DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NORTHWESTERN DIVISION
PO BOX 2870
PORTLAND OR 97208-2870

2022 Fish Operations Plan

1. INTRODUCTION

The 2022 Fish Operations Plan (2022 FOP) describes the U.S. Army Corps of Engineers' (Corps) planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2022 spring and summer fish migration seasons, generally April 3 through August 31. The 2022 FOP is consistent with spill operations for juvenile fish passage and the regional forum process for adaptive management and in-season management provisions outlined in the Record of Decision for the Columbia River System Operations Environmental Impact Statement (CRSO EIS ROD) dated September 28, 2020, CRSO Final EIS, 2020 National Marine Fisheries Service (NMFS) Columbia River System and U.S. Fish and Wildlife Service Biological Opinions (2020 BiOps)[1], the Extensions of the 2008 Columbia Basin Fish Accords (Accord Extensions), the Corps' requirements under the Endangered Species Act (ESA), and the ongoing consultation and communications with the relevant wildlife agencies to ensure consistency with the Act. The 2022 FOP also incorporates spill operations agreed to in the Term Sheet for Stay of Preliminary Injunction Motion and Summary Judgment Schedule (referred to as the 2022 Agreement) for the *NWF et al. v. NMFS et al.* (3:01-cv-00640-SI) litigation. Other project operations and water management actions not specifically addressed in this document will be consistent with other guiding operative documents, including the 2022 Water Management Plan (WMP), seasonal WMP updates, and the 2022 Fish Passage Plan (FPP).

In addition to discussing project-specific fish passage spill operations, the 2022 FOP identifies factors that the Corps, the Bureau of Reclamation (Reclamation), and the Bonneville Power Administration (Bonneville) (collectively referred to as the "Action Agencies") must address in the context of operating this complex system of fourteen multiple purpose projects. The 2022 FOP includes a discussion of how the Corps manages fish passage spill and total dissolved gas (TDG), identifies Planned and Routine Operational Adjustments (Section 4) that influence fish passage spill, addresses adaptive management and in-season management processes for fish passage spill and other fish operations including the juvenile fish transportation program, and describes the Corps' monthly implementation reports.

[1] The Corps, in coordination with the other Action Agencies, and NMFS, employs the Regional Implementation Oversight Group (RIOG) and technical teams including the Technical Management Team (TMT) and Fish Passage Operations & Maintenance (FPOM) coordination group, to coordinate with state, tribal and other federal experts for recommendations for implementing operations consistent with the 2020 BiOps.

2. MANAGEMENT OF SPILL FOR FISH PASSAGE AND TDG

2.1. State Water Quality Standards for TDG

The Corps will manage spill for fish passage in 2022 consistent with the State of Washington and the State of Oregon total dissolved gas (TDG) water quality standards (WQS).[2,3] The State of Washington, Department of Ecology (WADOE) adopted a WQS rule change which became effective in 2020 allowing spring juvenile fish passage spill operations to generate specified TDG levels in project tailraces (up to 125% TDG 12 hours, 126% TDG 2 hours), so long as the specified conditions are met, including that spring juvenile fish passage spill operations do not exceed the spill levels and durations reviewed in applicable ESA consultation documents. The Environmental Protection Agency (EPA) subsequently approved the rule change and found that the ESA consultation documents language ensures that any spring spill regime using the revised criteria must be performed in accordance with the spill levels and durations evaluated in ESA consultation documents for effects to ESA-listed species of all life stages, including juvenile out-migrating salmonids, resident salmonids, and adult migrating salmonids. EPA's approval of the rule further states that "compliance with the ESA consultation documents is a condition precedent for the revised criteria and so the criteria are not applicable for the purposes of the [Clean Water Act (CWA)] (i.e. have no effect for CWA purposes) without the ESA consultation documents addressing spill operations that result in TDG saturation levels above the pre-existing criterion." *Letter to WADOE from EPA Re: The EPA's Action on Revisions to the [WADOE's] Surface Water Quality Standards for the Site-Specific Total Dissolved Gas Criteria in the Columbia and Snake Rivers, and Other Water Quality Standards Revisions* dated March 5, 2020, page 9.

The State of Oregon, through its Environmental Quality Commission, approved a change to its TDG WQS (up to 125% TDG 12 hours, 127% TDG 2 hours), so long as spring spill is "applied in a manner consistent with the applicable requirements of the federal [ESA]." *Order Approving a Modification to the Oregon's Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem* dated February 11, 2020, page 4. Both states have thus accommodated levels of TDG above 110% for fish passage spill operations for ESA-listed juvenile salmonids at Corps projects on the lower Snake and lower Columbia rivers, as follows:

---

[2] WASH. ADMIN. CODE § 173-201A-200(l)(f)) provides the maximum TDG criteria for each of the aquatic life use categories and displays Table 200 (I)(f) that states: "Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection." The code also addresses exceptions and adjustments, including a provision allowing for an adjustment of the TDG criteria to aid fish passage over hydroelectric dams. *See* https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-200.

[3] OR. ADMIN. R. 340-041-0031 provides in part: "the concentration of TDG relative to atmospheric pressure at the point of sample collection may not exceed 110 percent of saturation." OR. ADMIN. R. 340-041-104(3) identifies findings the Environmental Quality Commission must make for the purpose of allowing increased spill for salmon migration. *See* https://www.oregon.gov/deq/wq/Documents/columbiaUSACEtmdlorder.pdf

Washington Administrative Code:

WAC 173-201A-200(1)(f)(ii) and WAC 173-201A-200(1)(f)(ii)(A)

(ii) The TDG criteria may be adjusted to aid fish passage over hydroelectric dams that spill for anadromous juvenile fish as of the 2020 spill season. The elevated TDG levels are intended to allow increased fish passage without causing more harm to fish populations than caused by turbine fish passage. The following special fish passage exemptions for the Snake and Columbia Rivers apply when spilling water at dams is necessary to aid fish passage:

(A) TDG must not exceed:

• An average of one hundred fifteen percent as measured in the forebays of the next downstream dams and must not exceed an average of one hundred twenty percent as measured in the tailraces of each dam (these averages are calculated as an average of the twelve highest hourly readings in a calendar day, relative to atmospheric pressure); and
• A maximum TDG saturation level of one hundred twenty-five percent calculated as an average of the two highest hourly TDG measures in a calendar day during spillage for fish passage.

WAC 173-201A-200(1)(f)(ii)(B)

(B) To further aid fish passage during the spring spill season (generally from April through June), spill may be increased up to the following levels as measured at the tailrace fixed site monitoring location:

• A maximum TDG saturation level of one hundred twenty-five percent calculated as an average of the twelve highest hourly TDG measures in a calendar day: and
• A maximum TDG saturation level of one hundred twenty-six percent calculated as an average of any two-consecutive hourly TDG measures. These TDG criteria may be applied in place of (f)(ii)(A) of this subsection during spring spill operations when applied in accordance with the following conditions:

(I) In addition to complying with the requirements of this chapter, the tailrace maximum TDG criteria at hydropower dams shall be applied in accordance with Endangered Species Act consultation documents associated with spill operations on the Snake and Columbia rivers, including operations for fish passage. The Endangered Species Act consultation documents are those by which dams may legally operate during the time that the adjusted criteria in (f)(ii)(B) of this subsection are in use.

(II) Application of the tailrace maximum TDG criteria must be accompanied by a department approved biological monitoring plan designed to measure impacts of fish exposed to increased TDG conditions throughout the spring spill season. Beginning in the year 2021, plans must include monitoring for non-salmonid fish species and must continue for a minimum of five years, and thereafter as determined by the department.

(III) TDG must be reduced to allowances specified in (f)(ii)(A) of this subsection if the calculated incidence of gas bubble trauma in salmonids (with a minimum sample size of

fifty fish required weekly) or non-salmonids (with a minimum sample size of fifty fish required weekly) exceeds:

- Gas bubble trauma in non-paired fins of fifteen percent; or
- Gas bubble trauma in non-paired fins of five percent and gas bubbles occlude more than twenty-five percent of the surface area of the fin.

If gas bubble trauma exceeds these biological thresholds, additional monitoring must demonstrate the incidence of gas bubble trauma below biological thresholds before TDG can be adjusted to allowances specified in this subsection. Gas bubble trauma monitoring data shall be excluded from comparison to biological thresholds when higher than normal river flow contributes to excess spill above the ability to meet (f)(ii)(B) of this subsection. This monitoring data exclusion shall apply for one full calendar day after reduced river flow allows attainment of (f)(ii)(B) of this subsection.

Oregon Water Quality Standard Modification:

The Environmental Quality Commission approves the following modification to the statewide standard for total dissolved gas (OAR 340-41-0031(2)) of 110 percent for the lower Columbia River at McNary, John Day, The Dalles and Bonneville dams, as provided for in OAR 340-41-0104(3):

1. The total dissolved gas standard for the Columbia River as measured in the tailraces of McNary, John Day, The Dalles, and Bonneville dams is 125 percent for the period from April 1 through June 15.

2. The total dissolved gas standard for the Columbia River as measured in the tailraces of McNary, John Day, The Dalles, and Bonneville dams is 120 percent for the period from June 16 through Aug. 31.

3. These limits do not apply when the stream flow exceeds the seven-day, ten-year frequency flood.

4. The DEQ Director may approve additional periods of application of this modification, beyond the April 1 to Aug. 31 period, subject to subsections 7.a) to 7.d) for reasons including passing Spring Creek Hatchery fish releases, maintenance activities, and biological or physical studies of spillway structures and prototype fish passage devices. The Corps must notify DEQ in writing describing the purposed action, the purpose of the action and dates of action at least one week prior to the spill. The Corps must obtain written approval from the Director prior to such spill.

5. The modified total dissolved gas standards will apply for five years, 2020, 2021, 2022, 2023 and 2024.

6. Voluntary fish passage spill during the spring spill season, occurring from April 1 through June 15, is subject to the following conditions:

a) Spill at a dam must be reduced when:

i. Instantaneous total dissolved gas levels exceed 127 percent of saturation, calculated as the average of any two-consecutive hourly TDG measurements in the tailrace of the dam; or

ii. The average of the twelve highest hourly TDG measurements in the tailrace of the dam in a calendar day exceeds 125 percent.

b) Spill at a dam must be reduced to 120 percent as calculated in 7.a)i. when:

i. The calculated incidence of gas bubble trauma in salmonids (with a minimum sample size of fifty fish required weekly) or non-salmonids (with a minimum sample size of fifty fish required weekly) exceeds gas bubble trauma in non-paired fins of fifteen percent, or gas bubble trauma in non-paired fins of five percent and gas bubbles occlude more than twenty-five percent of the surface area of the fin. If gas bubble trauma exceeds these biological thresholds, additional monitoring must demonstrate the incidence of gas bubble trauma below biological thresholds before TDG can be increased to the level specified in this order. Gas bubble trauma monitoring data shall be excluded from comparison to biological thresholds when higher than normal river flow contributes to excess spill above 125 percent. This monitoring data exclusion shall apply for one full calendar day after reduced river flow allows attainment of 125 percent TDG levels in the tailrace of the dam.

c) The tailrace maximum TDG criteria for spring spill in this modification will be applied in a manner consistent with the applicable requirements of the federal Endangered Species Act.

d) Physical monitoring must occur and be adequate for implementing the requirements of this order.

e) Application of the tailrace maximum TDG criteria must be accompanied by a DEQ-approved biological monitoring plan designed to measure impacts to fish exposed to increased TDG conditions throughout the spring spill season. Beginning in the year 2021, plans must include monitoring for non-salmonid fish species. Gas bubble trauma monitoring for juvenile salmonids may be halted if there is a high mortality risk due to compounded effects of the evaluation procedure and adverse environmental factors such as high stream temperatures.

7. Voluntary fish passage spill during the summer spill season, occurring from June 16 through Aug. 31, is subject to the following conditions:

a) Spill at a dam must be reduced when:

i. The average of the twelve highest hourly TDG measurements in the tailrace of the dam in a calendar day exceeds 120 percent of saturation; or

ii. Instantaneous total dissolved gas levels exceed 125 percent of saturation in the tailrace of the dam, calculated as the average of the two highest hourly total dissolved gas measures in a calendar day.

b) The DEQ Director may halt the voluntary spill program or require reductions in voluntary spill to reduce TDG levels if voluntary spill results in biological threshold exceedances when:

i. More than 15 percent of salmonids examined show signs of gas bubble disease in their non-paired fins, or

ii. More than five percent of salmonids examined show signs of gas bubble trauma in their non-paired fins where more than 25 percent of the surface area of the fin is occluded by gas bubbles.

c) Physical monitoring must occur and be adequate for implementing the requirements set out in this order.

d) Application of the tailrace maximum TDG criteria must be accompanied by a DEQ-approved biological monitoring plan designed to measure impacts to fish exposed to increased TDG conditions throughout the summer spill season. Beginning in the year 2021, plans must include monitoring for non-salmonid fish species. Gas bubble trauma monitoring for juvenile salmonids may be halted if there is a high mortality risk due to compounded effects of the evaluation procedure and adverse environmental factors such as high stream temperatures.

The terminology that has been adopted to refer to the State TDG WQS is the "gas cap." Gas cap spill is spill to the maximum level that meets, but does not exceed, the TDG criteria allowed under state law. In its implementation of spill for fish passage, the Corps will operate its fish passage projects in 2022 to the spill levels identified in the CRSO EIS ROD, 2020 BiOps, 2022 Agreement, and in accordance with the State TDG standards described above, including applying the different state calculation methodologies. When the standards vary or conflict, the Corps will apply the more stringent standard.

2.2. Spill Caps

The Corps' Reservoir Control Center (RCC) is responsible for daily management of spill operations responsive to changing conditions to manage TDG within all applicable State standards. To accomplish this, the RCC determines "spill caps" for each of the Corps' lower Columbia and lower Snake River projects daily throughout the fish passage spill season. Spill caps are the maximum spill level at each project that is estimated to meet, but not exceed, the gas cap. In spring 2022, the spill cap will be the hourly target spill level for a portion of the day as described below in Section 6, Table 3.

To calculate spill caps, the Corps evaluates observed and forecasted variables that influence TDG levels, including: (1) environmental conditions (e.g., total flow, wind, ambient temperature, barometric pressure, and incoming TDG from upstream); and (2) project operations (e.g., spill

level, spill pattern, tailwater elevation, proportion of flow through the turbines, and project configuration).

During spill for fish passage, the Corps reviews spill caps daily and adjusts as necessary to define the maximum spill level that maintains TDG within applicable State standards. Additional information about how the Corps will manage TDG is described in the 2022 Water Management Plan (see Appendix 4: TDG Management Plan)[4].

Higher spill than the target spill levels identified in Tables 3 and 4 may occur due to high river flow that exceeds powerhouse hydraulic capacity or due to a lack of power demand (load). During periods when spill is greater than the spill cap due to lack of load conditions, the Corps manages excess TDG on a system-wide basis by incrementally increasing spill at projects throughout the system in the order of priority defined in the Spill Priority List[5]. For this purpose, the RCC also defines spill rates to target multiple TDG levels in project tailraces that exceed the gas cap. The order of priority is coordinated with regional sovereigns in the Technical Management Team (TMT) to allocate spill to projects to best manage system TDG while also considering how best to protect fish and other aquatic biota.

3. SPILLWAY OPERATIONS AND SPILL LEVEL PRECISION

The Corps plans to achieve the target spill levels defined in Tables 3 and 4 to the extent feasible; however, actual hourly spill levels at each dam may vary depending on the precision of the spillbay gate settings, real-time fluctuations in flow and/or project head, or automatic load following. At each project, spill is distributed across the spillway according to patterns defined in the project-specific chapters of the FPP[6] to provide favorable fish passage conditions.

Spillbay gates are opened to the settings identified in the FPP spill pattern table that correspond to the spill level that is closest to the target but may be slightly higher or lower than the target spill level. Due to these physical limitations in spill level precision, the observed hourly average spill level may vary ±2 kcfs when the target spill is a flow rate (e.g. kcfs) and ±1% when the target spill is a percentage. Not all projects are able to achieve this level of precision (e.g. Little Goose, The Dalles, and Bonneville Dams). More information regarding project specific spill precision limitations may be found in Section 8 below.

Snake River projects make spillbay gate setting changes as soon as feasible in response to target spill changes; however, there may be instances when spill level changes are delayed by up to 1 hour or more due to operation of the navigation locks.

---

[4] The Water Management Plan (WMP) and associated appendices are updated annually. *See* http://pweb.crohms.org/tmt/documents/wmp/2022/.
[5] http://pweb.crohms.org/tmt/documents/spill-priority/
[6] The FPP is coordinated annually with regional sovereigns through the FPOM. *See* http://pweb.crohms.org/tmt/documents/fpp/2022/.

4. MODIFICATIONS TO PLANNED OPERATIONS AND IN-SEASON MANAGEMENT

For planning purposes, the operations described in the 2022 FOP assume average runoff conditions. Actual runoff varies in magnitude and timing and observed river flow may be higher or lower than average at any time such that modifications to the planned operations may be required. To accommodate these varying runoff conditions and other routinely observed conditions as they arise, the Corps, in conjunction with the other Action Agencies and NOAA Fisheries, coordinates with regional sovereigns on these conditions and other planned operations through the review of the 2022 FOP prior to spring spill operations (see section 4.1). The Corps responds in real-time to these routine conditions and planned operations by implementing adjustments as conditions require without additional coordination.

For unanticipated and unplanned conditions that are not pre-coordinated, the Corps responds as necessary to adjust to the condition, and when possible, will use the existing regional coordination process[7] to adaptively manage and make necessary in-season adjustments in spill and other fish operations (e.g., spill levels, spill caps, spill patterns, juvenile fish transportation, and pool operating ranges).

4.1. Conditions that May Require Adjustments to Planned Operations

Under certain conditions or circumstances, the Corps may be required to adjust spill higher or lower than the target spill level at one or more projects.

<u>Planned and Routine Operational Adjustments:</u>[8]

1. High flow conditions that exceed powerhouse hydraulic capacity and require spilling more than the target spill level.
2. Low flow conditions that require adjustments in spill level while maintaining project minimum generation requirements (see section 4.3.1. below).
3. Lack of power demand (load) resulting in increased spill.

---

[7] In-season adaptive management changes in spill levels could include adjustments that address unintended biological consequences caused by spill (e.g., adult passage delays), for the juvenile fish transportation program, for research activities for studies to evaluate fish passage facilities, survival, or other fish-related issues. Spill patterns and biological testing protocols that have not been coordinated to-date will be considered through the regional coordination process using the Corps' Anadromous Fish Evaluation Program (AFEP) subcommittees, which include the TMT, the Studies Review Workgroup (SRWG), Fish Facility Design Review Work Group (FFDRWG), and FPOM.

[8] Planned and Routine Operational Adjustments are spill adjustments due to (1) conditions that occur routinely every year (e.g., high or low flow), or (2) planned operations (e.g., scheduled maintenance, transit of fish transport barge in the tailrace). These are considered pre-coordinated through regional sovereign review of the FOP and the FPP and are implemented by the Action Agencies as conditions require and without additional coordination through the regional forum processes. Spill adjustments due to routine or planned operations are included in the monthly FOP Implementation Report in the hourly spill and flow charts (plots), and conditions with an (*) are reported in the "Pre-Coordinated Operations" Table. The FPP (Appendix A) identifies actions with pre-coordinated dates.

4. Operational limitations, for example physical limitations of gate settings, spill patterns (see section 3), forebay elevation, and deadband[9].
5. Scheduled turbine unit and/or transmission outages that reduce powerhouse hydraulic capacity and require spilling more than the target spill level.*
6. Standard operations for transmission reliability (see section 4.4.1. below)*
7. Navigation safety concerns (see section 4.6. below).*
8. Transition periods between Gas Cap spill and Performance Standard[10] spill hours may result in actual hourly spill levels that are slightly higher or lower than targeted spill levels.

Non-routine or Unplanned Operational Adjustments:[11]

1. Contingency operations for transmission reliability (see section 4.4.2 below).
2. Fish emergencies (e.g., high river temperatures that exceed levels safe for fish, adult fish passage blockages, actionable incidence of gas bubble trauma (GBT) incidence rates in either juvenile salmonids or native, non-salmonids[12], etc.).
3. Conditions related to project safety (e.g., erosion), health and human safety, navigation, or other unforeseen events that require spilling more or less than the target spill level.[13]
4. Other circumstances including human or programming error, unscheduled maintenance or outage, and other unanticipated events or emergencies.
5. In-season adjustments following adaptive management coordination through the existing regional coordination process (see section 4).

4.2. TMT Emergency Protocols

The Corps and the other Action Agencies operate the fourteen Columbia River System projects in emergency situations in accordance with the 2022 WMP Emergency Protocol (WMP Appendix 1). This protocol identifies the process the Action Agencies, in coordination with NOAA Fisheries, use in the event of an emergency concerning project operations that impact

---

[9] Deadbands occur when turbine outflow cannot achieve some flow ranges. When targeting spill as a percent of outflow, these deadbands will result in a spill percentage that is above or below the target percentage at certain outflows.

[10] "Performance standard" spill is a NMFS term and refers to spill levels intended to meet NMFS' performance standard testing, as described in the 2008 Biological Opinion and accompanying administrative record.

[11] Spill adjustments that occur due to non-routine or unplanned conditions or operations are implemented by the Action Agencies as conditions require and/or as coordinated with regional sovereigns through the in-season adaptive management process. Non-routine or Unplanned Operational Adjustments that affect spill levels are reported in the FOP Implementation Report Variance Table (and when warranted, a description may also be included in the Operational Adjustments section). When a Non-routine or Unplanned Operational Adjustment does not affect spill levels, information about this is provided in the Operational Adjustments section. If an adjustment continues into the next month, the adjustment is reported in the Pre-Coordinated Operations Table.

[12] *See* WAC 173-201A-200(1)(f)(ii)(B)(III) and *Order Approving a Modification to the Oregon's Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem*, page 5.

[13] When a generator requires repair, ongoing operations may require modification in order to prepare a turbine unit for the necessary maintenance without further damaging infrastructure or jeopardizing personnel safety. In order to safely install taillogs in a unit adjacent to the spillway, it may be necessary to cease spill through some spillbays for up to 6 or more hours during the installation of the physical barriers to isolate the area and subsequently dewater the draft tube environment. An alternate spill pattern for use during the maintenance period using the remaining spillbays will be coordinated through FPOM.

planned fish protection measures. The emergency protocols also address the process for coordination with regional sovereigns.

The most recent version of the Emergency Protocols is located at:
http://pweb.crohms.org/tmt/documents/wmp/2022/Appendices/Appendix_1_Emergency_Protocols_July_16_2008_with-ATTACHMENT-1.pdf

4.3. Low Flow Operations

4.3.1. Minimum Generation

All lower Snake and lower Columbia River dams have a minimum generation requirement that has been established to support power system reliability (see section 4.4.). The Corps has identified minimum generation powerhouse outflow values derived from the lower limit of the ±1% peak efficiency operating range defined in the project-specific chapters of the FPP and from actual generation records (see Table 1). Values stated in Table 1 are approximate ranges that account for varying head or other small adjustments in turbine unit operation that may result in variations from the reported minimum generation flow and spill amount. Conditions that may result in minor variations include:

1. Varying reservoir elevation: as reservoirs fluctuate within the operating range, flow rates through the generating unit change.
2. Generating unit governor deadband: the governor controls the number of megawatts the unit should generate but cannot precisely control a unit flow; variations may be 1-2% or more of unit flow. These variations can affect minimum generation ranges in Table 1.
3. System disturbances: once a generator is online and connected to the grid, it responds to changes in system voltage and frequency. These changes may cause the unit to increase or decrease flow and generation within an hour. Individual units operate differently from each other and often have unit specific constraints.
4. Generation control systems regulate megawatt (MW) generation only, not flow through individual turbine units.

All of the lower Snake River powerhouses may be required to keep one generating unit[14] online at all times for power system reliability under low river flow conditions, which may result in a reduction of spill at that project if there is insufficient flow in the river. Generally, units 1–3 are the priority units for operation during the fish passage season for adult fish attraction flow to the fish ladders, but unit priority is also based on availability. During low river flow conditions, the Corps operates the lower Snake River and lower Columbia River projects to the unit priority order specified in the FPP and minimum generation ranges identified in Table 1.

[14] Two generating units may be necessary at Ice Harbor Dam during elevated temperatures in order to meet transmission requirements.

Table 1.— Minimum generation flow ranges (kcfs) for turbine units at Corps hydropower projects on the lower Snake and lower Columbia rivers.[15]

Project	Turbine Unit	Minimum Generation Flow Range[A] (kcfs)
Lower Granite	1, 3	11.8 – 12.9
	2[B]	17.5 – 18.5
	4, 5, 6	13.7 – 14.8
Little Goose	1, 2, 3	11.3 – 11.8
	4, 5, 6	13.8 – 14.4
Lower Monumental	1, 2, 3	11.1 – 12.3
	4, 6	14.1 – 14.9
	5[B]	17.8 – 19.0
Ice Harbor	1	8.4 – 10.1
	2	12.1 – 14.0
	3[C]	TBD
	4	12.2 – 13.5
	5, 6[B]	13.1 – 14.1
McNary	N/A	50 – 60
John Day	N/A	50 – 60
The Dalles	N/A	50 – 60
Bonneville	N/A	30 – 40

A. "Minimum Generation" is the minimum number of megawatts (MW) that must be generated at each project in order to support power system reliability. This table defines the resulting flow range (kcfs) through turbines, which is a function of power output (MW), turbine efficiency, and project head.
B. Lower Granite Unit 2, Lower Monumental Unit 5, and Ice Harbor Units 4, 5, and 6 are restricted due to runner blades that are fixed at a set angle (non-adjustable). If a unit is restored to an adjustable-blade Kaplan in-season, the minimum generation range will revert back to the lower 1% operating range.
C. Ice Harbor Unit 3 is being rebuilt with a runner design that reduces impacts to fish, scheduled for completion in 2022. At that time, testing will be performed to determine the operating range.

There may be situations when river flows are insufficient to maintain minimum generation in Table 1 and the target spill level identified in Table 3 and Table 4 every hour. Under these conditions, the lower Snake River projects operate one turbine unit at minimum generation and spill the remainder of outflow. The lower Columbia River projects also operate at minimum generation and pass the remaining outflow as spill down to minimum spill levels. Under low river flow conditions during spring spill operations, the Corps attempts to remain as close as possible to spill target levels for either gas cap spill or performance standard spill, depending on which operation is targeted for a given hour. The inability to meet the target gas cap spill level due to low river flow does not preclude the ability of the Corps to target performance standard spill levels for up to 8 hours a day as specified in Table 3. Additionally, inflow provided by non-Federal projects upstream is often variable and uncertain, and in combination with low flow

[15] The table is accurate as of March 2022 but may change in-season as coordinated through FPOM (see the FPP).

conditions, may result in instances where forebay elevations go outside of the restricted operating ranges for Snake River and Columbia projects described in Section 4.6.[16]

4.3.2. Navigation Lock Operation During Low Flows

At projects that have a target spill level that is a percentage of total outflow, emptying the navigation lock during low flow conditions may temporarily result in a reduced percentage of outflow that is reported as spill. During this time, the spill rate remains constant, but the spill reported as a percent of total outflow may be temporarily reduced below the target percentage. This occurs because the volume of water needed to empty the navigation lock during periods of low flow is a greater percentage of the total project outflow than during periods of higher flow.

4.4. Operations for Transmission System Reliability

In managing the fish passage spill operations, the Corps and Bonneville plan to allocate generation and spill at the eight Corps projects on the lower Columbia and Snake rivers in accordance with the 2022 FOP. Periodically, to ensure the reliability of the transmission system when system conditions warrant, it is necessary to increase or decrease the amount of water flowing through a project's turbines and spillbays at one or more of these projects.

Consistent with past practice, if any of the transmission system conditions listed below are present and can be alleviated by temporarily modifying generation levels at one or more federal projects, the Action Agencies adjust generation and spill levels to avoid the transmission system impact. These events could result in actual spill being temporarily higher or lower than the target fish passage spill level. Such events may occur coincident with the transmission system event or in subsequent hour(s) should the event impact water balance at a specific hydro project or river reach. The Corps and Bonneville work to restore conditions to support target spill operations as soon as practicable. These actions are taken to minimize the risk and/or scope of a transmission system emergency and are reported in the monthly FOP Implementation Report (see section 8 below).

4.4.1. Standard Operations for Transmission Reliability

Consistent with past practice, the Action Agencies manage the fourteen Columbia River System projects to be prepared to provide electric reliability support as follows:

[16] Lower Snake River projects operate within the minimum operating pool (MOP) range during fish passage season (Table 2).

1. Ensuring sufficient range of generation capability is available to provide the Bonneville balancing authority[17] area with contingency reserves required by North American Electric Reliability Corporation (NERC) reliability standards.[18]
2. Ensuring generation is available to increase or decrease in order to balance load and generation within the Bonneville balancing authority area to support reliability.
3. Ensuring enough generating units are online and have sufficient capability to increase or decrease generation to meet the Bonneville balancing authority area frequency response obligations, consistent with reliability standard requirements.
4. Bonneville must first meet its reserve obligations for system reliability. Unless unavoidable due to system reliability requirements, Bonneville will make best efforts to minimize the allocation of decremental (DEC) reserves on fish passage projects if carrying these reserves would otherwise result in not meeting the target spill levels defined in Tables 3 and 4.[19]
5. Ensuring that there is generation operating at projects in specific locations sufficient for arming for Remedial Action Schemes (RAS).[20] RAS schemes allow the transmission system to automatically respond to unplanned events on the power system by immediately dropping or reducing generation at those specified locations.
6. Maintaining minimum generation levels (see Table 1) at generators in specific locations to maintain correct voltage levels on the power system to ensure reliability.
7. Maintaining enough generation units online in diverse locations on the electrical grid to ensure system stability through rotating inertia.

4.4.2. Contingency Operations for Transmission Reliability

If the routine reliability tools described above are insufficient to resolve the transmission condition, the Action Agencies implement the preemptive actions detailed in the Power System Emergency Action Plan (Attachment 1 to the TMT Emergency Protocols referenced in section 4.2 above) if time permits. Where necessary, the fourteen Columbia River System projects will be called upon to relieve the following conditions:

1. Increasing or decreasing generation at projects (redispatch) in specific geographic locations to relieve heavily loaded transmission lines if required by system conditions. This includes adjusting generation that flows over specific transmission facilities in order to keep flows over those paths within the requirements of NERC reliability standards.
2. Increasing or decreasing generation to ensure transmission system stability and/or reliable load service in local areas under specific system conditions. For example, increasing

[17] A balancing authority is the responsible entity that maintains load-interchange-generation balance within a Balancing Authority Area and supports interconnection frequency in real time. Balancing authority area is the collection of generation, transmission, and loads within the metered boundaries of the designated balancing authority. The balancing authority maintains load-resource balance within this area.
[18] The Federal Energy Regulatory Commission has certified the NERC as the Electric Reliability Organization responsible for establishing and enforcing national reliability standards.
[19] For example, generators may be required to maintain generation levels above minimum generation to provide sufficient capability to reduce generation.
[20] Remedial Action Schemes are sets of automatic control circuits that switch various types of power system components on or off in response to disturbances on the interconnected transmission system.

generation at Ice Harbor Dam to support transmission stability, including providing load service to the Tri-Cities area of Washington, when system conditions require.

3. Responding to unanticipated significant events, including NERC Energy Emergency Alerts or other system emergencies, consistent with the Power System Emergency Action Plan included as Attachment 1 to the TMT Emergency Protocols.
4. Other unanticipated significant events (e.g., fires, earthquakes, etc.).

These actions are implemented consistent with the TMT Emergency Protocols (see section 4.2 above).

4.5. Turbine Unit Testing for Maintenance

Turbine units may be operationally tested prior to maintenance and prior to return to service by running the unit at speed no load, various loads within the ±1% of peak efficiency range, and, if necessary, up to full load, to allow for measurements and testing. Testing of a unit under maintenance is in addition to a unit operating at minimum generation required for power system reliability. Testing may deviate from unit operating priorities specified in FPP Chapters 2-9 and may use water that would otherwise be used for spill if the unit operating for reliability is at the bottom of the ±1% of peak efficiency range. Water is used from the powerhouse outflow allocation if possible, and water diverted from spill for operational testing will be minimized. The Corps coordinates this testing with the region through FPOM. Unit outages for required maintenance are described in FPP Appendix A. Maintenance dates are subject to change.

4.6. Navigation Safety

Short-term adjustments in spill or minimum operating pool (MOP) elevations may be required at any of the fish passage projects to address navigation safety concerns.[21] This may include changes in spill patterns, reductions in spill, short-term spill curtailment, or operating above MOP. The Action Agencies will operate Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Dams at minimum operating pool (MOP) with a 1.5-foot operating range or a 1.0-foot range to the extent possible (referred to operationally as a "soft constraint") from April 3 until August 14 unless adjusted on occasion to meet authorized project purposes, primarily Navigation (2020 NMFS BiOp, page 58).

The 2020 BiOps describe MOP at the lower Snake River projects as a 1.5-foot range above the minimum forebay elevation (Table 2). To clearly communicate the implementation of this operation, the term "MOP" will refer to the 1.5-foot operating range above the minimum forebay elevation at the lower Snake River projects (i.e., "MOP" is a 1.5-foot operating range).

[21] The Corps conducts annual surveys to assess sedimentation in the reservoirs and under certain conditions. To ensure safe navigation, there may be a need to operate the pools above the MOP range.

Table 2.— Normal and minimum operating pool (MOP) elevation ranges for lower Snake River projects[A].

Project	Normal Operating Elevation Range (ft)[B]		MOP Elevation Range (ft)[C]	
	Minimum	Maximum	Minimum	Maximum
Lower Granite	733.0	738.0	733.0	734.5
Little Goose	633.0	638.0	633.0	634.5
Lower Monumental	537.0	540.0	537.0	538.5
Ice Harbor	437.0	440.0	437.0	438.5

A. MOP elevations provided in feet above mean sea level (NGVD29).
B. August 15 – April 2.
C. April 3 – August 14. Projects will be operated within a 1.0-foot range to the extent possible (referred to operationally as a "soft constraint").

Potential in-season adjustments to MOP, if necessary, will be an expanded forebay operating range (Expanded MOP), raised minimum forebay elevation (Raised MOP), or a variable forebay operating range (Variable MOP), as described below.

Expanded MOP: If the 1.5-foot MOP range is insufficient to maintain navigation safety, the range is expanded (e.g., to 2 feet). For instance, some flow conditions may require a 2-foot forebay operating range at Ice Harbor in order to provide safe conditions for barge traffic at the Ice Harbor forebay navigation lock exit. These adjustments may be necessary for both commercial traffic and fish transport barges. Using Ice Harbor as an example, this type of adjustment would be described as "2-foot expanded MOP (437.0-439.0 feet)". Additionally, large within day fluctuations between gas cap spill and performance standard spill may cause operational challenges in meeting MOP and an expanded MOP may be necessary, especially when combined with restricted turbine units that are not able to operate in the full ±1 percent range.

Raised MOP: If the minimum forebay elevation is insufficient to maintain navigation safety, the 1.5-foot MOP range is raised as necessary. Adjustments in MOP operations have been necessary at several fish passage projects, typically during low flow conditions. For instance, unsteady or low flow at Little Goose and Ice Harbor dams (approximately 50 kcfs or less) may impact reservoir elevations and cause inadequate navigation depths at the downstream entrances to the Lower Granite and Lower Monumental navigation locks, respectively. Adjustments up to 1.5 feet above the minimum pool elevations at Little Goose and Ice Harbor may be necessary to accommodate safe entrance to the upstream navigation locks at Lower Granite and Lower Monumental dams. Using Little Goose as an example, this type of adjustment would be described as "1.5-foot raised MOP (634.5-636.0 feet)".

Variable MOP: Due to sediment deposition in the confluence area of the lower Snake and Clearwater rivers near Lewiston, Idaho, the Corps began implementing a "variable MOP" operation at Lower Granite Dam in April 2018 to provide the required federal navigation channel depth of 14 feet. This operation will continue during the 2022 fish passage season (and/or until maintenance dredging occurs) with a 1.5-foot range above the minimum forebay elevation based

on inflow to Lower Granite. At high flows (≥ 120 kcfs), the required navigation channel depth can be maintained with Lower Granite operating in the MOP range of 733.0-734.5 feet. However, at flows below 120 kcfs, the Lower Granite forebay must be operated progressively higher to maintain the navigation channel depth, as follows:

- Inflow 80-119 kcfs = Lower Granite forebay operating range 734.0-735.5 feet (1-foot raised MOP).
- Inflow 50-79 kcfs = Lower Granite forebay operating range 735.0-736.5 feet (2-foot raised MOP).
- Inflow below 50 kcfs = Lower Granite forebay operating range 736.0-737.5 feet (3-foot raised MOP).

Spill Adjustments: High spill levels may create unsafe hydraulic conditions for commercial, non-commercial, and fish transportation barges entering and exiting the tailrace and/or while moored at the fish transport loading facility. Under these conditions, spill may be reduced temporarily as necessary to maintain safe navigation conditions for commercial, non-commercial, or fish transportation barges, which may result in temporarily filling the pool above the MOP range, depending on river flow.

5. JUVENILE FISH TRANSPORTATION PROGRAM

The best available information will be considered in the Corps' implementation of the juvenile fish transportation program operations at the Snake River collector projects in 2022. Should regional sovereigns recommend adjustments in transportation start dates that differ from those stated herein, the Corps uses the existing regional adaptive management process to reconcile recommended operational adjustments.

The following describes the proposed transportation operations for the lower Snake River projects. Detailed descriptions of project and transport facility operations to implement the juvenile fish transportation program are contained in the FPP Appendix B.

5.1. Lower Snake River Dams – Transport Operation and Timing

Transportation will be initiated at Lower Granite, Little Goose, and Lower Monumental dams on April 24 (collection starting on April 23) or as coordinated through the TMT and the RIOG but begin no later than May 1. Transport begins the following day after fish collection and collected juvenile fish will be transported from each facility on a daily or every-other-day basis (depending on the number of fish) throughout the migration season. Transportation of spring migrants ends on June 20. Truck transportation of summer migrants resumes on August 1 with allowance for TMT adaptive management adjustments and continues through September 30 at Lower Monumental and October 31 at Little Goose and Lower Granite. Transportation operations are carried out at each project in accordance with relevant FPP operating criteria. Transportation and spill operations may be adjusted due to research, conditions at fish collection facilities (e.g., overcrowding or temperature extremes), or through the adaptive management process with FPOM and/or TMT (e.g., to respond to expected environmental conditions, to respond to recent transport vs in-river research results, to better match juvenile outmigration, or to achieve/maintain performance standards).

5.2. Transport Research – Seasonal Effects of Transport

An ongoing annual study will be conducted again in 2022 to determine seasonal effects of transporting fish from the Snake River to optimize a transportation strategy. At Lower Granite, fish will be collected for this study starting on April 11, with marking beginning on April 12.

Depending on the number of fish available, fish will be collected 1-3 days each week with tagging occurring on the day following collection. A barge will leave each Thursday morning with all fish collected during the previous 1-3 days. By barging all fish (minus the in-river group) during 1 to 3 days of collection, barge densities are expected to be maintained similar to what would occur under normal transport operations at that time of year. This pattern will occur in the weeks preceding general transportation and will be incorporated into general transportation once that operation begins. The desired transported sample size is 6,000 wild Chinook, 4,000-6,000 wild steelhead, and 4,000-6,000 hatchery steelhead weekly for approximately eight weeks.

6. 2022 SPRING FISH PASSAGE SPILL OPERATIONS

Spring spill operations occur April 3–June 20 at the four lower Snake River projects, and April 10–June 15 at the four lower Columbia River projects. The Corps initiates spill at 0001 hours, or shortly after midnight, at each of the projects on the start date. Target spill levels for spring 2022 at each project are defined in Table 3. If deleterious impacts of the proposed spill operations are observed in-season, existing adaptive management processes may be employed to address the cause of the impacts. Spill may be temporarily reduced at any project to ensure navigation safety or transmission reliability. In order to operate consistently with state water quality standards, spill may also be reduced if observed GBT levels exceed those identified in state water quality standards (*See* WASH. ADMIN. CODE § 173-201A-200(l)(f)(ii)(B)(III) and *Order Approving a Modification to the Oregon's Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem*, page 5).

Spill up to the 125% Gas Cap is spill to the maximum level that meets, but does not exceed, the TDG criteria allowed under state laws. This includes a criterion for not exceeding 126% TDG for the average of the two greatest hourly values within a day.

Table 3.— Summary of 2022 spring target spill levels at lower Snake River (April 3 – June 20) and lower Columbia River (April 10 – June 15) projects.

PROJECT	SPRING SPILL DATES	SPRING SPILL OPERATION
Lower Granite [A, C]	April 3 until adult criteria met (no later than April 24)	24 hours/day: 125% Gas Cap
	Adult criteria met (no later than April 24) – June 20	16 hours/day: 125% Gas Cap 8 hours/day: 20 kcfs Performance Standard
Little Goose [B, C]	April 3 – June 20	16 hours/day: 125% Gas Cap 8 hours/day: 30% Performance Standard
Lower Monumental [A, C]	April 3 until adult criteria met (no later than April 24)	24 hours/day: 125% Gas Cap
	Adult criteria met (no later than April 24) – June 20	16 hours/day: 125% Gas Cap 8 hours/day: 30 kcfs Performance Standard
Ice Harbor	April 3 – June 20	24 hours/day: 125% Gas Cap
McNary	April 10 – June 15	24 hours/day: 125% Gas Cap
John Day [D]	April 10 – June 15	16 hours/day: 125% Gas Cap 8 hours/day: 32% Performance Standard
The Dalles [E]	April 10 – June 15	24 hours/day: 40% Performance Standard
Bonneville [F]	April 10 – June 15	24 hours/day: 125% Gas Cap

A. Lower Granite and Lower Monumental Adult Criteria – Within 1 business day of when the earliest of the following conditions occurs: (1) a cumulative total of 25 adult spring Chinook salmon (not including jacks) pass Lower Monumental Dam; or (2) a cumulative total of 50 adult spring Chinook salmon (not including jacks) pass Ice Harbor Dam; or (3) April 24, 2022, the Corps will implement performance standard spill for 8 consecutive AM hours, 0400–1200, to target hours of peak adult passage. If lack of load conditions preclude the implementation of performance standard spill during the targeted AM period, performance standard spill will begin as soon as practicable during AM hours and continue for up to 8 consecutive hours.

B. Little Goose Adult Criteria – Within 1 business day of a cumulative total of 25 adult spring Chinook salmon (not including jacks) passing Lower Monumental Dam, the Corps will implement performance standard spill at Little Goose Dam for 8 consecutive AM hours (April 3–15 starting at 0500 hours; April 16–June 20 starting at 0400 hours) to target hours of peak adult passage. If lack of load conditions preclude the implementation of performance standard spill during the targeted periods, performance standard spill will begin as soon as practicable during AM hours and continue for up to 8 consecutive hours.

C. During periods of high river flow that exceeds powerhouse hydraulic capacity, implementing performance standard spill for 8 consecutive hours as described in Footnotes A and B may result in storing additional inflow in the forebay above MOP. If it is necessary to pond water to achieve the 8-hour block of performance standard spill during high inflow, water stored above MOP should be drafted out over the remaining hours by increasing spill to pass inflow from 1200-1600 hours, then increasing spill as necessary from 1600-0400 to draft the pool back to MOP. If it is forecasted that the drafting spill will result in exceeding 130% TDG in the tailrace, all 16 hours will be used to return the pool to MOP.

D. John Day Dam – The 8 hours/day of performance standard spill may occur with some flexibility, in either a single 8-hour block or two separate blocks per calendar day. Performance standard spill will not be implemented between 2200-0300 hours.

E. The Dalles Dam –TDG in The Dalles tailrace may fluctuate up to 125% prior to reducing spill at upstream projects or reducing spill at The Dalles below 40%. Maintain 40% spill for 24 hours at The Dalles and reduce John Day spill below the 125% TDG spill cap as needed for TDG management.

F. Bonneville Dam – Spill for fish passage should not exceed 150 kcfs due to erosion concerns.

7. 2022 SUMMER FISH PASSAGE SPILL OPERATIONS

Summer spill operations occur June 21–August 31 at the four lower Snake River projects, and June 16–August 31 at the four lower Columbia River projects. The Corps initiates spill at 0001 hours, or shortly after midnight, at each of the projects on the start date. Target spill levels for summer 2022 at each project are defined in Table 4. At the Snake River Projects spill may range up to ±1 kcfs during the summer spill operation from August 15 – August 31.

Table 4.– Summary of 2022 summer target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	SUMMER SPILL[A] (June 21/16 – August 14) (24 hrs/day)	SUMMER SPILL[A] (August 15 – August 31) (24 hrs/day)
Lower Granite [B]	18 kcfs	SW flow (as river flow allows)
Little Goose [B, C]	30%	SW flow or 9 kcfs spill
Lower Monumental [B, D]	17 kcfs	SW flow or 8 kcfs spill
Ice Harbor [B, E]	30%	SW flow or 9 kcfs spill
McNary	57%	20 kcfs
John Day	35%	20 kcfs
The Dalles	40%	30%
Bonneville	95 kcfs	50 kcfs

A. Spill may be temporarily reduced below the FOP target summer spill level at any project if necessary to ensure navigation safety or transmission reliability, or to avoid exceeding State TDG standards.
B. Late summer spill August 15-August 31 will be through the SW or a constant spill rate through conventional spillbays using the appropriate FPP spill pattern. The SW spill rate is a function of forebay elevation (as pool elevation increases, more water is spilled over the SW), as defined in the FPP. The SWs will be operated per FPP criteria and closed when low flow criteria are met. When the SW is closed, the spill target will transition to a constant spill rate through conventional spillbays and will not vary with a fluctuating forebay elevation.
C. Flow corresponds to the SW high-crest position and a forebay elevation of 635.5 feet, the mid-point of the forebay range from 633-638 feet.
D. Flow corresponds to a forebay elevation of 538.5 feet, the mid-point of the forebay range from 537-540 feet.
E. Flow corresponds to a forebay elevation of 438.5 feet, the mid-point of the forebay range from 437-440 feet.

8. PROJECT-SPECIFIC OPERATIONS

The following sections describe 2022 spill operations for each project. The Corps implements established spill patterns for all projects as described in the FPP. Additional information regarding spill precision outside these dates may be found in Section 3 above.

8.1. Lower Granite Dam

8.1.1. Spring Spill (Table 3): 24-hour 125% Gas Cap until adult salmonid abundance criteria are achieved (Table 3, footnote B), then 125% Gas Cap (see section 2.1), 16

hours/day, and 20 kcfs for up to 8 hours/day.

8.1.2. Summer Spill (Table 4):

- June 21–August 14: 18 kcfs, 24 hours/day.
- August 15-August 31: SW flow, 24 hours/day.

8.1.3. Operational Considerations: None for 2022.

8.2. Little Goose Dam

8.2.1. Spring Spill (Table 3): 125% Gas Cap (see section 2.1), 16 hours/day, and 30%, 8 hours/day.

8.2.2. Summer Spill (Table 4):

- June 21–August 14: 30% (unless adjusted to a constant spill level during low flows per section 4.3.3), 24 hours/day.
- August 15-August 31: SW flow or approximately 7 kcfs, 24 hours/day.

8.2.3. Operational Considerations:

- When the spillway weir is closed and project outflow is less than or equal to 38 kcfs, actual hourly average spill levels at Little Goose may range up to ±4% according to the spill pattern Table LGS-10 in the FPP (Chapter 8).
- During low flow conditions at Little Goose, spill may exceed the target percentage if the spillway weir is in service and the project is restricted to a fixed minimum spill level (i.e., spill cannot be reduced below the spill rate through the spillway weir, which may result in spilling more than the target percentage at lower outflows).
- During the 30% spill operation when project outflows are ≤ 32 kcfs, the spill operation will transition from 30% to a constant spill level of approximately 7-11 kcfs to help stabilize project outflow, meet Lower Monumental target spill levels, and maintain MOP elevation at Little Goose. The constant spill level will be based on the previous day's average total project outflow, as follows: 11 kcfs when total outflow is 28.0 to 32.0 kcfs, 9 kcfs when total outflow is 24.0 to 27.9 kcfs, and 7 kcfs when total outflow is ≤ 23.9 kcfs. Actual spill may range up to ±1 kcfs from the target spill level.

8.3. Lower Monumental Dam

8.3.1. Spring Spill (Table 3): 24-hour 125% Gas Cap until adult salmonid abundance criteria are achieved (Table 3, footnote B), then 125% Gas Cap (see section 2.1) using the uniform spill pattern, 16 hours/day, and 30 kcfs using the uniform spill pattern for up to 8 hours/day.

8.3.2. Summer Spill (Table 4):

- June 21–August 14: 17 kcfs (bulk pattern), 24 hours/day.
- August 15-August 31: SW flow or approximately 7 kcfs, 24 hours/day.

8.3.3. Operational Considerations: Transit of the juvenile fish barge across the Lower Monumental tailrace, docking, and departure from the collection facility, may require a reduction in spill below the target spill level for safety concerns. The towboat captain may request spill be reduced or eliminated during transit. During juvenile fish barge loading operations, spill is typically reduced to 15 kcfs using the bulk pattern, but can be reduced further, if necessary, for safety reasons. Barge loading duration can be up to 3.5 hours. Reducing spill may cause the Lower Monumental pool to briefly operate outside of MOP elevations.[22]

8.4. Ice Harbor Dam

8.4.1. Spring Spill (Table 3): 24-hour 125% Gas Cap (see section 2.1).

8.4.2. Summer Spill (Table 4):

- June 21–August 14: 30%, 24 hours/day.
- August 15-August 31: SW flow or approximately 8.5 kcfs, 24 hours/day.

8.4.3. Operational Considerations:

- When the SW is open, the minimum project spill level is fixed at approximately 7.1-8.7 kcfs, depending on forebay elevation (i.e., spill cannot be reduced below the fixed volume through the SW). This operational limitation results in spilling more than 30% when total outflow drops below approximately 28 kcfs. Per FPP section 2.3.2.7, the SW is closed when day average outflow is below 30 kcfs and forecasted to stay below 30 kcfs for at least 3 days. However, outflow may drop below 28 kcfs on an hourly basis while the SW is still open, resulting in spill greater than 30% for those hours.
- Currently, all but one of the available units at Ice Harbor have runner blades that are locked at a set angle (non-adjustable) and a smaller operating range (also referred to as "fixed-blade" units). As a result, turbine outflow cannot achieve some flow ranges, referred to as deadbands. When targeting spill as a percent of outflow, these deadbands will result in a spill percentage that is above or below the target percentage

[22] With spill levels in spring 2022 targeting the gas cap for at least 16 hours/day, reducing spill at Lower Monumental for long durations could pose problems for staying within MOP at Ice Harbor Dam, the next downstream project.

at certain outflows. When Unit 3 returns to service in 2022, there will be two units available with adjustable blades (Units 1 and 3).

8.5. McNary Dam

8.5.1. Spring Spill (Table 3): 24-hour 125% Gas Cap (see section 2.1). A SW will be operated in both spillbay 19 and spillbay 20 for the period April 10 through June 7. As in past years, both spillway weirs will be closed and removed from service starting on June 8 (or next workday) for the benefit of subyearling Chinook. Currently, removing the SWs and reinstalling standard spill gate sections may take up to 5 normal workdays to complete, depending on wind and weather conditions. Temporary spill pattern changes to allow removal of the SWs and installation of standard spill gates will occur as described in FPP Chapter 5 section 2.3.2.6; however, spill will continue at the target level defined in Table 3 during removal of the SWs. Following removal of the SWs and installation of standard spill gates, the spill patterns in Table MCN-9 in FPP Chapter 5 will be used for the remainder of the spring and summer.

8.5.2. Summer Spill (Table 4):

- June 16–August 14: 57%, 24 hours/day, without SWs (removed in early June).
- August 15-August 31: 20 kcfs, 24 hours/day.

8.5.3. Operational Considerations: Currently, McNary Dam turbine units 5 and 6 have runner blades that are locked at a set angle (non-adjustable). As a result, the units are restricted to a very narrow ±1% operating range of approximately 10-12 kcfs (see FPP Chapter 5 Table MCN-6-A) and there may instances when the unit is unable to stay within this restricted range.

8.6. John Day Dam

8.6.1. Spring Spill (Table 3): 125% Gas Cap, 16 hours/day, and 32% for up to 8 hours/day with priority to maintain 40% spill for 24 hours at The Dalles Dam as needed for TDG management.

8.6.2. Summer Spill (Table 4):

- June 16–August 14: 35%, 24 hours/day.
- August 15-August 31: 20 kcfs, 24 hours/day.

8.6.3 Operational Considerations:

- Currently, units 3, 4, 8, 9, 10, 11, and 14 at John Day have runner blades that are locked at a set angle (non-adjustable) and a smaller operating range (see FPP Chapter 4 Table JDA-7). As a result, the turbines have a restricted operating range of approximately 17-19 kcfs and may not be able to stay within the narrow 1% turbine band associated with it.

- See sections 6.11.1.4 and Tables 2 and 5 and Section 6.11.1.3 in the WMP for discussion of springtime pool elevations to dissuade nesting of Caspian terns. This operation will increase the flow rate over the SW and may change tailrace flow patterns.

8.7. The Dalles

8.7.1. Spring Spill (Table 3): 40%, 24 hours per day. Maintain 40% spill for 24 hours at The Dalles Dam and reduce John Day 125% TDG spill cap as needed for TDG management.

8.7.2. Summer Spill (Table 4):

- June 16–August 14: 40%, 24 hours/day.
- August 15-August 31: 30%, 24 hours/day.

8.7.3. Operational Considerations:

- Actual hourly average spill levels at The Dalles may range up to ±3 kcfs according to the spill pattern tables in FPP Chapter 3.
- Spill bays 9[23], 10, 11, 13, 16, 18, 19, and 23 are operationally restricted due to wire rope, structural and concrete erosion concerns.

8.8. Bonneville Dam

8.8.1. Spring Spill (Table 3): 24-hour 125% Gas Cap up to maximum of 150 kcfs for fish passage spill (see section 2.1).

8.8.2. Summer Spill (Table 4):

- June 16–August 14: 95 kcfs, 24 hours/day.
- August 15-August 31: 50 kcfs, 24 hours/day.

8.8.3. Operational Considerations:

- Maximum fish passage spill level is 150 kcfs. This constraint is based on physical model observations indicating an increased incidence of rock deposition into the spillway stilling basin at spill ≥ 150 kcfs, which has caused erosion to the structure in the past.
- Minimum spill level is 50 kcfs; however, as observed in past years, to provide acceptable juvenile fish egress conditions in the tailrace under extreme low flow

[23] Spillbay 9 at The Dalles cannot be used due to failure of the trunnion pin in 2009.

conditions, lower spill levels may be considered and coordinated through the TMT and/or FPOM.

- Actual hourly average spill levels at Bonneville Dam may range up to ±3 kcfs according to spill pattern tables in FPP Chapter 2.

9. FOP IMPLEMENTATION REPORTING

The Corps posts monthly FOP Implementation Reports on the following website: http://pweb.crohms.org/tmt/documents/FOP_Implementation_Reports/. The updates include monthly project plots containing the following information:

- total flow: the total hourly river flow rate;
- generation flow: the hourly flow through the powerhouse units;
- target spill: the spill target for that hour (Tables 3, 4);
- adjusted spill: the hourly spill level that can be achieved taking into consideration that spill may vary as a function of total river flow, forebay elevation, and generator capacity, and is subject to routine operational adjustments that limit the ability to spill to the target spill (see section 4.1);
- actual spill: the hourly flow over the spillway; and,
- resultant 12-hour average TDG for the tailwater at each project.

The reports also provide information on non-routine or unplanned operational adjustments that arise during the spill program and address any spill adjustments due to emergency situations (such as unplanned maintenance or outages), and for contingency operations for transmission reliability. See section 4.1 for more information.

The Corps provides the following data to the public regarding project flow, spill rate, TDG level, and water temperature.

- Hourly flow, generation flow, and spill quantity data for the lower Snake and Columbia River dams are posted to the following website:
    - http://pweb.crohms.org/report/projdata.htm (web reports with the most recent 8 days of hourly project data and the current month of daily project data).
    - http://pweb.crohms.org/tmt/wq/historical/ (links to historic hourly project data files in .csv format organized by month back to 2004 including temperature and TDG information).
- Water quality data are received via satellite from TDG Fixed Monitoring Sites (FMS) in the Columbia and Snake rivers every hour and placed on a Corps public website upon receipt. Hourly TDG and water temperature data are posted to the following websites:
    - http://pweb.crohms.org/report/total.html (web reports with hourly TDG, project outflow and spill for the previous 3 days).
    - http://pweb.crohms.org/ftppub/water_quality/tdg/ (links to historic hourly water quality data files for each FMS including barometric and total gas pressure, TDG and project outflow and spill in csv-format organized by month back to 2005).
    - Using the hourly TDG readings for each station in the lower Snake and Columbia rivers, the Corps calculates both the highest 12-hour average TDG levels (Oregon

and Washington spring method) and the highest consecutive 12-hour average TDG levels (Washington summer method) on a daily basis. These averages are reported at: http://pweb.crohms.org/ftppub/water_quality/12hr/.

- Spill cap information is posted to the following site each day: http://pweb.crohms.org/tmt/documents/ops/spill/caps/.

In addition to the monthly FOP Implementation Reports, the Corps provides status updates at the regularly scheduled TMT meetings about the 2022 fish passage spill operations, including reasonably detailed information that is relevant to the Corps' process for implementing fish passage spill.