2025 TOTAL DISSOLVED GAS REPORT

U.S. Army Corps
of Engineers
Northwestern Division

Spill at Bonneville Dam

Columbia Basin Water Management Division
Reservoir Control Center
Water Quality Unit

January 2026

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COLUMBIA RIVER BASIN

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Reservoir Control Center, Columbia Basin Water Management Division
U. S. Army Corps of Engineers, Northwestern Division
Portland, Oregon

Including Material Provided by:
Portland District – U.S. Geological Survey (Portland Office)
Walla Walla District
Seattle District – Columbia Basin Environmental
Fish Passage Center

Table of Contents

Table of Contents ..... **i**
List of Tables ..... **ii**
List of Figures ..... **ii**
List of Appendices ..... **ii**
List of Acronyms ..... **iii**
Terminology **1**
Program Description **4**
State Water Quality Standards (WQS) for TDG 5
Washington Administrative Code 6
Oregon Water Quality Standard Modification 7
Implementation of Gas Abatement Measures 9
TDG Management Operations 10
Operating Conditions **10**
Water Supply and Weather 10
Reservoir Operation 11
Flood Risk Management 14
Observed Flows above 7Q10 14
Water Quality Monitoring **15**
Fixed Monitoring Stations (FMS) 15
TDG Monitoring Plan 15
Quality Assurance/Quality Control on Fixed Monitoring Stations 15
Seattle District Quality Assurance/Quality Control 16
Walla Walla District Quality Assurance/Quality Control 17
Portland District Quality Assurance/Quality Control 18
Fish Passage Spill Program **19**
Spring and Summer Fish Passage Spill Operations 19
TDG Exceedances of the WQS **22**
125% (Spring) and 115%/120% (GBT Exceedance and Summer) TDG evaluation 22
Categories of TDG Exceedances 23
Oregon and Washington maximum two-hour criteria 24
WQS exceedances outside of juvenile fish passage spill 24
Fall and early spring spill for adult steelhead 24
Gas Bubble Trauma Monitoring **25**

List of Tables

Table 1: Snake and Columbia River average unregulated flows in WY 2025 11
Table 2: 7Q10 criteria 15
Table 3: Summary of 2025 spring target spill levels at lower Snake River (April 3 – June 20) and lower Columbia River (April 10 – June 15) projects.....19
Table 4: Summary of 2025 summer target spill levels at lower Snake River (June 21-August 31) and lower Columbia River (June 16-August 31) projects.....20
Table 5: Fall/Winter Surface Spill Operations.....21
Table 7: Summary of TDG exceedances and data quality events. Does not include days when flows are greater than the 7Q10 23
Table 8: TDG exceedance type summary 23

List of Figures

Figure 1: Observed monthly runoff at The Dalles 12
Figure 2: 2025 Bonneville daily project generation flow and spill.....13
Figure 3: Ice Harbor daily project generation flow and spill. 14

List of Appendices

Appendix A Monitoring Stations
Appendix B 2025 Gas Bubble Trauma Monitoring and Data Reporting
Appendix C 2025 FOP BiOp Spill
Appendix D 2025 Summary of TDG Exceedance Tracking
Appendix E 2025 Seattle District TDG Report
Appendix F 2025 Walla Walla District TDG Report
Appendix G 2025 Portland District TDG Report

The appendices to this report are available on the internet:
https://public.crohms.org/tmt/wqnew/tdg_and_temp/2025/

List of Acronyms

The following acronyms are used throughout this report.

BiOp	Biological Opinion
BPA	Bonneville Power Administration
Corps	U.S. Army Corps of Engineers
CRS	Columbia River System
CRSO EIS	Columbia River System Operations Environmental Impact Statement
ESA	Endangered Species Act
FCOP	Flood Control Operating Plan
FMS	fixed monitoring station
FOP	Fish Operations Plan
GBT	gas bubble trauma
kcfs	thousand cubic feet per second
kaf	thousand acre-feet
Maf	million acre-feet
NMFS	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NWRFC	Northwest River Forecast Center
ODEQ	Oregon Department of Environmental Quality
PUD	Public Utility District
QA/QC	quality assurance/quality control
RCC	Reservoir Control Center
Reclamation	United States Bureau of Reclamation
SYSTDG	System total dissolved gas model used to estimate TDG production
TDG	total dissolved gas
TMT	Technical Management Team
TMDLs	Total Maximum Daily Loads
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WDOE	Washington Department of Ecology
WQS	Water Quality Standards
WY	water year

Terminology

The U.S. Army Corps of Engineers (Corps) provides the following definitions used throughout this report.

7Q10 Flows: The average peak annual flows for seven consecutive days that has a recurrence interval of 10 years, and at these flows, the ODEQ and WDOE TDG criteria do not apply.

Action Agencies: The three Federal agencies responsible for the operation of the Columbia River System or FCRPS projects are the Corps, Bureau of Reclamation (Reclamation), and Bonneville Power Administration (BPA).

CRS: The Columbia River System refers to the fourteen federal dam and reservoir projects within the Federal Columbia River Power System that are operated as a coordinated water management system for multiple congressionally authorized project purposes.

Data Quality Events: Data quality event occur when the Corps cannot evaluate TDG levels because the FMS gauge malfunctioned resulting in missing or erroneous data.

Fish Passage Spill (Planned Spill): The Corps provides spill for the benefit of juvenile fish passage at the four lower Snake River and four lower Columbia River dams in accordance with the operative biological opinions and in a manner that is consistent with the Clean Water Act and within the state TDG standards. The Corps also provides spill for the benefit of adult fish passage at the four lower Columbia River dams. Spill operations for juvenile fish passage are consistent with the provisions outlined in the 2020 NOAA Fisheries Columbia River System Biological Opinion (2020 BiOp), the Corps' requirements under the Endangered Species Act, and is the subject of ongoing consultation and communications with the relevant wildlife agencies to ensure consistency with the Act.

Gas Cap: The applicable State TDG WQS (in percent TDG). The TDG standard for the states of Washington and Oregon is 110%. Both states have provided exceptions to the TDG standard for juvenile fish passage spill operations on the lower Snake and lower Columbia rivers.

Hydraulic capacity: The maximum water flow rate that a hydropower facility can pass through the turbines. Capacity can be limited by outages, operating limits, and the carrying of mandatory power reserves by the project.

Forced Spill: Forced spill is driven largely by hydrologic capacity at each dam. It is the quantity of water that exceeds the capacity of a dam to either temporarily store the water upstream of the dam or pass the water through its turbines. In these circumstances, water must be released through the spillway. Forced spill occurs due to either **Lack of Load** or **Lack of Turbine**, but can also occur as a result of the management of reservoirs for flood

risk[1], scheduled or unscheduled turbine unit outages or transmission outages of various durations, passing debris, or any other operational and/or maintenance activities required to manage dam facilities for safety and authorized project uses.

1. **Lack of Load Spill:** Occurs when the available market for hydropower is less than the power that could be produced by the current river flow with available turbine capacity. When BPA cannot access sufficient markets to sell hydropower and there is insufficient storage capability, the river flow must be released over the spillway or through other regulating outlets. Lack of load spill generally occurs during times of high flows (e.g., in the spring when power demands are low both in California and the Pacific Northwest). Releases from upstream storage dams during high load periods (generally morning and evening) can result in high flows at downstream dams during low load periods (e.g., middle of the night), causing lack of load spill. Lack of load spill is managed on a system-wide basis to distribute TDG levels across the Federal projects using the spill priority list.

2. **Lack of Turbine Spill:** Occurs when flows exceed the hydraulic capacity of the available power generation facilities at a specific dam. Lack of turbine spill can be affected by high river flows, planned and unplanned unit outages, planned and unplanned transmission outages, and other transmission constraints. Any of these conditions physically limit the potential for hydropower production. Lack of turbine spill will generally be the amount of project outflow in excess of the maximum amount that can be released through all available generators and other outlet structures (e.g., sluiceways and fish ladders). In general, when this condition occurs, the affected project will be operating at maximum generation, but within the Fish Passage Plan turbine operating criteria capability to minimize the amount of spill.

   Lack of turbine spill can also occur when turbines cannot be used because their capacity must be held in reserve to provide mandatory reserve power capacity (reserves) for contingencies and load balancing. **Reserves** (Reserve Power Capacity) are the amount of generation capacity above the amount currently in use that is immediately available to maintain system reliability. At projects that must carry reserve power capacity, these projects can only be loaded to the maximum available generation minus the reserve capacity allocated to that project. Spill for maintaining reserves primarily occurs at Grand Coulee, Chief Joseph, The Dalles, John Day, Bonneville, and occasionally McNary dams.

[1] The Corps directs operations of storage projects in the Columbia River Basin to manage flood risk. Storage reservoir pools are drafted in the winter and early spring to provide space to capture part of the spring runoff, reducing peak flows in the river. This flood risk management operation may require spill from storage reservoirs, which may result in elevated levels of TDG in the river system. The Corps and other action agencies work to manage system flood risk operations in a manner that reduces the need to spill at levels that exceed TDG water quality standards; however, there are conditions in which fulfilling the Corps' flood risk management authorities necessitates drafting storage reservoirs.

(c) **Special Spill Events:** Occur for the purposes of passing debris or operational and/or maintenance activities required to manage dam facilities for safety and multiple uses. These are infrequent and generally of short duration.

2020 BiOps: The governing NMFS and USFWS Biological Opinions for the Columbia River System.

Percent TDG: Percent of total dissolved gas saturation (TDG) or concentration in the water-body. This may also appear as %TDG in the text or tables.

Performance Standard Spill – Performance standard spill is a NOAA Fisheries term and refers to spill levels intended to meet NOAA's performance standard testing, as described in the 2008 FCRPS Biological Opinion and accompanying administrative record.

Regulatory Methods - The regulatory method refers the TDG calculation methodology determined by the gas cap that applies on a specific date, at a specific location. When and where multiple calculation methods apply, 'regulatory' represents the calculation that results in the greater value.

Spill Cap – The spill level (flow through the spillway measured in kcfs) at each project that is estimated to maximize spill to a level that meets, but does not exceed, the gas cap in the tailrace and the next downstream forebay (if applicable).

Spill Priority List: Identifies the order and amount of spill at the Corps' Columbia River Basin dams and Grand Coulee Dam for management of lack of load spill and the expected TDG production system-wide. The Spill Priority List is used throughout the year during times of forced spill. The Spill Priority List consists of levels based on ascending TDG values, a spill rate for each project that is estimated to produce the TDG values and an order of projects.

TDG Exceedance: An exceedance occurs when TDG levels exceed applicable state water quality standards and applicable TDG modification (Oregon) and criteria adjustments (Washington).

TMT: The Technical Management Team (TMT) is an interagency sovereign technical group responsible for making recommendations on operations for fish to the Federal agencies with authority to operate FCRPS projects. This group is comprised of representatives from sovereign entities including five Federal agencies: BPA, Reclamation, National Oceanic and Atmospheric Administration (NOAA) Fisheries, U.S. Fish and Wildlife Service (USFWS), Corps, four states (Idaho, Oregon, Montana, and Washington), and participating Tribes.

Unit Outage: A unit outage is a period when a generating unit cannot be in operation because of maintenance or repairs.

Program Description

Total Dissolved Gas (TDG) is impacted by the U.S. Army Corps of Engineers' (Corps) projects in the mainstem Columbia and Snake rivers in the states of Oregon and Washington. Flow passing over the spillway of a dam can cause TDG concentrations that are greater than background levels. As TDG travels downstream it is influenced by environmental factors including water temperature and wind. This reports documents conditions and operations observed between October 1, 2024 and September 30, 2025 (water year [WY] 2025), focusing on the spring and summer.

Juvenile fish passage spill occurs from April through August, as specified in the 2025 Fish Operations Plan (FOP). Planned spill 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)[2], 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 incorporated 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 December 2023 Memorandum of Understanding between the National Wildlife Federation et al. plaintiffs, the State of Oregon, the State of Washington, the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Nez Perce Tribe, and the United States. Pursuant to a Presidential Memorandum issued in June 2025, the U.S. Government withdrew from the Memorandum of Understanding. Planned spill operations continued per the 2025 FOP.

This report describes the Corps' Columbia River Basin spill and water quality monitoring program for 2025 and addresses the Corps' reporting responsibilities related to the 2024 Oregon Department of Environmental Quality (ODEQ) TDG modification, the 2020 Washington Department of Ecology (WDOE) TDG rule change, and the 2002 and 2003 TDG Total Maximum Daily Loads (TMDLs) for the lower Columbia and lower Snake rivers.

ODEQ requires an annual TDG report summarizing the spill season and detailing the following: (a) flow and runoff descriptions, (b) spill quantities and durations, (c) quantities of water spilled for fish versus spill for other reasons, (d) data results from the physical and

[2] 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.

biological monitoring programs, including incidences of gas bubble trauma regardless of sample size, (e) evaluation of the relationship between observation of non-salmonid gas bubble trauma monitoring and exposure to elevated TDG levels, (f) biological or physical studies of spillway structures and prototype fish passage devices to test spill at operational levels, and (f) implementation of gas abatement measures identified through adaptive management. This report also includes documentation on the performance of the TDG monitoring system that is required in the Terms and Conditions outlined in the 2020 BiOps.

State Water Quality Standards (WQS) for TDG

The Corps manages spill for fish passage consistent with the State of Washington and the State of Oregon TDG WQS.[3,4] WDOE WQS allows spring juvenile fish passage spill operations to generate specified TDG levels in project tailraces (up to 125% TDG for 12 hours; 126% TDG for 2 hours), so long as the spring juvenile fish passage spill operations do not exceed the spill levels and durations reviewed in applicable ESA consultation documents. The EPA subsequently approved the rule change and found that the ESA consultation documents' language ensures that any spring spill regime using the revised criteria must be performed in accordance with the spill levels and durations evaluated in ESA consultation documents for effects to ESA-listed species of all life stages, including juvenile out-migrating salmonids, resident salmonids, and adult migrating salmonids. EPA's approval of the rule further states that "compliance with the ESA consultation documents is a condition precedent for the revised criteria and so the criteria are not applicable for the purposes of the 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 WDOE from EPA Re: The EPA's Action on Revisions to the [WDOE]'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 ODEQ approved a change to its TDG WQS (up to 125% TDG for 12 hours, 127% TDG for 2 hours), so long as spring spill is "applied in a manner consistent with the applicable requirements of the federal [ESA]." *Order Approving a Modification to the Oregon's Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem dated February 11, 2020, page 4.* Regarding Oregon's 105% TDG criterion, ODEQ clarified that this criterion does not apply to the Columbia River per their 29 January 2024 letter.

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

[4] 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

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:

Washington Administrative Code

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

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

(A) TDG must not exceed:

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

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

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

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

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

(II) Application of the tailrace maximum TDG criteria must be accompanied by a department approved biological monitoring plan designed to measure

impacts of fish exposed to increased TDG conditions throughout the spring spill season. Beginning in the year 2021, plans must include monitoring for non-salmonid fish species and must continue for a minimum of five years, and thereafter as determined by the department.

(III) TDG must be reduced to allowances specified in (f)(ii)(A) of this subsection if the calculated incidence of gas bubble trauma in salmonids (with a minimum sample size of fifty fish required weekly) or non-salmonids (with a minimum sample size of fifty fish required weekly) exceeds:

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

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

Oregon Water Quality Standard Modification

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

1. The total dissolved gas standard for the Columbia River as measured in the tailraces of McNary, John Day, The Dalles, and Bonneville dams is 125 percent for the period from April 1 through June 15.
2. The total dissolved gas standard for the Columbia River as measured in the tailraces of McNary, John Day, The Dalles, and Bonneville dams is 120 percent for the period from June 16 through Aug. 31.
3. These limits do not apply when the stream flow exceeds the seven-day, ten-year frequency flood.
4. The 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 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 11011-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;un
    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 ofnon-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 repott 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.

Implementation of Gas Abatement Measures

The Oregon TDG modification requests an update on the implementation of gas abatement measures through adaptive management. TDG management measures are currently in place for limiting Columbia and Snake River environments to acceptable TDG criteria levels for fish during most of the fish passage season. Significant TDG abatement has been accomplished through structural and operational improvements, but limited opportunities are available for further TDG reduction during flood flow conditions. The 2018 Update to

the TDG Gas Abatement Plan provides the status of the Corps' TDG TMDL implementation activities.

TDG Management Operations

The TDG Management Plan is an appendix to the Water Management Plan (found here: https://public.crohms.org/tmt/documents/wmp/) and describes forced and planned spill, use of the spill priority list, the process for setting spill caps, TDG management policies, and the TDG monitoring program. During spring and summer spill, WDOE's and ODEQ's WQSs use the same method for calculating a daily value of TDG: the average of the 12 highest hourly readings in a calendar day (termed Ave12hrMax). Daily averages are shown in the web report:

https://public.crohms.org/ftppub/water_quality/12hr/.

In 2025, the 12-hour metric was more restrictive than the 2-hour metric.

The spill priority list is a lack of load TDG management tool that has been developed for forced spill that results in exceeding the state TDG standards when lack of load conditions require spill. The Corps works with the region to develop the spill priority list identifying the order in which the projects spill in order to minimize TDG systemwide. This list calls for adding spill incrementally across all federally owned projects to prevent excessively high TDG levels from being generated in concentrated river reaches. Excess spill is spread over Federal projects to hold peak TDG levels to targeted TDG thresholds in 2 to 5 percent increments.

Operating Conditions

Water Supply and Weather

Water year (WY) 2025 streamflow and snowpack conditions were below average across the Columbia River Basin with an April-August runoff volume, measured at The Dalles, of 68.0 Million-acre feet, Maf, or 76 percent of the 30-year average (1991 – 2020). April-August runoff was also below average in the Snake River Basin (above Lower Granite) at 79 percent (Table 1).

For the third year in a row, drought conditions affected the northern half of the Columbia Basin in WY25, while the southern half experienced rapid recovery. There was flooding in November in the Upper Willamette River as a deep area of low pressure funneled copious amounts of moisture over the area. There was also unregulated flooding across southern Oregon throughout the winter, most pronounced in the Willamette Basin. Temperatures continued to trend above long-term averages. However, an Arctic outbreak in February 2025, and rapidly fluctuating water supply forecasts in late March challenged hydropower

and Flood Risk Management (FRM) operations, particularly in basins in the U.S. just before the spring runoff. The spring freshet began slowly across April, and mild days were offset by cold nights in the mountains. An early June heat spell that featured temperatures 10-15 °F (5-8 °C) warmer than average led to the peak of the runoff being about seven days earlier than typical.

Table 1: Snake and Columbia River average unregulated flows in WY 2025[5]

	Snake River at Lower Granite Unregulated Flow (kcfs)	Snake River at Lower Granite % of Average	Columbia River at The Dalles Unregulated Flow (kcfs)	Columbia River at The Dalles % of Average
October	16	86	78	79
November	20	87	79	72
December	22	80	75	93
January	25	75	74	80
February	31	88	83	103
March	62	72	163	83
April	77	106	231	85
May	104	76	365	67
June	59	75	288	68
July	21	69	146	80
August	14	76	93	82
September	15	84	70	89
2025 Water Year Average	39	81	146	77
Apr-Aug Average	55	79	224	76

Reservoir Operation

Generally, reservoir operation objectives include reaching the upper rule curve elevation on or about April 10 at the U.S. storage projects; refill on, or about June 30; and drafting reservoirs to summer draft limits. The observed runoff at The Dalles was below average in every month (Figure 1).

[5] From National Weather Service Runoff Processor (https://www.nwrfc.noaa.gov/runoff/runoff_summary.php). Note: Unregulated Flows exclude the effects of regulation provided by storage reservoirs. Runoff average period: 1991-2020.

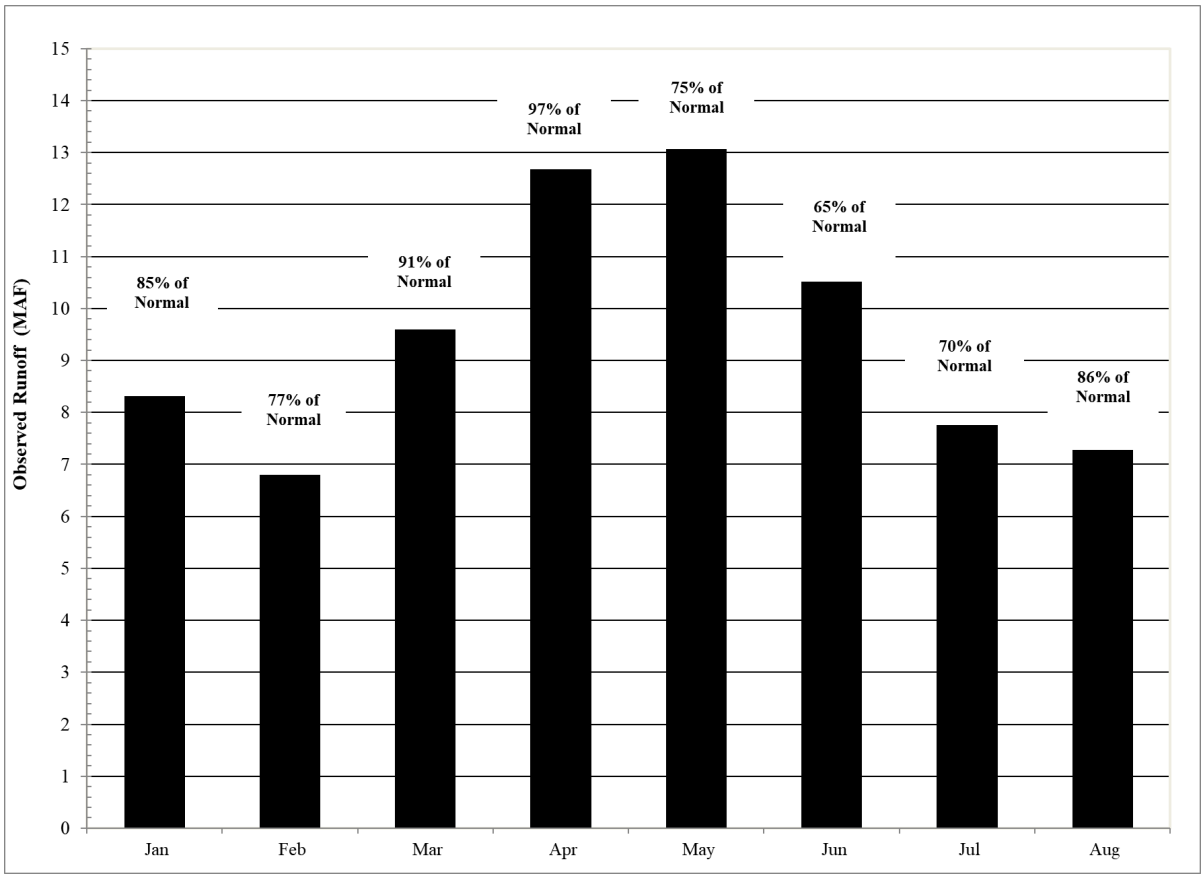

Figure 1: Observed monthly runoff at The Dalles

On the lower Columbia River as measured at Bonneville Dam, daily average total river flow from April 1 through August 31 ranged from 100 to 271 kcfs, averaging 169 kcfs and peaking June 7. A hydrograph for Bonneville Dam representing spill, generation, and miscellaneous flows (summing to total project flow in kcfs) is shown in Figure 2.

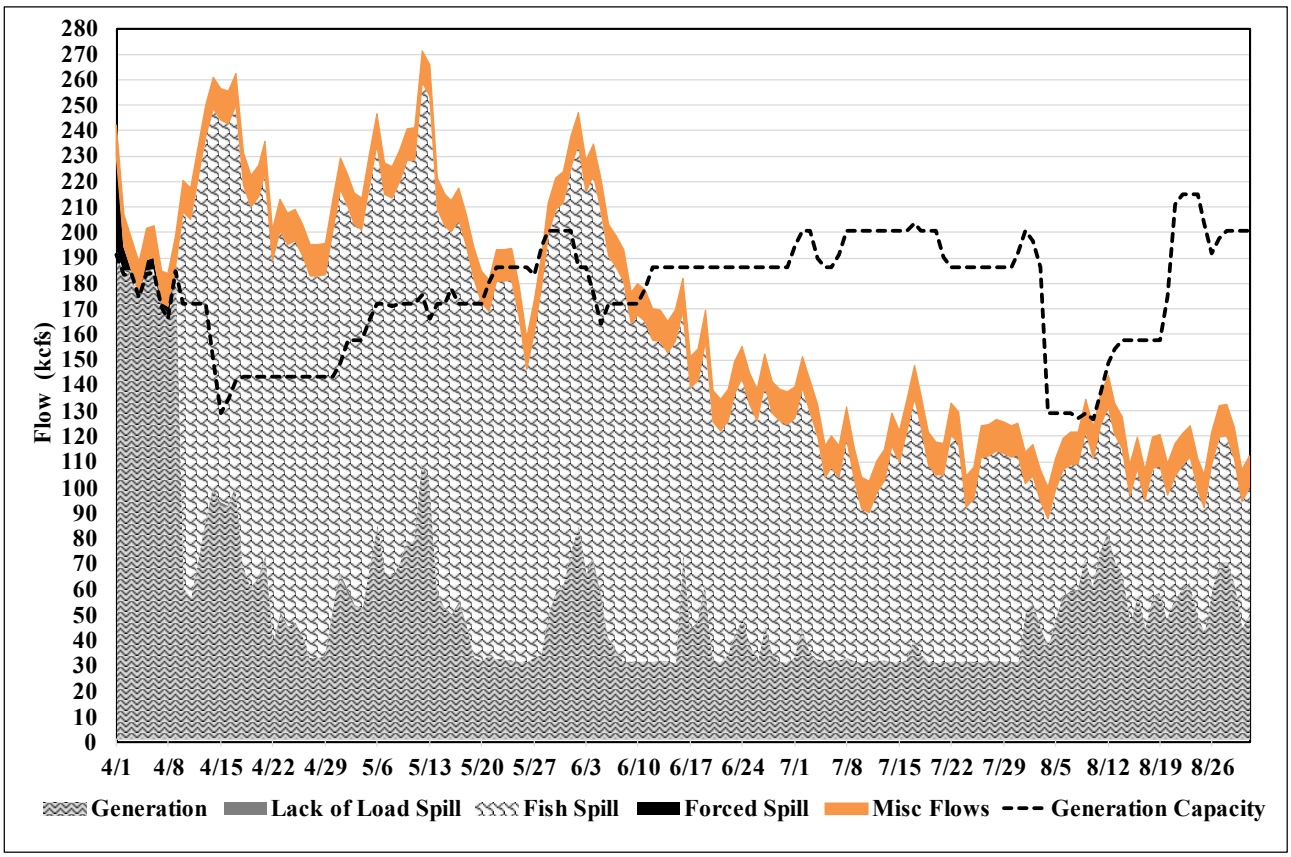

Figure 2: 2025 Bonneville daily project generation flow and spill.

On the lower Snake River as measured at Ice Harbor Dam, daily average total river flow from April 1 through August 31 ranged from 22 to 116 kcfs, averaging 56 kcfs and peaking June 4 (Figure 3). Hydrographs for the remaining lower Snake and Columbia River projects are shown in Appendix C.

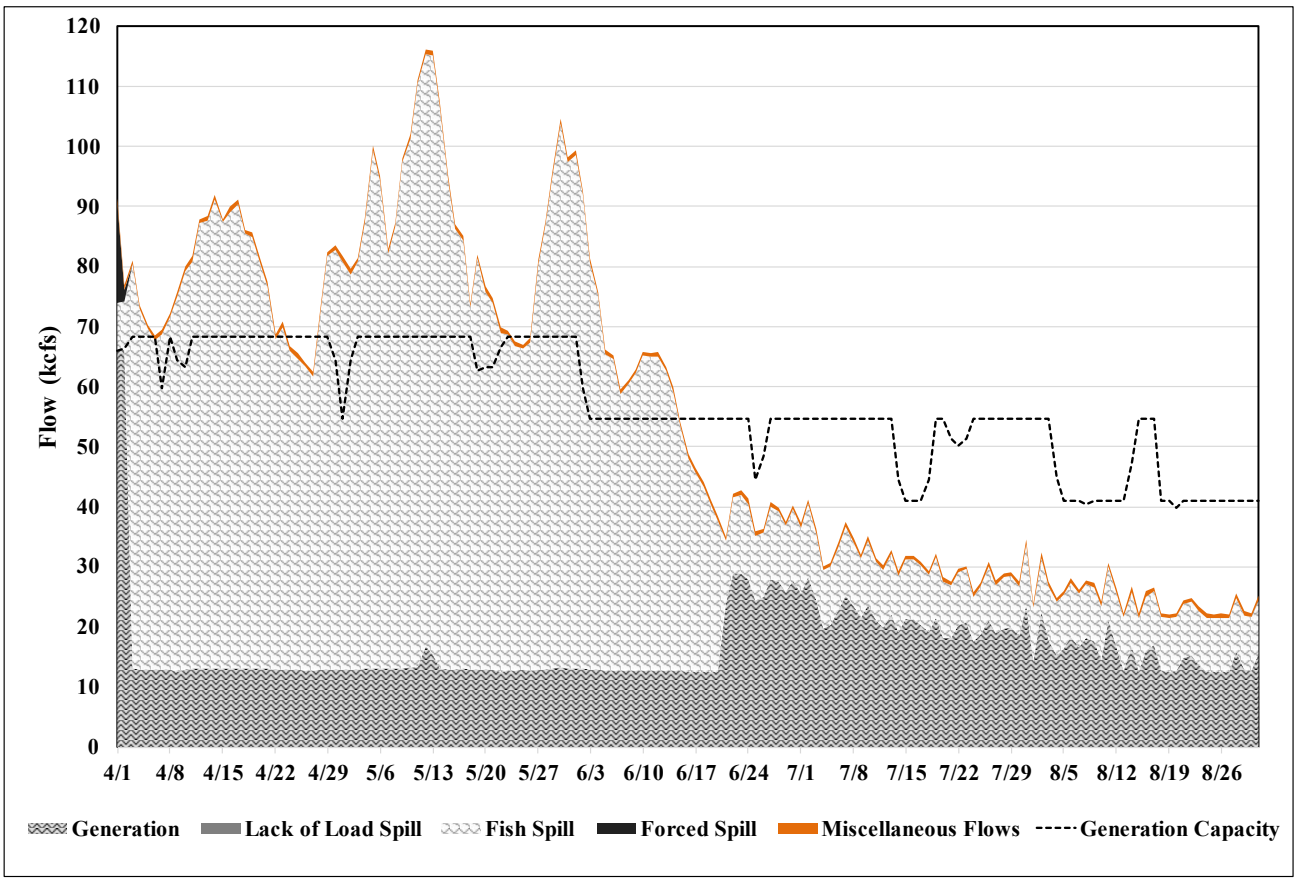

Figure 3: Ice Harbor daily project generation flow and spill.

Flood Risk Management

The Columbia River Basin storage projects were operated to their specified flood risk management requirements based on the information available during the season. The 2025 water supply for the Columbia River Basin at The Dalles was below average, though cool and wet conditions helped slow the spring runoff. Overall, the 2025 runoff volumes were below average for the Columbia River Basin. The regulated peak outflow during the freshet from The Dalles Dam was 257.5 kcfs on 13 May, and the unregulated peak flow was 350.7 kcfs on 01 June.

Observed Flows above 7Q10

Per the state WQS, TDG exceedances are not tracked during 7Q10 high flow periods. The 7Q10 flow criteria are shown in Table 2. No project outflows exceeded the 7Q10 threshold based on the 1975-2019 period of record.

Table 2: 7Q10 criteria

Date	LWG Flows (kcfs)	LGS Flows (kcfs)	LMN Flows (kcfs)	IHR Flows (kcfs)	MCN Flows (kcfs)	JDA Flows (kcfs)	TDA Flows (kcfs)	BON Flows (kcfs)
7Q10 Flow Criteria	**196**	**196**	**196**	**197**	**437**	**440**	**446**	**454**
Total Days Above 7Q10 Level	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Water Quality Monitoring

The Corps monitors the water quality of reservoir releases at the projects throughout the Columbia River Basin to manage fish passage spill operations at the fish passage projects in the lower Snake and lower Columbia rivers, as well as to manage system-wide water quality. The Corps monitors and tracks instances when TDG criteria are exceeded relative to state standards and applicable TDG modifications and criteria adjustments; and, when feasible, adjustments are made to meet the state criteria.

Fixed Monitoring Stations (FMS)

TDG and water temperature are monitored throughout the Columbia River Basin via the FMS gauges. The Corps' Portland, Seattle, and Walla Walla districts operate and maintain the TDG FMSs on the Columbia, Snake, and Clearwater rivers. Portland District is responsible for seven FMSs on the lower Columbia River from John Day Dam to Warrendale. The Seattle District is responsible for two FMSs on the Columbia River at Chief Joseph Dam. Walla Walla District is responsible for 14 FMSs in the lower Snake River and Clearwater River basins, and at McNary Dam on the Columbia River. Appendix A contains detailed information on the Corps' FMS system and a map of their locations.

TDG Monitoring Plan

The monitoring performed by the Corps is part of a larger interagency water quality monitoring system described in the TDG Monitoring Plan that includes the Reclamation and the Washington PUD monitoring systems (as conducted by Douglas County PUD, Chelan County PUD, and Grant County PUD). The TDG Monitoring Plan summarizes the Corps' roles and responsibilities with TDG and temperature monitoring and identifies channels of communications with other cooperating agencies and interested parties. See https://www.nwd.usace.army.mil/CRWM/Water-Quality/ for the most recent version.

Quality Assurance/Quality Control on Fixed Monitoring Stations

The NOAA Fisheries 2020 BiOp, section 2.17.4.1(D), calls for the monitoring of TDG, specifically:

"The Action Agencies shall monitor TDG (including Grand Coulee, Chief Joseph, and Dworshak Dams, and the lower Snake and lower Columbia River dams) and associated biological impacts in the lower Snake and Columbia rivers in coordination with the mid-

Columbia Public Utility Districts. This program will be developed in coordination with NMFS and relevant agencies or partners, and documented in the Water Quality Plan when periodically updated. A TDG monitoring plan will specify monitoring locations, sampling methodologies, calibration and maintenance of monitoring equipment, QA/QC, data collection and reporting, and archival storage in the Corps' online database. "

The Corps' districts operate the FMSs according to the TDG Monitoring Plan and prepare annual performance reports for the FMS operation. The 2025 reports are included as Appendices E, F, and G. Highlights from these reports are provided below.

Seattle District Quality Assurance/Quality Control

Seattle District maintains and operates the forebay and tailwater TDG FMSs at Chief Joseph Dam. The highlights of the Seattle District QA/QC report are:

- Data completeness for TDG data received was 99.5 percent at the forebay station (CHJ) and 99.4 percent at the tailwater station (CHQW). Data completeness for temperature data received was 99.5 percent at station CHJ and 98.2 percent at station CHQW. Missing TDG and temperature data at both stations were largely due to Data Collection Platform (DCP) malfunctions and programming problems.
- For TDG data, a total of four hours were rejected at the forebay station (CHJ) station and five hours at the tailwater station (CHQW) due to slow probe response time after recalibration. For temperature, a total of two hours were rejected at the forebay station (CHJ) and five hours at the tailwater station (CHQW) due to slow probe response time after recalibration. In addition, for temperature a total of 65 hours were rejected at the tailwater station (CHQW) due to a bad temperature sensor.
- Laboratory calibration data were good and generally within 0.1°C for temperature and two percent saturation for TDG. Field calibration data were good and generally within 1mm Hg of the secondary standard barometer, 0.2°C of the secondary standard thermometer, and 1 percent saturation of the secondary standard TDG instrument.
- The TDG sensors were removed from the field after two weeks of deployment and calibrated in the laboratory.
- A total of 24 out of 24 (100%) in-situ field checks of total-dissolved-gas sensors with a secondary standard were within ± 2 percent after two weeks of deployment in the river.

A total of 26 out of 26 (100%) in-situ field checks of barometric pressure were within ±2 mm Hg of a secondary standard, and 18 out of 24 (75%) water temperature field checks were within ±0.2°C.
A detailed QA/QC report on the Seattle District gauges can be found in Appendix E.

Walla Walla District Quality Assurance/Quality Control

Walla Walla District is responsible for maintaining and operating the forebay and tailwater TDG FMS stations at Dworshak, Lower Granite, Little Goose, Lower Monumental, Ice Harbor, and McNary dams. The highlights of the Walla Walla District QA/QC report include:

- Data completeness for BP was 99.86 percent, TDG was 98.95 percent, and temperature was 99.86 percent for the 14 sites operated in 2025.
- TDG data from the individual FMS stations ranged from 93.46 to 100.00 percent complete. Defective membranes accounted for the highest cause of incomplete data at 63 percent with the next highest cause being sediment buildup in the deployment pipe at 31 percent.
- The TDG sensors from the six annual FMS stations were calibrated in the laboratory at four-week intervals from September 2024 through March 2025. The 15 FMS stations were removed from the field and calibrated in the laboratory every three weeks from April 2025 through August 2025. The seasonal FMS were shut down for the season in September 2025 and the remaining stations again went back to being calibrated on four-week intervals.
- There was a total of 164 sensor pre deployment checks that had a calculated mean difference in ambient pressure of -0.37 mmHg, a mean of -0.24 mmHg for the difference in ambient pressure plus 300 mmHg, and a mean of 0.12 °C for the difference in temperature. For the 148-post deployment checks the calculated means for the differences in ambient pressure, ambient pressure plus 100 and temperature are as follows: -0.22 mmHg, -0.64 mmHg, and -0.30 °C.
- From the 115 station visits the calculated median values for the in-situ field checks were as follows:
    1. TDG; -0.14 % Saturation with the station medians ranging -0.40 % for the minimum and 0.10 % for the maximum
    2. BP; 0.00 mmHg with the station medians ranging from -0.35 for the minimum and 0.20 for the maximum.
    3. Temperature; 0.00 °C with the station medians ranging from -0.04 for the minimum and 0.04 for the maximum.
- Station repairs and maintenance were also completed during the 2025 water year:
    1. Began steps to update the Dworshak tailwater (DWQI) station box with an updated DCP to improve the functionality of the station moving forward.
    2. Blowouts with compressed air were completed on affected tailwater stations (ANQW, LMNW, PAQW) to clear out sediment buildup that was affecting data.

A detailed QA/QC report on the Walla Walla District gauges can be found in Appendix F.

Portland District Quality Assurance/Quality Control

Portland District maintains and operates the forebay and tailwater gauges at John Day, The Dalles and Bonneville dams. This work is performed through a contract with the Portland, Oregon Office of the USGS. The highlights of the Portland District QA/QC report include:

- Data received in real-time from the seven individual monitoring sites ranged from 87.1 percent (Bonneville forebay – faulty barometer) to 99.9 percent complete (Cascade Island).
- Criteria for real-time data completeness (95 percent) were met at all monitoring stations except Bonneville forebay (87.1 percent). A slow increase in amplitude of barometric pressure measurements was initially addressed by changes to the barometric pressure offset, rewiring, and finally replacement of the barometer which resolved the erroneous BP data. BP data from Cascade Island, less than 500 feet immediately downstream from Bonneville forebay, can be used as a surrogate for BP at Bonneville forebay. Although 602 BP data were eventually deleted, excluding that period, data completeness was 100 percent at the Bonneville forebay site.
- Fifteen of the 91 barometric pressure field checks (excluding 2 faulty barometer field checks) had comparison data larger than ±1.0 mmHg of primary standard values. BP discrepancies larger than ±1.0 mmHg are the result of the difference in precision of the digital reference and field barometers, where the reference barometers measures barometric pressure to a level of precision of 0.1 mmHg, whereas the field barometers measure barometric pressure to a level of precision of 1 mmHg.
- All 89 water-temperature field checks were within ±0.2 °C of a secondary standard, ranging from -0.16 to +0.11 °C.
- 73 of 89 TDG sensor field checks were within approximately ±0.5 percent saturation of a secondary standard sensor, and 15 sensor field checks exceeded this guideline. After deployment in the river, seven comparisons outside of the criteria were likely because of incomplete equilibration of the reference sensor after deployment for 50 to 107 minutes during periods of low to no spill. No data were deleted or corrected. Eight checks exceeded the criteria because of ruptured TDG membranes that resulted in deleted data at five of the seven stations. Three ruptured membranes occurred during a 25-day period at The Dalles tailwater, and appear to be the result of aquatic wildlife web-building.
- All 128 TDG sensor laboratory checks performed after field deployment were within ±0.3 percent saturation of a primary standard at ambient air pressure and at ambient air pressure plus 300 mmHg.
- Large woody debris at Bonneville forebay and macrophytes at The Dalles forebay prevented the retrieval of the deployed site sondes from June 12 and August 13, respectively, until after the end of the spill season. Site visits during this time consisted of typical field check procedures, excluding removing and replacing the deployed site sonde with another checked and calibrated sonde. All comparisons

of the secondary standard temperature and TDG sensors with the field temperature and TDG sensors were within ±0.20 °C, and ±3 mmHg, respectively.

A detailed QA/QC report on the Portland District gauges can be found in Appendix G.

Fish Passage Spill Program

Operation of the federal Columbia River System projects to meet multiple authorized purposes can result in exceedances of percent TDG state water quality standards. This section provides detailed information on the implementation of fish passage spill as well as forced spill (e.g., lack of turbine, lack of load, transmission constraints, etc.).

Spring and Summer Fish Passage Spill Operations

The 2025 FOP[6] provides detailed information on spill and transport operations at the Corps' four lower Snake River and four lower Columbia River projects. Fish passage spill quantity can be a specified level or a spill rate estimated to result in TDG target, referred to as the "gas cap spill". The maximum project spill level that meets but does not exceed the gas cap is referred to as the spill cap. 2025 target spill operations for spring and summer are summarized in Table 3 and Table 4, respectively.

Table 3: 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 [A, C]	April 3 - June 20	24 hours/day: 125% Gas Cap
Little Goose [B, C]	April 3 – June 20	125% Gas Cap 24 hours/day (until adult criteria met) *then* 16 hours/day: 125% Gas Cap; 8 hours/day: 30% of outflow (Performance Standard)
Lower Monumental [A]	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 [D]	April 10 – June 15	Daytime hours: 40% of outflow; Nighttime hours: 125% Gas Cap
The Dalles [E]	April 10 – June 15	24 hours/day: 40% of outflow (Performance Standard)
Bonneville [F]	April 10 – June 15	24 hours/day: 125% Gas Cap

[6] https://public.crohms.org/tmt/documents/fpp/ 2025/final/FPP25_AppE_04-08-2025.pdf

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.

Table 4: Summary of 2025 summer target spill levels at lower Snake River (June 21-August 31) and lower Columbia River (June 16-August 31) projects

Summer Spill[A]	EARLY SUMMER SPILL[A] (June 21/16 – July 31) (24 hrs/day)	LATE SUMMER SPILL[A] (August 1 – August 31) (24 hrs/day)
Lower Granite [B]	18 kcfs	RSW flow (as river flow allows)
Little Goose [B, C]	30%	ASW flow or 7 kcfs
Lower Monumental [B, D]	17 kcfs	RSW flow or 8 kcfs
Ice Harbor [B, E]	30%	RSW flow or 9 kcfs
McNary [F]	57%	2 TSWs flow or 20 kcfs
John Day	35% [G]	2 TSWs flow [H] or 20 kcfs
The Dalles	40% [G]	30% [G]
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 ±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.

The Corps tracks the rate of spill that occurs at the eight fish passage dams as part of the FOP Implementation Report requirements. Fish passage spill quantities are shown in monthly graphs of the flow, FOP spill, and generation for April through August. These monthly graphs are included in the monthly FOP implementation reports (https://public.crohms.org/tmt/documents/FOP_Implementation_Reports/Older/).

In addition to spring and summer spill for juvenile fish, surface spill was provided for adult steelhead passage per Table 5.

Table 5: Fall/Winter Surface Spill Operations.

Project	Dates	Hours	Notes
LWG, LGS, LMN, IHR, MCN	March 1 – March 20	4 hours/day in the morning, 7 days/week	LGS SW in high crest (~7 kcfs). MCN TSW in spillbay 20.
	March 21 – April 2 (Snake projects) or April 9 (MCN)	24 hours/day, 7 days/week	
	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.

The daily flow, FOP spill, and generation rates for April through August are further summarized in Tables C-3 through C-10 of Appendix C. The flow, generation, actual and FOP fish passage spill for the 2025 spill season at each dam is graphed for the entire April through August spill season and included in Appendix C as Figures C-1 through C-8.

TDG Exceedances of the WQS

Exceedance reporting in this section is consistent with the Corps' TDG Management Operations described in previous sections of this document.

125% (Spring) and 115%/120% (GBT Exceedance and Summer) TDG evaluation

Table 7 provides a summary of TDG exceedances and data quality events during the spill season for the lower Columbia and lower Snake rivers. There was a total of 15-gauge days in which the TDG levels were above the applicable TDG criteria and 30 gauge days in which there was a data quality event and TDG could not be evaluated. TDG exceedances are evaluated by day in Appendix D.

Table 6: Summary of TDG exceedances and data quality events. Does not include days when flows are greater than the 7Q10

Fixed Monitoring Stations	Exceedances	Data Quality Events
Lower Granite Forebay (LWG)*	0	0
Lower Granite Tailwater (LGNW)	1	7
Little Goose Forebay (LGSA)*	0	1
Little Goose Tailwater (LGSW)	0	2
Lower Monumental Forebay (LMNA)*	0	0
Lower Monumental Tailwater (LMNW)	0	6
Ice Harbor Forebay (IHRA)*	3	0
Ice Harbor Tailwater (IDSW)	0	0
McNary Forebay (MCNA)*	0	0
McNary Tailwater (MCPW)	11	0
John Day Forebay (JDY)*	0	6
John Day Tailwater (JHAW)	0	2
The Dalles Forebay (TDA)*	0	2
The Dalles Tailwater (TDDO)	0	4
Bonneville Forebay (BON)*	0	0
Bonneville Tailwater (CCIW)	0	0
Total	15	30

* Evaluated during spill reduction for GBT exceedance and summer spill only.

Categories of TDG Exceedances

The Corps tracked the daily TDG exceedance types for the forebay and tailwater of each of the Corps' Columbia and Snake River projects during the 2025 spill season. Each type of TDG exceedance represents conditions that cause daily average percent TDG to exceed the applicable WQS. Exceedance tracking results are summarized in Table 7. The daily TDG exceedance type designation given for each occurrence is based on the Corps' determination of causation. Notably, there were no exceedances due to forced spill during the fish passage season. Additionally, flows were low during the transition from spring to summer spill, so there were also no exceedances caused by the shift between WQS. Most exceedances in 2025 occurred below McNary during summer spill due to the low-flow spill pattern. A new, more uniform "gas abatement" spill pattern was coordinated with regional salmon managers and implemented starting on July 14.

Table 7: TDG exceedance type summary

TDG Exceedance Type	Definition	Quantity
Forced Spill Exceedance	TDG WQS exceedance due to spill above the FOP spill level.	**0**
Mechanical Exceedance	TDG WQS exceedance due to the operation or mechanical failure of non-generating equipment.	**11**
Uncertainty Exceedance	TDG WQS exceedance due to uncertainties when using best professional judgment, SYSTDG model and forecasts.	**4**

Transition Exceedance	TDG WQS exceedance due to change in the spill operation and WQS from spring to summer.	**0**
GBT Exceedance	TDG WQS exceedance during spill reduction following GBT exceedance.	**0**

Oregon and Washington maximum two-hour criteria

During the 2025 spill season, there were two gauge days when TDG readings exceeded either the Washington two-hour standard of 126% TDG or the Oregon two-hour standard of 127% TDG at the tailwater gauges during the spring (Appendix D). Both exceedances (127% TDG) were observed below Lower Granite Dam after the sensor was repaired following four days of erroneous data. Spill did not exceed the spill cap during this time. There were no gauge days during summer spill in which the two-hour standard of 125% TDG was exceeded.

WQS exceedances outside of juvenile fish passage spill

There are occasional exceedances of the 110% TDG criteria during periods when juvenile fish passage spill is not occurring, typically September through March. There are also occasions when there is missing data. TDG values are reported here: https://public.crohms.org/ftppub/water_quality/12hr/

Outside the juvenile fish passage spill period in WY 2025, TDG exceedances are typically due to forced spill from high flows and high TDG levels from fish ladders. The following TDG exceedances are notable either for duration or spatial extent:

- Lower Granite Dam was operated at station service during the following periods as part of the T1C Transformer Rehab: December 4-18, and January 20-February 6. A minimum spill of approximately 3.4 kcfs was coordinated during speed-no-load operation to dilute high TDG levels at the gauge.
- The Cascade Island gauge (CCIW) is immediately downstream of the Bonneville spillway and is not influenced by the flow and TDG from the powerhouses. During the period without juvenile fish passage spill (i.e. September to March), CCIW will exceed criteria due to TDG generated in the fish ladders. This elevated TDG is associated with relatively low flows and does not impact the downstream, well-mixed Warrendale gauge (WRNO). CCIW is a seasonal gauge. The Warrendale gauge (WRNO) is used to evaluate TDG downstream of Bonneville Dam during the period without juvenile fish passage spill.

Fall and early spring spill for adult steelhead

Per the FOP, surface-oriented spill is conducted via the spillway weir, for adult steelhead that overshoot and then migrate back downstream through McNary Dam and the lower Snake River dams four hours per day, seven days per week, from September 1 until November 15 and from March 1 to March 21. At John Day, surface spill occurs from March 21- April 9 for 24 hours per day, 7 days per week. In WY 2025, there were no exceedances of the 115%/120% WQS during spill for adult steelhead in the tailwaters of

the lower Snake River Project. Per an extension of the beginning date of the 2020 EQC Order from ODEQ, the WQS in the mainstem Columbia River was 125% TDG during the month of March. There were no exceedances in September through November at McNary dam of the 110% TDG WQS.

Gas Bubble Trauma Monitoring

As part of the TDG monitoring program, the NOAA Fisheries 2020 BiOp, section 2.17.4.1(D), specifies that the TDG monitoring program will include:

> " …a biological smolt monitoring component to assess GBT symptoms in smolts at selected smolt monitoring locations, especially between April 3 and June 20 when the flexible spring spill operation is being implemented. TDG pressure and percent saturation, water temperature, and barometric pressure must be sampled on at least an hourly basis. This information, and the results of biological monitoring shall be shared with resource agencies on a near real-time basis. This will reduce take by ensuring that incubating eggs and fry or migrating juvenile and adult salmon and steelhead are not exposed to TDG levels higher than anticipated and that the effects of increased exposure to TDG are not more severe for juvenile and adult migrants than expected."

The Fish Passage Center compiles a yearly report of Gas Bubble Trauma (GBT) monitoring results (Appendix B). The monitoring of juvenile salmonids in 2025 for GBT was conducted at five Columbia and Snake River projects as part of the Smolt Monitoring Program. Sampling occurred two days per week at the Columbia River sites and one day a week at each of the Snake River sites during 2025 fish passage spill operations. The goal of the GBT monitoring program is to sample 100 salmonids during each day of sampling at each site, limited to Chinook and steelhead. The eyes and unpaired fins of specimens were visually examined for the presence of bubble using magnification scopes. The GBT action criteria for spill curtailments is 15% of fish showing any signs of fin GBT, or 5% of the fish showing severe signs of fin GBT. Signs of fin GBT are deemed severe when ≥26% of an unpaired fin is covered with bubbles. Of the 7,823 juvenile salmonids examined, 33 had signs of GBT between April and August (see Appendix B, Table B-8).

GBT monitoring of native resident non-salmonids (NRN) was conducted by the U.S. Geological Survey in 2025 at four locations in the spring: below Lower Granite, Ice Harbor, McNary, and Bonneville with a goal of collecting 100 samples per sampling day. Fish were collected at each location weekly (3 April to 20 June) during the spring spill period by backpack electrofishing and beach seining[7].

[7]Report will be searchable at the following site once posted: https://www.cbfish.org/PiscesPublication.mvc/SearchByTitleDescriptionAuthorOrDate

Of the 4,112 non-salmonids examined, 124 had signs of GBT between April and August (see Appendix B, Table B-9). The most common non-salmonid species collected and examined were sculpin and northern pikeminnow. Under the summer non-salmonid monitoring program mandated by ODEQ, 2 total non-salmonids were examined by the SMP crews at BON and MCN (see Appendix B, Table B-7).

The action criterion of 15% fin GBT (or 5% severe fin GBT) was not met or exceeded in 2025 in either salmonid or non-salmonid samples.