

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Transalta )  
Centralia Generation LLC )  
\_\_\_\_\_ )

Order No. 202-26-18

Motion to Intervene, Motion for Clarification, and Requests for Rehearing and Stay  
of Sierra Club, NW Energy Coalition, Washington Conservation Action, Climate  
Solutions, Public Citizen, and Environmental Defense Fund  
(collectively, “Public Interest Organizations” or “PIOs”)

Exhibit 2-151:  
2025 Fish Operations Plan



DEPARTMENT OF THE ARMY  
CORPS OF ENGINEERS, NORTHWESTERN DIVISION  
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## 2025 Fish Operations Plan

### 1. INTRODUCTION

The 2025 Fish Operations Plan (2025 FOP) describes the U.S. Army Corps of Engineers' (Corps) planned operations for fish<sup>1</sup> passage at its four lower Snake River and four lower Columbia River dams and includes spring surface spill operations (March through early April), spring and summer spill operations (early April through August), and fall/winter surface spill operations (September through mid-November). The 2025 FOP is consistent with spill operations for 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) and U.S. Fish and Wildlife Service (USFWS) Columbia River System (CRS) Biological Opinions (2020 CRS BiOps)<sup>2</sup>, 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 2025 FOP also incorporates operations outlined in Appendix B of the "U.S. Government Commitments in Support of the Columbia Basin Restoration Initiative" (USG Commitments). The USG Commitments were agreed to as part of the 2023 Memorandum of Understanding (*see* Section 3 of the MOU). Other project operations and water management actions not specifically addressed in this document will be consistent with other guiding operative documents, including the 2025 Water Management Plan (WMP), seasonal WMP updates, and the 2025 Fish Passage Plan (FPP).

In addition to discussing project-specific fish passage spill operations, the 2025 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 2025 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.

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<sup>1</sup> ESA-listed salmon and steelhead.

<sup>2</sup> 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 2025 consistent with the State of Washington and the State of Oregon total dissolved gas (TDG) water quality standards (WQS).<sup>3,4</sup> 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 ensure 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 modification to its TDG WQS of up to 125% TDG from April 1-June 15 and up to 120% TDG from June 16-August 31, 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 December 31, 2024, page 4). Regarding Oregon's 105% TDG criterion, Oregon Department of Environmental Quality (ODEQ) clarified that this criterion does not apply to the Columbia River per their letter dated January 29, 2024. 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:

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<sup>3</sup> 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 (l)(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>.

<sup>4</sup> 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<sup>5</sup>:**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 115 percent as measured in the forebays of the next downstream dams and must not exceed an average of 120 percent as measured in the tailraces of each dam (these averages are calculated as an average of the 12 highest hourly readings in a calendar day, relative to atmospheric pressure); and
- A maximum TDG saturation level of 125 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 125 percent calculated as an average of the 12 highest hourly TDG measures in a calendar day; and
- A maximum TDG saturation level of 126 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

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<sup>5</sup> The text of the code is copied verbatim below for reference.

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 50 fish required weekly) or non-salmonids (with a minimum sample size of 50 fish required weekly) exceeds:

- Gas bubble trauma in non-paired fins of 15 percent; or
- Gas bubble trauma in non-paired fins of five percent and gas bubbles occlude more than 25 percent of the surface area of the fin.

In accordance with WADOE's Rule Implementation Plan, 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 approved the following modification<sup>6</sup> 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 modified total dissolved gas standards will apply for five years, beginning Jan. 1, 2025, through Dec. 31, 2029 (calendar years 2025, 2026, 2027, 2028, and 2029).
5. The DEQ Director may approve additional periods of application of this modification up to 120 percent total dissolved gas as calculated in 8.a)i., beyond the April 1 to Aug. 31 period, subject to subsections 8.a) to 8.c) for reasons including passing Spring Creek

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<sup>6</sup> The text of the modification is copied verbatim below for reference.

Hatchery fish releases and other voluntary fish passage operations, maintenance activities, and biological or physical studies of spillway structures and prototype fish passage devices. The Corps must notify DEQ in writing at least one week prior to the spill describing the proposed action, including its purpose, and the location and dates of elevated total dissolved gas levels. Spill must be reduced to meet the 110 percent total dissolved gas criterion if requested by the DEQ Director.

6. 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. Plans must include monitoring for non-salmonid fish species. Gas bubble trauma monitoring 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 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. The DEQ Director may halt the voluntary spill program or require reductions in voluntary spill to reduce TDG levels to 120 percent as calculated in 8.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 eyes or non-paired fins of fifteen percent, or gas bubble trauma in eyes or non-paired fins of five percent and gas bubbles occlude more than twenty-five percent of the surface area of the fin or eyes. If gas bubble trauma exceeds these biological thresholds and spill is reduced, 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.
8. 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 eyes or non-paired fins, or
      - ii. More than five percent of salmonids examined show signs of gas bubble trauma in their eyes non-paired fins where more than 25 percent of the surface area is occluded by gas bubbles.
    - c. Physical monitoring must occur and be adequate for implementing the requirements set out in this order.
  9. The Corps must provide written notice to DEQ within 24 hours of any violations of the conditions in the modification as it relates to voluntary spill. Such notice must include actions proposed to reduce total dissolved gas levels or the reason(s) for no action.
  10. No later than Jan. 31 following each year of this modification, the Corps must provide an annual written report to DEQ detailing the following:
    - a. Flow and runoff descriptions for the spill season;
    - b. Spill quantities and durations;
    - c. Quantities of water spilled for fish versus spill for other reasons for each project;
    - d. Data results from the physical and biological monitoring programs, including incidences of gas bubble trauma regardless of sample size;
    - e. Evaluation of the relationship between observations of non-salmonid gas bubble trauma monitoring and exposure to elevated total dissolved gas levels;
    - f. Description and results of any biological or physical studies of spillway structures and prototype fish passage devices to test spill at operational levels; and
    - g. Implementation of gas abatement measures identified through adaptive management.

11. If requested, the Corps must report to the commission on any of the above matters or other matters relevant to this order.

12. The commission reserves the right to terminate or modify this order at any time.

For the purposes of Oregon's Order, ODEQ defines non-salmonid as including non-native species per their letter dated June 10, 2022 and email dated January 18, 2023. Gas bubble trauma monitoring in bi-state waters will include evaluation of non-native species in the population of non-salmonids to comply with Oregon's Order. WADOE's Rule Implementation Plan is unchanged and continues to require GBT evaluation of native non-salmonids.

The terminology that has been adopted to refer to the States' TDG Water Quality Standards (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 2025 to the spill levels identified in the CRSO EIS ROD, 2020 CRS BiOps, and Appendix B of the USG Commitments as extended and modified, and in accordance with the States' 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.

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 2025 Water Management Plan (see Appendix 4: TDG Management Plan)<sup>7</sup>.

Higher spill than the target spill levels identified in Tables 3, 4, and 5 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

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<sup>7</sup> The Water Management Plan (WMP) and associated appendices are updated annually. See <https://public.crohms.org/tmt/documents/wmp/>.

throughout the system in the order of priority defined in the Spill Priority List<sup>8</sup>. 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, 4, and 5 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<sup>9</sup> 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  $\pm 2$  kcfs when the target spill is a flow rate (e.g., kcfs) and  $\pm 1\%$  when the target spill is a percentage. Not all projects are able to achieve this level of precision (e.g., Little Goose and Bonneville dams). Additional flexibility for balancing reserves ( $\pm 5\%$ ) could occur at John Day Dam (spring and summer) and The Dalles Dam (summer) as identified in Appendix B of the USG Commitments. More information regarding project-specific spill precision limitations may be found in Section 9 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. MODIFICATIONS TO PLANNED OPERATIONS AND IN-SEASON MANAGEMENT**

For planning purposes, the operations described in the 2025 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, NMFS, and USFWS, coordinates with regional sovereigns on these conditions and other planned operations through the review of the 2025 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

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<sup>8</sup> Spill Priority List: <https://public.crohms.org/tmt/documents/spill-priority/>

<sup>9</sup> The FPP is coordinated annually with regional sovereigns through the FPOM. See <https://public.crohms.org/tmt/documents/fpp/>.

coordination process<sup>10</sup> 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.

##### Planned and Routine Operational Adjustments:<sup>11</sup>

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.
4. Operational limitations, for example physical limitations of gate settings, spill patterns (see section 3), forebay elevation, and deadband<sup>12</sup>.
5. Scheduled turbine unit and/or transmission outages that reduce powerhouse hydraulic capacity and require spilling more than the target spill level.\* (see footnote 11)
6. Standard operations for transmission reliability (see section 4.4.1. below).\*(see footnote 11)
7. Navigation safety concerns (see section 4.6. below).\*(see footnote 11)
8. Transition periods between gas cap spill and lower spill rates (e.g., during performance standard spill blocks<sup>13</sup>) may result in actual hourly spill levels that are slightly higher or lower than targeted spill levels.

##### Non-routine or Unplanned Operational Adjustments:<sup>14</sup>

1. Contingency operations for transmission reliability (see section 4.4.2 below).

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<sup>10</sup> 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 Regional Forum subcommittees, which include the TMT, Studies Review Workgroup (SRWG), Fish Facility Design Review Work Group (FFDRWG), and FPOM.

<sup>11</sup> 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.

<sup>12</sup> 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.

<sup>13</sup> "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.

<sup>14</sup> 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

2. Fish emergencies (e.g., high river temperatures that exceed levels safe for fish, adult fish passage blockages, actionable incidence rates of gas bubble trauma (GBT) incidence rates in either juvenile salmonids or non-salmonids<sup>15</sup>, 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.<sup>16</sup>
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 2025 Emergency Protocols (WMP Appendix 1 – available online at <https://public.crohms.org/tmt/documents/wmp/>). This protocol identifies the process the Action Agencies, in coordination with NMFS and USFWS, use in the event of an emergency concerning project operations that impact planned fish protection measures. The emergency protocols also address the process for coordination with regional sovereigns.

## 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  $\pm 1\%$  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:

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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.

<sup>15</sup> See WAC 173-201A-200(1)(f)(ii)(B)(III), including WADOE's Rule Implementation Plan for Chapter 173-201A WAC Water Quality Standards for Surface Waters of the State of Washington (Publication 19-10-048; pages 7-9), and Order Approving a Modification to the Oregon's Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem, page 5, including clarifications from Oregon Department of Environmental Quality email dated 18 January 2023, RE: Request for Clarification of Spring Non-Salmonid Monitoring Requirement.

<sup>16</sup> When a generator requires repair, ongoing operations may require modification to prepare a turbine unit for the necessary maintenance without further damaging infrastructure or jeopardizing personnel safety. 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.

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<sup>17</sup> 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.

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<sup>17</sup> Two generating units may be necessary at Ice Harbor Dam during elevated air temperatures 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.<sup>18</sup>**

Project	Turbine Unit	Minimum Generation Flow Range <sup>A</sup> (kcfs)
Lower Granite	1, 3	11.6 – 12.7
	2 <sup>B</sup>	17.8 – 18.8
	4, 5, 6	13.8 – 14.9
Little Goose	1, 2, 3	11.8 – 12.3
	4, 5, 6	14.3 – 14.9
Lower Monumental	1, 2, 3	11.7 – 12.9
	4, 6	13.8 – 14.6
	5 <sup>B</sup>	17.8 – 19.0
Ice Harbor	1 <sup>C</sup>	Out of service
	2	12.1 – 14.1
	3	8.6 – 10.3
	4 <sup>B</sup>	12.2 – 13.5
	5, 6 <sup>B</sup>	12.5 – 14.1
McNary	N/A	50 – 60 (may increase up to 80 for reserves) <sup>D</sup>
John Day	N/A	50 – 60 (may increase up to 80 for reserves) <sup>D</sup>
The Dalles	N/A	50 – 60
Bonneville	N/A	30 – 40 (may increase to 60 for reserves) <sup>D</sup>

A. “Minimum Generation” is the minimum number of megawatts (MW) that must be generated at each project 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 fixed-blade (non-adjustable) runners that are set at a fixed angle (non-adjustable). If a unit is restored to an adjustable-blade Kaplan in-season, the minimum generation range will revert to the lower 1% limit.

C. Ice Harbor Unit 1 is being rebuilt with an adjustable-blade runner design that reduces impacts to fish, scheduled for completion in 2026. At that time, testing will be performed to confirm the operating range.

D. Powerhouse outflows may increase for reserves up to 80 kcfs at McNary Dam during spring and summer months, up to 80 kcfs at John Day Dam during spring months and up to 60 kcfs at Bonneville Dam during spring months (without triggering reporting requirements described in Section 4.1). Increased powerhouse generation allowances will allow for additional generation for the purpose of providing real-time operators greater access to reserve capacity prior to requiring variance tracking or declarations of power system emergency. As needed, the higher ranges will be utilized for reserves under low flow conditions (e.g., minimum generation and spill the rest) and when flexibility elsewhere (e.g., Grand Coulee and Chief Joseph dams to carry and deploy reserves) has been maximized. Powerhouse flows exceeding 80 kcfs at McNary and John Day dams or 60 kcfs at Bonneville Dam for reserves within the Bonneville balancing authority area will be reported in the Pre-Coordinated Operations Table. Any other exceedances for reserves will be reported in the Variance Table in the monthly FOP Implementation Report (see section 10).

There may be situations when river flows are insufficient to maintain minimum generation in Table 1 and the target spill level identified in Tables 3, 4, and 5 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

<sup>18</sup> The table is accurate as of March 2025 but may change in-season as coordinated through FPOM (see the FPP).

possible to spill target levels for either gas cap spill or other spill percentages or volumes, 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 as specified in Table 4. Additionally, inflow provided by non-Federal projects upstream is often variable and uncertain, and in combination with low flow 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.<sup>19</sup>

#### **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 2025 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 10 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:

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<sup>19</sup> 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<sup>20</sup> area with contingency reserves required by North American Electric Reliability Corporation (NERC) reliability standards.<sup>21</sup>
2. Ensuring generation is available to increase or decrease 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.<sup>22</sup> When conditions result in an inability to meet the target spill levels defined in Tables 4 and 5, Bonneville will make best efforts to minimize the allocation of reserves (decremental, DEC and/or incremental, INC) on fish passage projects if a spill reduction would be required to allocate the reserves.
5. Ensuring that there is generation operating at projects in specific locations sufficient for arming for Remedial Action Schemes (RAS).<sup>23</sup> RAS 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 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

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<sup>20</sup> 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.

<sup>21</sup> The Federal Energy Regulatory Commission has certified the NERC as the Electric Reliability Organization responsible for establishing and enforcing national reliability standards.

<sup>22</sup> For example, generators may be required to maintain generation levels above minimum generation to provide sufficient capability to reduce generation.

<sup>23</sup> 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  $\pm 1\%$  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  $\pm 1\%$  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 and Minimum Tailwater Elevations**

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.<sup>24</sup> This may include changes in spill patterns, reductions in spill, short-term spill curtailment, or operating above MOP. Adjustments to MOP may also be required to meet minimum tailwater elevations (Table 2). Current spill operations for fish passage result in complex downstream hydraulics that cause large fluctuations in tailwater elevations. 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).

The Corps will operate Lower Granite Dam at MOP with a 1.5-foot forebay operating range and a 1.0-foot range to the extent possible (referred to operationally as a “soft constraint”) from April 3 until August 31, unless adjusted on occasion to meet authorized project purposes, primarily navigation, except as noted below.<sup>25</sup> Little Goose, Lower Monumental and Ice Harbor dams will operate at MOP with a 1.5-foot forebay operating range and a 1.0-foot range soft constraint to

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<sup>24</sup> 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.

<sup>25</sup> The Corps conducts a bathymetric survey of the federal navigation channel annually to assure a 14-foot depth is maintained in the federal navigation channel. With the dredging completed in winter 2022/2023, Lower Granite will operate in the normal MOP range (733.0-734.5 feet) from April 3 until August 31 (and within a 1.0-foot soft constraint range to the extent possible).

the extent possible from April 3 until August 14, unless adjusted on occasion to meet authorized project purposes, primarily navigation, except as noted below.

**Table 2.— Normal and minimum operating pool (MOP) elevation ranges and minimum tailwater elevations for lower Snake River projects.<sup>A</sup>**

Project	Normal Operating Elevation Range (ft) <sup>B</sup>		MOP Elevation Range (ft) <sup>C</sup>		Project Tailwater (ft)
	Minimum	Maximum	Minimum	Maximum	Minimum
Lower Granite	733.0	738.0	733.0	734.5	633.0
Little Goose	633.0	638.0	633.0	634.5	537.0
Lower Monumental	537.0	540.0	537.0	538.5	437.0
Ice Harbor	437.0	440.0	437.0	438.5	337.0

A. Elevations provided in feet above mean sea level (NGVD29).

B. August 15 – April 2, except at Lower Granite (September 1-April 2).

C. April 3 – August 14, except at Lower Granite (April 3 – August 31). 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) or raised minimum forebay elevation (Raised 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 to provide safe conditions for barge traffic at the 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 spill percentages or prescribed volumes 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  $\pm 1$  percent range.

**Raised MOP:** If the minimum forebay elevation is insufficient to maintain navigation safety or meet project minimum tailwater elevations, the 1.5-foot MOP range is raised as necessary. Adjustments in MOP operations have been necessary at the lower Snake River projects, typically during lower flow conditions. For instance, low flows in combination with fish passage spill operations may impact reservoir elevations and cause dips below project minimum tailwater elevations or inadequate navigation depths. Using Little Goose as an example, this type of adjustment would be described as “1.5-foot raised MOP (634.5-636.0 feet)”.

**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 2025. 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 at Lower Granite and Little Goose resumes on August 1 with allowance for TMT adaptive management adjustments and continues through October 31. 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 spill targets).

### 5.2. Transport Research – Seasonal Effects of Transport

An ongoing annual study will be conducted again in 2025 to determine seasonal effects of transporting fish from the Snake River to optimize a transportation strategy. Fish will be collected for this study at Lower Granite starting on April 14, with marking beginning on April 15.

Depending on the number of fish available, fish will be collected 1-2 days each week with tagging occurring on the day following collection. A barge will leave on Thursday (17 April) morning with all fish collected during the previous 1-2 days (excluding fish tagged for in-river survival, which will be released into Lower Granite Dam tailrace). If necessary to achieve the proper loading density, additional fish will be collected on 16 April (but not tagged). 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 the week 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 five to six weeks.

## 6. FALL/WINTER SURFACE SPILL OPERATIONS

Surface spill operations in March–April and September–November (referred to in Appendix B of the USG Commitments Document as “Fall/Winter Spill Operations”) will occur during the dates and times defined below in Table 3. Surface spill will occur via the project’s spillway weir (RSW, TSW, or ASW<sup>26</sup>), except at The Dalles and Bonneville dams which do not have a spillway weir and will instead operate non-spillway surface passage routes as defined in Table 3.

**Table 3.— Fall/Winter Surface Spill Operations.<sup>A</sup>**

Project	Dates	Hours	Notes
LWG, LGS, LMN, IHR, MCN	March 1 – March 20	4 hours/day in the morning, 7 days/week	LGS ASW in high crest (~7 kcfs).
	March 21 – April 2 (Snake projects) / April 9 (MCN)	24 hours/day, 7 days/week	MCN TSW in spillbay 20.
	September 1 – November 15	4 hours/day in the morning, 7 days/week	
JDA	March 21 – April 9	24 hours/day, 7 days/week	Opening the JDA TSW requires a crew and crane and must be done during daylight hours. On March 21, an equivalent spill rate (~10 kcfs) will occur via the non-TSW pattern from 0001 hours until the TSW in spillbay 19 is opened in the morning as early as possible.
TDA Sluiceway	March 1 – December 15	24 hours/day, 7 days/week	TDA sluiceway is a non-spillway surface passage route. See FPP Chapter 3 for operating criteria.
BON B2CC	March 1–8	0600-1000 daily	BON PH2 corner collector (B2CC) is a non-spillway surface passage route. See FPP Chapter 2 for operating criteria.
	March 9–25	0600-1000, 1600-2000 daily	
	March 26 – August 31	24 hours/day, 7 days/week	
BON Sluiceway	Year-round	24 hours/day, 7 days/week	BON PH1 sluiceway is a non-spillway surface passage route. See FPP Chapter 2 for operating criteria.

A. Spill may be temporarily reduced below the FOP target spill level at any project if necessary to ensure navigation safety or transmission reliability, or to avoid exceeding State TDG standards.

## 7. 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 2025 at each project are defined in Table 4. If deleterious impacts of the proposed spill operations are observed in-season, existing adaptive management processes may be employed to address the

<sup>26</sup> Depending on their design, spillway weirs are referred to as either “Removable” (RSW—applies to LWG, LMN, IHR), “Adjustable” (ASW—applies to LGS), or “Top” (TSW—applies to MCN and JDA).

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 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 4.— Summary of 2025 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 <sup>A, C</sup>	April 3 - June 20	24 hours/day: 125% Gas Cap
Little Goose <sup>B, C</sup>	April 3 – June 20	125% Gas Cap 24 hours/day (until adult criteria met) <i>then</i> 16 hours/day: 125% Gas Cap; 8 hours/day: 30% of outflow (Performance Standard)
Lower Monumental <sup>A</sup>	April 3 - June 20	24 hours/day: 125% Gas Cap
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 <sup>D</sup>	April 10 – June 15	Daytime hours: 40% of outflow; Nighttime hours: 125% Gas Cap
The Dalles <sup>E</sup>	April 10 – June 15	24 hours/day: 40% of outflow (Performance Standard)
Bonneville <sup>F</sup>	April 10 – June 15	24 hours/day: 125% Gas Cap

A. Lower Granite and Lower Monumental Adult Delay Criteria – See Section 7.1.

B. Little Goose 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, 2025, 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. If a second block is needed, it will start as soon as load conditions allow, continue for at least two consecutive hours, and conclude no later than 2000.

C. During periods of high river flow that exceeds powerhouse hydraulic capacity, implementing 8 consecutive hours of spill 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 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. In lack of load conditions performance standard spill blocks will be prioritized at Little Goose, Lower Monumental, and Lower Granite dams, in that order.

D. John Day Dam – Daytime hours are defined in FPP Chapter 4, Table JDA-5. Daytime hourly spill target of 40% river flows with ±5% flexibility in river flow for balancing reserves, consistent with current target spill level calculations.

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. Spill above 40%, up to 125% TDG, may occur for TDG management or for carrying reserves.

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

### **7.1. Adult Migration Delay Protocol for Spring Spill Operations at Lower Granite and Lower Monumental Dams**

Lower Granite and/or Lower Monumental daytime spill levels will be decreased to 40% of project outflow for 8 hours per day during daytime hours (targeted start time between 0400-0800 if feasible) when adult delay or passage issues are observed at both/either of these projects. An adult delay or passage issue occurs when the following three criteria are met: (1) *fewer than 50%* of the single departure event per tag ID of PIT-tagged adult spring/summer Snake River Chinook detected at the downstream project (i.e., Ice Harbor or Little Goose dams) arrive at the upstream project (i.e., Lower Monumental or Lower Granite dams) within 3 days and this pattern persists for 4 consecutive days,<sup>27</sup> (2) a running 3-day minimum of 7 PIT-tagged adult spring/summer Snake River Chinook are detected at the downstream projects,<sup>28</sup> and (3) if the upstream dam’s average outflow was below 160 kcfs each day of the delay. If all three criteria are met, the Corps will implement a 40% daytime spill operation (adult daytime spill operation) for 8 hours per day during daytime hours (targeted start time between 0400-0800 if feasible) on the next calendar day and continue for 3 consecutive days. Based on the availability of information on the three criteria, the adult 40% daytime spill operation may begin as early as day 5 and no later than day 6. Consistent with past operations to reduce spill at Little Goose Dam, if load conditions preclude the implementation of 40% spill to begin between 0400-0800, reduced spill will occur as soon as practicable during morning hours and continue for up to 8 consecutive hours. If 8 hours of consecutive spill at 40% was not feasible, a second block will start as soon as load conditions allow, continue for at least two consecutive hours, and will conclude no later than 2000 (see Table 4, footnote B).

Assuming *greater than 50%* of the single departure event per tag ID of PIT-tagged adults arrive at the upstream project by day 3 then standard operations (125% TDG spill 24/7) would be reinstated the calendar day after information becomes available, as early as day 4 and no later than day 5. If greater than 50% of the daily cohort does NOT arrive at the upstream project by day 3 and project average flow was below 160 kcfs, adult daytime spill operations would continue an additional day and would be evaluated again the following day as previously described. This would continue until the adult delay or passage issue has been resolved and the standard operations can be reinstated as described in Table 4.

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<sup>27</sup> The return to 125% TDG spill 24/7 will be triggered if 50% or more of the running 3-day cohort for the most recent day (e.g., day 3 of adult daytime spill) is detected at the upstream dam. The agencies will use Columbia River DART’s Reach Distribution and Delay for PIT Tag Adult Returns tool for this purpose.

<sup>28</sup> The agencies will use the current Columbia River DART’s Reach Distribution and Delay for PIT Tag Adult Returns tool (“Running 3-day DART tool”) to determine if criteria one and two have been met. See top panel, in-season graphics of Cumulative Arrival Percent by Days in Route to Lower Granite or Lower Monumental dams. [https://www.cbr.washington.edu/dart/query/pitadult\\_reachdist](https://www.cbr.washington.edu/dart/query/pitadult_reachdist)

The TMT may consider in-season deviations from these criteria if unforeseen factors are reasonably expected to cause substantial delay (e.g., lack of load conditions, priority turbine unit outages, etc.) and the Fish Passage Operations and Maintenance (FPOM) Coordination Team may consider refinements to these triggers following each spring spill season.

## 8. 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 2025 at each project are defined in Table 5. At the Snake River Projects spill may range up to  $\pm 1$  kcfs during the summer spill operation from August 1 – August 31.

**Table 5.— Summary of 2025 summer target spill levels at lower Snake River and lower Columbia River projects.**

PROJECT	EARLY SUMMER SPILL <sup>A</sup> (June 21/16 – July 31) (24 hrs/day)	LATE SUMMER SPILL <sup>A</sup> (August 1 – August 31) (24 hrs/day)
Lower Granite <sup>B</sup>	18 kcfs	RSW flow (as river flow allows)
Little Goose <sup>B, C</sup>	30%	ASW flow or 7 kcfs
Lower Monumental <sup>B, D</sup>	17 kcfs	RSW flow or 8 kcfs
Ice Harbor <sup>B, E</sup>	30%	RSW flow or 9 kcfs
McNary <sup>F</sup>	57%	2 TSWs flow or 20 kcfs
John Day	35% <sup>G</sup>	2 TSWs flow <sup>H</sup> or 20 kcfs
The Dalles	40% <sup>G</sup>	30% <sup>G</sup>
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 1-August 31 will be through the spillway weir or a constant spill rate through conventional spillbays using the appropriate FPP spill pattern. The spillway weir spill rate is a function of forebay elevation (as pool elevation increases, more water is spilled over the weir), as defined in the FPP. The spillway weirs will be operated per FPP criteria and closed when low flow criteria are met. When the spillway weir 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 Little Goose ASW high crest elevation as adjusted relative to the forebay operating range (see FPP Chapter 8, section 2.3.2.7).

D. Flow corresponds to a Lower Monumental forebay elevation of 538.5 feet, the mid-point of the forebay range from 537-540 feet.

E. Flow corresponds to an Ice Harbor forebay elevation of 438.5 feet, the mid-point of the forebay range from 437-440 feet.

F. From June 16-July 31, McNary will adjust spill once a day to 57% of the previous day's average project outflow. The intent is to reduce the frequency of spillgate changes while implementing a more uniform pattern to the extent it can be done safely (see FPP Chapter 5, section 2.2.1.1).

G. Hourly spill percentage target of river flow with  $\pm 5\%$  flexibility of river flow for balancing reserves, consistent with current target spill level calculations.

H. John Day will also spill from bay 2 open 1 stop (approximately 1.6 kcfs) during daylight hours when spill is through the TSWs only to maintain attraction flow to the north adult ladder, per FPP Chapter 4 (JDA), section 2.2.3.

## 9. PROJECT-SPECIFIC OPERATIONS

The following sections describe 2025 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.

### 9.1. Lower Granite Dam

**9.1.1. Fall/Winter Surface Spill (Table 3).** The Lower Granite RSW spill rate will increase with increasing forebay elevation, from approximately 5.6 kcfs at the bottom of the normal forebay operating range up to 11.4 kcfs at the top of the range (see FPP Chapter 9, section 2.3.2.6).

- March 1–20: RSW spill 4 hours/day in the morning, 7 days/week.
- March 21 – April 2: RSW spill 24 hours/day, 7 days/week.
- September 1 – November 15: RSW spill 4 hours/day in the morning, 7 days/week.

**9.1.2. Spring Spill (Table 4):** 125% gas cap (see Section 2.1), 24 hours/day, April 3–June 20. If adult passage delay is observed (see Section 7.1), then 125% gas cap, 16 hours/day, and 40% of outflow, 8 hours/day.

#### 9.1.3. Summer Spill (Table 5):

- June 21–July 31: 18 kcfs, 24 hours/day.
- August 1–31: RSW spill, 24 hours/day.

**9.1.4. Operational Considerations:** During low flow when spill is less than 15 kcfs and the RSW is open, Lower Granite will transition to alternate spill patterns defined in FPP Table LWG-7-ALT if needed to maintain the tailwater elevation at no lower than 633 feet. The project will switch to these alternate patterns to avoid or minimize the need to raise the Little Goose forebay operating range to keep from dropping below the Lower Granite minimum tailwater elevation.

### 9.2. Little Goose Dam

**9.2.1. Fall/Winter Surface Spill (Table 3).** The Little Goose ASW will be adjusted relative to forebay up to once per day to maintain a “high crest” elevation and a minimum of 7 kcfs spill (see FPP Chapter 8, section 2.3.2.7).

- March 1–20: ASW high crest 4 hours/day in the morning, 7 days/week.
- March 21 – April 2: ASW high crest 24 hours/day, 7 days/week.
- September 1 – November 15: ASW high crest 4 hours/day in the morning, 7 days/week.

**9.2.2. Spring Spill (Table 4):** 125% gas cap (see section 2.1), 24 hours/day, April 3 until adult criteria are met, then 125% gas cap, 16 hours/day, and 30% of outflow (performance standard) 8 hours/day, through June 20 (Table 3, footnote B).

**9.2.3. Summer Spill (Table 5):**

- June 21–July 31: 30% of outflow, 24 hours/day (except when adjusted to a constant spill level during low flows, as described in Operational Considerations below).
- August 1–31: ASW spill or approximately 7 kcfs, 24 hours/day.

**9.2.4. Operational Considerations:**

- When the ASW 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  $\pm 4\%$  according to the spill patterns in FPP Chapter 8 Table LGS-11.
- During low flow conditions at Little Goose, spill may exceed the target percentage if the ASW is in service, which restricts the project to a fixed minimum spill level (i.e., spill cannot be reduced below the spill rate through the ASW, which may result in spilling more than the target percentage at lower outflows).
- During the 30% spill operation when project outflows are  $\leq 32$  kcfs, the spill operation will transition from 30% to a constant spill rate 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  $\leq 23.9$  kcfs. Actual spill may range up to  $\pm 1$  kcfs from the target spill level. Spill changes will be made by 0300 each day.

**9.3. Lower Monumental Dam**

**9.3.1. Fall/Winter Surface Spill (Table 3).** The Lower Monumental RSW spill rate will increase with increasing forebay elevation, from approximately 6.7 kcfs at the bottom of the forebay operating range up to 9.5 kcfs at the top of the range (see FPP Chapter 7, section 2.3.2.6).

- March 1–20: RSW spill 4 hours/day in the morning, 7 days/week.
- March 21 – April 2: RSW spill 24 hours/day, 7 days/week.
- September 1 – November 15: RSW spill 4 hours/day in the morning, 7 days/week.

**9.3.2. Spring Spill (Table 4):** 125% gas cap (section 2.1), 24 hours/day, April 3–June 20. If adult passage delay is observed (Section 7.1), then 125% gas cap, 16 hours/day, and 40% of outflow 8 hours/day. Spring spill will occur using the uniform pattern, except during low

flows (spill below 30 kcfs) when the bulk pattern will be used to avoid small gate openings that could impact fish.

### 9.3.3. Summer Spill (Table 5):

- June 21–July 31: 17 kcfs (bulk pattern), 24 hours/day.
- August 1–31: RSW spill or approximately 8 kcfs, 24 hours/day.

**9.3.4. 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.<sup>29</sup>

## 9.4. Ice Harbor Dam

**9.4.1. Fall/Winter Surface Spill (Table 3).** The Ice Harbor RSW spill rate will increase with increasing forebay elevation, from approximately 7.1 kcfs at the bottom of the forebay operating range up to 10.4 kcfs at the top of the range (see FPP Chapter 6, section 2.3.2.6).

- March 1–20: RSW spill 4 hours/day in the morning, 7 days/week.
- March 21 – April 2: RSW spill 24 hours/day, 7 days/week.
- September 1 – November 15: RSW spill 4 hours/day in the morning, 7 days/week.

**9.4.2. Spring Spill (Table 4):** 125% gas cap (see section 2.1), 24 hours/day, April 3–June 20.

### 9.4.3. Summer Spill (Table 5):

- June 21–July 31: 30%, 24 hours/day.
- August 1–31: RSW spill or approximately 9 kcfs, 24 hours/day.

### 9.4.4. Operational Considerations:

- When the RSW 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 RSW). This operational limitation results in spilling more

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<sup>29</sup> With spill levels in spring 2025 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.

than 30% when total outflow drops below approximately 28 kcfs. Per FPP section 2.3.2.7, the RSW 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 RSW is still open, resulting in spill greater than 30% for those hours.

- Currently, all but one of the five available Ice Harbor turbines have runner blades that are locked at a set angle (non-adjustable) and a smaller operating range (also referred to as “fixed-blade” or “locked-blade” units). Only Unit 3 has adjustable blades. 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 at certain outflows. Unit 1 is currently out of service until 2026 to install a new adjustable-blade runner design.

## 9.5. McNary Dam

**9.5.1. Fall/Winter Surface Spill (Table 3).** The McNary TSW spill rate will increase with increasing forebay elevation, from approximately 8 kcfs at the bottom of the normal forebay operating range up to 11 kcfs at the top of the range.

- March 1–20: Spillbay 20 TSW 4 hours/day in the morning, 7 days/week.
- March 21 – April 9: Spillbay 20 TSW 24 hours/day, 7 days/week.
- September 1 – November 15: Spillbay 20 TSW 4 hours/day in the morning, 7 days/week.

**9.5.2. Spring Spill (Table 4):** 125% gas cap (see section 2.1), 24 hours/day, April 10–June 15.

**9.5.3. Summer Spill (Table 5):**

- June 16–July 31: 57% of the previous day’s average outflow, 24 hours/day. Spill changes will be made by 0300 each day.
- August 1–31: Two TSWs spill or 20 kcfs, 24 hours/day.

**9.5.4. Operational Considerations:**

- Currently, McNary spillbays are restricted due to hoists and cranes that need replacement. As a result, McNary will implement modified spill patterns. For more information, see FPP Chapter 5 (MCN), section 2.2.
- 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  $\pm 1\%$  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.

## 9.6. John Day Dam

### 9.6.1. Fall/Winter Surface Spill (Table 3).

- March 21 – April 9: Spillbay 19 TSW spill 24 hours/day, 7 days/week.
- Opening the TSWs at John Day Dam requires a crew and gantry crane and must be done during daylight hours as weather allows. On March 21, spill will occur at an equivalent rate (approximately 10 kcfs) with the non-TSW pattern in FPP Table JDA-9 from 0001 hours until the TSW is opened in the morning.

**9.6.2. Spring Spill (Table 4):** 40% of outflow daytime and 125% gas cap nighttime, April 10–June 15, with priority to maintain 40% spill 24 hours/day at The Dalles Dam as needed for TDG management. Daytime hours are defined in FPP Chapter 4, Table JDA-5. A crew will install the TSW in spillbay 18 on the first day of spring spill as early as possible during daylight hours (see TSW operating criteria in FPP Chapter 4, section 2.3.2.4).

- Daytime 40% of outflow with  $\pm 5\%$  flexibility of river flows for balancing reserves, consistent with current target spill level calculations. Deviations outside of  $\pm 5\%$  of river flow for reserves within the Bonneville balancing authority area will be reported in the Pre-Coordinated Operations Table in the monthly FOP implementation report (see section 10). Any other exceedances for reserves will be reported in the Variance Table in the monthly FOP implementation report.

### 9.6.3. Summer Spill (Table 5):

- June 16–July 31: 35% of outflow, 24 hours/day with  $\pm 5\%$  flexibility for balancing reserves, consistent with current target spill level calculations. Deviations outside of  $\pm 5\%$  of river flows for reserves within the Bonneville balancing authority area will be reported in the Pre-Coordinated Operations Table in the monthly FOP Implementation Report (see section 10). Any other exceedances for reserves will be reported in the Variance Table in the monthly FOP Implementation Report.
- August 1–31: Two TSWs or 20 kcfs, 24 hours/day. A crew will close both TSWs on the last normal workday of summer spill, Thursday, August 28, 2025, as late in the day as possible. Spill will be maintained at an equivalent rate of 20 kcfs through midnight on August 31 using the spill patterns with no TSWs (see TSW operating criteria in FPP Chapter 4, section 2.3.2.4).

### 9.6.4 Operational Considerations:

- Currently, turbine units 2, 3, 8, 9, 10, 11, and 13 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-A). 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 the WMP sections 6.11.1.4 and Tables 2 and 5 and Section 6.11.1.3 for discussion of springtime pool elevations to dissuade nesting of Caspian terns at Blalock Island. This operation is also described in the FPP Appendix A. This higher forebay operation will increase the flow rate over the TSWs and may change tailrace flow patterns.

## 9.7. The Dalles

**9.7.1. Fall/Winter Surface Spill (Table 3):** The ice & trash sluiceway (ITS) is a powerhouse (non-spillway) surface passage route and will operate March 1–December 15, 24 hours/day, pursuant to criteria in FPP Chapter 3.

**9.7.2. Spring Spill (Table 4):** 40% of outflow, 24 hours/day, April 10–June 15. Maintain 40% spill 24 hours/day at The Dalles Dam and reduce John Day Dam TDG spill cap as needed for TDG management.

### 9.7.3. Summer Spill (Table 5):

- June 16–July 31: 40% of outflow, 24 hours/day, with  $\pm 5\%$  flexibility for balancing reserves, consistent with current target spill level calculations. Deviations outside of  $\pm 5\%$  of river flow for reserves within the Bonneville balancing authority area will be reported in the Pre-Coordinated Operations Table in the monthly FOP Implementation Report (see section 10). Any other exceedances for reserves will be reported in the Variance Table in the monthly FOP Implementation Report.
- August 1–31: 30% of outflow, 24 hours/day, with  $\pm 5\%$  flexibility for balancing reserves, consistent with current target spill level calculations. Deviations outside of  $\pm 5\%$  of river flow for reserves within the Bonneville balancing authority area will be reported in the Pre-Coordinated Operations Table in the monthly FOP Implementation Report (see section 10). Any other exceedances will be reported in the Variance Table in the monthly FOP Implementation Report.

### 9.7.4. Operational Considerations:

- Spill bays 9<sup>30</sup>, 10, 11, 13, 16, 18, 19, and 23 are operationally restricted due to wire rope, structural and concrete erosion concerns.

## 9.8. Bonneville Dam

**9.8.1. Fall/Winter Surface Spill (Table 3).** The PH1 ice & trash sluiceway (ITS) and PH2 corner collector (B2CC) are powerhouse (non-spillway) surface passage routes and will

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<sup>30</sup> Spillbay 9 at The Dalles Dam cannot be used due to failure of the trunnion pin in 2009.

operate pursuant to criteria in FPP Chapter 2:

- March 1–8: B2CC daily 0600-1000 hours.
- March 9–25: B2CC daily 0600-1000 and 1600-2000 hours.
- March 26–August 31: B2CC 24 hours/day, 7 days/week (beginning at 0600 on March 26).
- Year-round: ITS 24 hours/day, 7 days/week. From December 15–end of February, the ITS may be closed for up to 6 hours/day for maintenance.

**9.8.2. Spring Spill (Table 4):** 125% gas cap up to a maximum of 150 kcfs for fish passage spill (see section 2.1), 24 hours/day, April 10–June 15.

**9.8.3. Summer Spill (Table 5):**

- June 16–July 31: 95 kcfs, 24 hours/day.
- August 1–31: 50 kcfs, 24 hours/day.

**9.8.4. 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  $\geq$  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 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  $\pm 3$  kcfs according to spill pattern tables in FPP Chapter 2.

## 10. FOP IMPLEMENTATION REPORTING

The Corps posts monthly FOP Implementation Reports between April and August on the following website: [https://public.crohms.org/tmt/documents/FOP\\_Implementation\\_Reports/](https://public.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 turbine units;
- target spill: the spill target for that hour (Tables 3, 4 and 5);
- 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:
  - <https://public.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).
  - <https://public.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:
  - <https://public.crohms.org/report/total.html> (web reports with hourly TDG, project outflow and spill for the previous 3 days).
  - [https://public.crohms.org/ftppub/water\\_quality/tdg/](https://public.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) daily. These averages are reported at: [https://public.crohms.org/ftppub/water\\_quality/12hr/](https://public.crohms.org/ftppub/water_quality/12hr/).
- Spill cap information is posted to the following site each day: <https://public.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 2025 fish passage spill operations, including reasonably detailed information that is relevant to the Corps' process for implementing fish passage spill.

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Transalta )  
Centralia Generation LLC )  
\_\_\_\_\_ )

Order No. 202-26-18

Motion to Intervene, Motion for Clarification, and Requests for Rehearing and Stay  
of Sierra Club, NW Energy Coalition, Washington Conservation Action, Climate  
Solutions, Public Citizen, and Environmental Defense Fund  
(collectively, “Public Interest Organizations” or “PIOs”)

Exhibit 2-152:  
2026 Fish Operations Plan



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

## 2026 Fish Operations Plan

### 1. INTRODUCTION

The 2026 Fish Operations Plan (2026 FOP) describes the U.S. Army Corps of Engineers' (Corps) planned operations for fish<sup>1</sup> passage at its four lower Snake River and four lower Columbia River dams and includes surface spill operations (March through early April), spring and summer spill operations (early April through August), and fall surface spill operations (September through mid-November). The 2026 FOP is responsive to the U.S. District Court for the District of Oregon's (District Court) Preliminary Injunction Order issued February 25, 2026 and amended on March 2, 2026. The Corps will implement the 2026 FOP consistent with that order. It is also consistent with spill operations for 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) and U.S. Fish and Wildlife Service (USFWS) Columbia River System (CRS) Biological Opinions (2020 CRS BiOps)<sup>2</sup>, 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 ESA. Other project operations and water management actions not specifically addressed in this document will be consistent with other guiding operative documents, including the 2026 Water Management Plan (WMP), seasonal WMP updates, and the 2026 Fish Passage Plan (FPP).

In addition to discussing project-specific fish passage spill operations, the 2026 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 2026 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.

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<sup>1</sup> ESA-listed salmon and steelhead.

<sup>2</sup> 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 2026 consistent with the State of Washington and the State of Oregon total dissolved gas (TDG) water quality standards (WQS).<sup>3,4</sup> 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 ensure 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 modification to its TDG WQS of up to 125% TDG from April 1-June 15 and up to 120% TDG from June 16-August 31, 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 December 31, 2024, page 4). Regarding Oregon's 105% TDG criterion, Oregon Department of Environmental Quality (ODEQ) clarified that this criterion does not apply to the Columbia River per their letter dated January 29, 2024. 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:

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<sup>3</sup> WASH. ADMIN. CODE § 173-201A-200(1)(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>.

<sup>4</sup> 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<sup>5</sup>:**

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 115 percent as measured in the forebays of the next downstream dams and must not exceed an average of 120 percent as measured in the tailraces of each dam (these averages are calculated as an average of the 12 highest hourly readings in a calendar day, relative to atmospheric pressure); and
- A maximum TDG saturation level of 125 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 125 percent calculated as an average of the 12 highest hourly TDG measures in a calendar day; and
- A maximum TDG saturation level of 126 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

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<sup>5</sup> The text of the code is copied verbatim below for reference.

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 50 fish required weekly) or non-salmonids (with a minimum sample size of 50 fish required weekly) exceeds:

- Gas bubble trauma in non-paired fins of 15 percent; or
- Gas bubble trauma in non-paired fins of five percent and gas bubbles occlude more than 25 percent of the surface area of the fin.

In accordance with WADOE's Rule Implementation Plan, 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 approved the following modification<sup>6</sup> 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 modified total dissolved gas standards will apply for five years, beginning Jan. 1, 2025, through Dec. 31, 2029 (calendar years 2025, 2026, 2027, 2028, and 2029).
5. The DEQ Director may approve additional periods of application of this modification up to 120 percent total dissolved gas as calculated in 8.a)i., beyond the April 1 to Aug. 31 period, subject to subsections 8.a) to 8.c) for reasons including passing Spring Creek

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<sup>6</sup> The text of the modification is copied verbatim below for reference.

Hatchery fish releases and other voluntary fish passage operations, maintenance activities, and biological or physical studies of spillway structures and prototype fish passage devices. The Corps must notify DEQ in writing at least one week prior to the spill describing the proposed action, including its purpose, and the location and dates of elevated total dissolved gas levels. Spill must be reduced to meet the 110 percent total dissolved gas criterion if requested by the DEQ Director.

6. 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. Plans must include monitoring for non-salmonid fish species. Gas bubble trauma monitoring 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 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. The DEQ Director may halt the voluntary spill program or require reductions in voluntary spill to reduce TDG levels to 120 percent as calculated in 8.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 eyes or non-paired fins of fifteen percent, or gas bubble trauma in eyes or non-paired fins of five percent and gas bubbles occlude more than twenty-five percent of the surface area of the fin or eyes. If gas bubble trauma exceeds these biological thresholds and spill is reduced, 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.
8. 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 eyes or non-paired fins, or
    - ii. More than five percent of salmonids examined show signs of gas bubble trauma in their eyes non-paired fins where more than 25 percent of the surface area is occluded by gas bubbles.
  - c. Physical monitoring must occur and be adequate for implementing the requirements set out in this order.
9. The Corps must provide written notice to DEQ within 24 hours of any violations of the conditions in the modification as it relates to voluntary spill. Such notice must include actions proposed to reduce total dissolved gas levels or the reason(s) for no action.
10. No later than Jan. 31 following each year of this modification, the Corps must provide an annual written report to DEQ detailing the following:
- a. Flow and runoff descriptions for the spill season;
  - b. Spill quantities and durations;
  - c. Quantities of water spilled for fish versus spill for other reasons for each project;
  - d. Data results from the physical and biological monitoring programs, including incidences of gas bubble trauma regardless of sample size;
  - e. Evaluation of the relationship between observations of non-salmonid gas bubble trauma monitoring and exposure to elevated total dissolved gas levels;
  - f. Description and results of any biological or physical studies of spillway structures and prototype fish passage devices to test spill at operational levels; and
  - g. Implementation of gas abatement measures identified through adaptive management.

11. If requested, the Corps must report to the commission on any of the above matters or other matters relevant to this order.

12. The commission reserves the right to terminate or modify this order at any time.

For the purposes of Oregon's Order, ODEQ defines non-salmonid as including non-native species per their letter dated June 10, 2022 and email dated January 18, 2023. Gas bubble trauma monitoring in bi-state waters will include evaluation of non-native species in the population of non-salmonids to comply with Oregon's Order.

The language in WAC 173-201A-200(1)(f)(ii)(B)(II) states that monitoring for native nonsalmonid fish species must continue for a minimum of five years. The Action Agencies have conducted monitoring for five years and will continue to implement unless WADOE determines otherwise prior to implementation of spill for fish passage at levels that necessitate monitoring.

In its implementation of spill for fish passage, the Corps will operate its fish passage projects in 2026 consistent with the CRSO EIS ROD, 2020 CRS BiOps, the Court's Preliminary Injunction Order as amended, and in accordance with the States' TDG standards described above, including applying the different state calculation methodologies. WADOE's Rule Implementation Plan is unchanged and continues to require GBT evaluation of native non-salmonids.

The terminology that has been adopted to refer to the States' TDG Water Quality Standards (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. 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.

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 2026 Water Management Plan (see Appendix 4: TDG Management Plan)<sup>7</sup>.

Higher spill than the target spill levels identified in Tables 3, 4, and 5 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<sup>8</sup>. 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, 4, and 5 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<sup>9</sup> to provide favorable fish passage conditions.

Spillbay gates are opened to the settings identified in the FPP spill pattern table that corresponds 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  $\pm 2$  thousand cubic feet per second (kcfs) when the target spill is a flow rate (e.g., kcfs, including when projects are spilling a percent of total project outflow based on the previous day's average flow). Not all projects are able to achieve this level of precision (e.g., Little Goose and Bonneville dams). More information regarding project-specific spill precision limitations may be found in Section 9 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. MODIFICATIONS TO PLANNED OPERATIONS AND IN-SEASON MANAGEMENT**

For planning purposes, the operations described in the 2026 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

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<sup>7</sup> The Water Management Plan (WMP) and associated appendices are updated annually. *See* <http://public.crohms.org/tmt/documents/wmp/>.

<sup>8</sup> <http://public.crohms.org/tmt/documents/spill-priority/>

<sup>9</sup> The FPP is coordinated annually with regional sovereigns through the FPOM. *See* <http://public.crohms.org/tmt/documents/fpp/>.

conditions as they arise, the Corps, in conjunction with the other Action Agencies, NMFS, and USFWS, coordinates with regional sovereigns on these conditions and other planned operations through the review of the 2026 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<sup>10</sup> 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.

##### Planned and Routine Operational Adjustments:<sup>11</sup>

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.
4. Operational limitations, for example physical limitations of gate settings, spill patterns (see section 3), forebay elevation, and deadband<sup>12</sup>.
5. Scheduled turbine unit and/or transmission outages that reduce powerhouse hydraulic capacity and require spilling more than the target spill level.\* (see footnote 111)
6. Standard operations for transmission reliability (see section 4.4.1. below).\* (see footnote 111)
7. Navigation safety concerns (see section 4.6. below).\* (see footnote 111)

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<sup>10</sup> 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 Regional Forum subcommittees, which include the TMT, Studies Review Workgroup (SRWG), Fish Facility Design Review Work Group (FFDRWG), and FPOM.

<sup>11</sup> 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.

<sup>12</sup> 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.

8. Transition periods between gas cap spill and lower spill rates (e.g., during performance standard spill blocks<sup>13</sup>) may result in actual hourly spill levels that are slightly higher or lower than targeted spill levels.

Non-routine or Unplanned Operational Adjustments:<sup>14</sup>

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 rates of gas bubble trauma (GBT) incidence rates in either juvenile salmonids or non-salmonids<sup>15</sup>, 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.<sup>16</sup>
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 2026 WMP Emergency Protocols (WMP Appendix 1). These Protocols identify the process the Action Agencies, in coordination with NMFS and USFWS, use in the event of an emergency concerning project operations that impact 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:

<https://public.crohms.org/tmt/documents/wmp/2026/>

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<sup>13</sup> “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.

<sup>14</sup> 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.

<sup>15</sup> See WAC 173-201A-200(1)(f)(ii)(B)(III), including WADOE’s Rule Implementation Plan for Chapter 173-201A WAC Water Quality Standards for Surface Waters of the State of Washington (Publication 19-10-048; pages 7-9), and Order Approving a Modification to the Oregon’s Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem, page 5, including clarifications from Oregon Department of Environmental Quality email dated 18 January 2023, RE: Request for Clarification of Spring Non-Salmonid Monitoring Requirement.

<sup>16</sup> When a generator requires repair, ongoing operations may require modification to prepare a turbine unit for the necessary maintenance without further damaging infrastructure or jeopardizing personnel safety. 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.

### **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  $\pm 1\%$  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 lower Snake River powerhouses may be required to keep one generating unit<sup>17</sup> 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.

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<sup>17</sup> Two generating units may be necessary at Ice Harbor Dam during elevated air temperatures 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.<sup>18</sup>**

<b>Project</b>	<b>Turbine Unit</b>	<b>Minimum Generation Flow Range<sup>A</sup> (kcfs)</b>
<b>Lower Granite</b>	1, 3	11.6 – 12.7
	2 <sup>B</sup>	17.8 – 18.8
	4, 5, 6	13.8 – 14.9
<b>Little Goose</b>	1, 2, 3	11.8 – 12.3
	4, 5, 6	14.3 – 14.9
<b>Lower Monumental</b>	1, 2, 3	11.7 – 12.9
	4, 5, 6	13.8 – 14.6
<b>Ice Harbor</b>	1 <sup>C</sup>	TBD
	2	12.1 – 14.1
	3	8.6 – 10.3
	4 <sup>B</sup>	12.2 – 13.5
	5, 6 <sup>B</sup>	12.5 – 14.1
<b>McNary</b>	N/A	50 – 60
<b>John Day</b>	N/A	50 – 60 (may increase up to 80 for reserves) <sup>D</sup>
<b>The Dalles</b>	N/A	50 – 60
<b>Bonneville</b>	N/A	30 – 40

A. “Minimum Generation” is the minimum number of megawatts (MW) that must be generated at each project 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 and Ice Harbor units 4, 5, and 6 are restricted due to fixed-blade (non-adjustable) runners that are set at a fixed angle (non-adjustable). If a unit is restored to an adjustable-blade Kaplan in-season, the minimum generation range will revert to the lower 1% limit.

C. Ice Harbor Unit 1 is being rebuilt with an adjustable-blade runner design that reduces impacts to fish, scheduled for completion in 2026. At that time, testing will be performed to confirm the operating range.

D. Powerhouse outflows may increase for reserves up to 80 kcfs at John Day Dam during spring months (without triggering reporting requirements described in Section 4.1). Increased powerhouse generation allowances will allow for additional generation for the purpose of providing real-time operators greater access to reserve capacity prior to requiring variance tracking or declarations of power system emergency. As needed, the higher ranges will be utilized for reserves under low flow conditions (e.g., minimum generation and spill the rest) and when flexibility elsewhere (e.g., Grand Coulee and Chief Joseph dams to carry and deploy reserves) has been maximized. Powerhouse flows exceeding 80 kcfs at John Day Dam for reserves will be reported in the Pre-Coordinated Operations Table. Any other exceedances will be reported in the Variance Table in the monthly FOP Implementation Report (see section 10).

There may be situations when river flows are insufficient to maintain minimum generation in Table 1 and the target spill level identified in Tables 3, 4, and 5 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 other spill percentages or volumes, depending on which operation is targeted for a given hour. The inability to meet the target gas

<sup>18</sup> The table is accurate as of April 2026 but may change in-season as coordinated through FPOM (see the FPP).

cap spill level due to low river flow does not preclude the ability of the Corps to target performance standard spill levels as specified in Table 4. Additionally, inflow provided by non-Federal projects upstream is often variable and uncertain, and in combination with low flow 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.<sup>19</sup>

#### **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 2026 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 10 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:

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<sup>19</sup> 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<sup>20</sup> area with contingency reserves required by North American Electric Reliability Corporation (NERC) reliability standards.<sup>21</sup>
2. Ensuring generation is available to increase or decrease to balance load and generation to support reliability, including bidding such generation into applicable markets to more efficiently dispatch generation to support reliability.<sup>22</sup>
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.<sup>23</sup> When conditions result in an inability to meet the target spill levels defined in Tables 4 and 5, Bonneville will make best efforts to minimize the allocation of reserves (decremental, DEC and/or incremental, INC) on fish passage projects if a spill reduction would be required to allocate the reserves.
5. Ensuring that there is generation operating at projects in specific locations sufficient for arming for Remedial Action Schemes (RAS).<sup>24</sup> RAS 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.

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<sup>20</sup> 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.

<sup>21</sup> The Federal Energy Regulatory Commission has certified the NERC as the Electric Reliability Organization responsible for establishing and enforcing national reliability standards.

<sup>22</sup> BPA relies on regional energy markets to help support transmission reliability and meet operational objectives. This clarification ensures BPA can bid in reserves to maintain access to those markets for transmission reliability purposes.

<sup>23</sup> For example, generators may be required to maintain generation levels above minimum generation to provide sufficient capability to reduce generation.

<sup>24</sup> 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.

This includes adjusting generation that flows over specific transmission facilities 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 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  $\pm 1\%$  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  $\pm 1\%$  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 and Minimum Tailwater Elevations**

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.<sup>25</sup> This may include changes in spill patterns, reductions in spill, short-term spill curtailment, or operating above MOP. Adjustments to MOP may also be required to meet minimum tailwater elevations (Table 2). Current spill operations for fish passage result in complex downstream hydraulics that cause large fluctuations in tailwater elevations. 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).

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<sup>25</sup> 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 and minimum tailwater elevations for lower Snake River projects.<sup>A</sup>**

Project	Normal Operating Elevation Range (ft) <sup>B</sup>		MOP Elevation Range (ft) <sup>C</sup>		Project Tailwater (ft)
	Minimum	Maximum	Minimum	Maximum	Minimum
Lower Granite	733.0	738.0	733.0	734.5	633.0
Little Goose	633.0	638.0	633.0	634.5	537.0
Lower Monumental	537.0	540.0	537.0	538.5	437.0
Ice Harbor	437.0	440.0	437.0	438.5	337.0

A. Elevations provided in feet above mean sea level (NGVD29).

B. August 15 – April 2, except at Lower Granite (September 1-April 2).

C. April 3 – August 14, except at Lower Granite (April 3 – August 31). Projects will be operated within a 1.5-foot range.

Potential in-season adjustments to MOP, if necessary, will be an expanded forebay operating range (Expanded MOP) or raised minimum forebay elevation (Raised 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 to provide safe conditions for barge traffic at the 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 spill percentages or prescribed volumes 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  $\pm 1$  percent range.

**Raised MOP:** If the minimum forebay elevation is insufficient to maintain navigation safety or meet project minimum tailwater elevations, the 1.5-foot MOP range is raised as necessary. Adjustments in MOP operations have been necessary at the lower Snake River projects, typically during lower flow conditions. For instance, low flows in combination with fish passage spill operations may impact reservoir elevations and cause dips below project minimum tailwater elevations or inadequate navigation depths. Using Little Goose as an example, this type of adjustment would be described as “1.5-foot raised MOP (634.5-636.0 feet)”.

**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 2026. 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 and Little Goose 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 at Lower Granite and Little Goose resumes on August 1 with allowance for TMT adaptive management adjustments and continues through October 31. 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 spill targets).

### **5.2. Transport Research – Seasonal Effects of Transport**

An ongoing annual study will be conducted again in 2026 to determine seasonal effects of transporting fish from the Snake River to optimize a transportation strategy. Fish will be collected for this study at Lower Granite starting on April 13, with marking beginning on April 14.

Depending on the number of fish available, fish will be collected 1-2 days each week with tagging occurring on the day following collection. A barge will leave on Thursday (16 April) morning with all fish collected during the previous 1-2 days (excluding fish tagged for in-river survival, which will be released into Lower Granite Dam tailrace). If necessary to achieve the proper loading density, additional fish will be collected on 15 April (but not tagged). 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 the week 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 five to six weeks.

## 6. FALL/WINTER SURFACE SPILL OPERATIONS

Surface spill operations in March–April and September–November will occur during the dates and times defined below in Table 3. Surface spill will occur via the project’s spillway weir (RSW, TSW, or ASW<sup>26</sup>), except at The Dalles and Bonneville dams which do not have a spillway weir and will instead operate non-spillway surface passage routes as defined in Table 3.

**Table 3.— Fall/Winter Surface Spill Operations in 2026.<sup>A</sup>**

Project	Dates	Hours	Notes
LWG, LGS, LMN, IHR, MCN	March 1 – March 20	4 hours/day in the morning, 3 days/week	LGS ASW in high crest (~7 kcfs).
	March 21 – April 2 (Snake projects) / April 9 (MCN)	24 hours/day, 7 days/week	MCN TSW in spillbay 20 March 1-April 9 and in spillbays 19, 20 September 1-November 15.
	September 1 – November 15		
JDA <sup>B</sup>	March 21 – April 9 (TSW19)  September 1 – November 15 (TSW18 and TSW19)	24 hours/day, 7 days/week	Opening the JDA TSW requires a crew and crane and must be done during daylight hours as weather allows. On March 21, the TSW in spillbay 19 will be opened in the morning as early as possible. On November 15, both TSWs will be closed as late as possible during daylight hours, then spill maintained at ~20 kcfs with non-TSW patterns through 2359 hours.
TDA Sluiceway	Year-round	24 hours/day, 7 days/week	TDA sluiceway is a non-spillway surface passage route. See FPP Chapter 3 for operating criteria.
BON B2CC	March 1–8	0600-1000 daily	BON PH2 corner collector (B2CC) is a non-spillway surface passage route. See FPP Chapter 2 for operating criteria.
	March 9–25	0600-1000, 1600-2000 daily	
	March 26 begin year-round	24 hours/day, 7 days/week	
BON Sluiceway	Year-round	24 hours/day, 7 days/week	BON PH1 sluiceway is a non-spillway surface passage route. See FPP Chapter 2 for operating criteria.

A. Spill may be temporarily reduced below the FOP target spill level at any project if necessary to ensure navigation safety or transmission reliability, or to avoid exceeding State TDG standards.

B. John Day Dam will also spill from bay 2 open 1 stop (approximately 1.6 kcfs) 24 hours/day September 1-November 15 to maintain attraction flow to the North Shore adult fish ladder, per FPP Chapter 4 (JDA).

<sup>26</sup> Depending on their design, spillway weirs are referred to as either “Removable” (RSW–applies to LWG, LMN, IHR), “Adjustable” (ASW–applies to LGS), or “Top” (TSW–applies to MCN and JDA).

## 7. 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 2026 at each project are defined in Table 4. 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 Oregon’s Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem](#), page 4-5).

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 4.— Summary of 2026 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	April 3 - June 20	24 hours/day: 125% Gas Cap
Little Goose <sup>A, B, C</sup>	April 3 – June 20	125% Gas Cap 24 hours/day (until adult criteria met) <i>then</i> 16 hours/day: 125% Gas Cap; 8 hours/day: 30% of outflow (Performance Standard)
Lower Monumental <sup>D</sup>	April 3 - June 20	24 hours/day: 125% Gas Cap
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	April 10 – June 15	24 hours/day: 125% Gas Cap
The Dalles <sup>C, E</sup>	April 10 – June 15	24 hours/day: 40% of outflow (Performance Standard)
Bonneville <sup>F</sup>	April 10 – June 15	24 hours/day: 125% Gas Cap

A. Little Goose 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, 2026, 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. If a second block is needed, it will start as soon as load conditions allow, continue for at least two consecutive hours, and conclude no later than 2000.

B. During periods of high river flow that exceeds powerhouse hydraulic capacity, implementing 8 consecutive hours of spill as described in Footnote A 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 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. In lack of load conditions performance standard spill blocks will be prioritized at Little Goose, Lower Monumental dams, in that order.

C. All projects denoted by this footnote will adjust spill once a day to the indicated percentage level of the previous day’s average project outflow. The intent is to reduce the frequency of spillgate changes.

D. Lower Monumental Adult Delay – See Section 7.1.

E. 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. Spill above 40%, up to 125% TDG, may occur for TDG management or for carrying reserves.

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

### **7.1. Adult Migration Delay Protocol for Spring Spill Operations at Lower Monumental Dam**

At Lower Monumental Dam, monitor and manage adult conversion rates in-season via TMT process.<sup>27</sup>

## **8. 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 2026 at each project are defined in Table 5. At the Snake River Projects spill may range up to ±1 kcfs during the summer spill operation from August 1 – August 31.

**Table 5.— Summary of 2026 summer target spill levels at lower Snake River and lower Columbia River projects.**

<b>PROJECT</b>	<b>SUMMER SPILL<sup>A</sup> (June 21/16 – August 31) (24 hrs/day)</b>
Lower Granite	18 kcfs
Little Goose <sup>B</sup>	30%
Lower Monumental	17 kcfs
Ice Harbor <sup>B</sup>	30%
McNary <sup>B</sup>	57%
John Day <sup>B</sup>	35%
The Dalles <sup>B</sup>	40%
Bonneville	95 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. From June 16-August 31, all projects denoted by this footnote will adjust spill once a day to the indicated percentage level of the previous day’s average project outflow. The intent is to reduce the frequency of spillgate changes.

<sup>27</sup> The agencies will use all available information including adult dam counts and the current Columbia River DART’s Reach Distribution and Delay for PIT Tag Adult Returns tool (“Running 3-day DART tool”) to monitor adult delay. See top panel, in-season graphics of Cumulative Arrival Percent by Days in Route to Lower Monumental Dam. [https://www.cbr.washington.edu/dart/query/pitadult\\_reachdist](https://www.cbr.washington.edu/dart/query/pitadult_reachdist)

## 9. PROJECT-SPECIFIC OPERATIONS

The following sections describe 2026 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.

### 9.1. Lower Granite Dam

**9.1.1. Fall/Winter Surface Spill (Table 3).** The Lower Granite RSW spill rate will increase with increasing forebay elevation, from approximately 5.6 kcfs at the bottom of the normal forebay operating range up to 11.4 kcfs at the top of the range (see FPP Chapter 9, section 2.3.2.6).

- March 1–20: RSW spill 4 hours/day in the morning, 3 days/week.
- March 21 – April 2: RSW spill 24 hours/day, 7 days/week.
- September 1 – November 15: RSW spill 24 hours/day, 7 days/week.

**9.1.2. Spring Spill (Table 4):** 125% gas cap (see Section 2.1), 24 hours/day, April 3–June 20. If adult passage delay is observed (see Section 7.1), then 125% gas cap, 16 hours/day, and 40% of previous day average outflow, 8 hours/day.

#### 9.1.3. Summer Spill (Table 5):

- June 21–August 31: 18 kcfs, 24 hours/day.

### 9.2. Little Goose Dam

**9.2.1. Fall/Winter Surface Spill (Table 3).** The Little Goose ASW will be adjusted relative to forebay up to once per day to maintain a “high crest” elevation and a minimum of 7 kcfs spill (see FPP Chapter 8, section 2.3.2.7).

- March 1–20: ASW high crest 4 hours/day in the morning, 3 days/week.
- March 21 – April 2: ASW high crest 24 hours/day, 7 days/week.
- September 1 – November 15: ASW high crest 24 hours/day, 7 days/week.

**9.2.2. Spring Spill (Table 4):** 125% gas cap (see section 2.1), 24 hours/day, April 3 until adult criteria are met, then 125% gas cap, 16 hours/day, and 30% of previous day average outflow (performance standard) 8 hours/day, through June 20 (Table 3, footnote B).

#### 9.2.3. Summer Spill (Table 5):

- June 21–August 31: 30% of previous day average outflow, 24 hours/day (except when adjusted to a constant spill level during low flows, as described in Operational Considerations below). Spill changes will be made by 0300 each day.

#### **9.2.4. Operational Considerations:**

### **9.3. Lower Monumental Dam**

**9.3.1. Fall/Winter Surface Spill (Table 3).** The Lower Monumental RSW spill rate will increase with increasing forebay elevation, from approximately 6.7 kcfs at the bottom of the forebay operating range up to 9.5 kcfs at the top of the range (see FPP Chapter 7, section 2.3.2.6).

- March 1–20: RSW spill 4 hours/day in the morning, 3 days/week.
- March 21 – April 2: RSW spill 24 hours/day, 7 days/week.
- September 1 – November 15: RSW spill 24 hours/day, 7 days/week.

**9.3.2. Spring Spill (Table 4):** 125% gas cap (section 2.1), 24 hours/day, April 3–June 20. If adult passage delay is observed (Section 7.1), then 125% gas cap, 16 hours/day, and 40% of previous day average outflow 8 hours/day. Spring spill will occur using the uniform pattern, except during low flows (spill below 30 kcfs) when the bulk pattern will be used to avoid small gate openings that could impact fish.

#### **9.3.3. Summer Spill (Table 5):**

- June 21–August 31: 17 kcfs (bulk pattern), 24 hours/day.

### **9.4. Ice Harbor Dam**

**9.4.1. Fall/Winter Surface Spill (Table 3).** The Ice Harbor RSW spill rate will increase with increasing forebay elevation, from approximately 7.1 kcfs at the bottom of the forebay operating range up to 10.4 kcfs at the top of the range (see FPP Chapter 6, section 2.3.2.6).

- March 1–20: RSW spill 4 hours/day in the morning, 3 days/week.
- March 21 – April 2: RSW spill 24 hours/day, 7 days/week.
- September 1 – November 15: RSW spill 24 hours/day, 7 days/week.

**9.4.2. Spring Spill (Table 4):** 125% gas cap (see section 2.1), 24 hours/day, April 3–June 20.

#### **9.4.3. Summer Spill (Table 5):**

- June 21–August 31: 30% of previous day average outflow, 24 hours/day. Spill changes will be made by 0300 each day.

### **9.5. McNary Dam**

**9.5.1. Fall/Winter Surface Spill (Table 3).** The McNary TSW spill rate will increase with increasing forebay elevation, from approximately 8 kcfs at the bottom of the normal

forebay operating range up to 11 kcfs at the top of the range.

- March 1–20: Spillbay 20 TSW 4 hours/day in the morning, 3 days/week.
- March 21 – April 9: Spillbay 20 TSW 24 hours/day, 7 days/week.
- September 1 – November 15: Spillbays 19 and 20 TSWs 24 hours/day, 7 days/week.

**9.5.2. Spring Spill (Table 4):** 125% gas cap (see section 2.1), 24 hours/day, April 10–June 15.

**9.5.3. Summer Spill (Table 5):**

- June 16–August 31: 57% of previous day average outflow, 24 hours/day. Spill changes will be made by 0300 each day.

**9.5.4. Operational Considerations:**

- Currently, McNary spillbays are restricted due to hoists and cranes that need replacement. As a result, McNary will implement modified spill patterns. For more information, see FPP Chapter 5 (MCN), section 2.2.
- 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  $\pm 1\%$  operating range of approximately 10-12 kcfs (see FPP Chapter 5 Table MCN-6-A) and there may be instances when the unit is unable to stay within this restricted range.

## **9.6. John Day Dam**

**9.6.1. Fall/Winter Surface Spill (Table 3).**

- March 21 – April 9: Spillbay 19 TSW 24 hours/day, 7 days/week.
- September 1 – November 15: Spillbays 18 and 19 TSWs 24 hours/day, 7 days/week.

**9.6.2.** Opening the TSWs at John Day Dam requires a crew and gantry crane and must be done during daylight hours as weather allows. On March 21, spill will occur as soon as feasible, when the TSW is opened in the morning. On November 15, both TSWs will be closed as late as possible during daylight hours, then spill maintained at approximately 20 kcfs via the non-TSW pattern until 2359 hours.

**9.6.3. Spring Spill (Table 4):** 125% gas cap (see section 2.1), 24 hours/day, April 10–June 15, with priority to maintain 40% spill 24 hours/day at The Dalles Dam as needed for TDG management. Daytime hours are defined in FPP Chapter 4, Table JDA-5.

#### **9.6.4. Summer Spill (Table 5):**

- June 16–August 31: 35% of previous day average outflow, 24 hours/day. Spill changes will be made by 0300 each day.

#### **.9.6.4 Operational Considerations:**

- Currently, turbine units 2, 3, 7, 8, 9, 10, 11, and 13 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-A). 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 the WMP sections 6.11.1.4 and Tables 2 and 5 and Section 6.11.1.3 for discussion of springtime pool elevations to dissuade nesting of Caspian terns at Blalock Island. This operation is also described in the FPP Appendix A. This higher forebay operation will increase the flow rate over the TSWs and may change tailrace flow patterns.

### **9.7. The Dalles**

**9.7.1. Fall/Winter Surface Spill (Table 3):** The ice & trash sluiceway (ITS) is a powerhouse (non-spillway) surface passage route and will operate year-round, 24 hours/day, pursuant to criteria in FPP Chapter 3. Outages for maintenance will be coordinated with FPOM.

**9.7.2. Spring Spill (Table 4):** 40% of previous day average outflow, 24 hours/day, April 10–June 15. Spill changes will be made by 0300 each day. Maintain 40% of previous day average outflow spill 24 hours/day at The Dalles Dam and reduce John Day Dam TDG spill cap as needed for TDG management.

#### **9.7.3. Summer Spill (Table 5):**

- June 16–August 31: 40% of previous day average outflow, 24 hours/day. Spill changes will be made by 0300 each day.

#### **9.7.4. Operational Considerations:**

- Spill bays 9<sup>28</sup>, 10, 11, 13, 16, 18, 19, and 23 are operationally restricted due to wire rope, structural and concrete erosion concerns.

### **9.8. Bonneville Dam**

**9.8.1. Fall/Winter Surface Spill (Table 3).** The PH1 ice & trash sluiceway (ITS) and PH2 corner collector (B2CC) are powerhouse (non-spillway) surface passage routes and will

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<sup>28</sup> Spillbay 9 at The Dalles Dam cannot be used due to failure of the trunnion pin in 2009.

operate pursuant to criteria in FPP Chapter 2:

- March 1–8: B2CC daily 0600-1000 hours.
- March 9–25: B2CC daily 0600-1000 and 1600-2000 hours.
- March 26: Begin year-round B2CC 24 hours/day, 7 days/week. Outages for maintenance will be coordinated with FPOM.
- Year-round: ITS 24 hours/day, 7 days/week. Outages for maintenance will be coordinated with FPOM.

**9.8.2. Spring Spill (Table 4):** 125% gas cap up to a maximum of 150 kcfs for fish passage spill (see section 2.1), 24 hours/day, April 10–June 15.

**9.8.3. Summer Spill (Table 5):**

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

**9.8.4. 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  $\geq$  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 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  $\pm$ 3 kcfs according to spill pattern tables in FPP Chapter 2.

## 10. FOP IMPLEMENTATION REPORTING

The Corps posts monthly FOP Implementation Reports between April and November on the following website: [https://public.crohms.org/tmt/documents/FOP\\_Implementation\\_Reports/](https://public.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 turbine units;
- target spill: the spill target for that hour (Tables 3, 4 and 5);
- 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;

- resultant 12-hour average TDG for the tailwater at each project;
- reservoir elevation: the hourly reservoir forebay elevation;
- MOP: the target forebay elevation range; and,
- adjusted MOP: the adjusted MOP elevation range necessary to maintain project criteria. Adjusted can mean “raised” or “expanded” as specified in Section 4.

The reports also provide information on non-routine or unplanned operational adjustments that arise during the spill program and address any spill or MOP 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:
  - <https://public.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).
  - <https://public.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:
  - <https://public.crohms.org/report/total.html> (web reports with hourly TDG, project outflow and spill for the previous 3 days).
  - [https://public.crohms.org/ftppub/water\\_quality/tdg/](https://public.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 the applicable average TDG levels based on the Oregon and Washington water quality standards. These averages are reported at: [https://public.crohms.org/ftppub/water\\_quality/12hr/](https://public.crohms.org/ftppub/water_quality/12hr/).
- Spill cap information is posted to the following site each day: <https://public.crohms.org/tmt/documents/ops/spill/caps/>

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Transalta )  
Centralia Generation LLC )  
\_\_\_\_\_ )

Order No. 202-26-18

Motion to Intervene, Motion for Clarification, and Requests for Rehearing and Stay  
of Sierra Club, NW Energy Coalition, Washington Conservation Action, Climate  
Solutions, Public Citizen, and Environmental Defense Fund  
(collectively, “Public Interest Organizations” or “PIOs”)

Exhibit 2-153:  
Emergency Protocols for the Columbia River System

# **Appendix 1**

## **Technical Management Team Emergency Protocols**

COLUMBIA RIVER SYSTEM

FOR ATTACHMENT TO THE  
WATER MANAGEMENT PLAN  
AND OTHER APPROPRIATE ACTION PLANS

Updated December 5, 2025

## 1. Introduction

This document establishes a protocol that will be used by the Action Agencies for notification, consultation, and documentation in the event of an emergency concerning the operation of the Columbia River System (CRS) that impacts fish protection measures contained in the respective Biological Opinions (BiOps). The BiOps call for an annual Water Management Plan (WMP), which provides the detailed description of operations, based on the current year conditions, to ensure fish protection measures are consistent with Endangered Species Act responsibilities. This Protocol is meant to be general enough to encompass most kinds of emergencies. This Protocol pertains to short duration (approximately 1-7 days) interruptions or adjustments to protection measures for listed species that occur during the operation of the CRS.

The primary emergency types these protocols apply to are:

- Generation Emergency: the potential for or actual insufficiency of electrical generation to satisfy electrical demand or load.
- Transmission Emergency: the potential or actual loss or limitation in the ability to move electricity from the site of generation to the actual consumer or end-user.
- Fish Emergency: Unexpected equipment failures or other conditions that result in an interruption of fish protections measures.
- Other Emergency: the existence or result of extenuating circumstances which fall outside the range of normal operations, is unanticipated, and may significantly impair the ability to provide for other project uses, such as flood control or navigation, significant human health and safety concerns, or result in catastrophic impact, physical damage or failure to a dam, or other part of the physical power system. Examples include earthquakes, flood control operations, fires, navigation, dam safety, and failure of fish facilities infrastructure.

Specific Action Plans will be developed for Generation (*Completed-See Attachment 1*), Transmission and Fish Emergencies that identify pre-emptive actions and emergency actions that will be taken consistent with this Protocol. Examples of thresholds for these types of emergencies are shown in the respective Action Plans contained in Attachments 1 and 2 of this Protocol. Action Plans are coordinated in the TMT process.

The degree and/or nature of any emergency ranges from those that require immediate action to those that are amenable to coordination among affected parties prior to action. In some instances, it is possible to plan for and develop procedures to respond to an emergency, while in other instances this is not possible. In addition, while many types of emergencies can be described for purposes of this Protocol, not all emergencies can be identified prior to the actual occurrence. Discussion of emergencies with effects of exceptional magnitude or duration will include involvement of regional executives.

Emergency actions will not be taken in place of long-term investments necessary to allow full uninterrupted implementation of the planned reservoir and dam operations while maintaining other project purposes.

Interruptions to protection measures for non-listed species are inclusive in these Protocols; however, priority will be given to protection measures for listed species.

## 2. Goals

The primary goal of this Protocol is to have written procedures that describe how the Action Agencies will manage the CRS to avoid or minimize emergencies impacting fish protection measures in accordance with ESA biological opinions and other operative documents such as the WMP, and provide timely communication and coordination with the TMT when they occur. When emergencies occur, the Action Agencies will work with TMT to restore the protection measures and provide the planned life cycle survival rates with priority given to in-time and in-place actions to the extent practicable. *(This does not create legal rights or obligations on the part of any party.)*

## 3. Definitions:

**Emergency** – A sudden, urgent, usually unforeseen occurrence or occasion requiring immediate action. As applied to this Protocol: when necessary, interruptions or adjustments occur to fish protection measures identified in the applicable biological opinions, the Annual Water Management Plan, and other operative documents.

**Emergency Actions-** Actions taken by the Action Agencies in response to an emergency that affects fish protection measures.

**Action Agencies** - Bonneville Power Administration (BPA), Corps of Engineers (COE or Corps), and the Bureau of Reclamation (BOR or Reclamation)

**TMT** - Technical Management Team is one of the Regional Forum technical teams. Adaptive management of the CRS is coordinated in the Technical Management Team public meeting process.

**Water Management Plan.** - The Water Management Plan (WMP) describes how the Action Agencies plan to operate the Columbia River System (CRS) projects in accordance with the governing documents identified in Section 2 of the TMT Annual Water Management Plan.

## 4. Emergency Protocol

### 4.1. Advanced Planning – Pre-Emptive Actions

When the operation of the CRS is likely to require implementing emergency actions and the event can be anticipated approximately 24 hours in advance or earlier, the Action Agencies will convene a meeting of the TMT to discuss actions to undertake with the objective of averting or minimizing impacts to fish protection measures. This Protocol contains an Action Plan (see Attachment 1) that describes pre-emptive actions that will be pursued to avoid interrupting fish protection measures.

When conditions are identified that could potentially require the use of Emergency Actions within approximately 24 hours, the responsible agency, i.e. the Action Agency which would declare the emergency, shall notify the chair and co-chairs(s) of the TMT as soon as the

situation is observed. If there is time, a TMT call or meeting will be arranged by the TMT chair or co-chair(s). If time allows, a discussion will be arranged, however, in some situations, the call may provide notification to TMT members of pre-emptive actions the responsible agency has deemed necessary.

The Action Agencies will implement all available pre-emptive actions prior to implementing emergency actions, and when feasible, the Action Agencies will implement alternate operations recommended by TMT.

#### **4.2. Emergency Response**

Emergency actions may be required as an immediate response if the pre-emptive actions fail to resolve the situation or the situation deteriorates without warning. If emergency actions are implemented as an immediate response an emergency will be declared. The Agency declaring the emergency will consider the prioritized emergency action lists provided in appendices of this Protocol, direction from TMT or other groups, standard operating procedures for specific projects, and/or guidance from appropriate responsible agencies to resolve the condition.

The Action Plans provided in the appendices of this Protocol have been discussed in the TMT forum will be used as guidance when events unfold too quickly for pre-coordination to occur. For emergencies requiring immediate action by those operating the respective hydropower project(s) or other elements necessary to sustain the function of the hydrosystem, after stabilizing the situation they will contact the chairs of the TMT and IT. The TMT chair or co-chair(s) will disseminate a notification via phone calls and emails to a “first contact list,” which will include designated members from TMT and others that have requested inclusion on the first contact list as soon as practicable, but not later than the next working day. A meeting of the TMT will be convened at the earliest time available after notification of the first contacts.

#### **5. Documentation and Follow Up Requirement**

In all cases when emergency actions have been implemented, as soon as practicable, but not later than the next working day, the following information shall be provided by the agency declaring the emergency:

- Description of the emergency, how it occurred, and how long it is anticipated to last
- Description of how the emergency jeopardized system stability, public safety, or otherwise necessitated action that impacted fish protection measures.
- Identification of agencies that declared the emergency and agencies that responded to the emergency
- Identification of who was notified of the emergency
- Description of what actions were taken by each agency
- Identification of alternatives considered to reduce and offset impacts of the emergency.
- Further detailed information will be provided upon request of the TMT.

When requested by a TMT member, the TMT Chairperson will arrange for a follow-up TMT meeting or conference call to:

- Review status of the event,
- Ensure that all requirements for the implementation of emergency actions by the Action Agencies have been met and that all alternatives for offsetting adverse fish survival impacts of the implemented emergency actions have been considered, and
- Review the use of emergency action lists and revise the lists based on any lessons learned.

In general, system operations will revert to normal conditions, or as agreed upon in the TMT, when the event has been resolved or emergency actions are no longer required. The agency that declared the emergency will submit a detailed report of the incident and response at the next TMT meeting following the event unless other arrangements are arranged through the TMT process.

The Action Agencies will provide an opportunity for representatives of the region's affected parties to review the course of events and the implemented emergency actions to suggest refinements to the actions. These issues will be discussed at the next TMT meeting following the event.

## **6. Offsetting Adverse Effects of Emergency Response Actions**

When emergency actions are implemented that cause adverse effects to fish protection measures, the TMT will assess the magnitude of the adverse effect and provide information on measures available to offset these effects. Alternative operations to offset adverse effects in-place and in-kind in a timely manner shall receive the highest priority. The members of the Regional Forum agree to cooperate in the development of this information for consideration through the TMT process.

When emergency actions impact a fish protection measure(s) included in a Biological Opinion, the appropriate agency (National Marine Fisheries Service (NMFS) or Fish and Wildlife Service (USFWS)) will consider the available information to assess whether the alternative operation used in response to the emergency situation is inconsistent with the relevant Biological Opinion(s), in that, in its expert opinion, the effects were in excess of what was contemplated in the analyses used in the respective biological opinion. If the alternative operation is determined to provide a reduction in the life cycle survival rate than that recommended in the Biological Opinion(s) analyses, then NMFS or USFWS will recommend to the federal operating agencies offsetting measures to ensure that the action satisfies Endangered Species Act requirements.

An Action Agency deciding not to provide offsets or proposing offsetting actions that are different from those recommended through the TMT process, will provide a written explanation for the record stating the decision and the basis for the decision.

# **Emergency Protocols Attachment**

## **Attachment 1 – Power System Emergency Action Plan**

## **Attachment 1**

### **Power System Emergency Action Plan December 5, 2025**

If hydropower generation must be adjusted to support power system reliability, and this adjustment will alter planned fish operations specified in applicable biological opinions (and other guiding operative documents), Bonneville will attempt to implement the actions in the preemptive actions list below, where practicable. If these preemptive actions are unavailable, insufficient, or cannot be implemented in time, then Bonneville may implement additional actions as necessary to address the power system reliability need. The list of contingency actions below are examples of actions that can be taken to address the reliability conditions described in Section 4.4.2 of the FOP.

Where contingency action is necessary, notification to the region will be made as soon as practical, and will follow the protocols for notification, reporting, and documentation as specified in the *Technical Management Team Emergency Protocols, Appendix 1 – Emergency Protocols of the TMT Water Management Plan*.

**Pre-emptive Actions** (not in priority order)

- Purchase Energy and/or reserves at prices up to the applicable FERC WECC price cap.
- Request that Corps and Reclamation return all possible units to service by canceling or postponing scheduled generator or equipment outages (e.g., makes all units available).
- Request the transmission dispatcher consider adjusting transmission system maintenance or other possible actions that would allow increases or decreases in CRS generation as appropriate.
- Put into service (online) all possible generators (e.g., Grand Coulee pump-generators) while preserving sufficient energy storage to maintain reserve capability in subsequent hours
- Reshape flows within objectives at specific projects to meet immediate generation needs e.g., spill upstream projects to position water downstream.
- Cut any interruptible power commitments.
- Request adjustment of pumping schedule at Banks Lake.
- Request variance from non-power operational objectives or limits at CRS hydro projects (e.g., forebay draft limits, tailwater rate of change, recreation, irrigation, Treaty fishing, etc.)
- Reduce the amount of balancing reserves provided by the CRS to the minimum amount necessary for power system stability and reliability.
- Acquire any resources made available through the issuance of a “EEA Watch”.
- After exhausting all available reserve sharing opportunities ask the transmission dispatcher to request the Reliability Coordinator to declare an Energy Emergency ALERT 1 when there is concern about sustaining required operating reserves.

**Contingency Actions List**

(Updated February 25, 2022)

When routine reliability tools and preemptive actions are insufficient or unavailable to resolve the power system condition, the following is a list of contingency actions that may be taken to provide reserves, voltage, energy or inertia. The order and extent of the actual implementation of the actions in this list will be dictated by each specific condition but if possible, the order at each individual dam will be followed. The actions on the list may be updated as necessary through coordination with TMT.

Contingency Actions are prioritized by tier and within each tier.

<b>March 1 – April 2</b>	<b>April 3 – April 9</b>	<b>April 10 – June 15</b>	<b>June 16 – June 20</b>
<b><u>Tier 1</u></b>	<b><u>Tier 1</u></b>	<b><u>Tier 1</u></b>	<b><u>Tier 1</u></b>
LWG Move Spillway Weir Hours within morning hours or next day morning	JDA shutoff adult attraction spill	<b>BON:</b> Generate above 1% up to full load PH1	<b>BON:</b> Generate above 1% up to full load PH1
LGS Move Spillway Weir Hours within morning hours or next day morning	BON shutoff adult attraction spill	<b>TDA:</b> Generate above 1% up to full load	<b>TDA:</b> Generate above 1% up to full load
LMN Move Spillway Weir Hours within morning hours or next day morning	HGH, LIB, ALF, GCL: increase project drafts as coordinated with operators	<b>JDA:</b> Generate above 1% up to full load	<b>JDA:</b> Generate above 1% up to full load
IHR Move Spillway Weir Hours within morning hours or next day morning	HGH & LIB modify ramping rates as coordinated with operators	<b>MCN:</b> Generate above 1% up to 14.4 kcfs/unit	<b>MCN:</b> Generate above 1% up to 14.4 kcfs/unit
MCN Move Spillway Weir Hours within morning hours or next day morning	DWR: increase project drafts as coordinated with operators	<b>IHR:</b> Generate above 1% up to full load	<b>IHR:</b> Generate above 1% up to full load
		<b>LMN:</b> Generate above 1% up to full load	<b>LMN:</b> Generate above 1% up to full load
		<b>LGS:</b> Generate above 1% up to full load	<b>LGS:</b> Generate above 1% up to full load
		<b>LWG:</b> Generate above 1% up to full load	<b>LWG:</b> Generate above 1% up to full load
		Allow MOP excursion up to: 2 feet at IHR, LMN, LGS, and LWG (w/o reduction in FOP spill levels)	Allow MOP excursion up to: 2 feet at IHR, LMN, LGS, and LWG (w/o reduction in FOP spill levels)

**Appendix I, Water Management Plan**

<b>March 1 – April 2</b>	<b>April 3 – April 9</b>	<b>April 10 – June 15</b>	<b>June 16 – June 20</b>
<b><u>Tier 2</u></b>	<b><u>Tier 2</u></b>	<b><u>Tier 2</u></b>	<b><u>Tier 2</u></b>
JDA shutoff adult attraction spill	IHR 30% of flow	LWG reduce spill to 20 kcfs	LWG reduce spill to 20 kcfs
BON shutoff adult attraction spill	LMN 30 kcfs flat	LGS reduce spill to 30% of flow	LGS reduce spill to 30% of flow
HGH & LIB modify ramping rates	LGS 30% of flow	IHR reduce spill to 30% of flow	IHR reduce spill to 30% of flow
HGH, LIB, ALF, GCL : increase project drafts	LWG 20 kcfs	MCN reduce spill to 40% of flow	MCN reduce spill to 40% of flow
DWR: increase project drafts		JDA reduce spill to 30% of flow	JDA reduce spill to 30% of flow
		TDA reduce spill to 30% of flow	TDA reduce spill to 30% of flow
		BON reduce spill to 100 kcfs	MCN generate outside 1% up to full load
		MCN generate outside 1% up to full load	BON2 operate outside 1% up to full load
		BON PH2 operate outside 1% up to full load	Allow MOP excursion up to 3 feet at IHR, LMN, LGS, and LWG
		Allow MOP excursion up to 3 feet at IHR, LMN, LGS, and LWG	
<b><u>Tier 3</u></b>	<b><u>Tier 3</u></b>	<b><u>Tier 3</u></b>	<b><u>Tier 3</u></b>
BON1 shut off sluiceway	BON shut off sluiceway	LWG reduce spill to 18 kcfs	LWG 18 kcfs of spill
TDA shut off sluiceway	TDA shut off sluiceway	LMN reduce spill to 30% of flow	LMN 30% of flow
BON shut off B2CC	BON shut off B2CC	MCN reduce spill to 30% of flow	MCN 30% of flow
		BON 95 kcfs	BON 50 kcfs
		BON: Generate above 1% up to full load PH2	BON: Generate above 1% up to full load PH2

**Appendix I, Water Management Plan**

<b>March 1 – April 2</b>	<b>April 3 – April 9</b>	<b>April 10 – June 15</b>	<b>June 16 – June 20</b>
<b><u>Tier 4</u></b>	<b><u>Tier 4</u></b>	<b><u>Tier 4</u></b>	<b><u>Tier 4</u></b>
	LWG Reduce Spill to Spillway weir only	BON 75 kcfs	BON 75 kcfs
	LGS Reduce Spill to Spillway weir only	LWG Reduce Spill to Spillway weir only	LWG Reduce Spill to Spillway weir only
	LMN Reduce Spill to Spillway weir only	LGS Reduce Spill to Spillway weir only	LGS Reduce Spill to Spillway weir only
	IHR Reduce Spill to Spillway weir only	LMN Reduce Spill to Spillway weir only	LMN Reduce Spill to Spillway weir only
		IHR Reduce Spill to Spillway weir only	IHR Reduce Spill to Spillway weir only
		MCN Reduce Spill to Spillway weir only	MCN Reduce Spill to Spillway weir only
<b><u>Tier 5</u></b>	<b><u>Tier 5</u></b>	<b><u>Tier 5</u></b>	<b><u>Tier 5</u></b>
	Reduce spill to zero at LWG	BON reduce spill to 50 kcfs	BON reduce spill to 50 kcfs
		BON reduces spill to zero	BON reduces spill to zero
	Reduce spill to zero at LGS	BON shutdown B1 Sluiceway	BON shutdown B1 Sluiceway
	Reduce spill to zero at LMN	BON shutdown B2CC	BON shutdown B2CC
	Reduce spill to zero at IHR		
<b><u>Tier 6</u></b>	<b><u>Tier 6</u></b>	<b><u>Tier 6</u></b>	<b><u>Tier 6</u></b>
		LWG reduce spill to zero	LWG reduce spill to zero
		LGS reduce spill to zero	LGS reduce spill to zero
		LMN reduce spill to zero	LMN reduce spill to zero
		IHR reduce spill to zero	IHR reduce spill to zero
		MCN reduce spill to zero	MCN reduce spill to zero
		JDA reduce spill to zero	JDA reduce spill to zero
		TDA reduce spill to zero	TDA reduce spill to zero

**Appendix I, Water Management Plan**

<b>June 21 – August 14</b>	<b>August 15 - August 31</b>	<b>September – November 15</b>	<b>November 16 - End of Feb</b>
<b><u>Tier 1</u></b>	<b><u>Tier 1</u></b>	<b><u>Tier 1</u></b>	<b><u>Tier 1</u></b>
<b>BON:</b> Generate above 1% up to full load PH1	<b>BON:</b> Generate above 1% up to full load PH1	LWG Move Spillway Weir Hours within morning hours or next day morning	HGH, LIB, ALF, GCL: increase project drafts
<b>TDA:</b> Generate above 1% up to full load	<b>TDA:</b> Generate above 1% up to full load	LGS Move Spillway Weir Hours within morning hours or next day morning	HGH & LIB modify ramping rates
<b>JDA:</b> Generate above 1% up to full load	<b>JDA:</b> Generate above 1% up to full load	LMN Move Spillway Weir Hours within morning hours or next day morning	BON shut off sluiceway
<b>MCN:</b> Generate above 1% up to 14.4 kcfs/unit	<b>MCN:</b> Generate above 1% up to 14.4 kcfs/unit	IHR Move Spillway Weir Hours within morning hours or next day morning	TDA shut off sluiceway
<b>IHR:</b> Generate above 1% up to full load	<b>IHR:</b> Generate above 1% up to full load	MCN Move Spillway Weir Hours within morning hours or next day morning	Dworshak increase project drafts
<b>LMN:</b> Generate above 1% up to full load	<b>LMN:</b> Generate above 1% up to full load		
<b>LGS:</b> Generate above 1% up to full load	<b>LGS:</b> Generate above 1% up to full load		
<b>LWG:</b> Generate above 1% up to full load	<b>LWG:</b> Generate above 1% up to full load		
Allow MOP excursion up to: 2 feet at IHR, LMN, LGS, and LWG (w/o reduction in FOP spill levels)	<b>BON:</b> Generate above 1% up to full load PH2		

**Appendix I, Water Management Plan**

<b>June 21 – August 14</b>	<b>August 15 - August 31</b>	<b>September – November 15</b>	<b>November 16 - End of Feb</b>
<b><u>Tier 2</u></b>	<b><u>Tier 2</u></b>	<b><u>Tier 2</u></b>	<b><u>Tier 2</u></b>
LWG Reduce Spill to Spillway weir only	LWG reduce spill to zero	JDA shutoff adult attraction spill	
LGS Reduce Spill to Spillway weir only	LGS reduce spill to zero	BON shutoff adult attraction spill	
IHR Reduce Spill to Spillway weir only	LMN reduce spill to zero	HGH, LIB, ALF, GCL : increase project drafts	
MCN 40% of flow	IHR reduce spill to zero	HGH & LIB modify ramping rates	
JDA 30% of flow	MCN reduce spill to zero		
TDA 30% of flow	JDA reduce spill to zero		
BON 75 kcfs	BON reduce spill to zero		
MCN generate outside 1% up to full load	TDA reduce spill to zero		
BON PH2 operate outside 1% up to full load			
Allow MOP excursion up to 3 feet at IHR, LMN, LGS, and LWG			
<b><u>Tier 3</u></b>	<b><u>Tier 3</u></b>	<b><u>Tier 3</u></b>	<b><u>Tier 3</u></b>
MCN 30% of flow	BON1 shut off sluiceway	LWG reduce spill to zero	
JDA Spillway Weir only	TDA shut off sluiceway	LGS reduce spill to zero	
BON 50 kcfs	BON shut off B2CC	LMN reduce spill to zero	
IHR reduce spill to zero		IHR reduce spill to zero	
LMN reduce spill to zero		MCN reduce spill to zero	
LGS reduce spill to zero		BON1 Shut off sluiceway	
LWG reduce spill to zero		TDA Shut off sluiceway	

**Appendix I, Water Management Plan**

<b>June 21 – August 14</b>	<b>August 15 - August 31</b>	<b>September – November 15</b>	<b>November 16 - End of Feb</b>
<b><u>Tier 4</u></b>	<b><u>Tier 4</u></b>	<b><u>Tier 4</u></b>	<b><u>Tier 4</u></b>
BON reduce spill to zero		DWR: increase project drafts	
TDA reduce spill to zero			
<b><u>Tier 5</u></b>	<b><u>Tier 5</u></b>	<b><u>Tier 5</u></b>	<b><u>Tier 5</u></b>
<b><u>Tier 6</u></b>	<b><u>Tier 6</u></b>	<b><u>Tier 6</u></b>	<b><u>Tier 6</u></b>

**Definitions**

**Balancing Authority** - The responsible entity that integrates resource plans ahead of time, maintains load-interchange-generation balance within a Balancing Authority Area, and supports Interconnection frequency in real time.

**Balancing Authority Area** - The collection of generation, transmission, and loads within the metered boundaries of the Balancing Authority. The Balancing Authority maintains load resource balance within this area.

**BPA Power system** – This term includes the Federal Columbia River hydropower projects and transmission system.

**Energy Emergency Alerts** – Procedures by which a Load Serving Entity can obtain capacity and energy when it has exhausted all other options and can no longer provide its customers’ expected energy requirements. An Energy Emergency Alert may be initiated by Reliability Coordinator at the Reliability Coordinator’s own request or upon the request of a Balancing Authority or a Load Serving Entity. See: <https://www.caiso.com/documents/emergency-notifications-fact-sheet.pdf>

## Appendix I, Water Management Plan

Energy Emergency Watch - The EEA Watch is a communication tool that provides load serving entities a means to exchange information regarding issues that could impact the reliable operation of the power system when analysis shows all available resources are committed or forecasted to be in use, and energy deficiencies are expected. This notice can be issued the day before the projected shortfall or if a sudden event occurs. Consumers are encouraged to conserve energy.

Energy Emergency Alert 1 - All available resources in use.

- Balance Authority, Reserve Sharing Group, or Load Serving Entity foresees or is experiencing conditions where all available resources are committed to meet firm load, firm transactions, and reserve commitments, and is concerned about sustaining its required Operating Reserves, and
- Non-firm wholesale energy sales (other than those that are recallable to meet reserve requirements) have been curtailed.

Energy Emergency Alert 2 – Load management procedures in effect.

- Balancing Authority, Reserve Sharing Group, or Load Serving Entity is no longer able to provide its customer' expected energy requirements, and is designated an Energy Deficient Entity.
- Energy Deficient Entity foresees or has implemented procedures up to, but excluding, interruption of firm load commitments.

Energy Emergency Alert 3 – Firm load interruption imminent or in progress.

- Balancing Authority or Load Serving Entity foresees or has implemented firm load obligation interruption. The available energy to the Energy Deficient Entity, as determined from Alert 2, is only accessible with actions taken to increase transmission transfer capabilities.

Energy Emergency Alert 0 - Termination

- When the Energy Deficient Entity believes it will be able to supply its customers' energy requirements, it shall request of its Reliability Coordinator that the Energy Emergency be terminated.

Redispatch – The intentional incrementing of location-specific generation and the corresponding decrementing of different location-specific generation to mitigate loading on constrained transmission facilities.

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Transalta )  
Centralia Generation LLC )  
\_\_\_\_\_ )

Order No. 202-26-18

Motion to Intervene, Motion for Clarification, and Requests for Rehearing and Stay  
of Sierra Club, NW Energy Coalition, Washington Conservation Action, Climate  
Solutions, Public Citizen, and Environmental Defense Fund  
(collectively, “Public Interest Organizations” or “PIOs”)

Exhibit 2-154:  
NWF v. NMFS Plaintiff Energy Declaration

THE HONORABLE MICHAEL H. SIMON

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**UNITED STATES DISTRICT COURT**

**DISTRICT OF OREGON**

NATIONAL WILDLIFE FEDERATION,  
et al.

Plaintiffs,

and

STATE OF OREGON, et al.,

Intervenor-Plaintiffs,

v.

NATIONAL MARINE FISHERIES  
SERVICE, et al.,

Defendants,

and

PUBLIC POWER COUNCIL, et al.,

Intervenor-Defendants.

Civ. No. 3:01-cv-00640-SI

**DECLARATION OF NANCY  
HIRSH IN SUPPORT OF  
PLAINTIFFS' REPLY IN  
SUPPORT OF MOTION FOR  
PRELIMINARY INJUNCTION**

I, NANCY HIRSH, state and declare as follows:

1. I was employed at the NW Energy Coalition (NWECC) from April 1996 through August 2025. For the first eighteen years I was the policy director and then in 2015, I became the NWECC executive director.

2. I have a Bachelor of Science in Natural Resource Policy from the University of Michigan's School of Natural Resources and the Environment.

3. During my tenure at NWECC, I have developed substantial expertise from analyzing utility and regional resource planning and engaging in regulatory proceedings, utility rate cases, and utility program reviews. I worked with state policymakers and state agency staff on energy policy, clean energy development, state energy strategy, and greenhouse gas emissions and air pollution reduction approaches. I have prepared detailed comments for submission to state agencies, policymakers, and regulators in Oregon, Washington, and Idaho on utility industry restructuring, resource planning, and clean energy development.

4. Between 1999 and 2011, I submitted multiple rounds of testimony to the Washington Utilities and Transportation Commission and the Idaho Public Utilities Commission as part of utility rate case proceedings for Puget Sound Energy, Avista Utilities, and Idaho Power. I also submitted testimony and substantive comments during utility resource planning, energy efficiency and utility merger dockets.

5. I have been invited to provide testimony before Congress on two occasions. First in 1997 before the House Committee on Resources, Subcommittee on Water and Power. The hearing was on the Status of the Regional Review Process for the Bonneville Power Administration (BPA). In 2001 I testified before the Senate Finance Committee regarding BPA's role in Infrastructure development, energy efficiency, and load management.

DECLARATION OF NANCY HIRSH IN SUPPORT OF  
PLAINTIFFS' REPLY IN SUPPORT OF MOTION  
FOR PRELIMINARY INJUNCTION

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6. In 2001, I assisted NWECC staff in the preparation of testimony in a BPA rate case (WP-02 Phase II). During my career I have prepared and submitted numerous comments to the NW Power and Conservation Council (NPCC) on the Comprehensive Regional Review, the Future Role of BPA in Power Supply, the Regional Dialogue proposal, and carbon emissions, among others. Through this work, I have developed a reasonably detailed understanding of the role BPA plays in energy marketing and transmission in providing electricity to the people of the Northwest and the role of the federal dams on the Columbia and Snake Rivers.

7. In 2008, I was asked by Idaho Governor Otter to serve on the Idaho Strategic Energy Alliance. Since 2019, I have served on the Advancement Board of the Institute for Energy Studies at Western Washington University. In 2020, I was asked by Washington Governor Inslee to co-chair the advisory committee helping to develop the 2021 State Energy Strategy.

8. I reviewed declarations submitted by BPA staff – Rachel Dibble, Bartholemew McManus, and Audrey Stevenson.

9. In this declaration I will discuss my review of recent NPCC and the Pacific Northwest National Lab’s analysis on the following topics: A) Resource adequacy of the power system under fish operations; B) Fish operations impact on energy and peak needs; C) BPA has Many Tools to Provide Flexibility, Balancing and Operational Reserves; D) Lower Snake River & Lower Columbia projects contribution to system balancing; E) Power system support for the Tri-Cities; F) Handling extreme weather events; G) Maintaining affordability.

A. The Most Recent NPCC Power Supply Adequacy Assessment Shows that the Fish Operations, Including Those Similar to the Operations NWF Seeks in its Preliminary Injunction, Do Not Have a Substantial Impact on Resource Adequacy.

10. The NPCC is an interstate compact agency established by Congress in the 1980 Northwest Power Act.<sup>1</sup> The four state (Washington, Oregon, Idaho, Montana) agency is tasked with regional power system planning, establishing resource priorities for BPA and regularly conducting an assessment of electricity adequacy. On a five-year cycle, the NPCC and its staff experts prepare a twenty-year regional power plan that evaluates loads and supplies to determine the least cost resource needs for meeting future loads while maintaining system reliability. As part of this five-year cycle, the NPCC and its staff also prepare a Columbia River Basin fish and wildlife program to address the regional needs of fish and wildlife impacted by the federal hydropower system pursuant to the Northwest Power Act's requirement that this program mitigate and enhance the Basin's fish and wildlife resources, especially salmon and steelhead and provide "equitable treatment" for these resources while also ensuring an adequate, efficient, and economical regional power supply. Hydropower system operations to manage fish and wildlife issues are an important factor in the regional power planning analysis and are critical to assuring a reliable power system.

11. In 2011, the NPCC adopted a resource adequacy standard of 5-percent annual "loss of load probability" (LOLP) to determine if the region had sufficient resources to meet regional loads during periods of high demand on the system like winter cold snaps or summer heat waves or when major generating units like the nuclear plant at Hanford have to go off line for some reason. One of its tools to check adequacy by predicting the LOLP for different scenarios is a computer model that projects operations of the power system – both supply

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<sup>1</sup> [www.nwcouncil.org](http://www.nwcouncil.org)

(including from the Columbia and Snake River dams) and demand – over many different future simulations (the GENESYS model). The GENESYS model (**Generation Evaluation System**) was developed by NPCC in 1999 to replace earlier load-resource balance analysis. GENESYS uses a random probability analysis applied to a number of key variables, (e.g. loads, water levels, generation resources, energy efficiency) on a monthly operations basis. In 2019, the NPCC completed a substantial redevelopment of GENESYS to provide hourly analysis of operations, more granular/individual power plant dispatch, interactions between reserves and system optimized dispatch, and more interactive inclusion of regional and western power market dynamics.<sup>2</sup>

12. In 2022-2023, the NPCC recognized the increased complexity in the regional power system with more variable renewable energy resources, and a need for an even more sophisticated and precise approach to evaluate resource adequacy for the region. The NPCC made another round of significant changes to the GENESYS model and created a multi-metric adequacy framework to provide more detailed information about future demand and power supply needs to power system operators on the potential frequency, duration, and magnitude of shortfall events (i.e., time of high demand and limited supply) so they can plan for and mitigate risk with actions as well as determine the appropriate emergency measures to implement if necessary in order to avoid a significant loss of load (a power blackout of significant scope and duration).<sup>3</sup> This more sophisticated multi-metric approach has replaced the relatively simple

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<sup>2</sup> [https://www.nwcouncil.org/2021powerplan\\_genesys-model/](https://www.nwcouncil.org/2021powerplan_genesys-model/)

<sup>3</sup> <https://www.nwcouncil.org/fs/18853/2024-4.pdf>

single metric LOLP approach in the NPCC’s most recent analysis for its forthcoming Ninth Power Plan as described on the NPCC’s Resource Adequacy webpage.<sup>4</sup>

13. In the most recent update in 2024, NPCC’s Pacific Northwest Power Supply Adequacy Assessment for 2029 used this new multi-metric modeling approach<sup>5</sup> and included the hydrosystem operation commitments from the 2023 Resilient Columbia Basin Agreement (RCBA) that were implemented during the stay of litigation. These commitments made a number of changes to dam and river operations to better support fish recovery efforts at the eight lower Snake River (LSR) dams and the lower Columbia dams.

14. As NPCC has explained in this and previous adequacy assessments, predicted shortfalls or adequacy concerns using any metric “does not necessitate an actual blackout will take place.”<sup>6</sup> A shortfall in the adequacy modeling would signal the need for additional actions to be taken to avoid power disruptions, such as increased market purchases, mobilizing back-up generation, ramping up higher cost generation, suspension of fish protection operations, or calls for energy conservation or curtailment.

15. What is noteworthy in the analysis for the Adequacy Assessment for 2029 are the significant changes the NPCC made to reflect the broad challenges of matching the power supply with demand across a wide range of possible futures facing the region. As can be seen in Figure 8, the NPCC staff made adjustments due to significant new load growth from data center development and electrification, new transmission line development, coal-to-gas power plant

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<sup>4</sup> <https://www.nwcouncil.org/energy/energy-topics/resource-adequacy/>

<sup>5</sup> Ibid, page 9.

<sup>6</sup> Ibid, page 9.

conversions, RCBA hydro operations, and new planned resources available to meet overall system needs.

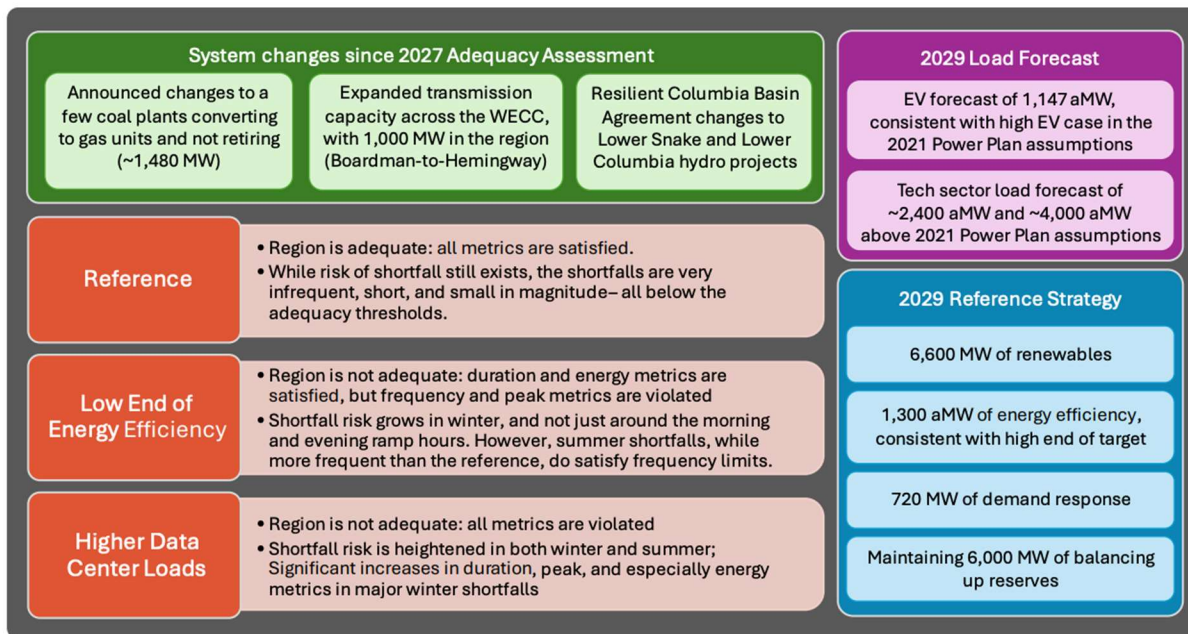


Figure 8. High-level summary of 2029 Adequacy Assessment

16. After including the RCBA operation changes to hydro operations, NPCC ran its power system adequacy assessment for 2029. The report states that “while hydropower is slightly reduced, ...the changes do not lead to a significantly different regional adequacy result.”<sup>7</sup> The model shows that the system adjusts to the RCBA dam and river operations by making a small increase in thermal generation and market purchases, particularly at night. The market purchases are within the market reliance limit set for the region. In the 2021 Power Plan, the NPCC set a power import limit to assure that the Northwest did not over rely on market purchases to satisfy resource needs.<sup>8</sup> Finding the RCBA operations are within the market reliance limit means that in

<sup>7</sup> Ibid, Page 22.

<sup>8</sup> [https://www.nwcouncil.org/2021powerplan\\_change-reliance-extra-regional-markets-resource-adequacy/#:~:text=Our%20baseline%20setup%20limits%20the,Energy](https://www.nwcouncil.org/2021powerplan_change-reliance-extra-regional-markets-resource-adequacy/#:~:text=Our%20baseline%20setup%20limits%20the,Energy)

the NPCC’s assessment, it is reasonable to assume that market purchases will be available to compensate for any small decrease in hydro generation due to RCBA operations in the context of the full system operations and regional demand.

17. The Adequacy Assessment for 2029 indicates that inclusion of the hydro operations from the RCBA are relatively insignificant given the magnitude of forecasted load growth changes and emphasizes the critical need for the region to accelerate deployment of energy efficiency, new renewable resource development and transmission system expansion. Further, the assessment concluded that the region could meet the NPCC’s multi-factor reliability standards under all but two of the scenarios that were examined. The first assumes low acquisition of energy efficiency and the second assumes high case data center development (Table 7).<sup>9</sup>

Table 7. Adequacy metric results

Type	Metric	Threshold	Reference	Low End EE	Higher Data Center
Frequency	Winter LOLEV	0.1	0.022	0.350	1.294
Frequency	Summer LOELV	0.1	0.017	0.033	0.3
Duration	Duration VaR 97.5	8 hours	0	1.5	20.6
Magnitude	Peak VaR 97.5	1,200 MW	0	1,567	3,076
Magnitude	Energy VaR 97.5	9,600 MW	0	4,196	196,324

18. For comparative purposes only, the NPCC staff note that if the multi-metric approach was compared to the LOLP, the reference case in the Adequacy Assessment for 2029,

<sup>9</sup> <https://www.nwcouncil.org/fs/18853/2024-4.pdf>, page 27.

which includes the RCBA operations, would be a 2.2% LOLP. The low EE resulted in a LOLP of 7.8%<sup>10</sup> and the high data center scenario increased the LOLP to 13.3%.<sup>11</sup>

19. BPA's results are significantly different than the NPCC analysis. In Rachel Dibble's declaration<sup>12</sup> (para. 29), she describes BPA's use of GENESYS to determine the LOLP with different hydrosystem operations. In Table 1 (below) and in para. 31, Dibble concludes that all the hydrosystem operation scenarios would result in significant reliability challenges with LOLP's at 15% for the 2026 Fish Operations Program, 18% for the 2020 BiOp (called 2020 CRSO EIS ROD) and because the preliminary injunction "will reduce power generation and thus result in a higher LOLP: 27 percent."<sup>13</sup> Dibble goes on to clarify in para. 65, that the preliminary injunction results in a 250 MW reduction in power generation. Based on the review of the NPCC analyses it is unclear how the modest loss of generation results in such a dramatic increase in LOLP.

20. In fact, Dibble does not provide the assumptions, metrics, or scenarios that BPA used as inputs to GENESYS or the version of GENESYS that BPA used. Based on the output of the "LOLP" metric in BPA's results, which NPCC has replaced in the newer and more sophisticated version of GENESYS as discussed above, it appears that BPA may not have used the most recent multi-metric approach that NPCC now uses. Without meaningful or complete information on the assumptions, methods, or scenarios used in Dibble's modeling, it is

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<sup>10</sup> Ibid, page 27.

<sup>11</sup> Ibid, page 28.

<sup>12</sup> 1404 2574 2025.12.16 Declaration of Rachel Dibble.pdf

<sup>13</sup> Ibid, Page 19, Para 31.

impossible to determine why her modeling reached such different results from NPCC staff's comprehensive resource adequacy analysis and modeling of RCBA operations.

21. As a reminder, the NPCC Adequacy Assessment for 2029 shown in Figure 8 above states that the reference case was “below the adequacy thresholds” using an arguably more stringent RCBA hydro operations than BPA used in its Table 1 GENESYS modeling. The Adequacy Assessment for 2029 also assumes that the new resources identified in the NPCC's 2021 regional Power Plan<sup>14</sup> would be developed in a timely manner. This plays a significant role in ensuring that all the power supply adequacy metrics are met.<sup>15</sup>

22. Separate from this Adequacy Assessment for 2029, as part of the development of the Ninth Power Plan, the NPCC staff are beginning to evaluate future energy needs. As part of this work, NPCC staff recently modeled the effect of the impact of different hydrosystem operations for fish passage, coupled with the needs assessment, on power generation and reliability, among other metrics. In the NPCC staff Needs Assessment for Changing Hydro Operations Scenario, presented to the full Council on October 14, 2025<sup>16</sup>, staff ran four different fish operation sensitivities against the 20-year forecasted needs of the power system through the updated GENESYS model. The four sensitivities analyzed by NPCC staff are: 2020 BiOp Operations (“current operations”); 2023 RCBA Operations; Fish managers Recommended Operations for MOP/spill (which is called “New MOP” and is virtually identical to the NWF's preliminary injunction request and Oregon's proposed preliminary injunction order); and Limited

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<sup>14</sup> [https://www.nwcouncil.org/fs/17680/2021powerplan\\_2022-3.pdf](https://www.nwcouncil.org/fs/17680/2021powerplan_2022-3.pdf)

<sup>15</sup> Pacific Northwest Power Supply Adequacy Assessment for 2029, NPCC 2024-4, page 35.

<sup>16</sup> [https://www.nwcouncil.org/fs/19637/2025\\_10\\_1b.pdf](https://www.nwcouncil.org/fs/19637/2025_10_1b.pdf)

Daily Flexibility (which starts with the 2020 BiOp as the base and then limits flexibility to reduce ramping).<sup>17</sup>

23. All of the fish operations analyzed including the “New MOP” sensitivity show very similar reliability results for power system operations, including the frequency and duration of events that risk a power supply shortfall. Critically, these winter and summer peak needs are extremely comparable across each of the modeled hydrosystem operations to address fish needs - - and the fish operation scenario that represents the preliminary injunction actually is predicted to perform *better* for reliability across seasons because the number of events and magnitude of the energy shortage events are lower for the New MOP than the BiOp or the RCBA using the “mixed bag” pathway with the 2031 load forecast, as shown in the chart below.<sup>18</sup>

## Overall Results Compared to Metrics

	Frequency			Extreme Deficits		
	Annual LOLEV (events)	Winter LOLEV (events)	Summer LOLEV (events)	VaR Duration (hr)	VaR Peak (MW)	VaR Energy (MWh)
Adequacy Criteria	0.2	0.1	0.1	8	1,200	9,600
BiOp	218	61	75	22	9,681	354,192
RCBA	210	57	85	21	10,366	348,771
New MOP	189	59	55	21	8,917	326,858
Limited Flex	168	49	53	22	10,200	327,008

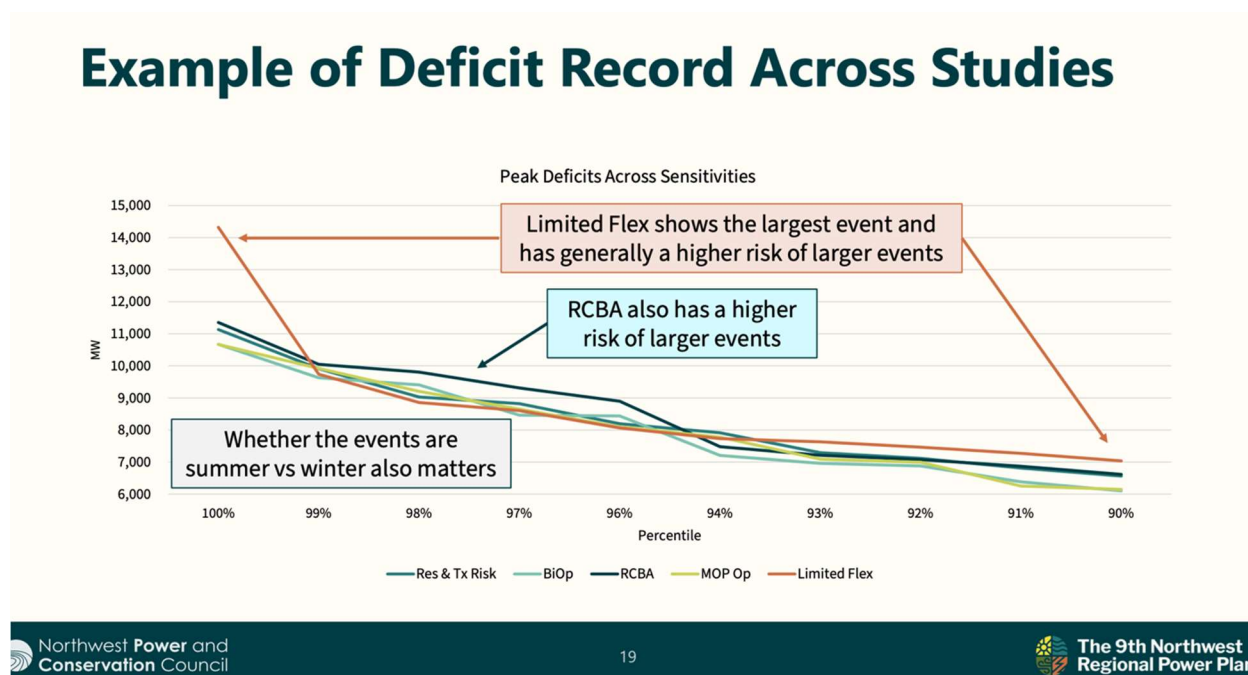
Again, these predicted reliability events do not mean a blackout will occur. Instead, they are projected as part of power system planning to evaluate and prepare for the amount of proposed

<sup>17</sup> [https://www.nwcouncil.org/fs/19637/2025\\_10\\_1b.pdf](https://www.nwcouncil.org/fs/19637/2025_10_1b.pdf) (page 6).

<sup>18</sup> Ibid, Slide 91.

new resource expansion or other power supply action (e.g., additional energy conservation) to address the events.

24. In January 2026, NPCC staff reran GENESYS after catching an error in irrigation demand.<sup>19</sup> This updated modeling shows similar results to the October 2025 hydro ops needs analysis which is that the region's projected large load growth will drive the need for new resources to meet winter and summer energy and peak capacity needs. On slide 19 (below), the revised modeling shows that the MOP sensitivity has fewer reliability events that are of less magnitude. This is a similar outcome to the October results.

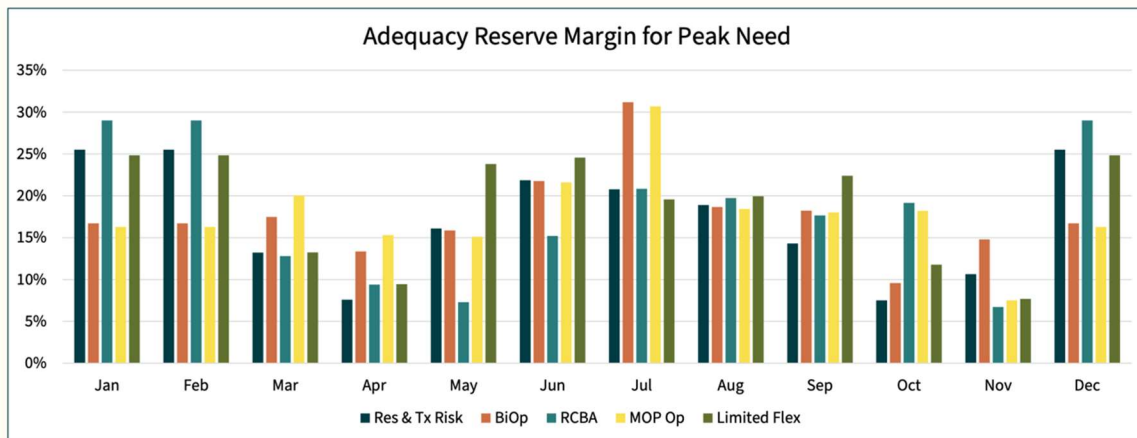


25. The NPCC staff go on to show how the corrected modeling impacts peak and energy needs across the year. While there are some variations across the different hydro operation sensitivities, the similarities are more striking than the differences. The New MOP operations do not create wildly different needs for additional peaking (Slide 21) or energy (Slide

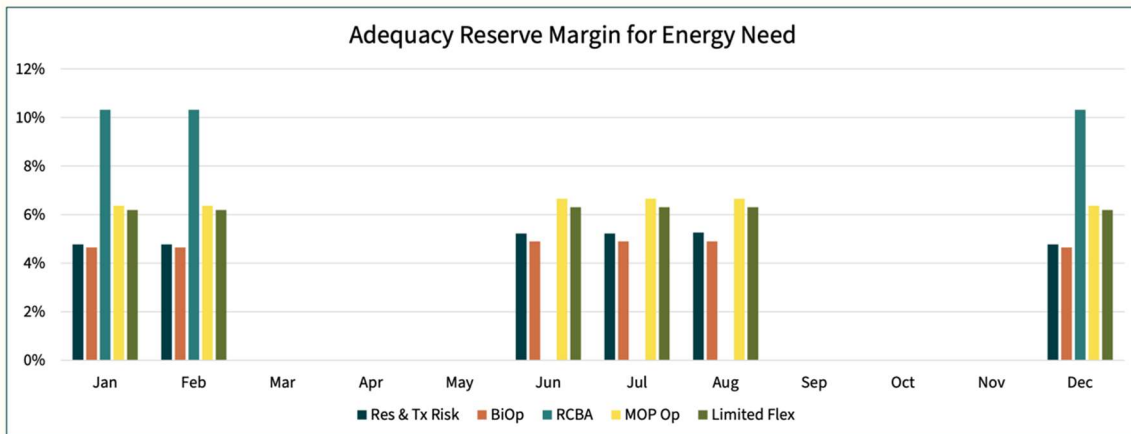
<sup>19</sup> [https://www.nwcouncil.org/fs/19713/2026\\_01\\_3.pdf](https://www.nwcouncil.org/fs/19713/2026_01_3.pdf) Pages 15-22.

22) resources. As described in more detail below, this modeling shows that significant new resources will be needed over the long-term under any fish operations scenario, and that changes in demand (including changes driven by load growth, decarbonization, and data centers) are the drivers for these substantial long-term resource needs. The different fish operations scenarios do not significantly change the timing or magnitude of these long-term resource needs.

## Updated Peak Needs



## Updated Energy Needs



26. As expected, there are still significant needs (because the resource addition model has not yet been run to solve for the shown need) in the winter and summer months. For all resource adequacy assessments, the modeling does not indicate that these reliability events will happen, just that there is a probability that they could happen and BPA and utilities should take steps to be prepared to manage the system (and add new resources as needed) to avoid these adverse impacts.

B. NPPC Analysis Shows that the Differences Between Fish Operations are Minor for Energy Needs and Peak Capacity Needs.

27. As part of the Ninth Plan development, NPCC staff put together a comprehensive needs assessment based on expected growth in loads from data centers, electrification and economic/population growth. It is expected that the needs assessment will indicate that the regional power system will need to develop thousands of megawatts of new resources to meet

growing energy and winter and summer peak demands.<sup>20</sup> The range of hydrosystem operations from the 2020 BiOp, RCBA or proposed injunction do not materially affect the actions the region needs to take to meet projected future demand.<sup>21</sup> The resource needs assessment built into GENESYS is then fed into the NPCC OptGen model<sup>22</sup> which is a capacity expansion model and it helps determine what mix of resources are needed to meet the adequacy requirements. It is expected that the NPCC will use all these analytics to recommend, in the Ninth Power Plan, that the region and BPA add new generation, demand management, energy storage, and energy efficiency to the system.

28. In the Needs Assessment for Changing Hydro Operations Scenario, the NPCC staff did a detailed examination of how the hydrosystem responded to four different hydro operations sensitivities and how those sensitivities impacted the system-wide needs assessment across 90 different system scenarios. In addition to resource adequacy, the NPCC staff also looked at the energy and capacity generation across the hydrosystem operations.

29. From the chart on Slide 14 the differences in the four sensitivities are clearly delineated, showing that the differences are at most modest. The New MOP includes one month of additional spill in August at the LSR dams, and one to one-and-a-half foot operating ranges at the lower Columbia and LSR dams during the Spring and Summer salmon migration seasons.

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<sup>20</sup> [https://www.nwcouncil.org/fs/19637/2025\\_10\\_1b.pdf](https://www.nwcouncil.org/fs/19637/2025_10_1b.pdf) Slide 83.

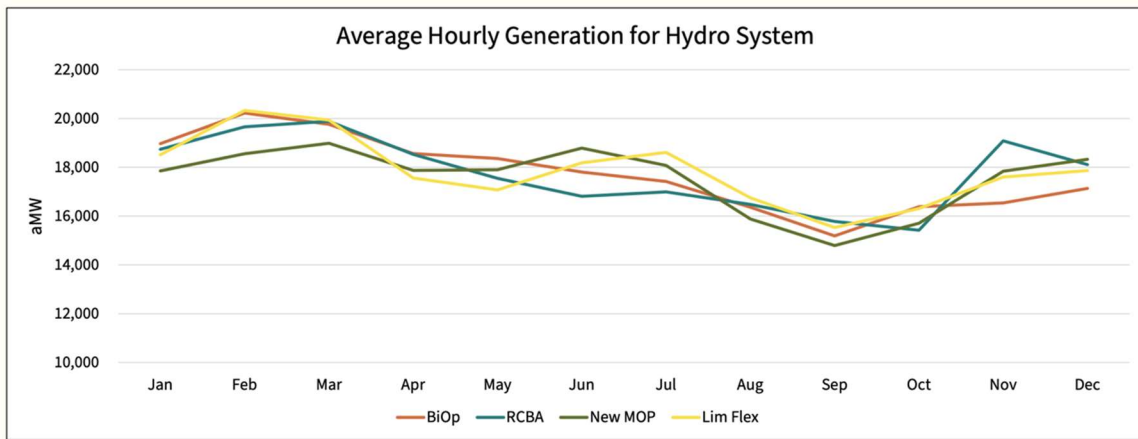
<sup>21</sup> Ibid, Slide 85.

<sup>22</sup> [https://www.nwcouncil.org/fs/19331/2025\\_04\\_07.pdf](https://www.nwcouncil.org/fs/19331/2025_04_07.pdf)

Sensitivity	Min Elevation	Elevation Target Sof-Constraint	Elevation Target Hard Constraint	Spill	Outflow Ramp	Reserves Allocation
2020 BiOp	2025 Water Management Plan (WMP)			BiOp spill	2025 WMP	Existing
2023 RCBA	2025 WMP			RCBA spill	2025 WMP	Existing
New MOP & Spill	2025 WMP	+1 lower Columbia + 0.5 Lower Snake	+1.5 lower Columbia + 1 Lower Snake	RCBA spill with Aug 30 date	2025 WMP	Existing
Limited Flex	2025 WMP			BiOp Spill	2020-2024 avg.	Half

30. For the system as a whole, the NPCC analysis shows very modest difference in average hourly energy generation between the different fish operations.<sup>23</sup> The New MOP is slightly lower than the BiOp in January-April and September, but higher than the BiOp in May-July and November-December. The differences in all cases represent a small percentage of the total generation of the regional and federal power systems.

## Average Hourly Hydro System Generation



31. The NPCC Ninth Power Plan, which is under development and should be finalized in late 2026, is designed to assess existing and planned resources and the gap between

<sup>23</sup> Ibid, Slides 58 and 59.

forecasted growth in demand and existing/planned resources.<sup>24</sup> The Ninth Plan will then recommend a portfolio of new resources to meet the forecasted demand growth and maintain a reliable power system. Projected load growth in power demand from data centers and electrification are the leading drivers of the need for new resources in the NPCC staff hydro operations and needs assessment. The analysis notes that some of the hydro operations that support fish recovery do not lead to greater resource needs.<sup>25</sup>

## Key Takeaways on Needs

- The modeling shows significant needs for the region in 2031
- Needs are seen across all seasons, but the largest and longest gaps appear in the winter
- The expected load growth is the largest driver of the needs seen in this study
- There are differences between the sensitivities in terms of needs, with some of the operations showing greater needs than others
  - Note: These differences are not necessarily intuitive, meaning some operations that might be more tuned towards supporting fish mitigation do not necessarily show greater needs
  - Reminder: The Power Act was set up to first do the F&W Program, which might result in derating the hydro system to mitigate for fish, which then allows the Council to identify resource solution that support those and other Bonneville obligations; all while maintaining an adequate, efficient, economical, and reliable power supply
- Peak challenges are greater than energy challenges, meaning that a portfolio of resources will be needed to meet both peak and energy needs identified in these studies throughout the year

### C. BPA has Many Tools to Provide Flexibility, Balancing and Operational Reserves

32. BPA operates 31 hydro projects as part of the federal hydrosystem across the region and has used all of the significant system flexibility to manage hydro operations for different fish survival regimes over the past decade to meet energy and capacity needs. In addition to the daily system operations activity that the BPA staff manage to provide a reliable

<sup>24</sup> <https://www.nwcouncil.org/energy/ninthpowerplan/>

<sup>25</sup> [https://www.nwcouncil.org/fs/19637/2025\\_10\\_1b.pdf](https://www.nwcouncil.org/fs/19637/2025_10_1b.pdf), Slide 85.

power system through many different kinds of system and operational constraints, there are other tools that BPA has and does use within and outside the federal system. These tools include, among others: Western Energy Imbalance Market, Fish Operations Plan variances, adding new strategic resources, and declaring an emergency. The point is, BPA has access to system flexibility and other flexibility tools to meet the kind of short duration supply constraints that the most recent NPCC modeling predicts under any hydro operations system while the agency and the region builds out new resources to meet load growth.

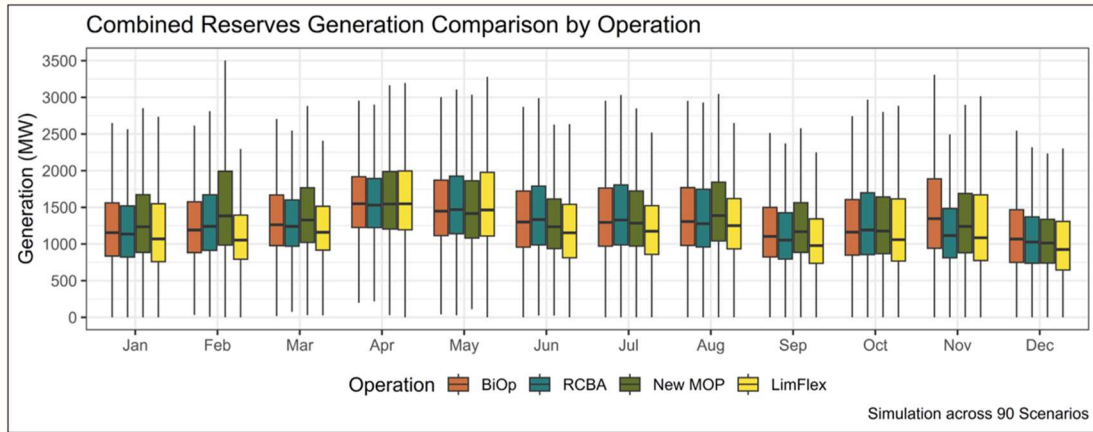
33. A key priority in system management is ensuring reserves. The NPCC hydro operations analysis in Slide 62 below shows very little difference across the four fish sensitivities and the 90 different simulation scenarios in terms of meeting requirements for overall system balancing and contingency reserves. February is the exception and it actually shows more generation across 90 scenarios from New MOP/preliminary injunction operations.<sup>26</sup> BPA's McManus' statement that there will be significant impact on balancing reserves (Page 8) is not evident in the NPCC modeling.<sup>27</sup>

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<sup>26</sup> [https://www.nwcouncil.org/fs/19637/2025\\_10\\_1b.pdf](https://www.nwcouncil.org/fs/19637/2025_10_1b.pdf), Slide 62

<sup>27</sup> 1404 2579 2025.12.16 Declaration of Bartholemew McManus.pdf

## Hydro Balancing & Contingency Reserves



34. Interestingly, the LimFlex sensitivity, that the NPCC staff model, reduces the reserve allocation by half for the eight projects being impacted by fish operations (see the chart above at my para 26). In other words, for this modeling exercise, the NPCC staff assumes strict limits on the flexibility of these projects, and as a result they cannot provide as much reserve to the system. In the model, BPA still holds the same 4,000 MW of total reserve but not at these eight projects. NPCC staff note that the reserve needs are taken up in other places in the system.<sup>28</sup> This is evident in the results as the LimFlex contingency and operating reserves are not significantly different from the other operations, despite the limitation on flexibility (Slide 62 above). I do note that LimFlex is slightly more limited in the winter when water flows are more constrained. Overall, this indicates that BPA would be using the other tools at its disposal to address operational changes and in fact has been using those tools.

<sup>28</sup> [Vimeo.com/1127583111](https://vimeo.com/1127583111) – starting time at 30:37 to 34:00

35. One of the most important tools available for meeting real-time energy balancing is the Western Energy Imbalance Market (WEIM) which includes 22 utilities across the West.<sup>29</sup> In the WEIM utilities and system operators can buy and sell power for load imbalances within fifteen-minute and five-minute intervals within an hour. This is a substantial market tool that provides significant support for balancing and flexibility needs. BPA joined the WEIM in 2022 and has seen significant financial and system operational benefits both in terms of purchasing power when demand spikes or when there is extreme weather and in terms of selling power to others when BPA has surplus supply to help with balancing the system. In fact, BPA's gross benefits from participation in the WEIM are equal to \$25-\$35 million/year.<sup>30</sup> It is notable that none of the BPA declarations by Dibble, McManus or Stevenson make mention of this important development for balancing power supply and demand.

36. Another tool to assist BPA with system operations are the variances and pre-coordinated operational changes used as part of the annual Fish Operation Plan (FOP) implementation. Attached hereto as Exhibit A is an Excel spreadsheet that summarizes my review of the data on variance and pre-coordinated operational changes for the past six years (2020 to 2025) to see how often variances and other operational changes were used to address energy or transmission (energy) related challenges.<sup>31</sup> The annual FOP reports show implementation changes from April to August in each year. The reasons for variances include human and program error, maintenance, navigation, and debris issues. The reasons for pre-coordinated operational changes include maintenance, navigation and transmission reliability.

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<sup>29</sup> <https://www.westernenergymarkets.com/western-energy-imbalance-market-weim>

<sup>30</sup> <https://www.westernenergymarkets.com/western-energy-imbalance-market-weim/benefits>

<sup>31</sup> [https://public.crohms.org/tmt/documents/FOP\\_Implementation\\_Reports/](https://public.crohms.org/tmt/documents/FOP_Implementation_Reports/)

All of these increases or decreases in spill occur at one hour increments up to 24 hours in a particular day. For the transmission reliability operational changes, the increases in spill are “to provide reserves.” And the decreases in spill are “due to an increase in generation to deploy reserves.”<sup>32</sup>

37. What is fascinating about this data is that spill operations were adjusted 3,786 hours during the five-year period for human/program error, maintenance, navigation, and debris management. Whereas spill operations were adjusted 483 hours during the five-year period for transmission reliability reasons. In 2024 and 2025, when the RCBA operations were in place, energy related changes occurred in only two hours in the period between April-August. Whereas in this same timeframe, the other reasons for change required 1,439 hours of variances and pre-coordinated changes.

38. The FOP variance data shows that many of the variances and pre-coordinated operational changes needed are for an hour. There is an interesting correlation between the use of the variances and changes and the NPCC hydro ops needs assessment which says that 90% of these reliability events are one hour in duration with another 8% at two hours in duration. Across the entire power system, 70% of the events are less than 500 megawatts and 93% of events are less than 1250 megawatts.<sup>33</sup> This indicates that routine short-duration variances may continue to be a useful tool to allow adjustments to meet any of the short-duration challenges that occur on BPA’s system.

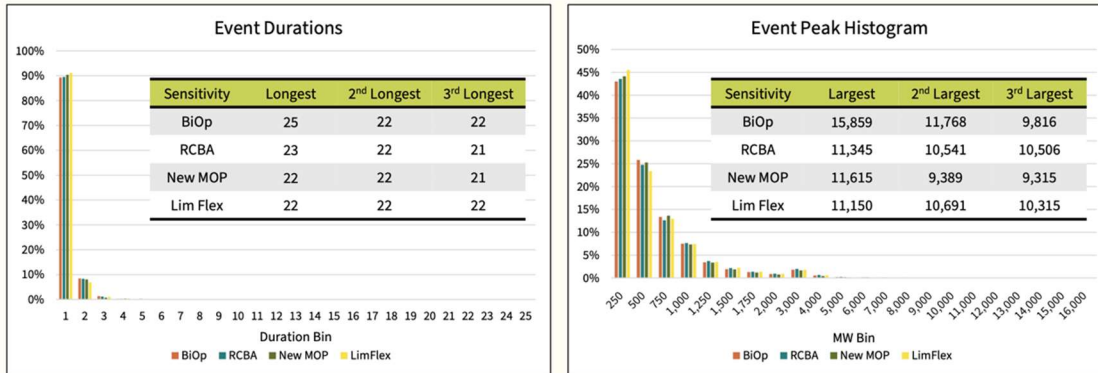
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<sup>32</sup> Ibid, Page 6.

<sup>33</sup> [http://nwcouncil.or/fs/19637/2025\\_10\\_1b.pdf](http://nwcouncil.or/fs/19637/2025_10_1b.pdf) Slide 88.

## Most Events are Short and Small

- In each sensitivity, 90% of these are 1 hour and ~93% are less than 1250 MW



39. While it has been clear for some time that BPA and other utilities in the region will need to add new resources to maintain resource adequacy in the face of load growth and other long-term challenges facing the region, BPA has surprisingly not taken significant action to add new power system resources. Section 6 of the Northwest Power Act authorizes BPA to acquire new resources to meet its needs, including its fish and wildlife protection operations.<sup>34</sup> New resources developed under this authority would provide more system flexibility and minimize the occurrence of emergencies in the future.

40. Top of the list for new resources is maximizing energy efficiency and working with BPA customers to manage loads to reduce peaks. The potential for regional demand management development (to reduce peak demand and provide dispatchable resources during capacity needs) is very substantial. Since 2010 and the 6<sup>th</sup> Power Plan, the NPCC has been calling on BPA and the region to make investments in demand management (often called

<sup>34</sup> 839d(a)(2)(B). to assist in meeting the requirements of section 839b(h) of this title. [Northwest Power Act, §6(a)(2)(B), 94 Stat. 2717.]

demand response). The NPCC's 2021 Plan ramped this call up even more with estimates of about 3,721 megawatts of summer load reduction potential and 2,761 megawatts of winter load reduction potential.<sup>35</sup> A large portion of NPCC's recommended demand response resources consist of rate design and conservation voltage reduction programs that can be implemented quickly and very inexpensively over the next several years. This recommendation is expected to be strengthened in the 9<sup>th</sup> Plan as the region considers increased pressure on Northwest resource adequacy and sufficient flows in the hydrosystem for fish and wildlife protection. Despite the long-standing push from the NPCC, BPA's 2022-27 Energy Efficiency Action Plan noted 300 MW of demand response resources, but made no commitment to achieve these flexibility resources, and only to engage with its customer utilities in exploring opportunities.<sup>36</sup>

41. Another critical new resource is battery storage. In the past 5-6 years, both Texas and California have added thousands of megawatts of battery storage to their systems to manage peak energy needs. Texas now has 15,000 MW.<sup>37</sup> California has grown its battery storage resource from 800 MW in 2019 to 17,000 MW in 2025.<sup>38</sup> Most of this storage in California is from utility scale systems. Within the region, between 2022 and mid-2025, Portland General Electric has moved forward with a total of 492 MW of battery storage capacity in four different facilities across its service territory to provide up to four hours of peak energy or to support PGE's system during extreme weather or unexpected disruptions.<sup>39</sup> While the Northwest has

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<sup>35</sup> <https://www.nwcouncil.org/2021-northwest-power-plan/> Page 64.

<sup>36</sup> [https://www.nwcouncil.org/fs/18206/2023\\_03\\_p3.pdf](https://www.nwcouncil.org/fs/18206/2023_03_p3.pdf)

<sup>37</sup> <https://ieefa.org/resources/summer-solar-and-battery-storage-records-texas>

<sup>38</sup> <https://www.energy.ca.gov/news/2025-11/californias-battery-storage-fleet-continues-record-growth-strengthening-grid#:~:text=WHAT%20YOU%20NEED%20TO%20KNOW,Gov.>

<sup>39</sup> <https://portlandgeneral.com/news/2025-08-pge-energizes-475-mw-of-battery-energy-storage-to-boost-grid>

historically used the reservoir system as our utility scale storage battery, the writing has been on the wall for the past decade that that flexibility and capacity is increasingly constrained due to climate impacts on precipitation patterns, the needs of salmon and steelhead, and the needs to integrate variable renewable resources. Yet, BPA and much of the region have been very slow to develop battery storage projects, even short duration systems, to support fish operations and peak energy needs.

42. Throughout Dibble's declaration she states that BPA's only option to address the system flexibility needs and assure system reliability is to declare an emergency and suspend fish operations. I understand that the emergency protocols are available for emergencies to maintain power system reliability and are not intended as a way to provide regular operational system support. NWF's motion assumes that the emergency protocols remain in place and are a key tool to maintain reliability as are the more routine variances discussed above that do not require a declaration of power system emergency. By emphasizing the need for and consequences of an emergency declaration, BPA seems to overplay the loss of flexibility and ignore the flexibility created by other tools, from the WEIM to variances to changes across the rest of the system's operations.

D. The System Balancing Interaction Between LSR and the Lower Columbia Projects

43. I have reviewed a study conducted by the Pacific Northwest National Laboratory (PNNL) on the role of the four lower Snake River dams over a five-year time frame.<sup>40</sup> PNNL's analysis of operations at the four LSR dams, and the other mainstem Columbia dams over the 2020-2024 timeframe included fish operations in place during each of the study years. These

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<sup>40</sup> September 2025, US Department of Energy, Lower Snake River Dams Contribution to Grid Services, <https://www.osti.gov/biblio/3000013>

operations included years when the 2020 BiOp operations and the RCBA operations were in place.

44. In the chapters on inter and intra hour ramping and balancing, PNNL shows that there is great consistency in the operation of the lower Columbia, LSR, Grand Coulee, and Chief Joseph projects to provide system flexibility across the five-year period and different hydro operations for fish recovery. The most significant variables to how the different projects are operated are energy market conditions and water levels, not reservoir elevations and spill regimes.<sup>41</sup>

E. Supporting the Tri-Cities

45. Providing reliable support service to the local load center of the Tri-Cities is vitally important. Ice Harbor generators provide voltage and reactive power support to the Tri-Cities. This type of support makes the power system more efficient, helps control and manage the oscillation in voltage that exists in an AC system and comes from synchronous generators like those at Ice Harbor. The PNNL study finds that “most, if not all synchronous generators operate in Automatic Voltage Regulation mode”.<sup>42</sup> Voltage regulation and reactive power support are more a function of the physical presence of the generators at Ice Harbor dam rather than the level of spill or MOP conditions at Ice Harbor. Stevenson also recognizes the important role of Ice Harbor in providing support to the Tri-Cities<sup>43</sup>, though her examples imply the loss of generation at Ice Harbor. The preliminary injunction in no way contemplates this outcome. In

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<sup>41</sup> Ibid, Chapters 3.0 and 4.0

<sup>42</sup> Ibid, page 38

<sup>43</sup> 1404 2582 2025.12.16 Declaration of Audrey Stevenson.pdf Paragraphs 17 and 33.

addition, reactive power could be provided by locally sited storage and distributed generation, that may have fast response times and could provide additional reactive power support.<sup>44</sup>

46. Another option to support the Tri-Cities is grid enhancements, and BPA is already moving forward with some of these projects. However, the reliability support for the Tri-Cities has been a concern since the mid-2010s and it was not until 2023 that BPA launched the Tri-Cities Reinforcement Project.<sup>45</sup> The series of three grid reinforcement projects are very important and will help address these local reliability issues. Even before these projects are completed, however, the analysis performed by PNNL and the NPCC shows that power services to in the Tri-Cities will not be at risk from the preliminary injunction and that there are other resources that could be quickly deployed to address BPA's concerns.

F. Extreme Weather Events

47. Extreme weather events, both heat domes and arctic blasts, can happen in the Northwest and system reliability is vital during these challenging times. Recent experience has shown that extreme weather conditions do not usually occur across regions at the same time which allows the Northwest, California and the Southwest to share resources on the transmission interties and through the Western Energy Imbalance Market. This type of connectivity and coordination is important and BPA has planned for and effectively used these resources across regions during extreme events.

48. The PNNL study, for example, examined how BPA managed its system during the Northwest extreme winter event (January 2024 with RCBA fish operations in place). During

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<sup>44</sup> <https://rmi.org/clean-energy-101-how-batteries-can-support-grid-reliability/>

<sup>45</sup> <https://www.bpa.gov/-/media/Aep/efw/nepa/active/south-of-tri-cities/Tri-Cities-Reinforcement-Project-Fact-Sheet-2023-FINAL.pdf>

the January 2024 arctic blast, Pacific Northwest loads went up dramatically and PNNL shows that BPA responded by ramping up generation at Grand Coulee from 2,000 MW to 3,500 MW and at Chief Joseph from 1,000 MW to 2,000 MW during time of peak demand (generally morning and evening hours). Low water conditions are normal in winter in the lower Snake River basin and the LSR dams provided their typical level of increased winter generation during a cold snap – about 1,000 MW total for specific peak hours within each day.<sup>46</sup> PNNL states that “due to water constraints, the LSR plants were unable to significantly increase their output beyond typical levels but still contributed approximately 1,000 MW during peak generation”.<sup>47</sup>

49. BPA used the ramping flexibility of its system to increase generation for a couple of hours at a time during these extreme emergency situations. The PNNL study also shows the crucial importance of interconnection within the West as BPA used the WEIM to bring 3,675 MW of power north on the California-Oregon Intertie – more power than the winter hydrosystem could provide under any circumstances.<sup>48</sup>

50. In the Dibble declaration, there is extensive reference to extreme weather events and the risk to public health and safety. As demonstrated in the PNNL analysis, BPA has many tools available to manage extreme weather events, including emergency protocols that allow suspension of fish operations to ensure reliability of the system. BPA has successfully used the WEIM power market to both bring resources into the northwest during extreme weather events and to send power to other parts of the west during their weather events.

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<sup>46</sup> Ibid, Page 58, Figure 7-3

<sup>47</sup> Ibid, Page 56

<sup>48</sup> Ibid, Page 59, Figure 7-6

G. Affordability

51. As I mentioned already, Dibble states that the proposed injunction operations will result in a loss of 250 average MW of power generation in fiscal year 2026. BPA's 2025 White Book<sup>49</sup> shows its total firm obligations to be approximately 8,000 aMW (with a high of 9,374 a MW in December and a low of 7,038 aMW in May).<sup>50</sup> Dibble's estimated lost generation of 250 aMW is approximately 3% of the yearly average MW generation for BPA. The White Book uses RCBA for hydro operations and the results state that in median water (50<sup>th</sup> percentile of system operations) there are annual energy surpluses throughout the 10-year planning period. However, BPA uses the 10<sup>th</sup> percentile of water flows (i.e., very low flow conditions) as its firm water conditions which results in annual deficits of 426 aMW to 1012 aMW.

52. In May 2025, BPA issued a letter to all Pacific Northwest utilities, and customers including outside the region customers, stating that it is "projecting that periodically through September 2026 BPA may have surplus power, capacity, and Transferred Frequency Response (TFR) available for sale."<sup>51</sup> While this notice is an annual notice of potential surplus resources, it is an indication that BPA has significant flexibility in how it utilizes the system to meet reliability requirements while also making additional sales to support increased revenue. Were BPA seriously concerned about the 15-27% LOLP presented in Dibble's declaration, this letter seems unusual at best.

53. On January 30, 2024, BPA Administrator John Hairston testified before the House Energy and Commerce Committee, Subcommittee on Energy, Climate and Grid Security

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<sup>49</sup> <https://www.bpa.gov/-/media/Aep/power/white-book/2025-whitebook.pdf>

<sup>50</sup> Ibid, Pages 15-16.

<sup>51</sup> <https://www.bpa.gov/-/media/Aep/power/power-products-catalog/fy-26-notice-of-surplus-power.pdf>

regarding the RCBA agreement and the impact on BPA.<sup>52</sup> Attached to Mr. Hairston’s testimony is a spread sheet with BPA’s preliminary rate assessment of the \$300 million commitment in the RCBA combined with the rate impact of the operational changes in that agreement indicated an incremental rate impact per year of 0.05%. This increases power rates by \$0.2 to \$0.3/megawatthour. This spread sheet shows a line item for “Ops Ave. Revenue Increase” to estimate the financial impact of the operations included in the RCBA or stay of litigation. BPA estimated these rate impacts as generating an extra \$1 million per year relative to the 2020 BiOp Record of Decision – in other words, BPA would *save* money by implementing these operational changes. The RCBA on the whole would impose only modest costs when the savings from changed operations are combined with the financial commitments BPA made in that agreement (which are addressed as separate line items in that spreadsheet, including “High Priority CBRI” and Lower Snake Comp Plan”, together totaling \$300 million over 10 years. BPA has abandoned the financial commitments in that agreement so the \$300 million in increased costs over ten years are no longer affecting rates.<sup>53</sup>

### Conclusions

54. Throughout Dibble’s declaration, she uses significant hyperbole stating that the unprecedented proposed preliminary injunction will lead to power shortages and blackouts that will risk human health and safety and have significant economic damage to the region. Yet, after reviewing the NPCC Adequacy Assessment for 2029, the PNNL LSR assessment and the NPCC hydro operations analysis I conclude that the impact of the various fish operation regimes,

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<sup>52</sup> [https://www.energy.gov/sites/default/files/2024-01/January%2030%202024%20HEC%20BPA%20John%20Hairston%20Testimony%20Columbia%20River%20System\\_Final.pdf](https://www.energy.gov/sites/default/files/2024-01/January%2030%202024%20HEC%20BPA%20John%20Hairston%20Testimony%20Columbia%20River%20System_Final.pdf)

<sup>53</sup> *Ibid*, Page 8 (page 2 of the spreadsheet).

including those NWF seeks in its preliminary injunction, have very modest impacts on power generation, peak needs, and overall ability to maintain a reliable power system. The preliminary injunction operations are similar to previous operations of the system over the past five years with some modest adjustments in spill and operating pool elevations to reduce the harm to migrating salmon and steelhead. BPA has experience with the spill and MOP conditions and has experience managing the power system with these conditions and providing the flexibility necessary to match power supply with demand. And if emergencies arise, the protocols for modifying fish operations remain available.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Executed this 22nd day of January, 2026.



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NANCY HIRSH

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Transalta )  
Centralia Generation LLC )  
\_\_\_\_\_ )

Order No. 202-26-18

Motion to Intervene, Motion for Clarification, and Requests for Rehearing and Stay  
of Sierra Club, NW Energy Coalition, Washington Conservation Action, Climate  
Solutions, Public Citizen, and Environmental Defense Fund  
(collectively, “Public Interest Organizations” or “PIOs”)

Exhibit 2-155:  
Centralia Output Data

	A	B	C	D	E	F
1	State	Facility Name	Facility ID	Unit ID	Associated Stacks	Date
2	WA	Centralia	3845	BW21		1/1/2021
3	WA	Centralia	3845	BW21		1/2/2021
4	WA	Centralia	3845	BW21		1/3/2021
5	WA	Centralia	3845	BW21		1/4/2021
6	WA	Centralia	3845	BW21		1/5/2021
7	WA	Centralia	3845	BW21		1/6/2021
8	WA	Centralia	3845	BW21		1/7/2021
9	WA	Centralia	3845	BW21		1/8/2021
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42	WA	Centralia	3845	BW21		2/10/2021
43	WA	Centralia	3845	BW21		2/11/2021

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915	WA	Centralia	3845	BW22		4/4/2023
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1345	WA	Centralia	3845	BW22		6/7/2024
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1696	WA	Centralia	3845	BW22		5/24/2025
1697	WA	Centralia	3845	BW22		5/25/2025
1698	WA	Centralia	3845	BW22		5/26/2025
1699	WA	Centralia	3845	BW22		5/27/2025
1700	WA	Centralia	3845	BW22		5/28/2025
1701	WA	Centralia	3845	BW22		5/29/2025
1702	WA	Centralia	3845	BW22		5/30/2025
1703	WA	Centralia	3845	BW22		5/31/2025
1704	WA	Centralia	3845	BW22		6/1/2025
1705	WA	Centralia	3845	BW22		6/2/2025
1706	WA	Centralia	3845	BW22		6/3/2025
1707	WA	Centralia	3845	BW22		6/4/2025
1708	WA	Centralia	3845	BW22		6/5/2025
1709	WA	Centralia	3845	BW22		6/6/2025
1710	WA	Centralia	3845	BW22		6/7/2025
1711	WA	Centralia	3845	BW22		6/8/2025
1712	WA	Centralia	3845	BW22		6/9/2025
1713	WA	Centralia	3845	BW22		6/10/2025
1714	WA	Centralia	3845	BW22		6/11/2025
1715	WA	Centralia	3845	BW22		6/12/2025
1716	WA	Centralia	3845	BW22		6/13/2025
1717	WA	Centralia	3845	BW22		6/14/2025
1718	WA	Centralia	3845	BW22		6/15/2025
1719	WA	Centralia	3845	BW22		6/16/2025
1720	WA	Centralia	3845	BW22		6/17/2025

	A	B	C	D	E	F
1721	WA	Centralia	3845	BW22		6/18/2025
1722	WA	Centralia	3845	BW22		6/19/2025
1723	WA	Centralia	3845	BW22		6/20/2025
1724	WA	Centralia	3845	BW22		6/21/2025
1725	WA	Centralia	3845	BW22		6/22/2025
1726	WA	Centralia	3845	BW22		6/23/2025
1727	WA	Centralia	3845	BW22		6/24/2025
1728	WA	Centralia	3845	BW22		6/25/2025
1729	WA	Centralia	3845	BW22		6/26/2025
1730	WA	Centralia	3845	BW22		6/27/2025
1731	WA	Centralia	3845	BW22		6/28/2025
1732	WA	Centralia	3845	BW22		6/29/2025
1733	WA	Centralia	3845	BW22		6/30/2025
1734	WA	Centralia	3845	BW22		7/1/2025
1735	WA	Centralia	3845	BW22		7/2/2025
1736	WA	Centralia	3845	BW22		7/3/2025
1737	WA	Centralia	3845	BW22		7/4/2025
1738	WA	Centralia	3845	BW22		7/5/2025
1739	WA	Centralia	3845	BW22		7/6/2025
1740	WA	Centralia	3845	BW22		7/7/2025
1741	WA	Centralia	3845	BW22		7/8/2025
1742	WA	Centralia	3845	BW22		7/9/2025
1743	WA	Centralia	3845	BW22		7/10/2025
1744	WA	Centralia	3845	BW22		7/11/2025
1745	WA	Centralia	3845	BW22		7/12/2025
1746	WA	Centralia	3845	BW22		7/13/2025
1747	WA	Centralia	3845	BW22		7/14/2025
1748	WA	Centralia	3845	BW22		7/15/2025
1749	WA	Centralia	3845	BW22		7/16/2025
1750	WA	Centralia	3845	BW22		7/17/2025
1751	WA	Centralia	3845	BW22		7/18/2025
1752	WA	Centralia	3845	BW22		7/19/2025
1753	WA	Centralia	3845	BW22		7/20/2025
1754	WA	Centralia	3845	BW22		7/21/2025
1755	WA	Centralia	3845	BW22		7/22/2025
1756	WA	Centralia	3845	BW22		7/23/2025
1757	WA	Centralia	3845	BW22		7/24/2025
1758	WA	Centralia	3845	BW22		7/25/2025
1759	WA	Centralia	3845	BW22		7/26/2025
1760	WA	Centralia	3845	BW22		7/27/2025
1761	WA	Centralia	3845	BW22		7/28/2025
1762	WA	Centralia	3845	BW22		7/29/2025
1763	WA	Centralia	3845	BW22		7/30/2025

	A	B	C	D	E	F
1764	WA	Centralia	3845	BW22		7/31/2025
1765	WA	Centralia	3845	BW22		8/1/2025
1766	WA	Centralia	3845	BW22		8/2/2025
1767	WA	Centralia	3845	BW22		8/3/2025
1768	WA	Centralia	3845	BW22		8/4/2025
1769	WA	Centralia	3845	BW22		8/5/2025
1770	WA	Centralia	3845	BW22		8/6/2025
1771	WA	Centralia	3845	BW22		8/7/2025
1772	WA	Centralia	3845	BW22		8/8/2025
1773	WA	Centralia	3845	BW22		8/9/2025
1774	WA	Centralia	3845	BW22		8/10/2025
1775	WA	Centralia	3845	BW22		8/11/2025
1776	WA	Centralia	3845	BW22		8/12/2025
1777	WA	Centralia	3845	BW22		8/13/2025
1778	WA	Centralia	3845	BW22		8/14/2025
1779	WA	Centralia	3845	BW22		8/15/2025
1780	WA	Centralia	3845	BW22		8/16/2025
1781	WA	Centralia	3845	BW22		8/17/2025
1782	WA	Centralia	3845	BW22		8/18/2025
1783	WA	Centralia	3845	BW22		8/19/2025
1784	WA	Centralia	3845	BW22		8/20/2025
1785	WA	Centralia	3845	BW22		8/21/2025
1786	WA	Centralia	3845	BW22		8/22/2025
1787	WA	Centralia	3845	BW22		8/23/2025
1788	WA	Centralia	3845	BW22		8/24/2025
1789	WA	Centralia	3845	BW22		8/25/2025
1790	WA	Centralia	3845	BW22		8/26/2025
1791	WA	Centralia	3845	BW22		8/27/2025
1792	WA	Centralia	3845	BW22		8/28/2025
1793	WA	Centralia	3845	BW22		8/29/2025
1794	WA	Centralia	3845	BW22		8/30/2025
1795	WA	Centralia	3845	BW22		8/31/2025
1796	WA	Centralia	3845	BW22		9/1/2025
1797	WA	Centralia	3845	BW22		9/2/2025
1798	WA	Centralia	3845	BW22		9/3/2025
1799	WA	Centralia	3845	BW22		9/4/2025
1800	WA	Centralia	3845	BW22		9/5/2025
1801	WA	Centralia	3845	BW22		9/6/2025
1802	WA	Centralia	3845	BW22		9/7/2025
1803	WA	Centralia	3845	BW22		9/8/2025
1804	WA	Centralia	3845	BW22		9/9/2025
1805	WA	Centralia	3845	BW22		9/10/2025
1806	WA	Centralia	3845	BW22		9/11/2025

	A	B	C	D	E	F
1807	WA	Centralia	3845	BW22		9/12/2025
1808	WA	Centralia	3845	BW22		9/13/2025
1809	WA	Centralia	3845	BW22		9/14/2025
1810	WA	Centralia	3845	BW22		9/15/2025
1811	WA	Centralia	3845	BW22		9/16/2025
1812	WA	Centralia	3845	BW22		9/17/2025
1813	WA	Centralia	3845	BW22		9/18/2025
1814	WA	Centralia	3845	BW22		9/19/2025
1815	WA	Centralia	3845	BW22		9/20/2025
1816	WA	Centralia	3845	BW22		9/21/2025
1817	WA	Centralia	3845	BW22		9/22/2025
1818	WA	Centralia	3845	BW22		9/23/2025
1819	WA	Centralia	3845	BW22		9/24/2025
1820	WA	Centralia	3845	BW22		9/25/2025
1821	WA	Centralia	3845	BW22		9/26/2025
1822	WA	Centralia	3845	BW22		9/27/2025
1823	WA	Centralia	3845	BW22		9/28/2025
1824	WA	Centralia	3845	BW22		9/29/2025
1825	WA	Centralia	3845	BW22		9/30/2025
1826	WA	Centralia	3845	BW22		10/1/2025
1827	WA	Centralia	3845	BW22		10/2/2025
1828	WA	Centralia	3845	BW22		10/3/2025
1829	WA	Centralia	3845	BW22		10/4/2025
1830	WA	Centralia	3845	BW22		10/5/2025
1831	WA	Centralia	3845	BW22		10/6/2025
1832	WA	Centralia	3845	BW22		10/7/2025
1833	WA	Centralia	3845	BW22		10/8/2025
1834	WA	Centralia	3845	BW22		10/9/2025
1835	WA	Centralia	3845	BW22		10/10/2025
1836	WA	Centralia	3845	BW22		10/11/2025
1837	WA	Centralia	3845	BW22		10/12/2025
1838	WA	Centralia	3845	BW22		10/13/2025
1839	WA	Centralia	3845	BW22		10/14/2025
1840	WA	Centralia	3845	BW22		10/15/2025
1841	WA	Centralia	3845	BW22		10/16/2025
1842	WA	Centralia	3845	BW22		10/17/2025
1843	WA	Centralia	3845	BW22		10/18/2025
1844	WA	Centralia	3845	BW22		10/19/2025
1845	WA	Centralia	3845	BW22		10/20/2025
1846	WA	Centralia	3845	BW22		10/21/2025
1847	WA	Centralia	3845	BW22		10/22/2025
1848	WA	Centralia	3845	BW22		10/23/2025
1849	WA	Centralia	3845	BW22		10/24/2025

	A	B	C	D	E	F
1850	WA	Centralia	3845	BW22		10/25/2025
1851	WA	Centralia	3845	BW22		10/26/2025
1852	WA	Centralia	3845	BW22		10/27/2025
1853	WA	Centralia	3845	BW22		10/28/2025
1854	WA	Centralia	3845	BW22		10/29/2025
1855	WA	Centralia	3845	BW22		10/30/2025
1856	WA	Centralia	3845	BW22		10/31/2025
1857	WA	Centralia	3845	BW22		11/1/2025
1858	WA	Centralia	3845	BW22		11/2/2025
1859	WA	Centralia	3845	BW22		11/3/2025
1860	WA	Centralia	3845	BW22		11/4/2025
1861	WA	Centralia	3845	BW22		11/5/2025
1862	WA	Centralia	3845	BW22		11/6/2025
1863	WA	Centralia	3845	BW22		11/7/2025
1864	WA	Centralia	3845	BW22		11/8/2025
1865	WA	Centralia	3845	BW22		11/9/2025
1866	WA	Centralia	3845	BW22		11/10/2025
1867	WA	Centralia	3845	BW22		11/11/2025
1868	WA	Centralia	3845	BW22		11/12/2025
1869	WA	Centralia	3845	BW22		11/13/2025
1870	WA	Centralia	3845	BW22		11/14/2025
1871	WA	Centralia	3845	BW22		11/15/2025
1872	WA	Centralia	3845	BW22		11/16/2025
1873	WA	Centralia	3845	BW22		11/17/2025
1874	WA	Centralia	3845	BW22		11/18/2025
1875	WA	Centralia	3845	BW22		11/19/2025
1876	WA	Centralia	3845	BW22		11/20/2025
1877	WA	Centralia	3845	BW22		11/21/2025
1878	WA	Centralia	3845	BW22		11/22/2025
1879	WA	Centralia	3845	BW22		11/23/2025
1880	WA	Centralia	3845	BW22		11/24/2025
1881	WA	Centralia	3845	BW22		11/25/2025
1882	WA	Centralia	3845	BW22		11/26/2025
1883	WA	Centralia	3845	BW22		11/27/2025
1884	WA	Centralia	3845	BW22		11/28/2025
1885	WA	Centralia	3845	BW22		11/29/2025
1886	WA	Centralia	3845	BW22		11/30/2025
1887	WA	Centralia	3845	BW22		12/1/2025
1888	WA	Centralia	3845	BW22		12/2/2025
1889	WA	Centralia	3845	BW22		12/3/2025
1890	WA	Centralia	3845	BW22		12/4/2025
1891	WA	Centralia	3845	BW22		12/5/2025
1892	WA	Centralia	3845	BW22		12/6/2025

	A	B	C	D	E	F
1893	WA	Centralia	3845	BW22		12/7/2025
1894	WA	Centralia	3845	BW22		12/8/2025
1895	WA	Centralia	3845	BW22		12/9/2025
1896	WA	Centralia	3845	BW22		12/10/2025
1897	WA	Centralia	3845	BW22		12/11/2025
1898	WA	Centralia	3845	BW22		12/12/2025
1899	WA	Centralia	3845	BW22		12/13/2025
1900	WA	Centralia	3845	BW22		12/14/2025
1901	WA	Centralia	3845	BW22		12/15/2025
1902	WA	Centralia	3845	BW22		12/16/2025
1903	WA	Centralia	3845	BW22		12/17/2025
1904	WA	Centralia	3845	BW22		12/18/2025
1905	WA	Centralia	3845	BW22		12/19/2025
1906	WA	Centralia	3845	BW22		12/20/2025
1907	WA	Centralia	3845	BW22		12/21/2025
1908	WA	Centralia	3845	BW22		12/22/2025
1909	WA	Centralia	3845	BW22		12/23/2025
1910	WA	Centralia	3845	BW22		12/24/2025
1911	WA	Centralia	3845	BW22		12/25/2025
1912	WA	Centralia	3845	BW22		12/26/2025
1913	WA	Centralia	3845	BW22		12/27/2025
1914	WA	Centralia	3845	BW22		12/28/2025
1915	WA	Centralia	3845	BW22		12/29/2025
1916	WA	Centralia	3845	BW22		12/30/2025
1917	WA	Centralia	3845	BW22		12/31/2025

	G	H	I	J
1	Operating Time Count	Sum of the Operating Time	Gross Load (MWh)	Steam Load (1000 lb)
2		0	0	
3		0	0	
4		0	0	
5		0	0	
6		0	0	
7		0	0	
8		0	0	
9		0	0	
10		0	0	
11		0	0	
12		0	0	
13		0	0	
14		0	0	
15		0	0	
16		0	0	
17		0	0	
18		0	0	
19		0	0	
20		0	0	
21		0	0	
22		0	0	
23		0	0	
24		0	0	
25		0	0	
26		0	0	
27		0	0	
28		0	0	
29		0	0	
30		0	0	
31		0	0	
32		0	0	
33		0	0	
34		0	0	
35		0	0	
36		0	0	
37		0	0	
38		0	0	
39		0	0	
40		0	0	
41		0	0	
42		0	0	
43		0	0	

	G	H	I	J
44	0	0		
45	0	0		
46	0	0		
47	0	0		
48	0	0		
49	0	0		
50	0	0		
51	0	0		
52	0	0		
53	0	0		
54	0	0		
55	0	0		
56	0	0		
57	0	0		
58	0	0		
59	0	0		
60	0	0		
61	0	0		
62	0	0		
63	0	0		
64	0	0		
65	0	0		
66	0	0		
67	0	0		
68	0	0		
69	0	0		
70	0	0		
71	0	0		
72	0	0		
73	0	0		
74	0	0		
75	0	0		
76	0	0		
77	0	0		
78	0	0		
79	0	0		
80	0	0		
81	0	0		
82	0	0		
83	0	0		
84	0	0		
85	0	0		
86	0	0		

	G	H	I	J
87	0	0		
88	0	0		
89	0	0		
90	0	0		
91	0	0		
92	24	24	10700	
93	24	24	7649	
94	24	24	8694	
95	24	24	11769	
96	24	24	10567	
97	24	24	11867	
98	24	24	14741	
99	24	24	12528	
100	24	24	12469	
101	24	24	10779	
102	24	24	13921	
103	24	24	13016	
104	24	24	9733	
105	24	24	13306	
106	24	24	9985	
107	24	24	10604	
108	24	24	10094	
109	24	24	12542	
110	24	24	16437	
111	24	24	13966	
112	24	24	14269	
113	24	24	12430	
114	24	24	14992	
115	24	24	14082	
116	24	24	15297	
117	24	24	15967	
118	24	24	15071	
119	24	24	13464	
120	24	24	14695	
121	24	24	9977	
122	24	24	11922	
123	24	24	14961	
124	24	24	11375	
125	24	24	12216	
126	24	24	9743	
127	24	24	9774	
128	24	24	9912	
129	24	24	13285	

	G	H	I	J
130	24	24	14764	
131	24	24	15421	
132	24	24	15461	
133	24	24	15263	
134	24	24	15582	
135	23	22.9	13455.9	
136	0	0		
137	0	0		
138	0	0		
139	0	0		
140	0	0		
141	0	0		
142	0	0		
143	17	16.35	19.35	
144	24	24	8458	
145	24	24	12232	
146	24	24	15667	
147	24	24	12499	
148	24	24	10816	
149	24	24	13110	
150	24	24	12552	
151	24	22.67	11400.24	
152	24	24	15097	
153	24	24	15815	
154	24	24	15778	
155	24	24	14262	
156	24	24	9673	
157	24	24	13554	
158	24	24	15814	
159	24	24	15805	
160	24	24	15836	
161	24	24	15816	
162	24	24	15799	
163	24	24	15505	
164	24	24	15391	
165	24	24	15080	
166	24	24	15291	
167	24	24	14819	
168	24	24	14214	
169	24	24	14044	
170	24	24	9017	
171	24	24	9493	
172	24	24	13387	

	G	H	I	J
173	24	24	13666	
174	24	24	12613	
175	24	24	13141	
176	24	24	10705	
177	24	24	9023	
178	24	24	11149	
179	24	24	13754	
180	24	24	14834	
181	24	24	14819	
182	24	24	14579	
183	24	24	13563	
184	2	1.53	179.4	
185	0	0		
186	0	0		
187	0	0		
188	0	0		
189	0	0		
190	0	0		
191	0	0		
192	0	0		
193	0	0		
194	0	0		
195	0	0		
196	0	0		
197	0	0		
198	0	0		
199	0	0		
200	0	0		
201	0	0		
202	0	0		
203	0	0		
204	0	0		
205	0	0		
206	0	0		
207	0	0		
208	0	0		
209	0	0		
210	0	0		
211	0	0		
212	0	0		
213	0	0		
214	0	0		
215	0	0		

	G	H	I	J
216	0	0		
217	0	0		
218	0	0		
219	0	0		
220	0	0		
221	0	0		
222	0	0		
223	0	0		
224	0	0		
225	0	0		
226	0	0		
227	0	0		
228	0	0		
229	0	0		
230	0	0		
231	0	0		
232	0	0		
233	0	0		
234	0	0		
235	0	0		
236	0	0		
237	0	0		
238	0	0		
239	0	0		
240	0	0		
241	0	0		
242	0	0		
243	0	0		
244	0	0		
245	0	0		
246	0	0		
247	0	0		
248	0	0		
249	0	0		
250	0	0		
251	0	0		
252	0	0		
253	0	0		
254	4	3.13	3.13	
255	11	10.53	10.53	
256	0	0		
257	23	22.5	1964.5	
258	19	18.5	8919	

	G	H	I	J
259	0	0		
260	0	0		
261	0	0		
262	0	0		
263	0	0		
264	0	0		
265	0	0		
266	0	0		
267	0	0		
268	21	20.45	1449.45	
269	24	24	12559	
270	24	24	14265	
271	24	24	16274	
272	24	24	13948	
273	24	24	12077	
274	24	24	11661	
275	24	24	13238	
276	24	24	12484	
277	24	24	14374	
278	24	24	16522	
279	24	24	16408	
280	24	24	16306	
281	24	24	16286	
282	24	24	14051	
283	24	24	12688	
284	24	24	12526	
285	24	24	11954	
286	24	24	13939	
287	24	24	15931	
288	24	24	14665	
289	24	24	15938	
290	24	24	16514	
291	24	24	15788	
292	24	24	14587	
293	24	24	16115	
294	24	24	16452	
295	24	24	16250	
296	24	24	16542	
297	24	24	16548	
298	24	24	16550	
299	24	24	16537	
300	24	24	16517	
301	24	24	16552	

	G	H	I	J
302	24	24	16527	
303	24	24	14715	
304	24	24	14793	
305	24	24	16556	
306	24	24	16567	
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343	24	24	16585	
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386	24	24	16384	
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449	24	24	8901	
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451	24	24	10358	
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558	24	24	14697	
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648	24	24	10332	
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653	24	24	10567	
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693	24	24	16987	
694	23	22.12	12746.12	
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715	24	24	16569	
716	24	24	16811	
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726	24	24	16975	
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728	24	24	15801	
729	24	24	16829	
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732	24	24	16973	
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735	24	24	17003	
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743	24	24	16954	
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748	24	24	17017	
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755	24	24	16184	
756	24	24	16742	
757	24	24	16842	
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765	24	24	15315	
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785	24	23.55	15036.6	
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794	24	24	16612	
795	24	24	17078	
796	24	24	17014	
797	16	15.68	9656.44	
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855	24	24	16612	
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860	24	24	16089	

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903	23	22.6	13497.6	

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1056	24	24	14898	
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1199	24	24	15589	
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1489	24	24	14404	
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1763	24	24	16124	

	G	H	I	J
1764	24	24	15953	
1765	24	24	14561	
1766	24	24	11886	
1767	24	24	8768	
1768	24	24	10779	
1769	24	24	13336	
1770	24	24	11630	
1771	24	24	10028	
1772	24	24	12477	
1773	24	24	12820	
1774	14	13.52	6385.68	
1775	0	0		
1776	12	10.2	1059.3	
1777	0	0		
1778	0	0		
1779	0	0		
1780	4	2.31	2.31	
1781	4	3.95	3.95	
1782	24	24	8316	
1783	24	24	15821	
1784	24	24	16053	
1785	24	24	16411	
1786	24	24	16013	
1787	24	24	16031	
1788	24	24	15654	
1789	24	24	16038	
1790	24	22.7	11590.6	
1791	24	24	16173	
1792	24	24	16049	
1793	24	24	15638	
1794	24	24	13815	
1795	24	24	9991	
1796	24	24	13240	
1797	24	24	16061	
1798	24	24	15988	
1799	24	24	15953	
1800	24	24	16052	
1801	24	24	15935	
1802	24	24	13657	
1803	6	5.18	2842	
1804	0	0		
1805	0	0		
1806	0	0		

	G	H	I	J
1807	17	15.75	266.75	
1808	24	24	11015	
1809	24	24	8552	
1810	24	24	15043	
1811	24	24	16098	
1812	24	24	15049	
1813	24	24	13788	
1814	24	24	15984	
1815	24	24	13926	
1816	24	24	9350	
1817	24	24	15809	
1818	24	24	16322	
1819	24	24	16333	
1820	24	24	14699	
1821	24	24	14719	
1822	24	24	16032	
1823	24	24	15495	
1824	24	24	14053	
1825	24	24	14211	
1826	24	24	14028	
1827	24	24	15549	
1828	24	24	14711	
1829	24	24	14501	
1830	24	24	13593	
1831	24	24	15908	
1832	24	24	15986	
1833	24	24	16040	
1834	24	24	15900	
1835	24	24	15430	
1836	24	24	8771	
1837	24	24	11642	
1838	24	24	15796	
1839	24	24	15892	
1840	24	24	16049	
1841	24	24	15454	
1842	24	24	12173	
1843	24	24	15822	
1844	24	24	9548	
1845	24	24	12799	
1846	24	24	15673	
1847	24	24	15941	
1848	24	24	16084	
1849	24	24	15119	

	G	H	I	J
1850	24	24	13679	
1851	24	24	12821	
1852	24	24	14632	
1853	24	24	15626	
1854	24	24	14577	
1855	24	24	15739	
1856	24	24	15846	
1857	24	24	9681	
1858	24	24	9981	
1859	24	24	14897	
1860	24	24	15929	
1861	24	24	15070	
1862	24	24	14134	
1863	24	24	11904	
1864	24	24	15949	
1865	24	24	14016	
1866	24	24	15680	
1867	24	24	16063	
1868	24	24	16076	
1869	24	24	14550	
1870	24	24	14422	
1871	24	24	15697	
1872	24	24	15863	
1873	24	24	15615	
1874	24	24	15103	
1875	24	24	9125	
1876	24	24	15649	
1877	24	24	15855	
1878	24	24	15852	
1879	24	24	15390	
1880	24	24	15497	
1881	24	24	15801	
1882	24	24	15600	
1883	24	24	15874	
1884	24	24	8337	
1885	11	10.67	3341.31	
1886	0	0		
1887	0	0		
1888	0	0		
1889	0	0		
1890	0	0		
1891	0	0		
1892	0	0		

	G	H	I	J
1893	3	2.9	2.9	
1894	24	23.17	1037.07	
1895	24	24	11303	
1896	24	24	8531	
1897	24	24	11587	
1898	24	24	8615	
1899	24	24	9423	
1900	24	24	8593	
1901	24	24	8544	
1902	24	24	8056	
1903	24	24	8495	
1904	24	24	8733	
1905	1	0.33	13.53	
1906	0	0		
1907	0	0		
1908	0	0		
1909	0	0		
1910	0	0		
1911	0	0		
1912	0	0		
1913	0	0		
1914	0	0		
1915	0	0		
1916	0	0		
1917	0	0		

	K	L	M	N
1	SO2 Mass (short tons)	SO2 Rate (lbs/mmBtu)	CO2 Mass (short tons)	CO2 Rate (short tons/mmBtu)
2				
3				
4				
5				
6				
7				
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11				
12				
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39				
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41				
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43				

	K	L	M	N
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	K	L	M	N
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90				
91				
92	0.869	0.0127	12362.9	0.105
93	0.152	0.0035	9119.2	0.105
94	0.273	0.0052	10182.6	0.105
95	1.558	0.0205	13606.1	0.105
96	0.607	0.0087	12221.9	0.105
97	0.846	0.0114	13705.2	0.105
98	3.78	0.0455	16807.2	0.105
99	1.923	0.0266	14269.1	0.105
100	1.895	0.0266	14090.6	0.105
101	1.56	0.0244	12299.3	0.105
102	3.568	0.0436	15806.7	0.105
103	3.188	0.0405	14924.3	0.105
104	1.771	0.0273	11241.7	0.105
105	3.012	0.0399	15042.1	0.105
106	1.176	0.0212	11327.6	0.105
107	1.424	0.0285	9380.9	0.105
108	1.629	0.0372	8974.6	0.105
109	2.563	0.0472	11029.8	0.105
110	3.492	0.0526	13933.8	0.105
111	5.005	0.1222	12014.1	0.105
112	1.734	0.0295	11332.5	0.105
113	0.264	0.0081	6129.3	0.105
114	1.663	0.0435	11179.4	0.105
115	3.408	0.044	16069.1	0.105
116	3.655	0.044	17232.7	0.105
117	3.776	0.044	17803.8	0.105
118	2.296	0.0282	17105.1	0.105
119	2.707	0.0346	15230.9	0.105
120	3.2	0.0401	16603.1	0.105
121	1.726	0.0308	11524.6	0.105
122	2.229	0.0336	13693	0.105
123	3.585	0.0437	17048.1	0.105
124	2.054	0.03	13026	0.105
125	1.752	0.0247	13936.7	0.105
126	0.973	0.017	11264.5	0.105
127	1.017	0.017	11298.6	0.105
128	1.172	0.0195	11390.9	0.105
129	3.28	0.0436	14967.9	0.105

	K	L	M	N
130	3.402	0.0428	16599.8	0.105
131	3.836	0.0466	17275.3	0.105
132	3.55	0.0428	17391.7	0.105
133	3.299	0.0403	17130.9	0.105
134	3.013	0.036	17532.7	0.105
135	2.5	0.0318	15380.15	0.105
136				
137				
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142				
143	4.018	0.4189	2817.105	0.105
144	0.535	0.0198	10259.6	0.105
145	0.78	0.0103	14047.8	0.105
146	1.262	0.0152	17448.8	0.105
147	0.805	0.0108	14155.3	0.105
148	0.639	0.009	12347	0.105
149	1.44	0.019	14901.1	0.105
150	1.281	0.018	14265.6	0.105
151	5.448	0.1867	13819.014	0.105
152	1.35	0.0164	17069.6	0.105
153	1.225	0.0146	17740	0.105
154	1.57	0.0186	17610	0.105
155	1.04	0.0134	15829.4	0.105
156	0.422	0.007	10926.9	0.105
157	1.116	0.0152	15025.5	0.105
158	1.562	0.0189	17415.7	0.105
159	1.485	0.0178	17469.9	0.105
160	1.287	0.0155	17500.2	0.105
161	0.996	0.0119	17548.8	0.105
162	1.053	0.0126	17576.2	0.105
163	1.034	0.0125	17342.7	0.105
164	1.394	0.0168	17275.5	0.105
165	1.5	0.0183	16882.6	0.105
166	1.692	0.0209	16997.3	0.105
167	1.608	0.0205	16491.1	0.105
168	1.527	0.0201	15807.1	0.105
169	1.405	0.0185	15640.2	0.105
170	0.362	0.006	10314.3	0.105
171	0.54	0.0083	10788.9	0.105
172	1.555	0.0213	14982.7	0.105

	K	L	M	N
173	1.815	0.0244	15225.1	0.105
174	1.232	0.0175	14118.7	0.105
175	1.388	0.0193	14589.2	0.105
176	0.863	0.0128	11963.6	0.105
177	0.328	0.0063	10195	0.105
178	0.915	0.0142	12488.5	0.105
179	1.751	0.0232	15327.8	0.105
180	1.917	0.0245	16411.2	0.105
181	1.535	0.0196	16405	0.105
182	1.133	0.0146	16130.6	0.105
183	0.959	0.0128	15047.6	0.105
184	0	0	239.532	0.105
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254	3.474	0.7338	1351.847	0.105
255	0.247	0.011	4547.907	0.105
256				
257	0.872	0.0179	9917.95	0.105
258	1.91	0.0375	10874.85	0.105

	K	L	M	N
259				
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264				
265				
266				
267				
268	2.201	0.1725	4989.635	0.105
269	3.297	0.0448	15107.3	0.105
270	4.605	0.0533	17049.8	0.105
271	5.657	0.063	18751.8	0.105
272	4.461	0.0565	15812	0.105
273	4.134	0.055	13803.9	0.105
274	3.997	0.0535	13416.4	0.105
275	4.891	0.0601	15094.3	0.105
276	3.847	0.0533	14169.9	0.105
277	5.162	0.0631	16237.6	0.105
278	8.35	0.0938	18640.2	0.105
279	8.089	0.0918	18474.2	0.105
280	7.434	0.082	18939.9	0.105
281	7.456	0.082	18994.4	0.105
282	6.5	0.082	16559.7	0.105
283	6.059	0.082	15437.4	0.105
284	5.925	0.082	15095.9	0.105
285	5.747	0.082	14641.9	0.105
286	6.499	0.0811	16775.8	0.105
287	7.245	0.081	18723.6	0.105
288	6.808	0.081	17594.8	0.105
289	7.146	0.081	18469.7	0.105
290	7.398	0.081	19120.8	0.105
291	7.382	0.0851	18238.5	0.105
292	7.32	0.09	17124.2	0.105
293	7.923	0.09	18534.5	0.105
294	8.214	0.09	19214.4	0.105
295	8.148	0.09	19060.2	0.105
296	8.172	0.09	19116	0.105
297	8.14	0.09	19041.9	0.105
298	8.136	0.09	19032	0.105
299	8.071	0.09	18880.9	0.105
300	8.074	0.09	18888	0.105
301	8.09	0.09	18925.6	0.105

	K	L	M	N
302	8.078	0.09	18896.8	0.105
303	7.443	0.09	17410.7	0.105
304	7.496	0.088	17947.8	0.105
305	8.238	0.086	20097.5	0.105
306	8.228	0.086	20071.6	0.105
307	8.154	0.086	19892.8	0.105
308	8.099	0.086	19758.4	0.105
309	8.164	0.0872	19638.1	0.105
310	9.278	0.1	19380.1	0.105
311	8.907	0.1	18606.6	0.105
312	9.606	0.1	20064.6	0.105
313	9.602	0.1	20058	0.105
314	9.469	0.1	19780.3	0.105
315	9.35	0.1	19531.4	0.105
316	9.45	0.1	19738.9	0.105
317	9.5	0.1	19844.3	0.105
318	9.438	0.1	19714.4	0.105
319	5.892	0.0633	19103.2	0.105
320	3.143	0.0359	18330.1	0.105
321	2.931	0.0326	18844	0.105
322	3.162	0.0353	18782.7	0.105
323	3.089	0.035	18504.7	0.105
324	3.195	0.0376	17687.1	0.105
325	1.685	0.0239	13583.3	0.105
326	3.531	0.0401	18412.1	0.105
327	3.235	0.0362	18796.1	0.105
328	1.557	0.0319	8968.577	0.105
329				
330				
331	3.635	0.1052	8417.782	0.105
332	3.969	0.0443	18784	0.105
333	3.773	0.0432	18244.4	0.105
334	2.831	0.033	17782.6	0.105
335	2.382	0.0272	18386.2	0.105
336	2.699	0.0306	18524.3	0.105
337	2.537	0.0288	18489.6	0.105
338	2.937	0.033	18612.7	0.105
339	2.988	0.0336	18637.8	0.105
340	2.852	0.033	18090.6	0.105
341	3.327	0.0374	18633.7	0.105
342	3.258	0.037	18473.7	0.105
343	3.405	0.038	18826.4	0.105
344	2.888	0.0329	18357.8	0.105

	K	L	M	N
345	2.848	0.0327	18192.9	0.105
346	2.441	0.0288	17668.9	0.105
347	2.898	0.033	18324.1	0.105
348	2.871	0.0328	18172.7	0.105
349	2.417	0.029	16409.3	0.105
350	0	0	1.26	0.106
351				
352	2.025	0.1585	3606.444	0.105
353				
354				
355				
356	1.207	0.0244	9749.02	0.105
357	3.03	0.034	18723.9	0.105
358	2.805	0.0315	18673.1	0.105
359	2.896	0.0326	18604.5	0.105
360	3.221	0.0366	18417.3	0.105
361	3.123	0.0359	18176.4	0.105
362	3.207	0.0366	18376.1	0.105
363	3.312	0.038	18351.9	0.105
364	3.618	0.0415	18276.7	0.105
365	3.449	0.039	18555.7	0.105
366	3.614	0.041	18514.2	0.105
367	3.235	0.0367	18474.5	0.105
368	3.879	0.044	18495.6	0.105
369	3.813	0.0431	18508	0.105
370	3.183	0.0365	18292.7	0.105
371	2.531	0.0352	14718.08	0.105
372				
373	2.922	0.0876	10603.487	0.105
374	1.756	0.0235	14550.2	0.105
375	3.113	0.0355	18420.6	0.105
376	3.161	0.0359	18453.7	0.105
377	3.135	0.0358	18360.7	0.105
378	3.422	0.0391	18346.1	0.105
379	3.015	0.0343	18430.5	0.105
380	2.841	0.0349	17071.2	0.105
381	2.918	0.0373	16366.9	0.105
382	3.57	0.0406	18383.3	0.105
383	3.281	0.0371	18509.6	0.105
384	3.043	0.0348	18374.2	0.105
385	2.323	0.0267	18150	0.105
386	2.354	0.0269	18306.9	0.105
387	2.702	0.0308	18338.1	0.105

	K	L	M	N
388	2.436	0.0278	18393.8	0.105
389	2.522	0.0288	18390.4	0.105
390	2.202	0.0261	17646.2	0.105
391	2.616	0.0305	17929.7	0.105
392	3.26	0.0375	18283.8	0.105
393	2.464	0.0286	18014.7	0.105
394	2.094	0.0236	18549.5	0.105
395	1.657	0.0188	18440.1	0.105
396	1.167	0.0133	18344.2	0.105
397	1.572	0.0177	18524.7	0.105
398	2.155	0.0243	18619.8	0.105
399	1.242	0.0142	18324	0.105
400	1.417	0.0159	18550.1	0.105
401	1.346	0.0151	18518.7	0.105
402	1.426	0.0163	18353.2	0.105
403	1.338	0.0151	18483.2	0.105
404	1.384	0.0164	17468.7	0.105
405	1.251	0.0163	14614.8	0.105
406	1.533	0.0185	16218	0.105
407	1.701	0.0198	17967.5	0.105
408	1.965	0.0226	18240.1	0.105
409	1.295	0.0177	14036.7	0.105
410	2.704	0.0317	17826.2	0.105
411	2.747	0.032	17931.8	0.105
412	2.731	0.0312	18362.2	0.105
413	2.405	0.0284	17029.4	0.105
414	0.003	0.0205	124.71	0.105
415				
416				
417				
418	3.282	0.315	3484.62	0.105
419	1.311	0.0525	5127.984	0.105
420				
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447	0.205	0.0217	2245.644	0.105
448	1.749	0.0329	11424.7	0.105
449	0.58	0.0115	10274.2	0.105
450	1.38	0.0193	12899.4	0.105
451	1.311	0.0206	11926.5	0.105
452	4.206	0.0487	18105.3	0.105
453	3.654	0.0418	18380.9	0.105
454	4.135	0.0495	17618.5	0.105
455	2.753	0.0316	18301.8	0.105
456	3.276	0.0381	17990.2	0.105
457	3.523	0.0541	13588.012	0.1058
458				
459				
460				
461				
462	4.142	0.2339	5136.418	0.105
463				
464	0.005	0.003	393.238	0.105
465	1.028	0.0198	10532.2	0.105
466	2.395	0.029	17010.4	0.105
467	3.558	0.0416	17805.9	0.105
468	2.152	0.0291	14639.9	0.105
469	3.39	0.039	18236.4	0.105
470	3.699	0.0436	17663.6	0.105
471	4.767	0.055	18209.9	0.105
472	4.709	0.0539	18317.4	0.105
473	4.702	0.0551	17174.4	0.105

	K	L	M	N
474	2.202	0.0318	11932.9	0.105
475	6.224	0.0712	18334.3	0.105
476	3.864	0.0502	14652.7	0.105
477	4.282	0.056	14246	0.105
478	0.01	0.089	23.832	0.105
479	1.577	0.691	652.066	0.105
480	2.919	0.0433	14502.2	0.105
481	2.521	0.0306	17295.3	0.105
482	3.871	0.045	18040.7	0.105
483	7.124	0.0824	18149.7	0.105
484	4.851	0.0573	17757.7	0.105
485	4.599	0.0534	18028.5	0.105
486	2.627	0.032	16771.9	0.105
487	2.12	0.0272	14977.3	0.105
488	2.092	0.0255	16940.1	0.105
489	2.69	0.0308	18339.2	0.105
490	4.158	0.0465	18715.9	0.105
491	5.321	0.0594	18779.9	0.105
492	4.669	0.0583	16400.9	0.105
493	5.175	0.062	16676.3	0.105
494	4.666	0.0568	16088.8	0.105
495	5.337	0.0621	17994.5	0.105
496	4.264	0.0524	16943	0.105
497	3.885	0.05	15479.8	0.105
498	6.843	0.0776	18468.4	0.105
499	7.248	0.0839	18035.4	0.105
500	5.33	0.0666	15183.8	0.105
501	3.795	0.0511	14500.8	0.105
502	2.308	0.037	11924.5	0.105
503	4.34	0.066	13594.4	0.105
504	2.246	0.035	12217.9	0.105
505	3.066	0.0389	15610.6	0.105
506	1.806	0.0294	11734.1	0.105
507	2.467	0.0393	11469.2	0.105
508	4.347	0.0522	17351.9	0.105
509	3.726	0.0513	14816.24	0.105
510				
511	4.343	0.1634	8322.818	0.1054
512	2.311	0.0287	16935.8	0.105
513	2.208	0.0259	17775.9	0.105
514	6.283	0.1524	15953.658	0.1053
515	9.602	0.1954	12557.6	0.105
516	2.414	0.0311	16385.3	0.105

	K	L	M	N
517	1.937	0.022	18467.3	0.105
518	1.688	0.0218	16262.7	0.105
519	3.758	0.043	18306.5	0.105
520	5.559	0.0633	18320.4	0.105
521	3.417	0.0412	17024.4	0.105
522	4.15	0.0517	16327.4	0.105
523	3.308	0.0436	14393.9	0.105
524	3.778	0.0463	15917.1	0.105
525	4.112	0.0494	16650.1	0.105
526	3.131	0.0385	15585.2	0.105
527	1.72	0.0255	12972.7	0.105
528	1.595	0.0227	13323	0.105
529	2.755	0.0324	17281.4	0.105
530	1.851	0.0234	15141.5	0.105
531	1.83	0.0239	14489.8	0.105
532	3.146	0.0371	17780.7	0.105
533	4.197	0.0476	18496.2	0.105
534	3.53	0.0443	15818.2	0.105
535	2.341	0.0347	12851.3	0.105
536	4.564	0.0512	18700.7	0.105
537	5.115	0.0584	18364.6	0.105
538	3.394	0.0439	15872.5	0.105
539	3.767	0.0456	17151.2	0.105
540	3.252	0.0381	16077.327	0.105
541				
542	1.151	0.0236	9736.23	0.105
543	2.401	0.0284	17308.7	0.105
544	3.807	0.0448	17877.7	0.105
545	3.368	0.044	15692.2	0.105
546	3.199	0.0385	17247.8	0.105
547	1.996	0.0248	16890.8	0.105
548	1.243	0.0177	13646.3	0.105
549	6.225	0.225	10178.606	0.105
550	0.841	0.014	12198.8	0.105
551	2.017	0.0268	15768.4	0.105
552	1.726	0.0238	15056.5	0.105
553	1.098	0.0176	12982.9	0.105
554	0.887	0.0151	11936.6	0.105
555	0.905	0.0157	11869.3	0.105
556	1.054	0.0179	12301.8	0.105
557	1.319	0.0203	13529.9	0.105
558	2.649	0.033	16736.5	0.105
559	2.775	0.0317	18328	0.105

	K	L	M	N
560	2.416	0.0288	17587	0.105
561	1.918	0.0223	17994	0.105
562	1.634	0.0209	16455.3	0.105
563	1.155	0.0154	15520.2	0.105
564	1.542	0.0182	17612.5	0.105
565	2.161	0.0256	17632.2	0.105
566	2.153	0.0251	17975.8	0.105
567	1.815	0.0212	17959.9	0.105
568	1.972	0.0226	18306.1	0.105
569	1.878	0.0221	17702.2	0.105
570	0.027	0.0797	641	0.105
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646	2.009	0.2272	2508	0.105
647	5.947	0.1183	10336.1	0.105
648	0.969	0.0154	11849.4	0.105
649	1.213	0.0163	14666.4	0.105
650	1.11	0.0149	13155.9	0.105
651	1.457	0.0178	14331.2	0.105
652	1.229	0.0165	12515.4	0.105
653	0.851	0.0125	11828.7	0.105
654	0.603	0.0108	9936.1	0.105
655	3.824	0.0451	15338.6	0.105
656	5.629	0.0633	18614	0.105
657	5.626	0.0643	18213.6	0.105
658	5.099	0.0591	17981.9	0.105
659	3.893	0.0474	16360.6	0.105
660	4.395	0.0509	18008.3	0.105
661	6.098	0.0675	18868.2	0.105
662	6.568	0.0715	19252.8	0.105
663	6.142	0.0674	19127.1	0.105
664	6.738	0.0745	18962	0.105
665	5.829	0.0645	18908.9	0.105
666	6.572	0.0742	18599.7	0.105
667	6.598	0.0761	18000.7	0.105
668	6.12	0.07	18299.6	0.105
669	4.874	0.0555	18392.7	0.105
670	5.12	0.0595	17957.4	0.105
671	5.629	0.0644	18266.7	0.105
672	5.307	0.0607	18394.8	0.105
673	7.044	0.0783	18828.7	0.105
674	6.148	0.068	18947.6	0.105
675	5.112	0.0572	18720.8	0.105
676	4.606	0.0554	17408	0.105
677	6.364	0.0712	18684.9	0.105
678	5.359	0.0601	18690.9	0.105
679	4.894	0.056	18298.2	0.105
680	4.922	0.0573	17930.1	0.105
681	4.893	0.0575	17784.7	0.105
682	6.237	0.0715	18206.4	0.105
683	7.801	0.0876	18647.1	0.105
684	7.216	0.0815	18539.1	0.105
685	5.948	0.0751	16503.4	0.105
686	2.985	0.0485	12023.9	0.105
687				
688	10.777	1.344	1682.725	0.105

	K	L	M	N
689	74.956	0.9133	17583.4	0.105
690	35.292	0.3804	18058.1	0.105
691	4.835	0.0542	18689.2	0.105
692	6.841	0.0765	18762.6	0.105
693	6.835	0.0767	18690.2	0.105
694	9.525	0.1802	15372.658	0.105
695	2.393	0.3295	3025.33	0.105
696	5.436	0.1555	9622.97	0.105
697	6.494	0.0793	16828.4	0.105
698	9.329	0.1052	18619.7	0.105
699	9.237	0.1038	18686.4	0.105
700	7.351	0.0828	18638.4	0.105
701	6.525	0.0732	18729.1	0.105
702	7.357	0.0827	18656.5	0.105
703	6.654	0.0749	18635.1	0.105
704	8.121	0.0919	18542.5	0.105
705	5.816	0.0661	18431.9	0.105
706	6.011	0.0701	17722.5	0.105
707	6.17	0.0698	18570.3	0.105
708	4.232	0.0476	18623	0.105
709	5.805	0.065	18711.2	0.105
710	7.102	0.0792	18843.6	0.105
711	8.434	0.0946	18673.7	0.105
712	8.491	0.0965	18391.1	0.105
713	6.846	0.0785	18057.7	0.105
714	6.3	0.0738	17709.5	0.105
715	5.887	0.0676	18243.8	0.105
716	7.001	0.0784	18701.6	0.105
717	7.333	0.0813	18947.3	0.105
718	6.431	0.0716	18838.2	0.105
719	6.018	0.0668	18871.7	0.105
720	5.814	0.064	19058.2	0.105
721	5.729	0.0655	18302.2	0.105
722	6.927	0.0755	19233.1	0.105
723	7.424	0.0804	19388.2	0.105
724	7.081	0.0761	19524.6	0.105
725	6.476	0.0695	19578.1	0.105
726	6.434	0.0689	19589.3	0.105
727	5.653	0.061	19389.5	0.105
728	3.817	0.0443	17973.2	0.105
729	4.087	0.0448	19095	0.105
730	7.075	0.0792	18761.8	0.105
731	8.276	0.0925	18754.1	0.105

	K	L	M	N
732	8.516	0.094	19003.5	0.105
733	6.039	0.0664	19050	0.105
734	6.864	0.0756	19030.7	0.105
735	5.344	0.0583	19192.7	0.105
736	4.86	0.0535	19003.4	0.105
737	5.575	0.0615	19045.5	0.105
738	5.696	0.0628	19075.2	0.105
739	5.142	0.0575	18729.7	0.105
740	4.87	0.0552	18510.6	0.105
741	5.124	0.0569	18884	0.105
742	5.705	0.0636	18838.6	0.105
743	5.776	0.0643	18855.5	0.105
744	6.608	0.0735	18858.1	0.105
745	6.089	0.0678	18824.5	0.105
746	5.664	0.0632	18845.5	0.105
747	4.951	0.055	18848.3	0.105
748	4.839	0.0537	18919.3	0.105
749	5	0.0566	18518.1	0.105
750	4.852	0.0554	18291.9	0.105
751	4.871	0.0544	18764.7	0.105
752	4.333	0.0485	18728.5	0.105
753	5.217	0.0594	18448.7	0.105
754	5.85	0.067	18253	0.105
755	5.424	0.0627	18101.6	0.105
756	5.681	0.0637	18690.6	0.105
757	6.576	0.0731	18863.7	0.105
758	6.225	0.0687	19033.6	0.105
759	5.369	0.0657	16902.6	0.105
760	5.249	0.0594	18461.5	0.105
761	4.924	0.0544	18945.9	0.105
762	4.931	0.0552	18762.3	0.105
763	4.845	0.0536	18946.3	0.105
764	4.825	0.0562	17931.3	0.105
765	4.202	0.0503	17453.2	0.105
766	4.66	0.0538	18169.1	0.105
767	4.811	0.0553	18202.1	0.105
768	5.419	0.0608	18697.6	0.105
769	5.109	0.0581	18378.3	0.105
770	5.688	0.0633	18840.9	0.105
771	5.196	0.123	14064.735	0.105
772				
773				
774				

	K	L	M	N
775				
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778				
779	4.264	0.392	2792.4	0.105
780	1.691	0.0326	11874.6	0.105
781	0.99	0.0112	18637.5	0.105
782	1.741	0.02	18301.2	0.105
783	2.69	0.0306	18413	0.105
784	2.511	0.0281	18730.7	0.105
785	2.261	0.026	16574.44	0.105
786				
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791				
792	0.972	0.0252	8138.315	0.105
793	2.241	0.0273	17237.8	0.105
794	3.351	0.0381	18315.4	0.105
795	3.781	0.0418	18927.6	0.105
796	4.301	0.0475	18976.3	0.105
797	2.872	0.0538	11140.608	0.105
798				
799				
800				
801	36.606	1.1692	6628.4	0.105
802	2.72	0.0321	17447.4	0.105
803	3.436	0.0381	18938.4	0.105
804	3.113	0.0346	18949.8	0.105
805	3.311	0.0367	18918.7	0.105
806	2.82	0.0313	18863.8	0.105
807	2.524	0.0284	18742.4	0.105
808	1.813	0.0208	18182.5	0.105
809	2.328	0.0295	16926.2	0.105
810	2.722	0.0341	17762.5	0.105
811	2.899	0.0332	18309.9	0.105
812	3.041	0.0343	18668.5	0.105
813	4.085	0.046	18609.1	0.105
814	3.89	0.0446	18267.4	0.105
815	3.602	0.0423	17867.6	0.105
816	2.589	0.0308	17622.2	0.105
817	1.797	0.022	17011.4	0.105

	K	L	M	N
818	0.009	0.003	390.43	0.105
819				
820				
821	3.276	0.2693	5927.64	0.105
822	2.27	0.0268	17725.6	0.105
823	3.565	0.0423	17694.4	0.105
824	3.396	0.0402	17757.1	0.105
825	2.938	0.0346	17795.3	0.105
826	2.553	0.03	17829.7	0.105
827	3.104	0.0364	17829	0.105
828	2.238	0.0281	15606.976	0.105
829				
830	1.673	0.2736	1883.021	0.105
831	5.821	0.0896	16045.5	0.105
832	3.35	0.0398	17720.4	0.105
833	3.65	0.0431	17722.3	0.105
834	3.253	0.0383	17797.4	0.105
835	3.056	0.037	17361.7	0.105
836	2.858	0.0342	17514.9	0.105
837	2.681	0.0319	17627.5	0.105
838	3.851	0.0456	17729.4	0.105
839	3.607	0.0435	17393.7	0.105
840	3.329	0.0404	17321.9	0.105
841	3.676	0.0435	17765.2	0.105
842	3.517	0.0415	17750.1	0.105
843	3.19	0.038	17609.2	0.105
844	3.298	0.0394	17523.9	0.105
845	2.878	0.0341	17696	0.105
846	2.534	0.0298	17820.7	0.105
847	2.35	0.0277	17848.4	0.105
848	2.459	0.0289	17926	0.105
849	2.44	0.0286	17907.7	0.105
850	2.248	0.0266	17771.7	0.105
851	2.215	0.0264	17640.6	0.105
852	2.133	0.0253	17714	0.105
853	2.221	0.026	17913.2	0.105
854	2.249	0.0262	18024.9	0.105
855	2.238	0.0263	17865	0.105
856	2.374	0.0279	17816.4	0.105
857	2.184	0.0262	17474.1	0.105
858	1.922	0.0232	17140.7	0.105
859	2.298	0.0274	17616.8	0.105
860	3.903	0.0469	17418.6	0.105

	K	L	M	N
861	4.093	0.0483	17823.2	0.105
862	4.383	0.0515	17893.7	0.105
863	4.726	0.0556	17815.7	0.105
864	4.536	0.0531	17926.7	0.105
865	4.611	0.0535	18064.4	0.105
866	4.555	0.053	18019.5	0.105
867	4.62	0.0542	17873.7	0.105
868	4.344	0.051	17895	0.105
869	4.27	0.0506	17704.7	0.105
870	4.072	0.0484	17605.8	0.105
871	3.1	0.0386	16029.3	0.105
872	3.613	0.0428	17704.9	0.105
873	3.554	0.0415	17949.1	0.105
874	3.461	0.0402	18055	0.105
875	4.198	0.0495	17782.1	0.105
876	5.541	0.0643	18079.7	0.105
877	4.843	0.0561	18100.2	0.105
878	5.966	0.0693	18050.1	0.105
879	5.038	0.0588	17993.9	0.105
880	3.543	0.0418	17878.5	0.105
881	3.864	0.0446	18196.2	0.105
882	4.429	0.051	18200.4	0.105
883	4.523	0.0519	18256.5	0.105
884	6.177	0.0712	18210.3	0.105
885	6.149	0.071	18181.7	0.105
886	4.73	0.0549	18097.6	0.105
887	4.603	0.053	18222.4	0.105
888	3.524	0.0405	18249.2	0.105
889	3.254	0.0374	18271.9	0.105
890	3.596	0.0411	18384.3	0.105
891	3.844	0.0438	18353.4	0.105
892	4.107	0.0471	18304	0.105
893	5.135	0.0597	18061.5	0.105
894	5.28	0.0607	18239.8	0.105
895	6.352	0.0728	18310	0.105
896	5.79	0.0677	17923.4	0.105
897	4.552	0.0533	17871.4	0.105
898	4.307	0.0498	18089.8	0.105
899	4.235	0.0487	18278.8	0.105
900	4.125	0.0476	18159.5	0.105
901	4.373	0.0503	18265.5	0.105
902	5.127	0.0598	17947.6	0.105
903	4.269	0.0787	15137.14	0.105

	K	L	M	N
904				
905	2.476	0.4008	2886.44	0.105
906	0.074	0.0285	1871.102	0.105
907	1.531	0.1731	11761.1	0.105
908	3.677	0.0418	18509.3	0.105
909	3.557	0.0405	18390.7	0.105
910	4.497	0.0515	18322.1	0.105
911	4.014	0.0458	18406.9	0.105
912	3.353	0.0393	17744.3	0.105
913	3.44	0.0398	18079.7	0.105
914	3.933	0.0448	18432	0.105
915	3.493	0.0397	18468.6	0.105
916	3.503	0.04	18372.6	0.105
917	4.402	0.0492	18741.3	0.105
918	3.935	0.0444	18548.2	0.105
919	3.589	0.0411	18239.4	0.105
920	3.565	0.041	18258.9	0.105
921	8.911	0.1013	18397.3	0.105
922	5.088	0.0583	18287.7	0.105
923	5.965	0.0678	18429.6	0.105
924	4.311	0.0503	17975.1	0.105
925	3.49	0.041	17846.5	0.105
926	3.497	0.0408	17929.3	0.105
927	3.828	0.046	17280.4	0.105
928	4.848	0.0569	17881.8	0.105
929	4.414	0.0515	17931.9	0.105
930	4.736	0.0553	18003.8	0.105
931	4.904	0.0569	18055.6	0.105
932	5.447	0.0642	17667	0.105
933	4.93	0.0582	17690	0.105
934	4.911	0.0583	17686.7	0.105
935	4.84	0.0584	17292.5	0.105
936	3.388	0.0405	17595.2	0.105
937	2.989	0.035	17868.9	0.105
938	2.686	0.0318	17751.2	0.105
939	2.45	0.0294	17485	0.105
940	5.532	0.0853	14550.2	0.105
941	0.203	0.0051	8137.4	0.105
942	0.37	0.0083	9019.1	0.105
943	0.286	0.007	8359	0.105
944	0.742	0.0149	8580.034	0.105
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982	3.902	0.3878	3049.63	0.105
983	0.065	0.0015	8739.6	0.105
984	0.143	0.0029	9793	0.105
985	0.259	0.006	9003.5	0.105
986	0.332	0.0078	8806.6	0.105
987	0.561	0.0112	10436.8	0.105
988	0.532	0.0104	10536.1	0.105
989	0.392	0.0088	9259.2	0.105

	K	L	M	N
990	0.605	0.0142	8915.6	0.105
991	0.731	0.0175	8762.1	0.105
992	0.778	0.0173	9402.3	0.105
993	0.904	0.0178	10569.3	0.105
994	0.844	0.0171	10338.4	0.105
995	0.804	0.0162	10360.8	0.105
996	0.918	0.0194	9815.5	0.105
997	0.708	0.0152	9621.4	0.105
998	0.647	0.014	9647.6	0.105
999	0.693	0.0144	10006.8	0.105
1000	0.698	0.0142	10214.5	0.105
1001	0.663	0.0137	10155.8	0.105
1002	0.859	0.1063	8670.694	0.105
1003				
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1008				
1009	17.667	1.902	1948.05	0.105
1010	20.149	0.574	10755.6	0.105
1011	1.754	0.0231	13957.1	0.105
1012	1.05	0.017	12015.9	0.105
1013	2.336	0.0306	15616.9	0.105
1014	2.943	0.0351	17088.6	0.105
1015	2.136	0.0267	15640.4	0.105
1016	2.896	0.0333	18220.2	0.105
1017	3.425	0.0395	18239.1	0.105
1018	3.09	0.0355	18218.2	0.105
1019	3.124	0.0358	18314.8	0.105
1020	3.004	0.0344	18282.4	0.105
1021	2.974	0.0346	17987.4	0.105
1022	3.183	0.0365	18291.4	0.105
1023	3.559	0.0409	18237	0.105
1024	3.552	0.0414	18005.9	0.105
1025	3.731	0.0439	17816.3	0.105
1026	4.096	0.0474	18131.8	0.105
1027	3.869	0.0454	17833.9	0.105
1028	3.605	0.0437	17306.2	0.105
1029	3.59	0.0428	17548.9	0.105
1030	3.808	0.0465	16969.8	0.105
1031	3.782	0.0451	17543.4	0.105
1032	3.325	0.0401	17338.9	0.105

	K	L	M	N
1033	3.665	0.0435	17666.9	0.105
1034	4.086	0.0484	17682.1	0.105
1035	4.319	0.0515	17577.3	0.105
1036	4.529	0.0538	17652.1	0.105
1037	4.374	0.0518	17672.7	0.105
1038	3.897	0.0463	17627.4	0.105
1039	4.389	0.052	17720.7	0.105
1040	4.518	0.0534	17774.9	0.105
1041	4.146	0.0505	17050.7	0.105
1042	5.473	0.0639	17984.7	0.105
1043	5.231	0.0613	17917.4	0.105
1044	4.539	0.053	17906.8	0.105
1045	4.07	0.0474	17973.1	0.105
1046	4.002	0.047	17789.4	0.105
1047	4.16	0.0492	17757.1	0.105
1048	4.515	0.0535	17695.9	0.105
1049	4.481	0.0528	17819.3	0.105
1050	4.215	0.0496	17797	0.105
1051	2.706	0.0361	14761.3	0.105
1052	3.831	0.0476	16705.3	0.105
1053	3.992	0.0486	16971.1	0.105
1054	3.583	0.045	15960.8	0.105
1055	3.527	0.0442	15589.9	0.105
1056	4.249	0.0518	16529.8	0.105
1057	4.426	0.0521	17806.7	0.105
1058	4.382	0.052	17730.2	0.105
1059	4.469	0.0528	17753.4	0.105
1060	4.748	0.0561	17735.6	0.105
1061	6.017	0.071	17778.4	0.105
1062	5.608	0.0673	17292.4	0.105
1063	5.198	0.0668	15964.5	0.105
1064	6.075	0.0719	17701.7	0.105
1065	4.214	0.0561	15371.3	0.105
1066	2.381	0.0368	12343.6	0.105
1067	1.076	0.022	9394.8	0.105
1068	0.616	0.0154	8338.4	0.105
1069	3.252	0.0447	14900.4	0.105
1070	4.567	0.0541	17691.8	0.105
1071	3.93	0.0476	17322.7	0.105
1072	3.94	0.0467	17651.4	0.105
1073	4.114	0.05	16969	0.105
1074	4.256	0.051	17515.2	0.105
1075	3.956	0.0479	17097.8	0.105

	K	L	M	N
1076	3.633	0.0441	16974.3	0.105
1077	4.007	0.0468	17991.9	0.105
1078	3.809	0.0447	17857.9	0.105
1079	3.584	0.0421	17843.7	0.105
1080	3.592	0.042	17929	0.105
1081	6.441	0.0769	17545.7	0.105
1082	7.891	0.0936	17662.7	0.105
1083	6.925	0.0823	17650.8	0.105
1084	5.747	0.0679	17763.2	0.105
1085	1.712	0.0409	8036.49	0.105
1086				
1087				
1088	5.636	1.4335	1257.83	0.105
1089	2.233	0.0452	12223.3	0.105
1090	3.861	0.0448	18039.3	0.105
1091	4.071	0.0487	17433.4	0.105
1092	3.898	0.0481	16827.3	0.105
1093	4.075	0.05	17061.3	0.105
1094	4.47	0.0519	18062.2	0.105
1095	4.59	0.0547	17591.9	0.105
1096	4.057	0.0481	17647.3	0.105
1097	4.172	0.0487	17992.6	0.105
1098	4.588	0.0531	18114.4	0.105
1099	5.148	0.0599	18000.5	0.105
1100	5.163	0.0597	18170.7	0.105
1101	6.441	0.0743	18192.2	0.105
1102	5.796	0.0668	18201.2	0.105
1103	5.546	0.064	18130.6	0.105
1104	6.127	0.0706	18217.7	0.105
1105	5.542	0.064	18156.9	0.105
1106	4.445	0.0512	18225.7	0.105
1107	5.345	0.0617	18169.2	0.105
1108	4.374	0.0505	18148.9	0.105
1109	4.529	0.0541	17575.8	0.105
1110	4.83	0.0555	18242.9	0.105
1111	5.096	0.0585	18300.6	0.105
1112	4.957	0.057	18251.2	0.105
1113	5.136	0.0589	18313.2	0.105
1114	4.666	0.0536	18291.7	0.105
1115	4.249	0.049	18161.4	0.105
1116	3.696	0.0443	17491.5	0.105
1117	2.472	0.034	14853.3	0.105
1118	3.989	0.0474	17488.2	0.105

	K	L	M	N
1119	3.95	0.0452	18308.6	0.105
1120	4.056	0.0464	18356.5	0.105
1121	3.996	0.0458	18267.9	0.105
1122	4.301	0.0493	18297.2	0.105
1123	3.918	0.0446	18378.3	0.105
1124	3.668	0.0433	17296.7	0.105
1125	4.136	0.0472	18350.4	0.105
1126	4.835	0.0554	18294.1	0.105
1127	4.286	0.0497	18077.7	0.105
1128	4.009	0.0469	17939.9	0.105
1129	3.546	0.043	17148.9	0.105
1130	3.041	0.0381	16011.9	0.105
1131	4.111	0.0483	17657.1	0.105
1132	3.654	0.0453	16138.7	0.105
1133	4.886	0.0574	17797.1	0.105
1134	5.384	0.0614	18393.3	0.105
1135	4.173	0.0515	16663.6	0.105
1136	0.702	0.0149	8756.69	0.105
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1140	4.472	0.2248	10835.541	0.105
1141	2.913	0.0335	18235.3	0.105
1142	2.601	0.0304	17932.8	0.105
1143	3.192	0.0369	18151.2	0.105
1144	3.562	0.0433	17159.8	0.105
1145	4.195	0.0482	18262	0.105
1146	3.123	0.0398	16024.2	0.105
1147	2.185	0.032	14069.5	0.105
1148	0.265	0.0211	2513.322	0.105
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1155	2.681	2.596	216.568	0.105
1156	3.038	0.1019	8264.1	0.105
1157	2.541	0.0304	17533.1	0.105
1158	4.235	0.0502	17735.9	0.105
1159	4.528	0.0528	17936.5	0.105
1160	13.466	0.1608	17564.2	0.105
1161	4.713	0.0567	17458.3	0.105

	K	L	M	N
1162	3.868	0.0468	17320.6	0.105
1163	5.026	0.0599	17595.6	0.105
1164	3.091	0.0441	12526	0.105
1165	4.849	0.0596	17002.3	0.105
1166	5.188	0.0615	17690.9	0.105
1167	4.422	0.0521	17810.7	0.105
1168	3.258	0.0386	17734.7	0.105
1169	3.748	0.0442	17755.6	0.105
1170	4.919	0.0586	17637.9	0.105
1171	5.186	0.0613	17759.8	0.105
1172	4.388	0.0517	17820.1	0.105
1173	4.505	0.053	17815.3	0.105
1174	4.371	0.0522	17540.8	0.105
1175	5.133	0.0604	17832.5	0.105
1176	4.594	0.0541	17799	0.105
1177	4.649	0.0553	17494.6	0.105
1178	3.736	0.0458	16228.2	0.105
1179	5.683	0.0674	17687.9	0.105
1180	4.113	0.0521	15587.8	0.105
1181	2.793	0.0412	13736.6	0.105
1182	1.692	0.0418	7853.83	0.105
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1196	2.417	2.315	219.04	0.105
1197	3.516	0.092	7306.402	0.105
1198	2.674	0.0333	16839.8	0.105
1199	2.982	0.0358	17358.9	0.105
1200	3.962	0.0457	18188.4	0.105
1201	3.642	0.0423	18065.2	0.105
1202	4.081	0.0473	18168.5	0.105
1203	3.357	0.0394	17895.8	0.105
1204	3.707	0.0434	17960.5	0.105

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1205	3.591	0.0417	18053	0.105
1206	3.451	0.0394	18329.1	0.105
1207	3.398	0.0398	17909.9	0.105
1208	3.597	0.041	18403.5	0.105
1209	3.462	0.0388	18678	0.105
1210	3.473	0.0384	19001.2	0.105
1211	3.619	0.04	18983	0.105
1212	3.597	0.0397	19027.9	0.105
1213	3.923	0.0437	18788.1	0.105
1214	2.471	0.0301	16753.3	0.105
1215	1.975	0.0254	15002.2	0.105
1216	2.511	0.0308	16301.1	0.105
1217	3.178	0.038	17481.3	0.105
1218	2.762	0.0334	16730.8	0.105
1219	2.996	0.035	17899.6	0.105
1220	1.969	0.0253	15609.7	0.105
1221	3.832	0.0447	17990.3	0.105
1222	3.596	0.0415	18091	0.105
1223	3.762	0.0435	18150.1	0.105
1224	3.936	0.0455	18114.7	0.105
1225	3.457	0.0411	17540	0.105
1226	3.933	0.0457	17984.1	0.105
1227	4	0.0462	18183.4	0.105
1228	3.836	0.0442	18225.4	0.105
1229	3.63	0.0431	17011.5	0.105
1230	4.404	0.0503	18410.8	0.105
1231	4.328	0.0498	18291.7	0.105
1232	4.503	0.0515	18319.3	0.105
1233	1.878	0.0405	9534.798	0.105
1234				
1235				
1236	36.526	1.1715	6886.013	0.105
1237	1.713	0.0197	18175.2	0.105
1238	2.752	0.0322	18008.5	0.105
1239	2.574	0.0311	17030.5	0.105
1240	3.097	0.0359	18085.9	0.105
1241	0.359	0.0083	8747.8	0.105
1242	0.404	0.0098	8610.7	0.105
1243	0.973	0.0181	10239	0.105
1244	0.563	0.022	4028.15	0.105
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1248	62.245	1.353	9650.264	0.105
1249	75.827	0.9539	16844	0.105
1250	32.98	0.3602	18710.3	0.105
1251	4.409	0.0504	18340.7	0.105
1252	3.608	0.0413	18340.3	0.105
1253	3.878	0.0443	18301.7	0.105
1254	3.931	0.0453	18237.8	0.105
1255	2.687	0.0327	16656.8	0.105
1256	1.196	0.0202	11815.7	0.105
1257	2.757	0.0352	16122.6	0.105
1258	0.755	0.0138	10422	0.105
1259	3.195	0.0404	16058.3	0.105
1260	3.631	0.0437	15963.6	0.105
1261	2.406	0.0312	14651.5	0.105
1262	1.189	0.0198	12066	0.105
1263	0.828	0.0155	11076.2	0.105
1264	1.224	0.0198	11751.5	0.105
1265	1.452	0.0563	10996.016	0.105
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1361	3.68	0.3765	2076.764	0.105
1362	0.943	0.0511	3793.486	0.105
1363	4.138	0.0987	7934.64	0.105
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1367				
1368	0.012	1.656	1.47	0.105
1369	3.185	0.1848	4305.3	0.105
1370	0.042	0.0013	5152.1	0.105
1371				
1372	0.352	0.0361	1945.665	0.105
1373	2.35	0.0708	3957.6	0.105
1374	0.021	0.0007	3376.4	0.105
1375	0.042	0.0016	3079.8	0.105
1376	0.113	0.0045	3286.9	0.105

	K	L	M	N
1377	1.791	0.0224	11379.8	0.105
1378	3.941	0.0448	18455.6	0.105
1379	4.28	0.0488	18404.4	0.105
1380	4.728	0.0539	18401.7	0.105
1381	4.214	0.0488	17900.5	0.105
1382	2.712	0.0373	13730.8	0.105
1383	2.318	0.0325	13266	0.105
1384	2.605	0.0329	14479.4	0.105
1385	5.226	0.0591	18552.7	0.105
1386	4.782	0.0544	18423.4	0.105
1387	3.832	0.0456	17422.4	0.105
1388	4.697	0.0528	18648.3	0.105
1389	4.247	0.0489	17857.7	0.105
1390	3.168	0.0385	16236.2	0.105
1391	3.923	0.0456	17796.3	0.105
1392	3.526	0.042	16709.1	0.105
1393	1.798	0.0274	12476.5	0.105
1394	3.056	0.0408	15266.2	0.105
1395	1.633	0.0266	12574.6	0.105
1396	0.73	0.0164	9446.1	0.105
1397	2.404	0.0349	13247.9	0.105
1398	2.496	0.0398	12457	0.105
1399	4.485	0.061	15131	0.105
1400	5.862	0.0758	16174.9	0.105
1401	6.146	0.0794	16090.5	0.105
1402	3.57	0.052	13116.8	0.105
1403	3.167	0.0424	14004.4	0.105
1404	4.152	0.0544	15724.4	0.105
1405	3.366	0.0475	13560.5	0.105
1406	4.921	0.0636	16134.5	0.105
1407	4.77	0.0619	15932	0.105
1408	6.08	0.0769	16558	0.105
1409	5.108	0.0674	15372.4	0.105
1410	2.62	0.0433	11015.1	0.105
1411	3.693	0.0574	12321.4	0.105
1412	1.145	0.0293	8201.9	0.105
1413	3.47	0.049	12826.4	0.105
1414	12.498	0.3052	11250.304	0.105
1415	4.788	0.0574	16128.8	0.105
1416	4.154	0.0486	17108.2	0.105
1417	1.691	0.0261	12280.4	0.105
1418	3.636	0.0436	15728.8	0.105
1419	2.968	0.041	13724.9	0.105

	K	L	M	N
1420	4.011	0.0519	14592.5	0.105
1421	3.932	0.0503	15746	0.105
1422	0.688	0.0147	9844.3	0.105
1423	0.845	0.0178	9987.7	0.105
1424	0.854	0.0173	10103.2	0.105
1425	2.963	0.0418	13531.4	0.105
1426	0.937	0.02	9872.6	0.105
1427	2.029	0.0353	11081.5	0.105
1428	4.868	0.0625	15225.1	0.105
1429	4.218	0.0541	15395.2	0.105
1430	4.243	0.0539	14539.8	0.105
1431	2.559	0.04	11800.5	0.105
1432	1.586	0.029	10912.2	0.105
1433	5.709	0.0673	16471.5	0.105
1434	5.694	0.0628	19015.4	0.105
1435	6.181	0.0669	19332.3	0.105
1436	6.577	0.0732	18807.9	0.105
1437	5.454	0.0619	18281.6	0.105
1438	5.286	0.0619	17398.3	0.105
1439	4.129	0.0508	15739.3	0.105
1440	3.037	0.0379	14981.5	0.105
1441	2.429	0.0316	13761.5	0.105
1442	0.725	0.0149	10117.5	0.105
1443	1.833	0.027	12264.2	0.105
1444	1.349	0.0217	11708	0.105
1445	0.775	0.0161	10118.7	0.105
1446	3.093	0.0388	14508.552	0.105
1447				
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1451				
1452	2.772	0.5816	831.465	0.105
1453	1.516	0.1045	2812.856	0.105
1454	0.873	0.011	15820.1	0.105
1455	1.49	0.017	17491.2	0.105
1456	2.27	0.0258	16952.1	0.105
1457	2.352	0.027	17309	0.105
1458	3.107	0.034	18761.3	0.105
1459	1.111	0.0166	12114.4	0.105
1460	4.242	0.0465	19140	0.105
1461	4.006	0.0441	18455	0.105
1462	3.657	0.0413	17926.7	0.105

	K	L	M	N
1463	3.742	0.0413	18895.1	0.105
1464	3.209	0.0365	17552.4	0.105
1465	3.284	0.0364	17425.5	0.105
1466	4.157	0.0448	19422.7	0.105
1467	4.048	0.0445	19013.9	0.105
1468	3.992	0.0453	18377.8	0.105
1469	4.498	0.0499	18715.7	0.105
1470	5.209	0.0565	19245.2	0.105
1471	4.542	0.0492	19369.9	0.105
1472	4.771	0.0515	19426.8	0.105
1473	4.778	0.0531	18617.7	0.105
1474	4.876	0.054	18479.1	0.105
1475	4.532	0.0525	17510.2	0.105
1476	3.423	0.0423	16396	0.105
1477	5.651	0.0697	17017.6	0.105
1478	5.07	0.0596	16718.6	0.105
1479	1.137	0.0213	10683.9	0.105
1480	1.106	0.0199	11071.2	0.105
1481	3.413	0.0411	15922.9	0.105
1482	0.932	0.0265	5855.64	0.105
1483				
1484	4.571	1.9225	562.06	0.105
1485	2.007	0.0278	15077.9	0.105
1486	3.119	0.0373	16651.3	0.105
1487	0.849	0.0163	10566.1	0.105
1488	3.704	0.0432	16452.6	0.105
1489	3.144	0.0376	16680.2	0.105
1490	3.911	0.0436	18837.3	0.105
1491	2.413	0.0303	15452.9	0.105
1492	1.044	0.0168	11734.8	0.105
1493	0.541	0.0117	9671.7	0.105
1494	0.546	0.0119	9666.2	0.105
1495	0.627	0.0124	10332.7	0.105
1496	1.945	0.0265	13109.2	0.105
1497	4.127	0.0466	18455.5	0.105
1498	3.266	0.0371	18346.1	0.105
1499	2.238	0.0275	15578.9	0.105
1500	0.913	0.0158	11341.3	0.105
1501	0.665	0.0137	10053.5	0.105
1502	1.049	0.019	10906.6	0.105
1503	1.082	0.0207	10710.7	0.105
1504	1.099	0.0196	11194.6	0.105
1505	1.638	0.023	13146.9	0.105

	K	L	M	N
1506	2.456	0.0315	15513.9	0.105
1507	1.597	0.0257	12219.7	0.105
1508	1.021	0.0203	10458.5	0.105
1509	1.925	0.027	13239.4	0.105
1510	3.992	0.046	17788.9	0.105
1511	2.531	0.0327	15125.5	0.105
1512	3.292	0.0368	18808.3	0.105
1513	2.903	0.0319	19161	0.105
1514	2.63	0.0299	18113	0.105
1515	4.154	0.0468	18155.7	0.105
1516	4.207	0.0459	19216	0.105
1517	4.57	0.0501	19154.3	0.105
1518	4.083	0.0464	17776.5	0.105
1519	3.985	0.0448	18581.4	0.105
1520	3.62	0.0416	18185.8	0.105
1521	3.63	0.041	18553.9	0.105
1522	3.604	0.0399	18912.5	0.105
1523	3.16	0.0349	18994.9	0.105
1524	1.701	0.0218	14945.9	0.105
1525	0.012	0.0065	366.075	0.105
1526	2.089	2.745	159.624	0.105
1527				
1528				
1529	23.874	2.745	1824.591	0.105
1530	17.399	0.6864	11366.8	0.105
1531	1.085	0.0123	18197.4	0.105
1532	1.9	0.0213	18759.8	0.105
1533	2.044	0.0229	18872.6	0.105
1534	1.799	0.02	18864.1	0.105
1535	1.58	0.0179	17893.3	0.105
1536	0.89	0.0113	14613.4	0.105
1537	1.753	0.0192	19105	0.105
1538	2.308	0.0266	18145.3	0.105
1539	0.454	0.0087	10651	0.105
1540	2.346	0.0277	17470.1	0.105
1541	1.889	0.0226	17338.9	0.105
1542	2.048	0.0262	16383.6	0.105
1543	2.285	0.0273	16344.1	0.105
1544	1.87	0.0228	15399	0.105
1545	0.729	0.0133	11133.7	0.105
1546	0.623	0.0132	9938.6	0.105
1547	0.5	0.0105	10064.3	0.105
1548	0.857	0.0179	10079.4	0.105

	K	L	M	N
1549	0.584	0.0122	10012.5	0.105
1550	0.622	0.0132	9932.1	0.105
1551	0.71	0.0151	9897	0.105
1552	3.309	0.0455	14832.7	0.105
1553	1.77	0.0363	9500	0.105
1554	3.341	0.0524	13328	0.105
1555	4.249	0.0644	13822.4	0.105
1556	4.52	0.0704	13366.9	0.105
1557	2.972	0.051	11982.9	0.105
1558	3.564	0.0525	14243.5	0.105
1559	3.575	0.0525	14289.6	0.105
1560	3.07	0.0477	13410.3	0.105
1561	2.508	0.04	12896.3	0.105
1562	0.014	0.0085	284.32	0.105
1563	3.754	0.5126	3316.782	0.105
1564	2.079	0.0358	12053.3	0.105
1565	3.053	0.0454	14179.1	0.105
1566	2.813	0.0408	14507.2	0.105
1567	2.802	0.0407	14425.8	0.105
1568	3.031	0.0447	14227.7	0.105
1569	3.164	0.0461	14405.4	0.105
1570	3.55	0.0519	14406.1	0.105
1571	3.372	0.0487	14543.5	0.105
1572	3.264	0.0473	14498	0.105
1573	3.242	0.0469	14513.5	0.105
1574	2.998	0.0434	14507.5	0.105
1575	3.152	0.0465	14228	0.105
1576	3.482	0.05	14586.1	0.105
1577	3.336	0.0483	14474	0.105
1578	3.2	0.0463	14507.1	0.105
1579	3.662	0.0533	14425.4	0.105
1580	3.413	0.0496	14450.1	0.105
1581	3.273	0.0473	14547.1	0.105
1582	3.418	0.0491	14605.2	0.105
1583	3.393	0.0498	14310.2	0.105
1584	2.774	0.0426	13743.9	0.105
1585	3.091	0.0458	14152.4	0.105
1586	3.415	0.0501	14301.1	0.105
1587	3.632	0.053	14394.2	0.105
1588	3.502	0.0508	14415.8	0.105
1589	3.371	0.0489	14478.1	0.105
1590	3.343	0.0494	14188.6	0.105
1591	3.187	0.0483	13811.9	0.105

	K	L	M	N
1592	3.465	0.053	13614.6	0.105
1593	3.266	0.0493	14011.1	0.105
1594	2.919	0.0417	14730.2	0.105
1595	2.856	0.0412	14546.7	0.105
1596	2.382	0.0343	14544.2	0.105
1597	2.486	0.0361	14454.7	0.105
1598	2.282	0.0348	13710.4	0.105
1599	2.213	0.0327	14168.7	0.105
1600	2.496	0.0356	14698.1	0.105
1601	2.441	0.0342	14994.2	0.105
1602	2.534	0.036	14743	0.105
1603	2.545	0.0395	13450	0.105
1604	2.581	0.0383	14137.8	0.105
1605	1.251	0.0264	9440.3	0.105
1606	1.039	0.0223	8998.4	0.105
1607	1.74	0.0334	9702	0.105
1608	0	0	0.595	0.105
1609				
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1614	22.644	4.003	1186.64	0.105
1615	18.335	1.0224	8298.7	0.105
1616	2.81	0.0405	14419.5	0.105
1617	2.993	0.0424	14760.1	0.105
1618	2.774	0.0421	13415.4	0.105
1619	2.407	0.0389	12333	0.105
1620	1.026	0.024	8625.7	0.105
1621	2.681	0.0406	13281.6	0.105
1622	3.326	0.0463	15074.7	0.105
1623	2.793	0.0392	14963.7	0.105
1624	2.083	0.0314	13424.1	0.105
1625	3.143	0.0438	15045	0.105
1626	1.604	0.0268	11111.4	0.105
1627	1.262	0.0243	9913.7	0.105
1628	2.959	0.044	14026.2	0.105
1629	5.962	0.0894	13908.6	0.105
1630	6.143	0.0871	14761.8	0.105
1631	2.302	0.0429	10645.2	0.105
1632	1.397	0.0276	9366.6	0.105
1633	0.55	0.0147	7617.9	0.105
1634	0.587	0.016	7642.9	0.105

	K	L	M	N
1635	0.952	0.025	7918.6	0.105
1636	2.821	0.049	10541.5	0.105
1637	0.659	0.0209	6154.598	0.105
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1707				
1708	2.847	0.5067	2140.005	0.105
1709	2.439	0.0679	8521.3	0.105
1710	2.445	0.0507	9160.5	0.105
1711	2.887	0.0706	8592.928	0.105
1712				
1713				
1714	3.143	0.2347	4247.425	0.105
1715	0.743	0.0212	7208.1	0.105
1716	0.736	0.0209	7143.9	0.105
1717	0.55	0.0162	7056.2	0.105
1718	1.84	0.0363	9109	0.105
1719	2.967	0.0539	10728.4	0.105
1720	2.958	0.0562	9794.5	0.105

	K	L	M	N
1721	4.007	0.0657	11779.7	0.105
1722	6.187	0.0953	13373.9	0.105
1723	1.187	0.0361	6872	0.105
1724	1.436	0.0441	6818.9	0.105
1725	1.677	0.0482	7162	0.105
1726	6.012	0.0965	13025.1	0.105
1727	8.475	0.1256	14141	0.105
1728	5.304	0.1012	10757.9	0.105
1729	6.685	0.1149	12044.1	0.105
1730	4.676	0.0839	11399.1	0.105
1731	4.46	0.08	10981.8	0.105
1732	5.131	0.0833	12579.1	0.105
1733	5.805	0.0877	13886.1	0.105
1734	5.392	0.0853	13120.4	0.105
1735	1.684	0.0478	7257.7	0.105
1736	4.018	0.0733	11007.5	0.105
1737	3.346	0.0671	9799.1	0.105
1738	3.691	0.066	11064.1	0.105
1739	4.261	0.0712	12249.3	0.105
1740	5.195	0.0779	13960.8	0.105
1741	6.682	0.1	14000.4	0.105
1742	5.83	0.0887	13718.8	0.105
1743	4.505	0.0703	13433.5	0.105
1744	4.739	0.0738	13445.5	0.105
1745	4.293	0.0672	13356	0.105
1746	3.7	0.0571	13578.1	0.105
1747	2.978	0.0509	12138.8	0.105
1748	3.861	0.0592	13717.4	0.105
1749	3.275	0.0503	13673.1	0.105
1750	2.269	0.0351	13560	0.105
1751	2.072	0.0328	12908	0.105
1752	1.343	0.0275	9611.5	0.105
1753	1.71	0.0302	11356.4	0.105
1754	2.884	0.0445	13504.2	0.105
1755	3.084	0.0472	13719.6	0.105
1756	3.12	0.0478	13676.9	0.105
1757	2.641	0.0452	11821.435	0.105
1758				
1759				
1760				
1761	1.74	3.921	93.08	0.105
1762	4.49	0.243	6144.4	0.105
1763	2.41	0.037	13711.6	0.105

	K	L	M	N
1764	2.74	0.0398	14479.1	0.105
1765	2.339	0.0376	12867.5	0.105
1766	2	0.039	10467.7	0.105
1767	0.976	0.0255	7706.1	0.105
1768	1.741	0.0321	10598.6	0.105
1769	2.799	0.0453	12520.9	0.105
1770	2.219	0.0386	11459.5	0.105
1771	1.531	0.0307	10044.1	0.105
1772	2.894	0.0455	12768.9	0.105
1773	3.028	0.0475	13153	0.105
1774	1.352	0.4571	6570.468	0.105
1775				
1776	15.725	10.3768	1762.264	0.0963
1777				
1778				
1779				
1780	2.509	2.4773	269.115	0.105
1781	0.073	0.0333	460.175	0.105
1782	2.27	0.055	9610.2	0.105
1783	4.002	0.052	16059.7	0.105
1784	4.802	0.0613	16293.7	0.105
1785	5.936	0.0748	16639.8	0.105
1786	6.155	0.0792	16307.5	0.105
1787	6.523	0.0831	16464.2	0.105
1788	6.474	0.0841	16094.6	0.105
1789	6.099	0.0773	16549.5	0.105
1790	7.792	0.2187	13128.665	0.105
1791	7.057	0.0891	16575.5	0.105
1792	5.577	0.0708	16500.9	0.105
1793	4.993	0.0645	16021.9	0.105
1794	3.623	0.0515	14162.3	0.105
1795	2.252	0.0414	10301.4	0.105
1796	5.003	0.0729	13658.9	0.105
1797	7.059	0.0893	16581.7	0.105
1798	5.967	0.0758	16504.7	0.105
1799	5.476	0.0698	16471.5	0.105
1800	3.813	0.0483	16607.4	0.105
1801	3.748	0.0481	16408.3	0.105
1802	3.704	0.0526	14046.1	0.105
1803	1.085	0.3753	3008.9	0.105
1804				
1805				
1806				

	K	L	M	N
1807	3.263	0.3022	4171.175	0.105
1808	2.996	0.0541	11268.5	0.105
1809	1.954	0.0462	8765.1	0.105
1810	5.106	0.0685	15339.3	0.105
1811	5.702	0.0721	16510	0.105
1812	5.374	0.07	15435.6	0.105
1813	4.86	0.0636	14971.1	0.105
1814	6.352	0.0765	17390.1	0.105
1815	4.626	0.0626	15083.7	0.105
1816	1.785	0.033	10290.6	0.105
1817	6.521	0.0787	17238.7	0.105
1818	6.736	0.0794	17768.6	0.105
1819	7.034	0.083	17779.8	0.105
1820	6.207	0.0789	15991.6	0.105
1821	5.648	0.0705	16047.7	0.105
1822	6.218	0.0742	17536.3	0.105
1823	6.15	0.076	16880.2	0.105
1824	4.685	0.0614	15324.2	0.105
1825	4.787	0.0623	15507.8	0.105
1826	4.418	0.0578	15342.1	0.105
1827	5.362	0.066	16959.1	0.105
1828	4.571	0.0587	16039.8	0.105
1829	4.463	0.0582	15837.4	0.105
1830	3.627	0.0484	14808.2	0.105
1831	4.39	0.0532	17288.4	0.105
1832	4.704	0.0566	17452.3	0.105
1833	4.28	0.0513	17485.3	0.105
1834	4.603	0.0555	17379.3	0.105
1835	4.617	0.0568	16933.3	0.105
1836	1.33	0.0283	9554.8	0.105
1837	3.047	0.0444	12706.3	0.105
1838	5.535	0.0674	17153.7	0.105
1839	5.397	0.0655	17229.7	0.105
1840	5.424	0.0655	17402.7	0.105
1841	4.949	0.0613	16792.5	0.105
1842	3.135	0.0462	13279.8	0.105
1843	4.596	0.0562	17156.2	0.105
1844	1.764	0.0326	10425.2	0.105
1845	4.018	0.0553	13999.1	0.105
1846	6.016	0.0742	17005.3	0.105
1847	5.668	0.0685	17372.5	0.105
1848	5.405	0.0645	17582.9	0.105
1849	14.881	0.1848	16572.7	0.105

	K	L	M	N
1850	3.999	0.0522	15116.9	0.105
1851	3.914	0.0525	14090	0.105
1852	5.343	0.0672	16089.8	0.105
1853	5.675	0.069	17219.9	0.105
1854	5.145	0.0664	15799.2	0.105
1855	5.739	0.0579	21058.6	0.105
1856	4.314	0.0398	22762.4	0.105
1857	1.935	0.0213	18714.3	0.105
1858	2.612	0.0278	19092.9	0.105
1859	5.405	0.0502	22306.4	0.105
1860	5.7	0.0568	21076.7	0.105
1861	5.528	0.0644	17787.8	0.105
1862	5.094	0.062	16768.8	0.105
1863	2.849	0.039	14110.9	0.105
1864	4.783	0.054	18593.8	0.105
1865	4.302	0.0538	16479	0.105
1866	5.718	0.0656	18297.5	0.105
1867	5.563	0.0625	18666.3	0.105
1868	5.842	0.0652	18774.5	0.105
1869	4.994	0.0593	17112.4	0.105
1870	5.41	0.0652	16998	0.105
1871	7.458	0.0851	18370	0.105
1872	8.891	0.1007	18520.9	0.105
1873	8.033	0.0929	18128.3	0.105
1874	6.4	0.0761	17603.8	0.105
1875	2.155	0.0334	10877.4	0.105
1876	5.601	0.0645	18200.6	0.105
1877	6.988	0.0799	18340.1	0.105
1878	7.374	0.0838	18413.8	0.105
1879	7.193	0.0845	17843.7	0.105
1880	6.834	0.0799	17918.9	0.105
1881	6.499	0.0745	18266	0.105
1882	5.13	0.0595	18075.5	0.105
1883	5.493	0.0628	18361.8	0.105
1884	4.112	0.0862	10096.9	0.105
1885	2.137	0.1349	4162.084	0.105
1886				
1887				
1888				
1889				
1890				
1891				
1892				

	K	L	M	N
1893	5.719	2.9213	417.89	0.105
1894	0.893	0.0468	4140.897	0.105
1895	2.918	0.0438	13417.8	0.105
1896	2.486	0.0498	10415.2	0.105
1897	4.848	0.0718	13761.8	0.105
1898	3.131	0.063	10424.9	0.105
1899	3.006	0.0545	11344.5	0.105
1900	2.305	0.0462	10437.2	0.105
1901	2.19	0.044	10430.9	0.105
1902	1.653	0.035	9907.6	0.105
1903	1.582	0.0319	10402.1	0.105
1904	1.739	0.0318	10629.8	0.105
1905	0.033	1.68	4.158	0.105
1906				
1907				
1908				
1909				
1910				
1911				
1912				
1913				
1914				
1915				
1916				
1917				

	O	P	Q	R
1	NOx Mass (short tons)	NOx Rate (lbs/mmBtu)	Heat Input (mmBtu)	Primary Fuel Type
2				Coal
3				Coal
4				Coal
5				Coal
6				Coal
7				Coal
8				Coal
9				Coal
10				Coal
11				Coal
12				Coal
13				Coal
14				Coal
15				Coal
16				Coal
17				Coal
18				Coal
19				Coal
20				Coal
21				Coal
22				Coal
23				Coal
24				Coal
25				Coal
26				Coal
27				Coal
28				Coal
29				Coal
30				Coal
31				Coal
32				Coal
33				Coal
34				Coal
35				Coal
36				Coal
37				Coal
38				Coal
39				Coal
40				Coal
41				Coal
42				Coal
43				Coal

	O	P	Q	R
44				Coal
45				Coal
46				Coal
47				Coal
48				Coal
49				Coal
50				Coal
51				Coal
52				Coal
53				Coal
54				Coal
55				Coal
56				Coal
57				Coal
58				Coal
59				Coal
60				Coal
61				Coal
62				Coal
63				Coal
64				Coal
65				Coal
66				Coal
67				Coal
68				Coal
69				Coal
70				Coal
71				Coal
72				Coal
73				Coal
74				Coal
75				Coal
76				Coal
77				Coal
78				Coal
79				Coal
80				Coal
81				Coal
82				Coal
83				Coal
84				Coal
85				Coal
86				Coal

	O	P	Q	R
87				Coal
88				Coal
89				Coal
90				Coal
91				Coal
92	8.092	0.1344	117877.4	Coal
93	7	0.1613	86950.5	Coal
94	6.448	0.1331	97087.2	Coal
95	10.328	0.1533	129732.2	Coal
96	8.174	0.1362	116533.1	Coal
97	9.888	0.1488	130675.9	Coal
98	13.208	0.1635	160252.3	Coal
99	10.843	0.1551	136050.9	Coal
100	10.863	0.1578	134350.7	Coal
101	9.449	0.1588	117268	Coal
102	13.083	0.171	150712.9	Coal
103	11.331	0.1546	142300.5	Coal
104	8.487	0.1515	107187.1	Coal
105	11.548	0.1561	143419.9	Coal
106	7.422	0.136	108007	Coal
107	6.779	0.1465	89445.6	Coal
108	6.231	0.1432	85571.3	Coal
109	8.58	0.1598	105164.8	Coal
110	11.942	0.1798	132852.5	Coal
111	10.6	0.1885	114551.4	Coal
112	8.989	0.1654	108049.5	Coal
113	4.438	0.1496	58441.6	Coal
114	9.45	0.1701	106593.9	Coal
115	13.921	0.1812	153213.1	Coal
116	14.953	0.1815	164310	Coal
117	15.668	0.1847	169754.5	Coal
118	13.92	0.17	163092.1	Coal
119	11.361	0.1514	145223.6	Coal
120	12.923	0.162	158307.3	Coal
121	7.033	0.1273	109884.3	Coal
122	8.669	0.1303	130558.3	Coal
123	13.155	0.1612	162548.4	Coal
124	9.456	0.1512	124199.8	Coal
125	9.87	0.1453	132883.3	Coal
126	6.595	0.1221	107403.1	Coal
127	7.275	0.1322	107729.6	Coal
128	7.581	0.1354	108606.6	Coal
129	11.965	0.1655	142711.1	Coal

	O	P	Q	R
130	13.764	0.1744	158273.2	Coal
131	14.749	0.1791	164715	Coal
132	14.9	0.1797	165827.8	Coal
133	14.701	0.18	163339.1	Coal
134	15.045	0.18	167171.1	Coal
135	12.681	0.1864	146644.93	Coal
136				Coal
137				Coal
138				Coal
139				Coal
140				Coal
141				Coal
142				Coal
143	5.882	0.438	26858.145	Coal
144	8.534	0.1921	97820.7	Coal
145	12.343	0.1822	133941.1	Coal
146	16.66	0.2002	166369	Coal
147	12.508	0.1816	134967.2	Coal
148	10.361	0.1699	117724.6	Coal
149	12.688	0.1771	142081.3	Coal
150	11.637	0.1683	136017.4	Coal
151	13.101	0.23	131760.969	Coal
152	14.288	0.1757	162754.1	Coal
153	14.234	0.1683	169143.6	Coal
154	14.532	0.1731	167903.9	Coal
155	12.049	0.1574	150927.2	Coal
156	7.659	0.1458	104188.2	Coal
157	11.29	0.1562	143263.7	Coal
158	13.9	0.1674	166052.4	Coal
159	14.171	0.1702	166571.7	Coal
160	14.378	0.1723	166859.8	Coal
161	14.644	0.175	167323.8	Coal
162	14.011	0.1672	167584.6	Coal
163	13.524	0.1635	165357.5	Coal
164	13.387	0.1626	164718.2	Coal
165	13.59	0.1679	160970	Coal
166	14.644	0.1807	162061.9	Coal
167	14.115	0.1795	157241.1	Coal
168	12.358	0.1635	150714.7	Coal
169	12.538	0.1668	149126.1	Coal
170	6.647	0.1342	98343.9	Coal
171	7.528	0.1444	102867.5	Coal
172	11.944	0.1658	142855.2	Coal

	O	P	Q	R
173	12.942	0.1778	145166.9	Coal
174	10.643	0.1568	134617.6	Coal
175	10.764	0.153	139104.1	Coal
176	8.065	0.1374	114068.3	Coal
177	6.092	0.1247	97205.4	Coal
178	9.064	0.1481	119074.5	Coal
179	12.394	0.1673	146146.8	Coal
180	13.913	0.1778	156474.9	Coal
181	13.882	0.1775	156418	Coal
182	13.297	0.1729	153802.5	Coal
183	11.506	0.1606	143476	Coal
184	0.353	0.339	2283.668	Coal
185				Coal
186				Coal
187				Coal
188				Coal
189				Coal
190				Coal
191				Coal
192				Coal
193				Coal
194				Coal
195				Coal
196				Coal
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198				Coal
199				Coal
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205				Coal
206				Coal
207				Coal
208				Coal
209				Coal
210				Coal
211				Coal
212				Coal
213				Coal
214				Coal
215				Coal

	O	P	Q	R
216				Coal
217				Coal
218				Coal
219				Coal
220				Coal
221				Coal
222				Coal
223				Coal
224				Coal
225				Coal
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227				Coal
228				Coal
229				Coal
230				Coal
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243				Coal
244				Coal
245				Coal
246				Coal
247				Coal
248				Coal
249				Coal
250				Coal
251				Coal
252				Coal
253				Coal
254	2.823	0.438	12889.34	Coal
255	9.496	0.438	43362.54	Coal
256				Coal
257	17.547	0.3767	94564.1	Coal
258	9.301	0.1902	103687.25	Coal

	O	P	Q	R
259				Coal
260				Coal
261				Coal
262				Coal
263				Coal
264				Coal
265				Coal
266				Coal
267				Coal
268	7.955	0.3778	47581.48	Coal
269	12.09	0.1648	144044.3	Coal
270	14.322	0.1736	162564.2	Coal
271	16.172	0.1808	178793.8	Coal
272	13.181	0.1728	150759.6	Coal
273	11.646	0.1763	131617.5	Coal
274	11.273	0.1754	127922.4	Coal
275	12.888	0.1779	143920.7	Coal
276	12.191	0.1795	135105.5	Coal
277	13.685	0.1763	154820.8	Coal
278	16.381	0.1843	177726.1	Coal
279	16.121	0.183	176145.7	Coal
280	16.912	0.1873	180586.6	Coal
281	17.891	0.1976	181106.3	Coal
282	14.876	0.1883	157889.1	Coal
283	13.517	0.1829	147188.9	Coal
284	13.293	0.1842	143933.3	Coal
285	12.856	0.1829	139606	Coal
286	15.249	0.1901	159950.6	Coal
287	17.121	0.1919	178522.7	Coal
288	16.158	0.1926	167761.8	Coal
289	16.859	0.1915	176103.1	Coal
290	18.35	0.2013	182312.5	Coal
291	16.57	0.1903	173899	Coal
292	15.519	0.1896	163270.4	Coal
293	16.901	0.1913	176721.2	Coal
294	17.496	0.191	183202.5	Coal
295	17.378	0.1913	181732.5	Coal
296	17.406	0.191	182265.6	Coal
297	17.339	0.191	181560.5	Coal
298	18.264	0.2013	181465.5	Coal
299	17.192	0.191	180023.8	Coal
300	18.134	0.2013	180092.7	Coal
301	17.233	0.191	180448	Coal

	O	P	Q	R
302	17.207	0.191	180173.1	Coal
303	15.758	0.1892	166006.4	Coal
304	18.487	0.2131	171125.1	Coal
305	21.845	0.228	191624	Coal
306	21.817	0.228	191378.5	Coal
307	21.623	0.228	189673.7	Coal
308	21.477	0.228	188391.1	Coal
309	21.318	0.2277	187244.4	Coal
310	21.009	0.2273	184783.9	Coal
311	19.89	0.2238	177406.9	Coal
312	22.647	0.2368	191308.4	Coal
313	21.802	0.228	191249.4	Coal
314	21.5	0.228	188599.6	Coal
315	21.23	0.228	186225.1	Coal
316	22.283	0.2368	188204.9	Coal
317	21.57	0.228	189208.5	Coal
318	21.402	0.2277	187971.6	Coal
319	18.153	0.198	182142.9	Coal
320	15.253	0.1744	174771	Coal
321	16.024	0.1784	179671.6	Coal
322	15.667	0.175	179089.5	Coal
323	15.608	0.1769	176435.4	Coal
324	15.078	0.1785	168642.2	Coal
325	9.758	0.1459	129511.5	Coal
326	15.67	0.1785	175555.5	Coal
327	15.92	0.1777	179218.3	Coal
328	7.407	0.1819	85512.275	Coal
329				Coal
330				Coal
331	10.003	0.2666	80263.226	Coal
332	16.24	0.1814	179100.7	Coal
333	15.481	0.1778	173956.8	Coal
334	14.592	0.1717	169552.8	Coal
335	15.351	0.1751	175308.9	Coal
336	15.592	0.1765	176623.9	Coal
337	15.239	0.1729	176292.3	Coal
338	15.432	0.1739	177467.9	Coal
339	15.299	0.1721	177705.5	Coal
340	14.684	0.1699	172487.4	Coal
341	15.285	0.172	177669.2	Coal
342	14.365	0.163	176141.4	Coal
343	15.201	0.1694	179503.4	Coal
344	14.31	0.1633	175035	Coal

	O	P	Q	R
345	14.513	0.167	173467.3	Coal
346	14.052	0.1664	168469.7	Coal
347	14.849	0.1697	174716	Coal
348	14.616	0.1686	173271.6	Coal
349	13.129	0.1676	156454.6	Coal
350	0.001	0.242	11.844	Coal
351				Coal
352	6.395	0.357	34384.529	Coal
353				Coal
354				Coal
355				Coal
356	10.942	0.2679	92956.7	Coal
357	15.179	0.17	178526.9	Coal
358	15.167	0.1704	178044	Coal
359	15.167	0.171	177390.8	Coal
360	14.71	0.1674	175604	Coal
361	14.689	0.1694	173305.6	Coal
362	14.82	0.1692	175212.3	Coal
363	14.909	0.1704	174976.6	Coal
364	15.154	0.1735	174262.3	Coal
365	14.979	0.1693	176922.3	Coal
366	14.975	0.1697	176527.2	Coal
367	15.05	0.1709	176150.4	Coal
368	14.868	0.1686	176349.7	Coal
369	14.4	0.1632	176468.8	Coal
370	14.517	0.1665	174415.4	Coal
371	11.898	0.171	140333.221	Coal
372				Coal
373	11.295	0.2516	101100.38	Coal
374	10.687	0.1512	138732.9	Coal
375	14.509	0.1652	175635.3	Coal
376	14.677	0.1668	175947.9	Coal
377	14.675	0.1676	175064.4	Coal
378	15.031	0.1719	174925.3	Coal
379	14.368	0.1635	175729.2	Coal
380	14.718	0.1817	162768.2	Coal
381	13.425	0.1721	156054.5	Coal
382	14.965	0.1707	175280.3	Coal
383	14.642	0.1659	176485.2	Coal
384	14.76	0.1685	175194.4	Coal
385	14.183	0.1637	173053.2	Coal
386	14.334	0.1642	174548.9	Coal
387	14.26	0.1631	174847.8	Coal

	O	P	Q	R
388	14.423	0.1644	175381.7	Coal
389	14.76	0.1683	175344.6	Coal
390	13.872	0.1647	168252.2	Coal
391	13.742	0.1606	170955.7	Coal
392	14.066	0.1614	174331.6	Coal
393	13.49	0.157	171765.1	Coal
394	14.138	0.1599	176864.6	Coal
395	14.559	0.1656	175823.3	Coal
396	14.293	0.1634	174906.8	Coal
397	14.741	0.1669	176629	Coal
398	15.641	0.1762	177535.5	Coal
399	15.244	0.1745	174709.9	Coal
400	14.158	0.1601	176870.2	Coal
401	14.236	0.1613	176569.7	Coal
402	14.039	0.1604	174993.5	Coal
403	14.135	0.1604	176229.9	Coal
404	14.299	0.1709	166557.8	Coal
405	11.148	0.1569	139347.9	Coal
406	12.638	0.1608	154632.9	Coal
407	13.979	0.1632	171315.2	Coal
408	13.225	0.1521	173915.9	Coal
409	9.594	0.1415	133836.5	Coal
410	13.461	0.1581	169966.4	Coal
411	13.707	0.1602	170974.4	Coal
412	14.361	0.164	175080.1	Coal
413	12.917	0.158	162370.4	Coal
414	0.266	0.32	1188.7	Coal
415				Coal
416				Coal
417				Coal
418	7.276	0.438	33225.39	Coal
419	10.708	0.438	48894.648	Coal
420				Coal
421				Coal
422				Coal
423				Coal
424				Coal
425				Coal
426				Coal
427				Coal
428				Coal
429				Coal
430				Coal

	O	P	Q	R
431				Coal
432				Coal
433				Coal
434				Coal
435				Coal
436				Coal
437				Coal
438				Coal
439				Coal
440				Coal
441				Coal
442				Coal
443				Coal
444				Coal
445				Coal
446				Coal
447	4.689	0.438	21411.918	Coal
448	15.616	0.2983	108932.6	Coal
449	7.114	0.1449	97960.8	Coal
450	9.859	0.154	122992.2	Coal
451	9.148	0.1573	113716.3	Coal
452	15.506	0.1796	172626.7	Coal
453	15.513	0.177	175259.1	Coal
454	14.598	0.1738	167986.5	Coal
455	15.025	0.1722	174502.4	Coal
456	14.552	0.1693	171532.2	Coal
457	11.016	0.1713	128466.752	Coal
458				Coal
459				Coal
460				Coal
461				Coal
462	10.726	0.438	48975.885	Coal
463				Coal
464	0.821	0.438	3749.535	Coal
465	10.447	0.2128	100423.3	Coal
466	13.278	0.1628	162189.3	Coal
467	14.242	0.1675	169774.8	Coal
468	10.989	0.1541	139586.3	Coal
469	14.809	0.1704	173880.7	Coal
470	14.13	0.1676	168416.8	Coal
471	14.619	0.1684	173624.5	Coal
472	14.733	0.1687	174652	Coal
473	13.658	0.164	163752.5	Coal

	O	P	Q	R
474	8.597	0.1467	113778.4	Coal
475	14.866	0.1701	174812.7	Coal
476	11.207	0.1575	139709.9	Coal
477	11.159	0.1678	135834.9	Coal
478	0.018	0.16	227.52	Coal
479	1.362	0.438	6217.458	Coal
480	14.544	0.2308	138274.2	Coal
481	13.81	0.1673	164904.3	Coal
482	14.568	0.1694	172012.1	Coal
483	14.75	0.1705	173051.9	Coal
484	14.25	0.168	169316.1	Coal
485	14.379	0.1673	171896.8	Coal
486	12.88	0.1598	159916.1	Coal
487	11.443	0.1592	142803.4	Coal
488	13.271	0.1632	161519.5	Coal
489	14.652	0.1675	174856.7	Coal
490	15.162	0.1699	178452.3	Coal
491	15.154	0.1691	179062.8	Coal
492	12.738	0.1615	156378.5	Coal
493	12.998	0.1598	159001.8	Coal
494	12.509	0.1596	153401	Coal
495	14.558	0.1694	171570.6	Coal
496	13.261	0.1633	161548.3	Coal
497	11.8	0.1593	147595.2	Coal
498	15.175	0.1723	176089.8	Coal
499	14.718	0.1705	171962.1	Coal
500	11.721	0.1574	144773.7	Coal
501	10.378	0.147	138260.7	Coal
502	7.465	0.1274	113696.8	Coal
503	8.783	0.1334	129619.3	Coal
504	8.188	0.1365	116496.9	Coal
505	11.608	0.1534	148840.8	Coal
506	8.631	0.155	111881.2	Coal
507	6.846	0.1223	109353.8	Coal
508	13.261	0.158	165445.4	Coal
509	11.852	0.17	141269.74	Coal
510				Coal
511	13.007	0.3513	78820.216	Coal
512	12.717	0.1568	161477.6	Coal
513	14.082	0.1662	169489.2	Coal
514	12.923	0.1845	151575.662	Coal
515	9.704	0.1706	119731.2	Coal
516	11.837	0.1503	156227.5	Coal

	O	P	Q	R
517	14.297	0.1623	176077.5	Coal
518	11.23	0.1439	155059.9	Coal
519	13.974	0.16	174545.1	Coal
520	14.319	0.164	174681.4	Coal
521	12.99	0.1585	162322.1	Coal
522	12.332	0.1568	155676.9	Coal
523	10.606	0.1504	137242	Coal
524	12.602	0.1653	151766.4	Coal
525	13.278	0.1654	158756.2	Coal
526	12.172	0.161	148598.7	Coal
527	9.26	0.1508	123689.6	Coal
528	8.91	0.1387	127032	Coal
529	13.238	0.1575	164773	Coal
530	10.459	0.1395	144368.8	Coal
531	10.193	0.1428	138155.7	Coal
532	13.735	0.1618	169534.9	Coal
533	14.834	0.1683	176354.7	Coal
534	11.746	0.1523	150822	Coal
535	8.822	0.14	122533.3	Coal
536	15.048	0.1688	178307.3	Coal
537	14.839	0.1695	175101.5	Coal
538	12.369	0.1619	151340.5	Coal
539	13.704	0.1666	163532.1	Coal
540	12.83	0.1715	153291.967	Coal
541				Coal
542	9.304	0.2132	92832.95	Coal
543	13.381	0.1598	165034.6	Coal
544	14.679	0.172	170457.7	Coal
545	12.341	0.163	149622.4	Coal
546	14.353	0.173	164453	Coal
547	13.958	0.1733	161050.9	Coal
548	9.198	0.1369	130113	Coal
549	10.463	0.2463	97050.987	Coal
550	6.981	0.1212	116312.3	Coal
551	11.584	0.1537	150346.1	Coal
552	10.629	0.1476	143558.1	Coal
553	8.251	0.133	123787.5	Coal
554	7.798	0.1384	113809.9	Coal
555	7.478	0.1325	113170.2	Coal
556	7.683	0.1309	117294.2	Coal
557	9.645	0.149	129004.3	Coal
558	13.277	0.1661	159575.7	Coal
559	15.106	0.1728	174753.3	Coal

	O	P	Q	R
560	13.865	0.1655	167685.9	Coal
561	13.558	0.158	171567	Coal
562	12.648	0.1614	156898.7	Coal
563	11.218	0.1498	147982	Coal
564	14.22	0.1693	167927.6	Coal
565	14.03	0.1668	168119.9	Coal
566	14.532	0.1695	171392.7	Coal
567	14.362	0.1675	171243.4	Coal
568	14.947	0.1712	174545.2	Coal
569	13.799	0.1629	168783.6	Coal
570	0.395	0.225	6111.65	Coal
571				Coal
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	O	P	Q	R
603				Coal
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643				Coal
644				Coal
645				Coal

	O	P	Q	R
646	5.237	0.438	23914.92	Coal
647	19.352	0.3874	98558.5	Coal
648	8.186	0.1443	112979.4	Coal
649	10.318	0.1437	139841.1	Coal
650	9.074	0.1408	125436.9	Coal
651	10.864	0.1533	136645.6	Coal
652	9.263	0.1546	119331.3	Coal
653	8.849	0.1551	112782.8	Coal
654	7.49	0.1593	94736.5	Coal
655	12.071	0.1625	146249.5	Coal
656	15.295	0.1723	177476.7	Coal
657	15.523	0.1785	173660.4	Coal
658	14.701	0.1715	171451.2	Coal
659	12.379	0.1568	155988.4	Coal
660	14.383	0.1675	171702.4	Coal
661	15.422	0.1715	179901.1	Coal
662	15.652	0.1705	183568.6	Coal
663	15.677	0.1719	182369.5	Coal
664	16.514	0.1827	180796.8	Coal
665	15.771	0.175	180291.4	Coal
666	15.901	0.1794	177342.4	Coal
667	15.347	0.1786	171628.9	Coal
668	15.688	0.1798	174479.4	Coal
669	15.395	0.1756	175369.6	Coal
670	14.728	0.1719	171219.5	Coal
671	14.889	0.1708	174167.9	Coal
672	14.86	0.169	175391.4	Coal
673	16.012	0.1783	179526.1	Coal
674	16.212	0.1795	180659.7	Coal
675	15.997	0.1793	178496.1	Coal
676	14.597	0.176	165980.5	Coal
677	15.999	0.1795	178157.4	Coal
678	15.537	0.1744	178210.7	Coal
679	14.897	0.1709	174466.9	Coal
680	14.502	0.1696	170957.6	Coal
681	15.325	0.1804	169573.7	Coal
682	15.155	0.1746	173593.6	Coal
683	15.822	0.178	177794.9	Coal
684	15.016	0.17	176764.1	Coal
685	13.83	0.1754	157356.9	Coal
686	9.1	0.1749	114643.55	Coal
687				Coal
688	3.513	0.438	16043.225	Coal

	O	P	Q	R
689	36.715	0.438	167647.4	Coal
690	25.149	0.2821	172178.8	Coal
691	15.096	0.1694	178196.2	Coal
692	16.458	0.184	178896.4	Coal
693	16.028	0.1799	178204.7	Coal
694	15.336	0.2339	146574.46	Coal
695	5.914	0.4158	28847.024	Coal
696	11.612	0.2736	91753.64	Coal
697	14.07	0.1751	160452.5	Coal
698	15.911	0.1793	177534.2	Coal
699	16.033	0.18	178170.6	Coal
700	15.547	0.175	177710.9	Coal
701	16.233	0.1818	178575.9	Coal
702	15.84	0.178	177883.5	Coal
703	15.791	0.1777	177678.5	Coal
704	15.834	0.1791	176798.4	Coal
705	16.023	0.1823	175743.9	Coal
706	14.605	0.172	168977.9	Coal
707	16.245	0.1835	177060.9	Coal
708	15.933	0.1795	177565.5	Coal
709	16.024	0.1796	178406.7	Coal
710	15.77	0.1755	179669.5	Coal
711	15.996	0.1797	178049.3	Coal
712	15.906	0.1814	175355.2	Coal
713	15.285	0.1774	172175.6	Coal
714	14.672	0.1735	168852.9	Coal
715	14.782	0.1698	173948.7	Coal
716	16.351	0.1833	178315.1	Coal
717	16.314	0.1805	180657.9	Coal
718	16.008	0.1783	179615.3	Coal
719	16.117	0.1791	179936	Coal
720	15.768	0.1735	181713.8	Coal
721	14.807	0.1693	174504.5	Coal
722	16.537	0.1802	183380.1	Coal
723	16.642	0.18	184860.2	Coal
724	16.735	0.1798	186161.4	Coal
725	17.063	0.1828	186670.2	Coal
726	16.98	0.1818	186775.9	Coal
727	16.459	0.1779	184871.3	Coal
728	15.11	0.1759	171372.1	Coal
729	16.327	0.1794	182066.6	Coal
730	16.233	0.1815	178886.9	Coal
731	16.223	0.1815	178815.4	Coal

	O	P	Q	R
732	16.372	0.1807	181192.6	Coal
733	16.441	0.181	181635.1	Coal
734	16.478	0.1816	181451.8	Coal
735	16.841	0.184	182996.4	Coal
736	16.069	0.1774	181191.9	Coal
737	16.254	0.179	181592.6	Coal
738	16.404	0.1804	181875.7	Coal
739	15.811	0.1769	178582	Coal
740	14.838	0.1681	176492.9	Coal
741	16.146	0.1793	180051.5	Coal
742	16.555	0.1843	179620	Coal
743	16.854	0.1875	179779.5	Coal
744	16.679	0.1855	179806.9	Coal
745	16.363	0.1823	179485.5	Coal
746	16.377	0.1823	179686.2	Coal
747	16.77	0.1866	179713.2	Coal
748	16.697	0.1851	180387.4	Coal
749	16.039	0.1815	176566.5	Coal
750	15.983	0.1831	174407.8	Coal
751	16.41	0.1835	178915.1	Coal
752	16.155	0.1808	178570.4	Coal
753	15.896	0.1807	175904.6	Coal
754	16.034	0.184	174035.7	Coal
755	15.702	0.1819	172595.9	Coal
756	16.476	0.1849	178208.9	Coal
757	16.255	0.1807	179859.4	Coal
758	16.585	0.1828	181482.4	Coal
759	14.638	0.1814	161161.6	Coal
760	16.375	0.1858	176026.2	Coal
761	16.872	0.1868	180644.7	Coal
762	16.167	0.1808	178892	Coal
763	16.845	0.1865	180646	Coal
764	17.071	0.1999	170967.7	Coal
765	15.36	0.1845	166412.3	Coal
766	16.096	0.1857	173236.6	Coal
767	15.744	0.1813	173553.5	Coal
768	17.076	0.1916	178276.5	Coal
769	15.96	0.1824	175232.9	Coal
770	16.732	0.1863	179644.3	Coal
771	12.844	0.1993	134103.65	Coal
772				Coal
773				Coal
774				Coal

	O	P	Q	R
775				Coal
776				Coal
777				Coal
778				Coal
779	5.831	0.438	26625.3	Coal
780	18.126	0.3412	113222.7	Coal
781	16.101	0.1812	177703.7	Coal
782	15.752	0.1805	174498.9	Coal
783	15.892	0.181	175560.8	Coal
784	15.88	0.1778	178592.7	Coal
785	13.819	0.1944	158032.2	Coal
786				Coal
787				Coal
788				Coal
789				Coal
790				Coal
791				Coal
792	15.454	0.3962	77599.94	Coal
793	14.925	0.1814	164355.3	Coal
794	15.859	0.1817	174631.5	Coal
795	16.498	0.1828	180470.3	Coal
796	15.994	0.1768	180934.5	Coal
797	10.402	0.2122	106222.172	Coal
798				Coal
799				Coal
800				Coal
801	12.557	0.3999	63194.74	Coal
802	14.253	0.1708	166353.3	Coal
803	15.868	0.1758	180571.4	Coal
804	15.678	0.1735	180681.3	Coal
805	15.848	0.1757	180383.5	Coal
806	15.505	0.1724	179859.7	Coal
807	15.638	0.1748	178705.1	Coal
808	16.691	0.1931	173363.6	Coal
809	16.111	0.2025	161387.7	Coal
810	18.169	0.2135	169358.9	Coal
811	15.679	0.1796	174577.4	Coal
812	15.723	0.1767	177999.5	Coal
813	15.962	0.1799	177431.9	Coal
814	16.219	0.1863	174175.1	Coal
815	15.798	0.1855	170362.5	Coal
816	14.76	0.1756	168021.9	Coal
817	14.479	0.178	162200	Coal

	O	P	Q	R
818	0.384	0.348	3722.802	Coal
819				Coal
820				Coal
821	6.595	0.2929	56517.888	Coal
822	15.279	0.1808	169005.2	Coal
823	15.511	0.1839	168710.6	Coal
824	15.394	0.1818	169309.2	Coal
825	15.051	0.1774	169672.4	Coal
826	15.071	0.1773	169998.6	Coal
827	15.348	0.1806	169994.7	Coal
828	13.4	0.1853	148807.98	Coal
829				Coal
830	3.932	0.438	17956.066	Coal
831	15.553	0.2123	152990.8	Coal
832	15.636	0.1851	168960	Coal
833	15.268	0.1807	168975.5	Coal
834	15.605	0.1839	169694.4	Coal
835	15.071	0.1821	165538.8	Coal
836	15.089	0.1807	166998.6	Coal
837	15.263	0.1816	168072.4	Coal
838	15.464	0.183	169046.6	Coal
839	15.201	0.1833	165845.3	Coal
840	14.971	0.1813	165162	Coal
841	15.265	0.1803	169383.6	Coal
842	15.173	0.1793	169243.9	Coal
843	15.5	0.1847	167898.4	Coal
844	15.233	0.1823	167084.9	Coal
845	15.34	0.1818	168724.1	Coal
846	15.32	0.1803	169914.9	Coal
847	15.281	0.1796	170179.1	Coal
848	15.657	0.1832	170919	Coal
849	15.442	0.1809	170745.8	Coal
850	15.501	0.183	169446.5	Coal
851	15.208	0.1808	168195.3	Coal
852	14.913	0.1766	168897.2	Coal
853	14.796	0.1733	170795.8	Coal
854	15.565	0.1811	171862.6	Coal
855	14.976	0.1759	170336.8	Coal
856	15.089	0.1777	169874.3	Coal
857	14.754	0.177	166609.4	Coal
858	14.231	0.1736	163429.1	Coal
859	15.072	0.1795	167970.6	Coal
860	15.43	0.1858	166080.7	Coal

	O	P	Q	R
861	14.128	0.1663	169939.3	Coal
862	14.246	0.167	170610.4	Coal
863	14.696	0.173	169867.7	Coal
864	15.113	0.1768	170927.8	Coal
865	15.225	0.1768	172240.8	Coal
866	15.098	0.1758	171809.5	Coal
867	15.313	0.1797	170418.9	Coal
868	14.88	0.1744	170623	Coal
869	14.744	0.1747	168807.9	Coal
870	15.023	0.179	167865.5	Coal
871	12.884	0.1648	152833.2	Coal
872	14.425	0.1709	168810.3	Coal
873	14.904	0.1741	171141.2	Coal
874	14.736	0.1712	172150.9	Coal
875	15.065	0.1777	169546.9	Coal
876	16.218	0.1882	172385.4	Coal
877	15.759	0.1826	172579.2	Coal
878	16.269	0.1891	172102.4	Coal
879	16.209	0.189	171566.1	Coal
880	15.399	0.1806	170464.9	Coal
881	15.325	0.1767	173495.3	Coal
882	15.13	0.1744	173538.4	Coal
883	15.442	0.1774	174070.8	Coal
884	15.247	0.1756	173630.2	Coal
885	15.013	0.1732	173356.1	Coal
886	15.461	0.1792	172555.7	Coal
887	14.985	0.1725	173744.4	Coal
888	14.924	0.1715	174001.5	Coal
889	14.613	0.1678	174218.9	Coal
890	15.301	0.1746	175290.1	Coal
891	15.705	0.1795	174993.5	Coal
892	15.442	0.177	174523.2	Coal
893	15.766	0.1831	172210.6	Coal
894	15.735	0.181	173912.6	Coal
895	15.464	0.1772	174580.3	Coal
896	15.165	0.1774	170893.3	Coal
897	15.168	0.1777	170400.1	Coal
898	15.019	0.174	172481.6	Coal
899	15.379	0.1765	174282.3	Coal
900	15.247	0.1761	173144	Coal
901	14.803	0.17	174154.3	Coal
902	14.689	0.1716	171123.4	Coal
903	12.419	0.1727	144326.9	Coal

	O	P	Q	R
904				Coal
905	3.782	0.3499	27520.08	Coal
906	1.571	0.1848	17840.494	Coal
907	10.57	0.2383	112138.1	Coal
908	15.578	0.1765	176481.9	Coal
909	15.275	0.1742	175349.7	Coal
910	15.205	0.1741	174699.5	Coal
911	15.4	0.1755	175505.2	Coal
912	14.657	0.1729	169185.2	Coal
913	15.071	0.175	172385.7	Coal
914	15.424	0.1755	175744	Coal
915	15.331	0.1741	176093.3	Coal
916	15.146	0.1729	175177	Coal
917	15.145	0.1696	178692.2	Coal
918	15.511	0.1755	176850.2	Coal
919	14.607	0.1678	173906.9	Coal
920	15.336	0.1762	174091.9	Coal
921	16.101	0.1835	175411.9	Coal
922	15.351	0.1761	174369.7	Coal
923	15.782	0.1796	175721.9	Coal
924	15.025	0.1753	171387.4	Coal
925	15.072	0.1772	170162.3	Coal
926	14.88	0.1741	170949.8	Coal
927	14.233	0.1727	164762.9	Coal
928	14.751	0.173	170499	Coal
929	15.024	0.1758	170974.2	Coal
930	15.382	0.1792	171659.9	Coal
931	15.266	0.1774	172153.9	Coal
932	15.252	0.1808	168450.6	Coal
933	14.595	0.173	168669.4	Coal
934	14.947	0.1773	168637.3	Coal
935	14.792	0.1793	164878.5	Coal
936	15.172	0.1808	167766.2	Coal
937	15.24	0.1789	170375.8	Coal
938	15.733	0.186	169252.3	Coal
939	14.841	0.178	166713.4	Coal
940	12.629	0.1808	138731.4	Coal
941	5.286	0.1363	77589	Coal
942	6.05	0.1411	85996.4	Coal
943	5.9	0.1481	79702.2	Coal
944	6.723	0.1654	81810.221	Coal
945				Coal
946				Coal

	O	P	Q	R
947				Coal
948				Coal
949				Coal
950				Coal
951				Coal
952				Coal
953				Coal
954				Coal
955				Coal
956				Coal
957				Coal
958				Coal
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970				Coal
971				Coal
972				Coal
973				Coal
974				Coal
975				Coal
976				Coal
977				Coal
978				Coal
979				Coal
980				Coal
981				Coal
982	6.117	0.4226	29083.64	Coal
983	7.351	0.1765	83329	Coal
984	6.594	0.1444	93375.4	Coal
985	6.328	0.1483	85846.3	Coal
986	6.951	0.1655	83969.6	Coal
987	6.809	0.1376	99509.9	Coal
988	7.08	0.1413	100458.6	Coal
989	5.959	0.1355	88285.1	Coal

	O	P	Q	R
990	5.954	0.1401	85007.8	Coal
991	5.888	0.141	83543.9	Coal
992	6.118	0.1373	89645.7	Coal
993	6.316	0.1254	100775.4	Coal
994	5.99	0.1215	98572.7	Coal
995	6.119	0.1239	98789.1	Coal
996	6.138	0.1312	93587.8	Coal
997	7.285	0.1593	91737.2	Coal
998	6.729	0.1478	91986.5	Coal
999	6.977	0.1472	95411.7	Coal
1000	7.493	0.1541	97393	Coal
1001	6.767	0.1396	96832.6	Coal
1002	5.772	0.1522	82672.636	Coal
1003				Coal
1004				Coal
1005				Coal
1006				Coal
1007				Coal
1008				Coal
1009	4.068	0.438	18575.05	Coal
1010	10.609	0.2321	102552.5	Coal
1011	11.031	0.1544	133078.9	Coal
1012	8.431	0.1446	114569	Coal
1013	12.926	0.172	148901.1	Coal
1014	14.17	0.1714	162934.4	Coal
1015	11.577	0.1495	149126.9	Coal
1016	15.304	0.1762	173721.8	Coal
1017	15.642	0.1799	173906	Coal
1018	15.498	0.1785	173704	Coal
1019	16.091	0.1843	174628.1	Coal
1020	15.883	0.1822	174319.7	Coal
1021	15.295	0.1784	171503.9	Coal
1022	16.048	0.184	174404.2	Coal
1023	15.743	0.1811	173884.5	Coal
1024	15.775	0.1838	171679.5	Coal
1025	15.405	0.1813	169870.9	Coal
1026	15.956	0.1846	172881.3	Coal
1027	14.967	0.1758	170042.6	Coal
1028	14.904	0.1806	165009	Coal
1029	14.639	0.175	167322.7	Coal
1030	13.936	0.1723	161803.3	Coal
1031	14.559	0.1741	167273.2	Coal
1032	14.033	0.1697	165320.8	Coal

	O	P	Q	R
1033	14.763	0.1753	168448.7	Coal
1034	14.865	0.1763	168594.2	Coal
1035	14.78	0.1764	167594.3	Coal
1036	14.534	0.1727	168306.9	Coal
1037	14.815	0.1758	168504.3	Coal
1038	14.257	0.1696	168071.6	Coal
1039	14.638	0.1733	168960.9	Coal
1040	14.724	0.1738	169480.3	Coal
1041	13.819	0.1698	162573.7	Coal
1042	15.146	0.1767	171479.5	Coal
1043	15.064	0.1764	170838.6	Coal
1044	14.623	0.1713	170734.2	Coal
1045	14.889	0.1738	171369.6	Coal
1046	14.184	0.1671	169615.9	Coal
1047	13.695	0.1618	169308.6	Coal
1048	14.513	0.172	168725.5	Coal
1049	14.551	0.1713	169903.2	Coal
1050	14.652	0.1728	169690.7	Coal
1051	11.425	0.1599	140745.1	Coal
1052	13.848	0.1735	159278.5	Coal
1053	13.058	0.1613	161814	Coal
1054	12.568	0.1644	152181	Coal
1055	11.833	0.1578	148643	Coal
1056	13.436	0.169	157605.3	Coal
1057	14.89	0.1754	169780.9	Coal
1058	15.099	0.1787	169052.5	Coal
1059	14.859	0.1756	169274.2	Coal
1060	14.796	0.175	169103.8	Coal
1061	14.809	0.1747	169511.3	Coal
1062	14.405	0.1743	164876.9	Coal
1063	12.574	0.1646	152215.8	Coal
1064	14.309	0.1696	168780.1	Coal
1065	11.699	0.1586	146561.8	Coal
1066	8.379	0.1383	117695.2	Coal
1067	5.229	0.1143	89578	Coal
1068	4.061	0.102	79504.9	Coal
1069	11.55	0.16	142072.6	Coal
1070	14.453	0.1713	168688.1	Coal
1071	13.728	0.1661	165165.5	Coal
1072	14.487	0.1722	168303	Coal
1073	12.746	0.1562	161794.8	Coal
1074	13.083	0.1566	167001	Coal
1075	13.119	0.1605	163023.2	Coal

	O	P	Q	R
1076	12.895	0.1584	161844.5	Coal
1077	14.638	0.1707	171547.2	Coal
1078	14.084	0.1654	170269.6	Coal
1079	13.211	0.1553	170135.3	Coal
1080	13.338	0.156	170949.5	Coal
1081	13.141	0.157	167292.5	Coal
1082	14.016	0.1665	168408.7	Coal
1083	13.795	0.1639	168296.3	Coal
1084	14.737	0.1739	169365.9	Coal
1085	6.367	0.1888	76625.86	Coal
1086				Coal
1087				Coal
1088	2.627	0.438	11995.2	Coal
1089	8.951	0.1749	116544.7	Coal
1090	14.523	0.1689	171999.2	Coal
1091	13.766	0.1656	166221.4	Coal
1092	13.562	0.1688	160443.3	Coal
1093	13.915	0.1708	162675	Coal
1094	16.076	0.1867	172216.2	Coal
1095	15.128	0.1801	167733.6	Coal
1096	14.942	0.1773	168261.9	Coal
1097	15.442	0.18	171556.5	Coal
1098	15.212	0.1762	172714.9	Coal
1099	15.671	0.1823	171629.2	Coal
1100	14.743	0.1702	173252.6	Coal
1101	15.022	0.1732	173456.2	Coal
1102	14.662	0.169	173544.3	Coal
1103	15.121	0.175	172871.6	Coal
1104	14.674	0.169	173699.9	Coal
1105	14.844	0.1714	173121.8	Coal
1106	14.617	0.1682	173778	Coal
1107	14.499	0.1674	173239.8	Coal
1108	14.456	0.1671	173043.6	Coal
1109	14.964	0.1786	167578	Coal
1110	15.245	0.1753	173941.3	Coal
1111	15.428	0.1768	174489.3	Coal
1112	15.467	0.1778	174018.3	Coal
1113	15.693	0.1798	174609.8	Coal
1114	15.246	0.1748	174405.9	Coal
1115	15.046	0.1737	173164.1	Coal
1116	14.328	0.172	166777.3	Coal
1117	11.456	0.1611	141623.1	Coal
1118	14.469	0.1728	166745.4	Coal

	O	P	Q	R
1119	14.437	0.1654	174567.6	Coal
1120	14.66	0.1675	175022.4	Coal
1121	15.676	0.18	174178.9	Coal
1122	16.496	0.1891	174456.9	Coal
1123	16.066	0.1834	175232.8	Coal
1124	14.6	0.1735	164920.7	Coal
1125	16.249	0.1858	174965.7	Coal
1126	15.448	0.1771	174430.2	Coal
1127	15.086	0.175	172365.7	Coal
1128	15.075	0.1763	171052.7	Coal
1129	14.408	0.1761	163510.2	Coal
1130	12.597	0.1643	152667.1	Coal
1131	14.301	0.1696	168355.2	Coal
1132	13.278	0.1712	153876.2	Coal
1133	15.148	0.1785	169689.1	Coal
1134	15.458	0.1763	175374.9	Coal
1135	13.401	0.1679	158881.6	Coal
1136	5.766	0.1487	83491.81	Coal
1137				Coal
1138				Coal
1139				Coal
1140	10.489	0.2621	103317.573	Coal
1141	14.576	0.1676	173868.8	Coal
1142	14.602	0.1709	170982.6	Coal
1143	14.104	0.163	173067.2	Coal
1144	14.085	0.172	163612.2	Coal
1145	15.452	0.1775	174125.1	Coal
1146	12.83	0.1671	152786.8	Coal
1147	10.478	0.1564	134148.8	Coal
1148	2.082	0.1947	23965.48	Coal
1149				Coal
1150				Coal
1151				Coal
1152				Coal
1153				Coal
1154				Coal
1155	0.452	0.438	2065.124	Coal
1156	11.187	0.3425	78800.2	Coal
1157	14.058	0.1682	167172.6	Coal
1158	14.763	0.1746	169109.5	Coal
1159	14.295	0.1672	171020.2	Coal
1160	15.973	0.1908	167467.9	Coal
1161	14.307	0.172	166459	Coal

	O	P	Q	R
1162	14.656	0.1775	165147.4	Coal
1163	14.659	0.1748	167770	Coal
1164	10.054	0.1662	119431.7	Coal
1165	14.334	0.1769	162113.3	Coal
1166	14.435	0.1712	168679.6	Coal
1167	15.06	0.1774	169818.7	Coal
1168	14.828	0.1754	169094.8	Coal
1169	14.557	0.172	169292.9	Coal
1170	14.793	0.1759	168169.4	Coal
1171	15.426	0.1822	169335.1	Coal
1172	15.738	0.1853	169910.6	Coal
1173	14.744	0.1736	169863.2	Coal
1174	14.558	0.174	167247.1	Coal
1175	14.553	0.1712	170027.8	Coal
1176	15.256	0.1798	169706.3	Coal
1177	14.491	0.1733	166805.3	Coal
1178	13.003	0.1671	154731.2	Coal
1179	14.784	0.1753	168648.1	Coal
1180	12.421	0.1645	148624.8	Coal
1181	10.05	0.1527	130973.8	Coal
1182	6.069	0.1645	74884.9	Coal
1183				Coal
1184				Coal
1185				Coal
1186				Coal
1187				Coal
1188				Coal
1189				Coal
1190				Coal
1191				Coal
1192				Coal
1193				Coal
1194				Coal
1195				Coal
1196	0.485	0.464	2088.56	Coal
1197	11.857	0.3713	69665.703	Coal
1198	13.022	0.1623	160562.6	Coal
1199	13.93	0.1683	165512.4	Coal
1200	15.256	0.176	173420.1	Coal
1201	15.382	0.1786	172247.1	Coal
1202	15.257	0.1762	173232.6	Coal
1203	14.723	0.1728	170630.9	Coal
1204	14.456	0.1689	171249.5	Coal

	O	P	Q	R
1205	14.964	0.1739	172128.3	Coal
1206	14.916	0.1707	174764.9	Coal
1207	14.567	0.1707	170765.1	Coal
1208	14.6	0.1665	175472.7	Coal
1209	14.019	0.1573	178090.8	Coal
1210	14.043	0.155	181170	Coal
1211	14.633	0.1616	180995.9	Coal
1212	15.451	0.1703	181425.8	Coal
1213	14.661	0.1636	179138.3	Coal
1214	12.191	0.1505	159739	Coal
1215	10.915	0.1462	143039.1	Coal
1216	12.431	0.157	155425.9	Coal
1217	13.689	0.1638	166678.8	Coal
1218	12.811	0.1583	159525.1	Coal
1219	14.495	0.1699	170668	Coal
1220	11.658	0.155	148832.9	Coal
1221	14.47	0.1687	171535.5	Coal
1222	14.374	0.1667	172494.4	Coal
1223	14.515	0.1678	173055	Coal
1224	14.584	0.1689	172719	Coal
1225	13.798	0.1649	167238.3	Coal
1226	14.441	0.1684	171473.2	Coal
1227	15.012	0.1732	173376	Coal
1228	14.875	0.1712	173773	Coal
1229	13.988	0.1712	162200.2	Coal
1230	15.284	0.1741	175539.5	Coal
1231	14.749	0.1691	174407.4	Coal
1232	14.475	0.1658	174667.4	Coal
1233	7.354	0.1604	90909.936	Coal
1234				Coal
1235				Coal
1236	9.059	0.2834	65658.177	Coal
1237	13.888	0.1601	173295.8	Coal
1238	14.576	0.1697	171706.2	Coal
1239	13.573	0.1668	162379.8	Coal
1240	14.732	0.1708	172444.7	Coal
1241	4.253	0.1013	83409.2	Coal
1242	4.962	0.1209	82100.3	Coal
1243	7.031	0.1428	97624.6	Coal
1244	3.154	0.2012	38406.695	Coal
1245				Coal
1246				Coal
1247				Coal

	O	P	Q	R
1248	24.071	0.5256	92012.214	Coal
1249	29.872	0.372	160603.3	Coal
1250	22.773	0.2531	178398.4	Coal
1251	16.074	0.1838	174873.3	Coal
1252	15.345	0.1755	174869	Coal
1253	14.996	0.1719	174500.4	Coal
1254	14.535	0.1672	173892.4	Coal
1255	13.406	0.1674	158819.7	Coal
1256	8.585	0.1523	112660.8	Coal
1257	12.542	0.1621	153723	Coal
1258	7.39	0.149	99369.6	Coal
1259	12.389	0.1592	153107.9	Coal
1260	12.316	0.1572	152207.6	Coal
1261	11.036	0.1545	139696.3	Coal
1262	8.608	0.1508	115047.8	Coal
1263	8.195	0.1563	105606.4	Coal
1264	8.812	0.1571	112046.4	Coal
1265	8.65	0.1726	104843.732	Coal
1266				Coal
1267				Coal
1268				Coal
1269				Coal
1270				Coal
1271				Coal
1272				Coal
1273				Coal
1274				Coal
1275				Coal
1276				Coal
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1281				Coal
1282				Coal
1283				Coal
1284				Coal
1285				Coal
1286				Coal
1287				Coal
1288				Coal
1289				Coal
1290				Coal

	O	P	Q	R
1291				Coal
1292				Coal
1293				Coal
1294				Coal
1295				Coal
1296				Coal
1297				Coal
1298				Coal
1299				Coal
1300				Coal
1301				Coal
1302				Coal
1303				Coal
1304				Coal
1305				Coal
1306				Coal
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1308				Coal
1309				Coal
1310				Coal
1311				Coal
1312				Coal
1313				Coal
1314				Coal
1315				Coal
1316				Coal
1317				Coal
1318				Coal
1319				Coal
1320				Coal
1321				Coal
1322				Coal
1323				Coal
1324				Coal
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1327				Coal
1328				Coal
1329				Coal
1330				Coal
1331				Coal
1332				Coal
1333				Coal

	O	P	Q	R
1334				Coal
1335				Coal
1336				Coal
1337				Coal
1338				Coal
1339				Coal
1340				Coal
1341				Coal
1342				Coal
1343				Coal
1344				Coal
1345				Coal
1346				Coal
1347				Coal
1348				Coal
1349				Coal
1350				Coal
1351				Coal
1352				Coal
1353				Coal
1354				Coal
1355				Coal
1356				Coal
1357				Coal
1358				Coal
1359				Coal
1360				Coal
1361	5.584	0.564	19801.296	Coal
1362	10.2	0.564	36169.704	Coal
1363	16.665	0.4366	75654.4	Coal
1364				Coal
1365				Coal
1366				Coal
1367				Coal
1368	0.003	0.417	14.03	Coal
1369	4.734	0.2633	41055.2	Coal
1370	2.992	0.1187	49123.6	Coal
1371				Coal
1372	3.732	0.403	18552.705	Coal
1373	2.311	0.1182	37735.4	Coal
1374	2.413	0.1485	32191.3	Coal
1375	2.174	0.1449	29364.9	Coal
1376	2.4	0.1503	31337.7	Coal

	O	P	Q	R
1377	8.823	0.1563	108503.1	Coal
1378	15.008	0.1706	175968.7	Coal
1379	14.318	0.1632	175479.9	Coal
1380	14.062	0.1603	175454.7	Coal
1381	13.73	0.1603	170676	Coal
1382	9.635	0.1436	130918.9	Coal
1383	9.879	0.1515	126488	Coal
1384	10.954	0.1538	138055.8	Coal
1385	15.077	0.1705	176895.3	Coal
1386	14.862	0.1693	175661.3	Coal
1387	13.987	0.167	166119.6	Coal
1388	15.398	0.1732	177802.3	Coal
1389	14.616	0.171	170266.9	Coal
1390	13.001	0.1655	154807.7	Coal
1391	14.464	0.1707	169681.3	Coal
1392	13.435	0.1667	159317.4	Coal
1393	9.2	0.1534	118958.7	Coal
1394	11.256	0.1542	145559.3	Coal
1395	8.908	0.1488	119896.5	Coal
1396	7.307	0.1623	90066.6	Coal
1397	10.146	0.16	126313.9	Coal
1398	9.972	0.1662	118773.7	Coal
1399	13.181	0.1818	144268.2	Coal
1400	13.922	0.1805	154223.5	Coal
1401	14.159	0.1845	153418.5	Coal
1402	11.196	0.1784	125064.6	Coal
1403	12.182	0.1823	133528.3	Coal
1404	13.123	0.1745	149928.2	Coal
1405	11.583	0.1779	129295.5	Coal
1406	13.841	0.1799	153838.9	Coal
1407	13.899	0.1829	151905.5	Coal
1408	14.685	0.1861	157874.4	Coal
1409	13.124	0.1772	146572.1	Coal
1410	8.5	0.1587	105027.2	Coal
1411	9.827	0.1637	117481.4	Coal
1412	6.685	0.1709	78204	Coal
1413	9.708	0.1583	122295.4	Coal
1414	10.508	0.2078	107271.382	Coal
1415	12.857	0.1681	153782.5	Coal
1416	12.922	0.1583	163122.8	Coal
1417	9.494	0.1628	117089.2	Coal
1418	12.734	0.165	149970.6	Coal
1419	10.428	0.1556	130862.9	Coal

	O	P	Q	R
1420	10.906	0.153	139136.1	Coal
1421	11.985	0.1583	150136.4	Coal
1422	5.726	0.122	93862.8	Coal
1423	6.378	0.134	95230	Coal
1424	6.409	0.1328	96331.8	Coal
1425	9.954	0.1495	129018.2	Coal
1426	4.538	0.0964	94131.9	Coal
1427	6.406	0.1171	105659.3	Coal
1428	11.827	0.1593	145166.3	Coal
1429	12.164	0.1638	146788.6	Coal
1430	10.893	0.1526	138632.2	Coal
1431	8.501	0.1491	112514.6	Coal
1432	7.393	0.1412	104044.7	Coal
1433	13.596	0.1684	157051.2	Coal
1434	15.981	0.1763	181306.1	Coal
1435	16.45	0.1785	184326.9	Coal
1436	15.47	0.1725	179329.4	Coal
1437	14.738	0.169	174310.2	Coal
1438	13.226	0.1593	165886.4	Coal
1439	12.579	0.1637	150073.2	Coal
1440	11.75	0.1587	142843.4	Coal
1441	10.285	0.1506	131212.8	Coal
1442	5.44	0.1124	96466.6	Coal
1443	7.543	0.1232	116937.1	Coal
1444	7.691	0.1349	111631.1	Coal
1445	7.367	0.1527	96480.7	Coal
1446	10.787	0.1745	138333.904	Coal
1447				Coal
1448				Coal
1449				Coal
1450				Coal
1451				Coal
1452	1.458	0.368	7926.255	Coal
1453	4.857	0.3629	26815.292	Coal
1454	11.657	0.1524	150840	Coal
1455	13.768	0.1628	166771.1	Coal
1456	13.307	0.1615	161633.1	Coal
1457	13.685	0.164	165035.7	Coal
1458	15.437	0.1712	178884.5	Coal
1459	8.444	0.144	115507.4	Coal
1460	15.351	0.1682	182493.6	Coal
1461	15.473	0.1748	175960.9	Coal
1462	15.117	0.1761	170925.3	Coal

	O	P	Q	R
1463	15.831	0.1759	180158.6	Coal
1464	14.233	0.1668	167357.5	Coal
1465	13.979	0.1624	166149	Coal
1466	15.959	0.1723	185189.4	Coal
1467	16.307	0.1798	181293.9	Coal
1468	15.317	0.1747	175228	Coal
1469	15.912	0.1783	178448.4	Coal
1470	15.721	0.1713	183497.6	Coal
1471	15.424	0.167	184685.7	Coal
1472	15.864	0.1713	185226.8	Coal
1473	14.461	0.1632	177515.4	Coal
1474	14.56	0.1645	176193.9	Coal
1475	14.579	0.173	166953.6	Coal
1476	12.962	0.1633	156329.3	Coal
1477	13.447	0.1612	162257.5	Coal
1478	13.212	0.1632	159408.7	Coal
1479	7.257	0.1426	101869.1	Coal
1480	7.835	0.1477	105561.4	Coal
1481	12.631	0.1654	151820.4	Coal
1482	4.506	0.2015	55831.06	Coal
1483				Coal
1484	1.613	0.602	5358.186	Coal
1485	12.266	0.1835	143762.9	Coal
1486	13.331	0.1651	158766.3	Coal
1487	7.064	0.1401	100745.5	Coal
1488	12.843	0.1605	156871.6	Coal
1489	13.53	0.1685	159040	Coal
1490	15.055	0.1677	179609.8	Coal
1491	11.321	0.1502	147339.9	Coal
1492	7.241	0.127	111887.9	Coal
1493	4.389	0.0952	92216	Coal
1494	4.207	0.0913	92163.7	Coal
1495	5.762	0.1158	98519	Coal
1496	8.748	0.1358	124991	Coal
1497	14.48	0.1645	175965	Coal
1498	14.473	0.1653	174923.8	Coal
1499	11.194	0.1462	148540.4	Coal
1500	7.784	0.1431	108135.7	Coal
1501	7.541	0.1573	95858.1	Coal
1502	7.68	0.1481	103990.6	Coal
1503	8.401	0.1655	102122.8	Coal
1504	8.224	0.1544	106739.6	Coal
1505	9.535	0.1483	125350.2	Coal

	O	P	Q	R
1506	11.605	0.1553	147924.1	Coal
1507	8.317	0.141	116511.5	Coal
1508	6.523	0.1307	99721.7	Coal
1509	9.997	0.1543	126232.4	Coal
1510	14.423	0.1697	169611.6	Coal
1511	11.203	0.1545	144218.4	Coal
1512	14.511	0.1619	179332.4	Coal
1513	15.631	0.1711	182695.1	Coal
1514	14.737	0.1686	172700.6	Coal
1515	13.293	0.152	173109.6	Coal
1516	16.635	0.1815	183216.3	Coal
1517	15.67	0.1716	182627.8	Coal
1518	12.901	0.1504	169491.7	Coal
1519	14.135	0.1595	177166.2	Coal
1520	14.074	0.1624	173395.9	Coal
1521	14.071	0.1592	176904.7	Coal
1522	14.743	0.1635	180324.8	Coal
1523	14.585	0.161	181111.5	Coal
1524	10.138	0.1365	142505.2	Coal
1525	0.287	0.273	3490.75	Coal
1526	0.458	0.602	1522.008	Coal
1527				Coal
1528				Coal
1529	5.237	0.602	17397.397	Coal
1530	9.915	0.243	108377.8	Coal
1531	14.009	0.1612	173507.3	Coal
1532	14.363	0.1606	178867.6	Coal
1533	15.149	0.1684	179945.7	Coal
1534	14.158	0.1576	179863.8	Coal
1535	13.035	0.1523	170608.1	Coal
1536	10.838	0.1544	139334.9	Coal
1537	15.215	0.167	182158.6	Coal
1538	14.057	0.162	173008.5	Coal
1539	7.495	0.1478	101553.7	Coal
1540	12.839	0.1532	166571.6	Coal
1541	13.668	0.1644	165319	Coal
1542	12.589	0.1612	156216.5	Coal
1543	12.554	0.156	155834.5	Coal
1544	10.907	0.1444	146824.9	Coal
1545	6.686	0.1252	106157	Coal
1546	6.622	0.1398	94761.4	Coal
1547	6.621	0.1381	95963.9	Coal
1548	6.471	0.1347	96104.4	Coal

	O	P	Q	R
1549	6.372	0.1335	95467	Coal
1550	6.52	0.1377	94699.7	Coal
1551	6.482	0.1374	94360.3	Coal
1552	12.622	0.1778	141425	Coal
1553	8.147	0.1779	90578.9	Coal
1554	12.264	0.1923	127077.8	Coal
1555	13.528	0.2052	131792.3	Coal
1556	13.403	0.2097	127449.5	Coal
1557	10.896	0.1878	114253.6	Coal
1558	13.666	0.2013	135808	Coal
1559	13.331	0.1956	136245.9	Coal
1560	11.875	0.1853	127863.6	Coal
1561	11.41	0.1852	122961.8	Coal
1562	0.366	0.3095	2710.94	Coal
1563	4.734	0.3641	31626.186	Coal
1564	10.407	0.1794	114924.9	Coal
1565	12.905	0.1908	135192.5	Coal
1566	13.637	0.1971	138322.7	Coal
1567	13.342	0.194	137546.1	Coal
1568	12.503	0.1843	135658.7	Coal
1569	12.809	0.1865	137349.6	Coal
1570	12.928	0.1882	137355.3	Coal
1571	12.743	0.1838	138667.1	Coal
1572	13.089	0.1894	138233	Coal
1573	13.028	0.1883	138381	Coal
1574	12.443	0.1799	138322.7	Coal
1575	12.425	0.1832	135658.4	Coal
1576	12.679	0.1823	139075.1	Coal
1577	12.508	0.1813	138004.3	Coal
1578	12.451	0.18	138322.4	Coal
1579	11.917	0.1733	137541.5	Coal
1580	12.067	0.1752	137773.4	Coal
1581	12.491	0.1801	138698.2	Coal
1582	12.536	0.18	139256.8	Coal
1583	11.736	0.1722	136443.1	Coal
1584	11.824	0.1804	131042	Coal
1585	12.215	0.181	134938.7	Coal
1586	12.283	0.1802	136357.6	Coal
1587	12.39	0.1805	137244.3	Coal
1588	12.418	0.1805	137450.8	Coal
1589	12.354	0.179	138042.5	Coal
1590	12.153	0.1797	135283.3	Coal
1591	11.893	0.1803	131693.5	Coal

	O	P	Q	R
1592	11.657	0.1793	129811.4	Coal
1593	12.363	0.1853	133593.3	Coal
1594	12.883	0.1835	140447	Coal
1595	12.639	0.1823	138699.7	Coal
1596	12.695	0.1831	138675.9	Coal
1597	12.353	0.1793	137819.5	Coal
1598	11.751	0.1797	130723.9	Coal
1599	12.139	0.1797	135095.3	Coal
1600	12.606	0.1799	140140.4	Coal
1601	12.678	0.1773	142966	Coal
1602	12.798	0.1821	140569.5	Coal
1603	11.575	0.1804	128241.8	Coal
1604	12.631	0.1874	134799.3	Coal
1605	7.896	0.1752	90010.2	Coal
1606	7.226	0.1658	85797	Coal
1607	8.538	0.1936	92506.8	Coal
1608	0	0.017	5.655	Coal
1609				Coal
1610				Coal
1611				Coal
1612				Coal
1613				Coal
1614	0.096	0.017	11314.645	Coal
1615	6.225	0.141	79128.1	Coal
1616	12.444	0.1812	137483.7	Coal
1617	12.75	0.1811	140734.9	Coal
1618	11.446	0.179	127910.9	Coal
1619	10.489	0.1771	117590.7	Coal
1620	7.385	0.1799	82245	Coal
1621	11.542	0.1814	126637.3	Coal
1622	13.413	0.1866	143734.3	Coal
1623	13.51	0.1894	142676	Coal
1624	11.658	0.1803	127993.6	Coal
1625	13.349	0.1861	143450	Coal
1626	9.282	0.1674	105942.9	Coal
1627	8.15	0.1696	94525.5	Coal
1628	12.821	0.1916	133736.1	Coal
1629	12.729	0.1913	132616.2	Coal
1630	13.521	0.192	140748.1	Coal
1631	9.174	0.1803	101498.5	Coal
1632	7.456	0.1658	89308.4	Coal
1633	5.968	0.1644	72633	Coal
1634	6.183	0.1697	72873.2	Coal

	O	P	Q	R
1635	6.579	0.1743	75502	Coal
1636	8.267	0.1569	100513.8	Coal
1637	4.915	0.1691	58682.01	Coal
1638				Coal
1639				Coal
1640				Coal
1641				Coal
1642				Coal
1643				Coal
1644				Coal
1645				Coal
1646				Coal
1647				Coal
1648				Coal
1649				Coal
1650				Coal
1651				Coal
1652				Coal
1653				Coal
1654				Coal
1655				Coal
1656				Coal
1657				Coal
1658				Coal
1659				Coal
1660				Coal
1661				Coal
1662				Coal
1663				Coal
1664				Coal
1665				Coal
1666				Coal
1667				Coal
1668				Coal
1669				Coal
1670				Coal
1671				Coal
1672				Coal
1673				Coal
1674				Coal
1675				Coal
1676				Coal
1677				Coal

	O	P	Q	R
1678				Coal
1679				Coal
1680				Coal
1681				Coal
1682				Coal
1683				Coal
1684				Coal
1685				Coal
1686				Coal
1687				Coal
1688				Coal
1689				Coal
1690				Coal
1691				Coal
1692				Coal
1693				Coal
1694				Coal
1695				Coal
1696				Coal
1697				Coal
1698				Coal
1699				Coal
1700				Coal
1701				Coal
1702				Coal
1703				Coal
1704				Coal
1705				Coal
1706				Coal
1707				Coal
1708	4.469	0.438	20406.19	Coal
1709	7.706	0.1945	81247.9	Coal
1710	8.327	0.1877	87343	Coal
1711	8.28	0.1989	81927.844	Coal
1712				Coal
1713				Coal
1714	4.428	0.2664	40497.747	Coal
1715	4.946	0.1428	68727.7	Coal
1716	5.655	0.1662	68114.9	Coal
1717	5.67	0.1685	67278.1	Coal
1718	7.506	0.1653	86851.9	Coal
1719	8.968	0.1719	102292.3	Coal
1720	8.091	0.1665	93384.8	Coal

	O	P	Q	R
1721	10.411	0.1809	112317.7	Coal
1722	12.107	0.1897	127519.2	Coal
1723	5.933	0.181	65523.2	Coal
1724	5.637	0.1734	65015.8	Coal
1725	5.994	0.175	68287.1	Coal
1726	11.632	0.1873	124190.8	Coal
1727	12.817	0.1901	134831.5	Coal
1728	10.148	0.1971	102572.4	Coal
1729	10.967	0.1903	114838	Coal
1730	10.541	0.1933	108685.5	Coal
1731	10.099	0.1944	104709.3	Coal
1732	11.128	0.185	119937.2	Coal
1733	12.335	0.1863	132400.3	Coal
1734	11.476	0.1831	125097.3	Coal
1735	5.634	0.163	69201.2	Coal
1736	8.965	0.1672	104952.6	Coal
1737	8.578	0.1829	93431.5	Coal
1738	9.529	0.179	105493.3	Coal
1739	10.64	0.1818	116790.8	Coal
1740	12.342	0.1854	133111.1	Coal
1741	12.969	0.1943	133490.7	Coal
1742	12.349	0.1887	130803.2	Coal
1743	11.828	0.1847	128085.2	Coal
1744	11.705	0.1826	128196.9	Coal
1745	11.881	0.1868	127346.2	Coal
1746	11.702	0.1808	129462.4	Coal
1747	10.659	0.184	115739.8	Coal
1748	12.02	0.1838	130792	Coal
1749	12.123	0.186	130370.2	Coal
1750	11.482	0.1775	129290.2	Coal
1751	11.3	0.1829	123072.6	Coal
1752	8.599	0.187	91642.5	Coal
1753	9.727	0.1793	108278.4	Coal
1754	11.975	0.1859	128759.6	Coal
1755	11.995	0.1834	130811.7	Coal
1756	12.097	0.1856	130403.8	Coal
1757	10.315	0.1891	112714.845	Coal
1758				Coal
1759				Coal
1760				Coal
1761	0.194	0.438	887.315	Coal
1762	7.499	0.3179	58581.1	Coal
1763	12.096	0.185	130735.7	Coal

	O	P	Q	R
1764	12.77	0.185	138053.8	Coal
1765	11.38	0.1849	122688	Coal
1766	9.2	0.184	99808.1	Coal
1767	6.45	0.1754	73479	Coal
1768	8.524	0.1697	101053.9	Coal
1769	10.516	0.1736	119384.4	Coal
1770	9.444	0.172	109265.5	Coal
1771	8.047	0.1685	95769.4	Coal
1772	10.38	0.1702	121750.7	Coal
1773	10.559	0.1678	125411.2	Coal
1774	5.217	0.2412	62648.872	Coal
1775				Coal
1776	2.456	0.3618	16803.254	Coal
1777				Coal
1778				Coal
1779				Coal
1780	0.562	0.438	2565.024	Coal
1781	0.961	0.438	4386.08	Coal
1782	9.656	0.2885	91626.9	Coal
1783	13.631	0.1777	153124.4	Coal
1784	13.954	0.1795	155355.9	Coal
1785	14.702	0.1853	158655	Coal
1786	13.544	0.1742	155485.3	Coal
1787	14.022	0.1786	156981.1	Coal
1788	13.603	0.1772	153456.9	Coal
1789	14.202	0.18	157795.9	Coal
1790	13.166	0.244	125179.655	Coal
1791	13.565	0.1717	158044.2	Coal
1792	13.656	0.1735	157331.2	Coal
1793	13.708	0.1792	152766.4	Coal
1794	11.844	0.1745	135032.9	Coal
1795	8.003	0.1624	98218	Coal
1796	11.182	0.1699	130233.4	Coal
1797	13.825	0.1749	158100.7	Coal
1798	13.951	0.1773	157367.4	Coal
1799	13.86	0.1765	157053.1	Coal
1800	14.325	0.181	158348.9	Coal
1801	13.735	0.1755	156449.2	Coal
1802	11.585	0.1708	133927.6	Coal
1803	2.611	0.2212	28688.656	Coal
1804				Coal
1805				Coal
1806				Coal

	O	P	Q	R
1807	8.344	0.4209	39767.525	Coal
1808	8.906	0.1641	107442	Coal
1809	6.634	0.1588	83574.2	Coal
1810	13.342	0.182	146255.6	Coal
1811	14.195	0.1802	157417.8	Coal
1812	13.356	0.1798	147172.4	Coal
1813	12.502	0.1731	142746.1	Coal
1814	14.546	0.1754	165812	Coal
1815	12.512	0.1738	143819.5	Coal
1816	7.802	0.1587	98117.7	Coal
1817	14.511	0.1763	164365.8	Coal
1818	14.897	0.1759	169418.5	Coal
1819	15.004	0.177	169524.2	Coal
1820	13.424	0.1751	152476.6	Coal
1821	13.578	0.1755	153008.7	Coal
1822	14.747	0.1765	167203	Coal
1823	14.097	0.175	160945.3	Coal
1824	12.435	0.1695	146109.8	Coal
1825	12.427	0.1684	147863.2	Coal
1826	12.431	0.1703	146281.6	Coal
1827	13.89	0.1717	161700.1	Coal
1828	12.777	0.1668	152934.2	Coal
1829	12.781	0.169	151005.9	Coal
1830	11.738	0.1646	141194.2	Coal
1831	13.817	0.1677	164839	Coal
1832	14.241	0.1712	166401.4	Coal
1833	14.508	0.174	166715.7	Coal
1834	14.497	0.175	165707.4	Coal
1835	13.791	0.1708	161453.5	Coal
1836	7.464	0.1635	91100.6	Coal
1837	10.262	0.1673	121151.7	Coal
1838	14.512	0.1776	163556.1	Coal
1839	14.669	0.1785	164279.1	Coal
1840	14.842	0.1789	165930.9	Coal
1841	13.634	0.1698	160111.1	Coal
1842	10.909	0.1714	126620.2	Coal
1843	14.669	0.1793	163580.5	Coal
1844	8.333	0.167	99403	Coal
1845	11.494	0.1701	133479.5	Coal
1846	14.075	0.1737	162139.8	Coal
1847	14.31	0.1728	165643.1	Coal
1848	14.353	0.1712	167651.8	Coal
1849	15.496	0.195	158015.3	Coal

	O	P	Q	R
1850	12.432	0.1705	144136.3	Coal
1851	11.701	0.1718	134345.5	Coal
1852	13.373	0.1738	153412.8	Coal
1853	14.806	0.1803	164188.5	Coal
1854	13.626	0.1814	150641.8	Coal
1855	16.931	0.169	200786.3	Coal
1856	18.914	0.1743	217031.2	Coal
1857	12.628	0.1405	178435.8	Coal
1858	13.259	0.1448	182041.1	Coal
1859	17.401	0.1623	212682.6	Coal
1860	17.27	0.1724	200960.6	Coal
1861	15.158	0.1777	169602.4	Coal
1862	14.446	0.1787	159883.8	Coal
1863	11.337	0.1663	134544	Coal
1864	15.184	0.1713	177286.9	Coal
1865	13.471	0.1716	157122.4	Coal
1866	15.368	0.1762	174460	Coal
1867	15.714	0.1766	177977.8	Coal
1868	15.499	0.1732	179008.7	Coal
1869	13.628	0.1657	163163.1	Coal
1870	14.256	0.1753	162070.9	Coal
1871	15.965	0.1823	175151.8	Coal
1872	15.55	0.1761	176590.9	Coal
1873	15.09	0.1747	172847.6	Coal
1874	15.36	0.1825	167846	Coal
1875	8.636	0.1718	103710.3	Coal
1876	15.297	0.1763	173538.4	Coal
1877	15.731	0.1799	174867.5	Coal
1878	15.633	0.178	175571.7	Coal
1879	14.949	0.1756	170133.1	Coal
1880	15.584	0.1822	170852.2	Coal
1881	16.147	0.1854	174160.1	Coal
1882	14.967	0.1737	172342.6	Coal
1883	15.421	0.1762	175070.7	Coal
1884	7.893	0.164	96270.1	Coal
1885	3.543	0.2055	39685.023	Coal
1886				Coal
1887				Coal
1888				Coal
1889				Coal
1890				Coal
1891				Coal
1892				Coal

	O	P	Q	R
1893	0.873	0.438	3984.02	Coal
1894	6.966	0.3994	39479.646	Coal
1895	10.773	0.1653	127935.5	Coal
1896	8.028	0.1617	99305	Coal
1897	11.246	0.1705	131213	Coal
1898	8.129	0.1638	99396.7	Coal
1899	9.501	0.1757	108164.4	Coal
1900	8.472	0.1702	99515.4	Coal
1901	8.512	0.171	99454.6	Coal
1902	7.789	0.165	94465.2	Coal
1903	8.118	0.165	99179.2	Coal
1904	7.09	0.1458	101351.7	Coal
1905	0.002	0.099	39.534	Coal
1906				Coal
1907				Coal
1908				Coal
1909				Coal
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1916				Coal
1917				Coal

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1	Secondary Fuel Type	Unit Type	SO2 Controls
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	V
1893	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1894	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1895	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1896	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1897	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
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1902	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1903	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1904	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1905	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1906	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1907	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
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1909	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1910	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1911	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1912	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1913	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1914	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1915	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1916	Low NOx Burner Technology w/ Closed-coupled/Separated OFA
1917	Low NOx Burner Technology w/ Closed-coupled/Separated OFA

	W	X	Y
1	PM Controls	Hg Controls	Program Code
2	Wet Scrubber   Electrostatic Precipitator		
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86	Wet Scrubber   Electrostatic Precipitator		





















































































	W	X	Y
1893	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1894	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1895	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1896	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1897	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1898	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1899	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1900	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1901	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1902	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1903	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1904	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1905	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1906	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1907	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1908	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1909	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1910	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1911	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1912	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1913	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1914	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1915	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1916	Wet Scrubber   Electrostatic Precipitator		ARP, MATS
1917	Wet Scrubber   Electrostatic Precipitator		ARP, MATS

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Transalta )  
Centralia Generation LLC )  
\_\_\_\_\_ )

Order No. 202-26-18

Motion to Intervene, Motion for Clarification, and Requests for Rehearing and Stay  
of Sierra Club, NW Energy Coalition, Washington Conservation Action, Climate  
Solutions, Public Citizen, and Environmental Defense Fund  
(collectively, “Public Interest Organizations” or “PIOs”)

Exhibit 2-156:  
NOAA March 15, 2026, Dalles Dam Forecast



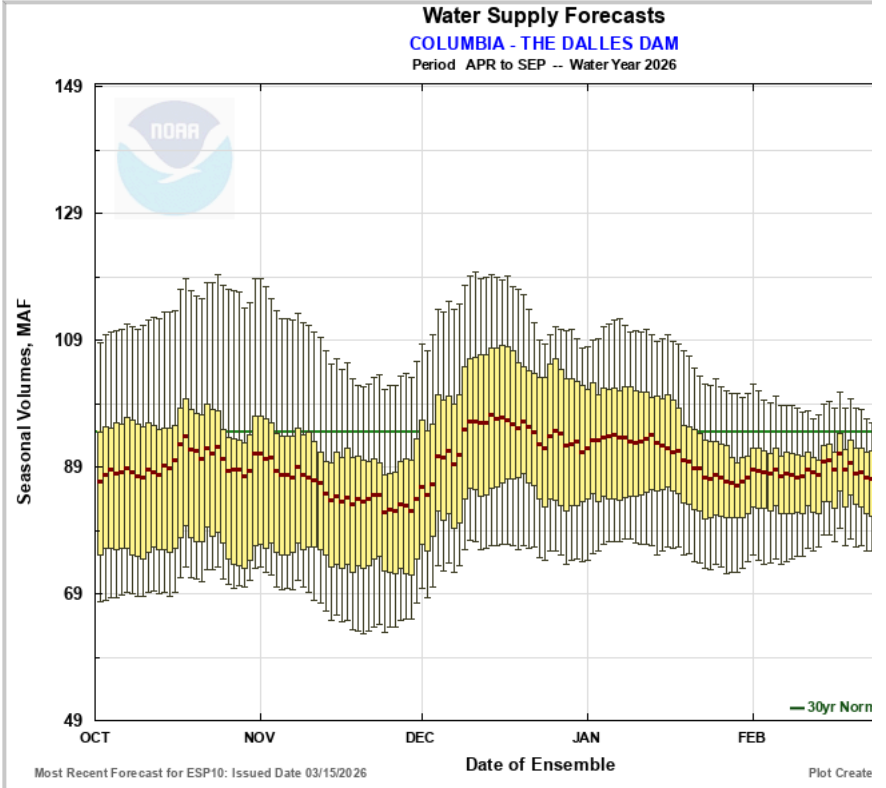
# Northwest River Forecast Center Water Supply Forecasts

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- Verify All Years
- Archive
- Monthly Water Supply Forecasts

Choose Date: 03/15/2026  Archive: Water Year

COLUMBIA - THE DALLES DAM (TDAO3) Forecasts for Water Year 2026					
Official Water Supply					
ESP with 10 Days QPF Ensemble: 2026-03-15 Issued: 2026-03-15					
Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	86032	93415	99	102994	94166
APR-JUL	72976	78425	96	88664	81933
APR-AUG	80557	87403	98	97461	89196
JAN-SEP	109931	117495	101	127227	115946
JAN-JUL	96925	102457	99	112552	103714
OCT-SEP	129816	137381	104	147112	132314
Experimental Water Supply					
HEFS with 15 days EQPF Ensemble: 2026-03-15 Issued: 2026-03-15					
APR-SEP	86380	92214	98	103834	94166
APR-JUL	73436	78830	96	89483	81933
APR-AUG	80954	86648	97	98420	89196
JAN-SEP	110478	115877	100	128038	115946
JAN-JUL	97097	102912	99	113246	103714
OCT-SEP	130364	135763	103	147923	132314
Reference					
ESP with 0 Days QPF Ensemble: 2026-03-15 Issued: 2026-03-15					
APR-SEP	85835	91890	98	105071	94166
APR-JUL	73438	78688	96	90096	81933
APR-AUG	80669	86631	97	99246	89196
JAN-SEP	108504	113845	98	127810	115946
JAN-JUL	95621	101041	97	112781	103714
OCT-SEP	128390	133730	101	147695	132314

Move the mouse over the desired "Forecast Period" to display a graph.



Most Recent Forecast for ESP10: Issued Date 03/15/2026 Plot Create

- Max Scale
- Scale To Data
- Scale To Last 45 Days
- Show Min/Max Ensemble Volume
- Show Tooltips He

**Overlay**

ESP10  HEFS  ESPO

**Data Files**

[CSV \(ESP10 / APR-SEP\)](#)



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BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Transalta )  
Centralia Generation LLC )  
\_\_\_\_\_ )

Order No. 202-26-18

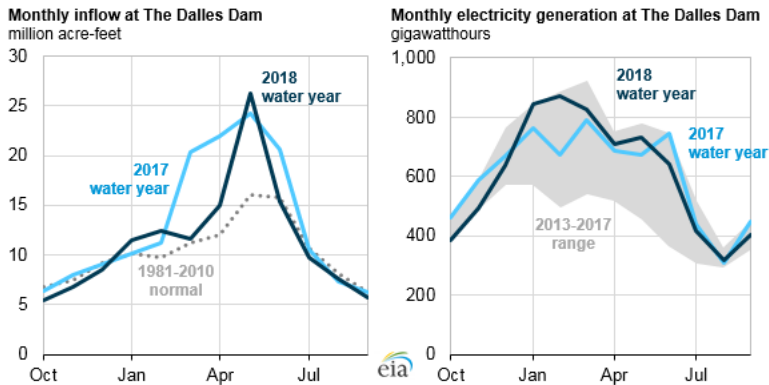
Motion to Intervene, Motion for Clarification, and Requests for Rehearing and Stay  
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Exhibit 2-157:  
EIA 2018 Article

## Today in Energy

September 28, 2018

### Columbia River electric generation in 2018 remains normal despite above-normal water flow



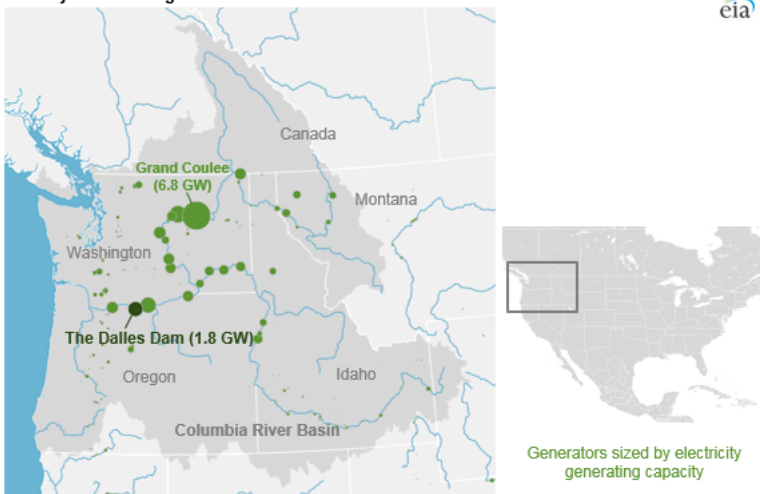
Source: U.S. Energy Information Administration, based on U.S. Army Corps of Engineers [Dataquery](#)

During the 2018 water year that ends September 30, 2018, The Dalles Dam in the Pacific Northwest experienced above-normal inflow—water volume flowing into the dam—but electricity generation from the dam remained relatively normal. The difference between the two is attributed to spilled flow, or water diverted past the dam without generating power. Monthly inflow at The Dalles Dam peaked in May, reaching 63% above normal, but more than half of that volume was spilled, some of which was likely required by a recent court order.

The Dalles Dam, located near the mouth of the Columbia River on the Washington-Oregon border, is one of the country's 10 largest hydroelectric power plants. As a run-of-river hydroelectric plant—as opposed to storage dams with substantial reservoirs—The Dalles Dam has limited storage capacity and generally passes water downstream at the same rate water enters the dam.

Because of its location near the Columbia River mouth, conditions at The Dalles Dam reflect the entire upstream Columbia River system and its many hydroelectric dams. Higher-than-normal inflow at The Dalles Dam typically signifies a wetter-than-normal water year in the Pacific Northwest region. In the past decade, hydroelectricity has accounted for 62% to 77% of the annual electricity generated in Washington, Oregon, and Idaho.

#### U.S. hydroelectric generators in the Columbia River Basin



Source: U.S. Energy Information Administration, [Annual Electric Generator Inventory](#)

The magnitude and timing of water inflow at the Columbia River Basin's dams largely depend on the accumulation and melting of the winter's snowpack. The flow of runoff can be adjusted at several upstream storage projects, many of which are operated by the [U.S. Army Corps of Engineers](#) (USACE).

Even after this modulation, the 2018 water year saw high springtime inflow at The Dalles Dam because of [below-normal temperatures and above-normal precipitation](#) last winter, followed by rapid warming in May. According to USACE, monthly flow volumes at The Dalles Dam this spring ranged from 4% to 63% above normal values established by averaging flows from 1981 through 2010. The total flow through The Dalles Dam during the 2018 water year (October 2017–September 2018) will be 10% above normal.

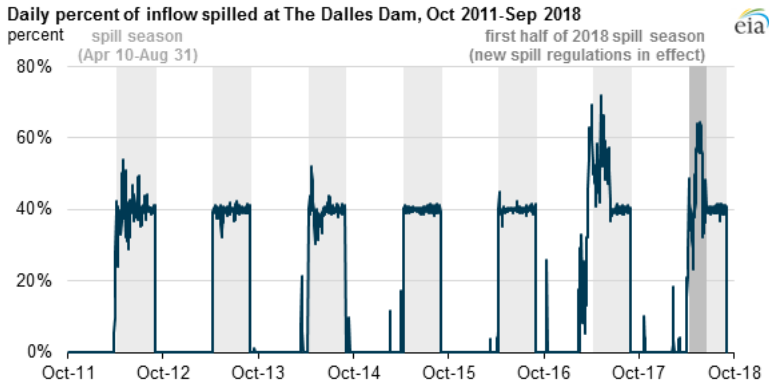
Although snowpack runoff in the Pacific Northwest typically peaks in May, year-to-year variations in weather can affect the timing of the melt onset and peak river flow. The 2017 water year (October 2016 through September 2017) saw high inflows because of [unusually high precipitation in February and March](#)

[2017](#).

Water can be [diverted around a hydroelectric plant's turbines](#), and, depending on the reason for the diversion, is considered voluntary or involuntary spill. Voluntary spill is required by law at some dams to protect marine wildlife. Involuntary spill is an operational decision that occurs at any dam when its plant must pass water downstream in excess of its turbine capacity, usually because of significantly high inflows. The 2018 water year experienced both types of spill, and a new court order in effect for this water year likely increased the voluntary spill at The Dalles Dam.

During the spill season, which lasts from April 10 through August 31, The Dalles Dam must voluntarily spill some of the water that passes through the dam to facilitate fish passage. The required amount had been set at 40% of inflow; however, beginning with the 2018 water year, [USACE's Fish Passage Plan](#) changed the required spill levels for the first half of the spill season, which ended June 15.

During the first half of the spill season, The Dalles Dam must spill the maximum amount deemed safe for fish, based on measurements of total dissolved gas in the water. Spilled water is beneficial because it allows fish to pass by a dam without going through its turbines. However, spilling water over dams makes the water more turbulent, and the extra air bubbles in the water can make fish respiration challenging. The requirement for the second half of spill season remained at 40% of inflow.



Source: U.S. Energy Information Administration, based on U.S. Army Corps of Engineers [Dataquery](#)

The combined effect of the new voluntary spill rules and involuntary spill led to a noticeable variation in daily spill levels this spring, ranging from 23% to 65% of daily inflow. Daily spill averaged 49% of the total inflow during the first half of spill season and averaged 57% during May. As a result, monthly power generation at The Dalles Dam in May was within the previous five-year range even though the monthly inflow at the dam was higher than normal.

**Principal contributors:** Michelle Bowman, Greg Lawson

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Transalta )  
Centralia Generation LLC )  
\_\_\_\_\_ )

Order No. 202-26-18

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Exhibit 2-158:  
NOAA March 15, 2026, Grand Coulee Dam Forecast



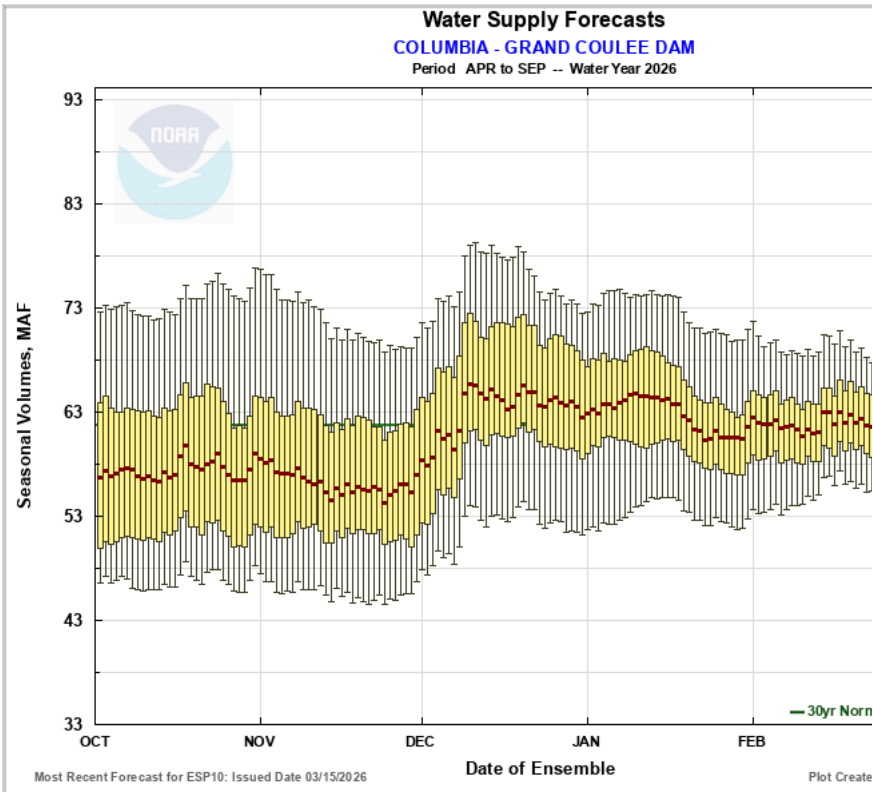
# Northwest River Forecast Center Water Supply Forecasts

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- Verification
- Verify All Years
- Archive
- Monthly Water Supply Forecasts

Choose Date:  Archive:

COLUMBIA - GRAND COULEE DAM (GCDW1) Forecasts for Water Year 2026					
Official Water Supply					
ESP with 10 Days QPF Ensemble: 2026-03-15 Issued: 2026-03-15					
Forecast Period	Forecasts Are in KAF				30 Year Average (1991-2020)
	90 %	50 %	% Average	10 %	
APR-SEP	62660	67945	111	72528	61483
APR-JUL	52660	57025	108	61815	52774
APR-AUG	58994	63594	109	68568	58186
JAN-SEP	74406	79632	113	84382	70457
JAN-JUL	64205	68872	112	73583	61749
OCT-SEP	84965	90191	114	94940	78842
Experimental Water Supply					
HEFS with 15 days EQPF Ensemble: 2026-03-15 Issued: 2026-03-15					
APR-SEP	62346	67002	109	72430	61483
APR-JUL	51681	56927	108	62388	52774
APR-AUG	58710	63274	109	68784	58186
JAN-SEP	74200	78645	112	84344	70457
JAN-JUL	63312	68818	111	74141	61749
OCT-SEP	84758	89203	113	94902	78842
Reference					
ESP with 0 Days QPF Ensemble: 2026-03-15 Issued: 2026-03-15					
APR-SEP	60893	65328	106	71518	61483
APR-JUL	50499	55436	105	61076	52774
APR-AUG	57338	62066	107	67158	58186
JAN-SEP	71932	76478	109	82378	70457
JAN-JUL	61330	66311	107	72333	61749
OCT-SEP	82490	87036	110	92936	78842

Move the mouse over the desired "Forecast Period" to display a graph.



- Max Scale
- Scale To Data
- Scale To Last 45 Days
- Show Min/Max Ensemble Volume
- Show Tooltips He

Overlay

ESP10

HEFS

ESPO

Data Files

CSV (ESP10 / APR-SEP)



BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
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Exhibit 2-159:  
Washington Executive Order 25-05



STATE OF WASHINGTON  
OFFICE OF GOVERNOR BOB FERGUSON

**EXECUTIVE ORDER 25-05**

**DATA CENTER WORKGROUP**

**WHEREAS**, data centers are critical infrastructure supporting Washington State's digital economy, providing essential services that drive innovation and economic growth; and

**WHEREAS**, the data center industry is highly competitive, with states offering various incentives to attract investments; and

**WHEREAS**, data centers consume significant amounts of electricity, which can put additional strain on the local power grid and can necessitate increased energy generation, storage, and transmission; and

**WHEREAS**, locating data centers in Washington State can lead to an increase in jobs and property tax revenue, particularly for rural communities; and

**WHEREAS**, the most recent analysis from the Joint Legislative Audit and Review Committee estimated that data center sales and use tax exemptions saved beneficiaries over \$100 million in the 2017-2019 biennium; and

**WHEREAS**, balancing economic development, state and local tax revenue, energy use, and environmental responsibility is vital to ensuring Washington state remains a leader in both technology and sustainability;

**NOW, THEREFORE**, I, Bob Ferguson, Governor of the state of Washington, by the power vested in me by the Constitution and the statutes of the state of Washington, do hereby order and direct as follows:

1. The Department of Revenue shall establish and lead a Data Center Workgroup.
2. The Workgroup shall include representatives from the Department of Commerce, the Utilities and Transportation Commission, the Department of Ecology, electric utilities, environmental advocacy groups, labor organizations, industry stakeholders, and others, as designated by the Office of the Governor.
3. The Workgroup shall discuss the impacts of data centers on Washington State's economy, tax revenue, energy use, and the environment. The Workgroup will consider policies that balance industry growth, tax revenue needs, energy constraints, and sustainability.
4. By December 1, 2025, the Workgroup shall submit its findings and any policy recommendations to the Governor.

This Executive Order shall be implemented consistent with applicable law. Provisions of this Order are not intended to alter any existing collective bargaining agreements. This Order is not intended to confer and does not confer any legal right or entitlement and shall not be used as a basis for legal challenges to any rule or any other action or inaction of the governmental entities and employees subject to it.

This Order takes effect immediately.

Signed and sealed with the official seal of the state of Washington on this 3rd day of February AD, Two Thousand and Twenty-Five, at Olympia, Washington.

By

/s/

---

Bob Ferguson  
Governor

BY THE GOVERNOR

/s/

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Secretary of State