RECLAMATION
Managing Water in the West

2008 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 (RPM) 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 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 2008 (October 1, 2007 to September 30, 2008). This is an appropriate reporting period but presents a challenge because annual minimum reservoir contents occur near the annual boundary. For 2008 the minimum contents of many reservoirs occurred in the first few days of the reporting period in October, 2007 and are the result of 2007 operations that were reported last year. Generally, the relevant 2008 minima are reported in this report and their relationship to the initial conditions is described when needed to enhance clarity.

II. Summary of 2008 Operations

Idaho

Carryover storage ranged from low to very low at the beginning of water year 2008. Mid-winter snow accumulation was below average but late winter snow and spring rain resulted in near average runoff volumes. Spring rain also enhanced soil moisture and delayed the commencement of stored water use by Reclamation contractors. Initial storage in October 2007 was well below average in the Payette basin (88%) and in the Boise basin (64%), and very low in the Snake River basin above Milner Reservoir (36%). Unregulated runoff for the April through July period was 102% of average for the Snake River at Heise, 105% for the Payette River at Horseshoe Bend, and 91% for the Boise River near Boise (Reclamation 2008a).

Of the three major reservoir systems, the Payette and Boise refilled completely in 2008 while the upper Snake River system filled to about 85% of physical capacity. Sufficient water was available in 2008 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 183,282 acre-feet from the upper Snake River above Milner Dam, 177,388 acre-feet from the Payette River basin, 48,681 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 2008. The watershed above Beulah Reservoir represents approximately 20% of the Malheur basin. Carryover storage in Beulah Reservoir was only about 1% of the 1971-2000 average to begin the 2008 water year due to drought conditions in 2007. Unregulated runoff for the April through July period was 96% of average for Beulah Reservoir. Beulah Reservoir filled to about 89% (53311 acre-feet) of physical capacity in 2008 and was drafted to 2 % of reservoir capacity (1339 acre-feet) on October 1, 2008. The Malheur basin does not contribute to Reclamation's flow augmentation program.

Flow information for the 2008 water year (October 1, 2007 to September 30, 2008) can be found at Reclamation's Hydromet website (http://www.usbr.gov/pn/Hydromet/; Reclamation 2008b). Reservoir water operations including daily average reservoir elevations, acre-feet contents, storage and outflow are graphically depicted in Figures 2-6 (American Falls Reservoir and Lake Walcott) and Figures 12-17 (Anderson Ranch, Arrowrock, Deadwood, and Beulah reservoirs).

III. Utah Valvata

Summary of the Utah Valvata Incidental Take Statement and 2007 Operations

The FWS determined incidental take at each reservoir and river reach using operational indicators (reservoir elevations and river stage heights for each project) and the population impacts that are expected to result when exceeding these operational thresholds (i.e.: the percent of snails affected based on an estimated amount of benthic habitat that may be exposed at a specific reservoir elevation and/or river stage height). The FWS further determined that all snails exposed in dewatered habitat will be subject to lethal take. These effects, operational indicators, and expected frequency are summarized in Table 1 on page 4. Figure 1 shows the location of Utah valvata in the action areas.

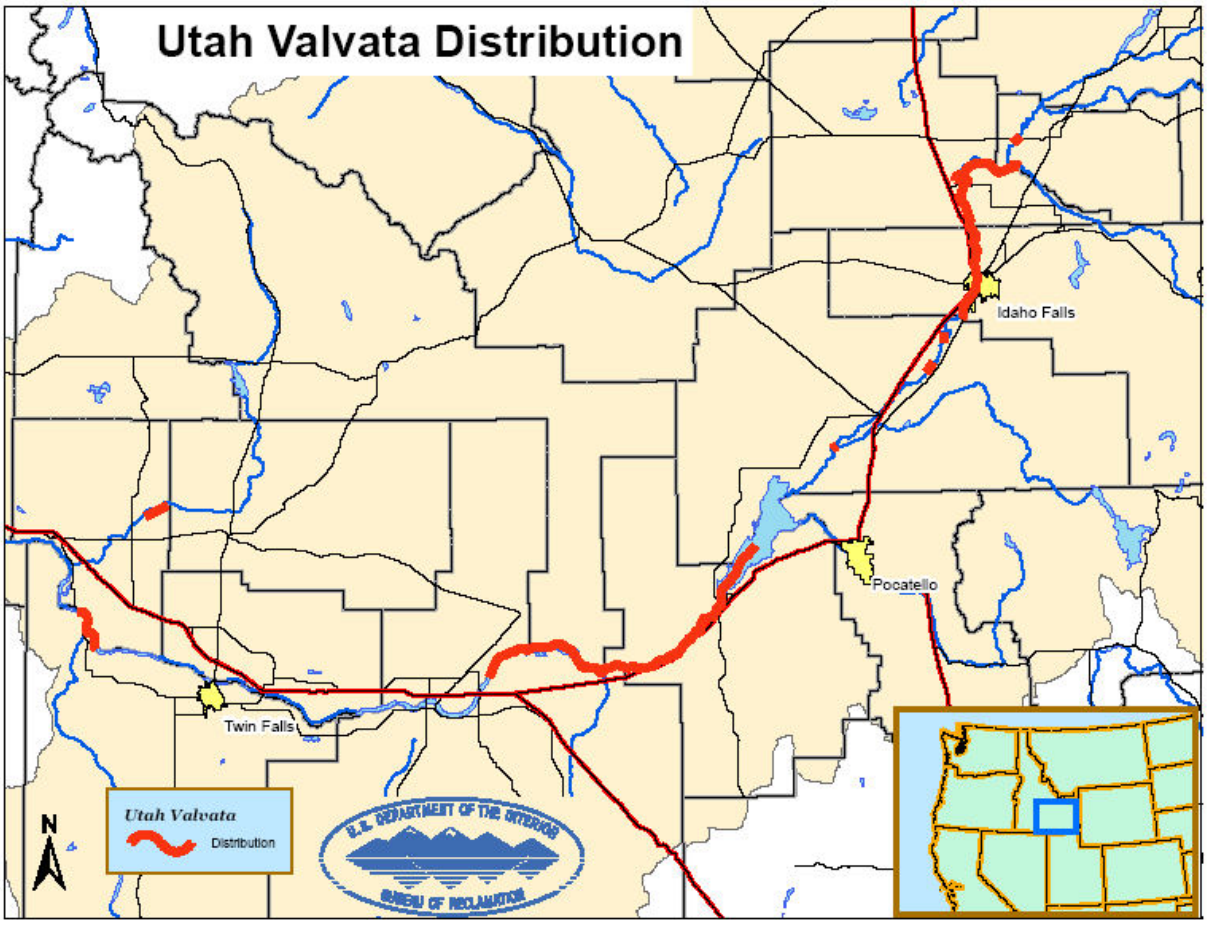

Figure 1. Known distribution of Utah valvata populations associated with Reclamation facilities in the upper Snake River basin.

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	2008 operation (Oct. 2007 to Sept. 2008)	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 (August-October)	2 of 30 years	In water year 2008 the lowest reservoir storage volume, after storage season, was 226,982 ac-ft. on Sept 22, 2008 (Figure 2).	0 of 2 years 2006: 0 2007: 0 2008: 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 (August-October)	2 of 30	In water year 2008 the lowest reservoir storage volume was 226,982 ac-ft. 4317.12 ft. on Sept. 22 (Figure 3).	1 of 2 years 2006: 0 2007: 4 days 2008: 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	Figure 2 depicts American Falls content in acre feet for water year 2008. Storage began in early Oct and continued thru April and then releases began.	3 of 30 years 2006: all year 2007: all year 2008: 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 2008 the lowest winter flows at Neeley were 350 cfs on 12/25/07 and 1/1/08 (Figure 4).	1 of 9 years 2006: 5 days 2007: 0 2008 0

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2008 operation (Oct. 2007 to Sept. 2008)	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 (August–October)	28 of 30 years	The reservoir was at its lowest elevation of 4239.88 (1.6 vertical meters below full pool) on Oct. 17, 2007 (Figure 5).	1 of 28 years 2006: 0 2007: 0 2008: 7 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 (August-October)	2 of 30	The reservoir was at its lowest elevation of 4239.88 (1.6 vertical meters below full pool) on Oct. 17, 2007 (Figure 5).	0 of 2 years 2006: 0 2007: 0 2008: 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 522 cfs on Dec. 23 2007 (Figure 6).	2 of 30 years 2006: all winter 2007: all winter 2008: 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 shutoff period was approximately Sep 15, 2007 – Apr 23, 2008. During the winter seepage was observed consistently at 50 – 70 cfs.	3 of 30 years 2006:fall/winter 2007:fall/winter 2008:fall/winter

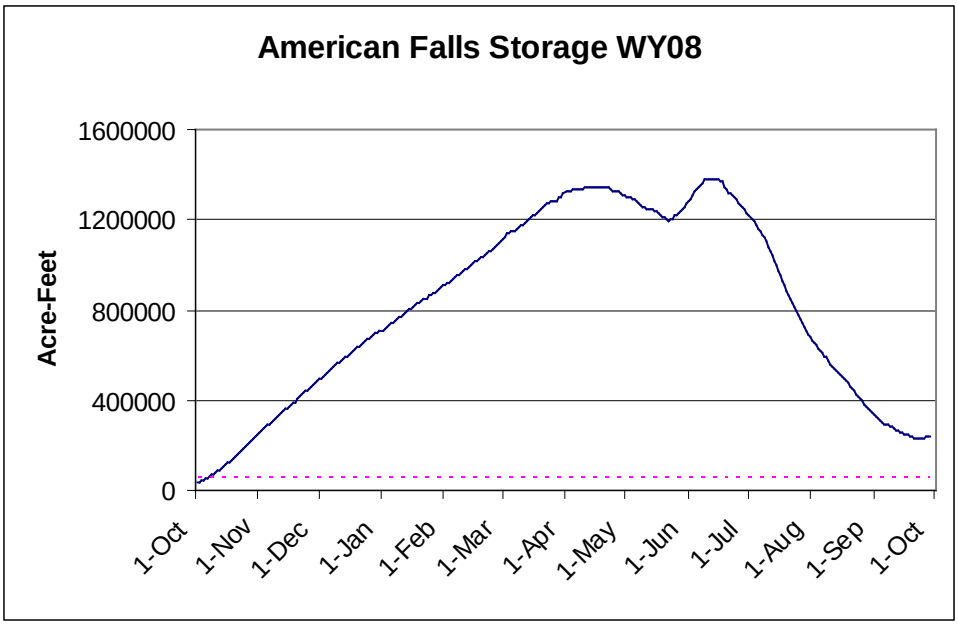

Figure 2. American Falls Dam reservoir storage volumes (acre-feet) for the 2008 water year (WY 08). The dotted line represents Reclamation's operational threshold storage of 50,000 acre-feet.

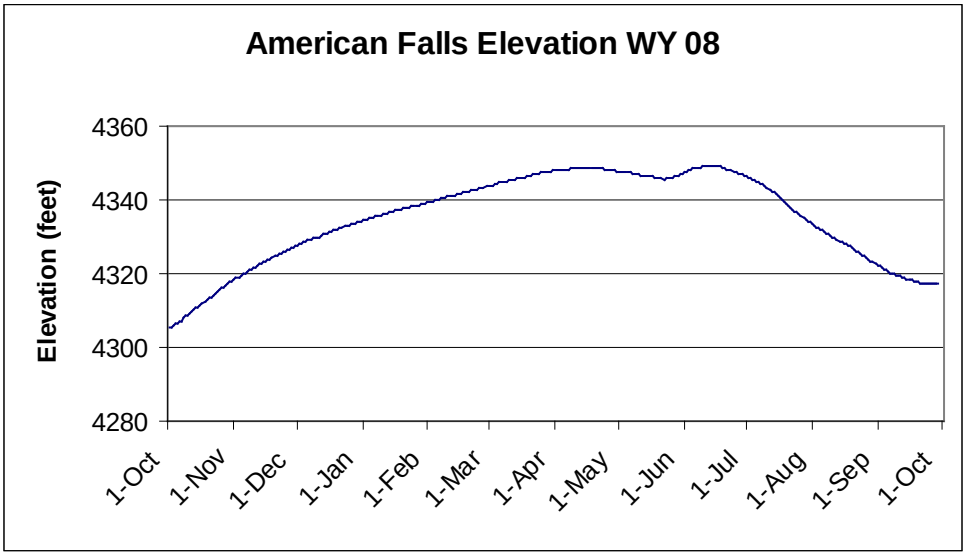

Figure 3. Reservoir elevations at American Falls Dam for the 2008 water year (WY08).

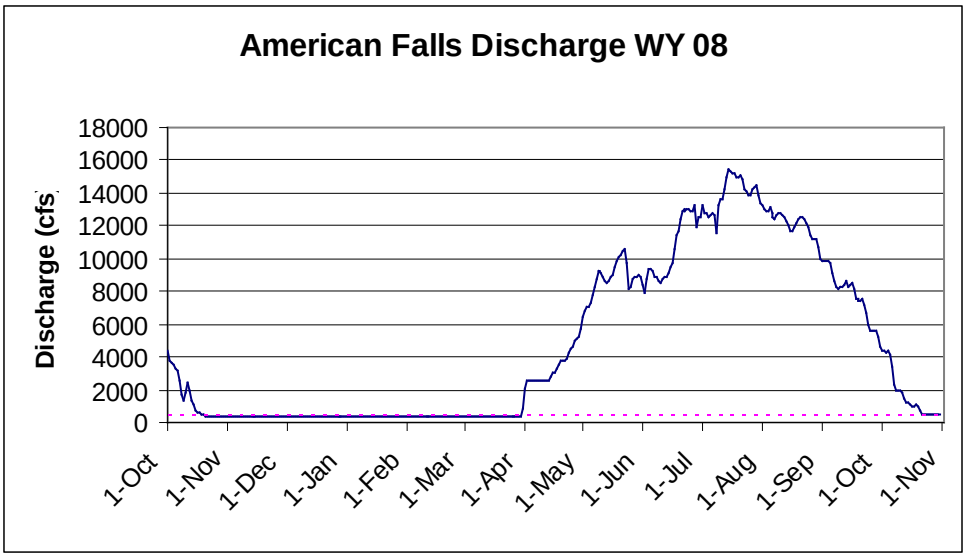

Figure 4. Discharge from American Falls Reservoir for the 2008 water year (WY 08). The dotted line represents Reclamation's operational threshold discharge flow of 350 cubic feet per second (cfs).

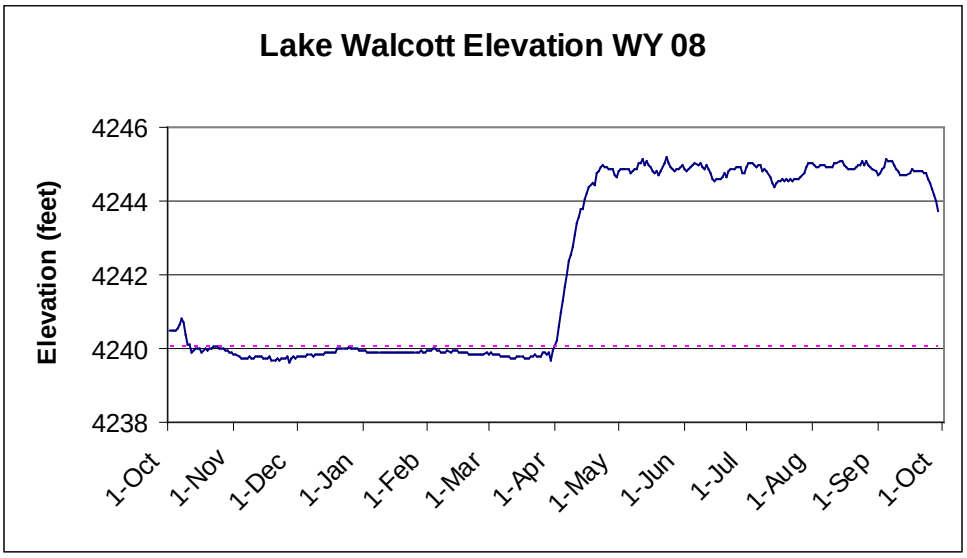

Figure 5. Reservoir elevation at Lake Walcott for the 2008 water year (WY 08). The dotted line represents Reclamation's Summer and early Fall threshold elevation of 4240.08 feet.

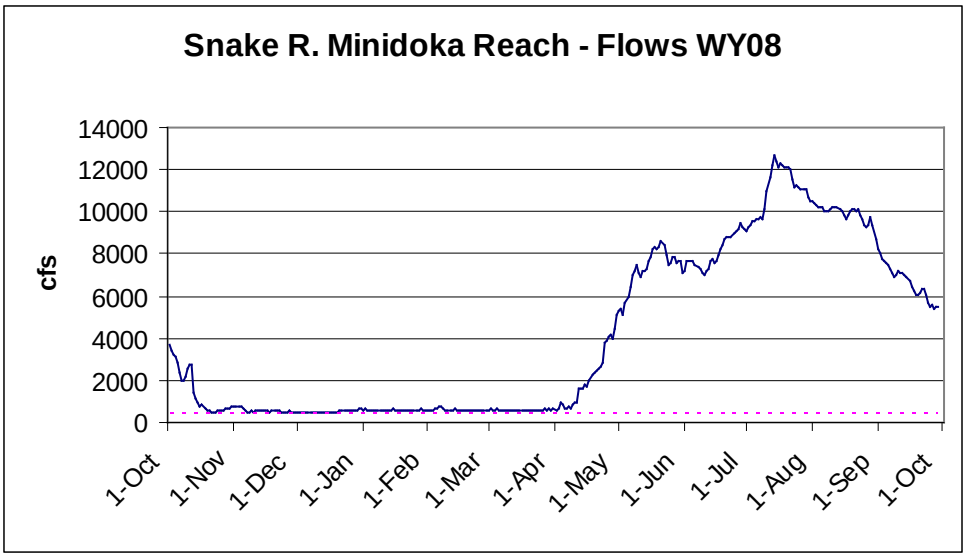

Figure 6. Snake River Minidoka reach river flows cubic feet per second (cfs) for the 2008 water year (WY08). The dotted line represents Reclamation's operational threshold discharge flow of 400 cfs.

Monitoring for Utah Valvata

Sample Locations

Five 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. The five sites, listed from downstream to upstream, are as follows:

- Lower Lake Walcott
- Upper Lake Walcott (Coldwater Area)
- Snake River at Vista (Neely reach)
- American Falls Reservoir
- Upper Snake River near Idaho Falls

Beginning in 2006, Reclamation discontinued annual monitoring surveys for each site and initiated monitoring surveys on an alternate year schedule. Although the alternate-year survey scheduled was conducted in 2007, it was not followed in 2008. Rather, at the FWS/Reclamation ESA Activity Review Meeting on January 29, 2008 at the Snake River Area Office in Boise, ID it was jointly determined by FWS and Reclamation biologists that a repeat survey in American Falls Reservoir during the 2008 irrigation season would be beneficial to help understand Utah valvata distribution and abundance following a low-water year, such was experienced in 2007. Subsequently, Utah valvata monitoring surveys occurred in American Falls Reservoir and the upper Snake River in July and

August of 2008, as well as in Upper Lake Walcott (Coldwater Area) and the Snake River at Vista (Neely reach).

The upper Snake River is characterized by a free-flowing riverine channel with bedrock, boulder, gravel, and fine sediments. Adjacent backwater and oxbow habitat and large woody-debris are common in this reach. The American Falls Reservoir and Upper Lake Walcott sites have deeper (greater than 32.8 ft depth; 10 meters) reservoir habitat where the channel was originally located. The reservoir has a broader, uniform bottom characterized by fine sediments. The Snake River at Vista is located below American Falls Reservoir and is highly regulated through annual irrigation delivery operations. The site is characterized by a steady flow regime with a uniform channel bottom consisting of medium to large gravel substrate and small cobbles interspersed with fines.

Consistent with the 2007 sampling protocol, Reclamation continued presence/absence surveys for Utah valvata monitoring based on Fore and Clark (2005). The presence/absence surveys were conducted at American Falls Reservoir and in the upper Snake River. Using GIS, Reclamation created a 100-meter grid layer over the lower half of American Falls Reservoir 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 GPS, Reclamation personnel navigated to each quadrat and collected samples inside the 100-meter square for 79 of the selected 100 quadrats. Time constraints and weather conditions prevented collection from all 100 quadrats. In the upper Snake River, no random or stratified sampling techniques were utilized in selecting survey sites. Reclamation personnel simply moved upstream, identifying potential Utah valvata habitat, and collected samples from it.

Montana State University (MSU) graduate student, Kiza Gates, collected data on Utah valvata as part of ongoing research related to her dissertation in 2008. Data collection conducted by MSU was dual purpose, meeting Kiza's dissertation requirements as well as Reclamation Utah valvata monitoring objectives. As part of Reclamation's annual monitoring program, MSU collected 250 samples from April, 2008 thru November, 2008 from the Coldwater and Vista sites to meet graduate research data requirements. Study objectives for Kiza's research are described in Newman (2009).

Snail Collection

Plots were sampled with a Venturi suction dredge operated by a SCUBA diver. A 0.25 m^2 plot was excavated approximately 2.5 cm deep by the vacuum dredge. The sample was transported through flexible tubing, and collected in a 1000 μm 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 assumed that all live Utah valvata encountered with broken shells were the result of our sampling. No dewatered sites were sampled.

Habitat Measurements

In June and August 2008, surveys were conducted in American Falls Reservoir (Figure 7) and the upper Snake River (Figure 8), respectively. Seventy nine samples were collected in American Falls Reservoir, with 3.8 percent occurrence of live Utah valvata (Table 2). Clear shells, suggesting recent (less than one year) mortality, were encountered at 18 sites (23% rate of occurrence; Figure 7). The 2008 water operations associated with irrigation demands, poor soil moisture conditions, low spring rains and poor over-winter snowpack resulted in the drafting of American Falls Reservoir to a minimum water surface elevation of 4317.12 ft (226,982 acre-feet capacity) on September 22 (after storage season).

Although annual take as a result of 2007 operations cannot be quantified, the low rate of occurrence of live Utah valvata and the associated higher rate of occurrence of clear Utah valvata shells in our 2008 data suggest take occurred as a result of water operations in 2007. Utah valvata presence from the 2007 monitoring data, shown in Figure 9, displays the distribution and a rate of occurrence of live Utah valvata of 30%.

By adjusting the depths of the collection points where live Utah valvata were encountered in 2007 by 14.3 ft (the amount American Falls Reservoir was drafted by the collection date of June 26, 2007) and relating it to the 2007 minimum water surface elevation of 4303.3 (occurred in September, 2007), we can see that five of the 2007 collection points where live Utah valvata were encountered were dewatered in September, 2007, thereby resulting in take. In other words, all live Utah valvata collected in June 2007 at depths less than 51.2 ft were dewatered in September, 2007. Therefore, the low rate of occurrence of live Utah valvata in our 2008 monitoring was an artifact of the previous year's operations.

In June 2008 a total of 23 samples were collected from the upper Snake River in a side channel and irrigation diversion located adjacent to the city of Blackfoot, ID. No live Utah valvata were encountered (Table 2).

No samples were collected from American Falls Reservoir in August due to rapidly decreasing water levels. Reclamation personnel were unable to launch the boat; therefore, they were unable to collect samples. Surveys were not repeated in the upper Snake River near Blackfoot in August due to the absence of suitable Utah valvata habitat and the June survey results.

Monitoring activities associated with MSU research were conducted each month from April thru November, 2008. The primary objective was to locate a colony for monthly monitoring during this period. Over 60 samples were collected from 7 of Reclamation's annual monitoring transects (Figure 10) located in the Coldwater Area in April, 2008. No live Utah valvata were encountered.

A Utah valvata colony was located at a Reclamation annual monitoring transect in the Vista/Neely Reach in May, and surveyed monthly thru November (Figure 10). A total of 250 samples were collected from the Vista/Neely site. Extensive water quality, habitat, community and snail size data was collected and is currently being analyzed by MSU. Live Utah valvata were collected each month at the Vista/Neely site (Figure 10).

Table 2. Total number of sites surveyed for Utah valvata (UV) and the respective percent occurrence at each monitoring location during the summer (June) and fall (August) of 2008.

Study Site	June			August		
	Number of Sites	Number of Sites with UV	Percent Occurrence	Number of Sites	Number of Sites with UV	Percent Occurrence
American Falls Reservoir	79	3	3.8%	0	0	n/a
Upper Snake River near Blackfoot, ID	0	0	n/a	23	0	0.0%

Consistent with data 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.

Utah valvata readily occupy a wide range of dissolved oxygen concentrations and water temperatures. The species' only habitat requirement appears to be any amount of silt, from small silt deposits associated with the interstitial space located within gravel and cobble substrates, to vast expanses of silt depositional zones associated with reservoir pools. Water quality data collected in 2008 was consistent with measurements from previous years. The water quality data summary for the 2008 field season is listed in Table 3. More comprehensive water quality information associated with specimen collections in the Coldwater and Neely reaches will be provided in the 2009 or 2010 report, pending analysis.

Despite extensive effort, live Utah valvata were not located during the month of April at the Coldwater site. The annual monitoring transects we selected at the Coldwater site for survey have historically had high numbers of live Utah valvata during normal monitoring periods (June thru September). To date, we have never located a live Utah valvata

between December and May. The over-winter habits of Utah valvata are still unclear.

Table 3. Summary water quality data for 2008 field season.

	June					
	Mean			Range		
Site	Temp (^{o}C)	DO (ppm)	Depth (ft)	Temp (^{o}C)	DO (ppm)	Depth (ft)
American Falls R.	14.75	9.52	37.93	13 – 20.8	7.1 – 11.62	0 – 59.1
	August					
	Mean			**Range**		
Site	Temp (^{o}C)	DO (ppm)	Depth (ft)	Temp (^{o}C)	DO (ppm)	Depth (ft)
Upper Snake River near Blackfoot, ID	16.9	9.6	4.9	16.8 - 17	9.18 – 9.9	3 - 7

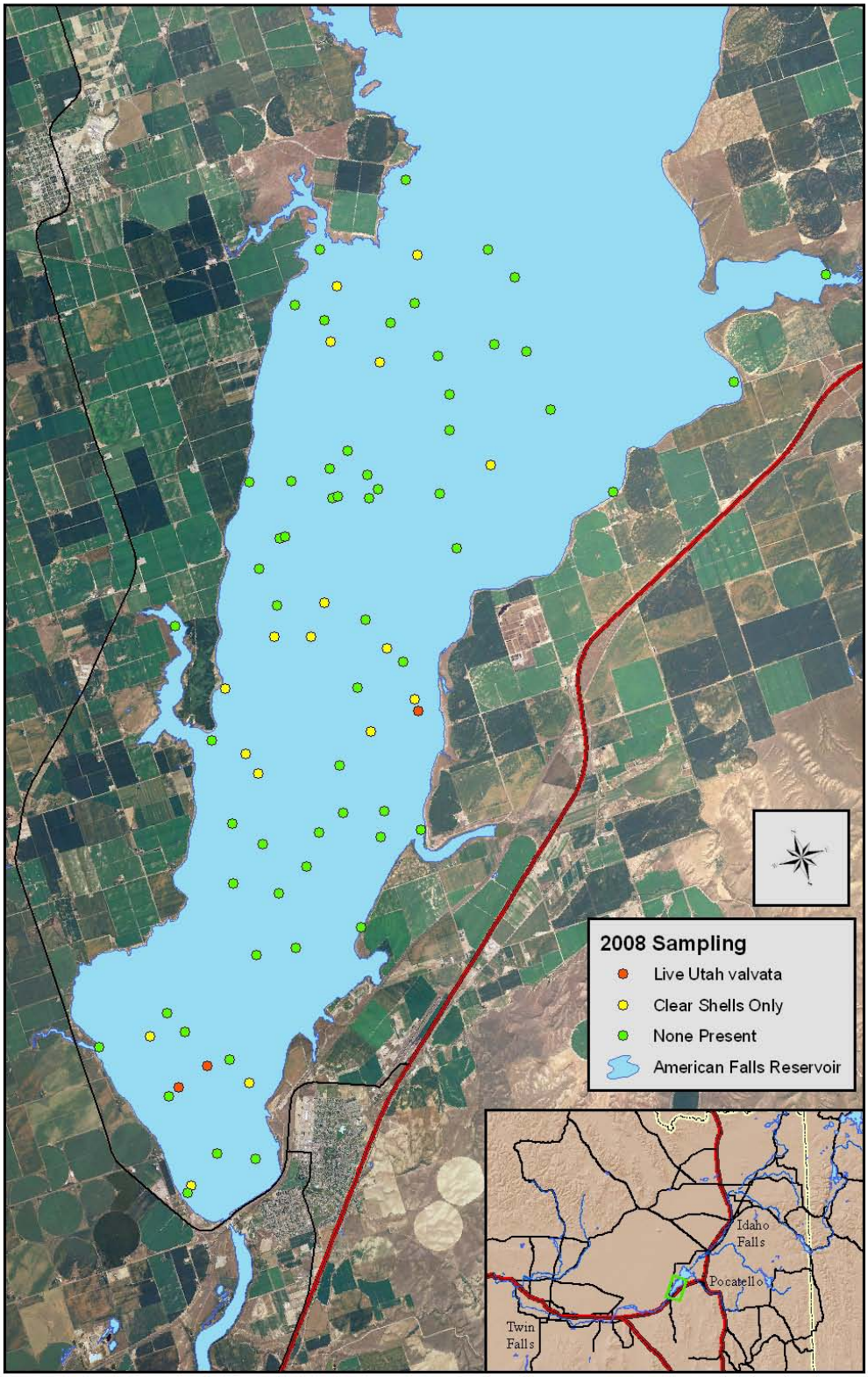

Figure 7. Locations of randomly selected survey sites on American Falls Reservoir in June 2008, for Utah valvata annual monitoring activities.

Figure 8. Survey locations on the upper Snake River near Blackfoot, Idaho for the 2008, annual Utah valvata monitoring activities.

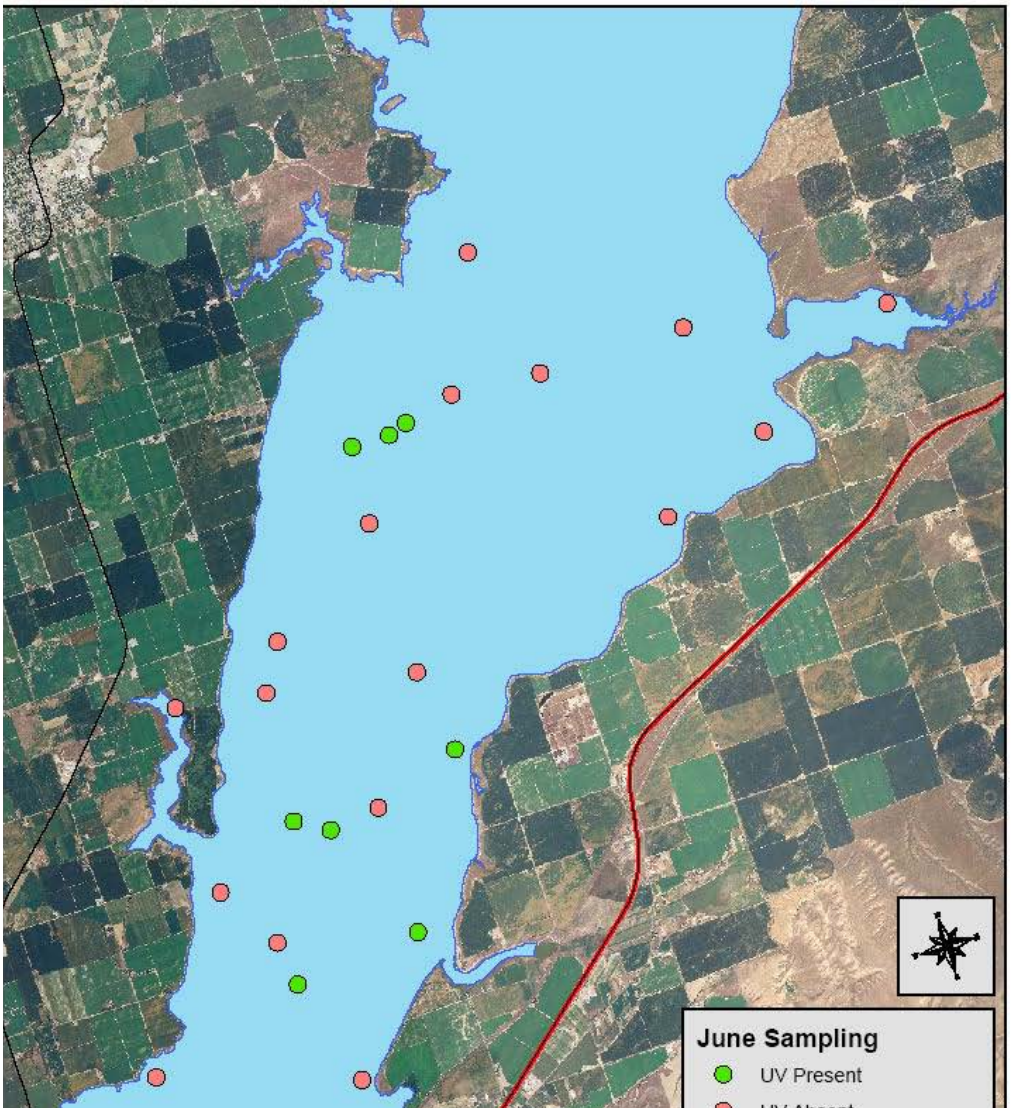

Figure 9. Locations of randomly selected survey sites on American Falls Reservoir in June 2007, for Utah valvata (UV) annual monitoring activities.

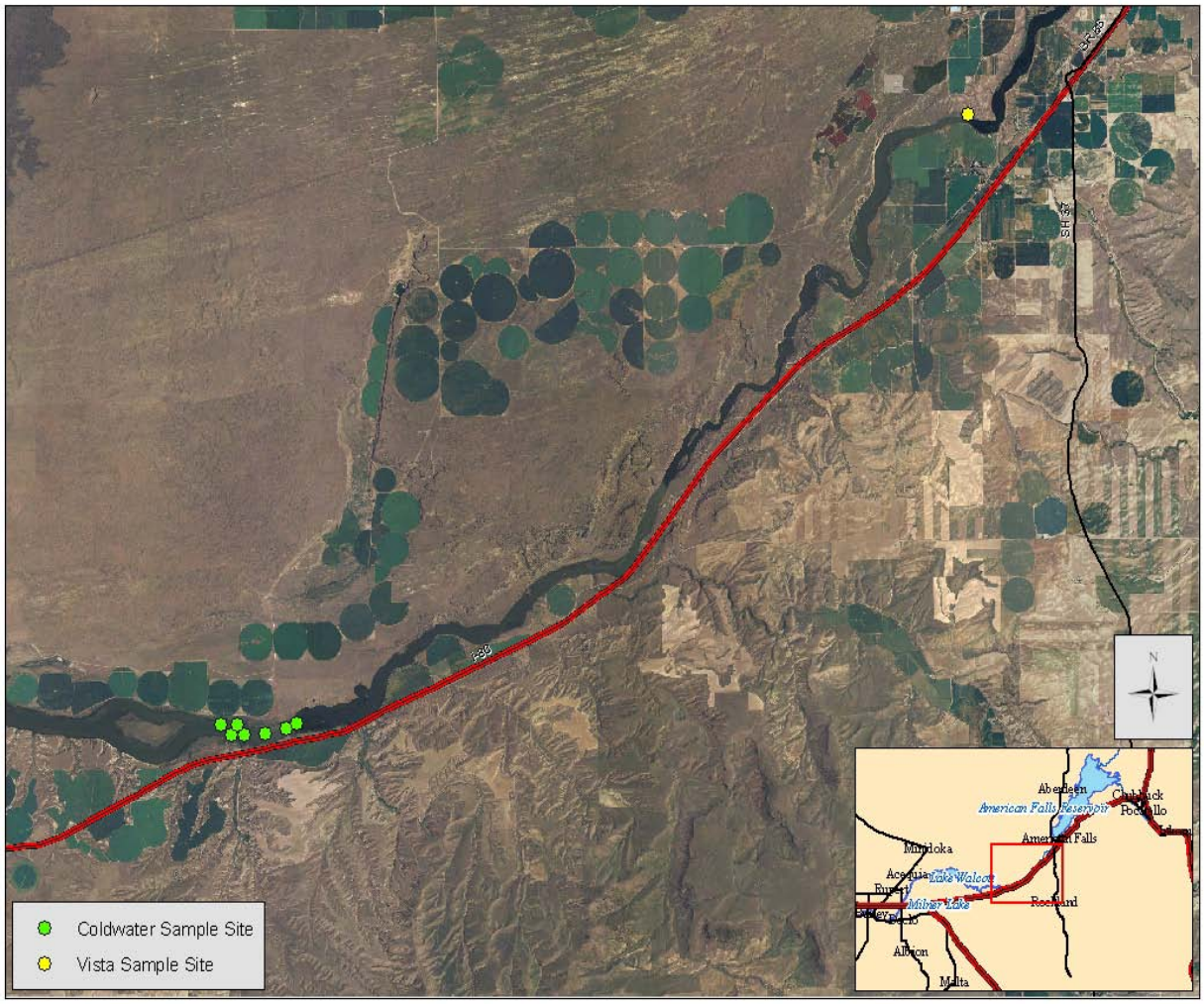

Figure 10. Montana State University (MSU) survey locations on the Snake River (Coldwater and Vista/Neely reaches) near American Falls, Idaho for the April thru November 2008 Utah valvata monitoring activities associated with MSU research.

Implementation of the Reasonable and Prudent Measures and Associated Terms and Conditions

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 RPM 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 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.

> Activities: Reclamation will use available storage from upstream reservoirs to increase or maintain inflow to American Falls Reservoir and will use water from Lake Walcott earlier to meet downstream irrigation needs when American Falls Reservoir drops below 100,000 acre-feet.
>
> Duration: Throughout the duration of the Biological Opinion.
>
> Evaluation: Reclamation will provide FWS with reservoir elevation data resulting from operations and a description of operational actions taken, if needed, to minimize drawdown below 50,000 acre-feet in each annual report.

T&C 1.b: When Reclamation drafts American Falls Reservoir to less than 50,000 acre-feet, Reclamation shall report to the Service when the operations occurred, the duration, and the conditions leading to such operation.

> Activities: Reclamation will report to FWS when American Falls Reservoir drops below 50,000 acre-feet.
>
> Duration: Throughout the duration of the Biological Opinion.
>
> Evaluation: In the event that American Falls Reservoir is drafted to below 50,000 acre-feet, Reclamation will provide a written explanation in its annual report.

American Falls Dam and Reservoir

Initial reservoir content for American Falls Reservoir in water year (WY) 2008 exceeded the 50,000 acre-foot threshold on October 6, 2007 (Figure 2). This reservoir carry over content resulted from a below average water supply, extreme irrigation demands caused by hot dry weather that started early in the spring, and fulfillment of Reclamation's downstream flow augmentation obligations under the NOAA Fisheries Biological Opinion and the Nez Perce Settlement in WY 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 Salmon Flow Augmentation has reduced demands on water from American Falls Reservoir disproportionately to system totals.

System carryover from 2008 was well above average and American Falls Reservoir minimum content was 239,968 acre-feet on October 1, 2008.

Discharge below American Falls Dam was decreased to 500 cfs after the irrigation season ended in October 2008 (Figure 4). System storage and American Falls storage were adequate to avoid minimum winter discharge.

Winter precipitation in the 2008 water year 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 later than average and valley rains reduced water demand. The compound affects of increasing supply and low demand allowed the storage system to fill better than had been anticipated. Fall rain was above average but overall snow accumulation at the higher elevations was below average. Poor carryover storage and the usual earlier onset of irrigation below American Falls Reservoir than above allowed the storage of the unanticipated water. Delivery of Salmon Flow Augmentation water began in July.

At the beginning of the water year flow below American Falls Dam was ramped down to 350 cfs. Flows near 350 cfs persisted until April 1 when discharge was increased to fill Lake Walcott. In most years Lake Walcott is filled in March in anticipation of higher April irrigation demand than was experienced in 2008.

American Falls Reservoir reached the maximum content of 1,380,990 acre-feet (82.6% of capacity) on June 12. The minimum content of the 2008 irrigation season of 226,983 acre-feet occurred on September 22. American Falls water rights filled because of temporary storage in upstream reservoirs and stored water used by junior water rights holders before the maximum content was reached.

Minidoka Dam and Lake Walcott

At the beginning of the 2008 water year, Lake Walcott had already been drafted to about 0.5 feet above the normal, winter, elevation of 4240.0 feet (Figure 5). Water was drafted below the normal winter elevation to meet late season downstream irrigation demands and to minimize further draws on water from the severely depleted American Falls Reservoir. During the winter only normal variations in water surface elevation were observed. The winter low of 4239.61 occurred on November 27, 2007.

Discharge below Minidoka Dam (Figure 6) 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 and Reclamation's Salmon 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 2000 cfs below Milner Dam during the month of August is reflected in the Minidoka discharge.

The winter draft of Lake Walcott began on September 24 at this time the pool was 1.6 feet below full and 3.5 feet above the normal, winter level.

IV. Bull Trout

Summary of the Salvelinus Confluentus Incidental Take Statement and 2008 Operations

Bull trout are present in four of Reclamation's facilities in the upper Snake River basin (Figure 11). Summary of the Bull Trout Incidental Take Statement including monitoring efforts and RPMs during the 2008 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 Monitoring for Bull Trout 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 2008 are summarized in Table 4.

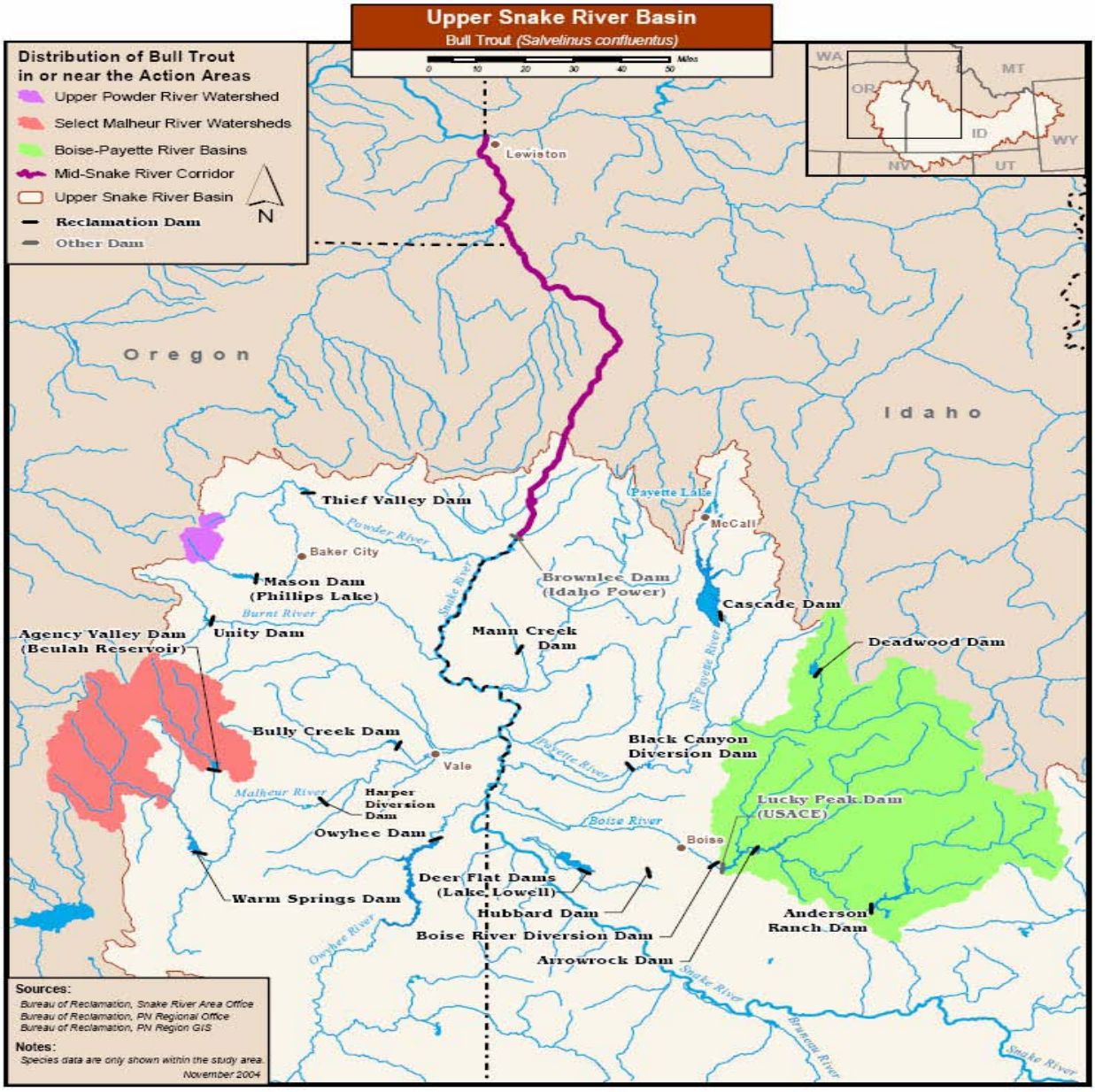

Figure 11. Known distribution of bull trout populations associated with Reclamation facilities in the upper Snake River basin (Reclamation 2004).

Table 4. Summary of amount or extent of anticipated take of bull trout associated with Reclamation facility operations during the 2008 reporting period.

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2008 Operations (Oct. 2007 to Sept 2008)	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 254,806 in 2008.	1 of 3 years 2006: 0 2007: yes 2008: 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
	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	Res. surface elevation was below 3,111 at the same time discharge was above 695 cfs for one day (Sept 02, 2008; Figure 12).	3 of 30 years 2006: 6 days 2007: 48 days 2008: 1 day
	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 elevations were between 3,112 and 3,138 from Sept 15, 2007 to Oct. 31, 2007.	0 of 18 years 2006: 0 2007: 0 2008: 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

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2008 Operations (Oct. 2007 to Sept 2008)	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
	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 water year 2008 are shown in Figure 14.	3 of 30 years 2006:spring/fall 2007:spring/fall 2008: 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 15).	0 of 2 years 2006: 0 2007: 0 2008: 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 discharged over the spillway June 6 – July 08, 2008.	3 of 11 years 2006: 32 days 2007: 33 days 2008: 33 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.	August through October	2 of 30 years	Reservoir storage volumes were maintained above 73,501 acre-feet during August through October of 2008 Figure 16).	0 of 2 years 2006: 0 2007: 0 2008: 0

Facility	Anticipated Take	Operational Indicators	Critical Season	Frequency	2008 Operations (Oct. 2007 to Sept 2008)	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 discharged over the spillway June 6 – July 08, 2008.	3 of 11 years 2006: 32 days 2007: 33 days 2008: 33 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.	3 of 30 years 2006: all year 2007: all year 2008: 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
	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.	August through October	10 of 30 years	Reservoir storage volume fell below 2,000 acre-feet from Oct. 01 to Oct. 26, 2007 and Sept. 23 to Sept. 30 2008 (Figure 17).	2 of 10 years 2006: 0 2007: 60 days 2008: 34 days

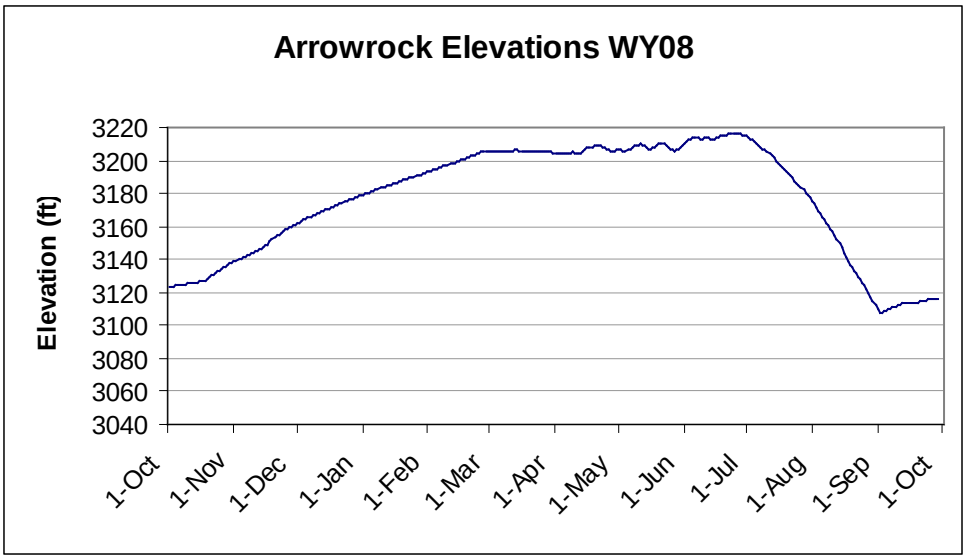

Figure 12. Arrowrock Reservoir elevation (feet above sea level) for the 2008 water year (WY08).

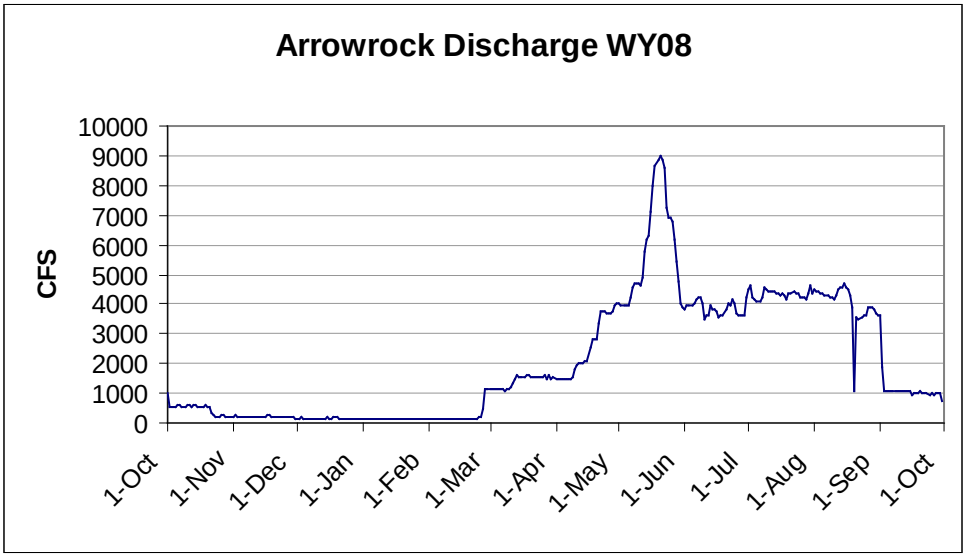

Figure 13. Arrowrock Reservoir discharge cubic-feet-per-second (CFS) for the 2008 water year (WY08).

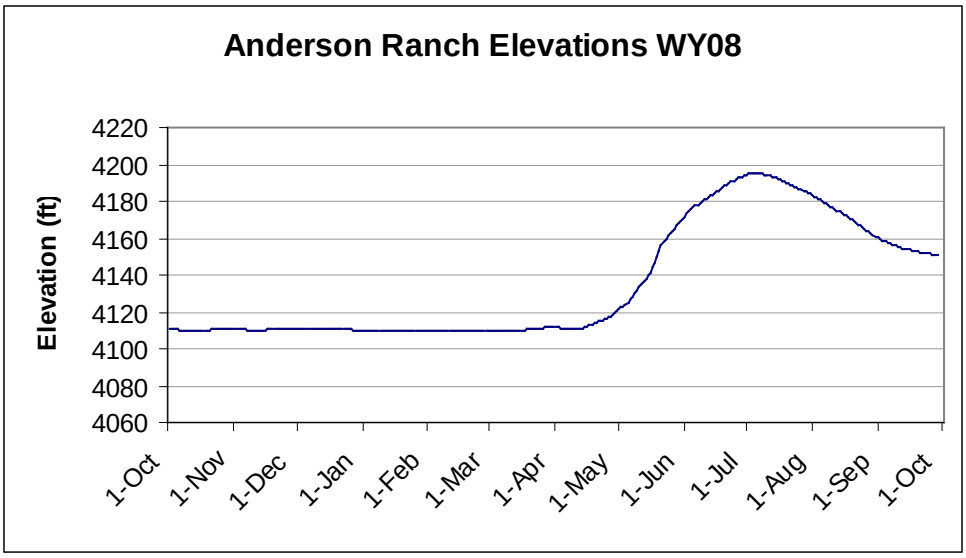

Figure 14. Anderson Ranch Reservoir elevations (feet above sea level) for the 2008 water year (WY08).

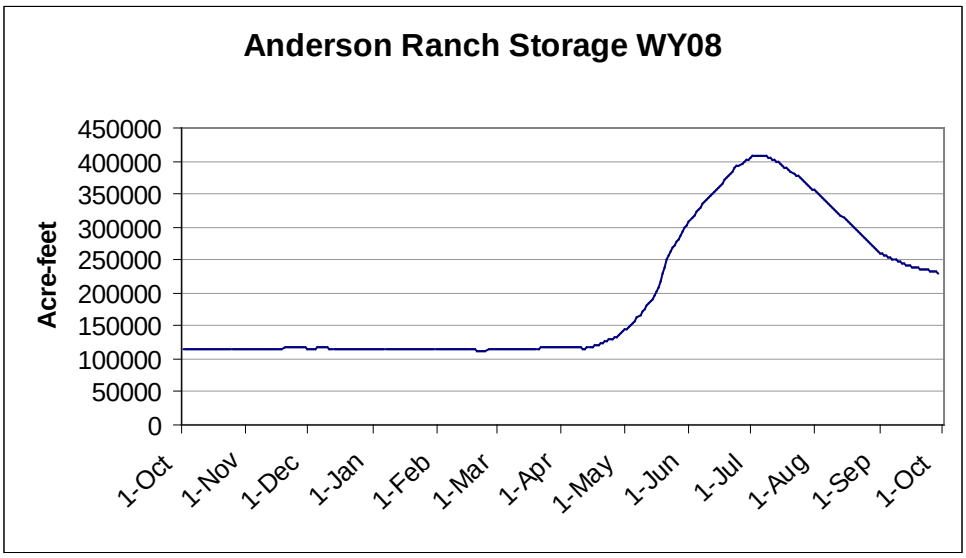

Figure 15. Anderson Ranch Reservoir storage volumes (acre-feet) for the 2008 water year (WY08).

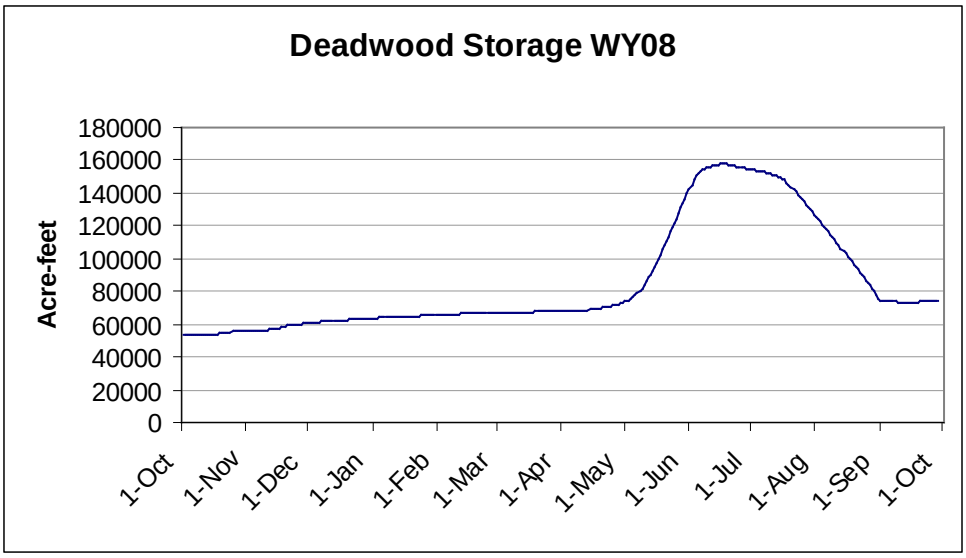

Figure 16. Deadwood Reservoir storage volumes (acre-feet) for the 2008 water year (WY08).

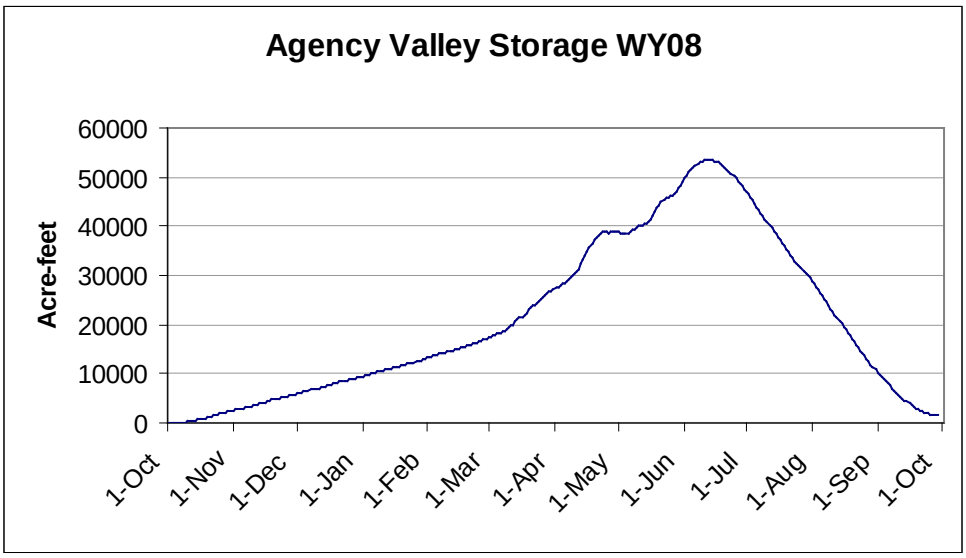

Figure 17. Agency Valley Reservoir storage volumes (acre-feet) for the 2008 water year (WY08).

Monitoring for Bull Trout

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 2008 were monitored, evaluated, and summarized using Reclamation's Hydromet system (Reclamation 2008b). 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 2008 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 (1 day) and water was stored and released at Anderson Ranch Dam during 2008. 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 2008 water year. Bull trout trap and haul work was performed as required in Term and Condition 1.d. and is fully described in the section titled Implementation of Reasonable and Prudent Measures, Boise River Basin.

The Idaho Department of Fish and Game (IDFG) oversaw three separate fish sampling projects on the South Fork Boise River during the 2008 water year two of which sampled bull trout. Although Reclamation was not directly involved with this work the results are relevant to bull trout management in the South Fork Boise River and Anderson Ranch Reservoir. A picket weir was operated on the South Fork Boise River above Anderson Ranch Reservoir from August 8 through November 6, 2008; catches included a total of 153 bull trout. Results of the picket weir work are summarized in the IDFG Magic Valley Annual Fisheries Report (Megargle et al. 2009 *in press*). Additionally, an ongoing research study on wild rainbow trout captured in excess of 45 bull trout above Anderson Ranch Reservoir (K. Meyer, IDFG, pers. comm.). Thirdly, 11 transects were sampled for rainbow trout between Anderson Ranch Dam downstream to Arrowrock Reservoir from July 19-20; no bull trout were captured (Kozfkay et al. in press).

Payette River Basin

Operational Indicators (Table 4) - Two operational indicators were exceeded during the 2008 reporting period in the Payette River Basin. The spillway was used at Deadwood Dam (33 days) and deep water releases did occur (all year) in 2008. Reclamation has exemptions for both actions for 11 of 30 years and 30 of 30 years, respectively.

Payette River basin bull trout population trend monitoring activities included operating

picket weirs on tributaries to Deadwood Reservoir to monitor bull trout during the 2008 water year. A summary of picket weir operations is described in the ***Picket weir*** section of this report.

Malheur River Basin

Operational Indicators (Table 4) - One operational indicator was exceeded during the 2008 reporting period in the Malheur River Basin. Beulah Reservoir pool fell below 2,000 acre-feet from September 23 through 30, 2008. 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; ODFW).

In 2008, North Fork Malheur River basin bull trout redd counts totaled 75; however, the survey area was reduced so an adjusted number of 76 redds (Perkins 2009) is used in some reporting. Assuming 2.68 bull trout per redd (Al-Chokhachy et al. 2005); an estimated 203 adfluvial adult bull trout were present in 2008. Figure 18 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.)

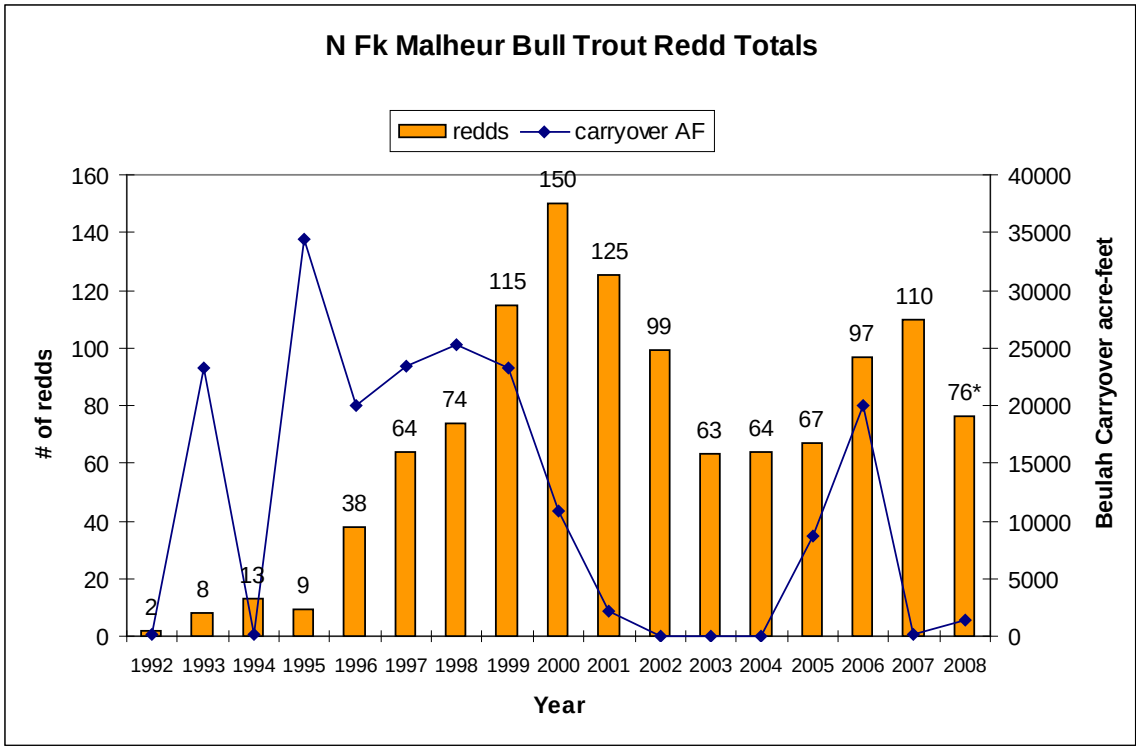

Figure 18. Bull trout redds observed in the North Fork Malheur River watershed (NFk Malheur) between 1992-2008 and carryover storage in Beulah Reservoir. *The number of redds observed in 2008 was adjusted to reflect a reduction in survey area, actual number equaled 75 redds.

Implementation of Reasonable and Prudent Measures and Associated Terms and Conditions

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 2008 Reclamation focused monitoring and implementation activities at both Deadwood and Beulah reservoirs. 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 Implementation and Monitoring Plan (Reclamation

2006) included a trap and haul effort to relocate bull trout from Lucky Peak Reservoir to Arrowrock Reservoir in 2008.

Trap and haul methods were similar to those used in previous years to capture bull trout in the tailrace of Arrowrock Dam (Lucky Peak Reservoir) and are described in Salow (2005). Methods consisted of using experimental mesh gill nets set perpendicular to the shoreline with soak times not exceeding 20 minutes. Sampling was performed between April and June, a period when bull trout have been documented to migrate into the tailrace of Arrowrock Dam (Flatter 2000). Sampling periods included: April 21-24, May 19-22, and June 2-5. A total of 355 fish were sampled during this effort representing nine species and included five bull trout (Table 5).

All captured bull trout were relocated to Arrowrock Reservoir and released at the High Water boat launch. Captured bull trout ranged from 380 to 560 mm total length (TL). The 2008 bull trout catch per unit effort (0.03 fish/ hr) was within the range (0.01 – 0.08 fish/hr) and below the average (0.04 bull trout/ hr) of previous sampling efforts (years 2000-2006).

Table 5. Catch data for Trap and Haul effort on Lucky Peak Reservoir, 2008. Catch per Unit Effort (CPUE) is measured in fish captured per hour.

	CPUE (mean)	2.41
	Total Fish	355
	Total Hours	147
Species	Number of fish Caught	CPUE (fish/hr)
Largescale sucker (Catostomus macrocheilus)	104	0.71
Bridgelip sucker (Catostomus columbianus)	96	0.65
Kokanee (Oncorhynchus nerka kennerlyi)	73	0.50
Northern Pikeminnow (Ptychocheilus oregonensis)	55	0.37
Rainbow trout (Oncorhynchus mykiss)	13	0.09
Mountain whitefish (Prosopium williamsoni)	6	0.04
Bull trout (Salvelinus confluentus)	5	0.03
Chiselmouth chub (Acrockeilus alutaceus)	1	0.01
Smallmouth bass (Micropterus dolomieue)	1	0.01
Rainbow trout/Cutthroat trout hybrid	1	0.01

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 one of these terms and conditions addresses a different aspect of the effects of operations on bull trout. However, addressing these aspects 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's ultimate goal is to manage 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 2008c) outlines the terms and conditions, hypotheses, assumptions, and assessments as well as identifying data needed to test the hypotheses.

The year 2008 was the third 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 deployed in Deadwood Reservoir and the Deadwood River above and below the dam to gather hydrology and limnology data such as temperature, river channel morphology, inflow and outflow quantities, water quality, and reservoir profile characteristics. The information collected within the reservoir is the 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 a holistic system 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 2008. Study objectives are described in the Deadwood Reservoir Flexibility Study proposal (Reclamation 2008c) 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).

Deadwood River System - Reservoir and Tributaries (data collection)

Bull trout were captured in the reservoir using fyke nets and in the tributaries using picket weirs. Most captured bull trout were surgically fit with radio transmitters and subsequently released at the point of capture. In addition to sampling bull trout, physical, hydrologic and water quality data were also collected within the river, reservoir and selected tributaries. A detailed description of these activities occurring within Deadwood Reservoir and its tributaries is presented below.

Fyke netting/ radio tracking

A total of 797 fish, including 7 bull trout, were sampled in Deadwood Reservoir in 2008 using fyke nets (Reclamation 2008d). Fyke netting occurred from June 16 to July 23 and October 6 through 8. Species composition for fish sampled in the fyke nets was similar to previous accounts for littoral fish assemblages in the reservoir. Mountain whitefish and speckled dace were the most abundant fish sampled (cumulatively 68% of the total catch) while bull trout represented 1% of the total catch; rainbow trout (13%), cutthroat trout (11%), longnose dace (4%), Kokanee, sculpin, and redside shiner (cumulatively 3%) were also sampled (Reclamation 2008d).

Seven bull trout were surgically implanted with radio transmitters in 2008; six were captured in fyke nets in the reservoir and one from the South Fork Beaver picket weir. Most bull trout (when captured for the first time) were implanted with a PIT tag and radio tag in addition to having genetic and isotope samples collected and other biological data recorded (Reclamation 2008d). Bull trout weighing less than 100 grams or on their upstream spawning migration were not radio tagged. Bull trout less than 100 millimeters were not radio or PIT tagged; their adipose fin was clipped to identify them as a recapture in the future. (A summary of picket weir operations is described in the ***Picket weir*** section of this report.)

A total of 9 bull trout were tracked by radio during the 2008 field season, including two 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 of migratory bull trout including: migration timing, days fish spend in the tributaries, and the distance fish travel from the reservoir.

Confirmed mortalities of tagged bull trout during this reporting period included three bull trout, two that were tagged in 2008 and one bull trout that was tagged in 2007. Five bull trout tagged in 2008 as well as one tagged in 2007 were still being tracked in the reservoir through the end of the reporting period. No tagged bull trout were entrained in 2008.

Fin clips and muscle plugs were also collected from sampled bull trout. Fin clips were collected from all bull trout and muscle plugs collected from the first five bull trout that were sampled. 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. Muscle plugs are being used in an associated isotope study (Reclamation 2008c). The collection of fin clips and muscle plugs were non-lethal and occurred while bull trout were anesthetized.

Bull trout collections, tagging, and radio tracking efforts during the 2009 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 fish and collecting gut content and isotope samples. Bull trout tracking efforts are scheduled to continue through 2011 in the Deadwood River basin.

Picket weirs

In a collaborative effort between Reclamation and the IDFG, temporary picket weirs were installed on selected tributaries to Deadwood Reservoir in order to evaluate bull trout populations and limit kokanee escapement from the reservoir. Weirs captured upstream and downstream migrating fish and were installed on Basin Creek (only downstream migrant trap), Beaver Creek, Deadwood River, Trail Creek, and South Fork Beaver Creek. The Basin Creek weir did not have an upstream trap installed due to the large concentrations of kokanee. All tributary weirs were installed on August 13 and removed on October 13 (Sievers and Dillon 2008). Weirs were occasionally breached because of heavy rain that caused increased stream and debris flow (Table 6).

Fourteen bull trout were handled at the five weirs throughout the season (Table 6). Lengths for all captured bull trout ranged from 155 to 570 mm TL and from 28 to 666 g in weight. Thirteen of these bull trout had not been previously handled in prior trapping activities. One previously radio tagged fish was captured at the Trail Creek weir in 2008 (Sievers and Dillon 2008). All bull trout over 100 mm not previously handled received a PIT tag and had scale and genetic samples collected. Additionally, the adipose fin was removed as a secondary identification.

Tributary weirs will not be operated in 2009. Tributary weirs have not worked as a method of estimating the Deadwood Reservoir bull trout population. Despite efforts to reinforce the weirs, fish have been able to pass through undetected and high flows have caused the weirs to breach. Additionally, IDFG is relocating their kokanee brood stock program to the South Fork Boise River above Anderson Ranch Reservoir. (The IDFG cooperatively ran the weirs as part of their kokanee management on Deadwood Reservoir.) Other means for determining a population estimate are being looked into.

Table 6. Dates that Deadwood Reservoir tributary weirs were breached and number of bull trout handled at each weir during the 2008 trapping season.

Tributary	Dates breached	Number of bull trout handled
Basin Creek	Not breached	1
Beaver Creek	10/04	3
Deadwood River	10/12	2
South Fork Beaver Creek	Not breached	2
Trail Creek	10/04	6 (includes one recapture)

Hydrologic and Water Chemistry

Water quality data were collected during the 2008 reporting period and are being used in reservoir and river modeling efforts. Reservoir, river, and tributary water chemistry samples and a water profile were collected through the ice on February 27. Additional

profiles were added and samples were collected every two weeks between June 5 and October 6. Eight water quality parameters were measured in the field and another twelve processed in the lab; all parameters are listed in Table 7. Hydrologic and water chemistry samples (Table 8) were collected at five locations on the reservoir, Trail Creek, Deadwood River inflow, and the Deadwood River outflow (Figure 19; limnologic and Figure 20; water quality).

A Lake Diagnostic System (LDS) was first installed in Deadwood Reservoir on July 15, 2007. 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. During the 2008 field season one of the meteorological sensors needed to be replaced causing placement at the open water site to be delayed until August 14 the equipment was then moved to the winter site on October 14. Data obtained by the LDS were transmitted via satellite communication to Boise, Idaho on a daily basis. These data can be viewed on the Centre for Water Research, University of Western Australia's website (OLARIS; CWR 2008).

Water temperatures were 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 19). Thermographs recorded hourly water temperature data and were manually downloaded a minimum of two times per year while 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 2008b). 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.

Hydrologic and water quality data will continue to be sampled through the 2009 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 2008c).

Table 7. Reservoir sampling locations and frequency of sampling for Deadwood River and Reservoir, 2007-2008.

Sampling Site	Description	2007 Sampling Frequency	2008 Sampling Frequency
DEA004	Reservoir Profile	Weekly	Every 2 weeks
DEA006	Reservoir Profile	Weekly	Every 2 weeks
DEA008	Reservoir Profile	Weekly	Not sampled
DEA010	Reservoir Profile	Weekly	Every 2 weeks
DEA012	Reservoir Profile	Every 2 weeks	Not sampled
DEA014	Reservoir Profile	Every 2 weeks	Every 2 weeks
DEA016	Reservoir Profile	Every 2 weeks	Every 2 weeks
DEA101	Deadwood River below the Dam	Weekly	Every 2 weeks
DEA102	Deadwood River upstream of the Reservoir	Weekly	Every 2 weeks
DEA104	Trail Creek	Weekly	Every 2 weeks

Table 8. Water quality parameters measured in the field and laboratory processed for Deadwood River and Reservoir, 2008.

Field Measured	Laboratory Processed
Temperature	Nitrate/Nitrite
Dissolved Oxygen	Ortho Phosphorus
pH	Total Phosphorus
Conductivity	Ammonia
Turbidity	Total Kjeldahl Nitrogen
Florescence (reservoir profiles only)	Total Organic Carbon
Barometric Pressure	Dissolved Organic Carbon
Secchi depth (reservoir profiles only)	Turbidity
	Chlorophyll-a (1 meter depth reservoir profiles only)
	Pheophytin-a (1 meter depth and at maximum florescence, 2008 only)
	Silica (2008 only)

Deadwood River System - Reservoir and Tributaries (discussion)

Water quality data sampling was modified for the 2008 field season after an evaluation of the 2007 data. Additional analyses were added to the 2008 sampling protocol to evaluate silica concentrations and low-level detections for nitrogen and phosphorus. The trichromatic spectrophotometric method used in 2007 for chlorophyll-a analyses was changed in 2008 to an acid-corrected spectrophotometric that yields values for both chlorophyll-a and pheophytin-a. Chlorophyll sampling during 2008 was modified to collect samples at the 1-meter depth as well as at the depth of the florescence maxima at most of the reservoir stations.

Sampling frequency and locations were also modified for the 2008 field season. Within reservoir sampling locations were reduced from ten to five and the frequency from weekly for most samples to every two weeks for all samples. This change resulted from funding reductions and evaluating the 2007 data to refine the data needs in 2008.

AquaRods and thermographs were replaced or updated as needed in 2008. The Trail Creek AquaRod was damaged by ice during the 2007 winter and was replaced in October 2008; data collected while the AquaRod was damaged is being analyzed for accuracy. All thermographs in place at the beginning of the reporting period were nearing the end of their battery charge and were replaced during the 2008 field season.

The IDFG picket weir in Trail Creek was relocated to a more secure location further upstream in 2008; the new location was upstream of the AquaRod and thermograph. Changes to the water stage and flow estimates are suspected to be negligible; however, on several occasions debris on the weir did reduce flow downstream of the picket weir.

Annual mortality of radio tagged bull trout in the reservoir was lower in 2008 then the previous two years. Two of the seven bull trout that were radio tagged in 2008 died in 2008 (29%) compared to seven of the nine bull trout tagged in 2007 died in 2007 (77%) and three of the eight that were tagged in 2006 died that same year (38%). Two of the bull trout that were tagged in 2007 were still alive in the spring of 2008; however, one of these fish died by the end of the reporting period. No mortality during this reporting period was directly attributable to handling associated with this research.

A collaborative multi-agency bull trout sampling effort was conducted on Deadwood Reservoir October 6-9 in an attempt to estimate the bull trout population in the reservoir using mark/recapture methods (Reclamation 2008d). Sampling methods included gill net sets – vertical (floating; 46.7 hours) and horizontal (sinking and floating; 69.8 hours), trap nets (545.14 hours), and hook and line sampling (31.5 hours). Sampling was conducted between 8:00 AM and 10:00 PM and gill net soak times averaged 43 minutes per net. A total of 143 fish were sampled representing six species. Mountain whitefish were the most abundant species captured (49%) followed by rainbow trout (23%) and cutthroat trout (13%); no bull trout were captured (Table 9).

Past efforts to estimate the bull trout population in Deadwood Reservoir have been unsuccessful, due to low catch rates for bull trout. Sampling efforts have included tributary weirs, trap nets in the reservoir, hook and line sampling, and gill netting. Sampling migrating bull trout in the tributaries has been the most successful method although ineffective at sampling smaller sized fish , weirs are prone to breaching, radio tagged bull trout have been documented passing through weirs without being handled, and not all tributaries are sampled. Sampling in the reservoir is best in the early spring and late fall when migrating fish are in the reservoir but prone to gear being ineffective because of water clarity/ gear avoidance and intensive effort. Merwin traps and electrofishing could be effective sampling gears in the reservoir but logistically may not be possible. Finally, however, low catch rates may simply be reflective of low numbers of bull trout.

Table 9. Catch data for bull trout population estimate sampling on Deadwood Reservoir, October 6-9, 2008. Effort is totaled for all gears and catch per unit effort (CPUE) is measured in fish captured per hour.

	CPUE (mean)	0.21
	Total Fish	143
	Total Hours	693.14
Species	Number Caught	CPUE
Kokanee (Oncorhynchus nerka kennerlyi)	10	0.01
Rainbow trout (Oncorhynchus mykiss)	33	0.05
Mountain whitefish (Prosopium williamsoni)	70	0.10
Bull trout (Salvelinus confluentus)	0	0.00
Cutthroat Trout (Oncorhynchus clarki lewisi)	18	0.03
Speckled Dace (Rhinichthys osculus)	12	0.02

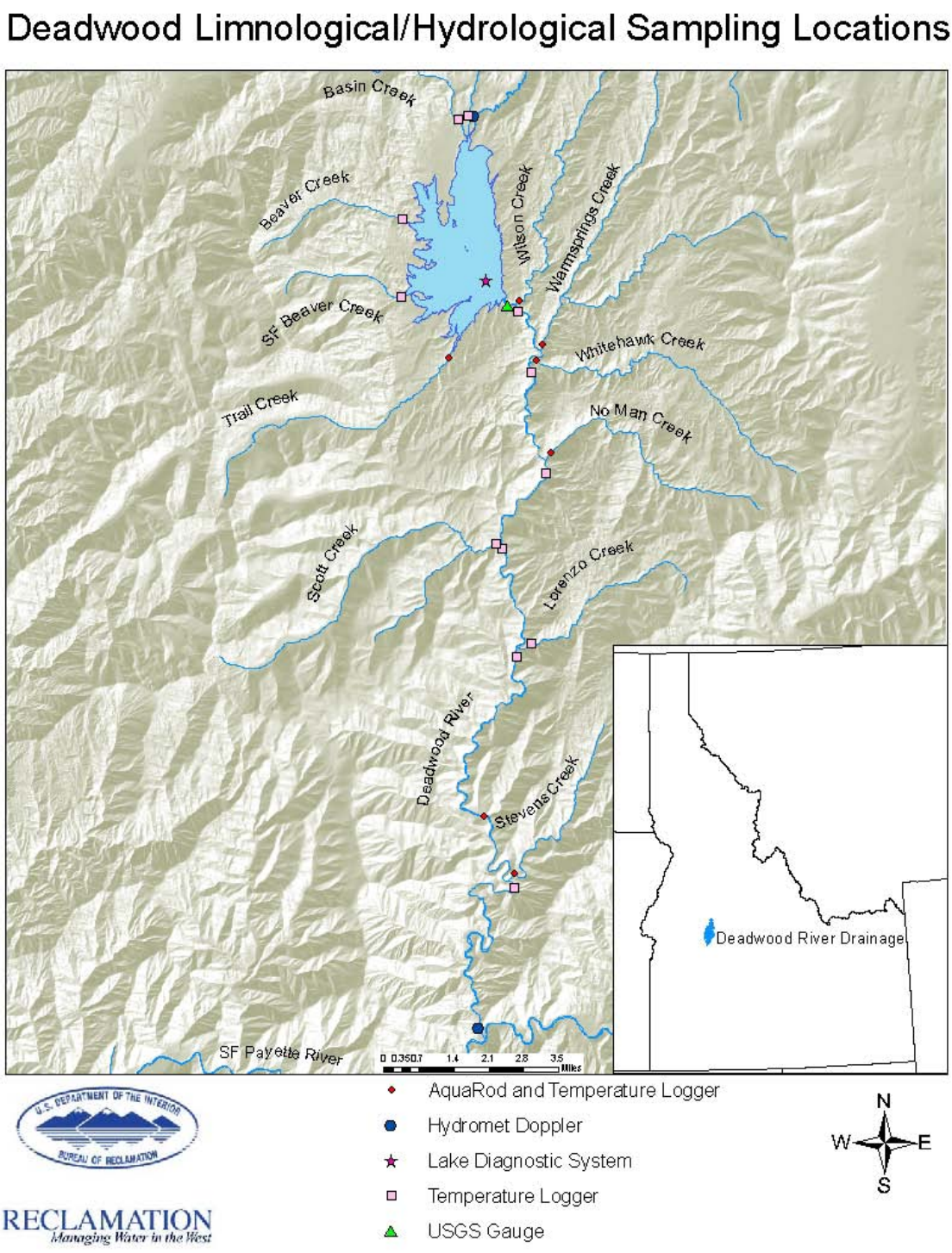

Figure 19. Limnologic and hydrologic sampling locations in the Deadwood study area, Idaho 2008. Equipment used to record data varied between locations and included AquaRods and Temperature Loggers, Temperature Loggers, a Lake Diagnostic System, Hydromet Doppler, and a U.S. Geological Survey water gauge (USGS gauge).

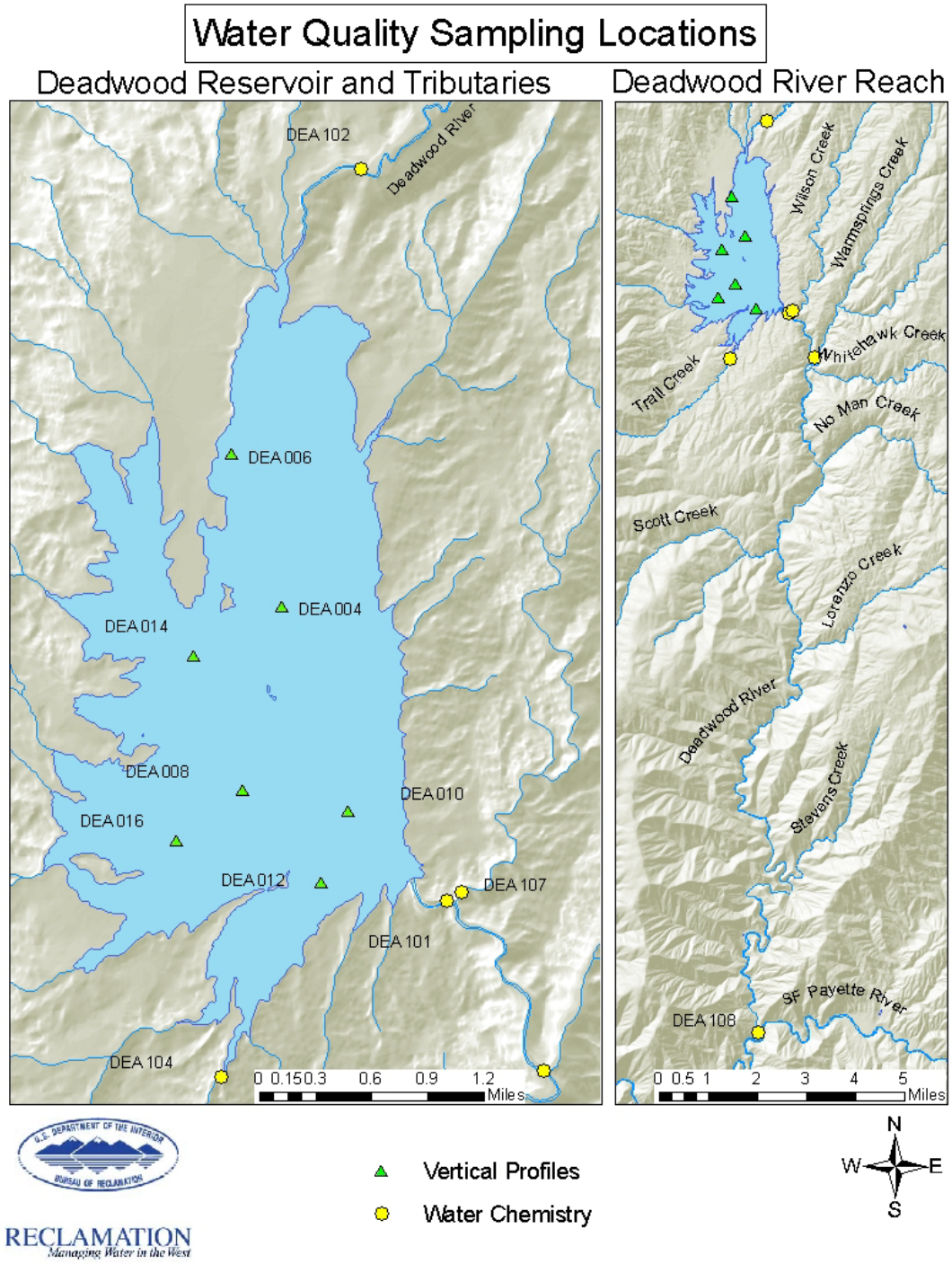

Figure 20. Water quality sampling locations in the Deadwood Reservoir and tributaries and the Deadwood River Reach study sections. Vertical profiles and water chemistry samples were collected in both reaches. Sample locations DEA 004, 006, 010, 014, 016, 101, 102, and 104 were sampled every two weeks from June 5 through October 6, 2008. Sample location DEA 108 was sampled once during 2008 and sample locations DEA 008 and 012 were not sampled during 2008.

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 both fyke nets and hook and line sampling methods. Most captured bull trout were surgically implanted with radio transmitters and released at the point of capture. In addition to sampling bull trout, physical, hydrologic and water chemistry data were also collected. A detailed description of these activities occurring within the Deadwood River Reach and tributaries is presented below.

Fyke netting/ radio tracking

Sampling in the Deadwood River below the dam was restricted to the stilling basin due to time limitations, past experience and logistics during the 2008 field season. A total of five bull trout were captured using hook and line sampling between July 3 and September 29 (Table 10). Captured bull trout ranged in length from 247 mm to 358 mm TL and from 114 g to 466 g in weight. Two of the bull trout were recaptures from 2007 that had been previously radio tagged; the radio tag was replaced in one fish while the tag in the other fish was still operable. The three bull trout that had not been previously captured were fitted with radio tags and released. Three of the five bull trout presently radio tagged in the river have radio tags equipped with temperature and depth sensors.

Tagged bull trout were tracked monthly by helicopter or ground surveys. (Ground surveys only covered two miles downstream of the dam because of the remote and inaccessible terrain.) Fish have been tracked moving up to 20 miles downstream of Deadwood Dam.

Fin clips and muscle plugs were collected from all sampled bull trout. Fin clips were sent to the FWS Genetics Lab, Abernathy, WA. Genetic analysis is being used for population assignment to natal streams in the drainage (above or below the reservoir). Genetic samples have been collected from all known bull trout populations in the Deadwood basin and a majority of the bull trout populations in the South Fork Payette basin allowing genetic assignments (DeHann and Aldren 2008). Muscle plugs are being used in an associated isotope study (Reclamation 2008c). The collection of fin clips and muscle plugs were non-lethal and occurred while each individual bull trout was anesthetized. Samples have not been analyzed from bull trout sampled in 2008.

Bull trout collections, tagging, and radio tracking efforts during 2009 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 10. Bull trout captured in Deadwood River downstream of Deadwood Reservoir in 2008. Both recaptured fish were originally tagged in 2007.

Date	Fork Length (mm)	Total Length (mm)	Weight (g)	Recapture (yes)
7/3/2008	336	355	464	
7/3/2008	324	344	466	yes
7/9/2008	234	247	114	
9/17/2008	345	358	398	yes
9/29/2008	255	270	178	

Hydrologic and Water Chemistry

Water quality data were collected during the 2008 reporting period for the purpose of riverine and habitat modeling efforts (Reclamation 2008c). Eight water quality parameters were measured in the field and another twelve 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 19 and 20. Sample locations and frequencies are listed in Table 7.

A total of 27 new Onset ® Tidbit temperature thermographs were placed in seven tributaries to the Deadwood River and the mainstem Deadwood River below (Wilson, Whitehawk, No-Man, Scott, Lorenzo, Julie, and Stevens creeks). A new installation design was developed for deployment during the 2008 field season after some of the previously deployed thermographs were lost. In addition to the new temperature thermographs a few older ones are still operable in those same tributaries. Tributaries with thermographs include: Wilson, Warmsprings, Whitehawk, Scott, No-Man, Lorenzo 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 19.

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 2008. The ADCM recorded water temperature, water velocity, and water depth. Data from the ADCM was transmitted via satellite to Reclamation's Hydromet website (Reclamation 2008b).

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.

Hydrologic and water quality data will continue to be sampled through the 2009 field season. 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 2008c).

Deadwood River Reach (discussion)

Hydrologic data sampling was modified for the 2008 field season due to funding reductions and evaluating the 2007 data to refine the data needs in 2008. Additional thermographs were placed at locations throughout the Deadwood River reach to more accurately assess tributary influence on the mainstem Deadwood River. New 2008 locations included Lorenzo and Scott creek and two thermographs in the mainstem Deadwood River (one near each bank) within 400 m downstream of Wilson, Whitehawk, Scott, No- Man, Lorenzo, and Stevens creeks

Sampling frequency and locations were also modified for the 2008 field season. Sampling location 108 was only sampled once during the field season. This change resulted from funding reductions and evaluating the 2007 data to refine the data needs in 2008.

Adjustments were made to two AquaRods in 2008 due to changes in hydrology over the 2007 winter. AquaRods located in Whitehawk and Wilson creeks were relocated short distances upstream to provide more reliable data, due to changes in the stream hydrology at the previous locations.

Payette River Basin - Deadwood River System (discussion)

The FWS 2005 Upper Snake River Opinion identified that operations at Deadwood Dam cause harm and harassment to bull trout. Bull trout captured and tagged below Deadwood Dam could help address the terms and conditions associated with Deadwood Dam. The terms and conditions discuss possible harm and harassment associated with low winter stream flows, low summer temperatures, the lack of biologically significant ramping rates, and disruption of migratory cues below the dam as well as entrainment over or through the dam. Bull trout captured below the dam will be tracked during these events to see if there is possible harm or harassment.

Bull trout were collected in the Deadwood River below the dam for the first time in 2007. Sampling efforts used in 2007 and 2008 varied from those used in previous efforts; angling and fyke nets set in the stilling basin will be used again in 2009. Biological data collection continues to include baseline water quality, fish tissue samples, fish length and weight as well as collection of bull trout movement within the basin.

In 2008, Reclamation continued work on a six year telemetry program to monitor migration and movement patterns of bull trout in the Deadwood River basin. A total of 25 bull trout were captured in the Deadwood basin as part of this study: nine in the reservoir (including two recaptures), 14 in tributaries to the reservoir (including one recapture), and five below the dam (including two recaptures). Eight of the 20 previously untagged bull trout were implanted with radio transmitters.

Mortality of radio tagged bull trout is monitored, however, the cause is difficult to assess even when a tag or carcass is recovered. When a radio tag is no longer detected it is unknown if the battery in the radio tag expired, if the fish died in a location that a signal can not be detected, or if the tag was removed from the fish and is no longer operable. In the reservoir in 2008, one of the radio tag mortalities appeared to have occurred from infection (the fish was tagged in 2007) and the fish died while in a livewell after being captured in a trap net at the mouth of Beaver Creek. The other radio tag/carcass was recovered at the mouth of the Deadwood River and could have resulted from angling.

The genetic analysis for the 11 bull trout sampled below the dam in 2007 was completed in 2008. The results indicated that 10 of the fish (the sample from one fish did not amplify) were more closely related to bull trout above the dam then from bull trout below the dam. The frequency of fish captured in the stilling basin during 2007 may suggest that certain conditions in 2007 led to increased entrainment compared to 2006 and 2008. Ongoing habitat modeling and continued sampling of bull trout in the river below the dam may help to further explain this condition.

Additional data and methodology can be found in the Technical Report for Idaho Fish and Game Permit Number F-10-99, Deadwood River Bull Trout Monitoring Activities, Annual Report - December 2008 (Reclamation 2008d).

Malheur River Basin - Beulah Reservoir (data collection)

Data collection efforts by the U.S. Geological Survey (USGS) continued through June 2008 in Beulah Reservoir to exam the effects of drawdown on the bull trout prey base. Study design and methodology for the prey base study is described in Rose and Mesa (2008). Water quality parameters, fish and aquatic insects were sampled.

Water quality sampling occurred every two weeks in each of the three stratum in the reservoir and included water temperature, dissolved oxygen, and water transparency. Fyke nets and gill nets were used to sample fish throughout the reservoir and totaled 2,378 and 36.5 hours respectively. Data from spring 2006 through spring 2008 was pooled and summarized in a completion report (Rose and Mesa 2009).

Trap and haul efforts were conducted during the 2008 reporting period as directed by the Monitoring and Implementation Plan (Term and Condition 4d) when reservoir pool elevations drop below 2,000 acre-feet or when the spillway is used. (Beulah Reservoir fell below 2,000 acre-feet in 2008; Table 4.) The Burns Paiute Tribe sampled a total of 90 hours in the tailrace immediately below Agency Valley Dam (16 hours a week from May

12 through June 13). All sampling was conducted using hook and line methods. A total of 227 fish were sampled in 2008 including rainbow trout (Oncorhynchus mykiss), northern pikeminnow (Ptychocheilus oregonensis), and largescale sucker (Catostomus macrocheilus); no bull trout were collected (Brown and Schwabe 2008).

Malheur River Basin - Beulah Reservoir (discussion)

Reclamation entered into an interagency agreement in 2006 with the USGS to evaluate the impact of specific reservoir volumes on the fishery and to identify the threshold at which bull trout and/or their prey are harmed. This work was completed in 2008 and summary report submitted in 2009. Results suggest that low pool elevations limit the prey base for bull trout; however, the prey base can recover during subsequent years. The extent of drawdown and consecutive years of drawdown influence the rate at which the prey base is able to recover. Other factors that may affect the bull trout prey base include predation by other piscivorous fishes, entrainment, and available habitat in the North Fork Malheur River (NFM).

Reclamation will use results from this study and all other available data to provide recommendations to the FWS for reducing impacts to bull trout in Beulah Reservoir by March 31, 2010. In addition to results from the prey base study, annual fisheries reports and trap and haul reports from the Burns Paiute Tribe and bull trout redd count data are available to use in making recommendations. Furthermore, annual coordination meetings with the Burns Paiute Tribe, ODFW, USFS and the FWS also provide an open forum to discuss results of completed research and the direction for future research.

Trap and haul efforts were conducted by the Burn Paiute Tribe in the spring from 1999 to 2006 and 2008. During this time 20 bull trout were captured in 1999, five in 2000, and seven in 2006, although entrained rainbow trout have been sampled every year. Since 2006 Reclamation has operated the dam to reduce the surface spill of water when feasible. Reducing spill may be limiting the frequency of bull trout entrainment as correlated to catch rates during trap and haul sampling (Table 11).

Spawning surveys were initiated by the ODFW in the NFM upstream from Beulah Reservoir in 1992 to determine the time and location of spawning bull trout and to monitor general population trends. Redd counts from 1992 continue to show a slight increasing trend with annual fluctuations (Figure 18). The 2008 total of 76 redds was above the previous 16 year average (69 redds) but below the previous 10 year average (96 redds).

Redd counts in the NFM system have been used to monitor trends in bull trout abundance since 1992; however, habitat conditions and logistics of completing the surveys have changed since the original surveys. Wildfires in the NFM system have caused riparian conditions to vary annually. Post fire revegitation in some survey reaches causes visibility to be extremely limited, questioning the reliability of surveyors to accurately count bull trout redds. Furthermore, budget cutbacks for all collaborative agencies necessitated the original survey reaches to be reduced in 2008. In order to allow a

comparison of historic redd counts with current redd counts an adjustment to the new survey totals was required. The adjusted value was computed from the observed redd counts (n=75) in 2008 to more accurately reflect the expected redds (n=76) based on previous survey counts and distances (Perkins 2009).

Table 11. Bull trout and rainbow trout catch rates (fish per hour) during Trap and Haul sampling below Agency Valley Dam. All sampling was performed in the spring 1999-2006 and 2008. 'No fish' indicate no fish were sampled during that period. (Frequency of spill and pool elevations less than 2,000 acre-feet (AF) are operational indices referenced in the 2005 Opinion.)

Year	Bull trout (fish/hr)	Rainbow trout (fish/hr)	Did spill occur?	Did pool drop below 2,000 AF?
1999	0.05	0.34	Yes	No
2000	0.01	0.21	Yes	No
2001	No fish	0.08	No	Yes
2002	No fish	0.44	No	Yes
2003	No fish	0.35	No	Yes
2004	No fish	0.48	No	Yes
2005	No fish	0.08	No	No
2006	0.04	0.67	Yes	No
2007	Did not	sample	No	Yes
2008	No fish	1.56	No	Yes

V. Other Activities

Physa Surveys

Surveys for Physa natricina (Snake River physa) were conducted in 2008 in the Snake River from just below the Jackson Bridge (RM 669.7) downstream to the I-84 bridge (RM 663.0). Surveys were conducted consistent with previous years sample protocol with the exception of location. In 2006 and 2007, Snake River physa surveys were conducted in the Snake River from Minidoka Dam (RM 674.5) downstream to the Jackson Bridge (RM 669.7). Live Snake River physa were encountered during the 2006 and 2007 field seasons and verified in 2008 by Dr. John Burch from the University of Michigan. To avoid over-sampling the population located between Minidoka Dam and Jackson Bridge, Reclamation and the FWS jointly agreed to conduct the final year of Snake River physa surveys below Jackson Bridge downstream to the I084 bridge.

Live Snake River physa were collected at 12 locations through the study area. Final results for the Snake River physa study will be available in March, 2010 following completion of data analysis, compilation and subsequent reporting by Montana State University.

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 2008. First, as part of Idaho and Oregon's on-going Total Maximum Daily Load (TMDL) 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 Lower Boise River, North Fork Payette River, Lower Payette River, Mid Snake River, Lake Walcott, and American Falls Reservoir Watershed Advisory Groups, as well as the Owyhee/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

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 2008, 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. This information was reported in Reclamation's 2008 Annual Report to the National Marine Fisheries Service (Reclamation 2008a).

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 2008. 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 2008. 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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