



— BUREAU OF —  
RECLAMATION

# 2023 Water Year: Annual Report

**Bureau of Reclamation Report on Monitoring and Implementation Activities Associated with the U.S. Fish and Wildlife Service 2005 Biological Opinion for Operation and Maintenance of the Bureau of Reclamation Projects in the Snake River Basin above Brownlee Reservoir**

**Columbia-Pacific Northwest Region**



## **Mission Statements**

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities.

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

Cover photograph: Springtime ice on Arrowrock Reservoir, Boise County, Idaho (Reclamation photograph by Dmitri Videgar).

# Table of Contents

<b>Acronyms and Abbreviations.....</b>	<b>v</b>
<b>1. Introduction .....</b>	<b>1</b>
1.1. Bull Trout .....	2
1.2. Snake River Snails .....	3
1.3. Yellow-Billed Cuckoo.....	4
<b>2. Summary of 2023 Operations .....</b>	<b>4</b>
2.1. Idaho.....	5
2.1.1. Boise River Basin Operational Indicators.....	5
2.1.2. Payette River Basin Operational Indicators.....	11
2.2. Oregon.....	13
2.2.1. Malheur River Basin Operational Indicators .....	14
2.2.2. Powder River Basin Operational Indicators.....	16
<b>3. Bull Trout.....</b>	<b>19</b>
3.1. Boise River Basin .....	19
3.1.1. Boise River Basin Data Collection.....	20
3.1.2. Arrowrock Water Quality Modeling .....	20
3.1.3. Historic Data Management – Boise River Bull Trout Weirs .....	20
3.1.4. Fish Sampling.....	21
3.1.5. Other Activities.....	21
3.2. Payette River Basin – Deadwood River System .....	24
3.2.1. Deadwood River Basin Data Collection.....	24
3.2.2. Fish Sampling.....	24
3.3. Malheur River Basin – Beulah Reservoir and the North Fork Malheur River.....	26
3.3.1. Prey Base Monitoring.....	26
3.3.2. Temporary Water Lease.....	27
3.3.3. Trap-and-Transport Efforts.....	27
3.3.4. Other Activities.....	28
3.3.5. Malheur River – Redd Counts .....	28
3.4. Powder River Basin – Phillips Reservoir .....	29
3.4.1. Bull Trout Monitoring.....	29
3.4.2. Other Activities.....	30
3.5. Agency Coordination and Conservation Recommendations.....	30

<b>4. Snake River Physa.....</b>	<b>33</b>
<b>5. References .....</b>	<b>35</b>

## List of Figures

Figure 1. Known distribution of bull trout populations (shaded areas on map) associated with Reclamation facilities in the upper Snake River basin (Reclamation 2004).....	3
Figure 2. Anderson Ranch Reservoir elevation (feet above sea level) for WY23.....	7
Figure 3. Anderson Ranch Reservoir storage volume (acre-feet) for WY23. The straight line represents Reclamation’s Operational Indicator minimum threshold of 62,000 acre-feet of storage. ....	7
Figure 4. Arrowrock Reservoir storage volume (acre-feet) for WY23. The straight red line represents Reclamation's Operational Indicator of reservoir volume of 200,000 acre-feet. Reservoir volume should exceed this minimum at the end of June, depicted by the dotted circle. On June 30, 2023, Arrowrock Reservoir storage volume was 240,236 acre-feet.....	10
Figure 5. Arrowrock Reservoir surface elevation (feet above sea level) for WY23 and discharge (cfs). The straight red line represents Reclamation’s fall minimum elevation threshold (September 15-October 31) of 3,100 feet, depicted by the dotted circles. ....	10
Figure 6. Deadwood Reservoir storage volume (acre-feet) for WY23. The straight red line represents Reclamation’s Operational Indicator minimum threshold of 50,000 acre-feet of storage. ....	13
Figure 7. Beulah Reservoir storage volume (acre-feet) for WY23. The straight red line represents Reclamation’s Operational Indicator minimum threshold of 2,000 acre-feet +/- 80 acre-feet of storage. The lowest reservoir volume during the reporting period occurred on October 1, 2022, when carryover storage measured 1,045 acre-feet. Storage increased from October 1 until drafting began at the end of June 2023.....	16
Figure 8. Phillips Reservoir storage volumes (acre-feet) for WY23. Minimum active storage occurs when pool elevation reaches 4,009 feet above sea level (3,100 acre-feet of storage), corresponding to the point of inactive storage indicated by the red line. ....	18
Figure 9. Phillips Reservoir surface elevation (feet above sea level) for WY23. The operational indicator spring/summer minimum for mean daily reservoir elevation of 4,048 is indicated by the red line.....	18
Figure 10. Powder River inflows to Phillips Reservoir in WY23 measured in cfs and recorded at USGS Gage No. 13275105, Powder River at Hudspeth Lane near Sumpter, Oregon.....	19

Figure 11. Data on bull trout redd trends observed in the North Fork Malheur River watershed (North Fork Malheur River) and carryover storage at the start of the water year in Beulah Reservoir for water years 1992–2023. The number of redds observed after 2007 has been adjusted by one to reflect the reduced size of the area surveyed. No redd count data exist for 2012, 2014, 2015, 2019, or 2020. See footnote 5 for notes about how this graph has been modified and corrected for previous years..... 29

Figure 12. Figure showing data correlation between reduced streamflow gage readings (shown in red, “MINI Q”) and increased wind speed data recorded at the Rupert weather station (shown in green, “RPTI WS”). Dips in streamflow readings occur when sustained wind causes water stacking in the area between Minidoka Dam and the downstream gage. Data shown are for February 7-22, 2023..... 34

## List of Tables

Table 1. Summary of amount or extent of anticipated take of bull trout associated with Reclamation’s Anderson Ranch Dam and Reservoir facility operations during the 2023 reporting period.....6

Table 2. Summary of amount or extent of incidental take of bull trout associated with Reclamation’s Arrowrock Dam and Reservoir facility operations during the 2023 reporting period.....8

Table 3. Summary of amount or extent of anticipated take of bull trout associated with Reclamation’s Deadwood Dam and Reservoir facility operations during the 2023 reporting period..... 12

Table 4. Summary of amount or extent of anticipated take of bull trout associated with Reclamation’s Agency Valley Dam and Beulah Reservoir facility operations during the 2023 reporting period..... 15

Table 5. Summary of amount or extent of anticipated take of bull trout associated with Mason Dam and Phillips Reservoir facility operations during the 2023 reporting period, as included in the monitoring and reporting plan finalized in 2016..... 17

Table 6. Summary of bull trout (BT) capture events in the dataset before and after data cleanup. Some individual bull trout had multiple capture events both in the same year and among multiple years..... 21

Table 7. Fish stocking by IDFG in WY23 in the Boise River basin for all fish types ..... 23

Table 8. Summary statistics for the Deadwood Dam stilling basin bull trout trap-and-transport. Sampling occurred in September 2023. Summary includes total catch, catch per unit effort (CPUE), and relative abundance (percent of total). Total sampling hours = 228.6..... 25

Table 9. Fish stocking by IDFG in 2023 in Deadwood Reservoir for all fish types..... 26

Table 10. Summary statistics for prey base sampling at Beulah Reservoir, Oregon (ODFW unpublished data). Sampling occurred in June 2023. Summary includes total catch, relative abundance and catch per unit effort (CPUE) reported for fyke nets. Relative abundance values for 2019, 2021, and 2022 sampling data are provided for comparison..... 27

# Acronyms and Abbreviations

Acronym or Abbreviation	Definition
BA	Biological Assessment
BID	Burley Irrigation District
BT	Bull trout
cfs	cubic feet per second
CPN	Columbia-Pacific Northwest Region
CPUE	Catch Per Unit Effort
eDNA	Environmental DNA
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FRM	Flood Risk Management
FY	Fiscal Year
HAB	Harmful Algal Bloom
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
ITS	Incidental Take Statement
MID	Minidoka Irrigation District
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
ODFW	Oregon Department of Fish and Wildlife
Opinion	Biological Opinion
Reclamation	Bureau of Reclamation
RPM	Reasonable and Prudent Measure
SVID	Sunnyside Valley Irrigation District
T&Cs	Terms and Conditions
TMDL	Total Maximum Daily Load
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WY	Water Year

This page intentionally left blank.



# 1. Introduction

The Bureau of Reclamation (Reclamation) consulted with the U.S. Fish and Wildlife Service (USFWS) pursuant to Section 7 of the Endangered Species Act (ESA) on 12 proposed actions involving the effects of future operations and routine maintenance at 12 federal projects in the upper Snake River basin on six different listed species known to occur in the area at that time (Reclamation 2004). In March 2005, USFWS completed a non-jeopardy Biological Opinion (2005 Opinion) for Reclamation's operations and maintenance (O&M) activities in the Snake River basin above Brownlee Reservoir (USFWS 2005). The 2005 Opinion contained a 30-year incidental take statement (ITS) for bull trout and corresponding reasonable and prudent measures (RPMs) that outlined nondiscretionary actions to minimize take of species listed under the ESA that may be impacted by Reclamation's operations (USFWS 2005). USFWS determined incidental take by correlating frequencies and magnitudes of streamflow and reservoir conditions at specific facilities with an estimate of population effects during critical seasonal time periods in the bull trout's life history. USFWS then described the amount or extent of incidental take at each facility based on operational thresholds.

At the time of the 2005 Opinion, bull trout (*Salvelinus confluentus*) were not known to exist in Phillips Reservoir<sup>1</sup> on the Powder River. Therefore, bull trout were not included in the 2005 Opinion or associated documents. In 2011, two bull trout were documented in Phillips Reservoir; accordingly, Reclamation consulted with USFWS for bull trout in this area (Reclamation 2013). USFWS completed a non-jeopardy Biological Opinion in June 2014 (2014 Opinion) for Reclamation's O&M activities in the Powder River basin (USFWS 2014) as a companion document to the 2005 Opinion. The 2014 Opinion contains a 21-year ITS corresponding to the 2005 ITS and RPMs that outlines nondiscretionary actions to minimize take of bull trout in Phillips Reservoir.

The 2014 Opinion also included consultation on bull trout critical habitat for the same area analyzed in the 2005 Opinion, as well as the newly-added Powder River basin. USFWS concluded that Reclamation's O&M of the upper Snake River projects is not likely to destroy or adversely modify designated critical habitat for bull trout.

In addition to bull trout, the 2005 Opinion also included consultation on the Snake River physa (*Physa* [*Haitia*] *natricina*, hereafter physa). Monitoring for physa was reinitiated in 2012 in anticipation of reconsultation related to the Minidoka Dam spillway replacement project. Project construction for the new spillway was completed during the summer of 2015. The consultation addressed the effects to physa located in the Snake River above Brownlee Reservoir, focusing on the known occupied range of the species which occurs in the Minidoka Dam spillway and in the Snake River just downstream from the dam. Reclamation received a Biological Opinion (2015 Opinion) on May 8, 2015, finding that Reclamation's proposed operations are likely to adversely affect physa in the Minidoka Dam spillway. An ITS with associated Terms and Conditions (T&Cs) and RPMs was provided. The consultation was aligned with ongoing actions associated with the long-term O&M under the existing 2005 Opinion (USFWS 2005) and is considered a supplement to the 2005 Opinion.

---

<sup>1</sup> Phillips Reservoir was referred to as Phillips Lake in the 2004 Assessment.

The ITS in the 2005 Opinion has two main components: 1) T&Cs that incorporate a monitoring component to ensure the action agency does not exceed the amount or extent of incidental take described in the ITS, and 2) RPMs to minimize the amount or extent of take without altering the basic design, location, scope, duration, or timing of the action. The 2005 Opinion requires Reclamation to provide an annual report to USFWS by December 31 of each year that documents incidental take monitoring efforts and implementation status of all T&Cs and RPMs. At Reclamation's request (a letter dated November 13, 2007), USFWS agreed to permanently change the submittal date from December 31 to March 31 of the following year.

This document is submitted as Reclamation's annual report for Water Year 2023 (WY23) (October 1, 2022, to September 30, 2023).

## **1.1. Bull Trout**

This section summarizes annual water operations at projects that support bull trout or bull trout critical habitat, and describes population monitoring and other relevant work associated with specific RPMs. In addition, this report may discuss other bull trout work that is not managed by Reclamation but is directly relevant to bull trout or bull trout critical habitat within Reclamation's projects.

In its Monitoring and Implementation Plan (Reclamation 2006), Reclamation identified methods to monitor bull trout throughout the duration of the 2005 Opinion. Monitoring elements include evaluating RPMs through operational indicators and tracking population trends. These monitoring methods are continually reassessed and adjusted, as appropriate, to incorporate study findings and new technologies and methodologies as they are developed. To monitor compliance with the operational thresholds defined in the ITS, Reclamation monitored, evaluated, and summarized operations for WY23 in Reclamation's Hydromet system.<sup>2</sup> Operational thresholds affecting the amount or extent of anticipated take are described in Section 3.

Bull trout have been documented in five of Reclamation's facilities in the upper Snake River basin. This report covers the four facilities assessed in Reclamation's 2004 Biological Assessment (BA) and 2005 Opinion (Anderson Ranch Dam and Reservoir; Arrowrock Dam and Reservoir; Deadwood Dam and Reservoir; and Agency Valley Dam and Beulah Reservoir), as well as Mason Dam and Phillips Reservoir, which were assessed in the 2013 Biological Assessment and 2014 Opinion. These facilities are shown in Figure 1.

---

<sup>2</sup> See Reclamation's Hydromet website at: <http://www.usbr.gov/pn/hydromet/select.html>

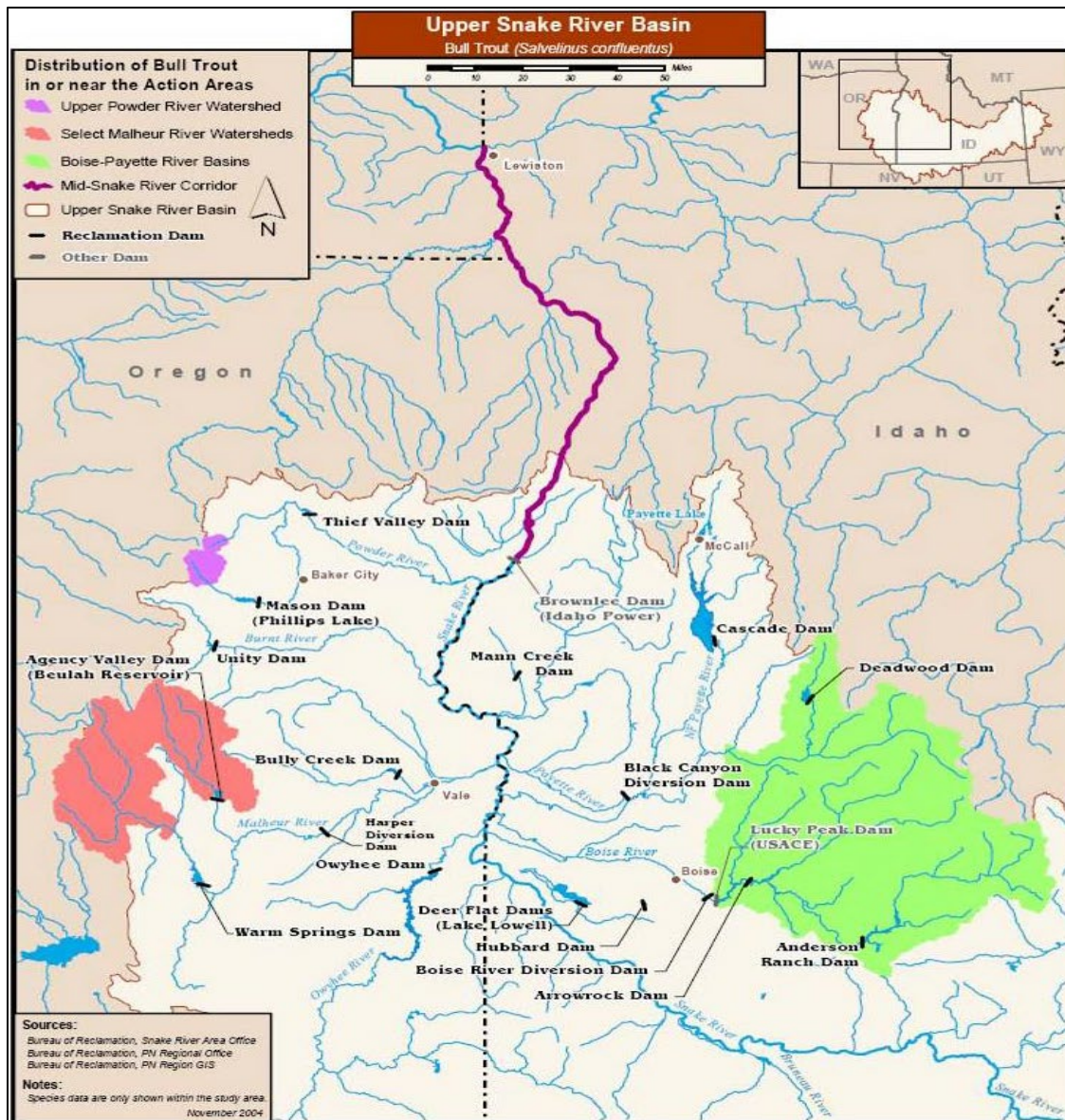


Figure 1. Known distribution of bull trout populations (shaded areas on map) associated with Reclamation facilities in the upper Snake River basin (Reclamation 2004)

## 1.2. Snake River Snails

Previous annual reports to USFWS documented two species of snails in the Snake River basin: Utah valvata (*Valvata utabensis*) and Snake River physa (*Physa natricina*). In 2010, the Utah valvata was removed from the ESA list, thereby removing all protections and subsequent monitoring and reporting requirements provided by the ESA (75 FR 52272). Accordingly, 2010 was the last year Reclamation monitored the Utah valvata.

The Snake River physa remains an ESA-listed species; however, the 2005 Opinion did not provide an ITS, monitoring requirements, or T&Cs for physa due to the uncertainty of their presence in the action area.

Subsequent to the 2005 Opinion, physa were confirmed in the action area. A supplemental consultation with USFWS was completed in 2015 to address possible effects to physa from long-term operation of the re-constructed spillway at Minidoka Dam. This supplemental consultation was initiated during construction of the spillway, which began in 2011 and was completed in the spring of 2015. The current take coverage for operations is covered under the *Biological Opinion for the Bureau of Reclamation, Operations and Maintenance above Brownlee Reservoir* (2015 Opinion) issued by USFWS in May 2015 (USFWS 2015). Information reported in this document is related to the most recent requirements set forth in this 2015 Opinion.

While Reclamation's physa monitoring requirements under the 2015 Opinion ended in 2017, Reclamation has continued to assist USFWS with ongoing survey efforts as personnel and funding allow. During the 2023 reporting period, Reclamation participated in ongoing USFWS-led suction dredge surveys for physa in the Snake River below Minidoka Dam, near the old Jackson Bridge site. Reclamation has no immediate plans to independently perform surveys in the future.

### **1.3. Yellow-Billed Cuckoo**

Reclamation entered into informal ESA Section 7 consultation with USFWS in the fall of 2016 for the western Distinct Population Segment of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*), following the USFWS determination to list this species as threatened in November 2014 (79 FR 67154). A BA comprehensively evaluating effects to the yellow-billed cuckoo from Reclamation's operations in the Snake River basin above Brownlee Reservoir was submitted to USFWS in July 2017. In August 2017, USFWS issued a Letter of Concurrence with that BA's findings, stating that Reclamation operations are not likely to adversely affect the species.

Critical habitat was designated for this species in 2021. Since Reclamation received USFWS concurrence for a determination that Reclamation's continued O&M in the Snake River basin above Brownlee Reservoir was Not Likely to Affect for the species and proposed critical habitat at the time, which was not expanded when critical habitat was finalized, there are no plans for additional consultation on this species.

## **2. Summary of 2023 Operations**

The following information summarizing 2023 operations was included in Reclamation's 2023 annual progress report to the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service on Reclamation's Salmon Flow Augmentation Program (available online at <https://www.usbr.gov/pn/fcrps/hydro/upperSnake/index.html>).

At the beginning of the 2023 season, reservoir carryover storage varied considerably depending on the watershed in the Snake River Basin above Brownlee Reservoir. Carryover storage on November 1, 2022, was 93 percent of average in the Payette River basin, 117 percent of average in the Boise River basin, and 41 percent of average in the upper Snake River basin.

During the early-winter months of November through December, above-normal precipitation fell in most basins. This transitioned to near-normal precipitation for the months of January and February and by March 1, snowpack was 96 percent of normal in the Payette River basin, 106 percent of normal in the Boise River basin, and 107 percent of normal in the upper Snake River basin. Precipitation during the month of March was much above normal, averaging 187 percent for the Payette and Boise basins and 140 percent in the Upper Snake. By April 15, the snowpack had increased and was 135 percent of normal in the Payette River basin, 143 percent of normal in the Boise River basin, and 121 percent of normal in the upper Snake River basin. The most unique aspect of WY23 was the extended cooler than normal temperatures during March and April which resulted in much of the low elevation snow remaining much longer than typical. During May, temperatures finally warmed to above average. These warmer than average temperatures resulted in rapidly increasing flows, with the Payette and Boise basins experiencing near normal precipitation and the Upper Snake experiencing below average precipitation. All basins experienced above average precipitation during the month of June which helped sustain streamflow through this period.

Observed unregulated runoff was reflective of the near average precipitation conditions experienced during the spring runoff period. The April-through-July unregulated runoff was 104 percent of normal in the Payette River basin, 131 percent of normal in the Boise River basin, and 102 percent of normal in the upper Snake River basin (as measured at Heise). As a result of the average to above average snowpack and runoff conditions, flood risk management (FRM) operations were required in all three basins. Although FRM operations were needed in the upper Snake River basin, no water was spilled past Milner.

The runoff was sufficient to completely fill the Boise and Payette basin reservoirs, while the upper Snake River basin reservoirs did not completely fill. The Payette River reservoir system reached a maximum storage content of 778,438 acre-feet, approximately 22,014 acre-feet below full capacity of 800,452 acre-feet, and would have filled completely but for early flow augmentation releases. The Boise River reservoir system reached a maximum storage content of 927,357 acre-feet, approximately 22,343 acre-feet below its full capacity of 949,700 acre-feet, and would have filled completely but for early flow augmentation releases. The upper Snake River reservoir system reached a maximum combined physical storage content of 3,841,412 acre-feet, approximately 344,283 acre-feet below full capacity of 4,185,695 acre-feet.

Above average snowpack and precipitation in Central and Eastern Oregon resulted in high runoff conditions. All the eastern Oregon reservoirs filled except for Owyhee Reservoir and Phillips Lake.

Due to average to above average runoff conditions experienced this season, coupled with good carryover storage in the Boise and Payette, a flow augmentation volume of 452,138 acre-feet was secured.

## **2.1. Idaho**

### **2.1.1. Boise River Basin Operational Indicators**

The term incidental take is defined as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (50 FR 26832, May 11, 2015). Specific operations or conditions at Anderson Ranch and Arrowrock dams and reservoirs that are expected to result in the

incidental take of bull trout were described in the USFWS 2005 Opinion. These operations or conditions are summarized as operational indicators for each dam in Table 1 and Table 2.

**Anderson Ranch Dam and Reservoir**

One operational indicator was exceeded during the 2023 reporting period for operations at Anderson Ranch Dam, i.e., “water is stored and released at Anderson Ranch Dam.”

Anderson Ranch Reservoir stored and released water during the 2023 reporting period as shown in Table 1, Figure 2, and Figure 3; however, the 2005 Opinion granted Reclamation an exemption for this action 30 out of 30 years for which the ITS issued in the 2005 Opinion is valid.

Table 1. Summary of amount or extent of anticipated take of bull trout associated with Reclamation’s Anderson Ranch Dam and Reservoir facility operations during the 2023 reporting period

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2023 Operations (October 2022 to September 2023)	Quick Reference: Number of Times Threshold has been Exceeded
Up to 50 percent of the Middle and North Fork populations are affected by spillway discharges that disrupt timing of migration and spawning and that alter metabolic rates and up to 10 percent of bull trout in the reservoir are entrained into the South Fork Boise River	Water is discharged over the spillway	Spring	6 of 30 years	The spillway was not used during the reporting period	<u>2 of 6 years</u> 2006: 9 days 2014: 3 days* 2017: 20 days 2018: 5 days*
Up to 50 percent of the Middle and North Fork populations are affected by the altered flow and temperature regime that disrupts migration and spawning and that increases metabolic rates	Water is stored and released at Anderson Ranch Dam	Spring through fall	30 of 30 years	Anderson Ranch Reservoir elevations for WY23 are shown in Figure 2	<u>17 of 30 years</u> Exceeds annually
Up to 4 percent of bull trout in the reservoir experience degraded water quality	Reservoir storage volume falls below 62,000 acre-feet (Figure 3)	Summer	2 of 30 years	Reservoir storage volume was maintained above 62,000 acre-feet (Figure 3)	<u>0 of 2 years</u>

\*The spillway was used to facilitate scheduled maintenance in both 2014 and 2018. In both instances, a Section 7 consultation was completed, resulting in separate T&Cs and ITSs specific to each of those activities. Spill from these 2 years was previously erroneously reported as 2 of the 6 exempted years identified in the 2005 Opinion; the counts of exceedance exemptions from the 2005 Opinion are corrected in Table 1 and supersede previous reporting.

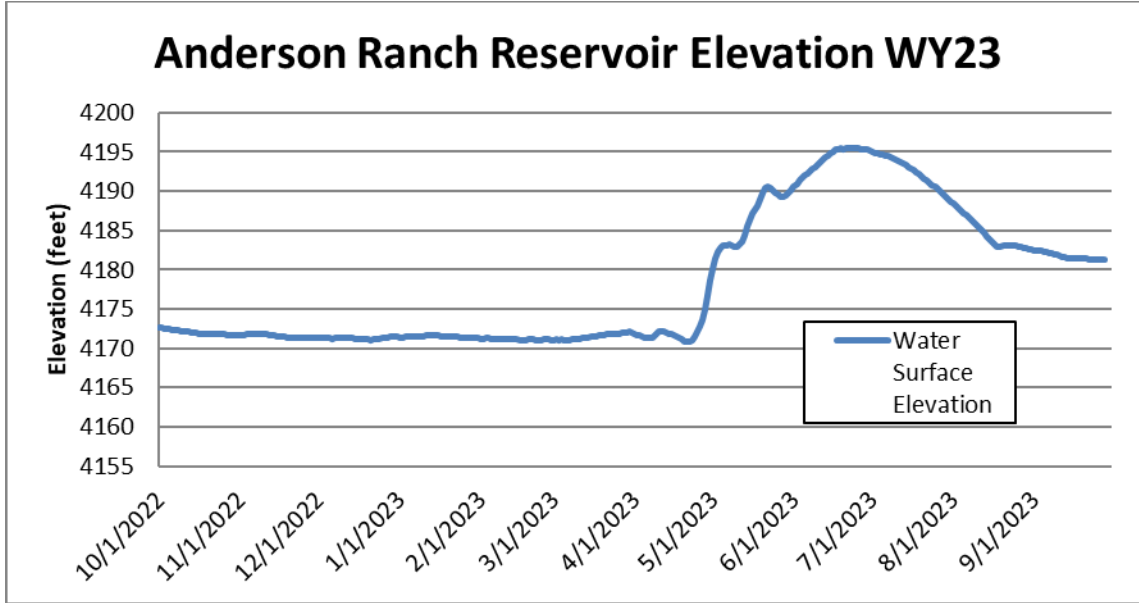


Figure 2. Anderson Ranch Reservoir elevation (feet above sea level) for WY23

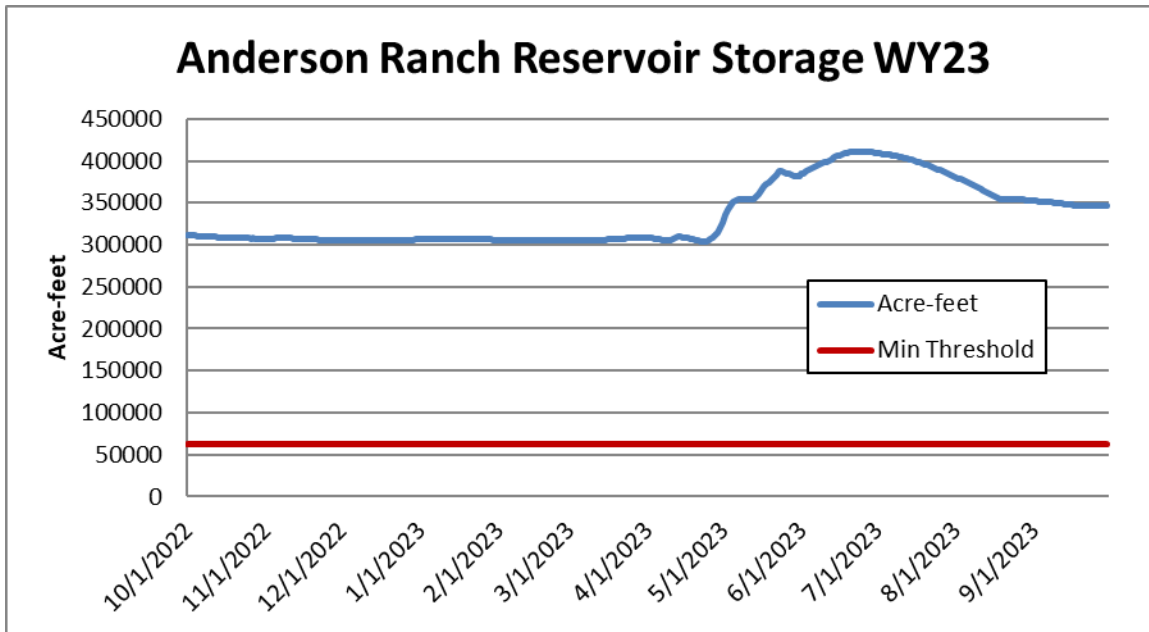


Figure 3. Anderson Ranch Reservoir storage volume (acre-feet) for WY23. The straight line represents Reclamation’s Operational Indicator minimum threshold of 62,000 acre-feet of storage.

**Arrowrock Dam and Reservoir**

No current operational indicators were exceeded during the 2023 reporting period.

Two operational indicators are based on discharge exceeding 695 cubic feet per second (cfs) while the reservoir water surface elevation was less than 3,111 feet (Table 2); however, since the 2005 Opinion was issued, valve reconfigurations at Arrowrock Dam have resulted in updated operations and a discontinuation of use of the upper release conduits, making this operational indicator obsolete. This is described in further detail in a 2018 Reclamation memorandum (Reclamation 2018a). These indicators are still listed in annual reporting but are considered no longer applicable.

Another operational indicator is being re-evaluated for operations at Arrowrock Dam. Reclamation identified an opportunity to align the modeling used to describe the end-of-June storage volume target with that of other operational indicators and more recent consultations. Reclamation is currently in discussions with USFWS to re-evaluate this operational indicator threshold (Vidregar 2021). After re-evaluation, the revised indicator and updated exceedances will be reported in subsequent reports.

Table 2. Summary of amount or extent of incidental take of bull trout associated with Reclamation’s Arrowrock Dam and Reservoir facility operations during the 2023 reporting period

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2023 Operations (October 2022 to September 2023)	Quick Reference: Number of Times Threshold has been Exceeded
Up to 8 percent of bull trout in the reservoir are entrained into Lucky Peak Reservoir, as averaged over any consecutive 5-year period	Water is discharged over the spillway	March through June	15 of 30 years	The spillway was not used during the reporting period	<u>2 of 15 years</u> 2006: 9 days 2017: 49 days



Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2023 Operations (October 2022 to September 2023)	Quick Reference: Number of Times Threshold has been Exceeded
Up to 20 percent of bull trout in the reservoir, as averaged over any 5 consecutive years, experience habitat degradation and predation	Mean daily reservoir elevation falls below 3,100 feet	September 15 through October 31	18 of 30 years	Reservoir surface elevation did not drop below 3,100 feet during the critical season in WY23 (Figure 5)	<u>0 of 18 years</u>
Up to 50 percent of the Middle and North Fork populations are affected by low reservoir productivity and decreased prey	Reservoir volume of less than 200,000 acre-feet at the end of June	June 30	3 of 30 years	<u>Re-evaluating</u>	<u>Re-evaluating</u>
Up to 5 percent of bull trout in the reservoir are entrained into Lucky Peak Reservoir, as averaged over any consecutive 5-year period	Discharge exceeds 695 cfs while the reservoir water surface elevation is less than 3,111 feet	Winter	20 of 30 years	This operational indicator is no longer applicable due to valve reconfigurations	This operational indicator is no longer applicable due to valve reconfigurations
Up to 2 percent of bull trout in the reservoir are entrained into Lucky Peak Reservoir	Discharge exceeds 695 cfs while the reservoir water surface elevation is less than 3,111 feet	July through September	30 of 30 years	This operational indicator is no longer applicable due to valve reconfigurations	This operational indicator is no longer applicable due to valve reconfigurations

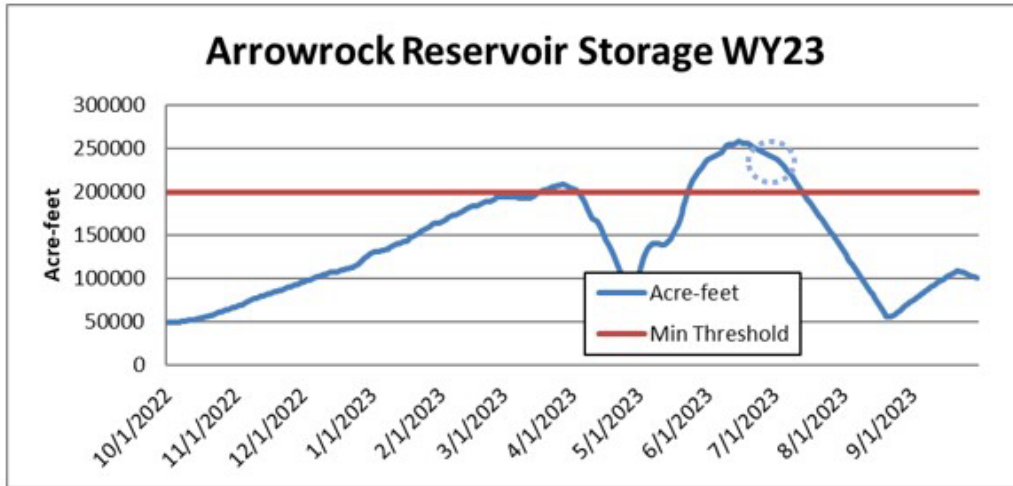


Figure 4. Arrowrock Reservoir storage volume (acre-feet) for WY23. The straight red line represents Reclamation's Operational Indicator of reservoir volume of 200,000 acre-feet. Reservoir volume should exceed this minimum at the end of June, depicted by the dotted circle. On June 30, 2023, Arrowrock Reservoir storage volume was 240,236 acre-feet.

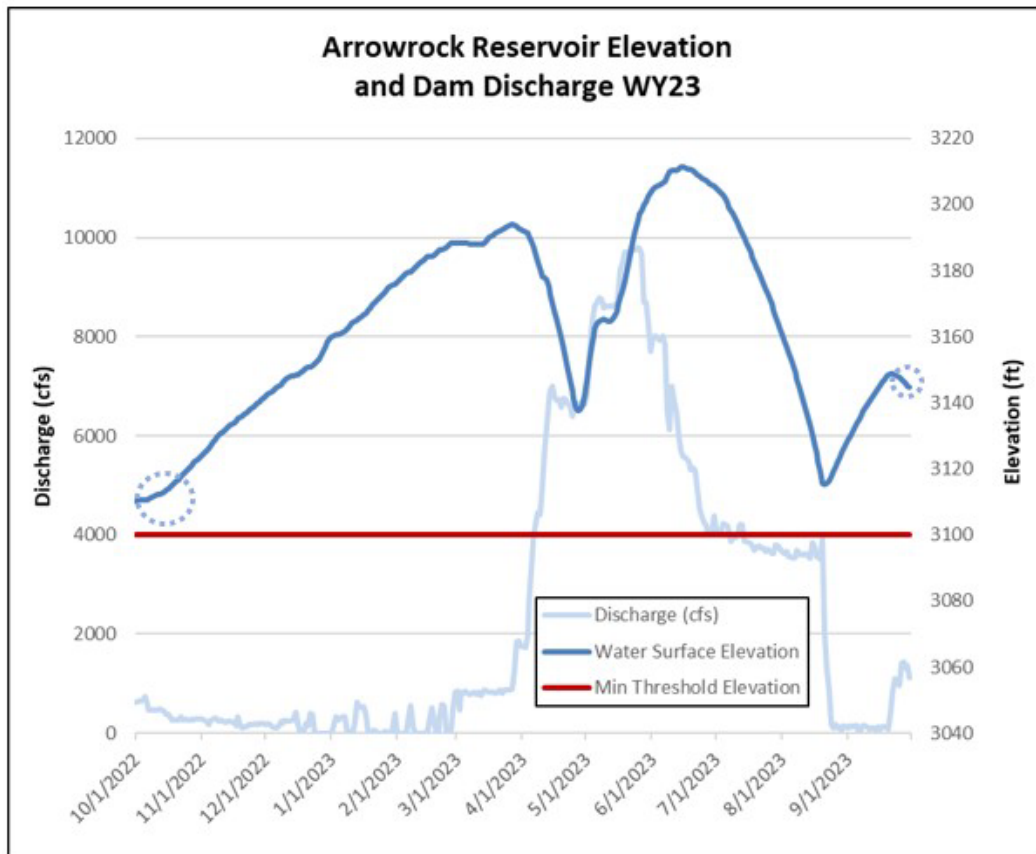


Figure 5. Arrowrock Reservoir surface elevation (feet above sea level) for WY23 and discharge (cfs). The straight red line represents Reclamation's fall minimum elevation threshold (September 15-October 31) of 3,100 feet, depicted by the dotted circles.

## 2.1.2. Payette River Basin Operational Indicators

The term incidental take is defined as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (50 FR 26832, May 11, 2015). Specific operations or conditions at Deadwood Dam and Reservoir that are expected to result in the incidental take of bull trout were described in the USFWS 2005 Opinion. These operations or conditions are summarized as operational indicators for Deadwood Dam and Reservoir in Table 3. Figure 6 illustrates Deadwood Reservoir storage volumes in WY23.

### ***Deadwood Dam and Reservoir***

Pursuant to T&Cs 3.a through 3.d of the 2005 Opinion, Reclamation formulated operational recommendations to better use existing operational flexibility to maximize benefits to bull trout and minimize biological impacts system-wide, while still fulfilling Reclamation’s non-discretionary flood control and water provision obligations. Section 7 consultation was completed on Reclamation’s proposed changes to O&M at Deadwood Dam and Reservoir in September 2022, resulting in the issuance of a Biological Opinion with a modified ITS and RPMs applicable to O&M at Deadwood Dam and Reservoir (USFWS 2022). The Operational Indicators in Table 3 have been altered as of this water year report to reflect the new ITS; the former limitation of spillway discharge to a maximum exemption of 11 of 30 years has been superseded by USFWS 2022’s exemption for spill in 12 of the 12 years remaining under the 2005 Opinion.

Two operational indicators were exceeded during the 2023 reporting period in the Payette River basin: deep water discharges were released, and water was released over the spillway at Deadwood Dam. Trap and transport and handling activities were performed; these are discussed in more detail in Section 3.2.2 of this report.

Deep water releases occurred throughout the year at Deadwood Dam; however, the 2005 Opinion granted Reclamation an exemption for this action for 30 of the 30 years for which the Opinion is valid. Spillway discharge occurred in June and July of the reporting period; however, the 2022 Opinion granted Reclamation an exemption for this action for 12 of the 12 remaining years for which the 2005 Opinion is valid (Table 3).

Table 3. Summary of amount or extent of anticipated take of bull trout associated with Reclamation’s Deadwood Dam and Reservoir facility operations during the 2023 reporting period

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2023 Operations (October 2022 to September 2023)	Quick Reference: Number of Days of Spill by Year
<p>Up to 2 to 4 percent of bull trout in Deadwood Reservoir are entrained into the Deadwood River below the dam</p> <p>All bull trout in the Deadwood River downstream from the dam are affected by spillway discharges that disrupt timing of migration and spawning and that alter metabolic rates</p>	Water is discharged over the spillway (surface elevation exceeds 5,334 feet)	Spring	12 of 12 years remaining under the 2005 Opinion (2023-2-34)	Water was discharged over the spillway during the reporting period in WY23 (6/24/23-7/7/23)	<p><u>7 of 11 years</u></p> <p>2006: 32 days 2007: 33 days 2008: 33 days 2010: 15 days 2014: 69 days 2015: 50 days 2022: 9 days 2023: 14 days</p>
Up to 2 to 4 percent of bull trout in Deadwood Reservoir are affected by degraded water conditions	Reservoir storage volume falls below 50,000 acre-feet	August through October	2 of 30 years	Reservoir storage volumes did not drop below 50,000 acre-feet during the reporting period in WY23 (Figure 6)	<u>0 of 2 years</u>
All bull trout in the Deadwood River downstream from the dam are affected by low winter streamflows and temperatures that affect bull trout movement and growth, and reproduction of bull trout and the prey base	Deep water releases at Deadwood Dam and low flows below the dam	Spring – temperature increases and flow decreases; Summer – temperature decreases and flow increases; Fall – temperature increases and flow reductions; Winter – temperature increases and flow reductions.	30 of 30 years	All releases are deep water releases except for water discharged over the spillway	<p><u>19 of 30 years</u></p> <p>Exceeds annually</p>

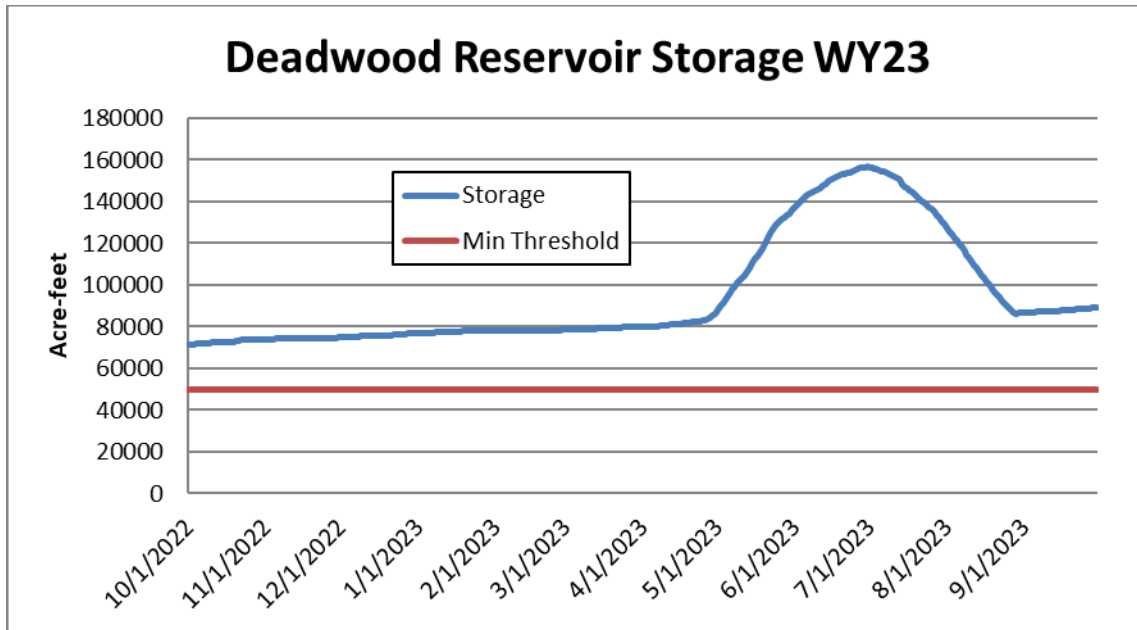


Figure 6. Deadwood Reservoir storage volume (acre-feet) for WY23. The straight red line represents Reclamation’s Operational Indicator minimum threshold of 50,000 acre-feet of storage.

## 2.2. Oregon

In eastern Oregon, the snowpack conditions were well below normal, dry soil conditions persisted, and no major spring rain events occurred. This resulted in below-normal runoff conditions in those basins as well.

Due to persistent dry conditions experienced this season, combined with low carryover storage, many reservoirs did not fill.

Carryover storage volume in Beulah Reservoir starting WY23 was 2,045 acre-feet on October 1, 2022. Beulah Reservoir filled to a peak WY23 level of 58,222 acre-feet (98.3 percent of full capacity) by June 14, 2023, and subsequently drafted to a low of 16,934 acre-feet (28.6 percent of full capacity) by the end of the reporting period.

Carryover storage volume in Phillips Reservoir starting WY23 was 1,584 acre-feet on October 1, 2023. Phillips Reservoir filled to a peak WY23 level of 53,602 acre-feet (73.4 percent of full capacity) by June 16, 2023, and subsequently drafted to a low of 23,336 acre-feet (32.0 percent of full capacity) by the end of the reporting period.

Information on flows discharged from the dams during WY23 (October 1, 2022, to September 30, 2023) can be found on Reclamation’s Hydromet website<sup>3</sup>. Reservoir water operations, including daily average

<sup>3</sup> <https://www.usbr.gov/pn/hydromet/>

reservoir elevations, contents in acre-feet, storage, and outflow for Reclamation facilities, are discussed in detail later in this report.

### **2.2.1. Malheur River Basin Operational Indicators**

The term incidental take is defined as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (50 FR 26832, May 11, 2015). Specific operations or conditions at Agency Valley Dam and Beulah Reservoir that are expected to result in the incidental take of bull trout were described in the USFWS 2005 Opinion. Conditions described in the T&Cs from the USFWS 2005 Opinion were described by Reclamation (2018d) and the USFWS agreed with Reclamation’s findings that the ITS is still valid (USFWS 2019). These operations or conditions are summarized as operational indicators in Table 4.

#### ***Agency Valley Dam/Beulah Reservoir***

No operational indicators were exceeded during the 2023 reporting period in the Malheur River basin. The reservoir reached a minimum volume of 2,024 acre-feet on October 5, 2022.

Table 4. Summary of amount or extent of anticipated take of bull trout associated with Reclamation’s Agency Valley Dam and Beulah Reservoir facility operations during the 2023 reporting period

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2023 Operations (October 2022 to September 2023)	Quick Reference: Number of Times Threshold has been Exceeded
Up to 10 percent of bull trout in Beulah Reservoir are entrained into the North Fork Malheur River below Agency Valley Dam	Water is discharged over the spillway	May through June	3 of 30 years	The spillway was not used during the WY23 reporting period	<u>1 of 3 years</u> 2006 2011* 2017*
All bull trout returning to Beulah Reservoir to overwinter are affected by a reduced prey base	Reservoir storage falls below 2,000 acre-feet (+/- 80 acre-feet)	August through October	10 of 30 years	The conservation pool was maintained in the WY23 reporting period (Figure 7)	<u>8 of 10 years</u> 2007: 60 days 2008: 34 days 2009: 53 days 2010: 28 days 2013: 45 days 2014: 56 days 2015: 35 days 2016: 15 days 2021*: 45 days
Reduced prey based caused by competition from non-native fish	Run-of-river operations triggered by fish sampling	October through May	3 of 15 years (2019 – 2034)	Following conditions identified in Reclamation 2018b, run-of-river operations were not used in WY23	<u>1 of 3 years</u> 2021*

\*Only discretionary spillway use is applicable to the number of excepted years for this operational indicator. Spill in 2011 and 2017 was necessary under flood control operations and, therefore, was non-discretionary. In past reports, the spill in 2011 was erroneously reported as one of the three excepted years. This has been corrected and the number in this report has been adjusted.

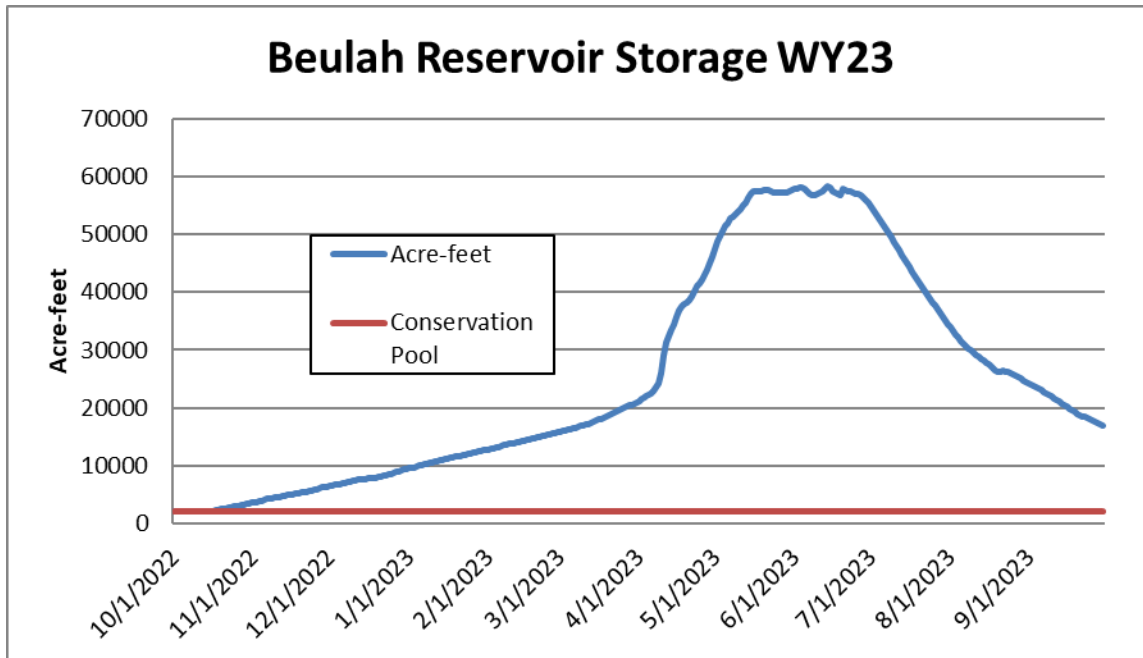


Figure 7. Beulah Reservoir storage volume (acre-feet) for WY23. The straight red line represents Reclamation’s Operational Indicator minimum threshold of 2,000 acre-feet +/- 80 acre-feet of storage. The lowest reservoir volume during the reporting period occurred on October 1, 2022, when carryover storage measured 1,045 acre-feet. Storage increased from October 1 until drafting began at the end of June 2023.

### 2.2.2. Powder River Basin Operational Indicators

Reclamation consulted with USFWS for bull trout and bull trout critical habitat in the Powder watershed (Reclamation 2013) and in June 2014 USFWS completed a non-jeopardy Biological Opinion (USFWS 2014) as a companion document to the 2005 Opinion. The 2014 Opinion contains a 21-year ITS and corresponding RPMs that outline non-discretionary actions for bull trout in Phillips Reservoir. Specific operations or conditions at Mason Dam and Phillips Reservoir that are expected to result in the take of bull trout in the form of “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” were identified in Reclamation’s *Bull Trout Monitoring and Reporting Plan for Phillips Reservoir* (Reclamation 2016), which was finalized with USFWS in WY16.

The operational indicators developed in that document are intended to minimize incidental take of bull trout resulting from operations of Phillips Reservoir. Low reservoir elevations increase the likelihood of elevated water temperatures (degraded habitat) in the reservoir and contribute to impaired migratory corridors (shallow varial zone habitat). As a result, low reservoir elevations limit the ability of fish to leave the reservoir to seek improved habitat in tributaries above Phillips Reservoir. These operational indicators are shown in Table 5. A summary of operations for WY23 is included in this report. Figure 8 and Figure 9 illustrate the water storage volume in acre-feet and reservoir elevation, respectively, and Figure 10 shows Powder River inflows into Phillips Reservoir during WY23.



**Mason Dam/Phillips Reservoir**

One operational indicator was exceeded during the 2023 reporting period in the Powder River basin, i.e., the mean daily reservoir elevation fell below 4,048 feet.

The mean daily reservoir storage elevations at Phillips Reservoir were below 4,048 feet throughout the WY23 reporting period (Figure 9); however, the 2014 Opinion granted Reclamation an exemption for this action for 21 of the 21 years for which the Opinion is valid.

Table 5. Summary of amount or extent of anticipated take of bull trout associated with Mason Dam and Phillips Reservoir facility operations during the 2023 reporting period, as included in the monitoring and reporting plan finalized in 2016

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2023 Operations (October 2022 to September 2023)	Quick Reference: Number of Times Threshold has been Exceeded
Up to 12 bull trout from resident headwater populations may be displaced during high flow events and be present in the reservoir	Powder River natural inflows exceeding 856 cfs daily mean (from 2014 Opinion)	Spring through summer	27 percent (6 of 21 years)	Powder River inflows did not exceed this threshold in the WY23 reporting period (Figure 10)	<u>0 of 6 years</u>
Up to 12 bull trout from resident headwater populations may be displaced during high flow events and be present in the reservoir	Mean daily reservoir elevation falls below 4,048 feet above sea level (Reclamation 2016)	Spring through summer	100 percent (21 of 21 years; monitoring occurring 2017-2034)	Reservoir surface elevation was below 4,048 feet for the entire WY23 reporting period (Figure 9)	<u>7 of 21 years</u> Occurs annually

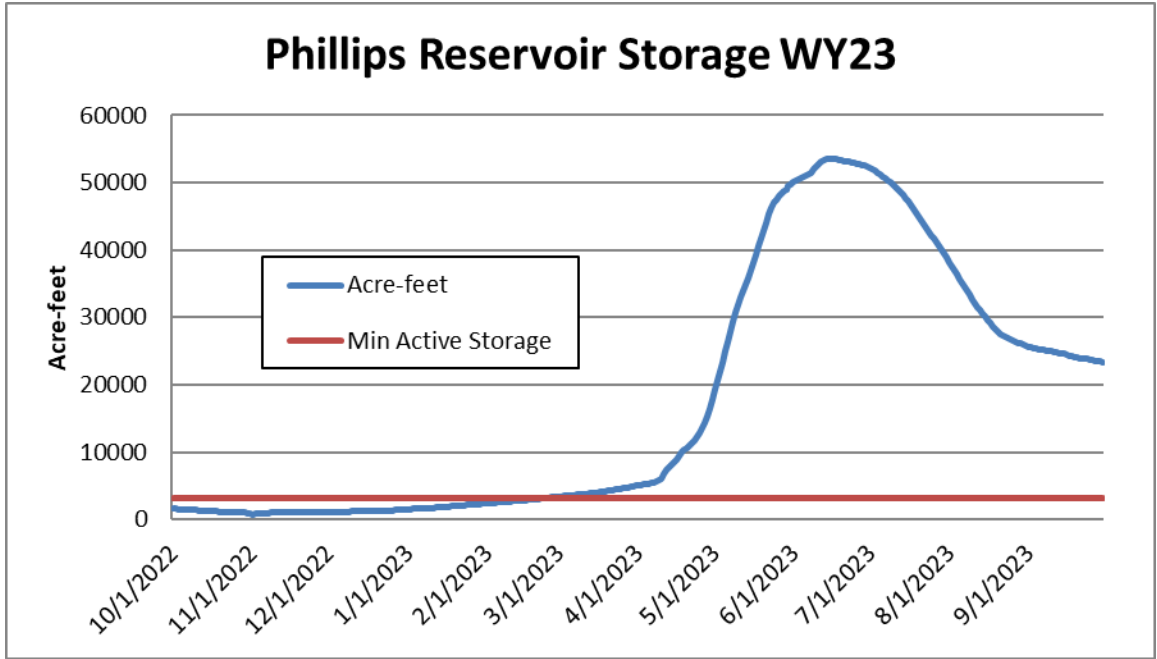


Figure 8. Phillips Reservoir storage volumes (acre-feet) for WY23. Minimum active storage occurs when pool elevation reaches 4,009 feet above sea level (3,100 acre-feet of storage), corresponding to the point of inactive storage indicated by the red line.

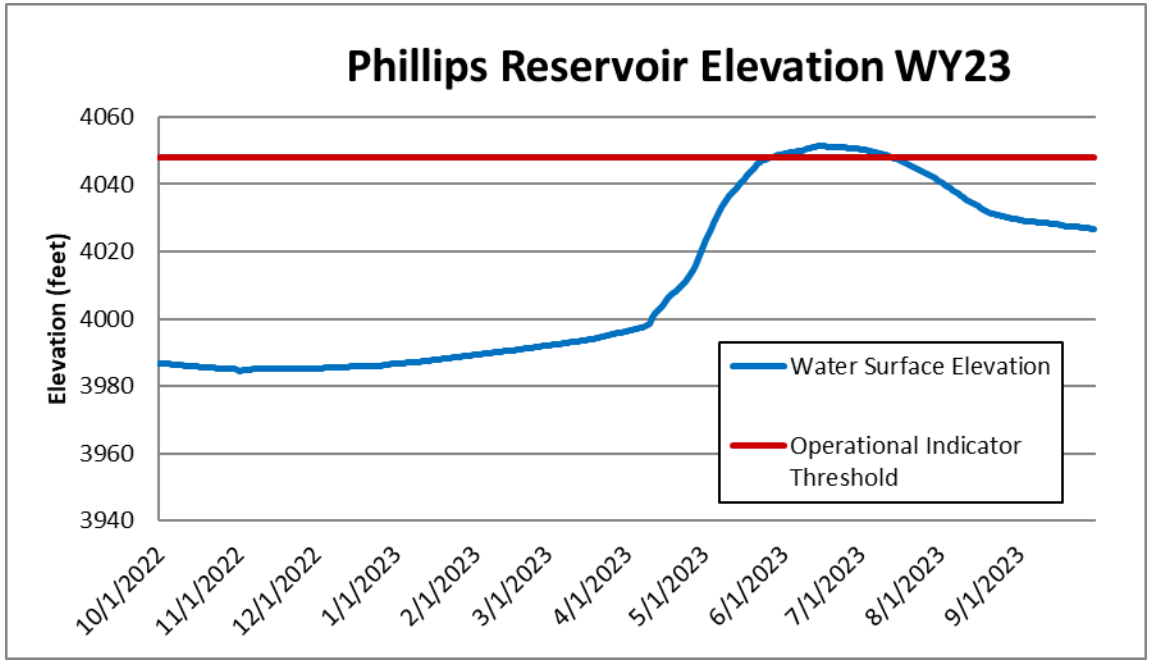


Figure 9. Phillips Reservoir surface elevation (feet above sea level) for WY23. The operational indicator spring/summer minimum for mean daily reservoir elevation of 4,048 is indicated by the red line.

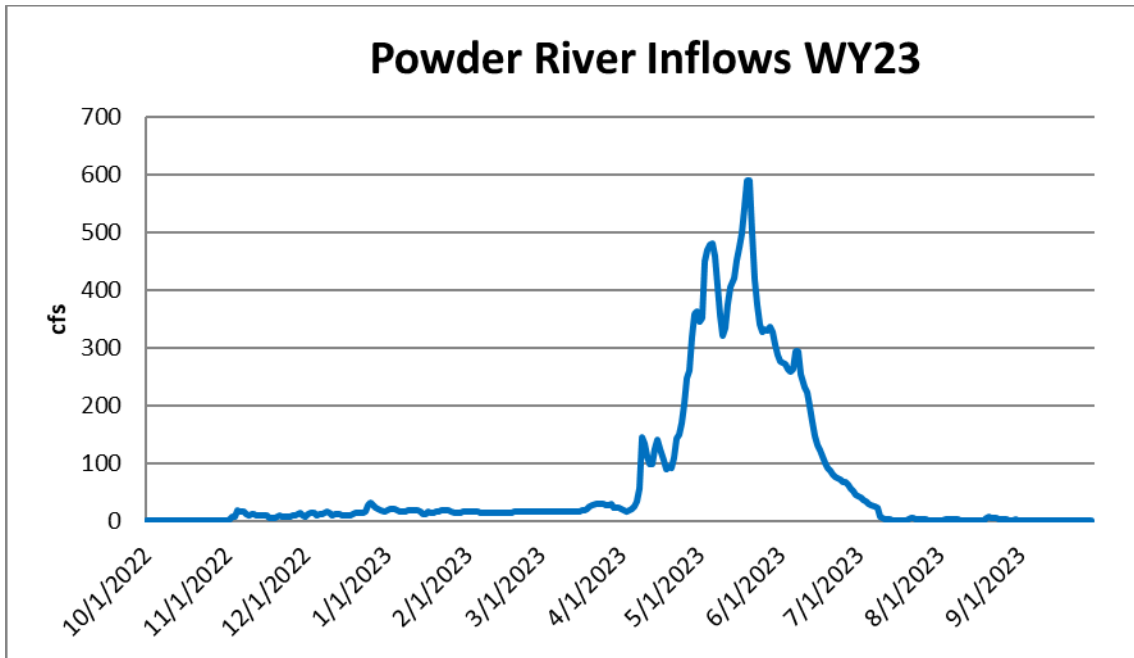


Figure 10. Powder River inflows to Phillips Reservoir in WY23 measured in cfs and recorded at USGS Gage No. 13275105, Powder River at Hudspeth Lane near Sumpter, Oregon

### 3. Bull Trout

This chapter describes the bull trout ITS and RPMs, including monitoring efforts during WY23. The ITS includes five RPMs and their associated T&Cs to minimize incidental take of bull trout related to O&M at Reclamation’s facilities in the identified action areas where bull trout are present. Collected data may be used to satisfy the T&Cs and/or monitoring requirements. For example, data collected during a fish sampling activity may be used to monitor population trends and to identify data trends that could be used in the future to address T&Cs or revise existing operational indicators and monitoring.

#### 3.1. Boise River Basin

For the purpose of this report, the Boise River basin study area includes Arrowrock Reservoir, Anderson Ranch Reservoir, the South Fork Boise River below Anderson Ranch Dam, portions of the Middle and North Fork Boise Rivers, and Lucky Peak Reservoir.

The 2005 Opinion identified five T&Cs for Arrowrock Dam and two T&Cs for Anderson Ranch Dam for minimizing the effect and/or amount of take associated with each dam’s operation. Each of the T&Cs addresses a different aspect of the effects of operations on bull trout or bull trout critical habitat. Most data collection efforts described in the following sections will be used to address T&Cs for both Arrowrock and Anderson Ranch reservoirs because the influence of both facilities overlap.

Summary reports for the Arrowrock Hydroelectric Project (Federal License #4656) can be referenced at <https://www.ferc.gov> and fish stocking performed by the Idaho Department of Fish and Game (IDFG) can be referenced at <https://idfg.idaho.gov/fish/stocking>. An overview of both activities is also included in this report.

### **3.1.1. Boise River Basin Data Collection**

To address T&C 2.b (minimize disruption to biological processes), streamflow and water temperatures were monitored on the South Fork Boise River. In 2020, Reclamation continued funding the U.S. Geological Survey (USGS) to maintain a temperature stream gage at Neal Bridge (USGS Gage No. 13192200) on the South Fork Boise River for the purpose of monitoring tributary flow below Anderson Ranch Dam. A new Interagency Agreement (R20PG00107) was established in fiscal year (FY) 2020, providing continued funding for this effort through 2024.

### **3.1.2. Arrowrock Water Quality Modeling**

In 2003, Reclamation developed a two-dimensional water quality model for Arrowrock Reservoir that was used in the analysis of the 2005 Biological Opinion. The model was subsequently updated in 2018 using data collected in 2013 and 2014 (Reclamation 2018c). Reclamation's 2018 work modeled effects of operations on primary productivity and water temperatures within the reservoir to assist in addressing questions concerning the food base and thermal habitats for ESA-listed aquatic species (Conservation Recommendations, 2005 Opinion). In the period from 2021 to 2023, Reclamation conducted additional updates to the 2018 model that focused on identifying operational effects during drought conditions. Analysis results will be presented in a standalone report.

### **3.1.3. Historic Data Management – Boise River Bull Trout Weirs**

Over time, discrepancies have been identified in bull trout summary data used in different reports and presentations. A look back at the historic data for the Boise River bull trout migration weirs identified both errors in the electronic data itself as well as in multiple methods being used to summarize the data. Data errors were identified and corrected by cross-referencing all available electronic and hardcopy sources of data. The data review process added a total of 81 bull trout capture events to the multiyear dataset (Table 6). A new Excel spreadsheet was produced that includes data for each year and location, as well as summary tabs. This Excel file should be used as the authoritative source of data for the Boise River weirs from this point forward, and will be made available upon request. The technical memorandum will be published later in 2024 and posted to Reclamation's website.

Table 6. Summary of bull trout (BT) capture events in the dataset before and after data cleanup. Some individual bull trout had multiple capture events both in the same year and among multiple years.

Year	Total BT Capture Events Before Data Cleanup	Total BT Capture Events After Data Cleanup	Difference
1999	259	275	16
2000	436	438	2
2001	232	244	12
2002	105	145	40
2003	85	85	0
2004	100	106	6
2005	59	61	2
2006	47	47	0
2011	91	91	0
2013	105	107	2
2021	64	65	1
Total	1,583	1,664	81

### 3.1.4. Fish Sampling

Fish sampling to address T&C 1.c (entrainment) is integrated into trap-and-transport efforts to move potentially displaced (entrained) bull trout from Lucky Peak Reservoir back upstream into Arrowrock Reservoir. Trap-and-transport efforts have historically been scheduled to occur in even-numbered years, and in any year (even- or odd-numbered) in which the spillway is used. The spillway at Arrowrock Dam was not used during the reporting period and no other trap-and-transport efforts occurred in the Boise River basin during the reporting period.

### 3.1.5. Other Activities

#### **Section 10 Permit**

Reclamation received a Section 10 Permit to conduct activities for scientific purposes as required by the 2005 Opinion. There were no field activities covered under this permit during the reporting year.

#### **Arrowrock Dam Hydroelectric Project – Boise Project Board of Control**

The Arrowrock Dam Hydroelectric Project, Federal Energy Regulatory Commission (FERC) licensee No.4656-020, started operations in 2010. Among the requirements of the FERC license, the licensee (Boise Project Board of Control) was obligated to perform water temperature and dissolved oxygen monitoring in the Arrowrock stilling basin for 5 years, culminating in 2015. Future monitoring recommendations may be prepared by the Boise Project Board of Control and presented to FERC after review by the Arrowrock Hydro Team.

Annual meetings of the Arrowrock Hydro Team (IDFG, Reclamation, U.S. Army Corps of Engineers, and USFWS) are expected to continue. The 2023 Meeting occurred in June and the water temperature and dissolved oxygen monitoring reports for WY23 were distributed.

### ***Recovery Planning Working Groups***

Reclamation is working with partners to update bull trout Species Status Assessments. Collaboration in 2023 included participation in multi-agency working groups for the Powder and Malheur watersheds in Oregon and the Boise and Payette watersheds in Idaho.

### ***South Fork Boise River – Salmonid Population monitoring***

Reclamation provided staff assistance to the IDFG trout population monitoring on the South Fork Boise River. A Mark/Recapture sampling methodology was used and sampling occurred during the month of October. Results will be presented in an annual report and referenced on the IDFG website: [Technical Reports | Idaho Fish and Game](#).

### ***South Fork Boise Watershed Collaborative***

Reclamation provided funding to Trout Unlimited to develop a working group to collaboratively provide insight to the management agencies for the conservation of the South Fork Boise River. A kickoff meeting occurred in October 2023 and attendees agreed to the establishment of six subcommittees; each has had subsequent meetings. Reclamation staff are active participants in each of the subcommittees. Trout Unlimited posts meeting announcements, meeting notes, presentation files, meeting recordings/transcripts and other files to: [Watershed Collaborative | \(southforkboise.org\)](#).

### ***Fish Stocking within Reclamation Projects – Boise River Basin IDFG***

IDFG annually stocks fish in the Boise River basin for recreational angling. Stocking practices are determined solely by IDFG following their most current 5-year Fisheries Management Plan. Stocking is not performed to meet Reclamation objectives. A summary of fish stocking<sup>4</sup> for all fish species that occurred at Arrowrock and Anderson Ranch Reservoirs and in the South Fork Boise River in WY23 is shown in Table 7.

---

<sup>4</sup> Comprehensive stocking data for the state is provided by IDFG and is available at <https://idfg.idaho.gov/ifwis/fishingPlanner/stocking/>

Table 7. Fish stocking by IDFG in WY23 in the Boise River basin for all fish types

Location	Date Stocked	Species Type	Size (inches)	Number Stocked
Anderson Ranch Reservoir	5/31/2023	Kokanee	Less than 6	280,964
Arrowrock Reservoir	10/4/2022	Rainbow trout	Catchable (6+)	1,035
	10/20/2022	Rainbow trout	Catchable (6+)	9,010
	3/28/2023	Rainbow trout	Catchable (6+)	2,886
	4/6/2023	Rainbow trout	Catchable (6+)	3,675
	4/7/2023	Rainbow trout	Catchable (6+)	1,384
	4/7/2023	Rainbow trout	Catchable (6+)	1,211
	6/1/2023	Kokanee	Less than 6	202,129
	7/19/2023	Rainbow trout	Catchable (6+)	789
	8/9/2023	Rainbow trout	Catchable (6+)	855
	8/22/2023	Rainbow trout	Catchable (6+)	540
South Fork Boise River (above Anderson Ranch Reservoir)	6/14/2023	Rainbow trout	Catchable (6+)	20
	6/14/2023	Rainbow trout	Catchable (6+)	20
	6/14/2023	Rainbow trout	Catchable (6+)	860
	6/14/2023	Rainbow trout	Catchable (6+)	20
	6/14/2023	Rainbow trout	Catchable (6+)	20
	6/14/2023	Rainbow trout	Catchable (6+)	435
	6/15/2023	Rainbow trout	Catchable (6+)	1,390
	6/15/2023	Rainbow trout	Catchable (6+)	20
	6/15/2023	Rainbow trout	Catchable (6+)	20
	7/03/2023	Rainbow trout	Catchable (6+)	1,900
	7/3/2023	Rainbow trout	Catchable (6+)	950
	7/3/2023	Rainbow trout	Catchable (6+)	950
	8/17/2023	Rainbow trout	Catchable (6+)	970
8/17/2023	Rainbow trout	Catchable (6+)	970	
8/17/2023	Rainbow trout	Catchable (6+)	970	

## 3.2. Payette River Basin – Deadwood River System

The 2005 Opinion identified five T&Cs for minimizing the effects to bull trout and the amount of take associated with the operation of Deadwood Dam and Reservoir. Each T&C addresses a different aspect of the effects of operations on bull trout and makes assumptions regarding the effects to bull trout from reservoir operations. Examining the system as a whole allows Reclamation to understand the systemic impacts of individual operational changes. Consequently, Reclamation engaged in the multi-year Deadwood Reservoir Operations Flexibility Evaluation (Deadwood Study) to address T&Cs 3.a through 3.d jointly, which was provided to USFWS in 2018.

Evaluating the flexibility of operations and the effects of varied operational scenarios for Deadwood Dam on water quality conditions and aquatic fauna in both Deadwood Reservoir and the Deadwood River below Deadwood Dam requires an understanding of the potential overall ecosystem response to operational changes over time. Using modeling of physical and biological parameters measured over the course of this project allows for an ecosystem analysis of the T&Cs for Deadwood Reservoir operations and their influence on bull trout populations. These efforts involved collaboration among multiple agencies and include annual activities not detailed in this report.

Conclusions from the Deadwood Study were used to develop Implementation Measures for Deadwood Dam that address T&Cs 3.a through 3.d. These operational recommendations seek to better use existing operational flexibility to maximize benefits to bull trout and minimize biological impacts system-wide, while still fulfilling Reclamation's non-discretionary flood control and water provision obligations. The final report, *Reclamation's Implementation Measures for Operating Deadwood Dam – Addressing Terms and Conditions from U.S. Fish and Wildlife Service 2005 Biological Opinion for Operations and Maintenance of the Bureau of Reclamation Projects in the Snake River Basin above Brownlee Reservoir*, was completed in July 2019. In 2022, formal Section 7 consultation for the implementation of actions identified in the 2019 report was completed, resulting in a modified ITS and RPMs applicable to O&M at Deadwood Dam and Reservoir.

### 3.2.1. Deadwood River Basin Data Collection

Operational indicators were monitored in WY23 and reported in Section 2.1.2 of this document. As part of the action identified in the 2022 consultation, Reclamation conducted annual fish sampling and a bull trout trap and transport effort, detailed below.

### 3.2.2. Fish Sampling

#### ***Trap-and-Transport***

Reclamation conducted sampling for bull trout in the tailrace of Deadwood Dam with assistance from USFWS. The effort occurred on several days (September 13, 14, 19, and 20, 2023) and totaled 228.6 sampling hours. This work was performed as a pilot effort to aid the development of a future bull trout trap-and-transport program. Bull trout were targeted because entrainment through the outlet works is suspected to occur (Reclamation 2018d) and other upstream passage methods or fish entrainment exclusion methods are not economically feasible. The time period was chosen due to safety and access concerns,



particularly targeting the cessation of irrigation releases when discharge could be limited to approximately 2.3 cfs for safety of the staff working in the area.

Captured bull trout (n=4) were released at a designated release location in Trail Creek approximately 2 miles upstream from the reservoir. All non-bull trout were released downstream of the stilling basin; fish less than approximately 200 mm were released below the access bridge, while larger fish were released in the pool at the mouth of Wilson Creek (approximately 0.25 miles downstream of the dam).

Sampling gear used in 2023 included fyke (trap) nets; three net locations were tested – in front of the outlet conduits (new), at the base of the spillway, and under the access bridge. Additionally, hook and line sampling was used for 9.6 hours total and no fish were caught; the effort was included in Table 8. The most common species encountered (relative abundance) included dace spp. (75.9 percent), rainbow trout (21.1 percent), and redbside shiner (1.2 percent). Other species included bull trout, westslope cutthroat trout, sculpin spp., mountain whitefish, and kokanee salmon (Table 8). Handling methods were similar to those used in previous efforts. Each fish was identified to the lowest practical taxonomic level. Bull trout were measured and weighed, and a small fin clip was collected for genetic analysis.

Bull trout were transported in a 120-quart cooler with supplemental oxygen released through a diffuser stone, following guidelines from IDFG. Water temperature in the transport cooler ranged from 10°C to 14°C and matched water temperature in the stilling basin; water temperatures at the release location ranged from 7°C to 8°C. Water temperatures in the transport cooler and release location were within the 5°C IDFG fish transport standard.

Table 8. Summary statistics for the Deadwood Dam stilling basin bull trout trap-and-transport. Sampling occurred in September 2023. Summary includes total catch, catch per unit effort (CPUE), and relative abundance (percent of total). Total sampling hours = 228.6.

Species	Total Catch (# of fish)	CPUE (fish/hour)	Percent of Total
Bull trout ( <i>Salvelinus confluentus</i> )	4	0.02	0.28
Cutthroat trout ( <i>Oncorhynchus clarki lewisi</i> )	3	0.01	0.21
Rainbow trout* ( <i>Oncorhynchus mykiss</i> )	308	1.35	21.21
Redside shiner ( <i>Richardsonius balteatus</i> )	17	0.07	1.17
Sculpin ( <i>Cottus spp</i> )	9	0.04	0.62
Dace ( <i>Rhinichthys spp</i> )	1,101	4.82	75.83
Mountain whitefish ( <i>Prosopium williamsoni</i> )	2	0.01	0.14
Kokanee salmon ( <i>Oncorhynchus nerka</i> )	8	0.03	0.55
Totals	1,452	6.35	100.00

\* Rainbow trout were not differentiated between hatchery or native origin.

### **Other Activities**

In 2023, IDFG stocked rainbow trout in Deadwood Reservoir as a measure to supplement a sport fishery (Table 9).

Table 9. Fish stocking by IDFG in 2023 in Deadwood Reservoir for all fish types

Date Stocked	Species Type	Size	Number Stocked
6/15/2023	Rainbow trout	Less than 6 inches	10,788
6/27/2023	Kokanee	Less than 6 inches	101,150

### **3.3. Malheur River Basin – Beulah Reservoir and the North Fork Malheur River**

The 2005 Opinion identifies four T&Cs for minimizing the effect and amount of take associated with the operation of Agency Valley Dam and Beulah Reservoir. Each of the T&Cs addresses a different aspect of the effects of operations on bull trout and critical habitat. In cooperation with USFWS, Reclamation developed and finalized seven implementation measures in 2018 that target the maintenance of a prey base for bull trout that overwinter in the reservoir. These seven implementation measures help maintain ESA compliance at Beulah Reservoir (Reclamation 2018e). Implementation of these measures began in WY19 and will maintain incidental take coverage through the duration of the 2005 Opinion. Additionally, Reclamation is working with USFWS and the Bureau of Land Management to minimize effects of grazing around the reservoir (Jackson 2017-2020, pers. comm.).

#### **3.3.1. Prey Base Monitoring**

Reclamation staff assisted the Oregon Department of Fish and Wildlife with sampling the fish community in Beulah Reservoir over the period from June 5 to June 7 for a total of 426 hours of sampling effort. This effort was performed by the Oregon Department of Fish and Wildlife (ODFW) but followed Reclamation’s sampling methods to monitor the prey base for migratory bull trout that use the reservoir for foraging, migratory, and overwintering habitat. Sampling gear used in 2023 included fyke traps. The most common species encountered (relative abundance) included northern pikeminnow (45.7 percent), redbside shiner (23.1 percent), and sucker spp. (28.8 percent). Other species included chiselmouth, rainbow trout, and dace spp.; no bull trout or largemouth bass were sampled (Table 10). Sampling locations were randomly chosen in each of the four quadrants (NW, NE, SW, and SE); 5, 6, 4, and 5 sets in each quadrant, respectively.

Differences between the 2023 effort and past years included less sampling effort and fewer gear types; however, for general comparison of population trends, comparisons are made to catch statistics from 2019 to 2023 (Table 10). The most common species remained similar, but the relative abundances changed slightly between years. Run of River operations occurred in 2021 to control for non-native species; catch rates since 2021 have increased for sucker spp. and northern pikeminnow and have decreased for redbside

shiner and rainbow trout. Rainbow trout were not genetically identified to be of native or hatchery origin; however, phenotypically most individuals had features characteristic of hatchery fish.

Table 10. Summary statistics for prey base sampling at Beulah Reservoir, Oregon (ODFW unpublished data). Sampling occurred in June 2023. Summary includes total catch, relative abundance and catch per unit effort (CPUE) reported for fyke nets. Relative abundance values for 2019, 2021, and 2022 sampling data are provided for comparison.

Species	Gill Net	Fyke (trap) net	Crayfish traps	E-fish	TOTAL	2023 Relative abundance	2022 Relative abundance	2021 Relative abundance	2019 Relative abundance
Largescale sucker		464			464	25.7%	11.2%	9.6%	7.3%
Bridgelip sucker		52			52	2.9%	3.0%	0.5%	11.9%
Sucker (juvenile, species unk.)		3			3	0.2%	2.1%	4.4%	16.5%
Northern pikeminnow		824			824	45.7%	47.0%	27.4%	21.7%
Chiselmouth		25			25	1.4%	0.7%	0.2%	1.5%
Redside shiner		417			417	23.1%	33.9%	47.9%	38.5%
Largemouth bass		0			0	0.0%	0.0%	0.4%	0.2%
Rainbow trout *		13			13	0.7%	2.1%	9.2%	2.2%
Sculpin spp		0			0	0.0%	0.0%	0.1%	0.0%
unknown dace		0			0	0.0%	0.1%	0.1%	0.0%
Speckled dace		0			0	0.0%	0.0%	0.0%	0.2%
Longnose dace		2			2	0.1%	0.0%	0.0%	0.1%
Bull trout		0			0	0.0%	0.0%	0.0%	0.0%
Signal crawfish		0			0	0.0%	0.0%	0.2%	0.1%
<b>TOTAL SAMPLING HRS</b>		426							
<b>TOTAL FISH CAUGHT</b>		1800							
<b>CPUE</b>		0.24							

\*Rainbow trout were not differentiated between hatchery or native origin.

### 3.3.2. Temporary Water Lease

Reclamation worked collaboratively with the Vale Irrigation District to update contracting to maintain the Beulah Reservoir conservation pool volume. In 2023, the water lease was not used to maintain the conservation pool within the required range. The lowest storage volume occurred on October 5, 2022, at 2,024 acre-feet and carryover into WY24 was 16,730 acre-feet on October 1, 2023.

### 3.3.3. Trap-and-Transport Efforts

#### Spring

The spillway was not used at Agency Valley Dam in 2023; therefore, spring trap-and-transport was not required.

#### Fall

Reclamation and the Vale Irrigation District operated Beulah Reservoir within the designated range of the conservation pool; therefore, fall trap-and-transport was not required.

### 3.3.4. Other Activities

Reclamation has identified that the riparian vegetation, predominantly willow stands, present in the upper varial zone area of Beulah Reservoir provides important habitat for the prey base (fish species) that bull trout feed upon (Reclamation 2013). Grazing permits on Reclamation lands surrounding the reservoir were curtailed in 2016, with the intent of determining whether grazing land use is compatible with the persistence of adequate habitat to support a prey base for bull trout that overwinter in the reservoir.

Reclamation generally performs an annual range use evaluation survey of the upper varial zone at Beulah Reservoir in the fall to assess the general distribution, density, and vigor of existing willow stands, and to assess the level of ongoing domestic grazing use (stray non-permitted cattle) and wildlife browsing impacts. However, in WY23, staffing availability precluded surveying during this timeframe. Surveys will resume in WY24.

### 3.3.5. Malheur River – Redd Counts

Reclamation routinely participates as a partnering agency in annual survey counts of bull trout redds in the North Fork Malheur River basin to satisfy coordination and basin monitoring requirements set forth in the 2005 Opinion (Reporting Requirements and Conservation Recommendations 2 and 3). In 2023, Reclamation participated in the second round of surveys.

The first round of surveys was performed August 29 through August 31, the second round was September 12 through 16, and the third round was September 26 through 30. Surveys focused on habitat with the highest potential for spawning and totaled approximately 22.0 miles but also included an additional 7.9 miles in rotating reaches. In total, 145 redds were observed throughout the North Fork Malheur River and tributaries<sup>5</sup> (no redds were observed in the rotating reaches in 2023).

Carryover storage in Beulah Reservoir can affect the bull trout prey base (Rose and Mesa 2009); however, a direct link between carryover pool elevations and bull trout redd counts remains speculative. Figure 11 shows the number of redds observed in the North Fork Malheur River basin and the carryover of reservoir storage in Beulah Reservoir.

---

<sup>5</sup> Redd count numbers from 2013 and 2016 were misrepresented in previous annual reports. Data shown in those reports erroneously included redd counts for both the Upper Malheur and the North Fork Malheur. The correct counts for the North Fork Malheur were 38 in 2013 and 50 in 2016. This figure reflects those adjustments. The alignment of this figure has also been adjusted to display carryover data by water year rather than calendar year. This was done to simplify interpretation so that the carryover numbers shown correspond to the redd counts observed the following summer.

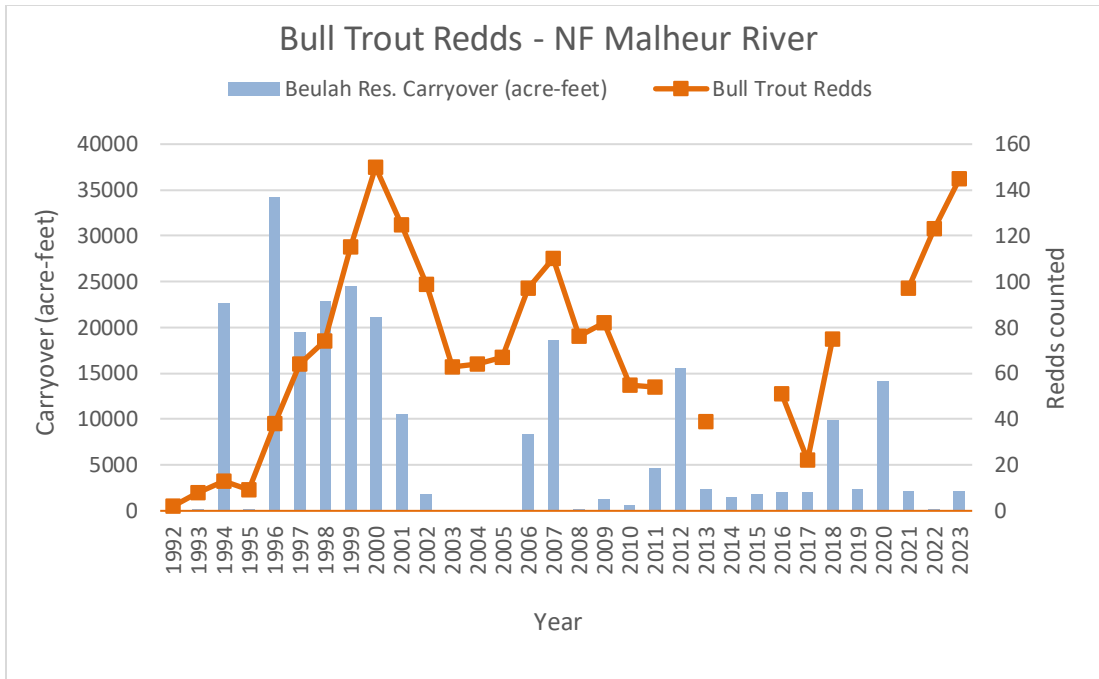


Figure 11. Data on bull trout redd trends observed in the North Fork Malheur River watershed (North Fork Malheur River) and carryover storage at the start of the water year in Beulah Reservoir for water years 1992–2023. The number of redds observed after 2007 has been adjusted by one to reflect the reduced size of the area surveyed. No redd count data exist for 2012, 2014, 2015, 2019, or 2020. See footnote 5 for notes about how this graph has been modified and corrected for previous years.

### 3.4. Powder River Basin – Phillips Reservoir

#### 3.4.1. Bull Trout Monitoring

The 2014 Opinion identifies one T&C associated with minimizing incidental take of bull trout resulting from operations of Phillips Reservoir (decreased water levels and increased temperatures) and from impaired fish migration above Phillips Reservoir. Reclamation accordingly finalized the 5-year *Bull Trout Monitoring and Reporting Plan for Phillips Reservoir, Oregon* with USFWS in 2016 (Reclamation 2016). This plan was developed in collaboration with ODFW in order to fulfill this T&C. From 2015 through 2019, Reclamation conducted spring fish sampling at targeted reservoir locations to enhance knowledge of project impacts to bull trout and to better determine bull trout use of Phillips Reservoir.

In accordance with this monitoring and reporting plan, Reclamation continues to monitor and report the Powder River gage (USGS Gage No. 13275105 – Powder River at Hudspeth Lane near Sumpter, Oregon). This effort records the frequency of high-inflow events that are expected to lead to bull trout migration into/through the reservoir. Also, Reclamation has continued to monitor pool elevation to record the frequency of drawdown that seasonally affects access through tributary varial zones. In the 2023 reporting

period, inflow measured at the Powder River gage did not exceed 856 cfs daily average, the operational indicator identified in the monitoring plan.

### **3.4.2. Other Activities**

Pursuant to RPMs and T&Cs in USFWS 2014, Reclamation developed a 5-year bull trout sampling and monitoring plan, a draft of which was first provided to USFWS for comment in March of 2015, and implementation of which began later that spring, in coordination with ongoing ODFW activities related to sampling for and control of invasive yellow perch in Phillips Reservoir. Reclamation’s final 5-year sampling plan, *Bull Trout Monitoring Plan for Phillips Reservoir, Oregon* (Reclamation 2016), was formally submitted to USFWS in 2016 in partial fulfillment of the Term and Condition set forth in the 2014 Opinion. In accordance with that document, fish sampling and monitoring of environmental conditions took place from 2015 to 2019. In 2024, Reclamation is finalizing a report synthesizing results from this effort; this report is the *Five-Year Bull Trout Monitoring Plan Report: 2014 Biological Opinion for Phillips Reservoir (Mason Dam), Oregon* (Reclamation 2024; forthcoming).

## **3.5. Agency Coordination and Conservation Recommendations**

The 2005 Opinion directs Reclamation to use its authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of ESA protected species. Conservation Recommendations are discretionary agency activities that minimize or avoid adverse effects of a proposed action on listed species or critical habit, help implement recovery programs, or develop information (USFWS 2005).

Reclamation participated in the following Conservation Recommendations during the 2023 reporting period.

- USFWS Quarterly Meetings
- Boise and Payette Watersheds
  - Reclamation’s 2023 Bull Trout Annual Meeting
  - Annual Deadwood coordination meeting
  - Boise Area Bull Trout Work Group
  - McCall Area Bull Trout Work Group
  - Arrowrock Hydro Annual Meeting
- Malheur Watershed
  - Malheur River Technical Advisory Team quarterly meetings
  - Malheur fish passage grant reviews
- Powder Watershed
  - Phillips watershed coordination meetings
  - Powder River Bull Trout working group
  - Powder River Watershed Council collaborative meetings

- Upper Snake River
  - Palisades/upper basin water management working groups
  - American Falls Resource Management Working Group
  - Salt River, Wyoming Watershed Working Group
  - White Sturgeon Technical Advisory Committee
  - Reclamation/IDFG annual water operation meeting
  - Reclamation/USFWS discussed with USGS flow calculations from the gage downstream of Minidoka Dam
- Other Activities
  - Idaho Chapter American Fisheries Society meetings
  - Idaho Department of Environmental Quality (IDEQ) Water Quality Workshop
  - Loggers Creek Data Summit
  - Slickspot Peppergrass identification training
- Water Quality – Various efforts conducted by Reclamation’s Columbia-Pacific Northwest (CPN) Regional Water Quality Laboratory

Reclamation participated in several water quality related projects in the upper Snake River basin during 2023. As part of Idaho and Oregon’s ongoing total maximum daily load (TMDL) development and implementation activities, Reclamation staff from the Snake River Area Office and CPN Regional Office participated in all appropriate watershed advisory groups and watershed council meetings in the upper Snake River basin, including activities listed below. Reclamation also provided technical assistance and analytical laboratory services to irrigation system operators and other appropriate entities throughout its project areas in the upper Snake River basin, including activities listed below.

A&B Irrigation District Water Quality Monitoring – A&B Irrigation District staff sample nitrate + nitrite and bacteria from 180-156 groundwater wells to measure groundwater depletion and nutrient infiltration associated with withdrawals in irrigated units A and B near Rupert, Idaho. These data are utilized by the district to comply with good agricultural practices as well as to evaluate the extent of nitrate infiltration in the Snake River aquifer.

American Falls Reservoir Water Quality Monitoring – IDEQ routinely collects samples from American Falls year-round for nutrients, bacteria, and sediment. The analytical portion of this project is funded by Reclamation, while samples are collected by IDEQ staff. The data are used to review TMDL implementation for American Falls Reservoir as water years differ greatly and reservoir conditions vary with volume and climatic conditions.

Boise Reservoirs Monitoring Program – The Boise Reservoirs Monitoring program is part of the CPN Water Quality Laboratory’s region-wide reservoir monitoring program. Almost all Reclamation reservoirs are routinely monitored for nutrients, bacteria, sediment, cations/anions, metals, and other physical parameters, with frequency being decided by a project’s importance and sensitivity. During the irrigation season, CPN Laboratory staff travel to reservoirs and collect thalweg (surface, bottom), and outflow samples. Data are used for TMDL development, National Environmental Policy Act compliance, Biological Opinion compliance, and long-term trend monitoring. The reservoirs monitored under this program include

Anderson Ranch, Arrowrock, Beulah, Black Canyon, Bully Creek, Cascade, Deadwood, Lake Lowell, Mann Creek, Owyhee, Phillips, Thief Valley, Unity, and Warm Springs.

Boise Watershed Watch – Once annually, usually in September, the Boise Watershed Watch program performs community outreach sampling with local Boise schools and tests Boise River samples for nutrients and bacteria. Reclamation’s Water Conservation Field Services program frequently funds this community program as it is low-cost and a valuable piece of public engagement in watershed health.

Burley Irrigation District Water Quality Monitoring – The Burley Irrigation District (BID) Water Quality Monitoring Program is a partnership between Reclamation and BID to assess the water quality of irrigation canals and drains associated with BID. BID samples for nutrients, sediment, and bacteria during the irrigation season. Data are provided to farmers and irrigators for good agricultural practices reporting.

Invasive Species Monitoring – The Invasive Species Monitoring program is part of the CPN Laboratory’s region-wide reservoir monitoring program. Almost all Reclamation reservoirs are routinely monitored for nutrients, bacteria, sediment, cations/anions, metals, and other physical parameters with two samples being taken at the thalweg (surface/bottom). In addition to chemical constituents, the CPN Laboratory performs plankton tows near boat launch sites to evaluate the presence/absence of quagga and zebra mussel veligers. Almost every Reclamation reservoir in the region is sampled at least once every 3 years, with some being sampled more often dependent on a project’s importance and sensitivity, and especially if there have been any invasive species veliger or eDNA positive results. This project is very large and has a dedicated CPN Laboratory field crew in the summer.

Minidoka Irrigation District Water Quality Monitoring – The Minidoka Irrigation District (MID) Water Quality Monitoring Program is a partnership between Reclamation and MID to assess the water quality of irrigation canals and drains associated with MID. MID samples for nutrients, sediment, and bacteria during the irrigation season. Data are provided to farmers and irrigators for good agricultural practices reporting.

Minidoka Reservoirs Monitoring Program – The Minidoka Reservoirs Monitoring program is part of the CPN Laboratory’s region-wide reservoir monitoring program. The Minidoka reservoirs monitored under this program are Little Wood River, Island Park, American Falls, Ririe, Lake Walcott, Grassy Lake, Palisades, and Jackson Lake.

Regional Algal Toxin Monitoring – In coordination with IDEQ and local health districts, some of the harmful algal bloom (HAB) cyanotoxin samples collected on Reclamation reservoirs are analyzed at the CPN Laboratory. This partnership has positioned the CPN Laboratory to be IDEQ’s primary cyanotoxin analysis lab in the state while also providing Reclamation with advance notice of upcoming advisories. It also provides a monitoring program to better scope the emerging problem of HABs in the CPN Region. This agreement covers both samples collected by the CPN Laboratory and samples collected by the IDEQ or public.

Rock Creek Water Quality – Rock Creek is a major tributary to the Snake River and has been identified as impaired by E. coli, total phosphorus, total suspended solids, and flow alterations. Using Reclamation funding, IDEQ samples this project for nutrients, bacteria, and sediment. Data analysis and the resulting



reports help IDEQ to work toward TMDL implementation efforts as well as to identify areas of concern where future water quality improvement work can be directed.

Sunnyside Valley Irrigation District Water Quality Monitoring – The Sunnyside Valley Irrigation District (SVID) Water Quality Monitoring Program is a partnership between Reclamation and SVID to assess the water quality of irrigation canals and drains associated with SVID. SVID samples for nutrients year-round.

Upper Payette River Water Quality Monitoring Program – To assess the quality of water traveling into and out of Cascade reservoir, the CPN Laboratory samples the north fork of the Payette River for nutrients and bacteria on a monthly basis. These data are utilized to calibrate water quality models and to measure long-term water quality trends in the Boise Project.

NAA and WCFS Support for Native American Tribes – Both the Native American Affairs and the Water Conservation Field Services programs provide analytical cost-sharing support for tribes in the CPN Region. In FY 2023, the Confederated Tribes of the Umatilla Reservation, the Nez Perce Tribe, and the Shoshone-Paiute Tribes of the Duck Valley Indian Reservation were among tribes that submitted samples to the CPN Laboratory.

## **4. Snake River Physa**

Following the USFWS 2015 Consultation, Reclamation implemented three measures to satisfy requirements in the ITS: a long-term flow strategy to protect snail habitat in the Physa pool below the dam (2020); a Water Quality Monitoring Plan (2016) to monitor sediment in low flow years (minimum non-irrigation season (November to March) flows past Minidoka Dam ranging between 425 and 525 cfs); and annual coordination/reporting on these activities with USFWS.

In February of the Reporting Period, USFWS noted intermittent slight dips below the 400 cfs winter flow minimum in data from the Snake River at Howell’s Ferry stream gage (USGS gage 13081500) and reached out to Reclamation for explanation. In response, Reclamation reviewed daily operational records showing a steady discharge rate from Minidoka Dam of 425 cfs as identified in the 2015 Opinion (USFWS 2015) and shared the observed correlation in wind data from the closest weather station, located in Rupert, Idaho. In these discussions it was noted that in periods of sustained upstream (west to east) winds in excess of 20 mph, temporary wind-driven water stacking occurs, where discharged water is pushed upstream into the areas between the powerplant and the gage that can hydraulically receive it. This results in temporarily-reduced flow readings at the downstream gage even absent any operational changes made by Reclamation. Drops in flow readings are not observed absent these wind conditions.



Figure 12. Figure showing data correlation between reduced streamflow gage readings (shown in red, "MINI Q") and increased wind speed data recorded at the Rupert weather station (shown in green, "RPTI WS"). Dips in streamflow readings occur when sustained wind causes water stacking in the area between Minidoka Dam and the downstream gage. Data shown are for February 7-22, 2023.

To further supplement understanding of the interplay of the meteorological/geographic factors discussed, Reclamation traveled with USFWS biologists for a July 28, 2023, site visit that included traveling to Minidoka Dam, visiting the snail pool below Minidoka Dam, and meeting with a USGS hydrologic technician at the downstream USGS gage 13081500 on the Snake River at Howell's Ferry to discuss the operation and limitations of the gaging equipment.

During the reporting period, Reclamation assisted USFWS with their trend monitoring of the snail population in the Snake River Between Minidoka Dam and Milner Reservoir. Surveys were conducted August 15 and 16, 2023. Population trend data suggest that Reclamation's long-term flow strategy continues to protect snail habitat downstream of Minidoka Dam.

American Falls Reservoir did not draft below 100,000 acre-feet; therefore, Reclamation was not required to monitor sediment.

Reclamation and USFWS staff met quarterly to discuss activities from the 2005 Upper Snake and associated consultations.

## 5. References

Parenthetical Reference	Bibliographic Citation
75 FR 52272	Federal Register. 2010. <i>Endangered and Threatened Wildlife and Plants; Removal of the Utah (Desert) Valvata Snail from the Federal List of Endangered and Threatened Wildlife</i> . Federal Register, August 25, 2010. Vol. 75, Number 164. pp. 52272-52282.
79 FR 67154	Federal Register. 2014. <i>Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo (Coccyzus americanus)</i> . November 12, 2014. Vol. 79, No. 218. pp. 67154-67155.
Jackson 2017-2020	Jackson, R. 2017-2020, personal communication. Telephone conversations between Rich Jackson, Natural Resource Specialist, (US Bureau of Reclamation, Boise, Idaho), Suzanne Anderson, Biologist, (U.S. Fish and Wildlife Service, LaGrande, Oregon), and Michelle McDaniel, Supervisory Range Conservationist (Bureau of Land Management, Vale, Oregon) in Boise, Idaho. Subject: Range use management, challenges of excluding grazing from adjacent (unfenced) Reclamation lands, and potential solutions and grazing use monitoring approaches. March 10, 2020.
Reclamation 2004	Bureau of Reclamation. 2004. <i>Biological Assessment for the Bureau of Reclamation Operations and Maintenance Activities in the Snake River Basin above Brownlee Reservoir</i> . U.S. Department of the Interior, Bureau of Reclamation, Snake River Area Office, Boise, Idaho.
Reclamation 2006	Bureau of Reclamation. 2006. <i>Utah Valvata and Bull Trout Monitoring and Implementation Plan, Bureau of Reclamation Operations and Maintenance in the Snake River Basin Above Brownlee Reservoir</i> . U.S. Department of the Interior, Bureau of Reclamation, Snake River Area Office, Boise, Idaho. March 2006.
Reclamation 2013	Bureau of Reclamation. 2013. <i>Biological Assessment for Bull Trout Critical Habitat in the Upper Snake River Basin</i> . U.S. Department of Interior, Bureau of Reclamation, Snake River Area Office. Boise, Idaho. December.
Reclamation 2016	Bureau of Reclamation. 2016. <i>Bull Trout Monitoring and Reporting Plan – Phillips Reservoir, Oregon</i> . U.S. Department of the Interior, Bureau of Reclamation, Snake River Area Office, Boise, Idaho. August 2016.
Reclamation 2018a	Bureau of Reclamation. 2018. <i>Memorandum for Record: Changes to Dam Configuration and Applicability of Arrowrock Dam and Reservoir Operational Indicators</i> . Snake River Area Office, Boise, Idaho. Email to file dated March 30, 2018.
Reclamation 2018b	Bureau of Reclamation. 2018. <i>Addressing Terms and Conditions for Beulah Reservoir Associated with the U.S. Fish and Wildlife Service 2005 Biological Opinion for Operation and Maintenance of the Bureau of Reclamation Projects in</i>

Parenthetical Reference	Bibliographic Citation
	<i>the Snake River Basin above Brownlee Reservoir</i> . Snake River Area Office, Boise, Idaho. April 2018.
Reclamation 2018c	Bureau of Reclamation. 2018. <i>Two-Dimensional Water Quality Modeling of Arrowrock Reservoir, 2013-14, Technical Memorandum</i> . U.S. Department of the Interior, Bureau of Reclamation, Pacific Northwest Regional Office. Available online at <a href="https://www.usbr.gov/pn/programs/esa/uppersnake/2004ba/index.html">https://www.usbr.gov/pn/programs/esa/uppersnake/2004ba/index.html</a> (last accessed March 30, 2020).
Reclamation 2018d	Bureau of Reclamation. 2018. <i>Addressing Terms and Conditions for Beulah Reservoir Associated with the U.S. Fish and Wildlife Service 2005 Biological Opinion for Operation and Maintenance of the Bureau of Reclamation Projects in the Snake River Basin above Brownlee Reservoir</i> . U.S. Bureau of Reclamation, Pacific Northwest Region, Snake River Area Office. Boise, Idaho. February 2018.
Reclamation 2018e	Bureau of Reclamation. 2018. <i>Protocol: Beulah Reservoir – Final Monitoring Requirements for the Conservation Pool Recommendations</i> . U.S. Bureau of Reclamation, Pacific Northwest Region, Snake River Area Office. Boise, Idaho.
Reclamation 2024 (forthcoming)	Bureau of Reclamation. 2024. <i>Five-Year Bull Trout Monitoring Plan Report: 2014 Biological Opinion for Phillips Reservoir (Mason Dam), Oregon</i> . Department of the Interior, Columbia-Pacific Northwest Region. 2024.
Rose and Mesa 2009	Rose, B. and M. Mesa. 2009. <i>Minimum pool and bull trout prey base investigations at Beulah Reservoir</i> . Final Report for 2008. Submitted to: United States Department of the Interior, Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho as Final Report for the Study Agreement #29-RO184. January 2009.
USFWS 2005	U.S. Fish and Wildlife Service. 2005. <i>Biological Opinion for Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Brownlee Reservoir</i> . U.S. Department of the Interior, Fish and Wildlife Service, Snake River Field Office, Boise, Idaho. March 31, 2005.
USFWS 2014	U.S. Fish and Wildlife Service. 2014. <i>Biological Opinion for Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Brownlee Reservoir. Effects to Bull Trout in the Powder River, Oregon and Critical Habitat in Idaho and Oregon</i> . U.S. Department of the Interior, Fish and Wildlife Service, Snake River Field Office, Boise Idaho. June 27, 2014.
USFWS 2015	U.S. Fish and Wildlife Service. 2015. <i>Biological Opinion for the Bureau of Reclamation, Operations and Maintenance in the Snake River above Brownlee Reservoir</i> . U.S. Department of the Interior, Fish and Wildlife Service, Idaho Fish and Wildlife Office, Boise, Idaho. May 8, 2015.
USFWS 2019	U.S. Fish and Wildlife Service. 2019. <i>Memo: Bureau of Reclamation (Bureau) Recommended Measures to Satisfy the Terms and Conditions for the Agency Valley Dam from the 2005 U.S. Fish and Wildlife Service Biological Opinion for Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Brownlee Reservoir, Malheur County, Oregon</i> .

Parenthetical Reference	Bibliographic Citation
USFWS 2022	U.S. Fish and Wildlife Service. 2022. <i>Biological Opinion for the Implementation of Operational Changes at Deadwood Dam and Reservoir (2022-0088327)</i> . Department of the Interior, US Fish and Wildlife Service, Idaho Fish and Wildlife Office, Boise, Idaho. 30 September 2022.
Vidergar 2021	Vidergar, D. 2021, personal communication. Email between Dmitri Vidergar, Fisheries Biologist (Reclamation, Boise, Idaho) and Mark Nelson, Fisheries Biologist (USFWS, Boise, Idaho) Subject: correcting value for Arrowrock operational indicator. June 30, 2021.

This page intentionally left blank.