely affect the SRKW.

3.4 Lamprey

The Selected Alternative addresses adult and juvenile lamprey passage through specific structural modifications to the projects. These measures provide benefits to lamprey through reducing impingements and incidences of lamprey falling out of the Washington Shore Fish Ladder. The Selected Alternative also includes other measures that are expected to further benefit lamprey passage conditions. These measures are described in Chapter 7 of the CRSO EIS.

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[19] *Southern Resident Killer Whale and the Snake River Dams,* NOAA Fisheries Service West Coast Region (March 16, 2016).

[20] Ford, M. J., J. Hempelmann, M. B. Hanson, K. L. Ayres, R. W. Baird, C. K. Emmons, et al. 2016. Estimation of a killer whale (Orcinus orca) population's diet using sequencing analysis of DNA from feces. PLoS ONE 11(1):e0144956.

[21] *See Clarification and Additional Information to the Biological Assessment of Effects of the Operations and Maintenance of the Columbia River System on ESA-listed Species Transmitted to the Services on January 23, 2020* (April 1, 2020). These independent congressionally-authorized hatchery mitigation responsibilities are consulted upon separately and are considered part of the environmental baseline for purposes of this consultation.

3.5 Tribal Viewpoints

Input from the tribes was a key consideration in the co-lead agencies' decision to select the Preferred Alternative. The tribes of the Columbia River Basin represent distinct cultures, each unique. Most of the 19 tribes identified as being affected by the operations of the CRS provided extensive input into the CRSO EIS either as cooperating agencies or through their comments, or both.

Many upper basin tribes were concerned there was an inequity in the analysis resulting from a historical continuation of focusing on lower river issues at the expense of others in the region. They expressed their perception that the co-lead agencies prioritize resources on the lower rivers over upper basin needs and problems. This group was very interested in the construction of fish passage facilities and reintroduction above Grand Coulee and Chief Joseph dams, which had been eliminated from further detailed analysis in the CRSO EIS. Many upper basin tribes commented that the co-lead agencies failed to adequately engage or consider their concerns as a cooperating agency in the process. In response, the co-lead agencies worked closely to keep a balance in the Selected Alternative to benefit the entire Columbia Basin, and not disproportionately affect upper basin cultural or tribal resources. They also committed to ongoing regional collaboration to discuss future studies and initiatives for fish management in blocked areas above Chief Joseph and Grand Coulee dams.

Lower basin tribes engaged in CRSO EIS cooperating agency teams; however, these tribes expressed that the EIS failed to analyze a broad range of alternatives and inadequately considered climate change. Most tribes also were concerned whether the co-lead agencies complied with several laws, including the ESA, NEPA, and the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act). Generally, their comments expressed that consideration of breaching the four lower Snake River dams was completed without a thorough analysis and with biased methods. They expressed that the co-lead agencies fell short of regional salmon and steelhead recovery goals, and did not prioritize or place ESA-listed species recovery on equal footing with other resource improvements. They expressed their belief that there was bias in the methods and analysis conducted by the co-lead agencies against fish and for power and other project purposes. Throughout the process, the co-lead agencies discussed with the Tribes their concerns and preferences in alternatives, and many Tribes, as cooperators, participated in the analysis of alternatives. This was important in having a shared understanding of the resource effects and ultimately in determining the effects of implementing the Selected Alternative.

A few tribes around Libby and Hungry Horse shared that they found the CRSO EIS to be thorough and balanced, and supported both the analysis and the Preferred Alternative. Their focus was primarily around the resident fish, wildlife, and cultural resources in this region, and provided the CRSO EIS cooperating agency teams with measures and assisted in effects analysis for this region.

3.6 Protect and preserve cultural resources

As discussed in Chapters 3, 4, 5, 6 and 7 of the CRSO EIS, the co-lead agencies considered the effects the alternatives had on cultural resources. Ongoing major effects to cultural resources under the Preferred Alternative would be similar to the No Action Alternative. The co-lead agencies determined that cultural resources affected by the implementation of the Preferred Alternative would be addressed under the ongoing FCRPS Cultural Resource Program.

The FCRPS Cultural Resource Program implements the terms of the existing Systemwide Programmatic Agreement for the Management of Historic Properties Affected by the Multipurpose Operations of Fourteen Projects of the Federal Columbia River Power System for Compliance with Section 106 of the National Historic Preservation Act (Systemwide Programmatic Agreement).[22] The FCRPS Cultural Resource Program had its origins in the System Operation Review Environmental Impact Statement and Records of Decision in the 1990s. During that process, eight cooperating groups were eventually established to address the effects of operations and maintenance on cultural resources. The cooperating groups formed the basis of the FCRPS Cultural Resource Program then and continue to do so today.

The Systemwide Programmatic Agreement commits the co-lead agencies to work collaboratively with the cooperating group participating organizations including states, tribes, and other federal agencies. The agencies will continue to support the FCRPS Cultural Resource Program over the course of implementing the CRSO EIS ROD. The agencies will continue to collaborate with participants in prioritization of actions and implementing treatments for cultural resources that are eligible for inclusion in the National Register of Historic Places that are adversely affected by implementation of the CRSO EIS ROD. Treatments may include a variety of both on-site and off-site options including less conventional treatments sometimes referred to as creative or alternative treatments. All treatments will be consistent with the respective implementing agency's authorities.

3.7 Protect Native American treaty and reserved rights and trust obligations for natural and cultural resources throughout the environment affected by System operations

The co-lead agencies also took into account Native American treaty and reserved right as well as their trust obligations in their decision-making. To the extent that the Preferred Alternative provides for protection and mitigation of natural and cultural resources, then it also helps protect and preserve Native American treaty and executive order rights and meet agency trust obligations. The Preferred Alternative includes operational measures designed to protect ESA-listed anadromous and resident species as identified by NMFS and USFWS, and to improve the quality of other natural resources through reservoir operation and management of natural streamflows. Operations at John Day, The Dalles, and Bonneville dams also facilitate tribal treaty fisheries.

The co-lead agencies' commitment to implement actions that benefit ESA-listed fish, their designated critical habitat, and other wildlife helps fulfill Federal tribal treaty and trust responsibilities. As part of the implementation of the Selected Alternative, the agencies committed to ongoing coordination and open dialogue through the established Regional Forum. The Regional Forum workgroups have consistent participation by regional tribal sovereigns and this participation is critical to informing management actions and policy decisions. The co-lead agencies will continue to fund actions that benefit tribal partners, including the implementation of hatchery programs, habitat improvement actions, and other projects. This funding provides jobs for tribal members and promotes broad opportunities for exercising natural resource management expertise. These opportunities help protect trust resources while supporting tribal sovereignty and the exercise of treaty and resource management rights both on reservations and in ceded areas throughout the Columbia River Basin.

[22] A description of the FCRPS Cultural Resource Program can be found here: https://www.bpa.gov/efw/CulturalResources/FCRPSCulturalResources/Pages/default.aspx.

The co-lead agencies also engaged tribes during the development of the CRSO EIS and made extensive fish and wildlife mitigation commitments to tribes through the Columbia Basin Fish Accords and the 2018 Accord Extensions. These commitments further tribal sovereignty by supporting the tribes' exercise of their rights as co-managers of the fisheries in coordination with other resource managers in the region.

3.8 Indian Trust Assets

Reclamation, consistent with its requirements for decision-making under this ROD, has complied with its policy to evaluate potential impacts to Indian Trust Assets (ITAs) in the development of the EIS. ITAs are "trust lands, natural resources, trust funds, or other assets held by the federal government in trust for Indian tribes or individual Indians."[23] Although there are multiple federally recognized Indian tribes in the vicinity of the project area on the Columbia and Snake Rivers and associated tributaries, Reclamation did not identify any potential impacts to ITAs as a result of the Preferred Alternative. Potentially adverse effects to the interests of federally recognized tribes evaluated include erosion of land or sites of cultural importance, degradation of water quality, detrimental effects on salmonid populations, and impediments to access for tribes with fishing rights. The Preferred Alternative is expected to improve some conditions for salmonid populations while other conditions are not expected to vary greatly from the No Action Alternative.

3.9 Water Quality

In Region A, the Preferred Alternative is expected to have negligible to minor effects to water temperatures and TDG conditions at the projects when compared to what would occur under the No Action Alternative. In Regions B and D, the Preferred Alternative is expected to have negligible effects on water temperatures and TDG when compared to the No Action Alternative. In Region C, the Preferred Alternative is expected to have negligible effects to water temperature at Dworshak and all four lower Snake River projects. For TDG, moderate increases in Regions C and D are anticipated due to the *Juvenile Fish Passage Spill* measure that would allow for spill up to 125 percent TDG 16 hours per day, from the beginning of April through the third week of June. Effects to other water quality parameters would be negligible.

Under the Selected Alternative, the co-lead agencies will continue to implement certain measures to improve water temperature, where practicable, to address potential effects from the dams and reservoirs. For example, the effects of the Dworshak Dam summer cool water releases are expected to continue to influence water temperatures in the lower Snake River. At the Lower Granite and Little Goose Projects, the forebay tends to stratify, with warm water near the surface and cool water from the Dworshak Project deeper in the water column. When temperatures in the fish ladders are equal to or greater than 68 degrees Fahrenheit, the Corps operates pumps to supply the fish ladders with cool water pumped from deep in the reservoir. The pumps are typically operated from mid- to late summer, depending on climatic conditions. From June 1 to September 30, water temperature data is collected at adult ladder entrances and exits at each Corps project in the lower Snake and lower Columbia Rivers. This serves to monitor for temperature differentials in the ladder that could act to block adult fish from ascending the fish ladders to migrate upstream of each dam.

[23] 25 C.F.R. § 115.002.

Moreover, the Corps would continue several actions related to adult fish ladder water temperature differentials: 1) continue monitoring all mainstem fish ladder temperatures and identifying ladders with substantial temperature differentials (>1.0 degree Celsius); 2) where beneficial and practicable, develop and implement operational and structural solutions to address high temperatures and temperature differentials in adult fish ladders at mainstem dams with identified temperature issues; 3) complete a study that evaluates alternatives to assess the potential to trap-and-haul adult sockeye salmon at lower Snake River dams after development of a contingency plan by NMFS and state and tribal fish managers; and 4) maintain or improve the adult trap at Ice Harbor Dam to allow for emergency trapping of adult salmonids as necessary. The Corps may refurbish the trap in the future to prepare for the implementation of emergency trap-and-haul activities (e.g., sockeye during high temperature water years similar to 2015).

In terms of impacts from TDG, measures under the Preferred Alternative would be implemented consistent with state water quality standards to manage TDG exposure to fish in the Clearwater River below Dworshak Dam as well as manage TDG at Ice Harbor, John Day and McNary dams. Juvenile fish passage spill operations would be implemented at the lower Snake River projects and the lower Columbia River projects. The spill would benefit salmon and steelhead through increased spring juvenile spill, while providing a degree of protection against unexpected or unintended consequences that may occur due to spilling up to the 125 percent TDG cap, such as adult migration delay, gas bubble trauma, or damage to infrastructure. These spill levels are slightly variable, depending on the project, and may be higher or lower, depending on river conditions and the opportunity to spill in the spring. Spring and summer juvenile spill operations would be managed adaptively, through the established Regional Forum processes and as described in the CRSO EIS, Appendix R, Part 2, to address anticipated and unexpected challenges, such as potential delays to adult migration, effects to navigation, and other challenges or opportunities that may require either a temporary or permanent change. Additionally, operations of the spill deflectors at Chief Joseph Dam would continue to decrease TDG saturations between the forebay and tailrace during high flow and high spill years, consistent with the Preferred Alternative.

3.10 Provide an adequate, efficient, economical and reliable power supply that supports the integrated Columbia River Power system

Bonneville, along with the Corps and Reclamation, evaluated whether the Preferred Alternative would continue to provide an adequate, efficient, economical and reliable power supply that supports the integrated Columbia River Power system. This purpose and objective holistically looks at maintaining the federal power system's ability to reliably produce power at a reasonable cost, while also balancing Bonneville's other statutory objectives and responsibilities. To assess whether the alternatives met this objective, the Final CRSO EIS measures the effects of the Alternatives on not only the federal system but also on broader regional reliability using the loss-of-load probability or LOLP metric.

LOLP is an electric industry reliability planning standard that measures the likelihood of an energy shortage in a given year.[24] In simple terms, the higher the LOLP percentage, the greater the chance that utilities supplying power in the region will have at least one blackout that year. The LOLP of the

[24] CRSO EIS, Appendix H, Power and Transmission, Section 2.1; *id.*, Appendix J, Hydropower, Section 4.1. While not a mandatory standard, LOLP operates as an "early warning" of a potential resource shortage for the region. *See id.*, Section 3.7.3.2 at 3-881, n. 58.

No Action Alternative is 6.6 percent, or roughly one or more blackouts in one of every 15 years.[25] This is the baseline from which all the Alternatives are measured.[26]

Using the effects analysis for CRS operations from the Alternatives, the Final CRSO EIS calculates an LOLP for each alternative and then compares this value to the LOLP of the No Action Alternative, (*i.e.,* 6.6 percent).[27] If the Alternative's LOLP is *higher* than the LOLP of the No Action Alternative (*i.e.,* higher than 6.6 percent), then additional resources would be needed until the LOLP of the alternative is equal to the LOLP of the No Action Alternative. The Final CRSO EIS identifies two resource groups that reduce LOLP cost effectively and presents these resources as a range of possible options that Bonneville or regional utilities would have when selecting specific resources to acquire.[28] The Final CRSO EIS then performs a rates analysis to estimate the incremental impact the alternative would have on Bonneville's wholesale power rate and regional retail consumers' rates as compared to the No Action Alternative.[29]

After reviewing the Final CRSO EIS, public comments, and analysis, the co-lead agencies concur with the findings in the Final CRSO EIS that the Preferred Alternative meets this objective and, therefore, is the agencies' choice for the Selected Alternative for CRS operations, maintenance and configuration. The Selected Alternative would decrease CRS hydropower generation relative to the No Action Alternative by 330 aMW of firm power assuming critical water conditions (roughly the amount of power consumed by about 250,000 Northwest homes in a year).[30] This decrease, however, would have no adverse effect on regional reliability compared to the No Action Alternative. The LOLP of 6.4 percent under the Selected Alternative is slightly lower than the LOLP of 6.6 percent under the No Action Alternative, but is essentially the same for purposes of the risk to regional reliability.[31]

The LOLP does not increase even with the loss of generation because of the shape of the remaining generation in the Selected Alternative. The largest reductions in annual average hydropower generation occur in periods when the system generally has surplus (spring) and loads are easier to meet. The reduction in generation in the Selected Alternative during this period does lead to some risk of power shortages in June when there was none in the No Action Alternative, and increases the risk of power shortages in July and the first half of August compared to the No Action Alternative. Conversely, the Selected Alternative increases generation in late August and in the winter, periods when demand is often high and it is more difficult to meet load, reducing the risk of power shortages compared to the No Action Alternative. The net effect of the spring and early summer generation decreases combined with the late-summer and winter increases returns the LOLP to essentially the same level of the No Action Alternative.[32]

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[25] CRSO EIS, Appendix H, Power and Transmission, Section 2.1, tbl. 2-1. For context, the regional LOLP target adopted by the Northwest Power and Conservation Council (Council) in 2011 was 5 percent. *Id.*, Section 3.7.2.2 at 3-823.

[26] CRSO EIS, Section 3.7.3.2 at 3-880.

[27] *Id.*, Appendix J, Hydropower, Section 4.1 at J-4-1.

[28] *Id.*, Appendix H, 2.2.2.4.3, at H-2-15. The CRSO EIS does not identify whether Bonneville or regional utilities would acquire the resources necessary to return regional reliability to the level of the No Action Alternative. This follows from the uncertainty around the nature of Bonneville's future power obligation. In general, if the supply of power from the federal power system declines, leaving Bonneville with insufficient power to meet its customers' firm power needs, Bonneville's customers have a choice: they may elect to have Bonneville acquire resources to make up the difference *or* they may choose to acquire the resources themselves.

[29] *See id.*, Section 3.7.3.1.

[30] *Id.*, Section 7.7.9.9.

[31] *Id.*, Section 7.7.9.2.

[32] *Id.*

While the Selected Alternative maintains reliability at the No Action Alternative levels in the near term, the analysis shows that over the long term this alternative meaningfully reduces the region's risk of blackouts when taking into account likely retirement of regional coal-fired resources in the future. As described in Section 3.7 of the Final CRSO EIS, the LOLP estimates used in the EIS analysis rely on the assumption that 4,246 megawatts (MW) existing coal generating capacity would continue to serve loads in the region over the study period.[33] The risk of blackouts in the region increases significantly under the No Action Alternative if some or all of the existing coal plants are retired. The Final CRSO EIS evaluates the impact additional coal retirements could have on regional reliability through two scenarios: a "limited coal scenario" (which captures current and expected coal retirements) and a "no coal scenario" (which assumes all regional coal is retired).[34] Under the "limited coal scenario", the No Action Alternative LOLP increases to 27 percent (a one in four chance of one or more blackouts each year), while under the "no coal scenario", the No Action Alternative LOLP jumps to 63 percent (a two out of three chance of one or more blackouts each year).[35] While these LOLP numbers are indicative of a serious reliability problem facing the region, the Selected Alternative has a downward effect on these high LOLP values. Specifically, the Selected Alternative decreases the LOLP by 3 percentage points (to 24 percent) under a limited coal scenario, and decreases it by 4 percentage points under the no coal scenario (to 59 percent), compared to the No Action Alternative.[36] In this way, the Selected Alternative not only maintains current regional reliability, but also reduces the amount of additional resources that would likely be need if/when additional coal facilities are retired.

Because the Selected Alternative essentially maintains regional reliability at the No Action Alternative levels, the Final CRSO EIS concludes that no replacement resources are needed to replenish lost firm power from the CRS projects.[37] Similarly, with no additional resources entering the grid, no new transmission interconnections or reinforcements would be required under the Selected Alternative.[38] Both of these factors contribute to the Selected Alternative having a low overall effect on wholesale and retail rate pressure, which is an important consideration in selecting this alternative.

Under the Selected Alternative, Bonneville's average wholesale Priority Firm (PF) power rate would experience upward rate pressure of $0.94 per megawatt-hour (MWh) or a 2.7 percent increase relative to the No Action Alternative, which results in a PF power rate of $35.50/MWh.[39] This rate pressure occurs because of a combination of increased costs for structural measures and reduced firm power sales to Bonneville's public power customers.[40] The upward rate pressure on Bonneville's wholesale transmission rates would be smaller – around 0.09 percent annually, largely due to reduced short-term transmission sales.[41] This pressure is modest and within a range that is generally manageable within

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[33] *Id.*, Section 3.7.3.1, at 3-875 to 3-877.
[34] *Id.*, Appendix H, Section 2.3, at H-2-24.
[35] *Id.* at H-2-25.
[36] *Id.*, Section 7.7.9.2, at 7-163.
[37] *Id.*, Section 7.7.9.3, at 7-163.
[38] *Id.*, Section 7.7.9.4, at 7-166.
[39] *Id.*, Section 7.7.9.5, at 7-169, tbl. 7-33. It should be noted that the wholesale rates described here represent the average rates paid by Bonneville's customers as calculated for the Preferred Alternative using the methodology and assumptions established in the Final EIS and is a useful comparison to the calculated rate for the No Action Alternative. It does not represent the effective rate paid by a particular Bonneville customer and it is not an actual or forecasted rate in Bonneville rate cases. Further, this rate pressure does not account for potential offsetting cost reductions Bonneville may engage in to reduce this pressure.
[40] *Id.*
[41] *Id.*, Section 7.7.9.5, at 7-173.

Bonneville's cost structure.

Regional average residential retail rates would experience slight upward rate pressure of +0.44 percent, though the effect would be larger for power customers of Bonneville and would range up to +1.2 percent in some counties.[42] Across the Pacific Northwest, changes to the average residential retail rate would range from an increase of less than of 0.01 cents per kilowatt-hour (kWh) to an increase of 0.11 cents/kWh (in percentage terms this represents an increase of less than 0.1 percent to an increase of 1.2 percent). For commercial end users, rate effects range from an increase of less than 0.01 cents/kWh to an increase of 0.11 cents/kWh (an increase of less than 0.1 percent to an increase of 1.4 percent). Moreover, for industrial customers, the rate effects range from an increase of less than 0.01 cents/kWh to an increase of 0.11 cents/kWh (an increase of less than 0.1 percent to an increase of 2.0 percent).[43] These increases are lower than the regional retail impacts created by MO1, MO3, and MO4. Moreover, they do not include potential offsetting reductions, which Bonneville may be able to achieve through cost management actions that could reduce the upward pressure on the PF rate paid by Bonneville's firm power customers.

3.10.1 Alternatives Considered

The co-lead agencies considered, but ultimately chose not to select, the No Action Alternative, MO1, MO2, MO3, or MO4. CRS operations under MO1, MO3, and MO4, reduce federal power generation, which results in a corresponding reduction in power system reliability relative to the No Action Alternative, *i.e.,* they increase the LOLP percentage. To return the region to the LOLP of the No Action Alternative, additional resources would need to be built or acquired at a substantial cost to regional ratepayers. As described more fully below, MO3 and MO4 result in long-term, major, adverse effects on power costs and rates.[44] Similarly, MO1 results in long-term, moderate, adverse effects on power costs and rates.[45] Furthermore, until replacement resources are built and operating, regional reliability would decline below the level of the No Action Alternative.

3.10.1.1 No Action Alternative

The No Action Alternative met the Purpose and Need Statement of the CRSO EIS, but it did not meet all of the objectives developed for the CRSO EIS.[46] The No Action Alternative generally satisfied the Power Objective[47] as it resulted in no additional upward power rate pressure or potential regional reliability issues. However, it only partially met the objectives for water supply and adaptable water management because it did not provide the additional authorized regional water supply. Further, it did not include effects of the changes to CRS operations from important maintenance activities at Grand Coulee needed in the near term.

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[42] *Id.*, Section 7.14, at 7-236, tbl. 7-55; *see also id.*, Section 7.7.9.6, at 7-175 to 7-178, tbls. 7-37, 7-38.
[43] CRSO EIS, Section 7.9.7.5, at 7-173; *see also id.*, Section 7.9.10, at 7-221.
[44] CRSO EIS, Section 7.14, at 7-236, tbl. 7-55.
[45] *Id.*
[46] *Id.*, Section 7.3.1, at 7-5 to 7-6.
[47] The "Power Objective" refers to Objective 4, ("providing an adequate, efficient, economical, and reliable power supply that supports the integrated Columbia River Power System") described above in Section 2.2, and in the CRSO EIS, Section 2.2.1, at 2-3.

3.10.1.2 MO1

The Final CRSO EIS concludes that MO1 would not meet the Power Objective.[48] Under this alternative, hydropower generation from the CRS projects would decrease by 130 aMW (roughly enough to power 100,000 households annually).[49] The FCRPS, which includes the CRS, would lose 290 aMW of firm power under critical water conditions. This reduces the total amount of firm power available to Bonneville for supplying power customers under current long-term, firm power sales contracts. While the decrease in generation in MO1 is less than under the Preferred Alternative, MO1 had a greater impact on regional reliability because of the timing of when these declines occur. Specifically, MO1 changed the availability of generation in the summer months, when demand for electricity is relatively high and existing generating capacity is already relatively low.[50] As such, regional reliability would decline under this alternative, with LOLP increasing to 11.6 percent (or one or more blackouts in 1 in every 9 years) in MO1.[51]

The Final CRSO EIS concluded that additional resources would need to be built to maintain regional reliability at the same level as the No Action Alternative. It considered two resource portfolios that regional utilities could likely select from to replace the decrease in generation capability under MO1. Those portfolios include: (1) a conventional least-cost portfolio (natural gas); and (2) a zero-carbon portfolio (solar and demand response). Under the conventional least-cost portfolio, approximately 560 MW of natural gas fired generation would be needed at a cost of around $43 million per year to return regional reliability to the level of the No Action Alternative.[52] If the zero-carbon portfolio is selected, then 1,200 MW of solar produced power and 600 MW of demand response would be needed, for a cost of around $162 million a year.[53]

As noted above, the Final CRSO EIS included a rate analysis to estimate the impact of each MO on Bonneville's wholesale power and transmission rates. This analysis showed that MO1 placed upward pressure on Bonneville's PF power rate. Depending upon the type of resources acquired and the source of funding for those resources, MO1 placed upward pressure on Bonneville's PF rate of between 4.5 percent and 8.6 percent over the No Action Alternative.[54] Sensitivities performed in the Final CRSO EIS around these values showed the range of rate impacts widening from a low of 5.9 percent to a high of 14.3 percent (if Bonneville acquires the resources).[55] The upward transmission rate pressure under MO1 has annual increases between 0.62 and 0.74 percent depending on the resource replacement scenario.[56]

The regional average residential retail electric rates would also see increases under MO1. Regional retail rates could see upward rate pressure from between +0.65 percent and +0.79 percent annually depending on the applicable scenario.[57] The retail impact would be even larger for power customers of Bonneville, with the retail increase ranging as high as +7.6 for residential consumers in some

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[48] CRSO EIS, Section 7.3.2, at pg. 7-7.
[49] *Id.*, Section 3.7.3.3; *id.*, Section 3.1.3, tbl. 3-1.
[50] CRSO EIS, Section 3.7.3.3, at 3-896.
[51] *Id.*; *id.*, Appendix H, at H-2-3, tbl. 2-1.
[52] CRSO EIS, Section 3.7.3.3, at 3-899.
[53] *Id.*
[54] *Id.* at 3-904, tbl. 3-135, and 3-907, tbl. 3-136.
[55] *Id.* at 3-904, tbl. 3-135.
[56] *Id.* at 3-908.
[57] *Id.* at 3-909.

counties.[58] These effects could be greater if fossil fuel generation is reduced under the No Action Alternative, as is expected.

3.10.1.3 MO2

MO2 best met the Power Objective.[59] MO2 was developed with the goal to increase hydropower production and reduce regional greenhouse gas emissions while avoiding or minimizing adverse effects to other authorized project purposes. MO2 would slightly relax the No Action Alternative's restrictions on operating ranges and ramping rates to evaluate the potential to increase hydropower production efficiency, and increase operators' flexibility to respond to changes in power demand and to integrate variable renewable resources.[60] Average CRS generation would increase under MO2 by 450 aMW or 5 percent.[61] Firm generation would increase by 380 aMW or 6 percent.[62] The LOLP improves under MO2 to 5 percent, which is below the No Action Alternative level of 6.6 percent and is consistent with the Northwest Power and Conservation Council's target for the region.[63]

MO2 also has the smallest wholesale power and transmission rate pressure of the alternatives, with a base power rate impact of -0.8 percent and a range of between -3.2 percent to a high of 1.3 percent under the sensitivity analysis.[64] Transmission rate pressure was approximately 0.11 percent annually. MO2 also has long-term benefits to regional reliability if additional coal retirements occur.[65] Because MO2 increased CRS hydropower generation, fewer replacement resources would be needed to maintain regional reliability if existing plants serving load in the region are retired.[66] While MO2 provides the greatest benefits for the Power Objective, it generally produced minor to major adverse effects for anadromous fish except for minor beneficial effects for Snake River Chinook as modeled by NMFS. Thus, this alternative was not selected as the Preferred Alternative because of the adverse effects to anadromous and resident fish as well as cultural resources.

3.10.1.4 MO3

The Final CRSO EIS concludes that MO3 would not meet the Purpose and Need Statement for the integrated FCRPS[67] or the Power Objective.[68] This is due primarily to the decline in reliability and the upward rate pressure resulting from breaching the four lower Snake River dams. Under MO3, FCRPS generation would decline by 1,100 aMW, or roughly 8 percent.[69] The firm power capability of the FCRPS – power that on a planning basis is made available to meet Bonneville's customers' firm power needs - would decrease by 750 aMW, or roughly 12 percent.[70] The risk of a regional shortage of power would more than double compared to the No Action Alternative to 14 percent under MO3,

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[58] *Id.* at 3-918 to 3-919, tbl. 3-147.
[59] *Id.*, Section 7.3.3, at 7-8.
[60] *Id.* at 7-7.
[61] *Id.*, Section 3.7.3.4, at 3-920.
[62] *Id.*
[63] *Id.* at 3-922.
[64] *Id.* at 3-927, tbl. 3-150.
[65] *Id.*, Section 3.7.3.4 at 3-922.
[66] *Id.* at 3-923.
[67] *Id.*, Section 7.2, at 7-4.
[68] *Id.*, Section 7.3.4, at 7-10.
[69] *Id.*, Section 3.7.3.5, at 3-939 to 3-940.
[70] *Id.* at 3-941.

or one or more blackouts in one out of every 7 years.[71]

Additional generation resources would be needed to maintain regional reliability at the No Action Alternative level. As with other MOs, the Final CRSO EIS considered two replacement resource portfolios: (1) conventional least-cost; and (2) zero-carbon.[72] The conventional least-cost portfolio required approximately 1,120 MW of natural gas generation for an annual cost of around $249 million.[73] The zero-carbon portfolio required 1,960 MW of solar generation supported by 980 MW of batteries and 600 MW of demand response to return regional reliability to the No Action Alternative levels.[74] This portfolio included battery storage to return some of the lost sustained peaking and ramping capability that would occur under MO3.[75] This feature of the MO3 resource portfolio recognized the important role that generation capacity (the ability of a generator to increase or decrease generation) plays in balancing solar resources. Without batteries, solar resources would need to rely on other regional resources to help balance their generation when the sun goes down or clouds roll in.[76] The cost of the zero carbon portfolio is about $416 million a year.[77]

The "base case" evaluation in the Final EIS described the resources needed to return regional reliability to the level of the No Action Alternative (*i.e.,* LOLP of 6.6 percent). These resources, however, would not return to the Federal system, or the region, the full functionality, flexibility, and capability provided by the four lower Snake River dams. The four lower Snake River dams provide many operational benefits to power system functionality, such as 2,000 MW of quickly responding up or down (*i.e.,* ramping) generation capacity that can be deployed to meet fluctuations in load and generation.[78] This type of flexibility is crucially important during times of system stress, such as when generation goes offline or wind and solar generation fluctuate. To account for these additional operational benefits, the Final CRSO EIS performed a sensitivity analysis to estimate the amount of additional resources needed to replace the flexibility attributes of the four lower Snake River dams. The EIS concludes that to fully replace the capability of these projects, 3,306 MW of solar, 1,144 MW of wind, and 2,515 MW of batteries (at a cost of over $800 million a year) would be needed.[79]

The Final CRSO EIS rates analysis showed that MO3 would place substantial upward rate pressure on Bonneville's PF power rates. Under the least-cost conventional portfolio, Bonneville's power rates could see rate pressure in a range between 8.2 percent and 9.6 percent.[80] The rate sensitivity analysis for this portfolio shows this range expanding from a low of 4 percent to a high of 10.1 percent (if Bonneville acquires the resources).[81] The upward pressure to Bonneville's PF power rate under the zero carbon portfolio would range from 9.8 percent (if regional utilities acquire replacement resources) to 20.6 percent (if Bonneville acquires the resources).[82] The rate sensitivity analysis in the Final CRSO EIS shows these rate impacts potentially growing even larger under MO3, with the low end of that

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[71] *Id.*, Section 3.7.3.5, at 3-942; *id.*, Appendix H, Power and Transmission, Section 2.1, tbl. 2-1.
[72] CRSO EIS, Section 3.7.3.5, at 3-942.
[73] *Id.* at 3-943.
[74] *Id.*
[75] *Id.*
[76] *Id.*
[77] *Id.* at 3-960, tbl. 3-168.
[78] *Id.* at 3-945 to 3-946.
[79] *Id.* at 3-947 to 3-948, tbl. 3-164.
[80] *Id.* at 3-960, tbl. 3-168 and at 3-964, tbl. 3-169.
[81] *Id.* at 3-960, tbl. 3-168.
[82] *Id.*

range at 11.8 percent to a high end of over 50 percent, if Bonneville acquires the resources.[83]

MO3 results in upward pressure on Bonneville's transmission rates as well. Upward transmission rate pressures would be 1.3 percent annually for the conventional least-cost portfolio and 1.6 percent annually under the zero-carbon portfolio, relative to the No Action Alternative.[84]

The regional average residential retail rates for power would see substantial increases under MO3. Regional retail rates across all utilities (both Bonneville customers and non-Bonneville customers) could see upward rate pressure from between +1.7 percent and +2.8 percent depending on the applicable scenario.[85] The retail impact would be even larger for Bonneville's power customers, with the retail increase ranging as high as +14 percent for residential consumers in some counties and +28 percent for some industrial consumers.[86] These effects could be greater if fossil fuel generation is reduced under the No Action Alternative, as is expected.

While the high cost of MO3 is an important factor in the co-lead agencies' decision to not include breaching the four lower Snake River dams in the Preferred Alternative, other factors under MO3 also weigh against its selection. For example, the time involved to select, permit, and build the replacement resources and any associated transmission facilities is unknown. The Final CRSO EIS assumes breaching the four lower Snake River dams would occur starting in 2021. The Final CRSO EIS also assumes all replacement resources would be available to serve load beginning in 2023.[87] This is a methodological assumption designed to create a level playing field to measure the effects of the Alternatives compared to the No Action Alternative. While useful for the rates analysis (and other affected resources), this assumption does not take into account the elements of the planning required, and the time needed to site, permit, and build the replacement resources. In the case of MO3, the zero-carbon replacement resources would be on a level well above those currently operating in the region. For a sense of scale, the region has around 1,000 MW of installed solar capacity,[88] and the largest operating battery in the world is 100 MW, though several larger batteries are in development.[89] Installing 1,960 MW of solar would require roughly 12,000 acres of land or approximately 18 square miles.[90]

The CRSO EIS acknowledges the timing issues with these large resource builds, noting that it would likely take years – perhaps decades – to complete the planning, environmental analysis, permitting, land acquisition, and physical construction of the transmission and generation resources needed in this alternative.[91] Moreover, the environmental effects from building this level of renewable resources would require its own evaluation. That evaluation would include, among other matters, impacts to the natural environment and methods to dispose of or recycle the metals and minerals used in large-scale solar, wind, and battery installations at the end of their useful life.[92] The feasibility of building thousands of megawatts of new resources, miles of new transmission infrastructure, upscaling emerging technologies (*e.g.*, batteries) to unprecedented levels, and the associated environmental review

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[83] *Id.*
[84] *Id.* at 3-965.
[85] *Id.* at 3-965 to 3-966.
[86] *Id.* at 3-966.
[87] *Id.*, Section 3.7.3.1, at 3-859.
[88] *Id.*, Section 3.7.3.2, at 3-882.
[89] *Id.*, Section 3.7.3.5, at 3-947.
[90] *Id.* at 3-943.
[91] *Id.*, Section 3.7.3.3 at 3-899; *see also id.*, Appendix H, Section 2.2.4.
[92] CRSO EIS, Appendix H, Section 2.2.4, at H-2-24.

of these actions, is a factor in the co-lead agencies' choice of an alternative. Until those resources are constructed and operating, actions to implement MO3 could not be undertaken without seriously undermining regional reliability.[93]

Another important consideration weighing against selection of this alternative is the long-term regional reliability impacts of reducing existing carbon-free, flexible resources. As discussed in the Preferred Alternative, the Final CRSO EIS analysis assumes that coal plants generating 4,246 MW would continue to serve loads in the region over the study period.[94] Several of these plants have already been slated for retirement, while others are likely to retire in the coming years as state policymakers continue to take actions to reduce the use of fossil fueled resources.[95] While the CRSO EIS focuses on selection of the operating strategy for the CRS projects, the Final CRSO EIS recognizes the effects that coal plant retirements can have on regional reliability.[96] The resource retirement choices that utilities make affect the reliability of the broader interconnected grid and markets, likely putting additional strain on the existing power system, particularly if the replacement resources are intermittent or variable renewable resources. If regional utilities retire their coal plants, the need for existing hydropower becomes greater.[97] A similar paradigm applies to hydropower generation. Breaching existing hydropower projects places additional strain on the existing power system, including thermal and renewable resources, compounding the reliability problems the region will already be facing with additional coal plant retirements. The end result is that regional utilities would need to fill the holes in reliability left by reductions in both resources (coal and hydropower), which may result in even *more* investments in resources by regional utilities.

The Final CRSO EIS analyzed the effects of coal plant retirements plus reductions in hydropower generation in the "Other Regional Cost" pressure sensitivity.[98] In simple terms, this sensitivity asks whether the combination of (1) accelerated coal plant retirements, and (2) operations under the applicable alternative, would require regional utilities to build *incremental* zero carbon resources, above and beyond what would be needed if (1) and (2) were viewed separately. For MO1 and MO4, the Final CRSO EIS concludes in the Other Regional Cost pressure analysis that no incremental resources were needed to maintain regional reliability when viewing (1) and (2) together. For MO3, however, an effect is identified, with a range of between 660 MW to 3,460 MW of additional zero-carbon resources.[99] This effect shows that the combined effects of MO3 operations *plus* coal plant retirements would potentially lead the region to build even more resources than the sum of coal plant retirements and hydropower generation losses occurring in isolation. This analysis confirms that eliminating the generation of the four lower Snake River projects would exacerbate the existing resource adequacy issue already facing the region.

3.10.1.5 MO4

The Final CRSO EIS concludes that MO4 would not meet the Power Objective.[100] This is primarily due to the large reductions in generating output resulting from CRS operations under MO4. Average

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[93] *Id.* at H-2-3, tbl. 2-1 (showing the region facing blackout/energy shortages in 1 out of every 7 years under MO3).
[94] *Id.*, Section 3.7.3.1, at 3-875-77.
[95] *Id.*, Appendix H, Section 2.3.
[96] *Id.*, Section 6.3.1.7, at 6-68 to 6-69.
[97] *Id.*, Appendix J, Hydropower, Section 4.2.5, at J-4-19.
[98] *Id.*, Section 3.7.3.1, at 3-875 to 3-876.
[99] *Id.*, Section 3.7.3.5, at 3-952, tbl. 3-167.
[100] *Id.*, Section 7.3.5, at 7-14.

CRS generation under MO4 would decline by 1,300 aMW, which is a 15 percent reduction.[101] The firm power capability of the CRS would decline by 890 aMW or 14 percent.[102] The risk of a regional shortage of power (LOLP) would increase to 30 percent, an almost fivefold increase to the No Action Alternative LOLP of 6.6 percent. This is equivalent to one or more blackouts every 3 years.[103]

Returning regional reliability to the level of the No Action Alternative would require substantial investments in new resources. Using conventional least-cost resources, the Final CRSO EIS estimates that 3,240 MW of power produced by new natural gas plants would be needed to return regional reliability to the level of the No Action Alternative at an annual cost of approximately $242 million.[104] If zero-carbon resources are selected, then roughly 5,000 MW of power produced by solar resources and 600 MW of demand response would be needed at an annual cost of roughly $576 million.[105]

MO4 would place substantial upward rate pressure on Bonneville's PF power rates. Under the least-cost conventional (natural gas) portfolio, Bonneville's PF power rates could see base case rate pressure in the range between 15.3 percent (if regional utilities acquire the resources) and 23.5 percent (if Bonneville acquires the resources).[106] The rate sensitivity analysis showed this rate pressure increasing, from a low of 18.6 percent to a high of 26.4 percent (if Bonneville acquires the resources).[107] The rate pressure to Bonneville's wholesale power rate under the zero-carbon portfolio ranges from 18.3 percent (if regional utilities acquire replacement resources) to 25.3 percent (if Bonneville acquires the resources).[108] The rate sensitivity analysis in the Final CRSO EIS shows these rate impacts potentially growing even larger under MO4, with the low end of that range at 20.2 percent to a high end of over 40 percent (if Bonneville acquires the resources).[109]

MO4 resulted in the most substantial upward pressure on Bonneville's transmission rates as well. Upward transmission rate pressures would be 1.6 percent annually for the conventional least-cost portfolio, and 1.9 percent under the zero-carbon portfolio, relative to the No Action Alternative.[110]

Regional retail rates would also see significant upward rate pressure. On average, counties would experience a 2.9 to 3.3 percent upward rate pressure on their residential retail rate, depending on the replacement portfolio, relative to the No Action Alternative.[111] The largest effect for all end-user groups under MO4 is a 36 percent upward rate pressure in the industrial retail rate for some counties.[112]

As with MO3, the co-lead agencies considered the long-term impacts on regional reliability and the feasibility of implementing this alternative. If the region selects a zero-carbon portfolio to replace the lost generation in MO4, then upwards of 30,000 acres of land or roughly 47 square miles would be

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[101] *Id.*, Section 3.7.3.6, at 3-978.
[102] *Id.* at 3-979.
[103] *Id.* at 3-980.
[104] *Id.* at 3-981. Although MO4 requires more natural gas plant capacity than MO3, the cost of operating and running these plants is slightly less because they will be operated less frequently than in MO3, and a lower-cost technology (frame as opposed to combined cycle) was selected in the resource selection process for MO4.
[105] *Id.* at 3-981 to 3-982.
[106] *Id.*, Section 3.7.3.6, at 3-989, tbl. 3-184, and at 3-992, tbl. 3-185.
[107] *Id.*
[108] *Id.* at 3-989, tbl. 3-184.
[109] *Id.*
[110] *Id.* at 3-993.
[111] *Id.* at 3-994.
[112] *Id.*

needed to site a solar project capable of producing 5,000 MW.[113] These replacement resources, which would take years, if not decades to site, permit, construct, and acquire would need to be up and running before CRS operations under MO4 could be in place. Without these resources, regional reliability would decline to unprecedented low levels, with a 30 percent chance of a year with one or more blackouts, i.e. one year every three years, creating potential public safety and health effects from decreased power reliability. In addition, as with MO3, the mass buildup of resources called for in MO4 would involve environmental effects that would have to be evaluated and considered.

3.11 Minimize greenhouse gas emissions from power production in the Northwest by generating carbon-free power through a combination of hydropower and integration of other renewable energy sources

Similar to MO1, MO3, and MO4, the Selected Alternative does not meet the CRSO EIS objective of minimizing greenhouse gases (GHG) emissions from power production in the Northwest. Hydropower generation will decrease, resulting in increased generation from existing gas and coal plants. The air quality analysis for the Selected Alternative concludes that power sector GHG emissions in the Northwest will increase by approximately 0.54 million metric tons per year, which is about 1.5 percent of total power sector emissions in the region. This increase is not as substantial as the increases for MO3 or MO4, but similar to the increase under MO1. For states that have established policies for reducing GHG emissions, such as Oregon and Washington, this could adversely impact the timeframe and costs associated with meeting these targets. Similarly, this could also increase the cost for utilities that need to comply with state policies that place a price on carbon or require use of a high percentage of renewables to meet retail load. For example, Washington's Clean Energy Transformation Act (2019) directs Washington retail utilities to serve loads with 100 percent carbon-neutral power by 2030 and 100 percent carbon-free power by 2045 (Revised Code of Washington 19.405). The CRSO EIS analysis indicates that in 2030 the approximately 0.54 million metric ton increase in GHG emissions could cost utilities - and ultimately ratepayers - across the region $15 to $77 million a year in compliance costs under these types of state programs (prices are stated in 2019 dollars).

Given the Selected Alternative's changes in hydropower generation largely occur in April through June, - a time of year when hydropower generation is typically surplus to Bonneville's preference customers' loads - it is more likely that increased fossil-fuel generation owned by the investor-owned utilities in the region would be serving investor-owned utility load, thus resulting in these GHG emissions costs being borne largely by investor-owned utilities. However, there could be conditions when some of these costs could also be borne by Bonneville and its preference customers depending on which entity is responsible under state programs for the GHG compliance costs associated with the increases in fossil-fuel generation. While the Selected Alternative results in increases in GHG emissions and likely additional costs to ratepayers, thus not meeting this CRSO EIS objective, this represents a trade-off to allow for potential benefits to ESA-listed salmonids.

3.12 Climate Change

Future climate projections indicate warming temperatures and changes in precipitation trends, which generally are likely to result in declining snowpack, higher average fall and winter flows, earlier peak spring runoff, and longer periods of low summer flows. These changes could lead to higher and more variable winter flows and lower flows during summer months across all regions in the basin. Water

[113] *Id.* at 3-981 to 3-982.

temperatures throughout the basin are likely to increase. Climate change is expected to affect nearly all purposes and uses of the CRS. These effects are not caused by the CRS (though changes in operations of the system evaluated in the CRSO EIS impact hydropower generation and in turn regional GHG emissions) and are expected to occur regardless of the alternative selected. However, certain measures could exacerbate or ameliorate the impacts of climate change, thus affecting the overall resiliency of a resource in response to these expected changes in climate.

The analysis concluded that climate change is expected to have negligible to moderate effects (beneficial or adverse) on resources and the effectiveness of the Preferred Alternative. The EIS analysis showed minor to moderate effects from climate change to these resources: Hydrology and Hydraulics; River Mechanics; Water Quality; Anadromous Fish; Resident Fish; Vegetation, Wildlife, Wetlands, and Floodplains; Power Generation and Transmission; Flood Risk Management; and Fisheries.

In the final biological opinion, NMFS states that climate change poses a substantial threat to anadromous fish species over the next twenty years. While climate change will affect anadromous fish in all stages of life, the impacts are largely driven by changes in ocean conditions that are projected to reduce survival during the marine life history stage. NMFS concluded that "these conditions are not caused by, nor will they be exacerbated by, the continued operation and maintenance of the CRS as proposed in the biological assessment." The USFWS concluded in its final biological opinion that the Preferred Alternative, in combination with other Federal and non-Federal actions, is likely to exacerbate the effects of climate change on resident fish by further diminishing habitat quality, decreasing forage availability, causing migration delays, and increasing the risk of injury and mortality. The USFWS recommended measures be taken where possible to increase instream flow to improve water quality, decrease stream temperatures, and otherwise reduce the impacts to resident fish from climate change.

The Selected Alternative contains measures that are adaptive to emerging changes in climate and ensure there is flexibility to respond to future changes.

Operational measures for the Selected Alternative as well as non-operational conservation measures are expected to improve the existing survival levels of fish species and contribute to overall resiliency in light of climate change. For example, the co-lead agencies committed to continuing the tributary and estuary habitat improvement program for salmon and steelhead (with considerations for benefits to bull trout, where appropriate), habitat restoration actions for KRWS, and to evaluate and improve tributary habitat access for species such as bull trout which will give spawning fish access to additional habitat. These actions improve resilience to climate change by increasing access to more diverse spawning habitat. Another example of this is the tributary habitat restoration program that counters increased stream temperature with deeper pools and more shaded areas. These types of habitat improvement projects are examples of many actions that will be implemented throughout the Columbia Basin. The Selected Alternative also contains operational measures that are expected to contribute to species resiliency, such as the continued use of cool water stored behind Dworshak Dam and structures to address ladder temperature differentials to help to reduce water temperatures in the lower Snake River as fish approach and pass Lower Granite and Little Goose dams.

The Preferred Alternative also contains measures that provide additional flexibility for operations of the CRS, which may contribute to the resiliency of other resources to climate change. For example:

- The reduction in fish passage spill in the second half of August, which increases generation during a time when climate change is expected to increase demand for power while at the same time reducing the volume of water.
- The updated flood risk management drawdown operation at Dworshak, which will provide more planning certainty counteracting the increased uncertainty from climate change.
- Sliding scale operations for summer flow augmentation are staged to better respond to local water supply conditions by using local forecasts and to better balance anadromous and resident fish needs.

A full discussion of climate and evaluation of resources are included in Chapters 4 and 7 of the CRSO EIS.

3.13 Scientific Integrity and Commitments to Independent Review

Based on the nature of the CRSO EIS, the standards in the applicable statutes, and comments during scoping from the public, the co-lead agencies concurred that scientific integrity and independent review of both the analysis in the CRSO EIS and the methodologies used to conduct the evaluation were important parts of the process. Following the Corps and OMB guidance described in Corps (2018) and OMB (2004), the agencies had independent technical review conducted in addition to agency and cooperator agency technical review. This helped assure the evaluations were sound and identified where materials need clarity or where the information had considerable risk and uncertainty. These findings were used by the decisionmakers in considering alternatives and making a final selection. Several of the tools used were not owned or operated by the co-lead agencies. The results of these peer reviews are discussed in the body of the CRSO EIS. The owners of these tools were provided the results from the peer review panel to help improve the tools in the future, should those entities choose to do so.

3.14 Comparable Benefits and Adverse Effects of the Alternatives

In addition to the benefits that could be achieved by implementing each of the alternatives, the agencies closely reviewed the analysis of both benefits of implementing an alternative, and potential adverse impacts to the human and natural environment, including risk to human health or safety, changes to community culture and wellbeing, impacts to local and regional economies, and ability to access and enjoy the natural environment. The Northwest region has diverse tribal communities and a rich history of cultural resources; the co-lead agencies gave particular consideration to not exacerbate any effects to, or adversely or disproportionately impact, tribal resources or communities. The agencies also consider risk, potential undesirable and unintended consequences of alternatives, and how climate variability, such as conditions of both the short term and long term shifts in climate, including extended droughts, or wetter and warmer weather, may affect the system operations and the resources in the region.

The No Action Alternative would continue with the planned operations and mitigation components in place in September 2016. The No Action Alternative also would not include the additional water supply commitments from Lake Roosevelt, or the operations of Grand Coulee during planned maintenance activities over the next 25 years. The No Action Alternative also would not meet the Power, GHG, or water supply objectives of the EIS for balancing considerations of future operations.

All of the alternatives included measures to benefit ESA-listed anadromous and resident fish and

lamprey. MO1 included several measures, which were carried forward or modified in the Preferred Alternative. MO1 included all lamprey structural measures included in the Preferred Alternative, except the *Closeable Floating Orifice Gates* measure, which was only added to the Preferred Alternative. Measures unique to MO1 for fish were the juvenile spill operation, the *Predator Disruption Operations* measure, and the *Modified Dworshak Summer Draft* measure. The *Predator Disruption Operations* measure (like the Preferred Alternative) could result in larval lamprey being stranded in shallow rearing areas, depending on dewatering rates. The *Modified Dworshak Summer Draft* measure was intended to provide cooler water for anadromous fish. The analyses showed it would actually increase temperatures and have an adverse effect on ESA-listed anadromous and resident fish as well as non-ESA-listed lamprey. This measure was not carried forward into the Preferred Alternative. Finally, MO1 did not meaningfully meet resident fish, power or GHG objectives.

MO2 included measures with less spill and spring flow compared to the No Action Alternative and generally had lower expected performance related to anadromous adult and juvenile fish. For some species, such as Snake River Chinook salmon, the analysis produced mixed results with the NMFS Lifecycle models predicting minor improvements and the CSS Lifecycle models predicting major declines. The MO2 resident fish results showed the measures to increase power generation and water supply would have moderate to localized major adverse effects to resident fish throughout the basin, especially at Hungry Horse Dam where increased winter flows and lower summer reservoir elevations would affect food productivity, tributary access, habitat suitability, and entrainment. Regions B and C would also experience adverse effects to resident fish from power generation and water management measures that were eliminated or modified for the Preferred Alternative. Finally, MO2 included the same lamprey structural measures as MO1. Relative to the Preferred Alternative, the overall shift to more powerhouse flow and passage makes this alternative less effective at improving conditions for lamprey. Greater numbers of lamprey would likely pass near fish bypass screens and would be at a higher risk of injury or impingement compared to the No Action Alternative. Thus, although MO2 met the power and GHG objectives, it did not meet the objectives for ESA-listed juvenile fish or resident fish and may not meet the ESA-listed adult anadromous fish objective. These adverse effects could impact tribal and commercial fishing. It also did not meet the water supply objective.

MO3 included improvements to fish passage by structural modification with the *Removal of the Earthen Embankments* measure at the four lower Snake River dams. Model estimates for MO3 showed the highest predicted potential smolt-to-adult returns (SARs) for Snake River salmon and steelhead as compared to the other alternatives analyzed in the CRSO EIS. Quantitative model results from both the CSS and NMFS Lifecycle models were available and indicated a range of potential long-term benefits largely due to how the models address latent mortality. Quantitative predictions for improvements for Upper Columbia Chinook were not anticipated to be at the same magnitude as Snake River species since upper Columbia stocks do not pass the four lower Snake River dams. Moreover, resident fish would have major adverse short-term effects during construction followed by major long-term benefits to bull trout and white sturgeon (not ESA-listed in this reach) due to habitat connectivity. Other native fish in the Snake River would also benefit from the conversion of reservoir conditions to more riverine habitat. MO3 analyses showed similar effects as MO1 for resident fish in other regions. The primary benefit is anticipated to be for ESA-listed fish in the lower Snake River, which could improve commercial and tribal fishing and recreation. Finally, MO3 included the same lamprey structural measures as MO1. Relative to the Preferred Alternative, the most substantial change would be the breaching of the four Lower Snake River dams. This could reduce mortality to lamprey during the downstream migration phase and would substantially improve the ease of upstream migration. Finally, MO3 did not meet the power or GHG objectives.

Significant human health and safety concerns were identified for MO3. This alternative has the potential to temporarily contaminate water, used for both municipal and agricultural purposes. Indirect impacts included potential to contaminate fish and communities that may consume these fish. The uncertainty around remediation actions that would be required to clean hot spots and underground storage leaks elevates the risk. Much of the safety improvements needed to public and private infrastructure (roads, rails, water intakes, pipes) in the reach of the lower Snake River would be conducted by other entities. The method of dam breaching would be staged and water levels lowered to prevent shoreline slumping, but changes in river velocities on infrastructure could contribute to degradation that would need to be addressed. Water intakes for municipal water access would need to be extended in some areas, a concern for communities to have access to adequate water supply. Several communities currently use the lower Snake and McNary reservoirs for fire prevention and emergency services via boats and sea planes, and would need to adjust their emergency plans. Carbon emissions and traffic congestion would be elevated in some communities as commodities shift from shipping by navigation to truck or rail. As sediment is moved through the system, areas of the navigation channel and shorelines could capture sediment and create temporary shoaling areas, which could pose hazards to boaters.

MO3 additionally would have adverse effects to the communities along the lower Snake River and confluence with the Columbia River. This area would have to adjust to changes in agricultural and shipping practices, and jobs. While economically these shifts will pass from one type of service to another, the people involved are likely to change, and the composition of these communities with it. There would be higher cost for shipping in the region, as well as upward pressure on power and transmission rates and increased risks for power outages unless and until replacement resources are acquired. Additionally, there would be significant shifts in use of this region for recreational purposes, from a reservoir to river system. Most access points to the river will be inaccessible until regional entities provide local infrastructure. Over time, it is anticipated these communities would stabilize. In the interim, these communities would have limited and changed use of the river, shifts in community practices, and impacts to visual and aesthetic enjoyment of the natural environment.

There was significant short term risk to the natural environment with MO3 implementation. While mitigation and time could help offset those impacts to wetlands, floodplains and wildlife usage adversely affected by the breaching measure, there is significant uncertainty around responses to extended years of low dissolved oxygen. Significant die-off of aquatic organisms could occur. Long term risks include increases in ambient air temperature, which could exacerbate water temperatures in a post breach lower Snake River, which would be much shallower and narrower. It is anticipated it would be more sensitive to air temperatures, including getting hotter in the spring, and cooling earlier in the fall. The potential of unintended consequences is higher as there is greater uncertainty in multiple breaching scenarios, which could also implicate funding and associated production at mitigation hatcheries.

MO4, which had the highest juvenile fish passage spill levels and the most flow augmentation, also produced mixed results based on the two primary modeling approaches. NMFS Lifecycle models predicted that survival and abundance would decrease under MO4 while the CSS models predicted increases. MO4 incorporates a flow augmentation measure to benefit juvenile anadromous fish that would have major adverse effects to resident fish in the upper basin (Region A), and also in Lake Roosevelt (Region B), especially in dry years. Notably, this alternative is the only one that showed adverse effects to resident fish in the Pend Oreille River and Lake Pend Oreille. Additionally, MO4 included the same lamprey structural measures as MO1. Relative to the Preferred Alternative, the

increased spill and flow augmentation under MO4 may result in minor beneficial effects for out-migrating juvenile lamprey. Adults migrating upstream in July would experience higher water temperatures in the Columbia River from Chief Joseph Dam to McNary Dam that would likely lower their survival and migration success relative to the Preferred Alternative. In MO4, drawdowns in late March could dewater sediment used for larval lamprey rearing, and this alternative could reduce the amount of habitat available for larval lamprey. MO4 has the potential to affect communities adversely along the upper storage reservoirs and rivers. The increase in water flows in the lower Columbia River would pull water from the upper basin projects, adversely affecting riparian and resident fish habitat. Many of these areas have tribal and commercial fishing, directly affecting the fish resources, economics, and community wellbeing. Additionally, these areas would have adverse visual effects. Several cultural sites would also be at risk of damage.

MO4 would remove flexibility for water discharge outlets at projects, and increase TDG in the water column. This has a known adverse impact to aquatic organisms, but uncertainty around the scale of adverse impacts at the project level. Additionally, the energy associated with the discharged spill could confuse and prevent migrating ESA-listed adult fish from passing the projects. There would be additional infrastructure maintenance and dredging of the navigation channel to sustain the higher spill, impacting the sediments and aquatic organisms more frequently. Finally, MO4 did not meet the ESA-listed resident fish, power or GHG objectives.

With these results, in concert with results relating to the other objectives in mind, the co-lead agencies developed the Preferred Alternative. A major difference from past operations is the Preferred Alternative includes a new spill operation to test balancing fish benefits and flexibility for hydropower production by spilling more water in the spring for juvenile fish passage. The Preferred Alternative did not carry forward some measures that were initially expected to provide a benefit to anadromous fish, including construction of additional powerhouse surface collectors because neither NMFS nor CSS Lifecycle modeling efforts predicted a measurable benefit to fish.

Relative to resident fish, the Preferred Alternative includes measures that provide benefits for resident fish, such as ramping rate restrictions, minimum downstream flow requirements, and temperature control, as well as ongoing non-operational conservation measures such as Kootenai River white sturgeon habitat restoration projects and leveraging benefits for bull trout where feasible when developing tributary habitat projects for salmon. Other measures allow for the summer draft from Libby and Hungry Horse Reservoirs for downstream flow augmentation to be determined based on local water supply forecast and to be sensitive to water supply conditions. As a result, water reservoir elevations would be a little higher in the summer, especially in dry years. This action is expected to affect resident fish by improving food production, tributary access, entrainment, and downstream habitat suitability. Finally, measures included in the Preferred Alternative should decrease susceptibility to physical stress and mortality for lamprey relative to the No Action Alternative. The Preferred Alternative is expected to contribute to improvements in spatial distribution and recruitment of Pacific lamprey in the Columbia Basin, though it remains difficult to quantify effects and benefits of some actions. Finally, the Preferred Alternative meets all EIS objectives except the GHG objective.

Section 4. Public Review

Public review of the Draft CRSO EIS was conducted February 28, 2020 through April 13, 2020 [Federal Register, Volume 85, Number 40, page 11986]. All comments submitted during the public comment period were responded to in the Final CRSO EIS and can be found in Appendix T. A 30-

day waiting period and state and agency review of the Final EIS was completed on August 31, 2020 [Federal Register, Volume 85, Number 148, page 46095].

4.1 Comments Received on the Final EIS

The co-lead agencies received two comment(s) after issuance of the Final EIS. Commenters, included the U.S. Environmental Protection Agency (EPA) and the Columbia-Snake River Irrigators Association.

EPA provided comments pursuant to the National Environmental Policy Act, (40 C.F.R. §§ 1500-1508), and Section 309 of the Clean Air Act. The comments focused on appreciation for adding information requested during a meeting of the co-lead agencies with EPA; support for refining monitoring and adaptive management proposed in the EIS; and acknowledgement of modifications that were made in collaboration with Federal and non-Federal agencies, cooperating agencies, and tribes. EPA also expressed its willingness to continue support on wide-ranging water quality issues, where appropriate.

The Columbia-Snake River Irrigators Association submitted comments related to irrigation and navigation effects of MO3. In response to Draft EIS comments received regarding over-estimating transportation costs associated with dam breaching, the Final EIS included a sensitivity analysis that examined the potential use of the Great Northwest Railroad for transporting grain to export elevators on the Columbia River. The sensitivity analysis determined that the costs to upgrade the rail lines to meet Positive Train Control (PTC) requirements, add sufficient space to port facilities, and modify port facilities to load trains would likely be economically unfeasible when compared to other options. The co-lead agencies deemed that the sensitivity analysis was sufficient for informed decision-making and that a more detailed and costly analysis would not result in a significantly different estimate of impacts or ultimately change the Selected Alternative.

4.2 Cooperating Agencies, Tribes, and Stakeholders Review

4.2.1 Review from States

The four states - Oregon, Washington, Idaho, and Montana - all provided expertise and contributions to the CRSO EIS as cooperating agencies. The states were unified in calling for a continued commitment to improving conditions for the region's fish and wildlife. In support of requests for continued regional collaboration, the co-lead agencies support efforts to hold forums focused on improving salmonid populations. The co-lead agencies expect that this EIS will provide a useful foundation of information as the region works together on a shared vision for abundant fish runs and a clean, reliable, and affordable energy future for the Northwest.

4.2.2 Tribal Views Shared Prior to the Joint Record of Decision

The agencies engaged with regional tribes after the release of the Final CRSO EIS and had additional discussions with five tribes.[114] These were not typical consultations as they were held remotely using

[114] These tribes included the Confederated Tribes of the Colville Reservation, the Coeur d'Alene Tribe, the Confederated Salish and Kootenai Tribes, the Confederated Tribes and Bands of the Yakama Nation, and the Nez Perce Tribe. Several informal meetings were also conducted with various tribes from the region, including an invitation to all regional tribes for a large virtual video conference.

video conferencing due to the coronavirus pandemic. Nearly all tribes reiterated the dramatic impacts to their culture and way of life resulting from the construction, operations and maintenance of the CRS and the importance of salmon and other fish to their people. Some tribes were complimentary and supportive of the CRSO EIS process, citing the considerable effort put into regional coordination, soliciting input from tribes, and the comprehensive analysis resulting in a quality report. Some expressed concerns about the expedited schedule of the EIS and a perceived lack of tribal consideration and contribution to the EIS process and content.

There was uniform interest in next steps following the CRSO EIS and how the tribes would be included in regional forums, implementation of the CRSO EIS, and notably mitigation actions. All tribes inquired about how regional forums would be conducted, who the lead entities would be, goals of the forums, and what the agency roles would be. Frustration was expressed about the decision to not include fish reintroduction into blocked areas as part of the CRSO EIS alternatives. A strong interest was expressed for having fish reintroduction into blocked areas be the primary focus of upcoming forums. Many expressed a desire to collaborate on mitigation planning efforts (e.g., fish habitat studies) to contribute technical expertise and tribal perspectives.

The pre-ROD tribal consultations were informative and provided helpful suggestions, some of which were included in this joint ROD. Tribal perspectives have and will always continue to improve our agency understanding of the CRS. Discussions about the future of managing the CRS does not end with this EIS and associated Tribal consultations. This EIS is part of the ongoing effort to manage the CRS.

4.2.3 Common Publicly-held Views

Many members of the public through public comments, cooperating agencies throughout their participation in developing the EIS and in comments on the EIS, and tribes expressed a preference for the agencies to select an alternative that included the dam breaching measures in MO3, sometimes in combination with juvenile spill operations in MO4. Although MO3 potentially had the greatest benefits for some species of ESA-listed fish, it would achieve those benefits at the expense of not meeting the other components of the agencies' Purpose and Need Statement or certain EIS objectives. The agencies also received numerous comments expressing opposition to MO3.

The measure to breach the four lower Snake River dams in MO3 (a main component of this alternative) has been the topic of a large amount of public discourse for decades. Many environmental organizations and some tribes have been strong proponents of breaching the dams. They assert breaching the dams will result in large improvements to certain salmonid populations, and this in turn would have beneficial effects to the overall function of the Northwest ecosystem and for tribal ways of life. At the same time, many stakeholders within the navigation industry, and agricultural producers within the region that depend on the navigation industry to export grains to overseas markets, have expressed high concern with the potential regional socioeconomic effects from breaching the dams. This alternative would eliminate approximately 48,000 irrigated acres, hydropower generation flexibility and navigation on the lower Snake River which affects the ability of this alternative to meet the Purpose and Need Statement.

Section 5. Environmental Compliance Summary

5.1 Section 7 of the Federal ESA

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, NMFS and USFWS issued biological opinions, both dated July 24, 2020, that determined that the Selected Alternative will not jeopardize the continued existence of the following federally listed species or adversely modify designated critical habitat: Snake River (SR) spring/summer Chinook salmon, SR Basin steelhead, SR sockeye salmon, SR fall Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, UCR steelhead, Middle Columbia River steelhead, Columbia River chum salmon, Lower Columbia River (LCR) Chinook salmon, LCR steelhead, LCR coho salmon, Upper Willamette River (UWR) Chinook Salmon, UWR steelhead, the southern Distinct Population Segment of eulachon, bull trout, and KRWS. The agencies will implement the Selected Alternative reviewed in the consultations, as well as the Services' terms and conditions to both minimize take of ESA-listed species and avoid jeopardizing the continued existence of ESA-listed species or destroying or adversely modifying designated critical habitat.

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, the co-lead agencies determined that the recommended plan may affect but is not likely to adversely affect the following federally listed species or their designated critical habitat: Southern Resident killer whales, southern Distinct Population Segment of green sturgeon, streaked horned lark, Columbian white-tailed deer, grizzly bear, Ute ladies tresses, and the western yellow-billed cuckoo. NMFS and USFWS concurred with the co-lead agencies' determination on July 24, 2020.

In order to inform ongoing implementation of the Selected Alternative (with adaptive management principles), the co-lead agencies would continue to rely upon annual species status monitoring results to ascertain the need for contingency actions. The co-lead agencies do not propose to use specific abundance or trend triggers as previously set forth in the 2009 Adaptive Management Implementation Plan[115] because they have become outdated (e.g., they were based on adult returns through 2007 or 2008), because many identified contingency actions are already being implemented (e.g., substantially higher spill levels due to the proposed flexible spill operation, refined transportation operations, hatchery reform, etc.), and because several contingency actions (e.g., reducing harvest, some elements of predator control, etc.) are outside their authority to implement. Instead, the co-lead agencies would work with NMFS, USFWS, Federal, state and tribal sovereigns and other appropriate parties in any region-wide diagnostic efforts to determine the causes of declines in the abundance of naturally produced salmon and steelhead and to identify potential contingency actions should the need arise. The co-lead agencies proposed three specific actions in the proposed action: modification of the fish transportation program, reprogramming of safety-net hatchery programs, and kelt reconditioning in years of low steelhead returns.[116]

The co-lead agencies complete appropriate environmental analysis prior to implementing fish and wildlife protection, mitigation and enhancement actions, whether that analysis is programmatic or site-specific. These analyses include review under all applicable laws and regulations. During the course of the implementation of future actions associated with operations from the CRS projects and the other actions addressed in the 2020 CRS BiOps, actions would continue to undergo site-specific environmental analysis prior to implementation.

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[115] FCRPS Adaptive Management Implementation Plan. U.S. Army Corps of Engineers, U.S. Department of Interior, and U.S. Department of Energy, September 11, 2009, *available at* https://www.salmonrecovery.gov/Files/BiologicalOpinions/AMIP/AMIP_09%2010%2009.pdf.

[116] 2020 CRS Biological Assessment at 2-120.

The current consultation in the 2020 CRS BiOps encompasses operations and maintenance of the CRS for a fifteen-year period. This decision to implement the 2020 CRS BiOps is therefore a decision to implement the action as described therein until the end of that fifteen-year period, subject to adaptive management. If the next consultation commences before the 2020 CRS BiOps are fully implemented, the co-lead agencies and the Services will consider adjustments in the timing and content of remaining implementation plans and reporting called for in the 2020 CRS BiOps.

5.2 Magnuson-Stevens Fishery Conservation and Management Act

Under Section 305 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the agencies consulted with NMFS as part of the consultation that resulted in the 2020 NMFS CRS BiOp. NMFS considered essential fish habitat (EFH) designated by the Pacific Fisheries Management Council for Pacific Coast groundfish and salmon and coastal pelagic species. NMFS concluded that further consultation under the MSA was not required for these habitats because the operation and maintenance of the CRS as described in the 2020 NMFS CRS BiOp would not adversely affect EFH for these species. NMFS made four conservation recommendations to mitigate adverse effects on EFH of species. In accordance with MSA Section 305(b)(4)(B), the agencies confirmed to NMFS that the agencies will adopt and follow these conservation recommendations, which were consistent with the measures in the proposed action and Terms and Conditions in the 2020 NMFS CRS BiOp.

5.3 Cultural Resources

Cultural resources affected by the implementation of the Selected Alternative will be addressed under the ongoing FCRPS Cultural Resource Program. The FCRPS Cultural Resource Program implements the terms of the existing *Systemwide Programmatic Agreement for the Management of Historic Properties Affected by the Multipurpose Operations of Fourteen Projects of the Federal Columbia River Power System for Compliance with Section 106 of the National Historic Preservation Act*.

5.3.1 National Historic Preservation Act

After reviewing the changes in operations, maintenance, and configuration proposed as a part of the Selected Alternative, the co-lead agencies have determined that the existing Systemwide Programmatic Agreement would address the co-lead agencies' responsibilities under Section 106 of the National Historic Preservation Act for all proposed operations. If it is determined at a later date that any proposed structural measures are not covered by the Systemwide Programmatic Agreement, then separate Section 106 compliance would be completed prior to construction, when sufficient site-specific information on the undertaking becomes available.

5.3.2 Archaeological Resources Protection Act

Unlike the National Historic Preservation Act, consultation under the Archaeological Resources Protection Act (ARPA) is only applicable to issuance of a permit to conduct archaeological investigations. Therefore, there is nothing specifically that the co-lead agencies would need to do as a part of considering these changes in operations, maintenance, or configuration. Under the Selected Alternative, the land managing co-lead agencies (Reclamation and Corps) will continue to issue ARPA-related permits to external project proponents for archaeological investigations occurring on their

respectively managed Federal land. The co-lead agencies will also continue efforts related to documenting destruction or alteration of archaeological resources in violation of ARPA.

5.3.3 Native American Graves Protection and Repatriation Act

There is not a general consultation requirement triggered under this act by changes in operations, maintenance, or configuration under the Selected Alternative. The existing FCRPS Cultural Resource Program maintained by the co-lead agencies addresses inadvertent discoveries of human remains that could result from system operations (43 C.F.R. § 10.4).

5.3.4 American Indian Religious Freedom Act

The co-lead agencies do not anticipate taking any actions under the Selected Alternative that would infringe upon the rights afforded under the American Indian Religious Freedom Act to Native American tribes. The co-lead agencies will continue to consult and work with area tribes to protect and provide access to sacred sites on CRS Federal lands, when possible and practicable to do so.

5.3.5 Curation of Federally Owned and Administered Collections

Under the Selected Alternative, the co-lead agencies will continue to implement the existing FCRPS Cultural Resource Program which ensures the ongoing responsibility of managing Federal archaeological collections generated from Federal lands as a result of construction, operations, and maintenance.

5.4 Clean Water Act

Pursuant to the Federal Water Pollution Control Act of 1972 (33 U.S.C. § 1251 et seq.), as amended, commonly referred to as the Clean Water Act (CWA). Section 401 water quality certifications would be obtained for project-specific structural measures, as appropriate, prior to construction. Section 402 of the CWA established the national pollutant discharge elimination system for permitting point source discharges to waters of the U.S. The Corps and Reclamation have filed applications for CWA Section 402 permits for discharges of pollutants at the CRS mainstem dams on the Columbia and Snake Rivers. These permits have not yet been issued by the U.S. Environmental Protection Agency (EPA) or Oregon Department of Environmental Quality.

For Section 404, the Corps prepared a 404(b)(1) evaluation to determine whether a project has unacceptable adverse impacts either individually or in combination with known or probable impacts of other activities that affect the aquatic resources in the project area. This evaluation can be found in Appendix W of the Final CRSO EIS.

Under the CWA, each state must develop a Total Maximum Daily Load (TMDL) for the waters identified on their Section 303(d) list of impaired waters, according to their priority ranking on that list. In May of 2020, EPA issued for public review and comment the TMDL for temperature on the Columbia and lower Snake Rivers to address portions of the rivers that Washington and Oregon have identified as impaired from temperatures that exceed the states' water quality standards.

The co-lead agencies will continue to operate certain measures to improve water temperature, where practicable, to minimize or offset potential effects from the dams and reservoirs, as described in the

Key Considerations for the Decision, Water Quality, Section 3.9 above.

In terms of impacts from TDG, measures under the Selected Alternative will be implemented consistently with state water quality standards to manage TDG exposure to fish in the Clearwater River below Dworshak Dam as well as manage TDG at Ice Harbor, John Day and McNary dams. Juvenile fish passage spill operations will be implemented at the lower Snake River projects and the lower Columbia River projects. These measures are described above in Key Considerations for the Decision, Water Quality, Section 3.9 above.

The Spill Prevention Control and Countermeasures Rule (40 C.F.R. Part 112) includes requirements to prevent discharges of oil and oil-related materials from reaching the navigable waters of the United States and adjoining shorelines, among others. It applies to facilities with total aboveground oil storage capacity (not actual gallons onsite) of greater than 1,320 gallons and facilities with belowground storage capacity of 42,000 gallons. Construction activities associated with the structural measures would comply with this rule in implementing the Selected Alternative, if needed.

5.5 Pacific Northwest Electric Power Planning and Conservation Act

Under the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act), 16 U.S.C. §§ 839 *et. seq.*, the co-lead agencies have certain responsibilities with respect to the operation, maintenance, and configuration of the 14 dams and reservoirs comprising the Columbia River System. In particular, the co-lead agencies share a mandate to exercise their responsibilities for management and operation of the CRS, consistent with the purposes of the Northwest Power Act and other applicable laws, to adequately protect, mitigate, and enhance affected fish and wildlife in a manner that provides such fish and wildlife equitable treatment with the other purposes for which the CRS is managed and operated.[117] Further, the co-lead agencies are to take into account, at the relevant stages of their decision-making and to the fullest extent practicable, the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power and Conservation Council (Council).[118]

In addition, Bonneville has separate duties under the Northwest Power Act that the Corps and Reclamation do not share, as explained in Section 7.3 below. Specifically, Bonneville must use its authorities under the Northwest Power Act and other laws to "protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation" of the FCRPS, including the CRS.[119] Bonneville must fulfill this mandate "in a manner consistent with" the purposes of the Northwest Power Act and the Council's Power Plan and Columbia River Basin Fish and Wildlife Program.

5.5.1 Equitable Treatment

The co-lead agencies must exercise their responsibilities for CRS projects, consistent with the purposes of the Northwest Power Act and other applicable laws, to adequately protect, mitigate, and enhance affected fish and wildlife in a manner that provides such fish and wildlife equitable treatment with the other purposes for which the CRS is managed and operated.[120]

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[117] 16 U.S.C. § 839b(h)(11)(A)(i).
[118] *Id.* § 839b(h)(11)(A)(ii).
[119] *Id.* § 839b(h)(10)(A).
[120] *Id.* § 839b(h)(11)(A)(i).

The equitable treatment provision of the Act specifically applies to the co-lead agencies' responsibilities for (1) "managing [and] operating" (2) the federal dam and reservoir projects themselves, including the CRS.[121] The co-lead agencies may consider equitable treatment of fish and wildlife, in relation to the other purposes for which the CRS is managed and operated, on a system-wide basis, meaning that they may, for example, make certain decisions that place power above fish, so long as on the whole, they treat fish on par with power.[122]

Further, the purposes of the Northwest Power Act also factor into the agencies' consideration of equitable treatment. In addition to protection, mitigation, and enhancement of fish and wildlife affected by the FCRPS, such statutory purposes include encouraging development of renewable generation resources and assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply.[123]

The CRSO EIS process and the Preferred Alternative identified in the Final CRSO EIS demonstrate the co-lead agencies' continued equitable treatment of fish and wildlife in their operation and management of the CRS. Under the No Action Alternative, the co-lead agencies had provided equitable treatment for fish in part through annual fish operations planning and preparation of an annual Water Management Plan for biological opinion purposes.[124] New alternatives considered in the CRSO EIS included further operational and structural measures with a range of anticipated benefits and effects to fish in relation to other authorized system purposes. As a starting point, the Purpose and Need Statement and four of the eight CRSO EIS objectives pertain to improvements for fish through system operation, maintenance, and configuration actions. Some alternatives favored, for example, hydropower generation while others would maximize certain fish benefits to the detriment of other purposes – e.g., MO3, which the CSS model predicts would create the greatest benefits for anadromous fish, but that would curtail or, in specific portions of the Basin, effectively eliminate other system purposes such as navigation, hydropower generation and irrigation.

Ultimately, the operational and structural measures of the Selected Alternative strike a new equitable balance by expanding on the actions of the No Action Alternative that benefit fish while also accommodating continuation of all authorized system purposes.[125] The combination of new and existing actions that benefit fish in the Preferred Alternative incorporates consideration of the Northwest Power Act's statutory purposes. In particular, the purposes of (1) assuring an adequate, economic, and reliable power supply, when balancing the system's treatment of fish with other authorized purposes, and (2) protecting, mitigating, and enhancing fish and wildlife—"particularly anadromous fish"—including related spawning grounds and habitat, by providing suitable environmental conditions substantially obtainable from management and operation of the CRS and other power generating facilities on the Columbia River and its tributaries.

With respect to wildlife, the existing effects associated with the majority of the CRS projects relate to the reservoirs' inundation of wildlife habitat; that is, the effects are the result of the dams' construction,

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[121] *Id.* § 839b(h)(11)(A). The Northwest Power Act's equitable treatment provision pertains to "managing [and] operating," which in the context of the CRSO EIS includes the system operation, maintenance, and configuration actions analyzed by the co-lead agencies.

[122] *See Nw. Envtl. Defense Ctr v. Bonneville Power Admin.*, 117 F.3d 1520, 1533-34 (9th Cir. 1997); *see also Confederated Tribes of the Umatilla Indian Reservation, et al. v. Bonneville Power Admin.*, 342 F.3d 924 (9th Cir. 2003).

[123] *See* 16 U.S.C. § 839(1)-(2), (6).

[124] *See generally* CRSO EIS, Sections 1.9.4-1.9.7.

[125] *See generally id.*, Sections 7.6.1-7.6.3.

not their operation, maintenance, or configuration. Bonneville's historic wildlife mitigation for construction and inundation effects have focused on offsetting effects up to the full-pool inundation level, which covers operational impacts that might occur between full-pool and minimum operations.[126] Nevertheless, where appropriate Bonneville will continue to support CRS operations that benefit wildlife, such as operations that may support establishment of wetland vegetation and soil conditions or increase the overall quantity and quality of wetlands in the John Day pool area.[127]

However, for the most part, the Northwest Power Act's equitable treatment provision tends to be more relevant in its application to fish rather than wildlife, particularly in light of the Act's stated emphasis on anadromous fish "which are dependent on suitable environmental conditions substantially obtainable from the management and operation of [the FCRPS]."[128] Even for storage projects, where operations can result in greater reservoir fluctuations and effects to wildlife can be more pronounced, the Final CRSO EIS generally found effects were minor, negligible, or not measurable for wildlife and vegetation.[129] Particular to wildlife, operations can lead to shoreline erosion and loss of terrestrial habitat. These effects are difficult to mitigate solely through operations because of the need to provide multipurpose operations for fish flows, power generation, and flood risk management among other purposes. When the nature of wildlife effects is impractical to address through management of operations themselves, wildlife managers have generally favored habitat enhancement actions as appropriate mitigation to address operational effects to wildlife.[130]

The CRS operations, maintenance, and configuration actions reflected in the Preferred Alternative and selected in this ROD, demonstrate the extent to which equitable treatment of fish and wildlife will continue in the co-lead agencies' management and operation of the CRS.

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[126] *See also* Bonneville Power Admin., Comments on Recommendations to Amend the Council's Fish and Wildlife Program (Feb. 8, 2019), *available at* https://app.nwcouncil.org/uploads/2018amend/comments/1221/Bonneville%20Comments%20on%20Recommendations%20to%20Amend%20the%20Council%20Fish%20and%20Wildlife%20Program%202.8.2019.pdf (regarding scope of Bonneville's wildlife mitigation responsibilities under the Northwest Power Act).
[127] *See* CRSO EIS, Section 7.7.7.4.
[128] 16 U.S.C. § 839(6).
[129] *See* CRSO EIS, Section 7.7.7; *see also* CRSO EIS, tbl. 7-55.
[130] *See*, *e.g.*, NORTHERN IDAHO MEMORANDUM OF AGREEMENT BETWEEN BONNEVILLE POWER ADMINISTRATION AND THE STATE OF IDAHO FOR WILDLIFE HABITAT STEWARDSHIP AND RESTORATION (2018) (providing in-place/in-kind habitat improvement funding to offset habitat losses from power operations).

5.5.2 Consideration of Columbia River Basin Fish and Wildlife Program

Under the Northwest Power Act, in their management and operation of the CRS, the co-lead agencies are to take into account, at the relevant stages of their decision-making and to the fullest extent practicable, the Columbia River Basin Fish and Wildlife Program ("Program") adopted by the Council.[131] An understanding of the statutory foundation, components, and requirements for the Council's Program itself is critical to inform and understand the co-lead agencies' responsibility to take this program into account during their decision-making.

According to the Act, the content of the Council's Program is to consist of "measures" – i.e., actions that can be taken – "to protect, mitigate, and enhance fish and wildlife affected by development, operation, and management of [hydroelectric] facilities while assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply,"[132] including off-site "enhancement" measures as appropriate in certain circumstances,[133] as well as "objectives for development and operation of such projects . . . in a manner designed to protect, mitigate, and enhance fish and wildlife."[134] With respect to anadromous fish, the Council Program's measures are to "provide for improved survival of such fish at hydroelectric facilities," and "provide flows of sufficient quality and quantity between such facilities to improve production, migration, and survival of such fish . . . ."[135] The Council must review its Program at least once every five years, pursuant to specified statutory processes.[136]

In practice, the Council's Program has grown to include a substantial aggregate of content addressing general policy, a regional vision for the Columbia River Basin, fisheries management goals, perspectives and advice on federal agency implementation practices, and other additional components to those prescribed by the statute – that is, the mitigation measures themselves. To the extent that these supplemental Program components are extraneous to content mandated by the Northwest Power Act, such components still prove useful context for the co-lead agencies to consider, but they do not carry the same weight as, for instance, the Program provisions that adhere to the statutory criteria for "measures." Moreover, the Council's inclusion of such additional content as regional vision and implementation provisions does not make the co-lead agencies responsible for adhering to the proffered processes or ensuring the particular outcome of a Council goal, especially when it depends on factors beyond the co-lead agencies' influence such as the effects of hundreds of non-federal dams, not just the 14 CRS projects.[137] Therefore, when taking the Council's Program into account during decision-making, the co-lead agencies look primarily to statutory-based content in the Program – such as actionable measures.

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[131] 16 U.S.C. § 839b(h)(11)(A)(ii).
[132] *Id.* § 839b(h)(5).
[133] *See id.*, § 839b(h)(8)(A).
[134] *Id.* § 839b(h)(2)(B).
[135] *Id.* § 839b(h)(6)(E).
[136] *Id.* § 839b(d)(1); *see generally id.* §§ 839b(h)(2)-(8).
[137] *See generally* Letter from S. Armentrout, Bonneville Exec. Vice President Environment, Fish and Wildlife, to R. Devlin, Council Chair, (June 20, 2020); *see also* Letter from S. Armentrout, Bonneville Exec. Vice President Environment, Fish and Wildlife, to J. Anders, Council Chair, at 4-8 (Oct. 19, 2018). Both letters are available at: https://app.nwcouncil.org/uploads/2018amend/comments/1392/Final%20Council%20Addendum%20Pt%201%20Cover%20Ltr%20and%20Comments%202020.06.22.pdf. Many of the Program's broad regional goals are also challenging for the co-lead agencies to consider or apply given that the goals are affected by many factors outside of the co-lead agencies' control or responsibility while the Program's mitigation measures are narrowly focused almost exclusively on the FCRPS and mitigation funded or implemented by Bonneville, the Corps and Reclamation.

The Council's Program is, in large part, an off-site mitigation (or "enhancement") program that primarily recommends continued implementation of fish and wildlife projects such as habitat protection and improvements, artificial production (i.e. hatchery production), and research, monitoring, and evaluation. However, Program content directly relevant to the actions under consideration in the CRSO EIS – operation, maintenance, and configuration of the CRS – is limited. In the various Program iterations since 2003—when it last provided comprehensive guidance on system operations in its "Mainstem Amendments"—the Council has for the most part amended its Program to follow or endorse the system management actions included in the current NMFS and USFWS biological opinions, Fish Accord agreements, and more recently the *2019-2021 Spill Operation Agreement*.[138] Furthermore, the findings associated with the Council's recent Program amendment process do not indicate any substantive review of the 2003 Mainstem Amendments by the Council, which leaves considerable question as to the extent to which such amendments still apply, given the Council's statutory duty to review the Program at least once every five years and the fact that the Council has supported further changes to operations since the 2003 Mainstem Amendments were adopted. Therefore, few current Program provisions directly address system operations in a way that would provide meaningful additional guidance to consider. The co-lead agencies have nonetheless taken appropriate Council guidance into account. For example, the majority of the Libby and Hungry Horse operations discussed in part two of the Council's 2020 Addendum to its Program were considered in the CRSO EIS alternatives and were either incorporated or modified in the Preferred Alternative.[139]

In addition, another operational matter included in both the CRSO EIS and past Council Program guidance relates to the timing of Lake Roosevelt's refill to a particular elevation level in the fall. Under the Preferred Alternative, the date for the elevation refill target may be shifted to later in the fall than the date initially proposed as guidance in the Council's 2003 Mainstem Amendments. However, in considering this operational measure in the CRSO EIS, the co-lead agencies took into account the fish protection purpose associated with the Council's 2003 guidance (protecting access to kokanee spawning habitat) as well as subsequent mitigation work that was implemented to address the underlying concern.[140] And further, through the Mitigation Action Plan in Attachment 1, the co-lead agencies have agreed to additional mitigation for the potential effects of this operation after evaluation by supplementing spawning habitat at locations along the reservoir and tributaries, if appropriate.

Another topic raised in both the CRSO EIS process and the Council's Program is passage and reintroduction of anadromous fish above Chief Joseph and Grand Coulee dams. The Council's 2020 Program amendments recommended "Bonneville and others are to continue to make progress on the program's phased approach to evaluating the possibility of reintroducing anadromous fish above Grand Coulee and Chief Joseph dams." It further said, "many others have a role to play—making progress on this effort is not the sole province of the program," and therefore not the sole effort of

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[138] *See, e.g.*, Council, Findings on Recommendation and Response to Comments for the 2020 Addendum [Part II] to the 2014 Fish and Wildlife Program, at 48-50 (recognizing and incorporating the 2019 NMFS CRS BiOp, 2018 Fish Accord Extensions, and 2019-2021 Spill Operation Agreement); 57 (supporting ongoing estuary restoration work); and 69 (recognizing 2018 Accord Extension agreements) (March 2020).

[139] *See* Northwest Power & Conservation Council, 2020 Addendum, Part II, Columbia River Basin Fish & Wildlife Program, at 7 (Jan. 14, 2020, pre-publication version).

[140] *See also* Categorical Exclusion Determination, Bonneville Power Admin., Dept. of Energy, Grand Coulee Dam/Lake Roosevelt Fall 2019 Operations (Sep. 27, 2019), *available at* https://www.bpa.gov/efw/Analysis/CategoricalExclusions/cx/20190927_Grand_Coulee_Lake_Roosevelt_Fall_2019_Operations_CX_FINAL.pdf.

the co-lead agencies, the primary implementers of the program. The co-lead agencies took reintroduction into account during the preparation of the CRSO EIS, but decided not to analyze it in detail for the reasons discussed in Section 2.5.10 of the Final CRSO EIS.

Finally, certain other Council Program provisions relating to general policy, regional vision, or fisheries management goals, rather than actionable statutory measures per se, have nonetheless been taken into account. For example, the Council's Program has continually included a 5 million fish goal and 2-6% SAR objective. This goal and objective apply to the entire Columbia River Basin and all federal and non-federal hydroelectric dams, not simply the FCRPS or the CRS. This goal and objective is also influenced greatly by fisheries management, climate, and ocean conditions, as well as farming, logging, mining, and development practices—all of which are beyond the co-lead agencies' control or sole responsibility to manage. The CRSO EIS nonetheless, examined the alternatives in terms of the likely effect each would have on SARs, and CSS analysis of the Preferred Alternative selected in this ROD estimates the potential for SARs greater than 2% for both Snake River spring Chinook and Snake River steelhead,[141] thus falling within the range recommended by the Council.

As described above, relevant provisions of Council's Program were taken into account by the co-lead agencies in their consideration of the CRSO EIS alternatives and adoption of the Preferred Alternative. And as discussed in greater detail in Attachment 1, the Mitigation Action Plan included with this ROD likewise reflects Bonneville's consideration of the Council's Program with respect to relevant off-site mitigation aspects of the Program.

5.6 National Environmental Policy Act

In accordance with the National Environmental Policy Act (NEPA) of 1969, the co-lead agencies published a Notice of Intent to prepare an EIS in the Federal Register on September 30, 2016, and held 16 public scoping meetings and two webinars. The 45-day public review period for the Draft EIS started February 28, 2020, and ended April 13, 2020. Six virtual public comment meetings and five virtual tribal meetings were held during the public review period. Appendix T of the CRSO EIS includes comments received during this EIS review and corresponding responses to substantive comments. Following the 30-day public review of the final EIS, the signing of this Record of Decision by co-lead agency decision makers, outlining the rationale for their decision, completes the NEPA process for the CRSO EIS.

The Selected Alternative provides flexibility to adjust to changing conditions by relying on adaptive management. However, the agencies may, if in the future they propose a new or altered measure, determine that it is appropriate to prepare a supplemental NEPA analysis or, if a site-specific analysis is needed, a tiered NEPA document. This situation may arise if there are substantial changes in the Selected Alternative that are relevant to environmental concerns or if there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts,[142] including, but not limited to, changes in natural conditions or actions outside of the control of the co-lead agencies. In such circumstances, the agencies may continue to rely on the CRSO EIS analysis and only focus on the new action, seeking public input on that action and notification of a final assessment and any changes to the agencies' decision outlined in the Record of Decision. A tiered document may look at multiple alternatives for that site-specific analysis, relying on the broader

[141] *See* CRSO EIS, at 7-109, tbl. 7-28.

[142] 40 C.F.R. § 1502.9(d) (since potential tiering or supplemental NEPA analysis may occur after CEQ updated its NEPA implementing regulations on July 15, 2020, this citation is to the revised NEPA regulations).

EIS for the impact analysis. If an action is being considered under a supplemental or tiered NEPA process, the subsequent NEPA analysis is only required to summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and will concentrate on the issues specific to the subsequent action,[143] not reconsider the action in its entirety.

5.7 Fish and Wildlife Coordination Act

Pursuant to the Fish and Wildlife Coordination Act of 1934, as amended, the co-lead agencies received the final Coordination Act Report (CAR) on May 28, 2020. The co-lead agencies considered the findings and recommendations while finalizing the EIS. Eighty-four recommendations are included in the final CAR and, of those, the majority are either part of the Selected Alternative or existing programs. A few recommendations are outside the scope of the action and were not adopted. Two recommendations are being considered as part of monitoring and adaptive management plans. The co-lead agencies' response to the USFWS' recommendations can be found in Appendix U of the CRSO EIS.

5.8 Executive Order 12898, Environmental Justice

In accordance with provisions of Executive Order 12898 Environmental Justice, dated February 11, 1994, the Selected Alternative will not cause disproportionately high and adverse effects on any environmental justice populations.

5.9 Executive Order 13007, Indian Sacred Sites

In compliance with this order, the co-lead agencies contacted 19 tribes to request their assistance in identifying sacred sites within the study area. Kettle Falls and Bear Paw Rock have been identified as sacred sites. The effects to these sacred sites under the Selected Alternative are negligible, as described in Section 7.7.18 of the CRSO EIS.

5.10 Secretarial Order 3175, U.S. Department of the Interior Responsibilities for Indian Trust Assets

In compliance with Secretarial Order 3175, this EIS has analyzed potential effects to Indian Trust Assets in Sections 3.17 and 7.7.19 of the CRSO EIS.

[143] 40 C.F.R. § 1501.11(b).

Section 6. Final Agency Findings

6.1 Corps' Decision

As summarized in Section 1.1.1 above, after reviewing the benefits, environmental effects, and unavoidable adverse impacts of the alternatives, as detailed in the Final EIS and this ROD, and thorough considerations of the views of Tribes, federal, state, and local agencies, and public comments, the Preferred Alternative described in the Final EIS is the Selected Alternative to be implemented for the ongoing operations, maintenance, and configuration of the Columbia River System. All applicable laws, regulations, executive orders, and local government plans were considered in evaluation of alternatives. Further, the Corps has determined, and the NMFS and USFWS Biological Opinions demonstrate, based on the best available commercial and scientific information that the Corps' implementation of the Selected Alternative will not jeopardize listed species or adversely modify or destroy critical habitat. This Record of Decision completes the National Environmental Policy Act process.

September 28th 2020

D. Peter Helmlinger, P.E.
Brigadier General, US Army
Division Commander

Date

6.2 Reclamation's Decision

After reviewing the Purpose and Need Statement, EIS objectives and effects analysis for the alternatives, as detailed in the Final EIS, biological assessment, 2020 biological opinions, and this ROD, as well as input from the Tribes, federal, state, and local agencies, and public comments, Reclamation selects the Preferred Alternative described in the Final EIS as the Selected Alternative for the ongoing operations, maintenance, and configuration of the Columbia River System. All applicable laws, regulations, executive orders, and local government plans were considered in evaluation of alternatives. This Record of Decision completes the National Environmental Policy Act process.

Lorri J. Gray — Sept 28, 2020

Lorri J. Gray
Regional Director
Bureau of Reclamation
Columbia-Pacific Northwest Region

Date

6.3 Bonneville's Decision

Bonneville decided to implement its part of the Preferred Alternative identified in the Columbia River System Operations Final Environmental Impact Statement (DOE/EIS-0529, July 2020) and analyzed in the 2020 CRS BiOps, including the applicable terms and conditions set forth in these BiOps. This decision, as well as the evaluation of the alternatives is consistent with the authorities granted to it under existing statutes and complies with all applicable environmental laws and regulations and other applicable federal statutory and regulatory requirements. This Record of Decision completes the National Environmental Policy Act process. The Selected Alternative would have negligible to minor effects to floodplains and minor effects to wetlands. This decision continues to support an adequate, efficient, economical and reliable power supply that supports the integrated Columbia River Power system while providing for the conservation of fish and wildlife and protection and preservation of cultural resources affected by System operation. This decision helps protect and preserve Native American treaty and executive order rights and meet trust obligations. This decision also considers and plans for climate change effects on affected resources and on the management of the System. Bonneville, with the Corps and Reclamation, will continue to use the collaborative Regional Forum framework and continue to collaborate with the region in other forums to allow for flexibility and adaptive management of the Columbia River System.

All mitigation measures described in the Draft CRSO EIS and updated in the Final CRSO EIS have been adopted with the signing of this Record of Decision. A complete list of the mitigation measures Bonneville is adopting from the Draft and Final EISs can be found in the Mitigation Action Plan in Attachment 1. Additional mitigation measures are being adopted by the Corps and Reclamation as discussed previously and noted in their decision sections of this Record of Decision. The mitigation measures include additional commitments Bonneville agreed to as part of implementation of the proposed action analyzed in the 2020 CRS BiOps and Incidental Take Statements and the Final CRSO EIS (see Section 7.6 of the Final CRSO EIS; Attachment 1, Mitigation Action Plan).

Consistent with the factors considered in Section 3, Bonneville considered the Purpose and Need Statement, CRSO EIS Objectives, as well as the effects analysis, including direct, indirect and cumulative effects as well as the effects from climate and mitigation. As described below, Bonneville considered the ESA, NEPA and Northwest Power Act in making its decision.

6.3.1 ESA Compliance

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, Bonneville consulted with the Services on the operation and maintenance of the CRS for a fifteen-year period. The proposed action[144] consulted upon was consistent with the Preferred Alternative analyzed in the Final CRSO EIS.[145] NMFS issued a biological opinion (2020 NMFS CRS BiOp), dated July 24, 2020, and

[144] For purposes of Bonneville's Rationale for Decision, the term "proposed action" is utilized to refer to the Selected Alternative. Proposed action is the appropriate term for an action consulted upon with the Services under Section 7 of the ESA.

[145] The co-lead agencies worked closely with the Services throughout the development of the CRSO EIS as the range of alternatives were developed and analyzed. The proposed action that underwent consultation with the Services was described in the draft and final CRSO EIS (February 2020 and July 2020); the *Biological Assessment of Effects of the Operations and Maintenance of the Federal Columbia River System* (January 2020) (2020 CRS Biological Assessment); *Clarification and Additional Information to the Biological Assessment of Effects of the Operations and Maintenance of the Columbia River System on ESA-listed Species Transmitted to the Services on January 23, 2020* (April 1, 2020) (2020 BA Clarification Letter); and additional discussions throughout the formal consultation process.

determined that the proposed action is not likely to jeopardize the continued existence of the federally listed species as listed in Section 6.1 of this ROD or destroy or adversely modify designated critical habitat. In addition, NMFS concurred with Bonneville's determination that the proposed action may affect, but is not likely to adversely affect the following federally listed species or their designated or proposed critical habitat: Southern Resident killer whales and the southern Distinct Population Segment of green sturgeon.

USFWS issued a biological opinion (2020 USFWS CRS BiOp), dated July 24, 2020, and determined that the proposed action is not likely to jeopardize the continued existence of the following federally listed species or destroy adversely modify designated critical habitat: Kootenai River white sturgeon and bull trout. In addition, USFWS concurred with the agencies' determination that the recommended plan may affect but is not likely to adversely affect the federally listed species as listed in Section 6.1of this ROD or their designated critical habitat.

As described in further detail above and in Sections 3 and 5 of this ROD, and informed by the analysis in the 2020 Biological Assessment and the determinations in the Services' 2020 CRS BiOps, Bonneville has concluded that implementation of the proposed action and the actions described in the Incidental Take Statements are not likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify their designated critical habitat. Bonneville's analysis of the proposed action has led to the conclusion that the benefits to ESA-listed species' survival and recovery offset the adverse effects resulting from the proposed action in a manner that will not reduce appreciably the likelihood of survival and recovery or appreciably diminish the value of critical habitat as a whole. Bonneville also concludes that it has the authority and discretion to implement the proposed action and the actions described in the Incidental Take Statements in cooperation with the other co-lead agencies. Given these findings regarding the action proposed by Bonneville, this document records Bonneville's determination to operate and maintain the Columbia River System, in collaboration with the Corps and Reclamation, consistent with the action as described in the 2020 Biological Assessment, the 2020 Clarification Letter, and the Incidental Take Statements, including all terms and conditions and reasonable. This fulfills the regulatory requirements for ESA consultations, which provide that "[f]ollowing issuance of a biological opinion, the Federal agency shall determine whether and in what manner to proceed with the action in light of its [ESA] Section 7 obligations and [NMFS'] biological opinion."[146]

6.3.1.1 Discussion of Actions Pertinent to the 2020 NMFS CRS BiOp

The following actions were proposed by Bonneville and analyzed by NMFS in its 2020 CRS BiOp. Bonneville believes that these actions are key to its finding under Section 7 of the ESA, either because of the associated benefits for ESA-listed salmonids or the lack of adverse effects from actions that benefit hydropower generation.

6.3.1.1.1 Spill Operations for ESA-listed Salmon and Steelhead

Juvenile Fish Passage Spill Operations

As described in more detail in Chapter 7 of the Final CRSO EIS and the 2020 Biological Assessment, the proposed action includes Flexible Spill that incorporates juvenile fish passage spill to levels that

[146] *See* 50 C.F.R. § 402.15(a).

are much higher than the operations that have been implemented as part of a discretionary action[147] prior to 2020. Flexible Spill is an operation that will be implemented during the spring juvenile salmonid migration season at the lower Snake River and Columbia River projects. Flexible Spill is variable over a 24-hour period and takes advantage of peak and off-peak load hours for hydropower generation in order to provide flexibility. Flexible Spill is envisioned to incorporate a range of spring spill levels up to a 125% TDG spill cap during designated hours each day, consistent with the concepts tested as part of the *2019−2021 Spill Operations Agreement*.[148]

The implementation of Flexible Spill is intended to increase overall survival of fish passing through the system and returning as adults by providing additional spill during periods of time when spill is expected to be most important. The increased spill is expected to decrease the number of juvenile fish that bypass the dams through non-spillway routes, improve fish travel through the forebays, gain scientific information on latent (delayed) mortality, and provide flexibility for hydropower generation. Under some conditions, and at some projects, high spill has been demonstrated to impede adult passage. Any potential delay for adult migration caused by high spill or impacts from elevated levels of TDG resulting from high spill are addressed through periods of reduced spill or adaptive management measures. These Flexible Spill spring operations will be implemented April 3–June 20 at the lower Snake River projects, and April 10–June 15 at the lower Columbia projects.[149] When Flexible Spill spring operations cease, the projects will transition to summer spill operations. Summer spill operations have been modified from past operations to include a reduction in spill in mid-August when few juveniles are migrating in the lower Snake and Columbia Rivers to offset CRS impacts to power.[150] Both spring and summer operations are subject to adaptive management.[151]

As described in Section 3.3.3 above, the CSS and NMFS Lifecycle modeling produced different results. In addition to differences in how latent mortality is addressed, the differences are also a result of a reduction in transportation rates as higher levels of spill resulting in fewer fish accessing the juvenile bypass systems where fish are collected for transportation. NMFS also qualitatively assessed potential improvements in adult abundance if reductions in latent mortality similar to those predicted by the CSS model were realized. Bonneville has included a robust monitoring plan for salmon and steelhead to help narrow the uncertainty between the biological models and help determine how effective increased spill can be in increasing salmon and steelhead returns to the Columbia Basin.[152] Despite the differences in the predictions from these models, Bonneville has determined that the monitoring and resulting data, as well as in-season management flexibility will reduce any risk of adverse consequences of higher levels of spill. Combined, this action is expected to materially benefit juvenile salmonids by increasing life-stage survival, thereby reducing risks to the species' survival and recovery.

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[147] Prior to 2020, spill levels at or above the 125% TDG only occurred during periods of high runoff that exceeded available turbine capacity.
[148] 2019-2021 Spill Operation Agreement, *Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv.*, No. 3:01-cv-00640-SI (D. Or. Dec. 18, 2018).
[149] *See* 2020 NMFS CRS BiOp Table 1.3-1 for initial spring spill levels.
[150] *See* 2020 NMFS CRS BiOp Table 1.3-2 for initial summer spill levels.
[151] *See* CRSO EIS, Appendix R, Part 2 *Process for Adaptive Implementation of the Flexible Spill Operational Component of the Columbia River System Operations Environmental Impact Statement*.
[152] *See id.*

6.3.1.1.2 Surface Spill to Reduce Adverse Effects to Overshooting Adult Steelhead

Adult steelhead can sometimes overshoot their natal streams, swimming above additional dams and then volitionally migrating back downstream past the dams to reach their natal streams in the fall, late winter, and early spring. In the CRS, substantial percentages of steelhead from some populations in the Middle Columbia River and Snake River Distinct Population Segments can exhibit this behavior. In order to reduce the adverse effects to overshooting adult Middle Columbia River and Snake River steelhead, in the fall of 2020, the Action Agencies will implement offseason surface spill as a means of providing safe and effective downstream passage for adult steelhead that overshoot and then migrate back downstream through McNary Dam and the lower Snake River dams during months when there is no scheduled spill for juvenile passage. The Action Agencies will implement this measure within the October 1 to November 15 and March 1 to March 30 timeframes, for a minimum of four hours per day, 3 times per week. The Action Agencies will utilize the information associated with these operations to investigate whether to refine the time period of spill based on benefits to steelhead through adaptive management.

6.3.1.1.3 John Day Reservoir Spring Operations for Caspian Tern Nesting Dissuasion

From April 10 to June 1 (or as feasible based on river flows), the John Day reservoir elevation will be held between 264.5 feet and 266.5 feet to deter Caspian terns from nesting in the Blalock Islands Complex. The Action Agencies intend to begin increasing the forebay elevation prior to initiation of nesting by Caspian terns to avoid take of tern eggs; operations may begin earlier than April 10 (when the reservoir is typically operated between 262.0 to 266.5 feet). The operation may be adaptively managed due to changing run timing; however, the intent of the operation is to begin returning to reservoir elevations of 262.5–264.5 feet on June 1, but no later than June 15, which generally captures 95% of the annual juvenile steelhead migration. The results of this action will be monitored and communicated with the Services. During the operation, safety-related restrictions will continue, including but not limited to maintaining ramp rates for minimizing project erosion and maintaining power grid reliability.

6.3.1.1.4 Operation of Turbines Above 1%

Operations of turbines within the ±1% peak efficiency of the turbine range is generally considered to be beneficial for juvenile fish passage. Based on an analysis of historic system operations, conditions that necessitate or call for consideration of operations above 1% from peak efficiency are relatively rare and are typically short in duration[153] and therefore the limited expansion of operations in the proposed action is not expected to affect ESA-listed species in a way that will appreciably reduce the likelihood of survival and recovery. The agencies will operate turbines as specified below during juvenile fish passage season in order to provide increased power generation flexibility and reliability or to assist with TDG management.

a) Contingency Reserves – Bonneville deploys contingency reserves to meet energy demands caused by unexpected events such as transmission interruption or failure of a generator. These events are unpredictable in timing, magnitude, and location of the necessary deployment of contingency reserves, but occur approximately once per month and average 35 minutes. Bonneville will strive

[153] *See* 2020 BA Clarification Letter.

to cover contingencies without temporarily operating above 1% from peak efficiency and the use of contingency reserves is limited to no more than 90 minutes under reliability regulations;

b) Balancing reserves – Bonneville is responsible for transmission system reliability, which requires the use of balancing reserves to respond to power demand and supply fluctuations (including the integration of renewable power sources). Operations will be set within ±1% of peak efficiency, but may exceed the upper end of this range for short durations of time; and,
c) TDG management – during periods of high spring run-off, TDG levels can exceed 125% saturation. The Action Agencies may operate above 1% from peak efficiency to mitigate TDG production when flexible spill targets are met, all available turbines are operating, and additional power demand and market exists.

Operations above 1% from peak efficiency are likely to improve attraction to the adult fish ladders and have beneficial impacts on water quality by reducing TDG exposure for juveniles and adults migrating through the tailrace. NMFS did find that increasing powerhouse flows can have the effect of increasing juveniles that pass downstream through turbines or the bypass systems and adults may fall back over the dam.[154] The Action Agencies will monitor the magnitude and frequency of this operation; if the expected frequencies and magnitudes of this operation are exceeded, the Action Agencies will notify NMFS.[155]

6.3.1.1.5 Zero Generation

Generating hydropower to meet demand in the winter in the Pacific Northwest can be a challenge when demand can increase dramatically and there is little additional electricity available due to adjustments in power generation in order to integrate variable renewable resources. Therefore, Bonneville has and will continue to use the capacity of the CRS to support the flexibility necessary for this integration and has proposed an expansion of that capacity under limited circumstances. Between October 15 and February 28, power generation may cease at the four lower Snake River projects and water may be stored during nighttime hours (2300 to 0500) when adult fish are typically not passing. This operation will end no later than 2 hours before dawn to facilitate adult upstream passage, which generally resumes as the sun rises. Between December 15 and February 28, a period of time when water temperatures are low and very few adult fish are still migrating in the river, daytime hours will no longer be excluded from this operation, and up to 3 hours of daytime cessation may occur. NMFS found that Passive Integrated Transponder (PIT)-tag data indicated that some adult Middle Columbia River steelhead will migrate through and overwinter in the lower Snake River during this operation (as will bull trout), but past zero generation operations have not produced observably negative impacts for Middle Columbia River steelhead.[156] It is expected that this operation will not appreciably reduce the likelihood of survival and recovery for these fish.

6.3.1.1.2 Non-Operational Conservation Measures for ESA-listed Salmonids

The conclusion that the proposed action is not likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat is further supported by the inclusion of non-operational conservation measures to assist in addressing any residual adverse effects of operation and maintenance of the CRS and uncertainties related to the impacts of climate change.

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[154] 2020 NMFS CRS BiOp, Section 2.2.5.2, at 292.
[155] *Id.*, Section 2.17, at 1398.
[156] *Id.*, Section 2.8.3.1.4, at 944.

These measures are further discussed below.

6.3.1.1.2.1 Structural Modifications

The Action Agencies have constructed and operated many structural modifications to the dams and to fish passage facilities associated with the dams over the past couple of decades that have had marked improvements in fish survival including juvenile bypass systems, improved turbine technology, spillway weirs, and modifications to ice and trash sluiceways and other surface routes. The Action Agencies are continuing to construct structural modifications that will benefit ESA-listed fish.

1) Improved Fish Passage Turbines

The first of these structural modifications is an ongoing effort to improve fish passage through the turbines by designing and constructing turbines (Improved Fish Passage or IFP Turbines) that will then be installed and tested for optimal configuration and to assess impacts to fish passage. The proposed action includes the completion of the efforts to design and install IFP turbines at Ice Harbor, McNary and John Day dams. Installation of the IFP turbines has the potential to improve fish passage conditions, improve hydropower efficiency and capacity, minimize greenhouse gas emissions, and indirectly improve water quality by reducing TDG. The proposed action also includes biological testing of the IFP turbines to determine whether the operation of the IFP turbines without fish screens would show a neutral or beneficial effect on ESA-listed fish survival metrics at each dam. The agencies will collaborate with the Services to develop a Turbine Intake Bypass Screen Management and Future Strategy process to monitor success of the IFP turbines and determine if and when it would be best to remove fish screens at these projects.

2) Adult Fish Ladder Differentials

At Lower Granite and Little Goose dams, warm river surface temperatures in the forebay during late summer can create a temperature difference between the adult ladder exit and the entrance that can contribute to delays in adult passage. The Action Agencies have modified the juvenile bypass system to route excess water to the adult trap for cooling and installed intake chimneys that draw cooler water from deep in the forebay that is then released or sprayed in the fish ladder. These improvements were completed and installed during the winter of 2015-2016 and successfully tested to show that they effectively reduced near-surface water temperatures near the ladder exit.[157] The Action Agencies will continue operating these structures, while also monitoring and reporting all mainstem fish ladder temperatures, and identify ladders that have substantial temperature differentials (>1.0°C). At fish ladders at mainstem lower Snake and Columbia River dams that are shown to have substantial temperature differentials, the Action Agencies will develop and implement operational or structural solutions to address these issues where beneficial and feasible.

6.3.1.1.2.2 Additional Improvements to Fish Migration and Survival

The proposed action includes several other measures that will provide additional improvements to fish migration and survival. The Action Agencies will complete follow-on modifications to a new adult separator integrated into the Lower Granite Dam Juvenile Bypass System to reduce delay, injury, and stress to salmon and steelhead, bull trout, and non-target species. The Action Agencies

[157] 2020 CRS Biological Assessment at E-57 (citing Anchor QEA. 2017. Lower Granite Adult Passage and Post-passage Evaluation Final Adult Passage and Post-passage Behavior Report. Prepared for Army Corps of Engineers. Project 161163-0201).

will also design and implement structural modifications to the Lower Granite Dam adult fish trap gate to reduce delay and stress for adult salmonids and non-target species such as Pacific Lamprey. The Action Agencies will also design and implement cost-effective solutions designed to minimize and reduce ESA-listed salmonid injury and mortality associated with debris accumulation at lower Snake River dams and McNary Dam.

6.3.1.1.2.3 Tributary and Estuary Habitat Actions

For over a decade, the agencies have implemented hundreds of projects to improve the quantity and quality of salmon habitat in the estuary[158] and tributaries[159] as non-operational conservation measures to address the residual adverse effects of operation and maintenance of the CRS and the uncertainties of the effects of climate change on migrating salmon and steelhead. These actions typically address impacts to fish not caused by the Columbia River System, but are things the agencies can do to improve the overall conditions for fish to help address uncertainty related to any residual adverse effects of the CRS on ESA-listed salmon and steelhead. Best available science indicates that these tributary spawning and rearing habitat improvements will result in benefits to distribution, abundance, and survival of these fish. The tributary habitat improvements implemented by Bonneville under previous CRS BiOps, as well as habitat improvement actions implemented by other federal agencies, form part of the environmental baseline. These completed actions will provide ongoing benefits into the future, which are expected to increase over time as natural processes are improved and fully realized.

Bonneville proposes to implement targeted tributary and estuary improvements during the term of this BiOp to provide meaningful biological benefits for ESA-listed species. Bonneville and Reclamation will implement tributary habitat actions in collaboration with local experts utilizing the best scientific and commercial data available to develop strategies, priorities, and specific actions. Bonneville, the Corps and NMFS will also continue to coordinate and implement the Columbia Estuary Ecosystem Restoration Program (CEERP). With an institutionalized adaptive management framework, CEERP will continue to provide forums to revisit the habitat improvement actions and pair them with action-effectiveness monitoring results. The agencies will continue to implement habitat actions that were identified by NMFS as priority actions[160] for restoring salmon habitat and for their ability to ameliorate climate change effects. Barrier removals, floodplain reconnection, incised channel restoration and improving stream flow regimes are the types of activities most effective at addressing increased temperatures, reduced base flow, increased peak flow and increasing salmon resilience. Through these efforts, the agencies will strategically evaluate the effectiveness of habitat improvement actions and inform any necessary adjustments to the current habitat improvement and monitoring strategies. The agencies have sufficient systems to track and assure progress on habitat improvement projects, which are designed to take future climate change effects into account.

6.3.1.1.2.4 Conservation and Safety-Net Hatcheries

To support ESA-listed salmon and steelhead species affected by CRS operations and maintenance, the Action Agencies will continue to fund the operations and maintenance of safety-net and conservation hatchery programs that preserve and rebuild the genetic resources of ESA-listed salmon and steelhead in the Columbia and Snake River Basins. These programs are helping to rebuild and enhance the

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[158] *See* 2020 CRS Biological Assessment at 2-104.

[159] *See* 2020 BA Clarification Letter.

[160] Beechie, T., Imaki, H., Greene, J., Wade, A., Wu, H., Pess, G., Roni, P., Kimball, J., Stanford, J., Kiffney, P., Mantua, N. 2012. Restoring salmon habitat for a changing climate. RIVER RESEARCH AND APPLICATIONS 29: 939-960.

naturally reproducing ESA-listed fish in their native habitats using locally adapted broodstocks, while maintaining genetic and ecologic integrity, and supporting harvest where and when consistent with conservation objectives. Safety-net programs are focused on preventing extinction and preserving the unique genetics of a population using captive broodstocks to increase the abundance of the species at risk. These programs have undergone separate, program-specific ESA consultations with NMFS, which have identified operations, best practices and associated monitoring to meet both production goals as well as reduce detrimental genetic and ecological effects on ESA-listed species. The programs will be operated in accordance with those BiOps. RM&E relevant to each hatchery program has been incorporated into the relevant hatchery program BiOp(s).[161] As discussed in Section 3.3.4, these programs were an important consideration for the conclusion that the proposed action is not likely to adversely affect SRKW.

6.3.1.1.2.5 Predation Management

The proposed action includes a suite of predation measures to reduce the impacts from avian, pinniped, and piscivorous predators. Maintaining avian wires in the tailrace of lower Columbia and Snake River dams, active hazing of gulls at the dams, and the pattern of operating the spillway gates all mitigate for predation at the dams by birds and fish. The *Predator Disruption Operations* measure at the John Day Reservoir will mitigate Caspian Tern predation on juvenile salmon and steelhead in the lower Columbia River. Management efforts are ongoing to reduce salmonid consumption by terns in the lower Columbia River, and similar efforts are in progress to reduce the nesting population of Double-crested cormorants in the estuary. The Action Agencies currently implement a Northern Pikeminnow Management Program which includes an ongoing base program and general increase in northern pikeminnow sport-reward fishery reward structure to reduce predation by these fish. The Action Agencies also will continue to implement measures to reduce pinniped predation in the tailraces of Bonneville and The Dalles dams. The agencies expect that these actions will reduce or maintain the levels of predation within the juvenile and adult migration corridors that were achieved in recent years.

6.3.1.1.2.6 Fish Status Monitoring Actions

The Action Agencies propose to continue monitoring and evaluation activities in coordination with other regional monitoring efforts that collectively track survival of ESA-listed species affected by the continued operation and maintenance of the CRS, including select PIT-tag marking, natural abundance monitoring, and selected fish status and trend monitoring in the Columbia and Snake River basins. The monitoring and evaluation efforts of the Action Agencies' tributary and estuary habitat programs have standardized and hierarchically organized the intensity of monitoring across sites. Collectively, these actions ensure a statistically sound sampling plan to inform adaptive management at the site and landscape levels.

These non-operational conservation measures, along with the continued operation and maintenance of the CRS, provide the basis for Bonneville to conclude that the action as described in the 2020 Biological Assessment and the Incidental Take Statement in the 2020 NMFS CRS BiOp is not likely

[161] The Action Agencies note the continued existence of their respective independent congressionally authorized hatchery mitigation responsibilities, including, but not limited to, Grand Coulee Dam mitigation, John Day Dam mitigation, and programs funded and administered by other entities, such as the Lower Snake River Compensation Plan, which is administered by USFWS. Similar to the conservation and safety-net programs, and where appropriate, the Action Agencies will conduct or have conducted separate consultations addressing effects to ESA-listed species from CRS operations and maintenance, as well as associated monitoring and evaluation (including tagging) for these programs.

to jeopardize the continued existence of ESA-listed species and is not likely to destroy or adversely modify designated critical habitat.

6.3.1.2 Discussion of Actions Pertinent to the 2020 USFWS CRS BiOp

The following actions were proposed by Bonneville and analyzed by USFWS in its 2020 CRS BiOp. Bonneville believes that these actions are key to its finding under Section 7 of the ESA. These actions offset the adverse effects of the proposed action such that the effects of the action as a whole will not appreciably reduce the likelihood of survival and recovery for KRWS or bull trout.

6.3.1.2.1 Actions for Kootenai River White Sturgeon

6.3.1.2.1.1 Operational Measures for Kootenai River White Sturgeon

The Action Agencies have proposed a suite of actions that have been designed to benefit KRWS and its designated critical habitat. As described in the proposed action, the Action Agencies will manage river flow and water temperature from Libby Dam in a manner that is likely to create improved river depth and water velocities in areas important for sturgeon migration, spawning and rearing, as well as to provide stable water temperatures during sturgeon migration and spawning periods. The sturgeon flow operation is a combination of three approaches: 1) releases from Libby Dam during the Kootenai sturgeon spawning season and in coordination with the Flow Plan Implementation Protocol (FPIP) process; 2) use of the selective withdrawal facilities to achieve appropriate downstream river temperatures; and 3) a tiered volume approach that varies the volume of water available for sturgeon conservation each year depending on the May 1 forecast of total volume into Koocanusa Reservoir expected during the April through August period. Based on this approach, there is no flow augmentation during low water years. These measures are specifically designed to improve the co-occurrence of the Primary Constituent Elements of designated critical habitat for KRWS during critical periods of sturgeon breeding (appropriate water depths, water temperature, flow velocities, rocky substrate, and inter-gravel spaces).

In addition, Libby Dam will be operated consistent with variable discharge (VARQ) and flood risk management (FRM) procedures, which provide greater assurance that Koocanusa Reservoir will refill in medium runoff years. The proposed action modifies the VARQ FRM procedure to incorporate local conditions in the draft rate and account for planned releases during refill, such as the Sturgeon Volume, in order to respond to local FRM conditions and increase the chances of refill.

6.3.1.2.1.2 Non-operational Conservation Measures for Kootenai River White Sturgeon

1) Conservation Aquaculture

The proposed action includes continued implementation of the conservation aquaculture program for KRWS. Over 300,000 hatchery-origin KRWS have been released into the Kootenai basin since 1990. Monitoring data indicate that these hatchery-origin sturgeon are surviving at high rates. The program has successfully captured between 70 and 80 percent of the genetic diversity in the wild population, which has and will continue to help reduce effects to KRWS from CRS operations.

2) Habitat Restoration Actions

The proposed action includes implementation of a habitat restoration program, which is likely to increase spawning sturgeon access to river reaches that have sufficient amounts of rocky substrate,

and is likely to address other habitat-related threats to Kootenai sturgeon. From 2011 to 2019, 12 habitat restoration projects have been successfully implemented in the Braided, Straight, and Meander reaches of the Kootenai River. Under the proposed action, the Action Agencies have committed to funding and implementing a minimum of one major habitat restoration project per year through at least 2025 (after 2025 additional projects may continue to be implemented, pending the results of an assessment of implemented restoration projects). Together, these projects have produced, and are expected to continue to produce, increased river depth and complexity, reduced bank erosion, increased available sturgeon spawning and rearing habitat, and enhanced fundamental ecosystem processes, which have and will continue to reduce effects to KRWS from CRS operations.

3) Nutrient Enhancement

The proposed action includes nutrient additions in the Kootenai River and Kootenay Lake. Monitoring of these projects has shown increased beneficial algal production, increased abundance, biomass and diversity of invertebrate food items for fish, and improved overall biological productivity in the Kootenai River, which has and will continue to reduce effects to Kootenai sturgeon from CRS operations.

6.3.1.2.2 Actions for Bull Trout

6.3.1.2.2.1 Operational Measures for Bull Trout

The Action Agencies have proposed a suite of actions that have been designed to benefit bull trout and its designated critical habitat. As described in the proposed action, Hungry Horse Dam is operated to meet minimum flows all year both below the dam on the South Fork Flathead River and at Columbia Falls, Montana on the mainstem Flathead River to benefit bull trout when not operating for FRM or releasing water for flow augmentation to benefit anadromous fish. Ramping rate limits were established below Hungry Horse Dam to reduce the likelihood of fish becoming stranded. Libby Dam is operated to provide minimum flows for bull trout and KRWS, including in September for bull trout habitat inundation. This action provides benefits that maintain water levels suitable for foraging and migrating throughout the Kootenai River. Libby's reservoir summer elevation is kept above 2,450 feet to improve primary production and zooplankton production. Providing surface spill to reduce adverse effects to overshooting adult steelhead at McNary and the lower Snake River dams is also expected to benefit bull trout during migration past the dams.

6.3.1.2.2.2 Non-operational Conservation Measures for Bull Trout

The Action Agencies' proposed action includes three non-operational conservation measures: tributary restoration actions, particularly on the Kootenai River, funding of the operations and maintenance of conservation and safety-net hatcheries, and monitoring of impacts to bull trout that are expected to minimize the long-term impact to survival and recovery of all affected Core Areas of bull trout during the timeframe of this consultation. In addition, the nutrient additions proposed for the Kootenai River will benefit bull trout at this location. Further, once construction of upstream passage occurs at Albeni Falls Dam, substantial benefits to bull trout in this Core Area are anticipated to occur, and have been included in this analysis as part of the environmental baseline as it is subject to a separate planning and environmental compliance process. Many of the proposed structural improvements discussed above in the discussion of the 2020 NMFS CRS BiOp for salmon and steelhead are expected to benefit bull trout, including the new IFP turbines at Ice Harbor, McNary, and John Day dams.

1) Restoration Actions for Bull Trout
Proposed habitat restoration projects will benefit bull trout both in tributaries and in mainstem river habitats. The proposed action includes an evaluation of delta formations at the mouths (confluences) of important bull trout spawning tributaries of the Kootenai River downstream of Libby Dam that may be causing upstream fish passage barriers to bull trout seeking spawning grounds in tributaries during summer months. In 2021, the Action Agencies will contribute funding for an initial assessment of blocked passage to bull trout key spawning tributaries identified by the USFWS. The assessment may cover a range of water year types but must include a dry water year to adequately understand the problem. Upon completion of the initial assessment, the Action Agencies, in collaboration with local stakeholders and USFWS, will develop an action plan and prioritization process for tributaries identified as having blocked passage. The Action Agencies will work with the USFWS and stakeholders to identify and initiate a process to address two restoration or improvement projects (or a combination of both) benefitting upstream passage over the period from 2021 to 2026. Any additional improvement opportunities to benefit bull trout passage in Kootenai River tributaries will be evaluated based on biological priorities and available funding.

Additionally, habitat enhancement actions on and adjacent to the Kootenai River may improve juvenile to adult survival of kokanee salmon that are an important prey species for both KRWS and bull trout. Further, the Action Agencies will work with USFWS to leverage benefits for bull trout where feasible when developing tributary habitat projects for ESA-listed salmon and steelhead.

2) Monitoring for Bull Trout in the Lower Columbia and Lower Snake River
The Action Agencies will continue to monitor for bull trout at the lower Columbia and lower Snake River dams. The primary means of monitoring bull trout will be through the Corps' adult fish counts program, PIT detection arrays in fish ladders and juvenile bypass systems, and through the Smolt Monitoring Program (SMP). Monitoring objectives will be refined as priorities evolve and the state of knowledge advances. The Action Agencies will continue to emphasize monitoring that informs management needs.

In consideration of this suite of proposed actions for KRWS and bull trout, Bonneville concludes that the action as described in the 2020 Biological Assessment and the Incidental Take Statement in the 2020 USFWS CRS BiOp is not likely to jeopardize the continued existence of ESA-listed species and is not likely to destroy or adversely modify designated critical habitat.

6.3.1.3 Climate Change Analysis

In the 2020 NMFS CRS BiOp, NMFS found that climate change poses a substantial threat to anadromous fish species over the next twenty years. While climate change will affect anadromous fish in all stages of life, the impacts are largely driven by changes in ocean conditions that are projected to reduce survival during the marine life history stage. NMFS concluded that "these conditions are not caused by, nor will they be exacerbated by, the continued operation and maintenance of the CRS as proposed in the biological assessment." USFWS concluded in the 2020 USFWS CRS BiOp that the proposed action, in combination with other Federal and non-Federal actions, is likely to exacerbate the effects of climate change on resident fish, but recognized the contributions that adaptive management and habitat improvement actions will have in supporting habitat and flexibility to respond to climate change.[162] Despite these impacts, Bonneville has

[162] *See* 2020 USFWS CRS BiOp at 34 and 37.

concluded that the proposed action, particularly operational measures and non-operational conservation measures, is expected to offset adverse effects that may impact the survival and recovery of ESA-listed species such that the action will not appreciably reduce the likelihood of survival and recovery and will positively contribute to the overall resiliency of the ESA-listed species in light of climate change. The measure to use local water supply conditions in order to implement sliding scale operations for summer flow augmentation are staged to better balance anadromous and resident fish needs. The agencies have committed to continuing the tributary and estuary habitat improvement program for salmon and steelhead (with considerations for benefits to bull trout, where appropriate) and to evaluate and improve tributary habitat access for bull trout which will give spawning fish access to additional habitat. The continued use of cool water stored behind Dworshak Dam and structures to address ladder temperature differentials help to reduce water temperatures as fish approach and pass Lower Granite and Little Goose dams.

6.3.1.4 Adaptive Management and RM&E

6.3.1.4.1 Regional Forum and Kootenai River Regional Coordination

The agencies will continue to utilize adaptive management principles in implementing the proposed action based on results of biological studies and monitoring information.[163] These results will be discussed, and operations modified in collaboration with federal, state and tribal sovereigns through the Regional Forum, to ensure expected benefits to salmon and steelhead are being met based on the best available scientific information. The Kootenai River Regional Coordination workgroups will continue to be utilized to provide recommendations regarding operations and address technical issues related to KRWS.

6.3.1.4.2 RM&E

Biological performance for system operations will be tracked through ongoing juvenile and adult fish monitoring at the lower Columbia and lower Snake River dams. Annual and in-season monitoring results are used to inform in-season operations decisions and through the Regional Forum, identify potential research or evaluation needs, and inform longer-term management decisions regarding system operations. Bonneville will assess a number of the proposed operations and structural modifications through action-effectiveness evaluations, including the deployment of IFP turbines, spill for steelhead overshoots, and Flexible Spill. The agencies will implement planning and progress reporting to the Services to inform and signal appropriate adaptations to changing circumstances.

6.3.2 NEPA Compliance

Bonneville will use the CRSO EIS for operational changes associated with CRS power marketing activities. These operations will be coordinated with other operational, maintenance or configuration actions for flood risk management, irrigation, fish and wildlife conservation, water quality, navigation and other congressionally authorized purposes. For mitigation actions, Bonneville will use a combination of existing programmatic NEPA documents as well as site-specific NEPA documents to implement certain mitigation measures described in Section 7.6 of the Final CRSO EIS and the Mitigation Action Plan. Since these actions mitigate for impacts from the CRS projects, these actions will be conducted as part of Bonneville's Northwest Power Act commitments.

[163] 2020 CRS Biological Assessment at 2-1 to 2-6.

Generally, if new or existing projects change the status quo or directly impact the human environment in a manner not considered in an existing NEPA document, commensurate NEPA analysis will be conducted. More specifically, Bonneville could either supplement or develop new NEPA documents consistent with 40 C.F.R. § 1502.9 and 10 C.F.R. § 1021.314. Moreover, consistent with its existing practice for new projects, Bonneville will determine the appropriate level of NEPA compliance once projects are proposed for implementation and integrate compliance with other applicable environmental laws, including but not limited to the Northwest Power Act, ESA and the National Historic Preservation Act.

For habitat restoration actions in tributaries in the Columbia River Basin, Bonneville will continue to conduct site-specific NEPA compliance for these actions (*e.g.*, Bird Track Springs Fish Habitat Enhancement Project [DOE/EA-2032]). Bonneville also plans to use programmatic NEPA documents analyzing habitat restoration actions, including the Aquatic Restoration Activities in and near Umatilla National Forest Environmental Assessment (DOE/EA - 2119) and the Columbia River Basin Tributary Habitat Restoration Environmental Assessment (DOE/EA-2126), pending completion of that NEPA process, where appropriate.

For habitat restoration actions in the estuary, Bonneville will continue to determine whether the project fits under the Columbia Estuary Ecosystem Restoration Program Environmental Assessment (DOE/EA-2006) or if site-specific NEPA compliance is needed.

For hatchery projects, Bonneville will continue to rely on existing hatchery NEPA documents, where appropriate (e.g. Springfield Sockeye Hatchery Project [DOE/EA-1913]; Kootenai River White Sturgeon and Burbot Hatcheries Project [DOE/EA-1901]), and will continue to conduct site-specific NEPA compliance for changes to existing hatchery programs.

Finally, for research, monitoring and evaluation actions, Bonneville will either integrate these actions into applicable NEPA documents for other actions (e.g. with habitat or hatchery actions), as appropriate, or conduct site-specific NEPA actions if the projects are not tied to other actions.

Thus, by completing the CRSO EIS, the agencies are ensuring the Preferred Alternative analysis and associated ESA consultations take into account updated information and analysis on operational, structural and mitigation measures. Additionally, using the flexibility afforded by NEPA, Bonneville will use existing NEPA documents, where appropriate or complete new or supplemental environmental evaluation, if necessary.

Table 2. Mitigation Measures and Existing or Planned NEPA Compliance

Mitigation Measure	Existing or Planned NEPA Compliance
Implement tributary habitat improvements for both Chinook salmon and steelhead as well as other species through implementation of specified construction projects, research, monitoring and evaluation actions, and species status and trend data collection on habitat and survival improvement.	Site-specific or other programmatic NEPA compliance or Columbia River Basin Tributary Habitat Restoration Environmental Assessment (DOE/EA-2126), pending completion of that NEPA process.

Mitigation Measure	Existing or Planned NEPA Compliance
Implement Kootenai white sturgeon habitat restoration as included in the CRS Biological Assessment.	Site-specific NEPA compliance, other programmatic NEPA documents or Columbia River Basin Tributary Habitat Restoration Environmental Assessment (DOE/EA-2126), pending completion of that NEPA process.
Implement estuary habitat improvements through implementation of specified construction projects; research, monitoring and evaluation actions; and species status and trend data collection on habitat and survival improvement.	Site-specific NEPA compliance or Columbia Estuary Ecosystem Restoration Program Environmental Assessment (DOE/EA-2006), if needed.
Continue support of the Kootenai River white sturgeon nutrient enhancement through FY 2025.	Kootenai River Ecosystem Environmental Assessment (DOE/EA-1518) and Supplement Analysis or site-specific NEPA Compliance, if necessary.
Continue to fund operations and maintenance of ongoing safety-net and conservation hatchery programs to provide benefits to ESA-listed stocks at high risk of extinction.	Site-specific NEPA Compliance.
Continue Northern Pikeminnow Management Program.	Northern Pike Suppression Project Categorical Exclusion.
Ongoing monitoring of East Sand Island Caspian tern and Double-crested cormorant colonies during nesting season through 2021 breeding season.	Site-specific NEPA Compliance.
Sea Lion Non-Lethal Hazing and Monitoring.	Site-specific NEPA Compliance.
Bull trout access to perched tributaries in Kootenai River: Contribute funding for an initial assessment of blocked passage to bull trout key spawning tributaries identified by the USFWS. Initiate two restoration or improvement projects benefitting upstream passage opportunities over the period of 2021-2026.	Site-specific NEPA compliance or Columbia River Basin Tributary Habitat Restoration Environmental Assessment (DOE/EA-2126), pending completion of that NEPA process.
Supplement spawning habitat at Lake Roosevelt at locations along the reservoir and tributaries (up to 100 acres).	Site-specific NEPA compliance or Columbia River Basin Tributary Habitat Restoration Environmental Assessment (DOE/EA - 2126), pending completion of that NEPA process.
Plant cottonwood trees (up to 100 acres) near Bonners Ferry to improve habitat and floodplain connectivity.	Site-specific NEPA compliance or Columbia River Basin Tributary Habitat Restoration Environmental Assessment (DOE/EA - 2126), pending completion of that NEPA process.
Plant native wetland and riparian vegetation (up to 100 acres) on the Kootenai River downstream of Libby.	Site-specific NEPA compliance or Columbia River Basin Tributary Habitat Restoration Environmental Assessment (DOE/EA - 2126), pending completion of that NEPA process.

6.3.3 Bonneville's Duty under the Northwest Power Act to Protect, Mitigate, and Enhance Fish and Wildlife

Apart from the co-lead agencies' shared Northwest Power Act duties discussed above, Bonneville's Administrator has a separate responsibility to use the Bonneville fund to "protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation" of the Federal Columbia River Power System, including the CRS.[164] Bonneville must fulfill this mandate "in a manner consistent with" the purposes of the Northwest Power Act and the Council's Power Plan and Columbia River Basin Fish and Wildlife Program.[165] The Ninth Circuit Court of Appeals has original jurisdiction over suits to challenge final actions and decisions taken pursuant to the Northwest Power Act by the Bonneville Administrator, or the implementation of such final actions.[166]

In the context of the CRSO EIS, this responsibility applies to Bonneville's ongoing programs described in Chapters 2, 5 and 7 as well as the additional mitigation measures Bonneville is adopting in the Mitigation Action Plan. One of the ongoing programs described in Chapters 2, 5, and 7 is Bonneville's existing Fish and Wildlife Program. Mitigation actions and projects funded through Bonneville's Fish and Wildlife Program are the means by which Bonneville addresses its responsibility to "protect, mitigate, and enhance" fish and wildlife under 16 U.S.C. § 839b(h)(10)(A).[167] Continuation of the actions and projects under Bonneville's existing Fish and Wildlife Program is consistent with the Council's Program because the existing Bonneville actions and projects have been subject to past Council review and have either been recommended for funding and implementation by the Council or have been incorporated into the Council's Program. Further, the Independent Scientific Review Panel periodically reviews the mitigation projects under certain statutory criteria—such as benefits to fish and wildlife.[168]

To the extent that the Mitigation Action Plan includes any new or expanded actions, those will likely be incorporated into existing fish and wildlife mitigation projects that are already funded consistent with the Council's Program, and can be designed for implementation in such a way that is consistent with appropriate Program measures or guidance. In addition, Bonneville's funding of these mitigation actions through its Fish and Wildlife Program projects will follow other applicable provisions of the Northwest Power Act, such as the in-lieu funding prohibition[169] and the congressional authorization requirement for construction of capital facilities.[170]

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[164] 16 U.S.C. § 839b(h)(10)(A).
[165] *Id.*
[166] *Id.* § 839f(e)(5).
[167] Bonneville's use of its Northwest Power Act authority and Fish and Wildlife Program as the tools for implementing actions from the Mitigation Action Plan should not be conflated with Bonneville's overall compliance with its Northwest Power Act mitigation responsibility under 16 U.S.C. § 839b(h)(10)(A), which is fulfilled through a broader set of mitigation actions in addition to those described in the Mitigation Action Plan in this ROD.
[168] 16 U.S.C. § 839b(h)(10)(D(iv).
[169] *Id.* § 839b(h)(10)(A).
[170] *Id.* § 839b(h)(10)(B).

6.3.4 Summary

The Selected Alternative and associated ESA consultations take into account updated information and analysis on operational and non-operational conservation and mitigation measures. This alternative also provides for the conservation of fish and wildlife resources, including threatened, endangered, and sensitive species throughout the environment affected by CRS operations consistent with the NEPA, ESA and Northwest Power Act analysis. Thus, Bonneville is acting within its existing authorities and complying with applicable environmental laws and regulations and all other applicable federal statutory and regulatory requirements in making this decision.

This document of the Department of Energy was signed on September 28, 2020, by John L. Hairston, Acting Administrator and Chief Executive Officer, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by the Department of Energy. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned Department of Energy Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the Federal Register.

Issued in Portland, Oregon.

28-September-2020

John L. Hairston
Acting Administrator and Chief Executive Officer
Bonneville Power Administration

Date

Attachment 1. Mitigation Action Plan

Columbia River System

Mitigation Action Plan

SUMMARY

This Mitigation Action Plan[1] is for the Preferred Alternative and includes all of the integral elements in the Columbia River System Operations Environmental Impact Statement (CRSO EIS) that the Bonneville Power Administration (Bonneville) would implement to mitigate potential adverse environmental impacts. For the full description of the mitigation measures, see Section 7.6 of the Final EIS.

Bonneville and Bonneville's contractors and sponsors are responsible for implementing the mitigation measures listed in the Mitigation Action Plan. Bonneville also will continue to fund the power allocated share of measures adopted by the Corps or Reclamation either directly (through its direct funding program) or through a reimbursement to the U.S. Treasury (if the measure is initially funded through appropriations). Relevant portions of this Mitigation Action Plan will be included in the construction contract specifications, which will obligate Bonneville and its contractors and sponsors to implement the mitigation measures identified that relate to Bonneville and contractor responsibilities during and after construction. This Mitigation Action Plan may be amended if revisions are needed due to new information or if there are project adjustments.

Bonneville Power Administration Fish and Wildlife Program

Bonneville's Fish and Wildlife Program funds hundreds of projects each year to mitigate the impacts of the development and operation of the Federal Columbia River Power System (FCRPS), which includes the Columbia River System (CRS) on fish and wildlife. Bonneville began this program to fulfill mandates established by Congress in the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act), 16 USC § 839b(h)(10)(A), to protect, mitigate, and enhance fish and wildlife affected by the development and operation of the FCRPS. In its role under the Northwest Power Act, the Council develops a program of measures to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries. Measures in the Council's program guide Bonneville's implementation of fish and wildlife mitigation projects.

Each year Bonneville funds projects, consistent with the Northwest Power and Conservation Council's program, with many local, state, tribal, and federal entities to fulfill its Northwest Power Act fish and wildlife responsibilities and to implement non-operational conservation measures consulted upon in various Biological Opinions for ESA-listed species. Non-operational conservation measures typically address impacts to fish and wildlife not caused directly by the CRS, but they are actions that can improve the overall conditions for fish to help address uncertainty related to any residual adverse effects of CRS operations, maintenance and configuration. For example, the Bonneville Fish and Wildlife Program funding improves habitat in the mainstem as well as tributaries and the estuary, builds hatcheries and boosts hatchery fish production, evaluates the success of these

[1] Bonneville is completing this Mitigation Action Plan as required under the Department of Energy's 10 C.F.R. § 1021.331 National Environmental Policy Act Procedures. The Corps included its mitigation, monitoring and adaptive management discussion in Appendix R, Part 1.

efforts, and improves scientific knowledge through research. This work is implemented through annual contracts, many of which are associated with multi-year agreements like the Columbia River Basin Fish Accords, the Accord Extensions, or wildlife settlements.

Lower Snake River Compensation Plan

In addition to the hatchery operations that are funded through the Bonneville's F&W Program, Bonneville directly funds the annual operations and maintenance of the Lower Snake River Compensation Plan (LSRCP). Congress authorized the LSRCP as part of the Water Resources Development Act of 1976 (90 Stat. 2917) to offset fish and wildlife losses caused by construction and operation of the four lower Snake River dams. A major component of the authorized plan was the design and construction of fish hatcheries and satellite facilities. The LSRCP is administered through the USFWS. The LSRCP hatcheries and satellite facilities produce and release more than 19 million salmon and steelhead as part of the program's mitigation responsibility. The 26 LSRCP hatcheries and satellite facilities are operated by Idaho Department of Fish and Game, the Washington Department of Fish and Wildlife, the Oregon Department of Fish and Wildlife, USUSFWS, the Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, and Shoshone-Bannock Tribes.

FCRPS Cultural Resource Program

Bonneville would continue to use the existing FCRPS Cultural Resource Program and the *Systemwide Programmatic Agreement for the Management of Historic Properties Affected by the Multipurpose Operations of Fourteen Projects of the Federal Columbia River Power System for Compliance with Section 106 of the National Historic Preservation Act* to implement mitigation actions, as warranted and appropriate. This includes for new effects to archaeological resources, traditional cultural properties, and the built environment at the fourteen projects caused by implementation of the Selected Alternative relative to the No Action Alternative. The FCRPS Cultural Resource Program will continue to be funded through the Corps and Reclamation's appropriations process as well as direct funding from Bonneville apportioned though the Integrated Program Review process. Funding levels will (at a minimum) be consistent with No Action Alternative levels.

MITIGATION MEASURES

Mitigation measures identified to reduce potential impacts associated with the Preferred Alternative are provided in the Mitigation Action Plan Table.

Table A1- 1 Mitigation Action Plan Table

RESOURCE[2]	MITIGATION MEASURES
Aquatic Habitat, Aquatic Invertebrates, and Fish	Implement tributary habitat improvement actions for both Chinook salmon and steelhead as well as other species through implementation of specified construction projects, research, monitoring and evaluation actions, and species status and trend data collection on habitat and survival improvement
	Implement Kootenai white sturgeon habitat restoration as included in the CRS Biological Assessment
	Implement estuary habitat improvement actions through implementation of specified construction projects; research, monitoring and evaluation actions; and species status and trend data collection on habitat and survival improvement
	Continue support of Kootenai River white sturgeon nutrient enhancement through FY 2025
	Continue support of Kootenai River white sturgeon Conservation Aquaculture for supplementation due to lack of wild, natural recruitment
	Continue to fund operations and maintenance of ongoing safety-net and conservation hatchery programs to provide benefits to ESA-listed stocks at high risk of extinction
	Continue Northern Pikeminnow Management Program
	Ongoing monitoring of East Sand Island Caspian tern and Double-crested Cormorant colonies during nesting season through 2021 breeding season
	Sea Lion Non-Lethal Hazing and Monitoring
	Bull trout access to perched tributaries in Kootenai River: Contribute funding for an initial assessment of blocked passage to bull trout key spawning tributaries identified by the USFWS. Initiate two restoration or improvement projects benefitting upstream passage opportunities over the period of 2021-2026.
	Supplement spawning habitat at Lake Roosevelt at locations along the reservoir and tributaries (up to 100 acres).
Vegetation, Wetlands, Wildlife, and Floodplains	Plant cottonwood trees (up to 100 acres) near Bonners Ferry to improve habitat and floodplain connectivity
	Plant native wetland and riparian vegetation (up to 100 acres) on the Kootenai River downstream of Libby

[2] The following eleven resources do not have mitigation proposed for anticipated effects from implementation of the Preferred Alternative: River Mechanics, Power Generation and Transmission, Air Quality and Greenhouse Gases, Flood Risk Management, Recreation, Water Supply, Visual, Noise, Fisheries and Passive Use, Indian Trust Assets, Tribal Perspectives, and Tribal Interests, and Environmental Justice. Mitigation was not proposed because either no mitigation measure was needed or mitigation proposed for another resource eliminated the need to propose additional mitigation.

Attachment 2. Comprehensive list of all mitigation and conservation measures for ESA-listed species from the CRSO EIS and Biological Opinions

Measure Type	Measure Sub-Type	Measure Summary
Mitigation	Resident Fish - ESA Kootenai River White Sturgeon	Plant 1- to 2-gallon cottonwoods near Bonners Ferry to improve habitat and floodplain connectivity, which would benefit ESA-Listed Kootenai River White Sturgeon by providing a food source. This would complement ongoing habitat actions already being taken in the region.
Mitigation	Vegetation, Wildlife, Wetlands & Floodplains	On Kootenai River downstream of Libby, plant native wetland and riparian vegetation up to ~100 acres along river.
Mitigation	Vegetation, Wildlife, Wetlands & Floodplains	Update Invasive Species Management Plan
Mitigation	Anadromous Fish	Temporary extension of performance standard spill levels in coordination with the Regional Forum to improve fish migration in the event that high spill levels block or delay fish passage.
Mitigation	Resident Fish - Burbot, Kokanee, and Redband Rainbow Trout	In 2019, Bonneville funded Year 1 of a 3-year study to determine potential effects of modifications in Lake Roosevelt fall refill to resident fish spawning habitat access. Other evaluations will be conducted to determine potential affected areas. If study evaluations and other available data indicate resident fish spawning habitat areas are affected by changes in reservoir elevations, the co-lead agencies will work with regional partners to determine where to augment spawning habitat at locations along the reservoir and in the tributaries (up to 100 acres).
Operational Conservation Measures	Water Quality	Operate the Selective Withdrawal Structures at Libby and Hungry Horse to improve temperature conditions for resident fish.
Operational Conservation Measures	Water Quality	Provide summer flow augmentation from Dworshak Dam to improve water quality (moderating river temperatures) and increase water velocities in the lower Snake River. Shape the summer temperature moderation and flow augmentation releases from Dworshak Dam with the intent to maintain water temperatures at or below 68°F at the fixed monitoring site at the Lower Granite Dam tailrace.
Operational Conservation Measures	Water Quality	Maintain Water Quality Plan for TDG and Water Temperature in the mainstem Columbia and Snake Rivers to continue to operate in a way to manage system TDG and water temperature
Operational Conservation Measures	Water Quality	Operate Hungry Horse Dam to the extent possible to minimize spill and generation of TDG.
Operational Conservation Measures	Flow Augmentation	Operate Hungry Horse, Libby, Grand Coulee and Banks Lake to augment summer flows for fish below Chief Joseph Dam. Additionally, Reclamation will adjust refill and the summer draft consistent with the Lake Roosevelt Incremental Storage Release Program is to reduce impacts on spring and summer flows. Lake Roosevelt is refilled after the summer flow augmentation period for resident fish considerations.
Operational Conservation Measures	Flow Augmentation	Operate Grand Coulee to augment spring flows including the use of Variable Draft Limits (VDLs) that balance flexibility for power generation with the objective to assure an 85 percent probability of meeting the April 10 elevation objective to benefit juvenile anadromous fish migration.

Measure Type	Measure Sub-Type	Measure Summary
Operational Conservation Measures	Flow Augmentation	Operate Grand Coulee Dam to, as appropriate, release water in the fall for spawning of chum below Bonneville Dam, and in the winter and spring for protection flows for both chum below Bonneville Dam and for fall Chinook below Priest Rapids. Operate Grand Coulee to support flow objectives in the Hanford Reach (Vernita Bar). Flow support for chum spawning and incubation is contingent on reservoir elevations and water supply conditions indicating that the tailwater elevation can be maintained through the incubation and emergence life stages. If water supply is deemed insufficient to provide adequate mainstem spawning or continuous tributary access, provide, as appropriate, intermittent mainstem flow to allow chum access to adequate tributary spawning habitat, if available.
Operational Conservation Measures	Flow Augmentation	VDLs developed at Hungry Horse to allow flexibility for power generation while ensuring a 75 percent probability of meeting the April 10 elevation objective, which is to maximize flow released between April 10 and June 30 to benefit juvenile anadromous fish migration.
Operational Conservation Measures	Flow Augmentation	Operate to VARQ FRM rule curves for Libby and Hungry Horse developed to reduce the draft for FRM in some years, thereby allowing for higher spring flows for juvenile anadromous fish migration in the Columbia River
Operational Conservation Measures	Resident fish	To the extent possible, operate Hungry Horse Dam to gradually transition between refilling and flow augmentation releases, to release steady or gradually declining outflows from July through September. This reduces the probability of creating a double peak at Columbia Falls on the mainstem Flathead River below Hungry Horse Dam. The double peak occurs when discharges are reduced at the end of FRM operations to allow refilling of the reservoir, then the discharges are increased to release water for flow augmentation.
Operational Conservation Measures	Resident Fish	Operate to meet minimum flows below Hungry Horse and Libby.
Operational Conservation Measures	Resident Fish	Operate to ramping rate limits established below Hungry Horse and Libby dams that reduce the likelihood of fish becoming stranded.
Operational Conservation Measures	Resident Fish	Operate Libby in a coordinated manner to augment flows and improve temperatures for Kootenai River White Sturgeon.
Operational Conservation Measures	Fish Passage Spill	Perform the flexible spill operation at the lower Columbia and Snake river dams to increase juvenile fish passage survival through the run-of-river dams, reduce any delayed mortality, and improve the number of returning adult salmon and steelhead. This operation increases fish passage benefits while balancing power generation and transmission reliability, and addresses other operational considerations developed through collaboration through the Regional Forum. This operation will be managed adaptively in accordance with established regional coordination and review processes.
Operational conservation measures	Improve Passage Conditions for Adult Sockeye Salmon to the Extent Practicable	Following the extremely high losses of adult sockeye in 2015, NMFS recommended several actions to improve the survival of adult sockeye salmon in the event that similar conditions reoccur. Continue this work and further improve fish passage for adult sockeye salmon under high temperature conditions.
Operational conservation measures	Reduce Take of Overshoot Adult Steelhead	To reduce the take of overshooting adult Middle Columbia River (MCR) and Snake River B-run steelhead, implement offseason surface spill beginning in 2020 to provide safe and effective downstream passage for adult steelhead that overshoot and then migrate back downstream through McNary Dam and the lower

Measure Type	Measure Sub-Type	Measure Summary
		Snake River dams during months when there is no scheduled spill for juvenile passage. The modifications to operations or structures designed to safely and effectively pass adult steelhead via surface spill are expected also benefit bull trout that are attempting to migrate downstream past McNary Dam
Operational conservation measures	Reduce Take Associated with the Implementation of the Northern Pikeminnow Management Program and Demonstrate Program's Current Efficacy	Implement the Northern Pikeminnow Management Program (NPMP) to reduce adverse impacts to ESA-listed salmonids.
Non-Operational Conservation Measures	Albeni Falls Actions for Benefit Bull Trout	Seek funding to pursue further design and eventual construction of the proposed upstream "trap and haul" fish passage facility at Albeni Falls and continuing coordination with federal, state, and tribal agencies throughout this process.
Non-Operational Conservation Measures	Adult fish ladder temperature differentials	After development of a contingency plan by NMFS and state and tribal fish managers, complete an alternatives study to assess the potential to trap-and-haul adult sockeye salmon at lower Snake River dams. The alternatives study would recommend the least-cost method to meet the goal and objectives of a contingency plan.
Non-Operational Conservation Measures	Adult fish ladder temperature differentials	Maintain the adult trap at Ice Harbor Dam to allow for emergency trapping of adult salmonids as necessary, including potentially refurbishing the trap in the future to prepare for the implementation of emergency trap-and-haul activities (e.g., sockeye during high temperature water years similar to 2015).
Structural Conservation Measures	Adult separator at the Lower Granite Dam Juvenile Bypass System	Complete follow-on modifications to new Lower Granite Dam juvenile bypass system (JBS) separator to reduce delay, injury, and stress to salmon and steelhead, bull trout, and non-target species.
Structural Conservation Measures	Lower Granite Dam adult fish trap improvements	Design and implement cost-effective structural modifications to the Lower Granite Dam adult fish trap to reduce delay and stress for adult salmonids and non-target species such as Pacific lamprey.
Structural and Operational Conservation Measures	Enhanced debris management at lower Snake River and McNary projects	Investigate potential operational or structural solutions for effective forebay debris management at McNary Dam and the lower Snake River dams. Where necessary and feasible after coordination with NMFS and FWS, design and implement cost-effective solutions designed to minimize and reduce ESA-listed salmonid injury and mortality associated with debris accumulation.
Conservation and Safety-net Hatchery Actions	Salmon hatchery funding	Fund the O&M of safety-net and conservation hatchery programs that preserve and rebuild the genetic resources of ESA-listed salmon and steelhead in the Columbia and Snake River Basins. The conservation and safety-net hatcheries to be funded under the Proposed Action are listed in Table 2-17.
Conservation and Safety-net Hatchery Actions	Kootenai River White Sturgeon	Provide funding in accordance with the terms outlined in the Memorandum of Agreement (MOA) between Bonneville and the Kootenai Tribe of Idaho (KTOI) for the KTOI's Kootenai River Native Fish Conservation Aquaculture Program for sturgeon (Bonneville and KTOI 2013).
Conservation and Safety-net Hatchery Actions	Hatchery monitoring	Collaborate with NMFS on broader, basin-wide, hatchery monitoring and action items that support these needs to the extent practicable.
Predation Management	Pinniped Predation Management at Bonneville and The Dalles Dams	Annually install (or leave installed year-round), and improve as needed, sea lion excluder devices at all adult fish ladder entrances at Bonneville Dam.

Measure Type	Measure Sub-Type	Measure Summary
Predation Management	Pinniped Predation Management at Bonneville and The Dalles Dams	Annually fund dam-based hazing of pinnipeds observed in the vicinity of fish ladder entrances at Bonneville Dam.
Predation Management	Pinniped Predation Management at Bonneville and The Dalles Dams	Provide the Oregon Department of Fish and Wildlife (ODFW), WDFW, and Columbia River Inter-Tribal Fish Commission personnel with access to Bonneville Dam and the Bonneville Dam boat restricted zone, as appropriate, to support sea lion predation management.
Predation Management	Pinniped Predation Management at Bonneville and The Dalles Dams	In coordination with NMFS, review the Corps' current (i.e., 2019) Bonneville Dam pinniped predation monitoring objectives and develop and implement a revised monitoring plan that reflects current and near-future management needs.
Predation Management	Pinniped Predation Management at Bonneville and The Dalles Dams	Monitor pinniped activity at Bonneville Dam annually and provide an annual report to NMFS and monthly reports to the FPOM coordination team.
Predation Management	Pinniped Predation Management at Bonneville and The Dalles Dams	Fund dam-based hazing of pinnipeds observed in the vicinity of fish ladder entrances at The Dalles Dam on an ad hoc, as needed basis.
Predation Management	Pikeminnow Predation Management	Fund, implement, and report on the NPMP, which consists of the Northern Pikeminnow Sport Reward Fishery and the Dam Angling programs.
Predation Management	Pikeminnow Predation Management	Work with partners to understand new management opportunities relating to pikeminnow predation management and coordinate with the Services on locations of future actions within Dam Angling programs, especially if new site-specific predation locations become a priority.
Predation Management	Pikeminnow Predation Management	Due to concerns regarding electro-fishing related to the Northern Pikeminnow Sport Reward Fishery, work with regional partners to develop a plan during 2020–2022 to replace electrofishing with alternative fish collection methods.
Predation Management	Avian Predation Management and Monitoring Actions	Implement the *Inland Avian Predation Management Plan (IAPMP).*
Predation Management	Avian Predation Management and Monitoring Actions	Conduct passive and active dissuasion efforts on Goose Island.
Predation Management	Avian Predation Management and Monitoring Actions	Monitor tern use of Crescent Island on an annual basis to determine whether objectives of the *Inland Avian Predation Management Plan* continue to be met (i.e. less than approximately 40 pairs of nesting Caspian terns) and coordinate with the Services as warranted.
Predation Management	Avian Predation Management and Monitoring Actions	Fund and implement the Caspian tern dissuasion and monitoring efforts at East Sand Island as described in the *Caspian Tern Management Plan.*
Predation Management	Avian Predation Management and Monitoring Actions	Implement the *Double-crested Cormorant Management Plan.*
Predation Management	Avian Predation Management and Monitoring Actions	Implement and improve, as needed, avian predator deterrent programs at lower Snake and Columbia River dams to reduce avian predation on juvenile salmonids.

Measure Type	Measure Sub-Type	Measure Summary
Predation Management	Avian Predation Management and Monitoring Actions	Increase the normal forebay operating range at John Day Dam by two feet to increase operational flexibility and reduce suitable avian nesting habitat. These operations would be initiated prior to the start of nesting by Caspian terns, to avoid take.
Predation Management	Avian Predation Management and Monitoring Actions	Review the most recent monitoring and effectiveness evaluation information from a regionally sponsored synthesis report (estimated completion September 2020) and determine, in coordination with NMFS and USFWS, if any additional management actions at Action Agency-managed lands are warranted.
Predation Management	Avian Predation Management and Monitoring Actions	Implement and evaluate the Caspian Tern Management Plan and Double-crested Cormorant Predation Management Plan at East Sand Island in the Columbia River estuary, as well as the Inland Avian Predation Management Plan.
Habitat Improvement	Tributary	Implement targeted tributary habitat improvements as offsite conservation actions that address uncertainties related to any residual adverse effects of CRS management on ESA-listed migrating salmonids, climate variability, and other environmental factors.
Habitat Improvement	Tributary	Convene, support, and rely on the Tributary Habitat Steering Committee (THSC), which includes representatives from NMFS, Reclamation, and Bonneville, to focus implementation on priority populations.
Habitat Improvement	Tributary	Convene and oversee a science committee that provides technical input, recommendations, and quality assurance guidance to the THSC to ensure implementation of the tributary habitat program consistent with best available science and in ways that achieve the goals of the tributary habitat improvement program.
Habitat Improvement	Kootenai River Perched Tributary Actions	Contribute funding in 2021 for an initial assessment of blocked passage to bull trout key spawning tributaries identified by USFWS. Upon completion, USFWS will develop an action plan and prioritization process for tributaries identified as having blocked passage. Action Agencies will work with USFWS and stakeholders to identify and initiate a process to address 2 restoration and /or improvement projects benefitting upstream passage opportunities over the period of 2021–2026.
Habitat Improvement	Priorities	Ensure the THSC and Science Committee revisit population prioritizations on a regular basis (most thoroughly at 5 year intervals) to assure that the tributary habitat improvement program is focusing efforts where the greatest benefits to both near-term improvements and long-term recovery can be achieved.
Habitat Improvement	Priorities	Regularly review and adaptively manage the Tributary Habitat Improvement Program through a series of prospective 5-year implementation plans, and report annually on actions implemented.
Habitat Improvement	Priorities	Fund the tributary habitat RM&E and collaborate with NMFS, USFWS, Council, Tribes, and regional partners to develop and implement a Columbia Basin tributary habitat RM&E strategy that aligns with and supports the needs of the THSC and associated Science Committee.
Habitat Improvement	Priorities	Fund ongoing implementation and compliance monitoring (I&C) for completed habitat actions to ensure habitat improvement actions are implemented as planned (e.g., meeting construction design and environmental compliance requirements).
Habitat Improvement	Priorities	Support effectiveness monitoring related to habitat mitigation efforts at a range of scales including the site and watershed scales.
Habitat Improvement	Estuary	Implement the Columbia Estuary Ecosystem Restoration Program (CEERP) to reduce uncertainties related to the residual effects of the Proposed Action on listed salmonids, climate variability, and other environmental factors.

Measure Type	Measure Sub-Type	Measure Summary
Habitat Improvement	Estuary	Establish a 5-year rolling review period to evaluate, with NMFS, the acreage restored to date and the increase in restored acreage that is most likely to be accomplished in the following 5 years in the estuary, as well as to determine an annual acreage goal.
Habitat Improvement	Estuary	Coordinate with NMFS, Expert Regional Technical Group (ERTG), and resource practitioners to discuss the appropriate level of monitoring for a given site and for addressing critical or new uncertainties.
Habitat Improvement	Estuary	Collaborate with NMFS, sponsors, and the ERTG to further refine the approach to restoring estuary habitat.
Habitat Improvement	Estuary	Discuss relevant climate science with ERTG and regional partners and evaluate future estuary projects for resiliency in the face of climate change (i.e., sea level rise, increasing temperatures, and changes to mainstem flow levels).
Habitat Improvement	Kootenai River white sturgeon	Implement habitat actions in the Kootenai River to benefit Kootenai River white sturgeon, including: (1) the Braided Reach Restoration Strategy, (2) the Straight Reach Restoration Strategy, (3) the Meander Reach Restoration Strategy.
Habitat Improvement	Bull trout	Implement prioritized tributary habitat actions that provide biological benefit for the interior Columbia River Basin ESA-listed anadromous salmonid species in this consultation. When developing tributary habitat projects for salmon in areas where bull trout are present, proactively engage with USFWS to leverage benefits for bull trout where feasible. See section for examples.
Habitat Improvement	Spawning Habitat Augmentation at Lake Roosevelt	Supplement spawning habitat at locations up to 100 acres along reservoir and tributaries if results from Bonneville's ongoing study, initiated in 2019, determine that modifications in Lake Roosevelt refill would impact resident fish access to spawning habitat and success.
Habitat Improvement	Kootenai River White Sturgeon	Work with implementation partners, including the KTOI, IDFG, and existing advisory teams (e.g., Co-manager Advisory Team and Peer Review Advisory Team), to identify and prioritize additional restoration opportunities in the Braided Reach and Meander Reach. Each restoration opportunity incorporates a number of different restoration treatments and is designed to address reach-specific limiting factors and restoration strategies, which are grouped together into restoration nodes.
Habitat Improvement	Nutrient Additions	Support the existing nutrient addition program during the period of this consultation; fund this action through fiscal year 2025 and use RM&E results to inform future management decisions.
Habitat Improvement	Nutrient Additions	Investigate the feasibility and effectiveness of additional nutrient supplementation downstream of Libby Dam and use RM&E results to inform management decisions regarding future actions.
Habitat Improvement	Nutrient additions	By July 2022, work with the USFWS and MFWP to assess the benefit of adding nutrients to the Kootenai River near Libby Dam to improve primary productivity for bull trout forage and to develop and implement a plan for improving nutrient conditions in the Kootenai River through December 2025. Long-term (post 2025) actions to improve nutrient conditions shall be jointly agreed upon by USFWS and the Action Agencies.
Adaptive Management and Contingency Actions		If the ESA-listed anadromous salmon and steelhead species reach a threshold of concern or substantial departures from current trends are detected, work with federal, state and tribal sovereigns and other

Measure Type	Measure Sub-Type	Measure Summary
		appropriate parties in any region-wide diagnostic efforts to determine the causes of significant declines in the abundance of naturally produced salmon and steelhead.
Adaptive Management and Contingency Actions		Work with NMFS and USFWS to identify and operationalize potential contingencies actions should the need arise.
Take Avoidance and Minimization		Ensure all bull trout capture and removal operations are conducted by a qualified biologist, and all staff participating in the operation have the necessary knowledge, skills, and abilities to ensure safe handling of fish. i. Fish capture and removal operations shall take all appropriate steps to minimize the amount and duration of fish handling; ii. The operations shall ensure captured fish remain in water with appropriate temperatures to prevent and minimize stress to the maximum extent possible; iii. The Action Agencies shall ensure water quality conditions are adequate in the buckets or tanks used to hold and transport captured fish. The operations shall use aerators to provide for the circulation of clean, cold, well-oxygenated water, and/or shall stage fish capture, temporary holding, and release, to minimize the risks associated with prolonged holding; iv. Electrofishing methods, when necessary, shall use the minimum voltage, pulse width, and rate settings necessary to immobilize fish. Water conductivity shall be measured in the field before electrofishing to determine appropriate settings. Electrofishing equipment and methods shall comply with the electrofishing guidelines outlined by the NMFS (NMFS 2000c) or current equivalent; and v. Any bull trout encountered during salvage activities shall be reported and, when practical, collect biometric data (size, weight), PIT-tag and take a genetic clip. Bull trout captured during smolt monitoring sampling shall receive a PIT tag, have a genetic clip taken, and biometric data collected (size, weight). If the number of bull trout encountered is locally abundant, a subsample of captured and handled fish shall be PIT tagged with associated genetic and biometric data collected. All data will be reported annually.
Research, Monitoring, and Reporting	Bull Trout Monitoring at Lower Columbia and Lower Snake River Dams and Adaptive Management Actions	Monitor for bull trout at the lower Columbia and lower Snake River dams. The primary means of monitoring bull trout will be through the Corps' adult fish counts program, PIT detection arrays in fish ladders and JBSs, and through the Smolt Monitoring Program (SMP).
Research, Monitoring, and Reporting	Juvenile Fish Monitoring	Annually fund and implement the Shoreline Management Plan based on program objectives.
Research, Monitoring, and Reporting	Juvenile Fish Monitoring	Implement and maintain the Columbia River Basin Passive Integrated Transponder Information System (PTAGIS) to support NMFS' ongoing annual development of in-river juvenile salmon and steelhead survival estimates.
Research, Monitoring, and Reporting	Adult Fish Passage Monitoring	Visually count adult salmon, steelhead, and bull trout passing lower Columbia and lower Snake River dams.
Research, Monitoring, and Reporting	Adult fish ladder temperature differentials	Monitor and report to NMFS mainstem fish ladder temperatures and identify ladders that have substantial temperature differentials (>1.0C) and where beneficial and feasible evaluate alternative methods to reduce maximum temperatures and temperature differentials.

Measure Type	Measure Sub-Type	Measure Summary
Research, Monitoring, and Reporting	Adult Fish Passage Monitoring	Maintain PIT detection capability in adult fishways at the lower Columbia and lower Snake River dams as needed to support monitoring of adult salmon and steelhead survival through the CRS and monitoring of PIT-based fishway re-ascension rates to identify any potential passage delay or fallback issues.
Research, Monitoring, and Reporting	Adult Fish Passage Monitoring	In coordination with NMFS, USFWS, and other regional sovereigns, monitor adult ladder counts and PIT-based re-ascension rates to identify any potential delay or fallback issues that may be associated with proposed CRS operations or delays that may be associated with temperatures in the exit sections of fishways.
Research, Monitoring, and Reporting	Adult Fish Passage Monitoring	Monitor pinniped activity at Bonneville Dam, consistent with the monitoring plan to be developed in coordination with NMFS.
Research, Monitoring, and Reporting	Salmon and Steelhead Status Monitoring	Fund fish population status and trend monitoring of adults and juveniles in support of population viability assessments and life-cycle models in order of priority.
Research, Monitoring, and Reporting	Salmon and Steelhead Status Monitoring	Monitor juvenile and adult survival through federal mainstem dams: • Snake River (SR) sockeye • Upper Columbia and SR steelhead and Chinook salmon • Representative populations of Middle Columbia River (MCR) steelhead
Research, Monitoring, and Reporting	Salmon and Steelhead Status Monitoring	Implement elements of natural origin adult abundance monitoring for the Snake River fall Chinook ESU in cooperation with LSRCP and US v. Oregon and Idaho Power actions.
Research, Monitoring, and Reporting	Salmon and Steelhead Status Monitoring	Use new and emerging tools, techniques, and methods that assist with status and trend monitoring such as genetics (GSI or SNPs) and tagging for abundance.
Research, Monitoring, and Reporting	Evaluate Biological Effects of Increased Spill	Work with NMFS and other interested regional sovereigns to develop and implement a test of the relative influence of system operations on any direct or indirect effects on juvenile salmon and steelhead passage, survival, and condition and adult passage (delay, fallback, re-ascension). The details of study designs, as well as any subsequent adaptive implementation that may be needed if unintended consequences result from high spill levels, are detailed in the Adaptive Implementation Framework. Specific study design elements are being developed collaboratively.
Research, Monitoring, and Reporting	Investigate Shad Deterrence at Lower Granite Dam	Investigate the feasibility of deterring adult shad from approaching and entering the Lower Granite Dam adult fish trap, alleviating the need to remove shad from the trap while processing adult salmon and steelhead, and thereby reducing stress and delay for ESA-listed target species. If feasible, implement operational or small-scale structural measures to address this issue. Any associated evaluations or changes in fishway operations or configurations will be coordinated with the appropriate regional coordination forums (e.g., FPOM).
Research, Monitoring, and Reporting	Biological Testing of Improved Fish Passage Turbines	As additional turbine unit runners are replaced at Ice Harbor, McNary, and John Day dams, conduct additional direct injury and survival studies or other evaluations, as necessary, to inform turbine designs and verify their biological effectiveness. Develop particular study objectives and needs with NMFS, USFWS, and other regional sovereigns through the Studies Review Work Group.
Research, Monitoring, and Reporting	Annual BiOp Implementation Reporting	Coordinate implementation planning and progress reporting with the USFWS and NMFS to inform and signal appropriate adaptations to changing circumstances. In addition to the information and reports (Table 2.21), work with the Services during the consultation to further identify information and reporting needs.

Measure Type	Measure Sub-Type	Measure Summary
Research, Monitoring, and Reporting	Evaluate Adult Reach Survivals	Annually estimate adult survival through key reaches of the migration corridor (Bonneville to Lower Granite dam for Snake River species and Bonneville to McNary Dam for Upper Columbia and Middle Columbia River species) in accordance with the PIT-tag conversion rate methodology used in NMFS's Biological Opinion, compare averages of the resulting annual mortality estimates (1-survival) to the values reported in Table 2.17-1, and inform NMFS of the results of this comparison.
Research, Monitoring, and Reporting	Evaluate Juvenile Reach Survivals	In coordination with NMFS through the annual planning process, annually estimate juvenile survival rates of Snake River spring/summer Chinook salmon, sockeye salmon, and steelhead from Lower Granite to Bonneville dam and UCR spring-run Chinook salmon and steelhead and MCR steelhead from McNary to Bonneville Dam between dams with PIT tag detectors in accordance with the methods used in NMFS's Biological Opinion. In addition, continue to support and fund studies to assess the survival, growth, and life history attributes of wild juvenile Snake River fall Chinook salmon.
Research, Monitoring, and Reporting	Monitor Effects of Dissolved Gas Supersaturation and Ladder Temperatures	Monitor TDG (including Hungry Horse, Libby, Grand Coulee, Chief Joseph, and Dworshak Dams, and the lower Snake and lower Columbia River dams) and associated biological impacts in the lower Snake and Columbia rivers in coordination with the mid-Columbia Public Utility Districts. Monitor and report the temperature differentials in all CRS adult fishways.
Research, Monitoring, and Reporting	Monitor Monthly Project Specific Excursions above the One Percent Peak Efficiency Range for Turbines at Mainstem Snake and Columbia River Dams	Monitor project specific excursions above the one percent peak efficiency range (both magnitude and duration) for turbine units at individual lower Snake and lower Columbia river dams on a monthly basis and compare these results to the information related to the expected frequencies and magnitudes of these incidents analyzed in NMFS's Biological Opinion. Summarize and report this information to NMFS in 2023 and at least every 3 years thereafter.
Research, Monitoring, and Reporting	Incidental Take Monitoring Reports	Report numbers of adult eulachon observed in samples from the juvenile bypass system at Bonneville Dam and annually provide this number to NMFS.
Research, Monitoring, and Reporting	Incidental Take Monitoring Reports	Submit using the Authorization and Permits for Protected Species (APPS) online reporting system or other NMFS-approved system the annual ESA take authorization applications and annual ESA take monitoring reports and for all RME programs identified in this incidental take statement (including the SMP/CSS and the NPMP).
Research, Monitoring, and Reporting	Implementation Progress Reporting	Report progress in implementing the Fish Passage Plan in a timely manner; providing 7-day Corps project adult/juvenile facility reports (including ESA and non-ESA fish mortalities) and 7-day fish transportation summaries to NMFS and FPOM via electronic mail once a week. In addition, provide facility reports and transportation summaries to NMFS and FPOM once a year in electronic format.
Research, Monitoring, and Reporting	Implementation Progress Reporting	Annually report to NMFS by February 15 of each year on the progress of action implementation.
Research, Monitoring, and Reporting	Implementation Progress Reporting	Monitor TDG levels in representative raceways and barges to assess the effect of increased TDG levels resulting from proposed flexible spill operations to ensure that transported juveniles are being safely collected and transported.
Research, Monitoring, and Reporting	Implementation Progress Reporting	Within 4 months of beginning implementation of the proposed action, ensure the THSC agrees on deadlines for submission of annual implementation reports and the 5-year comprehensive reviews.

Measure Type	Measure Sub-Type	Measure Summary
Research, Monitoring, and Reporting	Operational Reporting and Notification Requirements (for Protocol Change Requests and Take Limit Exceedance):	Follow the Operational Reporting and Notification Requirements set forth in NMFS's 2020 ITS..
Research, Monitoring, and Reporting	Kootenai River White Sturgeon	Provide a status report on the Kootenai River Habitat Restoration Program that includes a comprehensive assessment of the performance of projects implemented through 2025, a full roster of the entities who provided input into the process, and a notification to USFWS on how the Action Agencies will use the information and recommendations in the report, and the decision by the Action Agencies as to how they will proceed with regard to the restoration program for the duration of the Biological Opinion.
Research, Monitoring, and Reporting	Snake and Lower Columbia River Dams	By December 31, 2020, in coordination with USFWS, review the current fish count program, existing bull trout count/observation data, and clarify potential fish count program changes needed to inform CRS operations related to bull trout. If needed, develop a plan to increase video and visual monitoring at select Snake River and lower Columbia River dam adult passage facilities for at least five years. The proposed plan will include the following elements: 1. Increased winter (December through March) monitoring at Snake River and McNary Dams; 2. Visual monitoring during primary bull trout migration periods and hours as identified by USFWS, particularly in April, May and June; and 3. Timelines for implementing additional monitoring.
Research, Monitoring, and Reporting	Snake and Lower Columbia River Dams	At the end of five years (no earlier than June 2025), prepare a summary of bull trout observations at the passage facilities (from USFWS BiOp 17.2(1)a(i)) that includes: 1. Total observations 2. Directional movement (i.e. number of bull trout observed moving upstream, number moving downstream) 3. Month and timing (hours of the day) of passage 4. A proposal for how monitoring may continue for remainder of the Proposed Action, based on observation data.
Research, Monitoring, and Reporting	Snake and Lower Columbia River Dams	Within five years (June 2025), in coordination with USFWS, review existing information on physical and hydraulic conditions within the adult fish ladders (including approaches to fishway entrances), adult and subadult (10 inches in length or greater) bull trout swimming ability, bull trout distribution and migration behavior within the lower Snake River and lower Columbia River, and other studies (including, if appropriate, results of passage studies involving anadromous salmonids or studies at similar dam passage facilities (i.e. Mid-Columbia Public Utility District dams)) to identify key data gaps and opportunities that may inform operation and/or configuration changes to improve bull trout passage.
Research, Monitoring, and Reporting	Snake and Lower Columbia River Dams	Within two years (July 2022), convene, in coordination with the Services, a workshop to review existing information on seasonal passage routes used by adult and subadult bull trout for downstream passage at McNary and the lower Snake River dams in accordance with the FWS Biological Opinion. Following completion of the workshop, , in coordination with the Services and appropriate Regional Forum work groups, determine if additional data collection is feasible and needed to inform operation and/or configuration changes to improve bull trout passage. Implement passage studies, if feasible and warranted,

Measure Type	Measure Sub-Type	Measure Summary
		where study goals, objectives, and methods are developed in coordination with the Services and other regional sovereigns through the Studies Review Work Group.
Research, Monitoring, and Reporting	Snake and Lower Columbia River Dams	Within two years (June 2022), in coordination with USFWS, review and evaluate the PIT detection array infrastructure at mainstem dams and determine whether additional sites are needed to track movements of PIT-tagged bull trout through all downstream passage routes.
Research, Monitoring, and Reporting	Snake and Lower Columbia River Dams	Assess and minimize to the greatest extent possible the duration of maintenance closures at the lower Snake River and Lower Columbia River dams.
Research, Monitoring, and Reporting	Snake and Lower Columbia River Dams	Monitor for presence of bull trout in raceways and juvenile fish transport barges through the SMP. If bull trout are detected in the raceways or barges, in coordination with USFWS and NMFS, develop methods to reduce, minimize or eliminate the incidental transport of bull trout in barges, if reasonable and feasible.
Research, Monitoring, and Reporting	Snake and Lower Columbia River Dams	Within five years (July 2025), in coordination with USFWS, investigate the feasibility of using eDNA sampling procedures to assess the level of incidental bull trout transport occurring in juvenile transport barges. If eDNA sampling is determined to be an appropriate means of collecting the desired data that could inform changes to the transport program that would reduce or eliminate incidental bull trout transport, implement an eDNA monitoring study.
Research, Monitoring, and Reporting	Libby Dam	Work with local Federal, State and Tribal biologists to monitor bull trout conditions in tributaries to the Kootenai River and implement additional measures if necessary under the FWS biological opinion terms and conditions.
Research, Monitoring, and Reporting	Mainstem habitat	By July 2022, complete, in coordination with the USFWS, a baseline inventory of existing mainstem riparian habitat hydraulically-influenced by operation of the CRS within the Action Area (as defined in Section 5.9) using the latest GIS remote sensed and ground-truthed data sets, including, but not limited to, LANDFIRE or LF, USFWS' Wetlands mapper, multi-resolution land characteristics or MRLC, and State riparian and wetland datasets. In addition, the Action Agencies and USFWS may use or create new GIS imagery (e.g., using DigitalGlobe or other sources) and on-the-ground spot checks to further refine and assess existing riparian conditions.
Research, Monitoring, and Reporting	Mainstem habitat	Every five years following establishment of the baseline (described in USFWS BiOp 17.2(2)a), evaluate riparian habitat in coordination with the USFWS, either at selected index sites identified in the baseline inventory, or by conducting a complete, comprehensive review of the Action Area using methods similar to those used in establishing the baseline, to determine if riparian losses due to operation of the CRS exceed the 8 percent threshold set forth in the USFWS Biological Opinion. If said losses exceed the threshold, work with the USFWS to identify measures that could be implemented to improve riparian conditions prior to the next five-year review.
Research, Monitoring, and Reporting	Tributary habitat	Provide a report to the USFWS every five years summarizing projects completed under the Tributary Habitat Program that have resulted in benefits to bull trout populations.
Research, Monitoring, and Reporting	Mainstem habitat	Within eight years (July 2028), assess existing research and available data (similar in scope to Torgersen et al 2012, EPA 2019 or Mejia et al 2020) to determine existing nearshore habitat and cold water refugia in the Snake River from the mouth of the Clearwater to Columbia River to identify opportunities for restoration and protection of those areas and/or operational actions to minimize loss of refugia areas.

Measure Type	Measure Sub-Type	Measure Summary
Research, Monitoring, and Reporting	Turbidity	Monitor turbidity levels during sediment-generating activities at construction sites as set forth in the FWS Biological Opinion.
Research, Monitoring, and Reporting	Genetic sampling	Provide genetic tissues collected during implementation of the Proposed Action or associated mitigation activities consistent with the FWS Biological Opinion.
Research, Monitoring, and Reporting	Data management	Incorporate monitoring data into an existing site or database(s), or if necessary, develop a reporting site or database(s), for bull trout observations funded or implemented by the Action Agencies (including smolt monitoring programs, PIT arrays, and other monitoring programs) under the Proposed Action in association with dam operations, research, monitoring and evaluation. Database(s) shall be selected and/or updated with input from the Regional Forums for data to be queried by dam, date, passage facility or passage route (PIT arrays), source population (genetics, if available) or tagging location, and other information identified by the USFWS at FPOM; and
Research, Monitoring, and Reporting		Every five years by December 31, in combination with regular summary updates at regional forums, provide a report to the appropriate USFWS field offices as outlined in the ITS.