



— BUREAU OF —
RECLAMATION

2022 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: Reclamation biologists access the stilling basin at Deadwood Dam via kayak to perform bull trout sampling activities; Valley County, Idaho (Reclamation photograph by Amy Goodrich).

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Acronyms and Abbreviations

Acronym or Abbreviation	Definition
BA	Biological Assessment
BID	Burley Irrigation District
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
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

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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 Reservoir¹ 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, necessitating that Reclamation consult 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. 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 response to the Minidoka Dam spillway replacement project. Project construction was completed during the summer of 2015. Reclamation consulted on project operations following construction of the spillway. The consultation addressed Reclamation's impact to physa located in the Snake River above Brownlee Reservoir, including the Minidoka Dam spillway. 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 of the current 2005 Opinion (USFWS 2005) and is considered a supplement to the 2005 Opinion.

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

¹ Phillips Reservoir was referred to as Phillips Lake in the 2004 Assessment.

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 (WY) 2022 (October 1, 2021, to September 30, 2022).

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 WY 22 in Reclamation's Hydromet system.² 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.

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

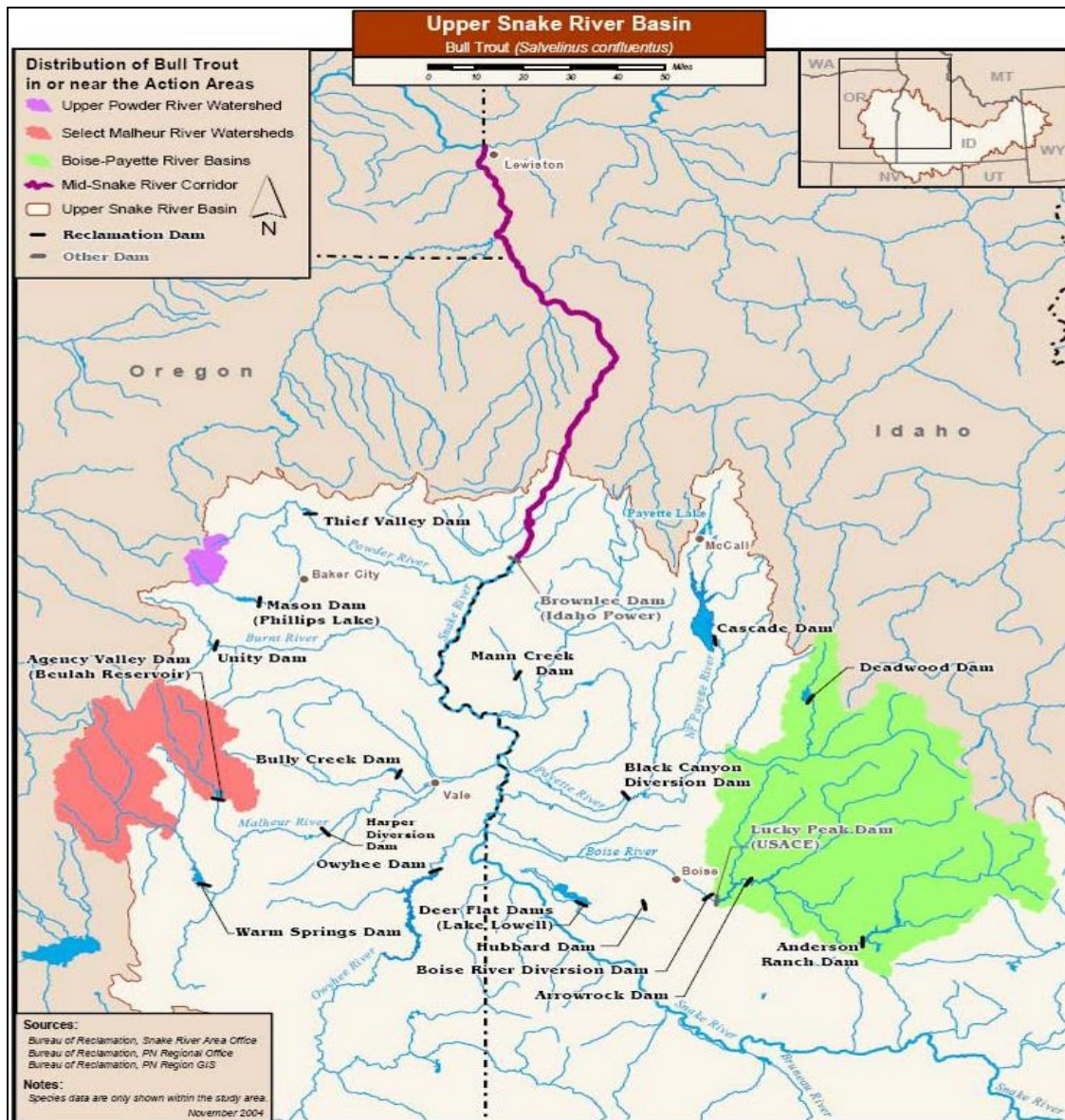


Figure 1. Known distribution of bull trout populations (shaded areas on map) associated with Reclamation facilities in the upper Snake River basin (Reclamation 2004)

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*). USFWS determined that Utah valvata did not meet the definition of an endangered or threatened species under the ESA. 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 2022 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 were 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 2022 Operations

The following information summarizing 2022 operations was included in Reclamation's 2022 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 2022 season, reservoir carryover storage was considerably below average in the Snake River basin above Brownlee Reservoir. Carryover storage on November 1, 2021, was 83 percent of

average in the Payette River basin, 72 percent of average in the Boise River basin, and 48 percent of average in the upper Snake River basin. 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.

During the early-winter months of November through December, above-normal precipitation fell in most basins. After about mid-January, dry conditions began to dominate, and by March, snowpack was 85 percent of normal in the Payette River basin, 81 percent of normal in the Boise River basin, and 79 percent of normal in the upper Snake River basin. By April 15, the snowpack had declined to 79 percent of normal in the Payette River basin and 74 percent of normal in the Boise River basin, and increased slightly to 84 percent of normal in the upper Snake River basin. During May and June, most basins experienced cooler-than-average temperatures and above-average precipitation, which helped improve the water supply and increased the amount of water available for flow augmentation.

Observed unregulated runoff was reflective of the dry conditions experienced during the spring runoff period. The April-through-July unregulated runoff was only 85 percent of normal in the Payette River basin, 79 percent of normal in the Boise River basin, and 72 percent of normal in the upper Snake River basin. As a result of the dry conditions and below-normal runoff, flood risk management (FRM) operations were not required in the upper Snake River basin, and very little FRM occurred in the Boise and the Payette River basins during the spring runoff of 2022.

With dry conditions, the runoff was insufficient to completely fill the Boise and upper Snake River basin reservoirs, but both reservoirs in the Payette River basin filled. The Payette River reservoir system reached a maximum storage content of 778,952 acre-feet, approximately 21,500 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 898,110 acre-feet, approximately 51,590 acre-feet below its full capacity of 949,700 acre-feet. The upper Snake River reservoir system reached a maximum combined physical storage content of 2,691,089 acre-feet, approximately 1,494,606 acre-feet below full capacity of 4,185,695 acre-feet.

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 2022 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 2022 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 2022 reporting period

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2022 Operations (October 2021 to September 2022)	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 2017: 20 days ————— Effects covered separate ITS 2014*: 3 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 WY 21 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 two years was previously erroneously reported as two of the six 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.

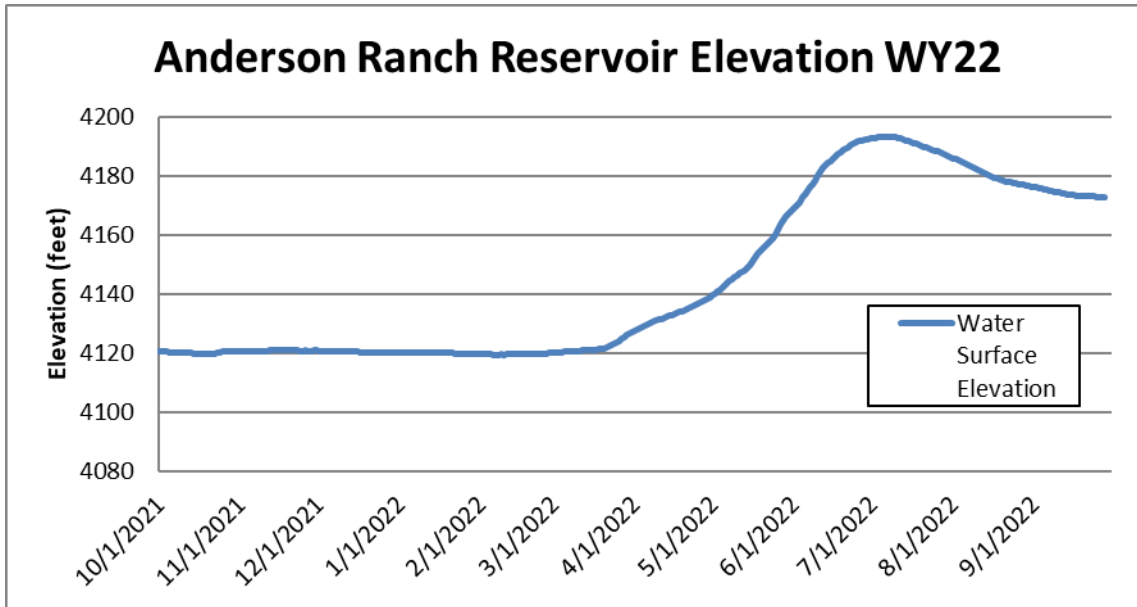


Figure 2. Anderson Ranch Reservoir elevation (feet above sea level) for WY 22

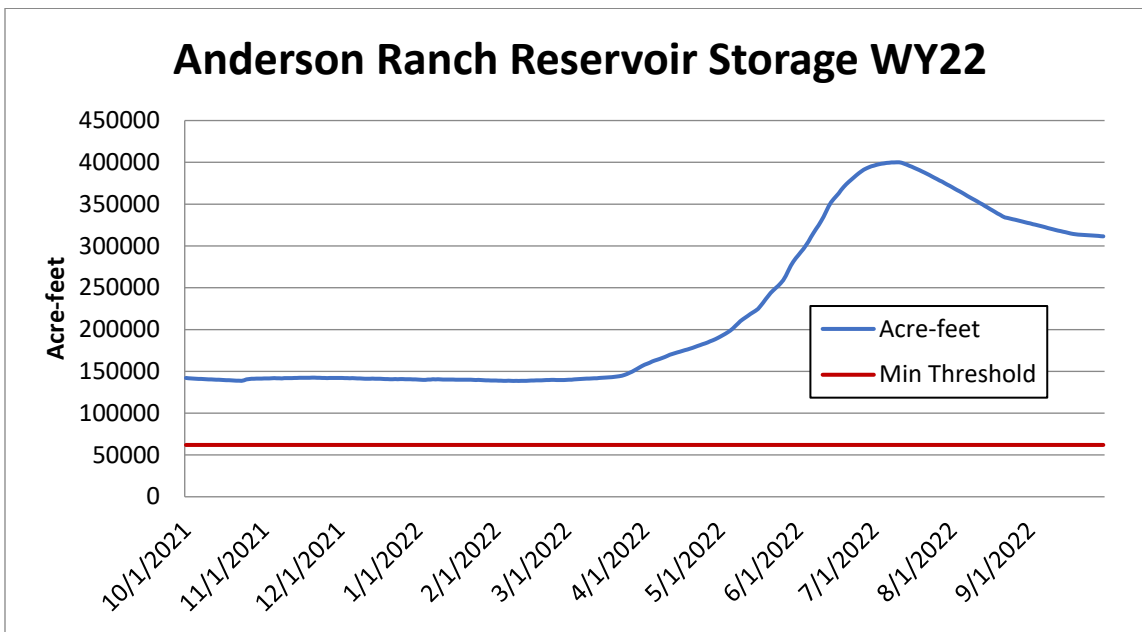


Figure 3. Anderson Ranch Reservoir storage volume (acre-feet) for WY 22. The straight line represents Reclamation’s Operational Indicator minimum threshold of 62,000 acre-feet of storage.

Arrowrock Dam and Reservoir

No current operational indicators were exceeded during the 2022 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 2022 reporting period

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2022 Operations (October 2021 to September 2022)	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
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 WY 2022 (Figure 5)	<u>0 of 18 years</u>

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2022 Operations (October 2021 to September 2022)	Quick Reference: Number of Times Threshold has been Exceeded
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

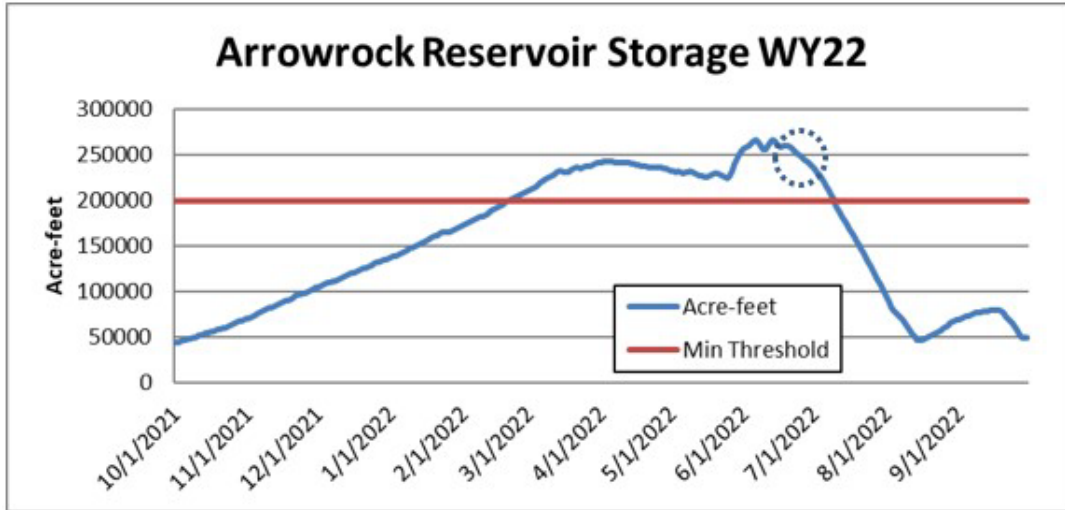


Figure 4. Arrowrock Reservoir storage volume (acre-feet) for WY 22. The straight red line represents Reclamation's Operational Indicator of reservoir volume of 200,000 acre-feet. Reservoir volume should exceed this minimum at the end of June, depicted by the dotted circle. On June 30, 2022, Arrowrock Reservoir storage volume was 237,757 acre-feet.

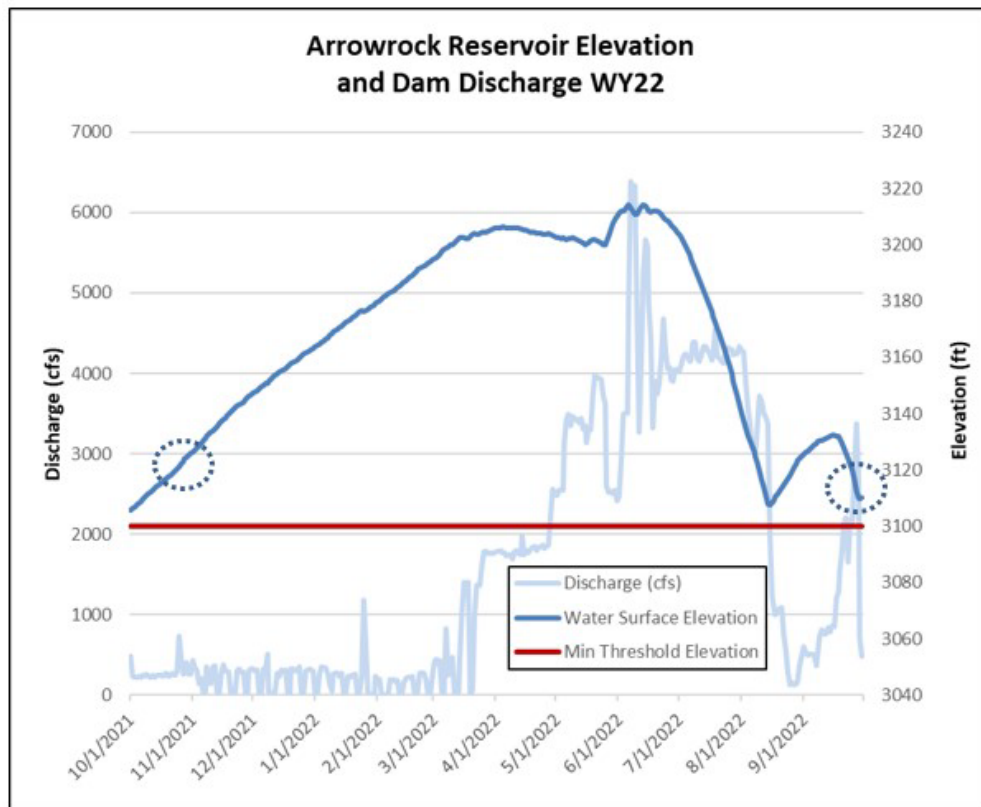


Figure 5. Arrowrock Reservoir surface elevation (feet above sea level) for WY 22 and discharge (cfs). The straight red line represents Reclamation's fall minimum elevation threshold (September 15-October 31) of 3,100 feet, depicted by the dotted circle.

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 WY 22.

Deadwood Dam and Reservoir

One operational indicator was exceeded during the 2022 reporting period in the Payette River basin, i.e., “deep water releases at Deadwood Dam.”

Deep water releases occurred throughout the year at Deadwood Dam (Table 3); however, the 2005 Opinion granted Reclamation an exemption for this action for 30 of the 30 years for which the Opinion is valid.

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 2022 reporting period

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2022 Operations (October 2021 to September 2022)	Quick Reference: Number of Times Threshold has been Exceeded
Up to 2 to 4 percent of bull trout in Deadwood Reservoir are entrained into the Deadwood River below the dam	Water is discharged over the spillway (surface elevation exceeds 5,334 feet)	Spring	11 of 30 years	Water was discharged over the spillway during the reporting period in WY 22 (6/24/22-7/2/22)	<u>7 of 11 years</u> 2006: 32 days 2007: 33 days 2008: 33 days 2010: 15 days 2014: 69 days 2015: 50 days 2022: 9 days
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 WY 22 (Figure 6)	<u>0 of 2 years</u>

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2022 Operations (October 2021 to September 2022)	Quick Reference: Number of Times Threshold has been Exceeded
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	Water is discharged over the spillway	May through July	11 of 30 years	Water was discharged over the spillway during the reporting period in WY 22 (6/24/22-7/2/22)	<u>7 of 11 years</u> 2006: 32 days 2007: 33 days 2008: 33 days 2010: 15 days 2014: 69 days 2015: 50 days 2022: 9 days
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	<u>17 of 30 years</u> Exceeds annually

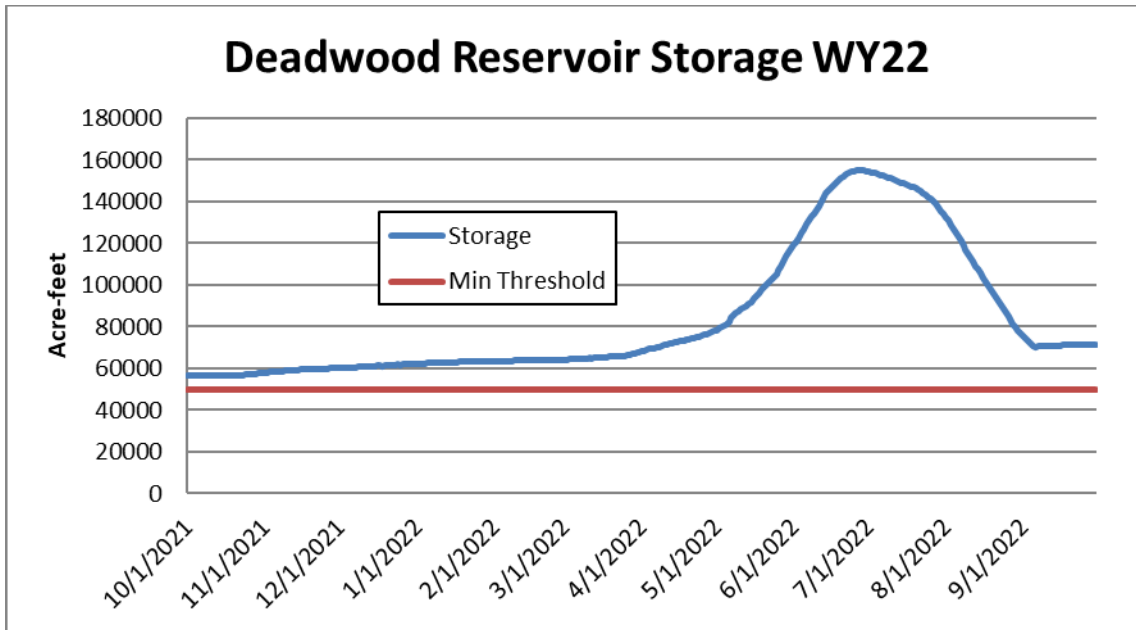


Figure 6. Deadwood Reservoir storage volume (acre-feet) for WY 22. The straight red line represents Reclamation’s Operational Indicator minimum threshold of 50,000 acre-feet of storage.

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 WY 22 was 176 acre-feet on October 1, 2021, following a year where run-of-river operations were exercised to control non-native fish populations in the reservoir, as recommended by Reclamation (2018e). Beulah Reservoir filled to a peak WY 22 level of 30,836 acre-feet (51 percent of full capacity) by May 10, 2022, and subsequently drafted to a low of 1977 acre-feet (3.3 percent of full capacity) by the end of the reporting period.

Phillips Reservoir began WY 22 with a nearly-nil carryover storage volume, which rose to a measurable point of 22.6 acre-feet on December 8, 2021. Hydromet storage readings between August 22 and December 7, 2021, were unattainable due to minimal water; the water surface elevation readings during this time period ranged from 3,977 to 3,981 feet. Phillips Reservoir refilled to a peak of 18,850 acre-feet (26 percent of full capacity) by June 23, 2022. Phillips Reservoir was subsequently drafted to a low of 1,610 acre-feet (2.2 percent of full capacity) by the end of the reporting period.

Information on flows discharged from the dams during WY 22 (October 1, 2021, to September 30, 2022) can be found on Reclamation’s Hydromet website³. Reservoir water operations, including daily average 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 Terms and Conditions from the USFWS 2005 Opinion were described by Reclamation (2018) 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 2022 reporting period in the Malheur River basin; the reservoir volume was less than 2,000 acre-feet but within the range of gaging tolerance as defined by Reclamation (2018).

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 2022 reporting period

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2022 Operations (October 2021 to September 2022)	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 WY 22 reporting period	<u>1 of 3 years</u> 2006: Yes Non-discretionary spill in 2011 and 2017*

³ <https://www.usbr.gov/pn/hydromet/>

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2022 Operations (October 2021 to September 2022)	Quick Reference: Number of Times Threshold has been Exceeded
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 WY 22 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 used in WY 21	<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.

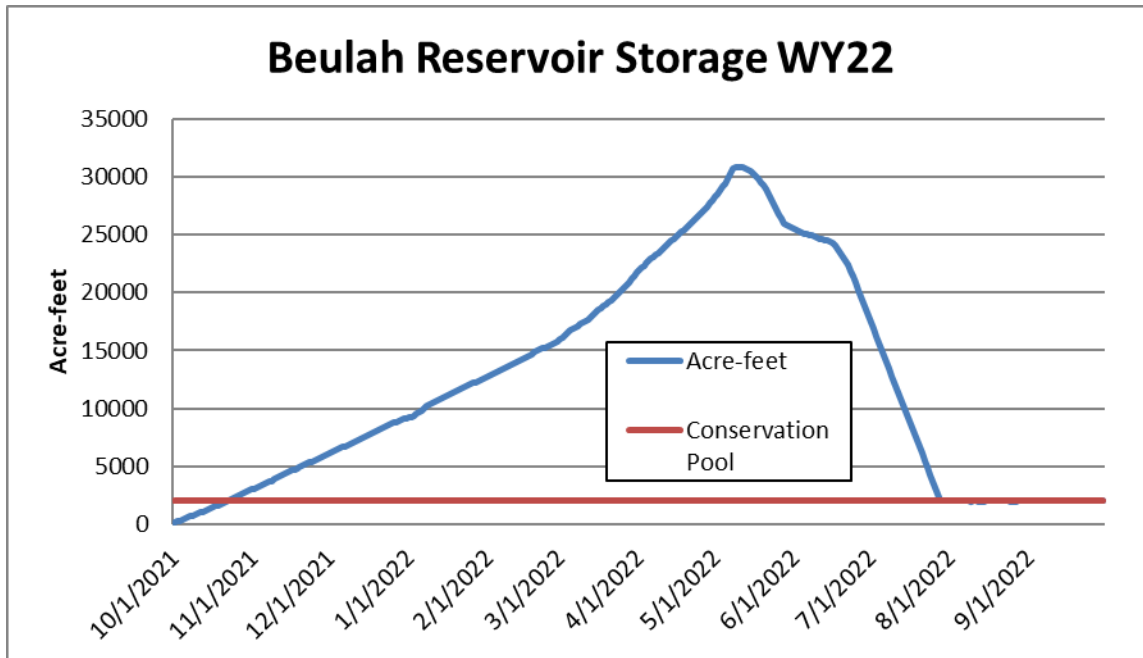


Figure 7. Beulah Reservoir storage volume (acre-feet) for WY 22. The straight red line represents Reclamation’s Operational Indicator minimum threshold of 2,000 acre-feet +/- 80 acre-feet of storage. Lowest reservoir volume during reporting period occurred in the early part of October 2021, when carryover storage remained below 1,000 acre-feet. Storage reached 2,000 acre-feet on October 22, 2021, and remained within the acceptable range of the conservation pool for the remainder of the reporting period.

2.2.2. Powder River Basin Operational Indicators

An Oregon Department of Fish and Wildlife (ODFW) crew sampled two bull trout in Phillips Reservoir in 2011, which triggered a requirement that Reclamation consult with USFWS for bull trout and bull trout critical habitat in this area (Reclamation 2013). USFWS completed a non-jeopardy Biological Opinion in June 2014 for Reclamation’s O&M activities in the Powder River (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 WY 16.

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 WY 22 are 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 WY 22.

Mason Dam/Phillips Reservoir

One operational indicator was exceeded during the 2022 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 WY 22 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 2022 reporting period, as included in the monitoring and reporting plan finalized in 2016

Anticipated Take	Operational Indicators	Critical Season	Frequency of Exemptions	2022 Operations (October 2021 to September 2022)	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 WY 22 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 WY 22 reporting period (Figure 9)	<u>7 of 21 years</u> Occurs annually

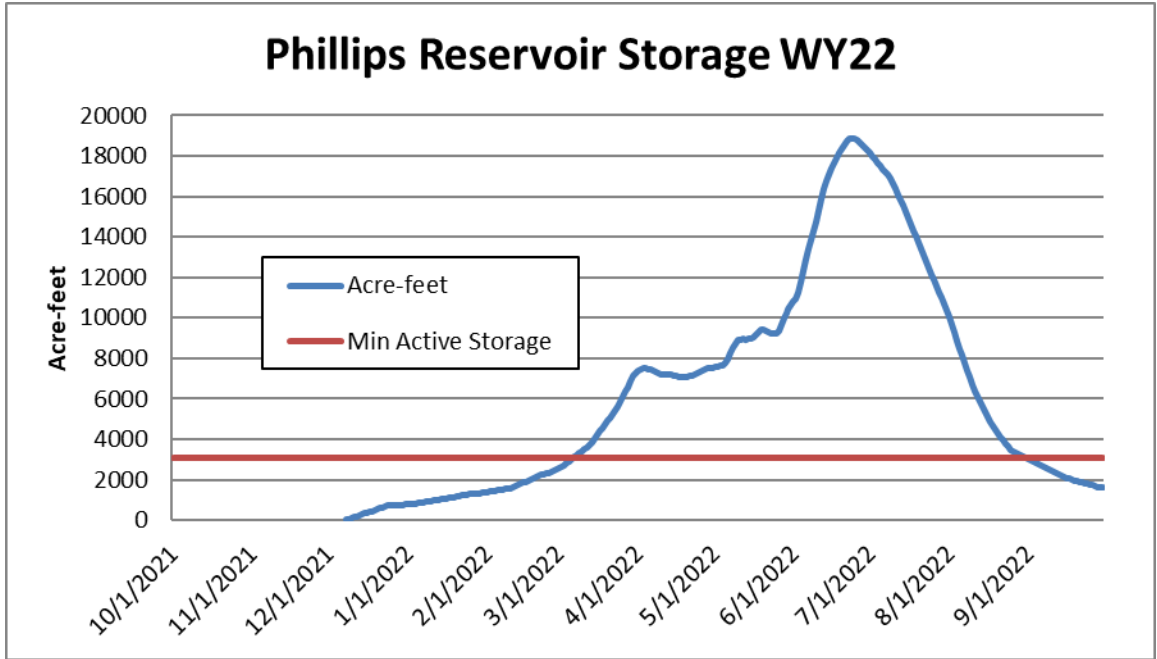


Figure 8. Phillips Reservoir storage volumes (acre-feet) for WY 22. Minimum active storage occurs when pool elevation reaches 4,009 feet above sea level (3,100 acre-feet of storage), corresponding to the point of inactive storage indicated by the red line.

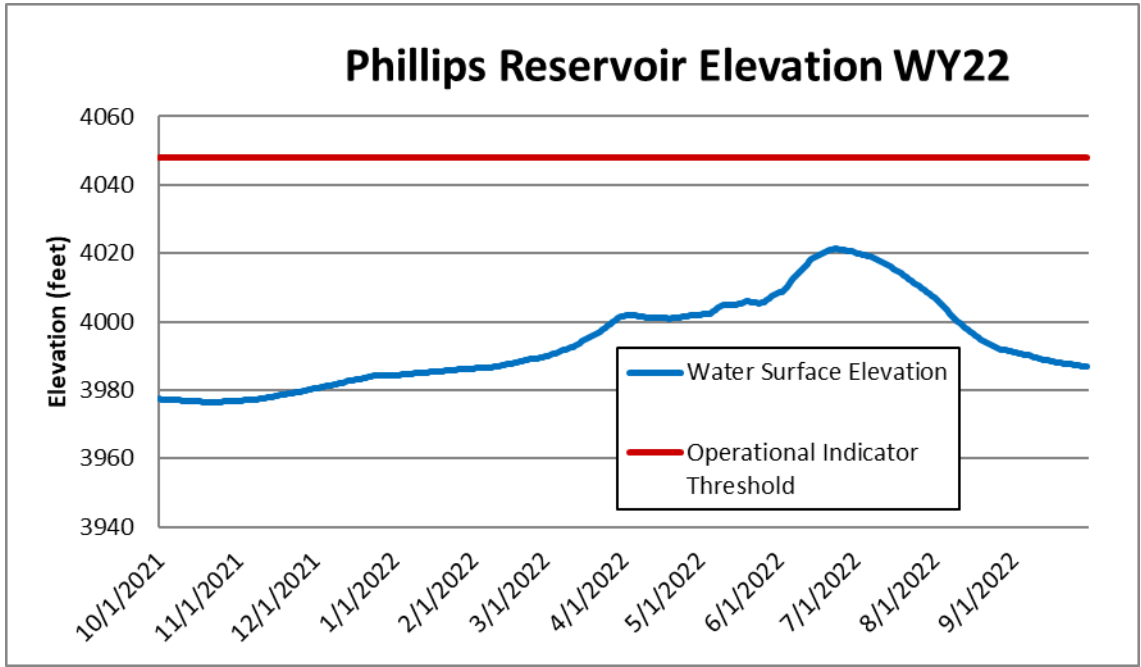


Figure 9. Phillips Reservoir surface elevation (feet above sea level) for WY 22. The operational indicator spring/summer minimum for mean daily reservoir elevation of 4,048 is indicated by the red line.

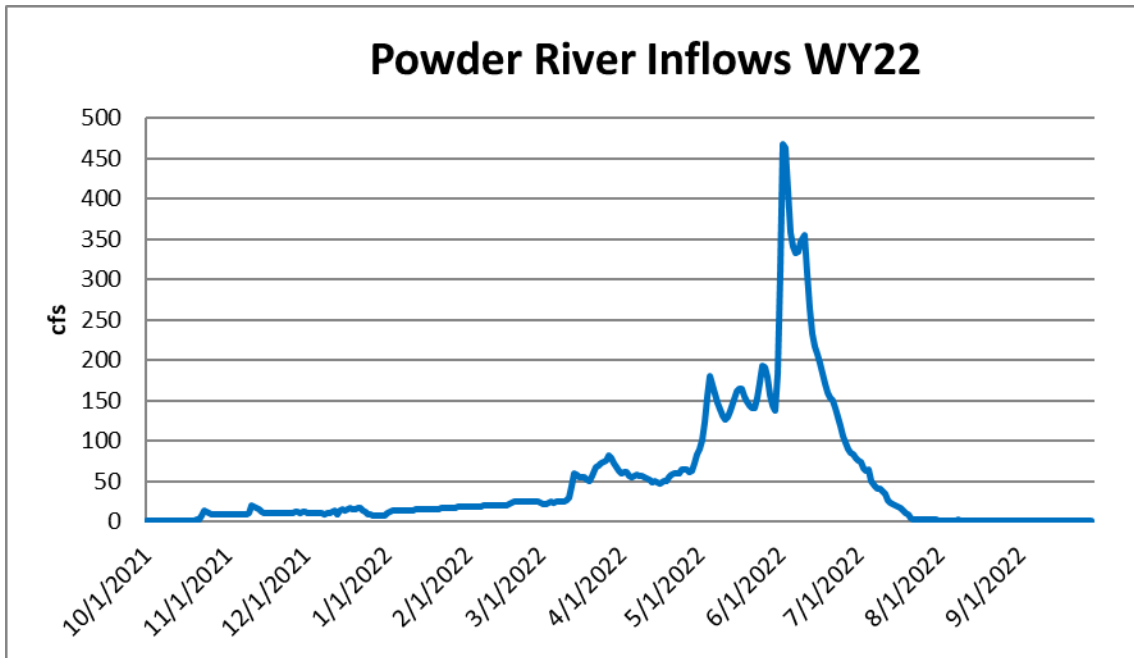


Figure 10. Powder River inflows to Phillips Reservoir in WY 22 measured in cfs and recorded at USGS Gage No. 13275105, Powder River at Hudspeth Lane near Sumpter, Oregon

3. Bull Trout

This chapter describes the bull trout ITS and RPMs, including monitoring efforts during WY 22. 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 flow/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. South Fork Boise River Geomorphology Study

Reclamation completed a geomorphology and time-series study at key locations on the South Fork of the Boise River below Anderson Ranch Dam to better understand migration conditions through the South Fork Boise River/Arrowrock Reservoir varial zone.

Reclamation's River Systems and Restoration group in the Columbia-Pacific Northwest (CPN) Regional Office collected water depth measurements along a longitudinal profile of the South Fork Boise River on September 19, 2022. The area of focus was the varial zone where the South Fork Boise River enters Arrowrock Reservoir. Data were collected starting from below Neal Bridge on Blacks Creek Road (Road 189) and ending at the backwater of Arrowrock Reservoir near Willow Creek (Figure 11). The minimum depth recorded with the acoustic doppler current profiler was 0.19 meters (0.61 feet). Spot-checks done using a meterstick indicated a minimum water depth of 0.25 meters (0.83 feet). Full report details and procedures are in the 2023 South Fork Boise Thalweg Project Technical Memorandum (Reclamation 2023).

Reclamation staff also placed game cameras at two locations along the varial zone to better understand the influence of tributary input within the varial zone. Cameras were located near Blacks Creek Road along the South Fork Boise River at the confluences of Willow and Rattlesnake creeks and the South Fork Boise River. Time-series photographs were taken from June 2 through September 10, 2022.



Figure 11. Overview map of the area of interest on the South Fork Boise River

3.1.3. 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 BiOp. 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 2021 and 2022, Reclamation conducted additional updates to the 2018 model that focused on identifying operational effects during drought conditions. Study analyses are ongoing.

3.1.4. 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 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 (Appendix A). This Excel file should be used as the authoritative source of data for the Boise River weirs from this point forward. The Excel file will be published with a technical memorandum later in 2023 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	1583	1664	81

3.1.5. 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; however, a trap-and-transport was conducted in Lucky Peak Reservoir in 2022 because it was an even-numbered year. No other trap-and-transport efforts occurred in the Boise River basin during the reporting period.

Lucky Peak trap-and-transport efforts were conducted on 8 separate days between May 2 and May 24, 2022. Fyke nets were used with a 4-foot-square trap panel frame reduced to 5 fykes with 50-foot-long by 4-foot-wide leads and 0.25-inch mesh. Fifty-foot gill nets with one of three different mesh sizes (2.5-inch, 3-inch, and 3.5-inch) were used in random deployment throughout the upper arm of the reservoir between Macks Creek boat ramp and below the safety boom line near Arrowrock Dam. Soak times were limited to under 1 hour, when possible, to maximize fish survival.

Water surface temperatures during the sampling period ranged from 5.2°C to 15°C and varied from day to day and between net set locations. Operational changes to the amount of water being discharged from Arrowrock Dam during the sampling period seemed to influence both water temperatures and the locations of cooler pockets of water, which were not consistent between days and did not appear to follow any trend over the sampling period. Drought conditions caused water management to maintain lower volume in

Lucky Peak Reservoir during the spring. These conditions exposed shoreline habitat that was conducive to the deployment of fyke nets in addition to the typical deployment of gill nets.

No bull trout were captured/relocated during the 2022 sampling effort. A total of 884 fish, including 9 species, were captured and subsequently released, during a total of 234 effort hours, with a total catch per unit effort (CPUE) of 3.78. Largescale sucker, bridgelip sucker, and redbreast shiner comprised 90 percent of the total catch. A by-species breakdown of total catch is provided in Table 7.

Table 7. Trap-and-transport effort on Lucky Peak Reservoir, May 2 through May 24, 2022. The unit of effort for CPUE is one hour.

Species	Total	CPUE	Percent of Total Catch
Bull trout (<i>Salvelinus confluentus</i>)	0	0	0
Largescale sucker (<i>Catostomus macrocheilus</i>)	211	0.90	23.9
Rainbow trout (<i>Oncorhynchus mykiss</i>)	9	0.04	1
Mountain whitefish (<i>Prosopium williamsoni</i>)	1	0.004	0.1
Smallmouth bass (<i>Micropterus dolomieu</i>)	12	0.05	1.4
Northern pikeminnow (<i>ptychocheilus oregonensis</i>)	18	0.08	2
Chiselmouth chub (<i>Acrocheilus alutaceus</i>)	6	0.03	0.7
Bridgelip sucker (<i>Catostomus comumbianus</i>)	88	0.38	10
Redside shiner (<i>Richardsonius balteatus</i>)	491	0.21	55.5
Yellow perch (<i>Perca flavescens</i>)	26	0.11	2.9
Unknown sucker (<i>Catostomus spp</i>)	22	0.09	2.5
Totals	884	3.78	100

3.1.6. Other Activities

Section 10 Permit

Reclamation received a Section 10 Permit to conduct activities for scientific purposes as required by the 2005 Opinion. The activities covered under this permit during the reporting year included the Arrowrock trap-and-transport effort.

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 2022 Meeting occurred in April and the water temperature and dissolved oxygen monitoring reports for the 2022 WY were distributed.

Recovery Planning Working Groups

Reclamation is working with partners to update bull trout Species Status Assessments. Collaboration in 2022 included participation in multi-agency working groups for the Powder and Malheur watersheds in Oregon and the Boise and Payette watersheds in Idaho.

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 stocking⁴ for all fish species that occurred at Arrowrock and Anderson Ranch Reservoirs and in the South Fork Boise River in WY 2022 is shown in Table 8.

Table 8. Fish stocking by IDFG in WY 2022 in the Boise River basin for all fish types

Location	Date Stocked	Species Type	Size (inches)	Number Stocked
Anderson Ranch Reservoir	6/2/2022	Kokanee	Less than 6	45,369
	6/2/2022	Kokanee	Less than 6	37,517
	6/2/2022	Kokanee	Less than 6	41,665
Arrowrock Reservoir	10/13/2021	Rainbow trout	Catchable (6+)	9,040
	10/13/2021	Rainbow trout	Catchable (6+)	11,520
	4/4/2022	Rainbow trout	Catchable (6+)	3,762
	4/4/2022	Rainbow trout	Catchable (6+)	2,650
	4/4/2022	Rainbow trout	Catchable (6+)	518
	4/4/2022	Rainbow trout	Catchable (6+)	1,260
	4/5/2022	Rainbow trout	Catchable (6+)	75
	4/5/2022	Rainbow trout	Catchable (6+)	75
	4/5/2022	Rainbow trout	Catchable (6+)	75
	4/5/2022	Rainbow trout	Catchable (6+)	75

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

Location	Date Stocked	Species Type	Size (inches)	Number Stocked
	4/5/2022	Rainbow trout	Catchable (6+)	75
	4/5/2022	Rainbow trout	Catchable (6)	75
	4/6/2022	Rainbow trout	Catchable (6)	884
	6/2/2022	Kokanee	Less than 6	65,549
	6/2/2022	Kokanee	Less than 6	32,670
South Fork Boise River (Above Anderson Ranch Reservoir)	6/3/2022	Rainbow trout	Catchable (6+)	530
	6/3/2022	Rainbow trout	Catchable (6+)	530
	6/3/2022	Rainbow trout	Catchable (6+)	530
	6/28/2022	Rainbow trout	Catchable (6+)	945
	7/14/2022	Rainbow trout	Catchable (6+)	1,905
	7/14/2022	Rainbow trout	Catchable (6+)	950
	7/14/2022	Rainbow trout	Catchable (6+)	950
	8/11/2022	Rainbow trout	Catchable (6+)	1,000
	8/11/2022	Rainbow trout	Catchable (6+)	950
	8/11/2022	Rainbow trout	Catchable (6+)	950

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 WY 22 and reported in Section 2.1.2 of this document. As part of the action identified in the 2022 consultation, Reclamation conducted 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 October 3-6 and totaled 123.4 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 2.3 cfs for safety of the staff working in the area.

Captured bull trout (n=7) 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 either below the access bridge (fish less than approximately 200 mm) or fish over approximately 200 mm were released in the pool at the mouth of Wilson Creek (approximately 0.25 miles downstream of the dam).

Sampling gear used in 2022 included fyke (trap) nets; three net locations were tested (Figure 12, Figure 13, and Figure 14). The most common species encountered (relative abundance) included dace spp (82.7 percent), rainbow trout (9.1 percent), and mountain whitefish (3.3 percent). Other species included bull trout, westslope cutthroat trout, sculpin spp, redbelt shiner, and kokanee salmon (Table 9). Handling methods were similar to those used in previous efforts. Each fish was identified to the lowest practical taxonomic level. Additionally, 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.



Figure 12. Fyke net location under the access bridge to the dam. Wings were attached to both shorelines and lead line was angled around bridge abutment and anchored to the river left shoreline. This location worked well and should be used in the future. Note that algae, detritus, and oxidized iron sediment accumulated on wings. Fish were generally loaded/unloaded on the concrete shelf under the bridge.



Figure 13. Fyke net location at spillway base, center position. The upstream wing was attached to the face of the dam and the downstream wing was positioned off the spillway shelf with an anchor on the lead line and a buoy with slack line attached to the float line. The lead line was stretched across the stilling basin and secured with line to the erosion wall. Note that this location was the least effective and would require adjustment if used again.



Figure 14. Fyke net location at spillway base, shoreline position. The upstream wing was attached to the face of the dam and the downstream wing was anchored to shoreline cobble. The lead line was stretched across the spillway shelf and secured to the catwalk under outlet conduits. This location worked well and should be used in the future. Note that discharge from the hydro-generator releasing approximately 2.3 cfs can be seen between the operations building and the face of the spillway.

Table 9. Summary statistics for the Deadwood Dam stilling basin bull trout trap-and-transport. Sampling occurred in October 2022. Summary includes total catch, catch per unit effort (CPUE), and relative abundance (percent of total). Total sampling hours = 123.40.

Species	Total Catch (# of fish)	CPUE (fish/hour)	Percent of Total
Bull trout (<i>Salvelinus confluentus</i>)	7	0.06	0.43
Cutthroat trout (<i>Oncorhynchus clarki lewisi</i>)	5	0.04	0.30
Rainbow trout* (<i>Oncorhynchus mykiss</i>)	150	1.22	9.13
Redside shiner (<i>Richardsonius balteatus</i>)	2	0.02	0.12
Sculpin (<i>Cottus spp</i>)	19	0.15	1.16
Dace (<i>Rhinichthys spp</i>)	1,359	11.01	82.71

Species	Total Catch (# of fish)	CPUE (fish/hour)	Percent of Total
Mountain whitefish (<i>Prosopium williamsoni</i>)	54	0.44	3.29
Kokanee salmon (<i>Oncorhynchus nerka</i>)	47	0.38	2.86
Totals	1,643	13.31	100.00

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

Other Activities

In 2022, IDFG stocked rainbow trout in Deadwood Reservoir as a measure to supplement a sport fishery (Table 10).

Table 10. Fish stocking by IDFG in 2021 in Deadwood Reservoir for all fish types

Date Stocked	Species Type	Size	Number Stocked
6/15/2022	Rainbow trout	Less than 6 inches	10,121

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 WY 19 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 2017-2022, 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 June 6 to 9 for a total of 679 hours of sampling effort. This effort was performed by 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 2022 included fyke traps. The most common species encountered (relative abundance) included northern pikeminnow (47.0 percent), redbreasted sunfish (33.9 percent), and sucker spp. (16.3 percent). Other species included chiselmouth, rainbow trout, and dace spp.; no bull trout or largemouth bass were sampled (Table 11). Sampling locations were randomly chosen in each of the four quadrants (NW, NE, SW, and SE). Eight net sets occurred in each quadrant: 1 (SW), 2 (NW), 3 (NE), and 4 (SE) shorelines.

Differences between the 2022 effort and past years included less sampling effort, fewer gear types, and run-of-river conditions during the previous year; however, for general comparison of population trends, comparisons are made to catch statistics from 2019 and 2021 (Table 11). The most common species remained similar, but the relative abundances changed slightly from 2021 to 2022 for redbside shiner (47.9 percent to 33.9 percent), northern pikeminnow (27.4 percent to 47.0 percent), and sucker spp. (14.6 percent to 16.3 percent). The presence of non-native species, including largemouth bass, decreased from 2021. In 2022, no largemouth bass were sampled compared to 12 individuals, representing several age classes, sampled in 2021. The presence of rainbow trout also decreased, from 9.2 percent in 2021 to 2.1 percent in 2022, although genetic testing was not performed to identify native or hatchery origin, most individuals had features characteristic of hatchery fish.

Table 11. Summary statistics for prey base sampling at Beulah Reservoir, Oregon (ODFW unpublished data). Sampling occurred in June 2022. Summary includes total catch, relative abundance and catch per unit effort (CPUE) reported for Fyke nets. Relative abundance values for 2019 and 2021 sampling are provided for comparison).

Species	Gill Net	Fyke (trap) net	Crayfish traps	E-fish	TOTAL	2022 Relative abundance	2021 Relative abundance	2019 Relative abundance
Largescale sucker		430			430	11.2%	9.6%	7.3%
Bridgelip sucker		116			116	3.0%	0.5%	11.9%
Sucker (juvenile, species unk.)		79			79	2.1%	4.4%	16.5%
Northern pikeminnow		1808			1808	47.0%	27.4%	21.7%
Chiselmouth		26			26	0.7%	0.2%	1.5%
Redside shiner		1303			1303	33.9%	47.9%	38.5%
Largemouth bass		0			0	0.0%	0.4%	0.2%
Rainbow trout *		79			79	2.1%	9.2%	2.2%
Sculpin spp		0			0	0.0%	0.1%	0.0%
unknown dace		2			2	0.1%	0.1%	0.0%
Speckled dace		0			0	0.0%	0.0%	0.2%
Longnose dace		0			0	0.0%	0.0%	0.1%
Bull trout		0			0	0.0%	0.0%	0.0%
Signal crawfish		0			0	0.0%	0.2%	0.1%
TOTAL SAMPLING HRS		679						
TOTAL FISH CAUGHT		3843						
CPUE		0.18						

*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 2022, the water lease was used to maintain the conservation pool within the required range. The lowest storage volume occurred on August 26 at 1,977 acre-feet and carryover into WY 23 was 2,045 acre-feet on October 1, 2022.

3.3.3. Trap-and-Transport Efforts

Spring

The spillway was not used at Agency Valley Dam in 2021; therefore, spring trap-and-transport was not required.

Fall

Reclamation and the Vail 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 2013b). 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 WY 22, staffing availability precluded surveying during this timeframe. Surveys will resume in WY 23.

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 2022, Reclamation was not able to participate in the data collection effort due to staffing limitations.

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 24.3 miles. In total, 123 redds were observed throughout the North Fork Malheur River and tributaries.⁵

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 15

⁵ 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 WY 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.

shows the number of redds observed in the North Fork Malheur River basin and the carryover of reservoir storage in Beulah Reservoir.

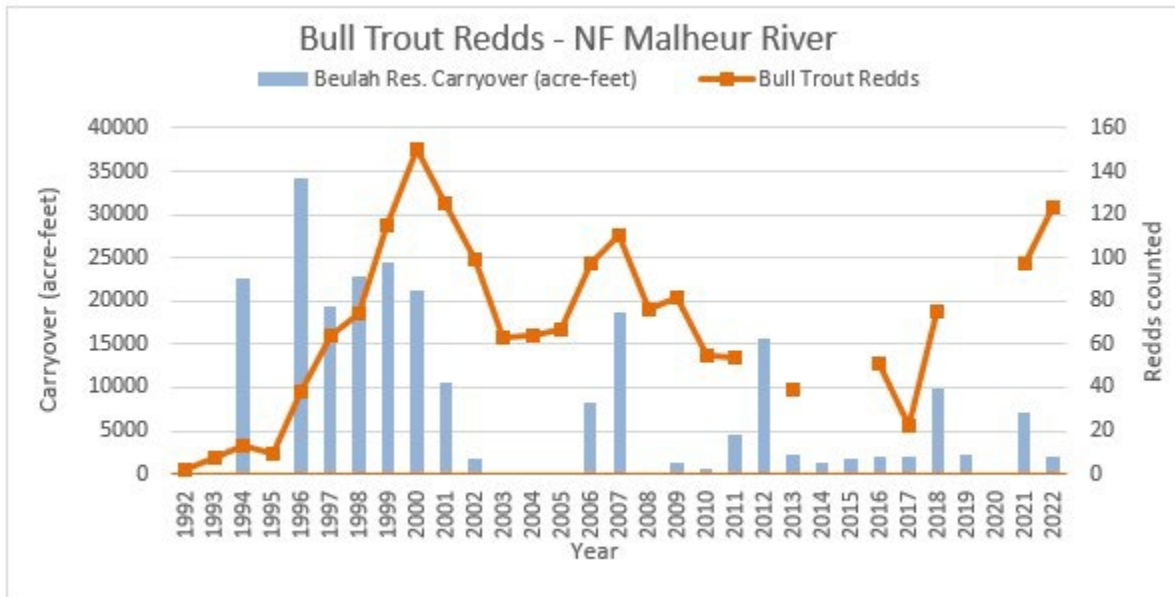


Figure 15. Data on bull trout redd trends observed in the North Fork Malheur River watershed (North Fork Malheur River) and carryover storage at the start of the water year in Beulah Reservoir for WYs 1992–2021. The number of redds observed after 2007 has been adjusted by one to reflect the reduced size 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 a 5-year Bull Trout Monitoring and Reporting Plan for Phillips Reservoir 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 2022 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

In 2016, Reclamation implemented environmental DNA (eDNA) sampling to supplement other sampling methods used at Phillips Reservoir as part of the 5-year sampling plan to better understand bull trout use, if any, of the reservoir. Sampling took place at four locations, including the mouth of the Powder River approximately 20 meters (66 feet) above its inflow into Phillips Reservoir, the mouth of Deer Creek approximately 20 meters (66 feet) above its inflow into Phillips Reservoir, and a sampling location on each bank (north and south) of the Powder River outflow, approximately 50 meters (164 feet) below the outflow from Mason Dam. The same locations were sampled for eDNA repeatedly during multiple sampling event in the spring of 2017 and 2018. Additionally, in the fall of 2018 and 2019, several eDNA samples were taken from locations both within the drawn-down reservoir pool and upstream in the Powder River (at USGS Gage No. 13275105). Synthesized results of fish sampling and eDNA sample analysis will be provided in the forthcoming summary report of results of the 5-Year Bull Trout Monitoring and Reporting Plan for Phillips Reservoir, which will inform the formulation of forthcoming operational recommendations for Phillips Reservoir.

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 2022 reporting period.

- USFWS Quarterly Meetings – January 25, 2022; April 22, 2022; July 11, 2022; August 31, 2022; and October 12, 2022
- Boise and Payette Watersheds – Annual Multi-Agency Bull Trout Coordination Meeting February 10, 2022
- Malheur Watershed – Active member of the Technical Advisory Committee. Meetings on December 8, 2021, and April 14, 2022. Also, finalized a Memorandum of Understanding for Bull Trout Conservation Plan in the Upper Malheur watershed and reviewed Biological Assessment for work associated with the Upper Malheur Bull Trout Conservation Plan.
- Powder Watershed - Phillips watershed coordination meetings – January 11-12, 2022
- Upper Snake River - Upper Snake River working group for Palisades sediment and drought – August 26, September 30, October 14, and October 3
- Water Quality – Various efforts conducted by Reclamation’s CPN Regional Water Quality Laboratory

Reclamation participated in several water quality related projects in the upper Snake River basin during 2022. 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 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 – Idaho Department of Environmental Quality (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.
- American Falls Sediment Study - <100,000 Acre Feet – As part of conditions agreed upon with IDEQ and USFWS in a 2015 USFWS BiOp, Reclamation monitors sediment transport downstream of American Falls and Lake Walcott on a twice-weekly basis to evaluate water management actions that may be taken to minimize harm to Snake River physa snail whenever American Falls is below 100,000 acre-feet of active storage.
- Boise Reservoirs Monitoring Program – The Boise Reservoirs Monitoring program is part of the CPN Water Quality Laboratory 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, NEPA compliance, BiOp 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 with Reclamation and the 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.

- Cascade Reservoir Operations Pilot Study Sampling – The goal of this project is to model potential changes to operations at Cascade and Deadwood reservoirs to determine if water quality can be improved in Cascade Reservoir. The CPN Laboratory collected nutrient and biological data in Cascade Reservoir to assist with model development for the pilot study. In addition, CPN Laboratory staff deployed and temperature tidbits in the three largest tributaries to Cascade Reservoir. This initial field data collection occurred in FY 21 and FY 22.
- Invasive Species Monitoring – The Invasive Species Monitoring program is part of the CPN Laboratory 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 with 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 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.
- 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.

4. Snake River Physa

In 2022, Reclamation assisted USFWS with their August 16 and 17 trend monitoring of the snail population in the Snake River between Minidoka Dam and Milner Reservoir. Reclamation has completed the monitoring requirements outlined in the 2015 Opinion. Long-term flow recommendations were accepted by USFWS in the spring of 2020. These recommendations fulfill requirements identified in the 2015 Opinion (USFWS 2015).

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