RECLAMATION
Managing Water in the West

2009 Annual Report

Bureau of Reclamation
Report on Monitoring and Implementation Activities Associated with the USFWS 2005 Biological Opinion

for

Operation and Maintenance of the Bureau of Reclamation Projects in the Snake River Basin above Brownlee Reservoir

Pacific Northwest Region
Snake River Area Office
Boise, Idaho

U.S. Department of the Interior
Bureau of Reclamation

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I. Introduction

The U.S. Bureau of Reclamation (Reclamation) consulted with the U.S. Fish and Wildlife Service (FWS) on 12 proposed actions involving the effects of future operations and routine maintenance at 12 Federal projects in the upper Snake River Basin. The FWS completed a non-jeopardy biological opinion (Opinion) in March 2005 for Reclamation operations and maintenance activities in the Snake River Basin above Brownlee Reservoir. The Opinion (FWS 2005) contains a 30-year incidental take statement (ITS) and corresponding reasonable and prudent measures (RPMs) that outline nondiscretionary actions to minimize take for Utah valvata (*Valvata utahensis*) and bull trout (*Salvelinus confluentus*).

Section 9 of the Endangered Species Act (ESA) defines take as any action that can harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in such conduct toward a listed species. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the ESA; provided that such taking is in compliance with the terms and conditions (T&C) of the ITS. The ITS has two main components: a monitoring component to ensure the action agency does not exceed the amount or extent of incidental take described in the ITS, and RPMs to minimize the amount or extent of take (without altering the basic design, location, scope, duration, or timing of the action). The Opinion requires that Reclamation provide an annual report to the FWS reporting incidental take monitoring efforts, and implementation status of all RPMs and terms and conditions. The annual report is due by March 31 of each year. The submittal date was changed from December 31 to March 31 after FWS agreed (letter dated November 13, 2007) to a request by Reclamation for a permanent change.

This document is submitted as Reclamation's annual report for Water Year (WY) 2009 (October 1, 2008, to September 30, 2009). This is an appropriate reporting period but presents a challenge because annual minimum reservoir contents occur near the end of the reporting period. For 2009 the minimum contents of many reservoirs occurred in the first few days of the reporting period in October 2008 and are the result of 2008 operations that were reported last year. Generally, the relevant 2009 minima are reported in this report and their relationship to the initial conditions is described when needed to enhance clarity.

Also referenced in this report is an Opinion from the National Oceanic Atmospheric Administration (NOAA) Fisheries, May 2008, for the continued operation and maintenance of Reclamation projects in the Snake River Basin above Brownlee Reservoir (NOAA 2008). The incidental take statement included RPMs and associated terms and conditions to minimize incidental take to 13 listed salmon and steelhead evolutionarily significant units (ESUs) or adversely modify or destroy critical habitat that is designated for three of the ESUs. The annual progress report for the NOAA Opinion is reported under a different cover (Reclamation 2009a).

II. Summary of 2009 Operations

Idaho

Carryover storage ranged from below average to near average at the beginning of water year 2009. Mid-winter snow accumulation was near average and a wet and cool spring resulted in near average runoff volumes. Initial storage in October 2008 was near average in the Payette Basin (98%) and in the Boise Basin (97%), and low in the Snake River Basin above Milner Reservoir (83%). Unregulated runoff for the April through July period was 112% of average for the Snake River at Heise, 91% for the Payette River at Horseshoe Bend, and 87% for the Boise River near Boise (Reclamation 2009a).

Of the three major reservoir systems, the Payette and Upper Snake refilled completely in 2009, while the Boise reservoir system was deliberately held about 18,000 acre-feet from full in order to move the flow augmentation release to an earlier time frame as outlined in the 2008 Opinion (NOAA 2008). Sufficient water was available in 2009 to provide 487,000 acre-feet for Reclamation's flow augmentation program for salmonid species below Brownlee Reservoir. This amount is the upper limit of flow augmentation to be provided in any given year. Contributions to the flow augmentation included 199,758 acre-feet from the upper Snake River above Milner Dam, 166,402 acre-feet from the Payette River Basin, 43,191 acre-feet from the Boise River Basin, and 77,649 acre-feet of natural flows.

Oregon

Carryover storage was very low for the Malheur Basin in particular Beulah Reservoir in water year 2009. The watershed above Beulah Reservoir represents approximately 20% of the Malheur Basin. Carryover storage in Beulah Reservoir was about 32% of the 2000-2009 average to begin the 2009 water year due to drought conditions in recent years. Unregulated runoff for the April through July period was 63% of average for Beulah Reservoir. Beulah Reservoir filled to about 63% (37,894 acre-feet) of physical capacity in 2009 and was drafted to 1 % of reservoir capacity (572 acre-feet) on August 2, 2009. The Malheur Basin does not contribute to Reclamation's flow augmentation program.

Flow information for the 2009 WY (October 1, 2008 to September 30, 2009) can be found at Reclamation's Hydromet website (http://www.usbr.gov/pn/Hydromet/; Reclamation 2009b). Reservoir water operations including daily average reservoir elevations, acre-feet contents, storage and outflow are graphically depicted in Figures 5-8 (American Falls Reservoir and Lake Walcott) and Figures 10-15 (Anderson Ranch, Arrowrock, Deadwood, and Beulah reservoirs).

III. Utah Valvata

Summary of the Utah valvata Incidental Take Statement and 2009 Operations

The FWS completed an Opinion for Reclamation operations and maintenance activities in the Snake River Basin above Brownlee Reservoir in March 2005 (FWS 2005). The FWS found that operations associated with the proposed operations of American Falls and Minidoka Dams would result in incidental take of Utah valvata (*Valvata utahensis*).

Figure 1 shows the location of Utah valvata in the monitoring area.

The FWS included T&C in its Opinion to minimize incidental take of Utah valvata. The Opinion contains the ITS and corresponding RPMs that outline nondiscretionary actions for Utah valvata. The RPM requires Reclamation to minimize incidental take of Utah valvata related to Reclamation's operations of two facilities: at American Falls Dam and Reservoir, and at Minidoka Dam and Lake Walcott. Reclamation must comply with the RPMs to receive Section 9 coverage under the ESA, 16 U.S.C. 1531 *et seq*. In addition, the Opinion requires Reclamation to develop monitoring plans to ensure that Reclamation's operations do not exceed the defined extent or amount of incidental take. Operational thresholds and the respective effects, frequency and timing for 2009 are summarized in Table 1.

Reclamation received a section 10(a)(1)(A) of the ESA, recovery permit from the FWS in July, 2007, for the purpose of monitoring Utah valvata snail (*Valvata utahensis*) and Snake River physa snail (*Physa natricina*) at specific locations in the Snake River in southern Idaho. [Permit # TE056557-3] The permit expires July 1, 2011. The purpose of this document is to summarize Reclamation's monitoring activities for Utah valvata in WY 2009[1/], pursuant to the special T&C set forth in the permit. Monitoring activities summarized in this report will also include data collected by Montana State University (MSU) research personnel, as identified in the permit under "List of Authorized Individuals, TE-056557-3".

Presence/absence surveys for Utah valvata were conducted by Reclamation in Lake Walcott in June and August 2009. A total of 236 samples were collected in WY 2009; no Utah valvata were knowingly killed as a result of collection and handling during this period. All Utah valvata were returned to the monitoring site collection points immediately following species verification. In addition, MSU collected 85 samples in the Neeley Reach of the Snake River in WY 2009. No Utah valvata were knowingly killed. All Utah valvata collected by MSU were returned to their respective collection locations following identification.

Reclamation collected additional samples in 2009 associated with Reclamation's Minidoka Spillway Replacement project. Reclamation is proposing to replace the existing stop-log spillway structure with an over-flow and gated spillway structure. Reclamation is currently analyzing potential impacts associated with the replacement project through the National Environmental Policy Act (NEPA) process. As part of this analysis, Reclamation collected

[1] WY 2009 began October 1, 2008, and went through September 30, 2009.

44 additional samples for Utah valvata and Snake River physa in the general vicinity the Minidoka Dam spillway. No snails were encountered; therefore, no take occurred as a result of this collection activity. Results for this collection activity are included in this report.

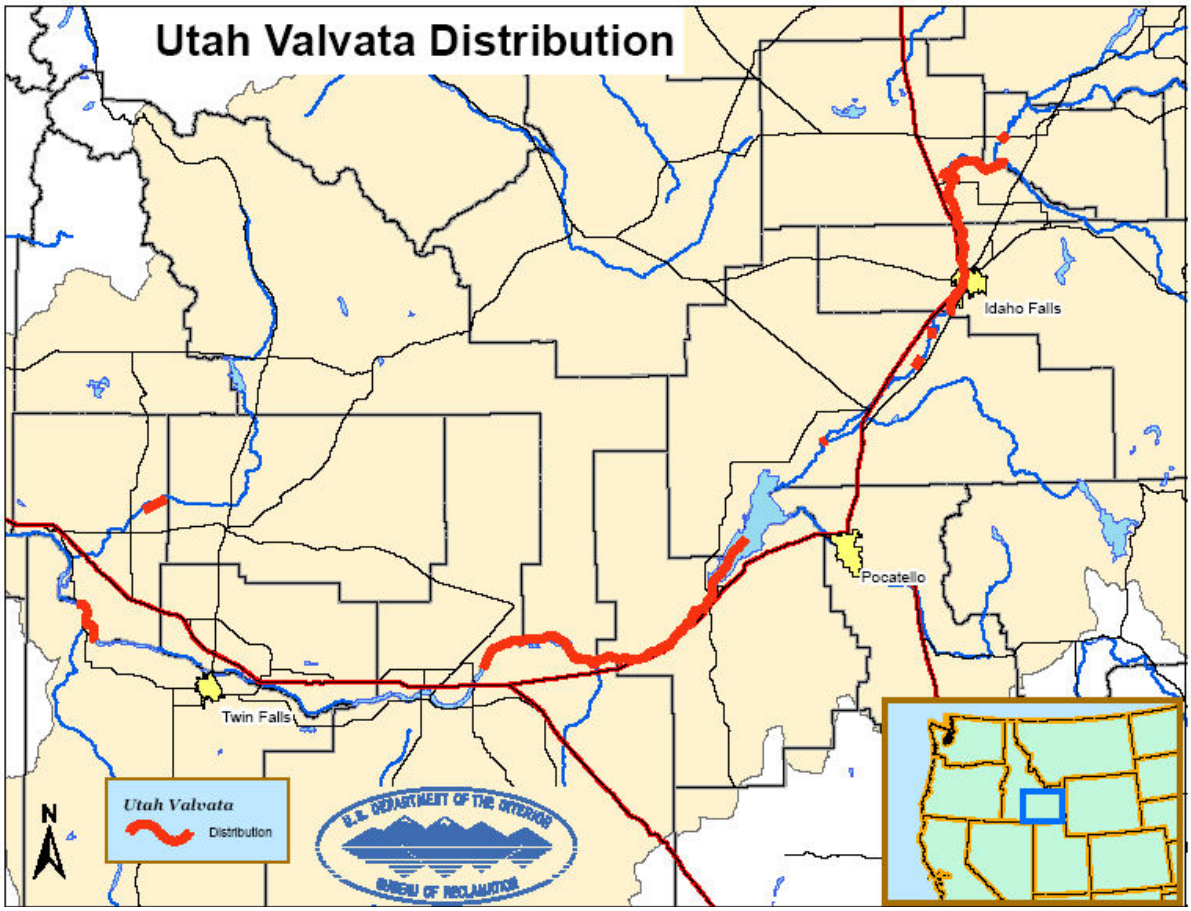

Figure 1. Known distribution of Utah valvata populations in the Upper Snake River Basin.

Table 1. Summary of amount or extent of anticipated take of Utah valvata associated with Reclamation facility operations.

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2009 operation (Oct. 2008 to Sept. 2009)	Quick reference: Times threshold was exceeded
American Falls Dam and Reservoir	Up to 85 percent of Utah valvata in the reservoir are affected by stranding and desiccation when the reservoir is drafted to its lowest levels.	Reservoir storage volume falls to 0 percent of capacity (475 acres of wetted habitat), corresponding to a reservoir surface elevation of 4295.6 ft.	summer and early fall (Aug.-Oct.)	2 of 30 years	In water year 2009 the lowest reservoir storage volume, after storage season, was 566,407 ac-ft. on Sept. 29, 2009 (Figure 5).	0 of 2 years 2006: 0 2007: 0 2008: 0 2009: 0
	Between 40 and 85 percent of Utah valvata in the reservoir are affected by stranding and desiccation when the reservoir is drafted to low levels.	Reservoir storage volume is between 475 and 22,351 AF (surface elevation ranges between 4,295.6 and 4,303.4 feet)	summer and early fall (Aug.-Oct.)	2 of 30 years	In water year 2009 the lowest reservoir storage volume was 566,407 ac-ft. on Sept. 29, 2009 (Figure 5).	□□□□□□□ ò□006: 0 2006: 0 2007: 4 days 2008: 0 2009: 0
	Between 5 and 40 percent of Utah valvata in the reservoir are affected by stranding and desiccation when the reservoir is drafted as part of normal operations.	Water stored in and released from American Falls Reservoir.	Year-round	30 of 30 years	Figure 5 depicts American Falls content in acre feet for water year 2009. Storage began in early Oct. and continued thru Apr. and then releases began.	4 of 30 years 2006: all year 2007: all year 2008: all year 2009: all year
Neely Reach	Up to 54 percent of Utah valvata in the Snake River, Neeley Reach, are affected by stranding and desiccation when river flows are at their lowest levels.	Minimum winter flows at the Snake River at Neeley gage reach 350 cfs.	winter	9 of 30 years	In water year 2009 the lowest winter flows at Neeley were 448.68 cfs on 02/03/09 (Figure 6).	1 of 9 years 2006: 5 days 2007: 0 2008: 0 2009: 0

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2009 operation (Oct. 2008 to Sept. 2009)	Quick reference: Times threshold was exceeded
Minidoka Dam and Lake Walcott	Up to 0.5 percent of Utah valvata in the lake are affected by exposure and desiccation when the lake is drafted annually.	Lake Walcott is drafted to a level, not to exceed, 1.5 vertical meters below full pool. Full pool is 4245 feet; 1.5 meters below full pool is 4240.08 feet)	summer and early fall (Aug.–Oct.)	28 of 30 years	The reservoir was at its lowest elevation of 4239.75 (5.25 vertical meters below full pool) on March 15, 2009 (Figure 7).	2 of 28 years 2006: 0 2007: 0 2008: 7 days 2009: 138 days
	Up to 10.5 percent of Utah valvata in the lake are affected by exposure and desiccation when the lake is drafted beyond typical operations.	Lake Walcott is drafted to a level 2.1 vertical meters below full pool. Full pool is 4245 feet; 2.1 meters below full pool is 4238.11 feet)	summer and early fall (Aug.-Oct.)	2 of 30 years	The reservoir was at its lowest elevation of 4239.75 (5.25 vertical meters below full pool) on March 15, 2009 (Figure 7).	0 of 2 years 2006: 0 2007: 0 2008: 0 2009: 0
	Any Utah valvata present in the Snake River, Minidoka reach, above the area submerged by the minimum flow of 400 cfs are affected by stranding and desiccation.	Minimum flows at the Snake River near Minidoka gage falls to 400 cfs.	winter	30 of 30 years	The lowest recorded flow of 619 cfs on Dec. 01, 2008 (Figure 8).	2 of 30 years 2006: all winter 2007: all winter 2008: 0 2009: 0
	Any Utah valvata in the spillway are affected by stranding and desiccation.	Flows through the spillway are shut off.	Late fall and winter	30 of 30 years (Exceeded one additional year since 2006.)	Spillway shut-off period was approximately Oct. 1, 2008 – Apr. 12, 2009. During the winter seepage was observed consistently at 50 –70 cfs.	4 of 30 years 2006:fall/winter 2007:fall/winter 2008:fall/winter 2009:fall/winter

Utah valvata Monitoring

Introduction and Background

The operation of Reclamation projects in the upper Snake River directly affects aquatic species and physical habitat by limiting their dispersal and migration, altering habitat and water quality, decreasing bedload movement, and altering the transport of fine sediment. The primary effects to water quality include increased suspended sediment, nutrient loading, and changes in the thermal regimes of the riverine and reservoir environments. For Reclamation to implement the RPMs issued by FWS in its Opinion (FWS 2005), the two agencies implemented a cooperative research and monitoring plan for the Utah valvata (*Valvata utahensis*) in the Snake River from the confluence of the Henry's Fork and the Snake River, downstream to Lake Walcott. In this chapter, the field monitoring activities conducted by Reclamation during WY 2009 are summarized.

The known distribution area of Utah valvata ranges from the Henry's Fork River at the Idaho Highway 33 bridge (Henrys Fork RM 9) near Rexburg, downstream to Brownlee Reservoir
Figure 1).

Monitoring Area

The monitoring area is located in southeast and south-central Idaho and includes the Snake River from the confluence of the Henrys Fork downstream to Minidoka Dam. The elevation ranges from 1326 meters to 1294 meters (4805 feet to 4245 feet). Near the upstream end of the monitoring area, the Snake River Basin has a drainage area of 35,224 square kilometers (13,600 square miles) with water diversions supporting nearly 3,238 square kilometers (800,000 acres) of irrigated agricultural lands (http://id.waterdata.usgs.gov). The area is high desert with sage brush (*Artemisia sp*.) vegetation.

The hydrology of the monitoring area is primarily influenced by winter snowfall and springtime runoff from the mountainous areas in the basin. Reclamation maintains two dams in the monitoring area (Minidoka and American Falls Dams), and manages the river for water storage and hydroelectric generation. The maximum river flow (at the Snake River near Neeley Reach) measured prior to regulation (period of record is 1907–1926) was 48,400 cfs in 1918 and the minimum flow measured was 2,180 cfs in 1924. The maximum river discharge measured since regulation was 46,100 cfs in 1997, and the minimum was 50 cfs in 1941, 1961, and 1970 (http://id.waterdata.usgs.gov). Many tributaries have irrigation diversions, and at times, these diversions remove all the surface flow that would enter the Snake River (Gianotto 1995). Currently, the monitoring area is listed under Section 303(d) of the Clean Water Act for the water-quality parameters of dissolved oxygen, nutrients, oil and grease, and sediment (Idaho Department of Environmental Quality 1998).

The usual range of parameters for water conductivity were from 430 to 470 micromhos per centimeter; for pH, from 8.4 to 8.7; and for alkalinity, from 140 to 200 milligrams per liter of calcium carbonate ($CaCO_3$). The monitoring area contains several endemic mollusk species thought to be a relict from the Pliocene epoch, such as the California floater (*Anodonta californiensis*) and the Utah valvata (Taylor 1982). Historically, this portion of the Snake River was not accessible to anadromous fish, and today primarily supports populations of stocked, non-native rainbow trout (*Oncorhynchus mykiss*) and smallmouth bass (*Micropterous dolomieui*) to provide a sport fishery. Several species of macrophytes are commonly found in reservoir and other lower velocity habitats throughout the monitoring area.

Methods

Sample Locations

Four long-term monitoring sites were selected at locations where Utah valvata snails were detected during previous distribution surveys. All sites are located in regulated river or reservoir habitat. Listed from downstream to upstream, the four sites are:

- Lake Walcott RM 680 – 702,
- Snake River at Vista (Neeley Reach) RM 710 - 713,
- American Falls Reservoir RM 714 - 720,
- Upper Snake River (Snake River above American Falls Reservoir) RM 746 – 901.6.

Beginning in WY 2006, Reclamation discontinued annual monitoring surveys for each site and initiated monitoring surveys on an alternate-year schedule. Utah valvata monitoring surveys occurred in American Falls Reservoir and the Upper Snake River in the summer and fall of 2008, as well as in Upper Lake Walcott (Coldwater Area) and the Snake River at Vista (Neeley Reach). In WY 2009, Utah valvata monitoring surveys were conducted throughout Lake Walcott and the Neeley Reach.

Lake Walcott has deeper (greater than 10 meters depth) reservoir habitat where the channel was originally located. The reservoir has a broader, uniform bottom characterized by fine sediments. The upper portions of Lake Walcott is characterized by a steady flow regime with a diverse channel bottom consisting of medium to large gravel substrate and small cobbles interspersed with fines; boulder habitat; and bedrock. Depths change dramatically throughout the upper portions of the reservoir due to underwater basalt outcrops and ledges.

Consistent with the WY 2007 & 2008 sampling protocol, Reclamation continued presence/absence surveys for Utah valvata monitoring based on Fore and Clark (2005). The presence/absence surveys were conducted at Lake Walcott. Using Geographic

Information System, Reclamation created a 100-meter grid layer over Lake Walcott and assigned a random numeric value to each quadrat. A random number generator was utilized to randomly select 100 numeric values. The corresponding quadrats were selected as potential sample locations. Using Geographic Positioning System, Reclamation personnel navigated to each quadrat and collected samples inside the 100-meter square for each of the selected quadrats. Reclamation selected a different set of quadrats for each sampling period (i.e., June and August).

Montana State University graduate student, Kiza Gates, collected data on *Valvata humeralis* as part of ongoing research related to her dissertation in 2009. Montana State University is currently working on Reclamation's Snake River physa study and is also conducting research related to *Valvata humeralis*. Montana State University research objectives involve the entire gastropod community, therefore all gastropods were identified, enumerated and released. Montana State University conducted surveys for Valvata humeralis in the Snake River below American Falls Dam, in the Neeley Reach, in 2009. No data collection activities were required by MSU in 2009 as part of Reclamation's Snake River physa study. All work conducted in 2009 associated with the Snake River physa study, involved laboratory and data analysis work. No field collection activities were conducted.

Snail Collection

All plots were sampled with a Venturi suction dredge operated by a SCUBA diver. A 0.25-m^2 plot was excavated approximately 2.5 centimeters deep by the vacuum dredge. The sample was transported through flexible tubing, and collected in a 1,000-micrometer sieve. Samples were immediately searched for live Utah valvata. When the first live Utah valvata was encountered, the presence of Utah valvata was noted for that plot and the sample was returned to the collection point. We assume that all live Utah valvata encountered with broken shells are the result of our sampling, however, none were encountered in 2009. No dewatered sites were sampled.

Habitat Measurements

Water depth, temperature, and dissolved oxygen were measured with a water-quality meter made by Yellow Springs Instruments, Inc. Macrophyte presence was recorded for all plots. Dominant substrate types were visually determined and recorded.

Results and Discussion

In June and August of 2009, surveys were conducted in Lake Walcott (Figure 2 & 3). One hundred four samples were collected from Lake Walcott in June, with 10.6 percent occurrence of live Utah valvata (Table 2). Clear shells, suggesting recent (possibly less than one year) mortality, were encountered at 29 sites (27.9% rate of occurrence) (Figure 2). One hundred thirty two samples were collected from Lake Walcott in August, with 12.9 percent occurrence of live Utah valvata. Clear shells, suggesting recent (possibly

less than one year) mortality, were encountered at 54 sites (40.9% rate of occurrence) (Figure 3).

The 2005 Opinion states less than one percent of Utah valvata in Lake Walcott are affected by stranding and desiccation when the reservoir is drafted annually to an elevation of 4240 feet. In WY 2009, Lake Walcott was drafted to its annual non-irrigations season elevation of 4240 feet, consistent with previous year's operations. Due to the annual, consistent five foot drafting of Lake Walcott, it is not anticipated that increased mortality occurred to Utah valvata as a result of annual operations. During the 2009 survey period, multiple sites were surveyed within the five-foot fluctuation zone. No live Utah valvata were encountered within this zone. All live Utah valvata were found at depths greater than seven feet.

In addition to Reclamations annual monitoring program, MSU (Kiza Gates) collected 85 samples during the period May – August, 2009 to meet graduate research data requirements, as well as Reclamation monitoring requirements. Collections were made in the Neeley Reach of the Snake River, below American Falls Reservoir (Figure 4). Live Utah valvata were encountered in 9 samples. Densities ranged from 4 to 32 live individuals per square meter. All Utah valvata were immediately returned, unharmed, to their respective collection locations.

Table 2. Total number of sites surveyed for Utah valvata (UV) and the respective percent occurrence at Lake Walcott during June and August, 2009.

Study Site	June			August		
	Number of Sites	Number of Sites with UV	Percent Occurrence	Number of Sites	Number of Sites with UV	Percent Occurrence
Lake Walcott	104	11	10.6%	132	17	12.9%

As encountered in previous years, Utah valvata habitat was characterized as dominated with fines. Although Utah valvata were encountered in sand, small gravel, medium gravel, and some cobbles, the substrate types still consisted of fines occupying the interstitial space associated with the small and medium gravel with intermittent cobble. The Utah valvata appear to occupy this space, where velocities are near zero and fines are deposited. No Utah valvata were found in sand-only substrates. All plots containing live Utah valvata contained silt. Although Utah valvata were occasionally encountered in sites with macrophytes present, the snails do not appear to be dependent upon them. Utah valvata and macrophytes are each associated with fines and subsequent low water velocities, with little to no dependence on each other.

Interestingly, some fine sediments appear to be possibly void of Utah valvata. For example, the Raft River arm of Lake Walcott is dominated by fine substrates. That portion of the reservoir is characterized by a uniform depth, fine substrate and intermittent aquatic vegetation. To date, Reclamation has not collected live Utah valvata or clear Utah valvata shells from this small portion of Lake Walcott. However, it should

be noted more samples need to be collected in order to more accurately assess the status of the species from this portion of the reservoir.

Water quality data collected in WY 2009 was consistent with measurements from previous years. The water quality data summary for the WY 2009 field season is listed in Table 3.

Table 3. Summary water quality data for June and August 2009 including Temperature (^{o}C), Dissolved Oxygen (DO) measured in parts per million (ppm), and Depth (ft).

	June					
	Mean			**Range**		
Site	Temp (^{o}C)	DO (ppm)	Depth (ft)	Temp (^{o}C)	DO (ppm)	Depth (ft)
Lake Walcott	16.6	9.14	17.02	15.6 – 17.7	0.26 – 11.21	2 – 43
	August					
	Mean			**Range**		
Site	Temp (^{o}C)	DO (ppm)	Depth (ft)	Temp (^{o}C)	DO (ppm)	Depth (ft)
Lake Walcott	21.12	8.64	17.43	19.8 – 23.6	4 – 12.1	2.6 - 42

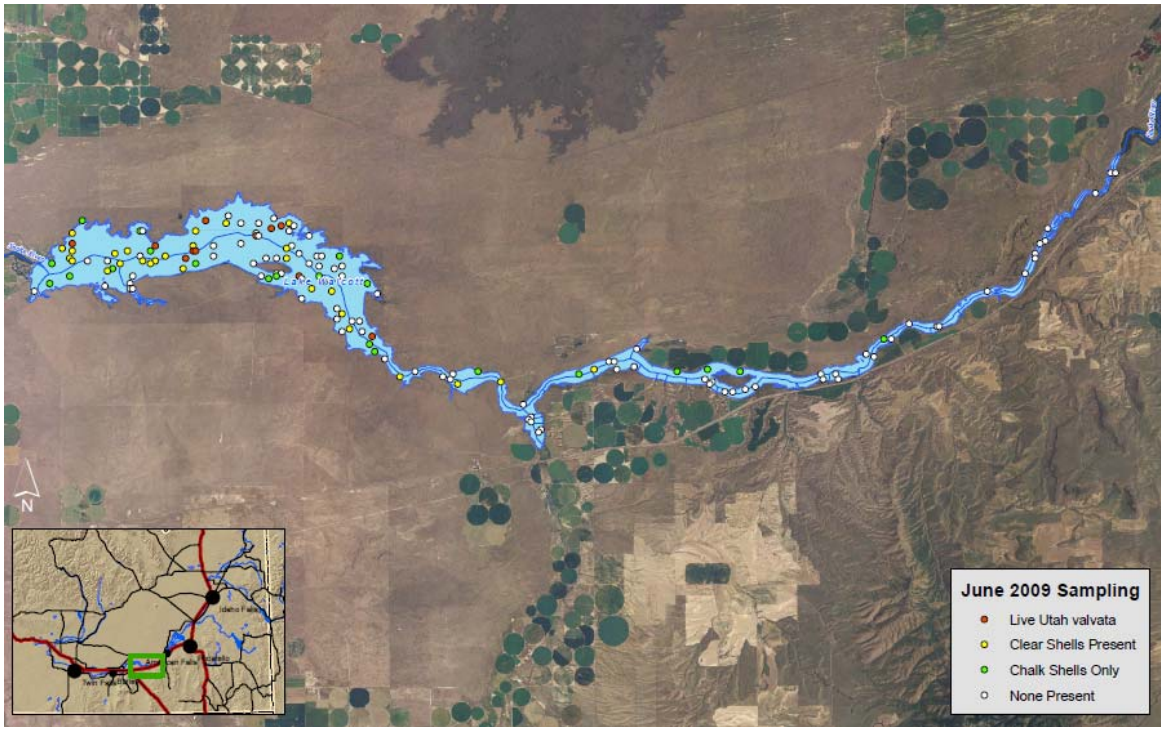

Figure 2. Locations of randomly selected survey sites on Lake Walcott in June 2009, for Utah valvata annual monitoring activities.

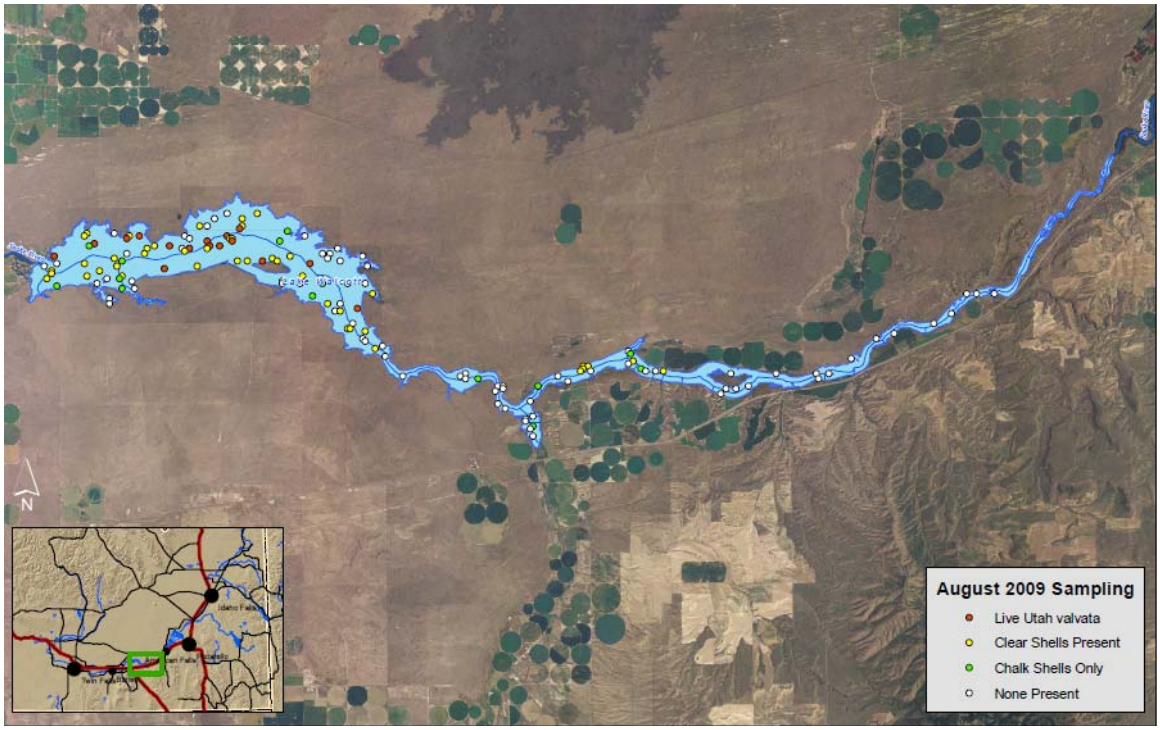

Figure 3. Locations of randomly selected survey sites on Lake Walcott in August 2009 for Utah valvata annual monitoring activities.

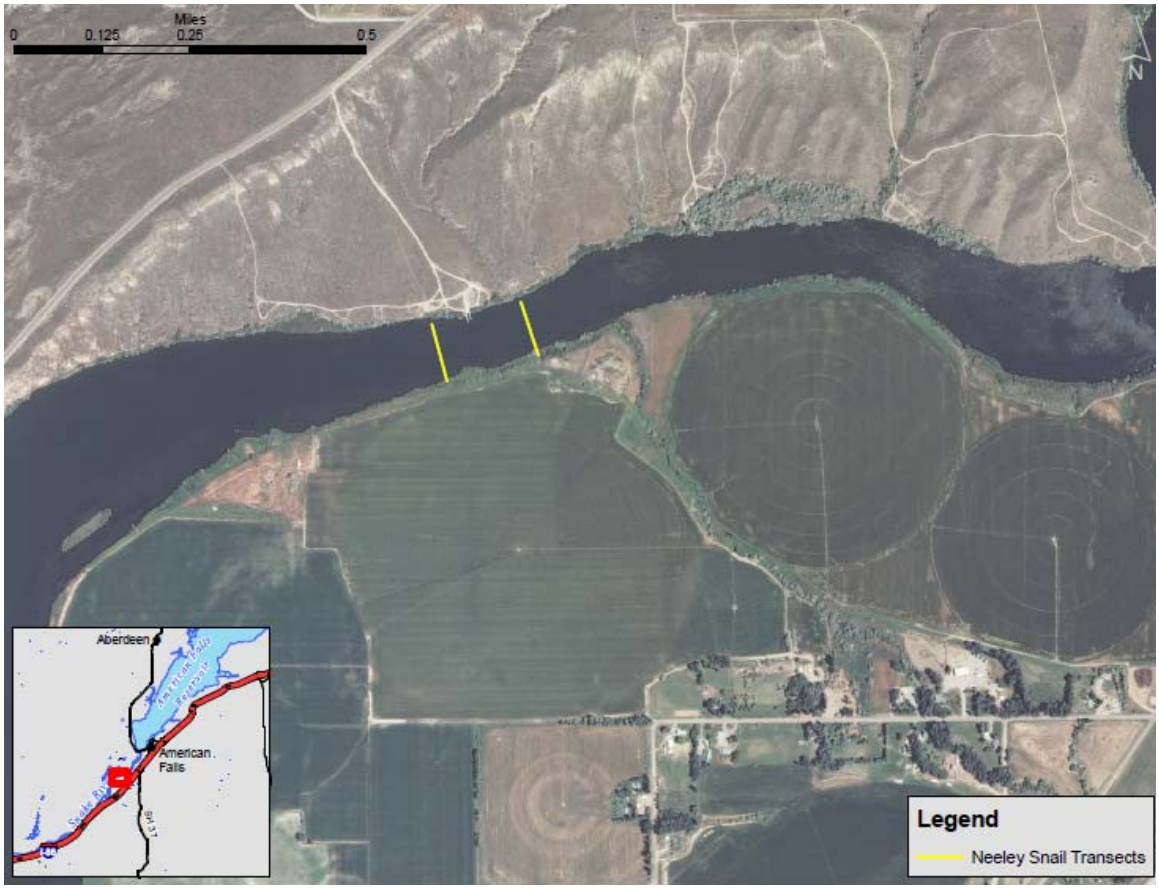

Figure 4. Locations of MSU 2009 monitoring transects in the Neeley Reach of the Snake River, below American Falls Dam.

Implementation of the Reasonable and Prudent Measures and Associated Terms and Conditions for Utah valvata

The FWS identified one RPM and two T&Cs for American Falls Dam and downstream reaches to reduce the take associated with the operation of the project. The RPMs states that Reclamation shall implement measures to minimize the amount and the effect of take of Utah valvata from stranding, exposure, and desiccation within American Falls Reservoir and downstream reaches associated with operation of American Falls Dam and Reservoir.

T&C Number	Terms and Conditions
1.a.	*Within the range of operations defined in the proposed action, minimize the frequency, extent, and duration of drawdown of American Falls Reservoir to levels below 50,000 acre-feet for the period of the proposed action.*
1.b.	*When Reclamation drafts American Falls Reservoir to less than 50,000 acre-feet, Reclamation shall report to the Service when the operation occurred, the duration and the conditions leading to such operation.*

American Falls Dam and Reservoir

Initial reservoir content for American Falls Reservoir in WY 2009 was 239,936 on October 1, 2008, much above the 50,000 acre-foot threshold (Figure 5). This reservoir carry-over content resulted from an average water supply, slightly above average irrigation demands allowed by the adequate supply, and fulfillment of Reclamation's downstream flow augmentation obligations under the NOAA Fisheries Opinion (NOAA 2008) and the Nez Perce Settlement in 2007.

Since the Palisades Project came on line, more than 50 years ago, the upper Snake River reservoir system has been operated to hold storage in upstream reservoirs to enhance the subsequent year's storage and to increase winter stream flow in the river reaches above American Falls. Delivery of water below Milner for flow augmentation has increased the delivery of water from American Falls reservoir disproportionately to system totals.

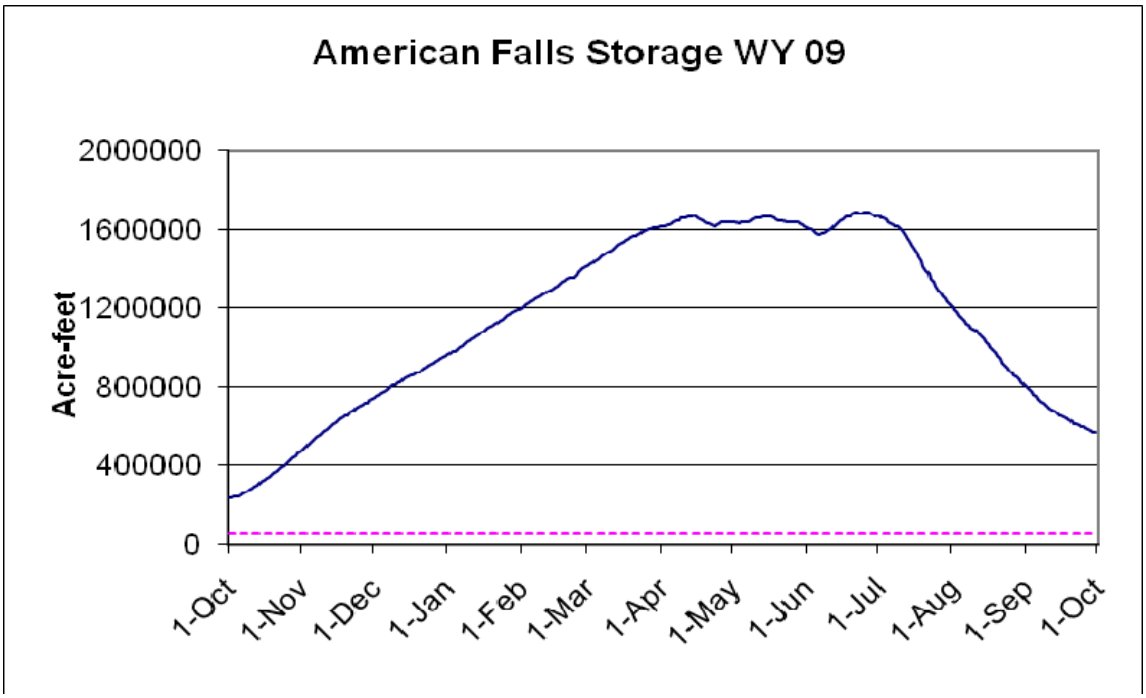

Figure 5. American Falls Reservoir storage volumes (acre-feet) for the 2009 Water Year (WY09). The dotted line represents Reclamation's operational threshold storage of 50,000 acre-feet.

System carry-over from 2008 was well above average and American Falls minimum content was 226,983 acre-feet on September 22, 2008. Discharge below American Falls Dam was decreased to 500 cfs after the irrigation season ended in October 2009 (Figure 6). System storage and American Falls storage were adequate to avoid minimum winter discharge.

Winter precipitation in WY 2009 on the upper Snake River watershed was not exceptional until late in March. Cool weather and precipitation contributed to increasing snowpack after snowmelt begins in most years. Peak runoff occurred with average timing but rain in June sustained high inflows and reduced water demand. The compound affects of increasing supply and low demand allowed the storage system to fill. Delivery of augmentation water began early in June. Following the unanticipated fill of the reservoir system in June and additional release of flood waters, augmentation was resumed early in July and was completed by the end of the month.

At the beginning of the 2009 water year flow below American Falls Dam was ramped down to 500 cfs. Flows near 500 cfs persisted until March 20 when discharge was increased to fill Lake Walcott and because American Falls Reservoir was approaching full.

The total storage capacity of American Falls Reservoir is 1,672,600 acre-feet. American Falls Reservoir was substantially full from April 12 through July 1. Maximum content of almost 101% of capacity occurred on June 25. Minimum American Falls Reservoir

content of 14 % (226,983 acre-feet) carried over from 2008. Following the 2009 fill, the minimum content was 566,407 acre-feet, (34% of capacity).

Minidoka Dam and Lake Walcott

At the beginning of the 2009 WY, Lake Walcott had already been drafted to about 3 foot above the normal, winter, elevation of 4240.0 feet (Figure 7). The draft continued and the winter level was reached on October 13. The water was delivered to meet downstream irrigation demand. During the winter only normal variations in water surface elevation were observed. (The intent of the operation is to limit the formation of ice on the spillway structure and to keep the ice cover below the piers' contacts with the ogee crest. To achieve this intent the reservoir is operated at approximately 4239.8 and abrupt corrections are avoided while the reservoir remains between 4239.5 and 4240.0.) The winter low elevation of 4239.75 feet occurred on March 15, 2009.

Discharge below Minidoka Dam followed American Falls discharge plus reach gains from the end of the irrigation season through early April when downstream irrigation demands began. Flows were maintained to meet downstream irrigation demand, Idaho Power Company's flow requirements below Milner Dam and Reclamation's augmentation flows through the summer. As flows for delivery of augmentation were receding, Idaho Power Company completed a lease of stored water from the Shoshone-Bannock Tribal Water Bank. A flow of about 2,000 cfs below Milner Dam during the month of August is reflected in the Minidoka discharge (Figure 8).

The winter draft of Lake Walcott began on September 24 and reached the over-winter elevation of 4240 on October 15.

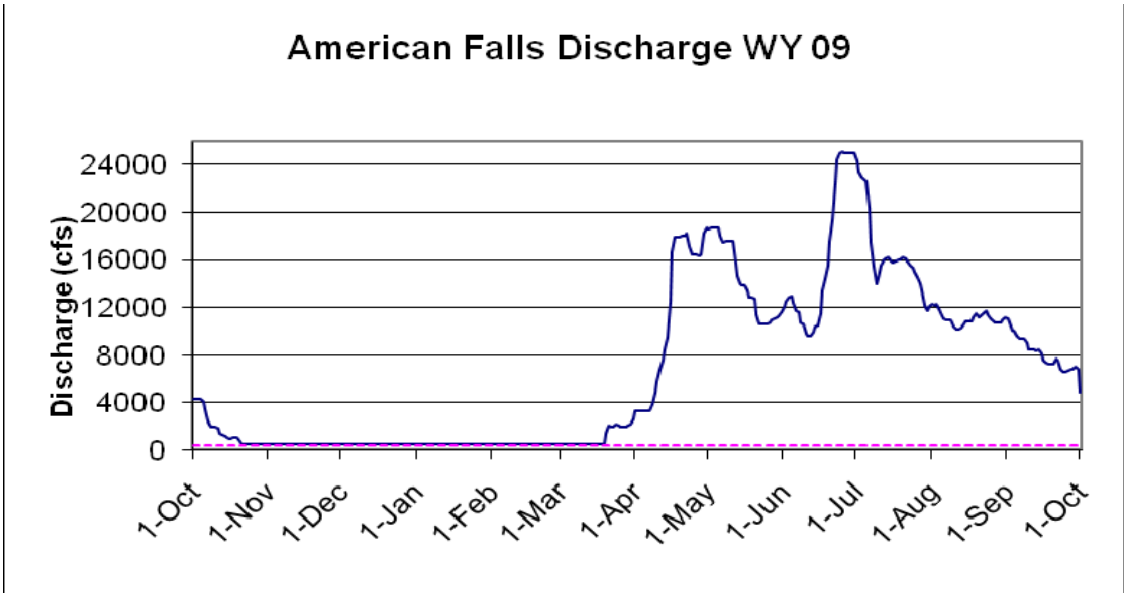

Figure 6. Discharge from American Falls Reservoir (Neeley Reach) for the 2009 Water Year (WY09). The dotted line represents Reclamation's operational threshold discharge flow of 350 cubic feet per second (cfs).

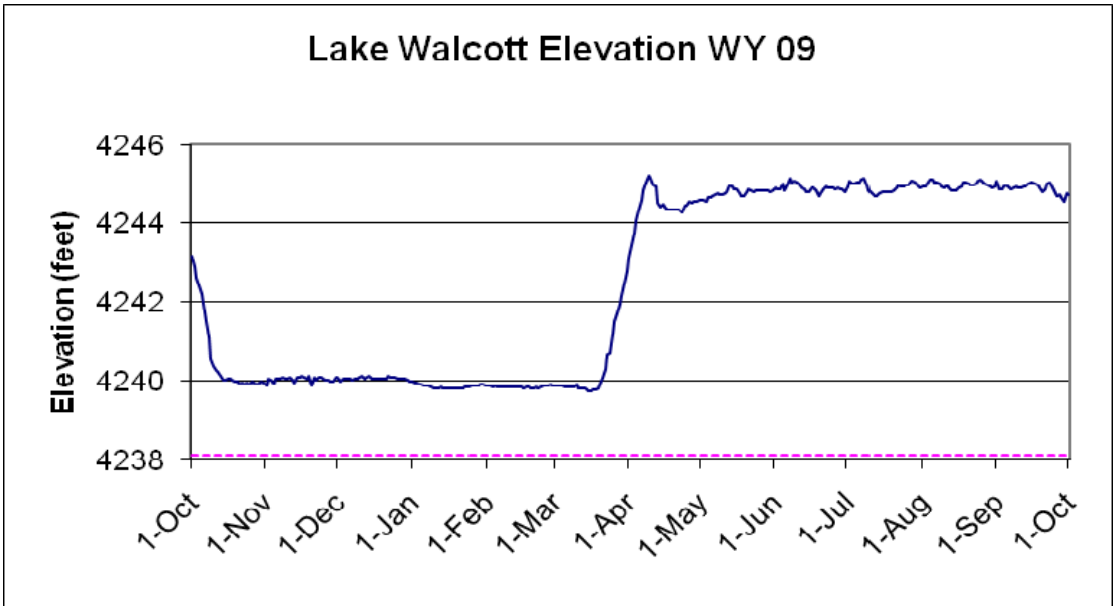

Figure 7. Reservoir elevation at Lake Walcott for the 2009 Water Year (WY09). The dotted line represents Reclamation's summer and early fall threshold elevation of 4238.11 feet.

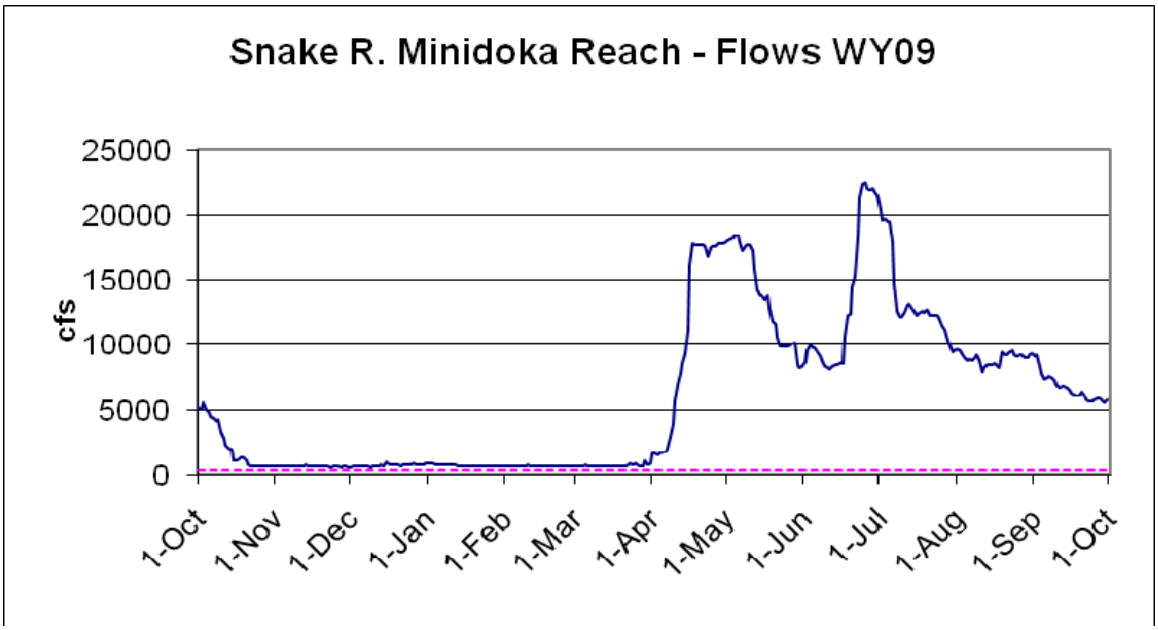

Figure 8. Snake River Minidoka Reach river flows cubic feet per second (cfs) for the 2009 Water Year (WY09). The dotted line represents Reclamation's operational threshold discharge flow of 400 cfs.

V. Bull Trout

Summary of the Salvelinus Confluentus Incidental Take Statement and 2009 Operations

Bull trout are present in four of Reclamation's facilities in the upper Snake River Basin (Figure 9). Summary of the Bull Trout Incidental Take Statement including monitoring efforts and RPMs during the 2009 water year are described in this chapter. Operational thresholds, population monitoring and other relevant (but not managed by Reclamation) bull trout work is described in the Bull Trout Monitoring section. Work associated with research projects that address specific RPMs is described in the Implementation of Reasonable and Prudent Measures and Associated Terms and Conditions section.

The FWS 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. The FWS then described the amount or extent of incidental take at each facility based on operational thresholds (FWS 2005). Operational thresholds and the respective effects, frequency and timing for 2009 are summarized in Table 4.

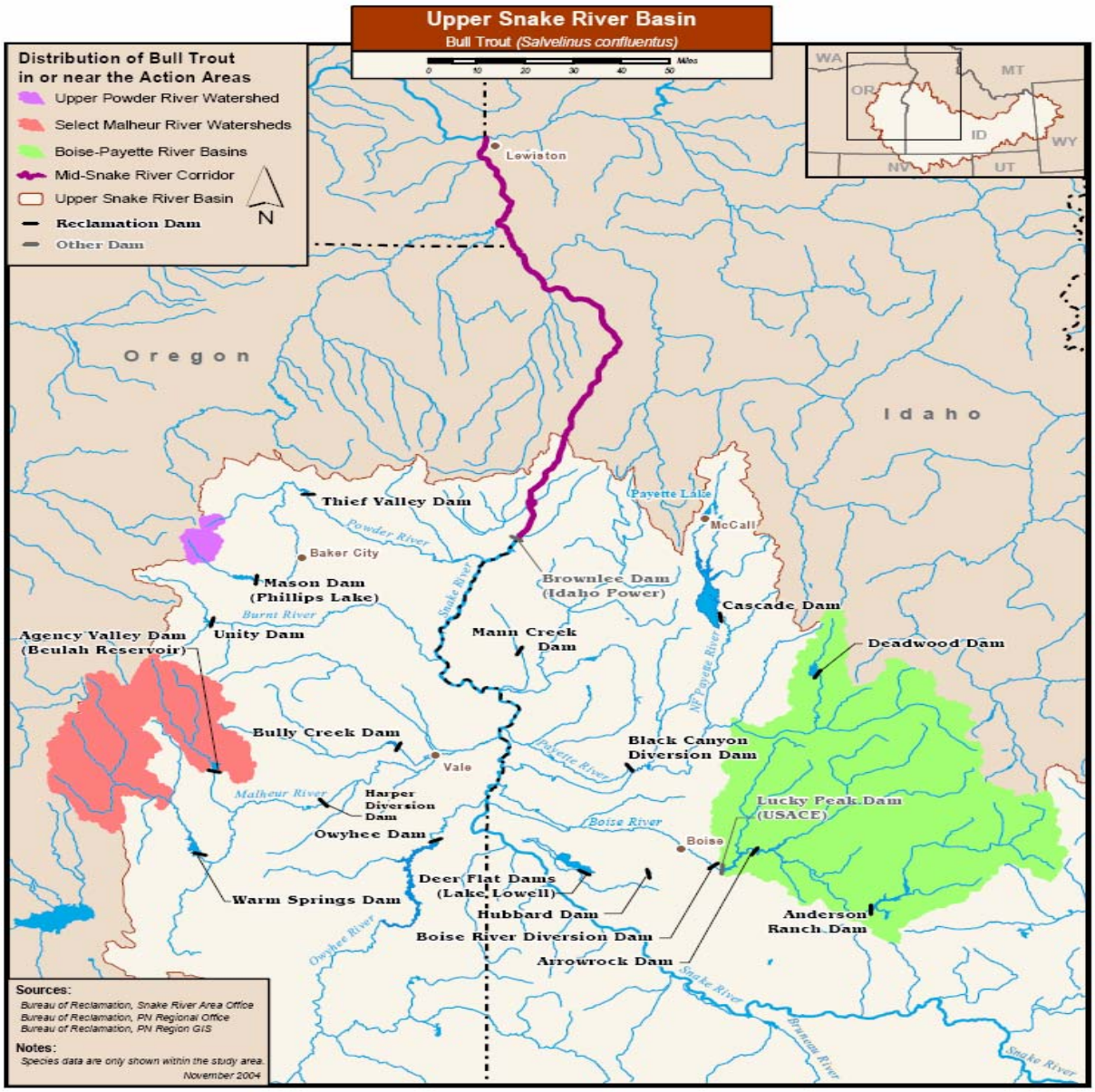

Figure 9. Known distribution of bull trout populations associated with Reclamation facilities in the upper Snake River Basin (Reclamation 2004).

Table 4. Summary of amount or extent of anticipated take of bull trout associated with Reclamation facility operations during the 2009 reporting period.

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2009 Operations (Oct. 2008 to Sept 2009)	Quick reference : Times threshold was exceeded
Arrowrock Dam and Reservoir	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 by the end of June.	June 30	3 of 30 years	Reservoir volume did not fall below 240,439 during June in 2009.	1 of 3 years 2006: 0 2007: yes 2008: 0 2009: 0
	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	Spillway use did not occur during the reporting period.	1 of 15 years 2006: 9 days 2007: 0 2008: 0 2009: 0
	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 Sept.	30 of 30 years	Res. surface elevation was below 3,111 at the same time discharge was above 695 cfs for three days (Sept 06-08, 2009; Figure 10).	4 of 30 years 2006: 6 days 2007: 48 days 2008: 1 day 2009: 3 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.	Sept. 15 through Oct. 31	18 of 30 years	Reservoir elevations were between 3,114 and 3,137 from Sept 15, 2009 to Oct. 31, 2009.	0 of 18 years 2006: 0 2007: 0 2008: 0 2009: 0
	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	Reservoir elevations did not go below 3,111 in the winter months of 2008.	0 of 20 years 2006: 0 2007: 0 2008: 0 2009:0

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2009 Operations (Oct. 2008 to Sept 2009)	Quick reference: Times threshold was exceeded
Anderson Ranch Dam	Up to 50 percent of the North and Middle Fork Boise Rivers' spawning population 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 SF Boise River.	Water is discharged over the spillway.	spring	6 of 30 years	Spillway use did not occur during the reporting period.	1 of 6 years 2006: 9 days 2007: 0 2008: 0 2009: 0
	Up to 50 percent of the North and Middle Fork Boise Rivers' spawning population 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 2009 are shown in Figure 12.	4 of 30 years 2006:spring/fall 2007:spring/fall 2008: spring/fall 2009: spring/fall
	Up to 4 percent of bull trout in reservoir experience degraded water quality.	Reservoir storage volume falls below 62,000 acre-feet.	summer	2 of 30 years	Reservoir storage volume was maintained above 62,000 acre-feet (Figure 13).	0 of 2 years 2006: 0 2007: 0 2008: 0 2009: 0
Deadwood Dam	Up to 2 to 4 percent of bull trout in Deadwood Reservoir are entrained into the Deadwood River below the dam.	Water discharged over the spillway.	spring	11 of 30 years	Water was not discharged over the spillway during WY09.	3 of 11 years 2006: 32 days 2007: 33 days 2008: 33 days 2009: 0 days
	Up to 2 to 4 percent of bull trout in Deadwood Reservoir are affected by degraded water quality.	Reservoir storage volume falls below 50,000 acre-feet.	Aug. through Oct.	2 of 30 years	Reservoir storage volumes were maintained above 74,997 acre-feet from August through October of 2009 (Figure 14).	0 of 2 years 2006: 0 2007: 0 2008: 0 2009: 0

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2009 Operations (Oct. 2008 to Sept 2009)	Quick reference: Times threshold was exceeded
Deadwood Dam	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 not discharged over the spillway during WY09.	3 of 11 years 2006: 32 days 2007: 33 days 2008: 33 days 2009: 0 days
	All bull trout in the Deadwood River downstream from the dam are affected by low winter stream flows 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.	4 of 30 years 2006: all year 2007: all year 2008: all year 2009: all year
Agency Valley Dam	Up to 10 percent of bull trout in Beulah Reservoir are entrained into the NF Malheur River below the dam.	Water is discharged over the spillway.	May through June	3 of 30 years	Spillway was not used during this reporting period.	1 of 3 years 2006: 53 days 2007: 0 2008: 0 2009: 0
	All bull trout that return to Beulah Reservoir to over winter are affected by a reduced prey base.	Reservoir storage volume falls below 2,000 acre-feet.	Aug. through Oct.	10 of 30 years	Reservoir storage volume fell below 2,000 acre-feet from Oct. 01 to Oct. 11, 2008 and Aug. 20 to Sept. 30 2009 (Figure 15).	3 of 10 years 2006: 0 2007: 60 days 2008: 34 days 2009: 53 days

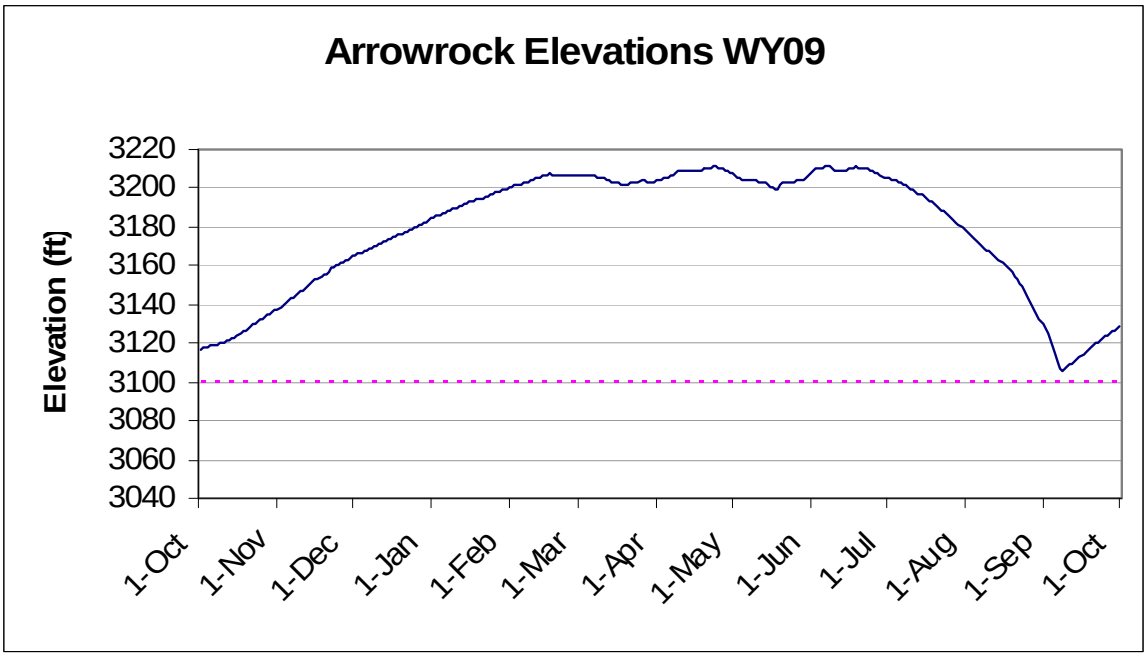

Figure 10. Arrowrock Reservoir elevation (feet above sea level) for the 2009 Water Year (WY09). Bottom dotted line represents Reclamation's fall minimum threshold of 3,100 feet elevation.

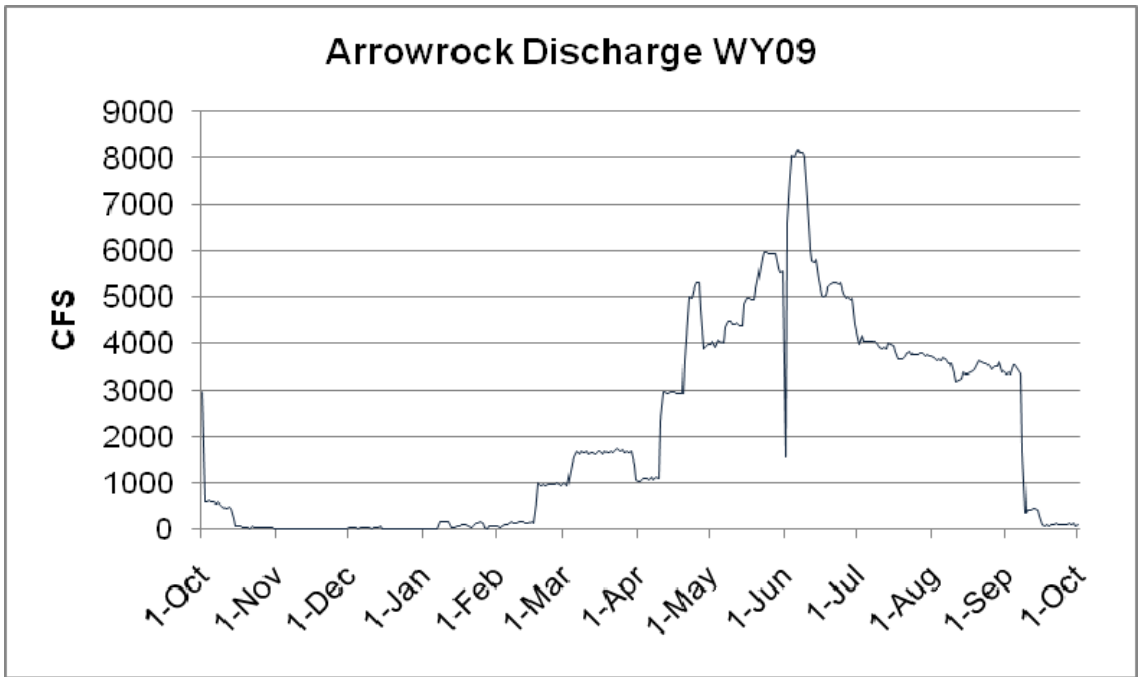

Figure 11. Arrowrock Reservoir discharge cubic feet per second (CFS) for the 2009 Water Year (WY09).

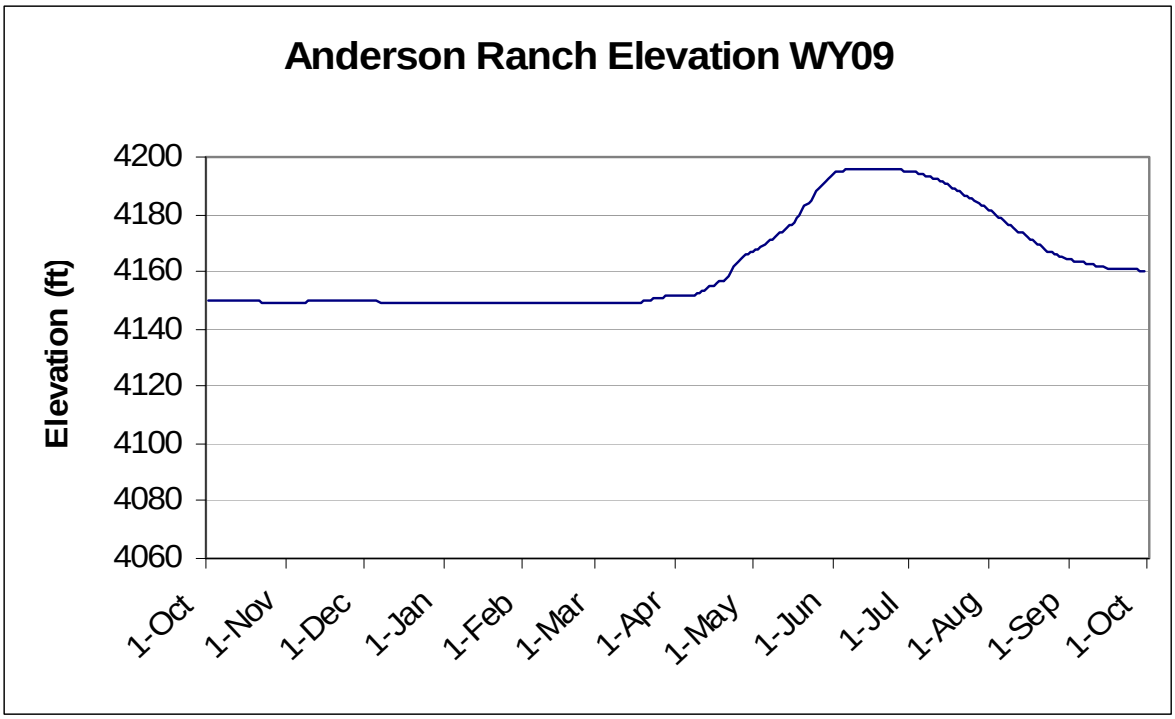

Figure 12. Anderson Ranch Reservoir elevations (feet above sea level) for the 2009 Water Year (WY09).

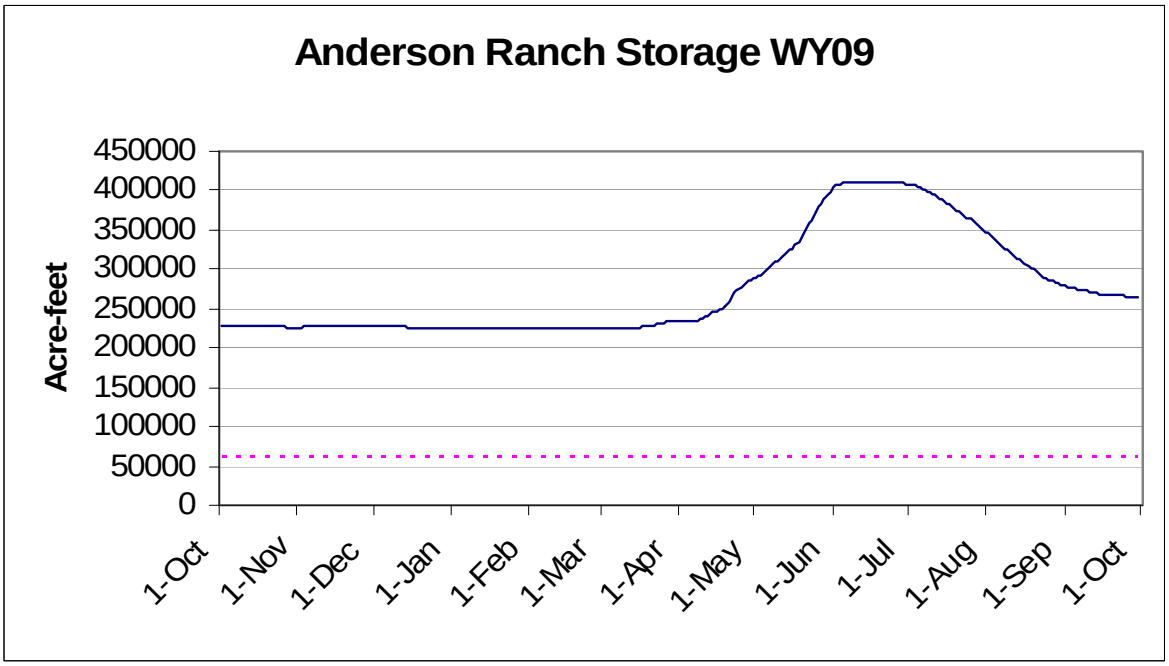

Figure 13. Anderson Ranch Reservoir storage volumes (acre-feet) for the 2009 Water Year (WY09). Bottom dotted line represents Reclamation's minimum threshold of 62,000 acre-feet of storage.

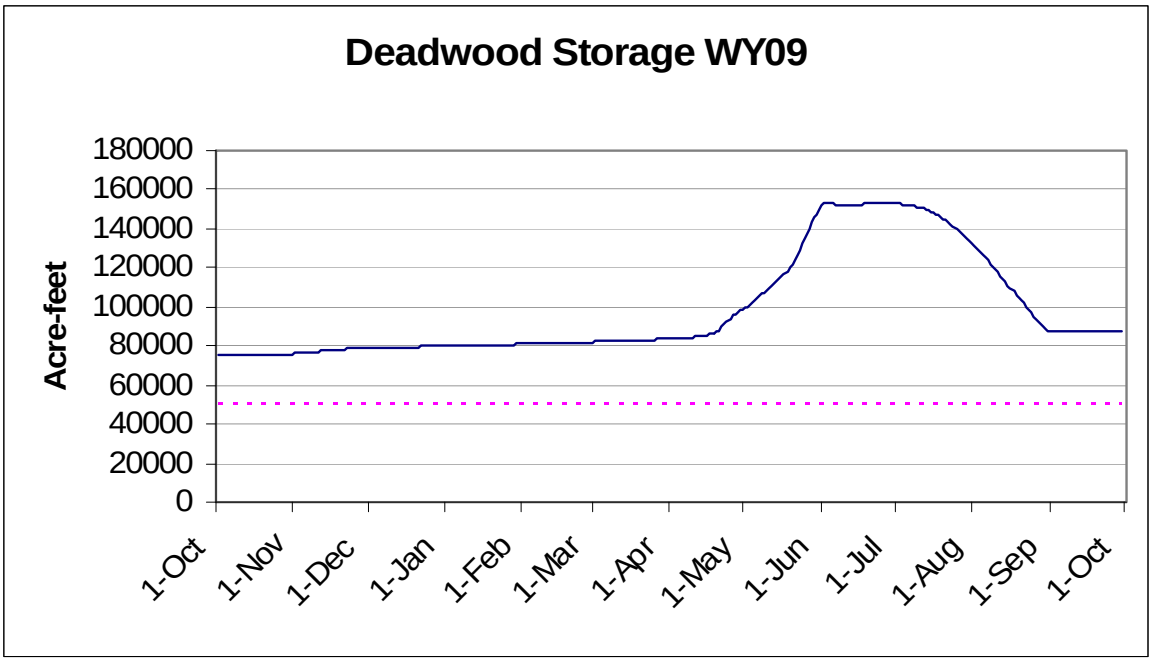

Figure 14. Deadwood Reservoir storage volumes (acre-feet) for the 2009 Water Year (WY09). Bottom dotted line represents Reclamation's minimum threshold of 50,000 acre-feet of storage.

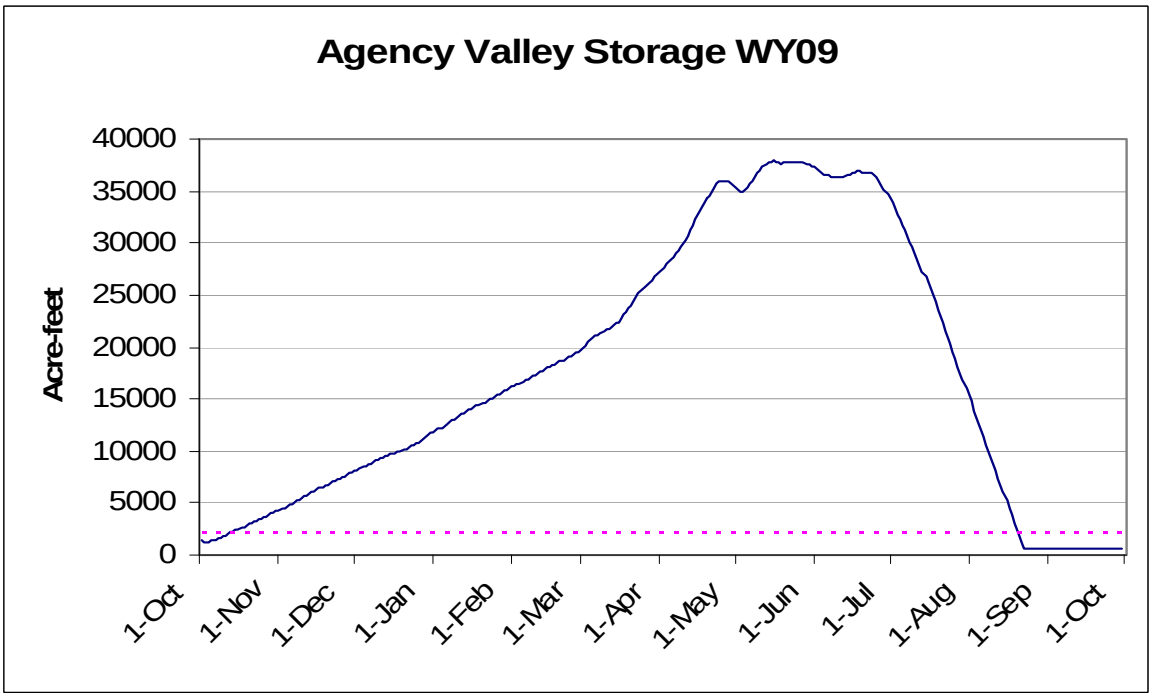

Figure 15. Agency Valley Reservoir storage volumes (acre-feet) for the 2009 Water Year (WY09). Bottom dotted line represents Reclamation's minimum threshold of 2,000 acre-feet of storage.

Bull Trout Monitoring

The Implementation and Monitoring Plan (Reclamation 2006) identifies how Reclamation will monitor bull trout. Monitoring elements include 1) evaluating operational indicators, 2) tracking population trends, and 3) estimating the proportion of annual take. To monitor compliance with the operational thresholds defined in the ITS, operations for water year 2009 were monitored, evaluated, and summarized using Reclamation's Hydromet system (Reclamation 2009b). Operational thresholds affecting amount or extent of anticipated take are described in Table 4. Monitoring population trends may not occur annually.

Boise River Basin

Operational Indicators (Table 4) – Two operational indicators were exceeded during the 2009 reporting period in the Boise River Basin. Discharge at Arrowrock exceeds 695 cfs while the reservoir water surface elevation is less than 3,111 feet (3 days) and water was stored and released at Anderson Ranch Dam during 2009. Reclamation has exemptions for both actions for 30 of the 30 years in the Opinion.

Boise River Basin bull trout population trend monitoring activities did not occur during the 2009 WY.

Payette River Basin

Operational Indicators (Table 4) - One operational indicator was exceeded during the 2009 reporting period in the Payette River Basin. Deep water releases did occur throughout the year in 2009. Reclamation has an exemption for this action 30 of 30 years.

Payette River Basin bull trout population trend monitoring activities did not occur during the 2009 WY.

Malheur River Basin

Operational Indicators (Table 4) - One operational indicator was exceeded during the 2009 reporting period in the Malheur River Basin. Beulah Reservoir pool fell below 2,000 acre-feet from October 1 through October 11, 2008 and August 20 through September 30, 2009. Reclamation has an exemption for this action for 10 of the 30 years in the Opinion. This is also the pool elevation that initiates trap and haul efforts for entrained bull trout.

Malheur River Basin bull trout population trend monitoring activities included bull trout redd counts in the North Fork Malheur River, interagency cooperation planned by Oregon Department of Fish and Wildlife.

In 2009, North Fork Malheur River Basin bull trout redd counts totaled 82; however, the

survey area was reduced from past surveys (Perkins 2009). Assuming 2.68 bull trout per redd (Al-Chokhachy et al. 2005); an estimated 219 adfluvial adult bull trout were present in 2009. Figure 16 depicts the number of redds observed in the North Fork Malheur River Basin, and carryover of reservoir storage in Beulah Reservoir. Carryover storage in Beulah Reservoir has been shown to affect the bull trout prey base (Rose and Mesa 2009); however, a direct link between carryover pool elevations and bull trout redd counts remains to be speculative.

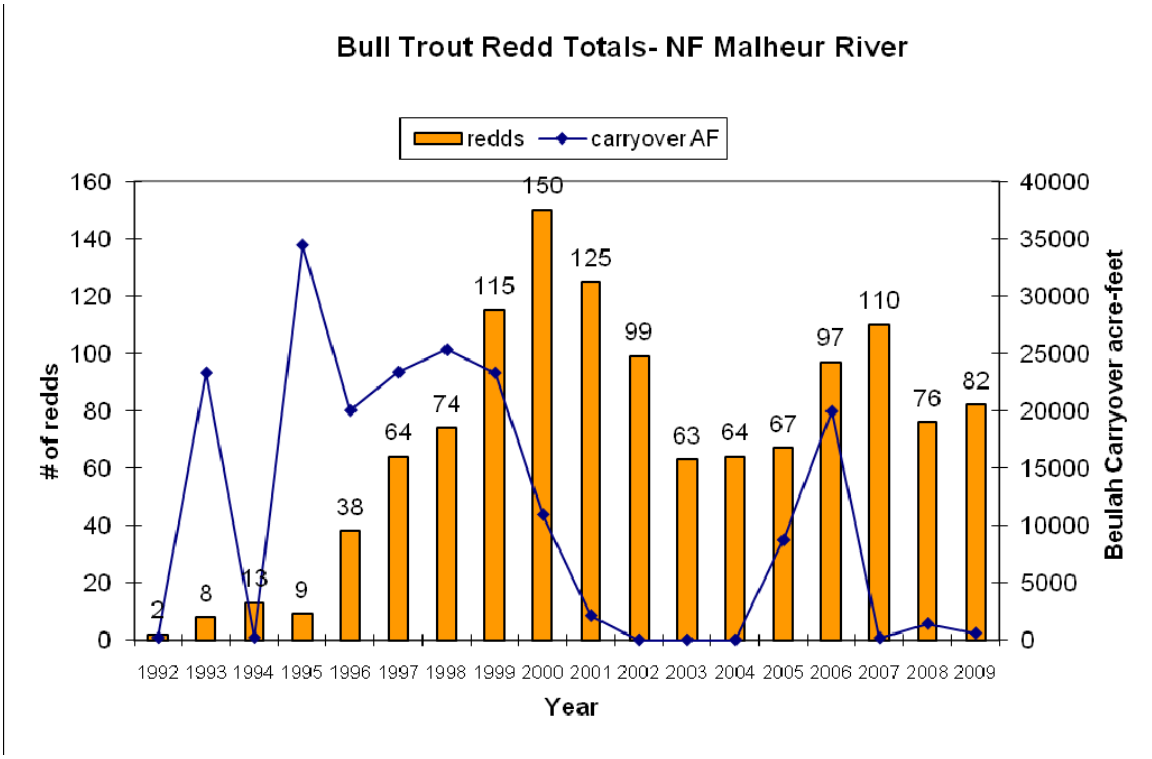

Figure 16. Bull trout redds observed in the North Fork Malheur River watershed (NF Malheur River) between 1992-2009 and carryover storage in Beulah Reservoir. *The number of redds observed in 2008 was adjusted to reflect a reduction in survey area, actual number equaled 75 redds.

Implementation of Reasonable and Prudent Measures and Associated Terms and Conditions for Bull Trout

The ITS includes four RPMs and associated terms and conditions to minimize incidental take of bull trout related to operations at Reclamation's facilities within the identified action area where bull trout are present: Arrowrock, Anderson Ranch, Deadwood, and Agency Valley dams and associated reservoirs. In 2009 Reclamation focused monitoring and implementation activities at Deadwood Reservoir. The sequence of activities presented in this document reflects the priorities identified by the FWS in the ITS and has been further documented in Reclamation's Monitoring and Implementation Plan (Reclamation 2006). This document presents the activities for each location.

Boise River Basin

Bull trout work associated with the 2005 Opinion (FWS 2005) includes a trap and haul effort to relocate bull trout from Lucky Peak Reservoir to Arrowrock Reservoir. A trap and haul effort is required every two years or every year that the Arrowrock Dam spillway is used, neither condition required a trap and haul effort to be conducted in 2009. A trap and haul effort is scheduled for the spring of 2010.

Payette River Basin - Deadwood River System

The FWS 2005 Opinion identifies five terms and conditions for Reclamation to address in order to minimize the effect and/or amount of take associated with the operation of Deadwood Dam.

Each of the terms and conditions address a different aspect of the effects of operations on bull trout. However, addressing each aspect individually limits the ability to understand how much flexibility Reclamation has in operation of the system as a whole, and the systemic impacts of individual changes in operations. By addressing the terms and conditions jointly and looking at the system in its entirety, Reclamation can evaluate operational flexibility to minimize biological impacts. The Deadwood Reservoir Flexibility Study was initiated in 2006 to collectively address all five terms and conditions and their relative tradeoffs and balances when looking for system flexibility in minimizing impact.

The terms and conditions of the Opinion made several assumptions regarding the reservoir operation effects on bull trout. Therefore, before an evaluation of the operational flexibility to minimize impacts to bull trout can be done, there needs to be an understanding of what those impacts are, and to what degree they can be quantified. The Deadwood Reservoir Flexibility Study proposal (Reclamation 2008) outlines the terms and conditions, hypotheses, assumptions, and assessments as well as identifying data needed to test the hypotheses.

The year 2009 was the fourth year of an intensive six year data collection process to

establish a comprehensive understanding of physical and biological factors limiting bull trout productivity as well as understanding bull trout movement in the reservoir and in the river below the dam. Physical and water quality data collection instruments were monitored in Deadwood Reservoir and the Deadwood River above and below the dam to gather hydrology and water quality data such as temperature, river channel morphology, inflow and outflow quantities, water quality, and reservoir profile characteristics. The information collected within the reservoir is key to providing the resulting habitat conditions entering the reach below the dam under varying operational conditions.

Evaluating the flexibility of the operational effects of Deadwood Dam on aquatic fauna requires an understanding of the potential overall ecosystem response to an operational change over time. Using modeling and physical and biological parameters measured over the course of this project will allow for an ecosystem analysis of the terms and conditions for Deadwood Reservoir operations and its influence on bull trout populations.

Data collection and data processing as part of the Deadwood Reservoir Operations Flexibility Study began in 2006 and continued during 2009. Study objectives are described in the Deadwood Reservoir Flexibility Study proposal (Reclamation 2008) and encompass both the Deadwood Reservoir and the Deadwood River reach (located below the dam extending to the confluence with the South Fork of the Payette River).

A detailed description of the Deadwood Reservoir Operations Flexibility Evaluation Study can be found in the study plan (Reclamation 2008) and Reclamation's 2009 fish sampling report to IDFG (Reclamation 2009c). Results from both reports are summarized below.

Deadwood River System - Reservoir and Tributaries (data collection)

Fish sampling occurred in the reservoir during the reporting period using fyke nets, gill nets, minnow traps, and hook and line sampling from mid June through mid October. Most captured bull trout were surgically fitted with radio transmitters and subsequently released at the point of capture. In addition to sampling bull trout, physical, hydrology and water quality data were also collected within the river, reservoir and selected tributaries.

Fish sampling/ radio tracking

A total of 719 fish, including 7 bull trout, were sampled in Deadwood Reservoir June through October in 2009 (Reclamation 2009c). Species composition was similar to previous accounts for littoral fish assemblages in the reservoir. Mountain whitefish and dace (*Rhinichthys spps*) were the most abundant fish sampled (cumulatively 71% of the total catch) while bull trout represented 2% of the total catch. Other fishes sampled included: Kokanee (12%), rainbow trout (6%), and cutthroat trout, sculpin, and redside shiner (cumulatively 9%; Reclamation 2009c).

Seven bull trout were captured in Deadwood Reservoir in 2009, five of which were surgically implanted with radio transmitters. Most bull trout when captured for the first

time were implanted with a PIT tag and radio tag in addition to having, scales, genetic and isotope samples collected and other biological data recorded (Reclamation 2009c).

A total of nine different bull trout were tracked during the 2009 field season, including one from the 2007 tagging efforts. Behavior of radio tagged bull trout has varied since the radio telemetry work started in 2006 and will be summarized upon completion of this project. In general, tributary inflow (timing and extent of spring runoff) as well as reservoir and tributary water temperatures appear to influence the behavior and migration timing of bull trout in the reservoir.

Four radio tags were recovered during this reporting period from previously tagged bull trout (presumed mortalities or tag expulsion); one from a fish that was tagged in 2006, two from 2008, and from 2009. Five bull trout were still being tracked in the reservoir through the end of the reporting period. No tagged bull trout were entrained in 2009.

Biological samples were collected from all sampled bull trout including: fin clips (n=6), muscle plugs (n=9), scales (n=9), and gut samples (n=3) when possible. Fin clips were sent to the FWS Genetics Lab, Abernathy, WA. Genetic analysis may be used for population assignment to a natal stream in the South Fork Payette drainage (DeHann and Ardren 2008). Muscle plugs are being used in an associated isotope study (Reclamation 2008). Bull trout scales are being analyzed by Reclamation staff and being used to determine general age and growth patterns in the population. The collection of fin clips, muscle plugs, scales, and gut samples were non-lethal and occurred while bull trout were anesthetized. Bioenergetic modeling, scheduled to occur after field studies are complete, will utilize data from age and growth and diet analyses.

Bull trout collections, tagging, and radio tracking efforts during the 2010 field season will concentrate on the Deadwood River below the reservoir. Fish sampling will continue to occur in the reservoir but will focus on tracking radio tagged bull trout. Bull trout tracking efforts are scheduled to continue through 2011 in the Deadwood River asin.

Picket weirs

Picket weirs were not operated on any of the Deadwood Reservoir tributaries in 2009.

Table 5. Bull trout sampling summary for Deadwood Reservoir 2009, including date of capture, Location, Total length, Weight, and Notes.

2009 Deadwood Reservoir bull trout summary				
Date	**Location**	**Total length (mm)**	**Weight (g)**	**Notes**
7/1/2009	Trail Creek Mouth	420	730	
7/1/2009	Trail Creek Mouth	432	840	
7/1/2009	Trail Creek Mouth	500	1300	Recapture
7/2/2009	Trail Creek Mouth	500	1164	Recapture
7/7/2009	Trail Creek Mouth	342	406	
7/7/2009	Trail Creek Mouth	394	554	
8/4/2009	Trail Creek Mouth	285	200	
8/12/2009	Trail Creek Mouth	394	572	Recapture
8/12/2009	Trail Creek Mouth	396	530	Bait hook in stomach not tagged
8/12/2009	Trail Creek Mouth	428	738	Recapture
8/19/2009	Trail Creek Mouth	391	588	Recapture

Table 6. Deadwood Reservoir total catch summary for 2009 including numbers of each species captured (Total Catch), catch per unit effort (CPUE; fish per hour), and Percent (%) of total catch. Includes catches from trap and gill nets, minnow traps and hook and line sampling.

2009 Deadwood Reservoir total catch summary			
	Total sampling effort		**1382.33 hours**
Species	**Total Catch**	**CPUE**	**% of total catch**
Bull Trout (*Salvelinus confluentus*)	11	0.01	1.53
Cutthroat Trout (*Oncorhynchus clarki lewisi*)	25	0.02	3.48
Kokanee (*Oncorhynchus nerka kennerlyi*)	84	0.06	11.68
Rainbow Trout (*Oncorhynchus mykiss*)	46	0.03	6.40
Redside Shiner (*Richardsonius balteatus*)	38	0.03	5.29
Sculpin *Cottus spps.*	5	0.00	0.70
Dace *Rhinichthys spps.*	362	0.26	50.35
Mountain Whitefish (*Prosopium williamsoni*)	148	0.11	20.58
Total	**719**	0.52	

Hydrology and Water Chemistry

Reservoir and tributary samples were collected about monthly during 2009, with sampling beginning in late June and ending in late September. Similar to 2008 protocols eight water quality parameters were measured in the field and another eleven processed in the lab; all parameters are listed in Table 7. Hydrology and water chemistry samples (Table 8) were collected at five locations on the reservoir as well as Trail Creek, Deadwood River inflow, and the Deadwood River outflow (Figure 17; hydrology and Figure 18; water quality).

The Lake Diagnostic System (LDS) was moved from the winter site to the open water site on July 2009. Operations during the open water season were normal and the equipment was relocated to the winter site on October 14. During the summer months the meteorological sensors are located on the reservoir at the original installation site (open water site); however, during the winter months the meteorological sensors are moved to a shoreline location (winter site) to protect the equipment from damage that would result from the winter ice cover on the lake. Data obtained by the LDS were transmitted via satellite communication to Boise, Idaho and subsequent uploaded onto the Online Lake and Reservoir Information System (OLARIS) website on a daily basis. These data can be viewed on the Centre for Water Research, University of Western Australia's website (OLARIS; CWR 2009).

Water temperatures continued to be collected in five tributaries to the reservoir using Onset ® TidbiT temperature thermographs, in the Deadwood River inflow with an acoustic Doppler current meter (ADCM), and in the reservoir using the LDS (Figure 17). Thermographs recorded hourly water temperature data and were manually downloaded a minimum of two times per year. The ADCM collected water temperatures at 15 minute intervals and transmitted data via satellite communications to Boise, Idaho where data was uploaded onto Reclamation's Hydromet website (Reclamation 2009b). The LDS recorded water temperature at various depths every minute while it was deployed.

Flow stage was collected at the mouth of the Deadwood River into Deadwood Reservoir using an ADCM and in Trail Creek using an AquaRod ® Water Level gauge. In addition to flow stage and water temperature the ADCM recorded water velocity. Data from the ADCM was transmitted via satellite to Reclamation's Hydromet website (Reclamation 2009b). The AquaRod recorded flow stage every 30 minutes from June through October and hourly during the rest of the year. Data was downloaded monthly from the AquaRod during the field season. On several occasions, manual flow measurements were made at the same location as the AquaRod for the purposes of developing stage/discharge relationships to quantify flow and water quality constituent concentrations entering the reservoir. All temperature, flow and stage data is stored on Reclamation's Hydromet database and is being used for the biological and hydrology modeling.

Hydrology and water quality data will continue to be sampled through the 2010 field season. Incorporation of these data into the modeling efforts as well as additional study background information is described in the Deadwood Reservoir Flexibility Study proposal (Reclamation 2008).

Table 7. Reservoir sampling locations and frequency of sampling for Deadwood River and Reservoir, 2007-2009.

Sampling Site	2007 Sampling Duration	2007 Sampling Frequency	2008 Sampling Duration	2008 Sampling Frequency	2009 Sampling Duration	2009 Sampling Frequency
DEA004	5/23-10/9	weekly	6/16-10/6	biweekly	6/29-9/28	monthly
DEA006	5/23-10/9	weekly	6/16-10/6	biweekly	6/29-9/28	monthly
DEA008	4/30-10/9	weekly	---	---	---	---
DEA010	4/30-10/9	weekly	6/5-10/6	biweekly	6/29-9/28	monthly
DEA012	5/29-9/10	biweekly	---	---	---	---
DEA014	5/29-9/10	biweekly	6/30-10/6	biweekly	6/29-9/28	monthly
DEA016	5/29-9/10	biweekly	6/16-10/6	biweekly	6/29-9/28	monthly
DEA101	4/26-10/9	weekly	6/5-10/6	biweekly	6/29-9/28	monthly
DEA102	4/26-10/9	weekly	6/5-10/6	biweekly	6/29-9/28	monthly
DEA104	5/10-10/9	weekly	6/5-10/6	biweekly	6/29-9/28	monthly

Table 8. Water quality parameters measured in the field and laboratory processed for Deadwood River and Reservoir, 2009.

Water-column profiles and field data	Analyzed water-quality variables
Water temperature	Nitrite+nitrate, dissolved
Dissolved-oxygen concentration	Ammonia, dissolved
pH	Orthophosphate, dissolved
Conductivity	Total phosphorus
Turbidity	Total Kjeldahl nitrogen
Fluorescence (reservoir only)	Organic carbon, dissolved
Barometric pressure	Organic carbon, total
Secchi depth (reservoir only)	Turbidity
	Chlorophyll-a
	Pheophytin-a
	Silica, dissolved

Deadwood River System - Reservoir and Tributaries (discussion)

Evaluation of the 2007 hydrology and water chemistry data indicated a need for some modifications to the sampling program. Analyses of silica concentrations and low-level detection analyses for nitrogen and phosphorus were initiated in 2008 and continued in 2009. The trichromatic spectrophotometric method used in 2007 for chlorophyll-*a* analyses was changed in 2008 and 2009 to an acid-corrected spectrophotometric one that yields values for both chlorophyll-*a* and pheophytin-*a*. Chlorophyll sampling during 2008 and 2009 was modified to collect samples at the 1-meter depth as well as at the depth of the fluorescence maxima at most of the reservoir stations.

Sampling frequency and locations were modified for the 2009 field season. Within reservoir sampling locations included the same five sites but the frequency was reduced from bi-weekly to monthly for all samples. This change resulted from funding reductions and evaluating the 2008 data to refine the data needs in 2009.

Idaho Department of Fish and Game (IDFG) presence at Deadwood Reservoir was reduced from previous years. The IDFG did not run weirs on any tributaries in 2009 leaving kokanee, bull trout, and Chinook escapement unmonitored. Trawling and hydroacoustic surveys were conducted on July 21 to provide estimates of kokanee recruitment. The IDFG also stocked 5,208 age-0 Chinook into Deadwood Reservoir to as a measure to control kokanee. All work performed by the IDFG is summarized in IDFG Region 3 Fish Management Report (Butts et al. 2009 *in press*).

Annual mortality of radio tagged bull trout in the reservoir was lower in 2009 than the previous three years. One of the five bull trout that was radio tagged in 2009 died in 2009 (20%) compared to 38% (2006); 78% (2007); and 34% (2008). The majority of confirmed mortalities during the entire study, based on where radio tags were found, occurred in the transition zone of the reservoir (n=11) presumably as fish were migrating up or downstream from spawning. Tag recovery rates were next highest in the spawning tributaries (n=7) while only three tags have been recovered in the reservoir. The remainder of radio tags have not been recovered. No mortality during this reporting period was directly attributable to handling associated with this research.

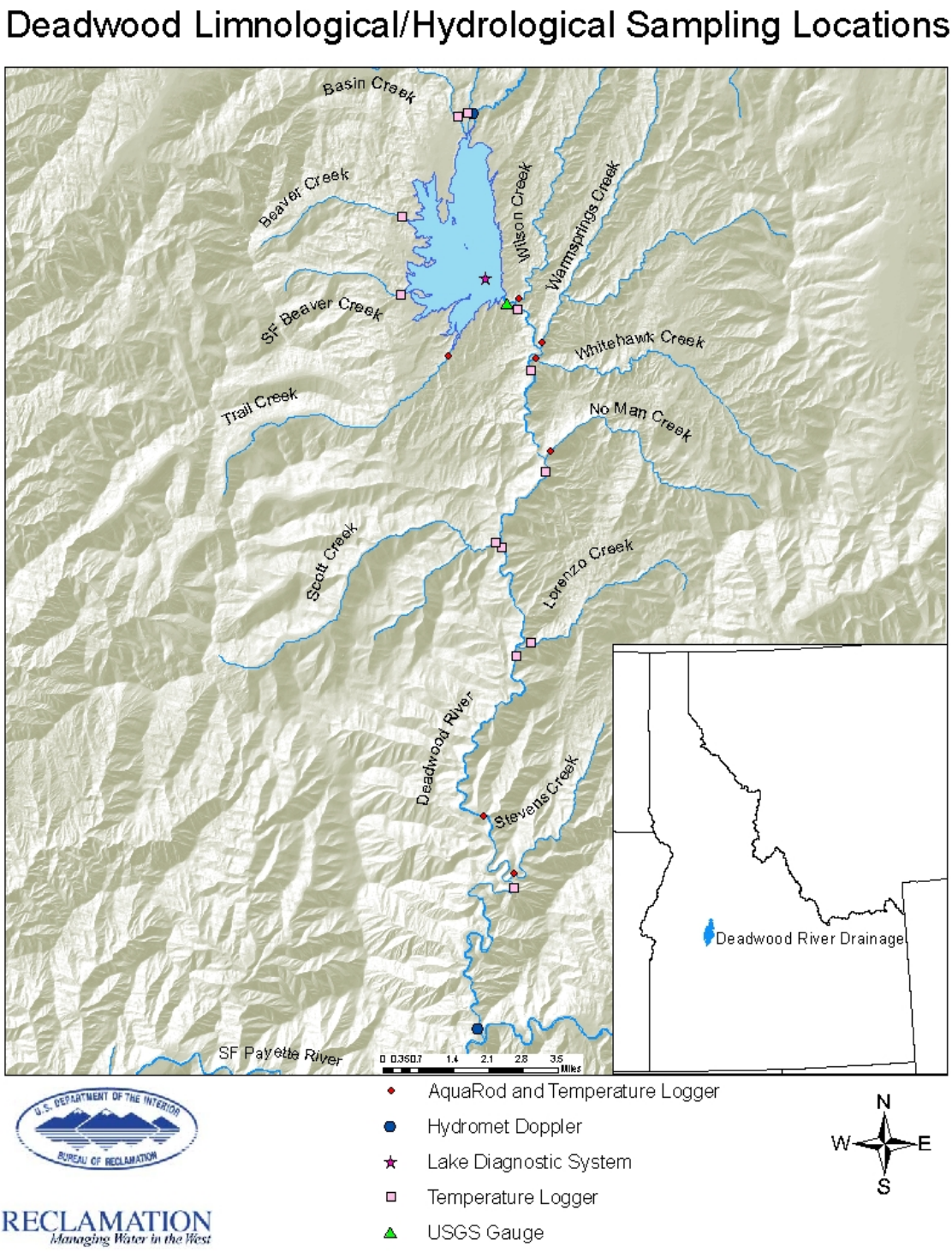

Figure 17. Limnologic and hydrologic sampling locations in the Deadwood study area, Idaho 2009. Equipment used to record data varied between locations and included AquaRods and Temperature Loggers, Temperature Loggers, a Lake Diagnostic System, Hydromet Doppler, and a U.S. Geological Survey water gauge (USGS gauge).

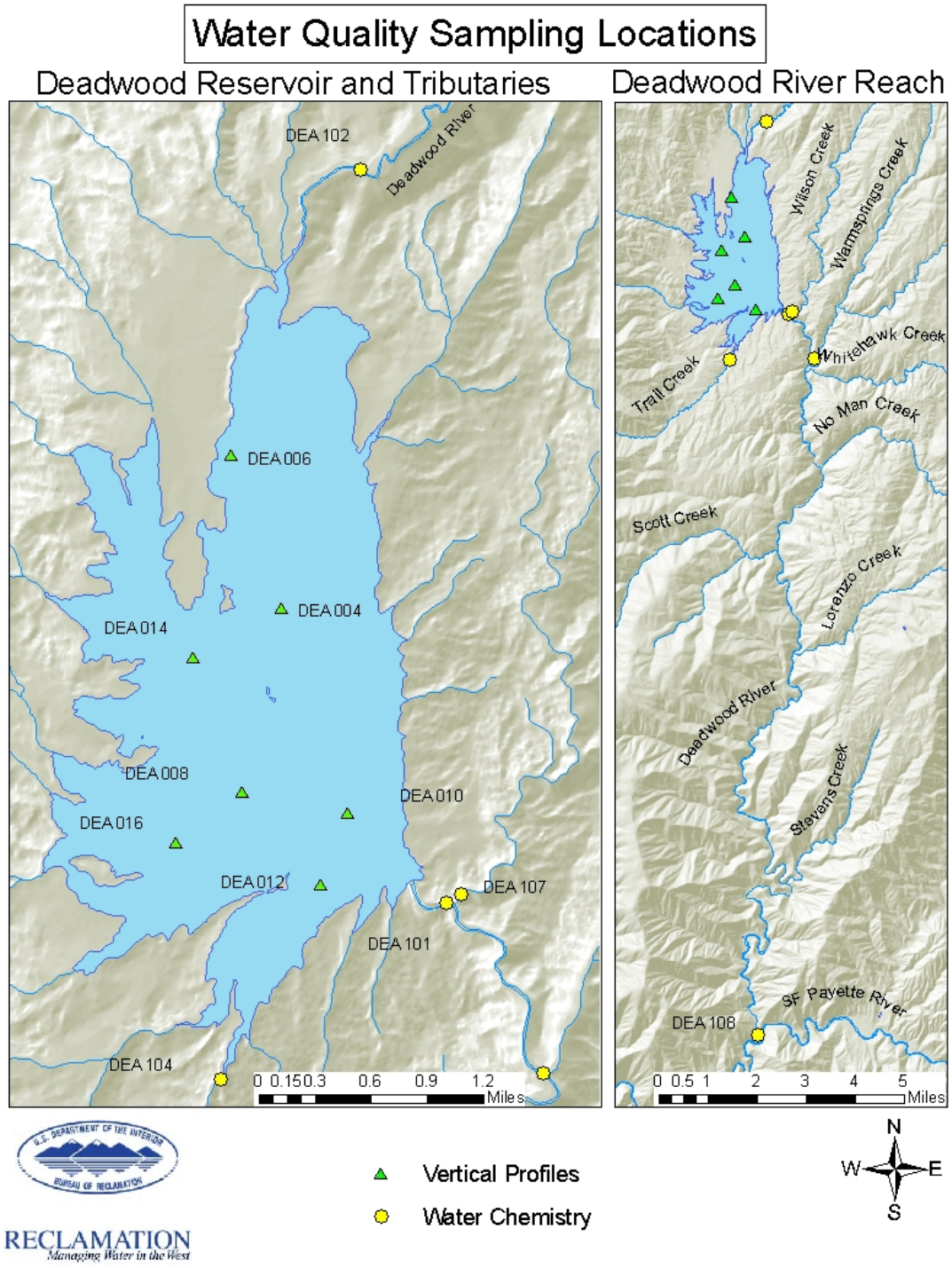

Figure 18. Water quality sampling locations in the Deadwood Reservoir (DEA) and tributaries and the Deadwood River Reach study sections. Vertical profiles and water chemistry samples were collected in both reaches. Sample locations DEA 004, 006, 010, 014, 016, 101, 102, and 104 were sampled monthly from June through September, 2009. Sample locations DEA 108, 008 and 012 were not sampled during 2009.

Deadwood River System – Deadwood River Reach: Downstream of Deadwood Dam to the confluence with the South Fork Payette River (data collection)

Bull trout sampling occurred in the Deadwood River below the reservoir using trap nets, hook and line sampling, and minnow traps. Most captured bull trout were surgically implanted with radio transmitters and all fish were released at the point of capture. In addition to sampling bull trout, physical, hydrology and water chemistry data were also collected. A detailed description of these activities occurring within the Deadwood River Reach and tributaries is presented below.

Fish sampling/ radio tracking

A total of 150 fish, including eight bull trout, were sampled in Deadwood River June through October in 2009 (Reclamation 2009c). Species composition included rainbow trout (51% of the total catch), mountain whitefish (17%), dace (13%), bull trout (11%; with replacement), and Kokanee, sculpin, and redside shiner (cumulatively 8%; Reclamation 2009c).

Sampling in the Deadwood River below the dam focused in the stilling basin but also occurred in portions of the lower 9 miles of river during the 2009 field season. Sampling gears included hook and line, trap nets, and minnow traps. A total of eight bull trout were captured between July 16 and October 7 at a catch rate of one fish every 84 hours, each was fitted with a telemetry tag (Table 10). All bull trout were captured in the stilling basin; three were captured using hook and line sampling and five were captured using trap nets. Five bull trout were recaptured throughout the season with some individuals up to three times. Captured bull trout ranged in length from 202 mm to 435 mm total length and from 66 g to 686 g in weight. One bull trout had a surgery scar from a previous tagging event but lost both tags that could have uniquely identified the date of previous capture.

Tagged bull trout were tracked monthly by helicopter or ground surveys and continually from two stationary receivers. One stationary receiver is at the dam and the other at the confluence of the Deadwood and South Fork Payette rivers. Ground surveys only covered two miles downstream of the dam because of the remote and inaccessible terrain. Fish have been tracked, in the past, moving up to 20 miles downstream of Deadwood Dam but never leaving the Deadwood River. However, in 2009 the furthest downstream movement occurred when three of the fish moved into Wilson Creek (approximately 0.25 miles downstream) two of which were observed spawning.

Biological samples were collected from all sampled bull trout including: fin clips (n=8), muscle plugs (n=5), scales (n=12 including samples from recaptures), and gut samples when possible (n=9). Fin clips were sent to the FWS Genetics Lab, Abernathy, WA. Genetic analysis may be used for population assignment to natal streams in the South Fork Payette drainage (DeHann and Ardren 2008). Muscle plugs are being used in an associated isotope study (Reclamation 2008). Bull trout scales are being analyzed by Reclamation staff and being used to determine general age and growth patterns in the population. The collection of fin clips, muscle plugs, scales, and gut samples were non-

lethal and occurred while bull trout were anesthetized. Bioenergetic modeling, scheduled to occur after field studies are complete, will utilize data from age and growth and diet analyses.

Bull trout collections, tagging, and radio tracking efforts during 2010 will shift from focusing on the reservoir to focusing on habitat in the Deadwood River below the reservoir. Sampling efforts in the stilling basin to collect bull trout will depend on available resources. Bull trout tagging and tracking efforts are scheduled to continue through 2011.

Table 9. Bull trout sampling summary for Deadwood River 2009, including date of capture, Location, Total length (mm), Weight (g), and if the fish was recaptured.

2009 Deadwood River bull trout summary				
Date	**Location**	**Total length (mm)**	**Weight (g)**	**Notes**
6/16/2009	Stilling Basin	380	550	
7/8/2009	Stilling Basin	350	492	
8/13/2009	Stilling Basin	202	66	
8/19/2009	Stilling Basin	360	460	Recapture
9/2/2009	Stilling Basin	307	276	
9/2/2009	Stilling Basin	314	328	
9/2/2009	Stilling Basin	221	96	
9/10/2009	Stilling Basin	312	312	Recapture
9/10/2009	Stilling Basin	365	488	Recapture
9/10/2009	Stilling Basin	292	220	
9/11/2009	Stilling Basin	433	582	Old tag scar
9/22/2009	Stilling Basin	365	470	Recapture
9/24/2009	Stilling Basin	227	110	Recapture
10/7/2009	Stilling Basin	435	686	Recapture
10/7/2009	Stilling Basin	253	150	Recapture
10/7/2009	Stilling Basin	231	122	Recapture

Table 10. Deadwood River total catch summary for 2009 including numbers of each species captured (Total Catch), catch per unit effort (CPUE; fish per hour), and Percent (%) of total catch. Includes catches from trap and gill nets, minnow traps and hook and line sampling.

2009 Deadwood River total catch summary			
	Total sampling effort		**673.650 hours**
Species	**Total Catch**	**CPUE**	**% of total catch**
Bull Trout (*Salvelinus confluentus*)	16	0.024	10.67
Cutthroat Trout (*Oncorhynchus clarki lewisi*)	0	0.000	0.00
Kokanee (*Oncorhynchus nerka kennerlyi*)	7	0.010	4.67
Rainbow Trout (*Oncorhynchus mykiss*)	77	0.114	51.33
Redside Shiner (*Richardsonius balteatus*)	2	0.003	1.33
Sculpin *Cottus spps*.	3	0.004	2.00
Dace *Rhinichthys spps*.	19	0.028	12.67
Mountain Whitefish (*Prosopium williamsoni*)	26	0.039	17.33
Total	150	0.223	

Hydrology and Water Chemistry

Water quality data were collected during the 2009 reporting period for the purpose of riverine and habitat modeling efforts (Reclamation 2008). Eight water quality parameters were measured in the field and another eleven processed in the lab; all parameters are listed in Table 8. Water quality sampling sites included two locations on the Deadwood River (below the dam and near the confluence with the South Fork Payette River) and Wilson Creek. Sampling locations for hydrology and water quality data are depicted in Figures 17 and 18. Sample locations and frequencies are listed in Table 7.

Water temperatures continued to be collected downstream of Deadwood Dam in seven tributaries to the Deadwood River and the mainstem Deadwood River below (Wilson, Whitehawk, No-Man, Scott, Lorenzo, Julie, and Stevens creeks). Thermographs recorded hourly water temperature data throughout the year and were manually downloaded a minimum of once per year. Locations of all temperature thermographs in the Deadwood Basin are illustrated in Figure 17.

An ADCM located near the confluence of the Deadwood River with the South Fork of the Payette River was maintained and continued to record data during 2009. The ADCM recorded water temperature, water velocity, and water depth. Data from the ADCM was transmitted via satellite to Reclamation's Hydromet website (Reclamation 2009b).

AquaRod ® Water Level and Temperature Loggers were maintained in Wilson, Warmsprings, Whitehawk, No-Man, and Stevens creeks, and in the Deadwood River near Julie Creek. The AquaRod loggers recorded flow stage every 30 minutes from June through October and hourly during the rest of the year. Data was downloaded monthly during the field season. On several occasions, manual flow measurements were made at these locations for the purposes of developing stage/discharge relationships in order to quantify flow and water quality constituent concentrations entering the river.

Two flow measurement efforts occurred in 2009 to assist in developing stage-discharge relationships at the gages and to verify discharge measurements from the automated sensors. On the first event August 24 through August 27) flows were recorded at the following locations: Wilson, Warmsprings, Whitehawk, NoMan, Lorenzo, Nine Mile, Scott, Slaughterhouse, Slim, Deadwood Jim, Stevens creek, and an un-named tributary above Deadwood Jim Creek. An attempt was made during the first effort to record flow on the Deadwood River at Julie Creek Bridge and Deadwood River near South Fork Payette River but the river velocities were too high to use the equipment. On the second event (October 20 through October 21) flows were recorded a the following locations: Slaughterhouse, Slim, Deadwood Jim, Stevens, Nellies Basin, Pine, Josie creeks, an un-named tributary above Deadwood Jim Creek, the mainstem Deadwood River at Julie Creek Bridge, and the mainstem Deadwood River at the ADCM near the confluence with the South Fork Payette.

Hydrology and water quality data will continue to be sampled through the 2010 field season. All temperature, flow and stage data is stored on Reclamation's Hydromet database and is being used for the biological and hydrologic modeling. Results will be available in the final report upon completion of the project following the outline

described in the Deadwood Reservoir Flexibility Study proposal (Reclamation 2008). Survey protocols were developed for the Deadwood Project using a number of published resource agency stream survey techniques (Platts et al. 1983, Bevenger and King 1995, Overton et al. 1997, Armantrout 1998, Thorne 1998, Bain and Stevenson 1999, Gordon et al. 2004). Stream reaches were divided into individual geomorphic channel units, or habitat units. Measured parameters included 24 different constituents to identify stream geomorphology and instream habitat. A detailed methodology is described in Prisciandaro and Dillinger (2010; Reclamation internal files).

A total of 14.2 kilometers (8.8 miles) were surveyed in the fall of 2009. During the first few sampling efforts protocols were still being refined, so not all of the parameters were collected for all 109 habitat units. General characteristics of each reach include reach length, average width and length of habitat units, counts of large woody debris per reach and per mile, as well as percent pools. Surveys will continue through the 2011 field season, complete results will be presented in the final Deadwood Reservoir Flexibility Study report.

Deadwood River Reach (discussion)

Prior to 2007 no bull trout had been sampled in the Deadwood River below the dam using a combination of gill nets, trap nets, tributary weirs, hook and line, and electrofishing methods. Since 2007, 21 bull trout have been sampled below the dam all within the stilling basin using trap nets and hook and line sampling. Movement of radio tagged fish has varied between years and seasons.

During the 2009 reporting period a total of eight bull trout were captured in the stilling basin including one recapture from a previous year. Throughout the field season, five of the eight fish had been recaptured at least once. The difference in number of fish captured could be attributed to better net placement and increased sampling effort. Until the genetic analyses are completed it is uncertain if the 8 fish were entrained. If entrained, it is unknown when the fish were entrained; however, past sampling success may suggest entrainment occurred in 2007. Furthermore, 2009 was the first year that radio tagged fish were observed in tributaries during the spawning season. In 2009, three fish were tracked into Wilson Creek and two were observed spawning together.

Payette River Basin - Deadwood River System (discussion)

The Deadwood Reservoir Flexibility Study involves methods that include fish population dynamics, productivity, hydrology and water chemistry monitoring (Reclamation 2008). These data are being used in physical, hydrodynamic, and bioenergetic modeling. These efforts involve a collaborative effort between multiple agencies and include annual activities not detailed in this report. The results of the Deadwood Reservoir Flexibility Study will be provided at the completion of the project and reported under a different cover.

Additional data and methodology can be found in the Technical Report for Idaho

Fish and Game Permit Number F-10-99 (Reclamation 2009c) and the Deadwood River Flexibility Study Proposal (Reclamation 2008).

Malheur River Basin - Beulah Reservoir (data collection)

A memo sent to the FWS in 2009 (May 15, 2009: Mark Robertson FWS) described revisions to the Monitoring and Implementation Plan. The Monitoring and Implementation Plan (March 16, 2006) originally identified trap and haul to be initiated when reservoir pool elevations dropped below 2,000 acre-feet or when the spillway was used. Trap and haul sampling has been conducted in the spring from 1999-2008 (excluding 2007) and in the fall of 2000-2002. Bull trout have only been collected during spring sampling efforts during or following spill. Based on this data, the May 15 memo revises the trap and haul requirement to be conducted only when spill occurs.

Spill did not occur at Agency Valley Dam in 2009 precluding the need for trap and haul to be conducted.

Malheur River Basin - Beulah Reservoir (discussion)

The 2005 Opinion identified concerns regarding the management of Beulah Reservoir affecting bull trout. Fisheries research projects over the last ten years have provided better insight into the behavior of bull trout in the North Fork Malheur River (NFMR) Basin. Factors effecting bull trout in the NFMR Basin include: entrainment, unscreened diversions, habitat loss due to drawdown and prey base loss due to drawdown. Pertinent questions that have been addressed from the Opinion include: identifying the resilience of prey species to repopulate the reservoir following a complete drawdown and the potential of mechanisms besides minimum pool to reduce anticipated take.

Two variables may affect bull trout in the NFMR Basin more than any other – water availability and current fish assemblage in Beulah Reservoir. The NFMR Basin has been experiencing decreasing trends in precipitation over the last three decades. Reduced annual precipitation limits the operational flexibility to provide minimum pool elevations for bull trout in Beulah Reservoir. The fish assemblage in Beulah Reservoir has also changed in the last 30 years. The current fish assemblage is comprised of species that compete for the same resources. Furthermore, changes in stocking could negatively affect prey availability for bull trout. Efforts to maintain a minimum pool or to manipulate the current fish assemblage in Beulah Reservoir may benefit bull trout but logistically may be difficult to negotiate.

Despite challenges with decreasing water availability, several measures have been taken to protect bull trout over the past ten years. Three large irrigation diversions in the NFMR upstream of Beulah Reservoir have been screened eliminating most fish loss through entrainment upstream of the reservoir. The frequency of spill over Agency Valley Dam has been limited in recent years reducing entrainment downstream of the reservoir. Lastly, the Vale irrigation district has implemented many water conservation projects that have helped to reduce the demand of water from Beulah Reservoir. The

benefits of all these measures may not be evident in the population trends for several years but could provide noticeable improvements.

Issues still unanswered include: solutions to prey loss due to drawdown, identifying a biologically supported minimum pool, and bull trout use of the NFMR. Past research has identified a loss to the prey base when a complete drawdown occurs. Recovery of the prey base can occur within a couple of years but depends largely on refill/drawdown the following year. The affect of prey fluctuations on the bull trout population could be tracked through age class structure and length/weight comparisons of bull trout over time if the data was available. Few bull trout have been captured in the reservoir during any study making population trends difficult to monitor. At this time only redd count data provides a general idea of the adult (migratory) bull trout population.

Minimum pool recommendations cannot be determined using the available data, however, studies by USGS in 2000 and 2001 suggest that pool elevations as small as 2,000 acre-feet may provide a benefit to prey species (fish, insects and zooplankton). Other studies by USGS (2006-2008) suggest that a minimum pool elevation as large as 18,656 acre-feet (79% of full pool) can support enough prey to maintain a modeled population of 188 adult, adfluvial bull trout. (Extrapolation of redd count data at the time of the study estimated adult bull trout in the NFMR to be 188 fish.) A more specific range of minimum pool elevations is not able to be determined with the available data. Without further work, it is not possible to determine whether bull trout would use Beulah Reservoir if a minimum pool was established. If the main benefit to maintaining a minimum pool is to protect the prey base then other options may include a post irrigation fish salvage below the dam or under certain conditions stocking prey sized fish in the fall.

Based on available fisheries data Reclamation (at the time this report is submitted) is outlining a research plan for the next five years (2011-2015). Furthermore, Reclamation will explore the possibility to begin refilling Beulah Reservoir earlier in the fall. Completely draining Agency Valley Reservoir may not always be avoidable but there may be the possibility to reduce the amount of time the reservoir is empty. Upon completion of the outlined work Reclamation will examine the results and discuss with FWS the direction of future research.

V. Other Activities

Physa Surveys

No surveys were conducted for physa during this reporting period.

Water Quality

Reclamation participates in several water quality related activities in the upper Snake River Basin. This discussion describes the breadth of Reclamation's participation in 2009. First, as part of Idaho and Oregon's on-going Total Maximum Daily Load development and implementation activities, Snake River Area Office and/or Pacific Northwest Region Reclamation staffs participated in all appropriate watershed advisory group and watershed council meetings in the upper Snake River Basin. These include activities in the North Fork Payette River, Lower Payette River, Mid Snake River, Lake Walcott, and American Falls Reservoir Watershed Advisory Groups, as well as the Malheur Watershed Council.

Reclamation also provided technical assistance to irrigation system operators and other appropriate entities throughout its project areas in the upper Snake River Basin. Reclamation's Pacific Northwest Region Laboratory provided analytical laboratory services to several entities in the basin. These entities included:

Idaho Department of Environmental Quality

Aberdeen Springfield Irrigation District

Burley Irrigation District

Lower Boise River Watershed Advisory Group

A & B Irrigation District

Minidoka Irrigation District

Lake Walcott Watershed Advisory Group

Malheur Soil & Water Conservation District

In addition, Reclamation has developed and implemented a basin-wide temperature monitoring study for the upper Snake River Basin. In 2009, Reclamation and the USGS maintained a total of 52 stream temperature loggers throughout the basin. The intent of the on-going study is to describe temperature regimes in the Snake River relative to Reclamation's management activities; this work will continue through 2010. The information from this study was reported in Reclamation's 2009 Annual Report to the National Marine Fisheries Service (Reclamation 2009a).

Reclamation also performed routine water sampling across the region. Reclamation performed nutrient monitoring on drains that return water to Lake Lowell; this monitoring is aimed at identifying the affects of added nutrients on the water quality in Lake Lowell. Lastly, Reclamation performed routine water quality sampling at Ririe, Palisades, and Walcott reservoirs in 2009. This sampling was performed as part of an on-going regional reservoir sampling regime. The conditions at American Falls Reservoir did not trigger sediment and nutrient monitoring in 2009. When threshold conditions are met, monitoring is performed to track the effects of low pool elevations on water quality below the reservoir.

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