



**PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY**

P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801  
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

April 14, 2009

**VIA ELECTRONIC FILING**

Honorable Kimberly D. Bose, Secretary, and  
Nathaniel J. Davis, Sr., Deputy Secretary  
FEDERAL ENERGY REGULATORY COMMISSION  
888 First Street NE  
Washington, DC 20426

Subject: Rocky Reach Hydroelectric Project, FERC No. 2145-065  
Rock Island Hydroelectric Project, FERC No. 943-091

Dear Secretary Bose and Deputy Secretary Davis:

Public Utility District No. 1 of Chelan County, Washington (Chelan PUD), licensee for Rock Island Hydroelectric Project No. 943 (Rock Island Project) and the Rocky Reach Hydroelectric Project No. 2145, (Rocky Reach Project) respectfully submits the 2008 Annual Report – Implementation of Reasonable and Prudent Measures for bull trout.

In accordance with Article 415 of the Commission's *Order Amending License*<sup>1</sup> for the Rock Island Project and Article 412 of the Commission's *Order Amending License*<sup>2</sup> for the Rocky Reach Project, Chelan PUD respectfully submits the annual report that describes the results of the implementation of Reasonable and Prudent Measures and Associated Terms and Conditions regarding bull trout that were developed to satisfy the requirements of the FWS' biological opinion and incidental take statement (ITS) for the operation of the projects consistent with Chelan PUD's Anadromous Fish Agreements and Habitat Conservation Plans (HCPs) for the Rocky Reach Project and the Rock Island Project.

On February 19, 2009, the Commission issued a new license for the Rocky Reach Project.<sup>3</sup> In accordance with Ordering Paragraph E, Article 4 of Appendix B, and the Reporting Requirements of Appendix D of the new license, Chelan PUD is required to submit subsequent annual reports (starting 2010) for the Rocky Reach Project directly to the U.S. Fish & Wildlife Service Central Washington Field Office in Wenatchee, Washington.

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<sup>1</sup> 107 FERC ¶ 61,282 (2004)

<sup>2</sup> 107 FERC ¶ 61,281 (2004)

<sup>3</sup> 126 FERC ¶ 61,138 (2009)

*Ms. Kimberly D. Bose, Secretary  
Mr. Nathaniel J. Davis, Sr., Deputy Secretary  
Federal Energy Regulatory Commission*

Please forward any questions regarding this filing or requests for additional information to me at Chelan PUD, 327 North Wenatchee Avenue, Wenatchee, Washington 98801.

Sincerely,



Michelle Smith  
Licensing and Compliance Manager  
michelle@chelanpud.org  
(888)663-8121, Ext. 4180

cc: Mark Miller, Steve Lewis, Jessie Gonzales, USFWS  
Erich Gaedeke, FERC  
Keith Truscott, Chelan PUD  
Steve Hemstrom, Chelan PUD  
Shane Bickford, Douglas PUD  
Mike Schiewe, HCP Coordination Committee Coordinator

Attachments: 2008 Annual Report

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# **Reasonable and Prudent Measures and Associated Terms and Conditions for the Protection of Bull Trout**

**2008 Annual Report and Final Summary of RPMs and  
Incidental Take Monitoring for Years 2005-2008**

**ROCKY REACH HYDROELECTRIC PROJECT  
FERC Project No. 2145**

**ROCK ISLAND HYDROELECTRIC PROJECT  
FERC Project No. 943**

**April 14, 2009**



**Public Utility District No. 1 of Chelan County  
Wenatchee, Washington**

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## ***SECTION 1: INTRODUCTION***

The Public Utility District No. 1 of Chelan County (Chelan PUD) owns and operates the Rocky Reach Hydroelectric Project, Federal Energy Regulatory Commission (FERC) license, No. 2145 and the Rock Island Hydroelectric Project, FERC, No. 943 (Figure 1). Chelan PUD is responsible for evaluating and addressing any impacts of ongoing operations of these projects on species listed under the Endangered Species Act (ESA) such as bull trout.

In 2004, the United States Fish and Wildlife Service (USFWS) after concluding its ESA section 7 consultation on operation of the Rocky Reach and Rock Island projects (Projects) consistent with the Rocky Reach and Rock Island Anadromous Fish Agreement and Habitat Conservation Plans (HCPs), issued a Biological and Conference Opinion (Opinion) on the license amendments to incorporate the HCPs into the existing federal operating licenses for both Projects. The Opinion analyzed potential effects of HCPs operations on bull trout, which are not directly covered by the HCPs. The USFWS concluded in the Opinion that operation of the Projects, consistent with implementation of the HCPs, is not likely to jeopardize the continued existence of the Columbia River distinct population segment of bull trout. Currently, critical habitat is not designated for bull trout in the Project areas.

In the Opinion, the Service issued an accompanying incidental take statement to Chelan PUD that includes reasonable and prudent measures and terms and conditions designed to minimize the incidental take of bull trout at the Rocky Reach and Rock Island Projects (Projects). These measures, along with the impact minimization measures, formed the basis for development of Comprehensive Bull Trout Management Plans (BTMPs) for the Rocky Reach and Rock Island projects (Chelan PUD 2005a, 2005b).

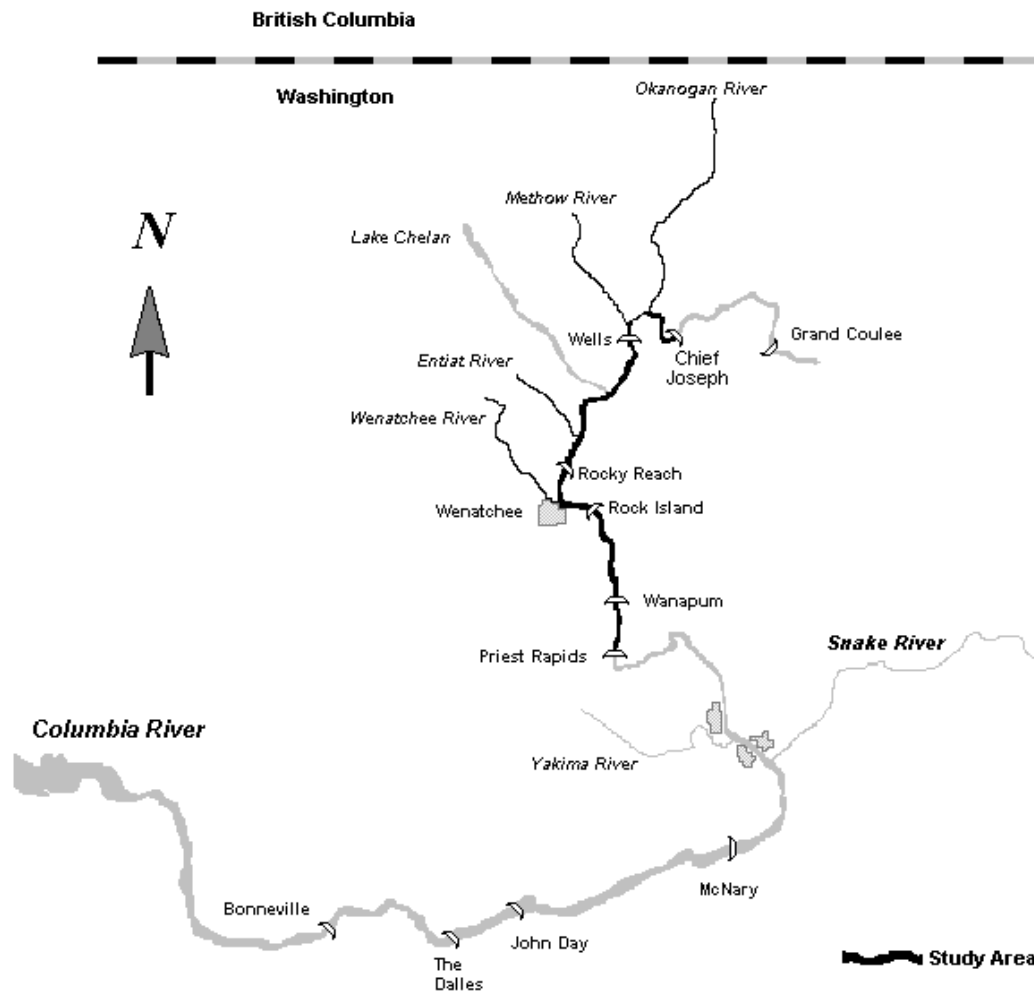
On 19 February, 2009, the Rocky Reach Project received a new 43-year FERC operating license. A new BO was issued by the USFWS on 5 December, 2008 analyzing the effect on bull trout for the new Rocky Reach license actions specified in the accompanying Settlement Agreement for the new license. Specific goals and objectives to monitor, protect, and enhance bull trout resources related to the Rocky Reach Project are contained in the Order on Offer of Settlement Agreement and Issuing New License received from FERC. However, this report will serve as the last annual report for bull trout incidental monitoring conducted in 2008 for both Projects, and as the final summary report required for the full three-year monitoring period (2005-2008) for both the Rock Island and Rocky Reach Projects.

Throughout the remaining term of the Rock Island license, the BTMP will be the guiding document to implement goals for monitoring and minimizing potential adverse effects on bull trout related to Project operations and facilities. For the Rocky Reach Project, the Bull Trout Management Plan contained in new license issued by FERC, will guide bull trout monitoring activities and reporting requirements for 2010 and beyond. Annual reports on bull trout monitoring required in the Bull Trout Management Plan will be submitted on or before April 15 each year to the USFWS Central Washington Field Office

This annual report is also a requirement of the USFWS 2004 Opinion for the Rock Island Project. However, it provides a summary of the results of Chelan PUDs implementation of required reasonable and prudent measures, their associated terms and conditions, and Incidental Take monitoring for bull trout in both the Rocky Reach and Rock Island Projects, for all three years, 2005-2008. Incidental Take monitoring for bull trout at both Projects was completed on June 30, 2008. This report summarizes the Incidental Take level observed for the three year monitoring period, May 2005 through June 2008, and completion of Reasonable and Prudent Measures and associated Terms and Conditions for that same 3-year period at both Projects.

The BTMPs for both Projects call for continued monitoring of radio-tagged bull trout through June 2009, but only for those fish tagged in 2005-2007 that have battery life remaining in their transmitters. For Rock Island, a final report will be submitted by April 15, 2010 to summarize the final results of that monitoring. Figure 1 depicts the full study area of the Mid-Columbia River where radio-telemetry tracking occurred.





**Figure 1: Study Area for Assessing Migration Patterns of Bull Trout in the mid-Columbia River.**

Location of Rocky Reach and Rock Island dams and reservoirs in relation to other mid-Columbia hydroelectric projects on the Columbia River. The bolded river corridor between Rock Island Dam and Wells Dam (Rocky Reach and Rock Island dams and reservoirs) shows the study area in which Chelan PUD is conducting bull trout radio telemetry and incidental take monitoring in the mid-Columbia River 2005 – 2009.

## ***SECTION 2: 2004 BIOLOGICAL OPINION MEASURES***

The following is a summary of the measures contained in the 2004 USFWS BO for the HCPs contained in the Rock Island and Rocky Reach licenses. Chelan PUD has been implementing these measures for the Rocky Reach and Rock Island projects from 2005-2008.

### ***2.1 Impact Minimization Measures***

#### ***2.1.1 Rocky Reach Project***

##### ***Juvenile Passage***

Document the age-group, year-class, length-weight information, and degree and frequency of de-scaling for all juvenile bull trout that are observed in the juvenile bypass system sampling facility.

##### ***Bull Trout Management Plan***

Complete a Rocky Reach Comprehensive Bull Trout Management Plan.

##### ***Bull Trout Monitoring and Evaluation Program***

Upon completion of a signed and executed Settlement Agreement for the relicensing of Rocky Reach Project, implement a bull trout Monitoring and Evaluation Program within one year after the new license is accepted.

##### ***Adult Passage Monitoring***

Capture digital pictures of bull trout passing through the fishway. Conduct the following to monitor adult bull trout passage: 1) continue ladder counts; 2) maintain adult fishways in accordance with anadromous fish criteria; and 3) expand video counts to off-season for an experimental period of 1 year. Investigate the feasibility of providing video monitoring of the adult separator at the juvenile bypass system to enumerate bull trout entering the sampling facility during index sampling periods.

##### ***USFWS Recovery Plan***

Participate in the USFWS bull trout recovery plan for areas affected by Project operations.

##### ***Tributary Habitat Enhancement***

Consider collecting and hauling large woody debris from Rocky Reach and placing it in tributaries as part of the HCP tributary enhancement plan.

### ***2.1.2 Rock Island Project***

#### Juvenile Passage

Continue to collect and evaluate passage events for adult and juvenile bull trout in order to monitor monthly passage trends through adult fishways. Implement a monitoring and evaluation program. Continue to capture digital pictures of bull trout passing through fishways at Rock Island Dam.

#### Adult Passage Monitoring

Conduct the following to monitor adult bull trout passage: 1) continue ladder counts; 2) maintain adult fishways in accordance with anadromous fish criteria; and 3) expand video counts to off-season for an experimental period of 1 year.

#### Tributary Habitat Enhancement

Consider collecting and hauling large woody debris from Rock Island and placing it in tributaries as part of the HCP tributary enhancement plan.

#### Compliance with Recovery or Management Plans

Continue to participate in ongoing recovery plan meetings and assist with recovery tasks to address uncertainties on project effects on bull trout that are outlined in the recovery plan.

## ***2.2 Incidental Take Permits***

### ***2.2.1 Rocky Reach and Rock Island Projects***

#### **Reasonable and Prudent Measures (2004 Opinion)**

##### RPM 1.

The licensee shall develop and implement, in coordination with the Service, appropriate measures to reduce impediments to up and downstream passage of adult and juvenile bull trout at Rocky Reach and Rock Island dams and their associated reservoir systems.

##### RPM 2.

The licensee shall design a monitoring program to: 1) detect adverse effects resulting from the proposed action; 2) assess the actual level of incidental take in comparison with the anticipated incidental take level documented in the biological opinion; 3) detect when the level of anticipated incidental take is exceeded; and 4) determine the effectiveness of reasonable and prudent measures and their implementing terms and conditions. Specifically, the program shall be designed to monitor the abundance, distribution, and timing of adult and juvenile bull trout utilizing Rocky Reach and Rock Island dams and their associated reservoir systems.

### **2.3 Terms and Conditions( 2004 Opinion)**

1. To implement RPM 1, the licensee shall develop, in coordination with the Service, a prioritized list of monitoring efforts necessary to evaluate the effects of the Project on the up- and downstream passage needs of bull trout at Rocky Reach Dam by February 28, 2005. Based on this prioritized list, the licensee shall then initiate studies to evaluate the up- and downstream passage needs for bull trout at Rocky Reach and Rock Island dams and assess the Project impacts on those passage needs.
2. To implement RPM 1, the licensee shall, in coordination with the Service, develop a prioritized list of monitoring efforts necessary to determine the extent of bull trout entrainment through the turbines at Rocky Reach and Rock Island dams by February 28, 2005. If the studies contained in the prioritized list are determined by the Service, in consultation with FERC and the licensee, to be feasible, the licensee shall assess the extent of bull trout entrainment through the turbines at Rocky Reach Dam.
3. To implement RPM 2, the licensee shall, in coordination with the Service, develop and implement a comprehensive bull trout monitoring program, that includes the presence of a sufficient number of radio-tagged (or other appropriate tracking technology) bull trout, to enable monitoring of bull trout utilizing Rocky Reach and Rock Island dams and their associated reservoir systems and tracking of incidental take exemptions.

### **2.4 Conservation Recommendations (2004 Opinion)**

1. The Service recommends that the licensee continue to participate in development and implementation (when completed) of the bull trout recovery plan.
2. The Service recommends that the licensee continue monitoring TDG levels, and invest in facility improvements to keep TDG levels at or below 110% (or other applicable state water quality standards).

## ***SECTION 3: IMPLEMENTATION OF REASONABLE AND PRUDENT MEASURES***

In 2008, Chelan PUD completed the third year of a three-year study (June 2005 – June 2008) to satisfy the requirements of the USFWS Opinion for bull trout monitoring and incidental take determination (Stevenson et al. 2006, 2007, 2008, and 2009). The results for the 2008 calendar year are presented in Stevenson et al. (2009) (Appendix A). Incidental take monitoring continued at Rocky Reach and Rock Island through June 2008, as specified in the BTMPs. This annual report summarizes Chelan PUD's 2008 implementation for RPMs and Terms and Conditions contained in the USFWS Opinion to protect of bull trout.

The specific objectives of the field studies are to:

- Assess the mortality rate (incidental take) of radio-tagged bull trout that migrate both up and downstream of Rock Island and Rocky Reach dams, identified by the location of passage (i.e., the adult fishway, the powerhouse, spillway or juvenile bypass facility).
- Describe the movements and migrations of bull trout at Rocky Reach and Rock Island dams, and within their reservoirs.
- If project related mortality is observed, evaluate cause and effect based on operations of the PUD hydroelectric Projects.

### ***3.1 Rocky Reach Project***

#### ***3.1.1 Impact Minimization Measures***

##### ***Juvenile Passage Monitoring***

The USFWS, Chelan PUD, and other the parties who developed the Rocky Reach BTMP agreed that in 2008 it was not possible to collect a sufficient sample size of juvenile bull trout at Rocky Reach Dam, and that juvenile bull trout are not of adequate size to be radio-tagged with a transmitter having adequate battery life to collect meaningful data. As of 2008, it is still not possible to assess the effects of Rocky Reach Dam on downstream passage of juvenile bull trout. However, Chelan PUD developed a juvenile bull trout PIT-tag program to passively monitor upstream movements of juvenile bull trout past Rocky Reach Dam, and. For three years, 2005-2007, this effort involved PIT-tagging juvenile bull trout that were incidentally captured at Rocky Reach Dam and at smolt traps and broodstock traps that are either operated by, or funded by, Chelan PUD (Table 1). In 2008, no bull trout were PIT-tagged at Rocky Reach facilities.

In 2008, as part of its assistance and coordination effort with the USFWS for bull trout, Chelan PUD provided PIT tags to the USFWS to monitor movements of juvenile bull that were incidentally captured at USFWS smolts traps in the Entiat River and Peshastin Creek basin. The USFWS captured and tagged 61 juvenile bull trout in an Entiat River smolt trap in 2008 (Table 1). This may assist the USFWS to determine how and when sub-adult bull trout move from the Entiat River.

Table 1. Numbers of juvenile bull trout captured during Chelan PUD smolt bypass sampling operations at the Rocky Reach Project, and smolt monitoring by USFW in its Entiat River smolt trap and incidental take observed, 2005-2008.

| <b>Location</b>                  | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>Incidental Take</b> |
|----------------------------------|-------------|-------------|-------------|-------------|------------------------|
| RR Juvenile Bypass               | 1           | 1           | 1           | 14          | <b>0</b>               |
| Entiat River smolt traps (USFWS) | 8           | 10          | 10          | 61          | n/a                    |

The Rocky Reach Dam juvenile fish bypass operated from April 1, 2008 to September 7, 2008. Juvenile (smolt) sampling at the bypass took place for the first one-half hour period of each hour, 8 am through 11 am every day. During bypass operations in 2008, 14 juvenile bull trout (Mean Length = 165.1 mm; range 132-230) were captured (April – 1 fish; May – 9 fish; June – 3 fish; August – 1 fish). All fish were released and transported downstream, alive and in excellent condition. In 2008, no PIT- tagged juvenile bull trout were detected in the fishways at Rocky Reach or Rock Island dams (PITAGIS database, SLH tag ID, 2008).

In 2008 as part of the monitoring and evaluation for juvenile bull trout passage, Chelan PUD captured digital photographs of adult and sub-adult bull trout that passed Rocky Reach Dam via the adult fishway during normal fish counting periods (April 14- Nov 14). These photographs allow for observation and assessment of juvenile bull trout as they migrate upstream past Rocky Reach dam. In 2008 a total of 104 bull trout ascended the Rocky Reach fishway, 19 of which were juvenile bull trout. These photographs show bull trout that appear to be in excellent physical condition. Three years of digital photographs are stored for review by the USFWS.

The Rocky Reach fishway was dewatered for required annual inspection, maintenance, and attraction water pump (AWS) overhaul from 3 December 2007 to March 3, 2008. Following water-up of the ladder on 2 March 2008, the first bull trout to pass Rocky Reach did so 57 days later. This fish was a juvenile bull trout that passed the Dam on 29 April. The next bull trout passed on 2 May, and a single fish passed later on 12 May; no other bull trout utilized the fishway until 19 May. The fact that so few bull trout utilize the fishway to pass the dam early in the year suggests that the fishway maintenance period at Rocky Reach has virtually no biological effect on movements of bull trout in the Project. Because few or no fish appear to be waiting to pass Rocky Reach Dam after the fishway is re-watered following the maintenance period, the existing maintenance schedule in the off-season at Rocky Reach does not appear to affect any desire by bull trout to pass the Project during in those months.

Chelan PUD completed three years of “off-season” bull trout passage counts at Rocky Reach from fall 2004 through winter of 2007, more than satisfying the one year requirement in the 2004 USFWS Biological Opinion. The number of bull trout passing Rocky Reach in the off-season (approximately 1 March - 15 April and 15 November - 5 January) was 46 fish in total for all three years. For these off-season counts, no bull trout passed Rocky Reach during the off-season period in 2007, 37 fish passed in 2006, two fish passed in 2005, and seven bull trout passed in 2004.

### Bull Trout Management Plan

Chelan PUD completed the Rocky Reach Comprehensive Bull Trout Management Plan (Chelan PUD 2005a) on February 25, 2005, and submitted it to the FERC and USFWS on February 28, 2005. No further action was required on this plan in 2008.

### Bull Trout Monitoring and Evaluation Program

Chelan PUD's bull trout monitoring and evaluation program (to monitor incidental take at the Project and complete other evaluations) was implemented for the first year of study on May 16, 2005. This annual report summarizes result from the third year (2008) of bull trout monitoring, including bull trout passage, behavior, and incidental take (no incidental take was observed in 2008) from 1 January, 2008 to 31 December, 2008. Some bull trout observations made in 2009 are included in the 2008 annual report (Appendix A) to clarify important behavior or final locations of radio tagged fish. This report is the final submittal to the FERC and USFWS for fulfilling Chelan PUD's requirement to monitor bull incidental take at for the Rocky Reach Project from 15 May 2005- 30 June 2008.

By the conclusion of the annual monitoring period (31 December, 2008), a total of eight fish made eight upstream passage events at Rocky Reach Dam (Table 7 Appendix A). Of these eight fish, one was tagged in 2005 at Rock Island Dam, three were tagged in 2006 Rocky Reach Dam, and four were tagged in 2007, also at Rocky Reach. The fishway migration rates for these fish to various locations are shown in Table 5 and Table 6 of Appendix A.

To clarify fish behavior, we classified all passage events at Rocky Reach into one of two time periods (Table 7 of Appendix A). The first time period represents what is typically viewed as "upstream migration". This is the period when fish generally migrate upstream through the Columbia River, and enter tributaries (Wenatchee, Entiat, and Methow). Most passage events at the Projects during this time generally consist of fish movement upstream through the fishways. However, some downstream movement may also occur during this period (Table 8 of Appendix A). The upstream migration period typically concludes by the end of July at both projects. The second time period, referred to as "after tributary exodus", is the time period following completion of the spawning. While bull trout typically pass downstream of the Projects in this period which typically begins in late November, they may pass upstream as well.

A total of 3 downstream passage events occurred at Rocky Reach during the 2008 monitoring period (Table 8 of Appendix A). All three of these fish moved downstream through the powerhouse. Subsequent mobile boat tracking detected each of these fish verified that no mortality (no incidental take) occurred during turbine passage. None of three fish moving downstream was a "fallback" event after ascending a ladder, and no mortality of bull trout was observed in 2008. Table 2 summarizes the number of passage events and the route of passage for all downstream movements made by radio-tagged bull trout from 2005 through 2008. No Incidental Take was observed for any bull trout passing downstream through Rocky Reach Dam in this three year period.

Table 2. Summary of downstream passages made by radio-tagged adult bull trout through each passage route at Rocky Reach Dam, 2005-2008.

| Year         | Turbine   | Spillway | Juvenile Bypass | Unknown  | Incidental Take |
|--------------|-----------|----------|-----------------|----------|-----------------|
| 2005         | 9         | 0        | 1               | 0        | 0               |
| 2006         | 15        | 1        | 1               | 3        | 0               |
| 2007         | 10        | 1        | 1               | 1        | 0               |
| 2008         | 3         | 0        | 0               | 0        | 0               |
| <b>Total</b> | <b>37</b> | <b>2</b> | <b>3</b>        | <b>4</b> | <b>0</b>        |

During the course of the 2008 monitoring period, Chelan PUD monitored Project “take” by using passage route detections (all possible routes wired with telemetry receivers) at the dam, bi-weekly mobile surveys in the reservoirs, and monthly aerial surveys (Cessna 180 fixed wing) to ascertain the location and condition of tagged fish. For fish that migrated either up or downstream of the dams, and were within 400 meters of the position logged during a previous survey without obvious movement, dive operations occurred to assess the status of the fish. For the 2008 monitoring period, two SCUBA dive surveys were conducted. These fish appeared to be resting on the bottom and moved off when the divers approached.

Of all bull trout tagged at Rocky Reach or Rock Island from 2005 through 2007, fish monitoring suggests that 17 tags still remain active and the fish are alive and at large within the Columbia or its tributaries. A total of eight transmitters were recovered in 2008 from fish tagged in 2006 and 2007 at both Projects. None of these bull trout passed upstream or downstream of any Project in 2008. Four of these tags were recovered in the Entiat River, one in the Wenatchee River Basin (Peshastin Creek), one in the Methow River. The one tag recovered in the Columbia River was from a bull trout that had spent the spawning period in the Entiat River in 2008, then exited and remained near the Entiat/Columbia confluence for some time before the transmitter was recovered in the Columbia near the town of Orondo, WA. This fish did not pass any dams after it exited the Entiat River following the spawning period.

*Identification of Bull trout Core Areas and Local Populations*

As planned, no genetic samples were collected in 2008 as no bull trout were radio tagged in 2008. For the samples collected from 2005-2008, Chelan PUD will fund genetic analysis of these samples to help the USFWS establish a genetic baseline for populations of bull trout that use Rocky Reach and Rock Island reservoirs. The 3-year collection of tissue samples have all been delivered USFWS Central Washington Field Office in Wenatchee Washington, and now reside at the USFWS Abernathy genetics lab. As of January 2009, the USFWS had not initiated the genetic analysis for any bull trout tissue samples that were collected at Rocky Reach or Rock Island as part of bull trout work conducted in 2001-2003, nor for the tissue samples collected from 2005-2008. Chelan PUD will fund this genetics work if it is ever completed by the USFWS.



*Determine potential for stranding or entrapment of bull trout in Rocky Reach Reservoir*

This evaluation was completed in 2007; data from 2005-2007 was analyzed. This work demonstrated that no stranding or entrapment of adult or juvenile bull trout in Rocky Reach reservoir would occur due to reservoir operations. No adult bull trout have ever been detected (2001-2003 or 2005-2008) using swimming areas associated with Chelan PUD parks along the Columbia River in within the Project area. No additional work on stranding or entrapments will be conducted in 2009 or beyond.

Adult Up-stream Passage Monitoring

1) Chelan PUD recorded and stored digital photos of all bull trout passing Rocky Reach Dam during the normal fish passage season (14 April – 14 November, 2008). All pictures are stored on a viewable CD for review by the USFWS.

2) Chelan PUD conducted normal, in-season adult fishway counts during the period of 14 April to 14 November, 2008. A total of 104 bull trout were observed ascending the Rocky Reach Dam fishway during this time period in 2008 (Table 1, Appendix A).

3) Chelan PUD maintained the adult fishway in accordance with current anadromous fish criteria at Rocky Reach in 2008.

4) In 2008, Chelan PUD compiled hourly project operations data to conduct an analysis intended to evaluate whether dam or reservoir operations correlates with hourly or daily trends in upstream bull trout passage at Rocky Reach Dam. Hourly, daily, and seasonal bull trout passage data was compiled in 2008 and is reported in Stevenson, et al., 2009 (Appendix A). Diel and seasonal passage trends do not appear to be correlated with any specific operation of the dam.

Participation in USFWS Recovery Plan

Chelan PUD is still a member of the USFWS Upper Columbia Bull Trout Recovery Team and has participated in all of the USFWS Recovery Plan meetings. Chelan PUD voluntarily assisted the USFWS to develop baseline data on movement of juvenile bull trout within the Entiat River by supplying PIT tags (USFWS tagged 61 juvenile bull trout with PIT tags in 2008). Chelan PUD also assisted the USFWS by making airplane flights (plane outfitted with telemetry receiver) over the Wenatchee, Entiat, and Methow Basin to locate bull trout tagged by the USFWS and Chelan PUD.

Only one USFWS recovery plan meeting was held in 2008, Chelan PUD will participate in all future meetings when they are held by the USFWS. Chelan biologists met with USFWS biologists twice in 2008, and once in 2009 to discuss and coordinate radio tag locations of bull trout in the mainstem Columbia and associated tributaries (Wenatchee, Entiat, and Methow) in the study area.

### Tributary Habitat Enhancement

*(Consider collecting and hauling LWD)*

In 2008 work was started on one project, and completed on three projects, in the Entiat River, a tributary to Rocky Reach Reservoir. The *Harrison Side Channel Project* was completed. This project was designed to reconnect an old channel and provide access to the flood plain by removing a levee and installing a barb in the mainstem Entiat River to provide perennial flow to the new channel providing more than 20,600 square feet of high quality, permanently watered habitat. Work on the *Entiat PUD Canal System Conversion Project* started in 2008 which will decommission an irrigation pipeline system and covert existing irrigation users to Wells which is designed to conserve water and improve flow in the lower Entiat River, and eliminate juvenile fish entrainment into the irrigation system. The *Keystone Canyon Habitat Restoration Project* placed in-stream structures into the lower Entiat River to restore habitat complexity and promote important gravel recruitment function and retention in the lower river channel. The *Roaring Creek Flow Enhancement and Barrier Removal Project* replaced two surface water irrigation diversions and delivery system with new groundwater wells with the goal of improving fish passage and conserving surface flow.

### Incidental Take Monitoring and Final Take Numbers

In 2008, bull trout injury or mortality was observed for any upstream or downstream passage routes at Rocky Reach Dam, reservoir operation, or during any predator control program for the Project. For the full three year monitoring period from May 2005 through June 2008, no injury or mortality was observed as a result of dam passage, reservoir operations, or predator control programs (Table 3).

Table 3. Annual number of adult bull trout tagged, location and number of radio-tags recovered from all tagged fish, and incidental take observed at the Rocky Reach Project, 2005-2008.

| Year | # of fish tagged | Tags found in Tributaries | Tags found in Project Area | Incidental Take |
|------|------------------|---------------------------|----------------------------|-----------------|
| 2005 | 29               | 4                         | 0                          | 0               |
| 2006 | 25               | 2                         | 0                          | 0               |
| 2007 | 16               | 6                         | 2                          | 0               |
| 2008 | 0                | 4                         | 1                          | 0               |

### **3.1.2 Reasonable and Prudent Measures**

#### RPM 1.

*Develop and implement measures to reduce upstream and downstream passage impediments.*

In 2008, Chelan PUD collected passage data for adult bull trout that moved upstream and downstream past Rocky Reach Dam (Figures 1-2; Tables 5-8, Appendix A). In 2008, no identifiable effects were observed in terms of bull trout migrations to reach spawning areas or to access foraging areas. Of the 8 bull trout migrating upstream using the adult fishway at Rocky Reach Dam in 2008, five fish entered either the Entiat River and remained there over the spawning period (September-October), and two migrated up to Wells Dam where the fish were

not detected passing that dam because telemetry systems were dismantled on June 24. No impediments were observed that precluded fish from passing the Project or entering a tributary. Five fish entered tributaries, the last on 2 July. The latest date of entry into a tributary by any fish was 2 July, months before initiation of the bull trout spawning period in September-October.

## RPM 2.

*(M&E program; 1-4)*

In 2008, Chelan PUD continued the M&E program to: 1) detect adverse effects resulting from the Operations of Rocky Reach Dam and activities associated with the Rocky Reach HCP to 2) assess the actual level of incidental take in comparison with the anticipated incidental take level documented in the biological opinion; 3) detect when the level of anticipated incidental take is exceeded; and 4) determine the effectiveness of reasonable and prudent measures and their implementing terms and condition, and monitor the abundance, distribution, and timing of adult and juvenile bull trout utilizing Rocky Reach Dam and its associated reservoir system.

### **3.1.3 Terms and Conditions**

#### 1. *(Prioritized list of M&E for passage effects).*

Bull trout passage effects were evaluated at Rocky Reach in 2008. A total of 8 upstream and 3 downstream passage events by tagged bull trout occurred at Rocky Reach Dam in 2008. Chelan PUD observed no deleterious effects on tagged bull trout for either up or downstream passage. Of the eight fish that passed upstream of Rocky Reach Dam from Wanapum reservoir (2) and Rock Island reservoir (6), during spawning migrations, five successfully entered the Entiat River and were detected 4.8 km upstream in the Entiat between 28 May and 2 July, 2008, well before the start of the spawning period in September-October (Table 6, Appendix A). Chelan PUD will continue to collect passage data on radio-tagged bull trout through June 2009 to evaluate passage and to assist the USFWS in monitoring its radio-tagged bull trout.

#### 2. *(Prioritized list of M&E for entrainment effects).*

Chelan PUD monitored downstream movement of radio tagged bull trout at Rocky Reach to identify negative effects that may occur (Table 7 and 8, Appendix A). In 2008, tagged bull trout made 3 downstream movements through Rocky Reach Dam. No fish mortality occurred as all three fish have been detected moving about in multiple locations after the downstream passages. No entrainment or “fall back” occurred after any upstream passage event in any year that passage was monitored, 2005-2008. Chelan PUD will continue to monitor turbine and Project passage by radio-tagged bull trout through June 2009 as a coordination effort with the USFWS.

#### 3. *(Develop comprehensive M&E program).*

Chelan PUD implemented the bull trout Monitoring and Evaluation Program in 2005.

This program has been ongoing continuously at Rocky Reach and Rock Island dams from 2005-2008. Incidental Take monitoring was completed in June 2008 with no bull trout “taken by project or reservoir operations in the three-year monitoring period. Chelan PUD will continue to monitor dam passage and reservoir locations for the Rocky Reach Project from June 2008 through June 2009.

#### 4. *(Interim measures)*

Chelan PUD has completed the Interim Measures called for in Term and Condition #4. Work on these measures was reported in the 2004 Interim Measures report by Chelan PUD (Chelan PUD 2004).

### **3.1.4 Conservation Recommendations**

#### 1) *Collaborative process for developing M&E plans.*

Chelan PUD completed this recommendation in 2005 and no work was necessary in years 2006-2008. Chelan PUD developed the Rocky Reach BTMP with numerous agencies and Tribes as part of the Rocky Reach Natural Resources Working Group (NRWG, Bull Trout Technical subgroup). Monitoring and evaluation work set forth in the Rocky Reach BTMP occurred in 2005 through 2008, and will continue through June 2009.

#### 2) *Participate in Recovery Plan*

Chelan PUD is a member of the USFWS Upper Columbia Bull Trout Recovery Team and has participated in all of the USFWS Recovery Plan meetings. One meeting was held in 2008. Chelan PUD will participate in all future meetings when held by the USFWS.

#### 3) *TDG monitoring and TDG abatement*

At Rocky Reach, studies were completed as a part of the relicensing effort that have defined the relationship between spill and TDG levels. From these studies, Chelan PUD has concluded that Rocky Reach can continue to use current operational procedures and, if necessary, apply additional water through the turbines to comply with TDG standards up to the 7Q10 flows. Additionally, Chelan PUD conducted smolt passage studies (passage route and fish survival tests) in 2005-2008 to evaluate effectiveness of the Juvenile Bypass System; studies are on-going to further optimize the use of the bypass system at Rocky Reach to reduce TDG created by fish spill. Operations at Rocky Reach were operated under hourly coordination with other Mid-Columbia Projects to ensure that the greatest system efficiency related to fish passage and spill was realized.

## **3.2 Rock Island Project**

### **3.2.1 Impact Minimization Measures**

#### Juvenile Passage

As with juvenile bull trout passage at Rocky Reach Dam parties to the BTMP at Rock Island agreed that in 2008, a sufficient sample size of sub-adult bull trout is not available at Rock Island Dam, and that sub-adult bull trout are not of adequate size to be radio-tagged with a transmitter having adequate battery life to collect meaningful data. Therefore it is not feasible to assess the effects of Rock Island Dam on passage of juvenile bull trout. Chelan PUD developed a juvenile bull trout PIT-tag program for 2005-2007 to enable passive monitoring of upstream movements by juvenile bull trout, and if possible, monitor incidental take during these movements. This effort involves PIT-tagging juvenile bull trout that are incidentally captured at the Rock Island Dam smolt bypass trap, and at smolt traps and adult broodstock traps on the Wenatchee River

that are operated by, or funded by, Chelan PUD. In 2008, 12 juvenile bull trout were captured in the smolt bypass trap at Rock Island Dam - all were released in good condition with no injuries. Table 4 summarizes all of the juvenile bull trout that have been captured at Rock Island smolt traps and the gate-well bypass trap.

In 2008, 12 sub-adult bull trout were captured and at the Rock Island gate well bypass trap. Washington Department of Fish and Wildlife personnel released these fish in good condition back to the Columbia below the dam. No juvenile bull trout were reported captured in adult broodstock traps in the basin (Chiwawa River, Tumwater Dam, Dryden Dam) in 2005-2008. None detections of a juvenile or sub-adult bull trout carrying a PIT tag have been detected at either Rock Island or Rocky Reach Dam fishways where PIT detections systems are in place (PITAGIS data base, 2008).

Table 4. Number of juvenile bull trout captured and PIT tagged during smolt sampling operations associated with the Rock island Project, and incidental take observed, 2005-2008 (No bull trout were PIT tagged in 2008)

| <b>Location</b>                 | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>Incidental Take</b> |
|---------------------------------|-------------|-------------|-------------|-------------|------------------------|
| RI gate-well bypass trap        | 0           | 5           | 2           | 12          | 0                      |
| Chiwawa R. smolt trap           | 8           | 10          | 10          | 0           | 0                      |
| Peshastin Cr. smolt trap        | 10          | 0           | 0           | 0           | 0                      |
| Upper Wenatchee R. smolt trap   | 0           | 0           | 2           | 0           | 0                      |
| Wenatchee R.,Monitor smolt trap | 0           | 0           | 2           | 0           | 0                      |

As part of the monitoring and evaluation for juvenile bull trout passage in 2008, Chelan PUD captured digital photographs of all sub-adult bull trout that passed Rock Island Dam via the adult fishways during normal fish counting period. These photographs allow for observation and visual assessment of the condition of juvenile bull trout as they migrate upstream past Rock Island dam.

For the 2008 normal counting period 15 April to 14 November, five sub-adult bull trout ascended the Rock Island fishways. Chelan PUD has completed its off-season bull trout counts for four years, (fall 2004- spring 2007 and thus fulfilled the 2004 USFWS Opinion requirement for 1 year of off-season bull trout counting. For the off season period (15 Nov - 10 December; 10 March-April 14) only one bull trout passed Rock Island dam in the fall period of 2005.

Bull Trout Management Plan

Chelan PUD completed the Rock Island Comprehensive Bull Trout Management Plan (Chelan PUD 2005a), dated February 25, 2005, and submitted it to the FERC and USFWS on February 28, 2005. No further action was required in 2008 to complete this plan. This 2009 report is the final submittal to the FERC and USFWS for fulfilling Chelan PUD’s requirement to monitor bull incidental take at for the Rock Island Project from 15 May 2005- 30 June 2008.

### Bull Trout Monitoring and Evaluation Program

Results of bull trout passage and behavior are summarized here from the beginning of the 2008 monitoring period, 1 January to 31 December. We note, however, that some observations from early 2009 may be included within this report (Appendix A) if the observations help to clarify fish behavior or fish locations relevant to movement documented in 2008.

As planned in 2008, no bull trout were tagged, three years of tagging occurred from 2005 through 2007. Instead, movement, behavior and dam passage was monitored for all fish tagged in prior years if battery life remained in their radio transmitters.

Only two radio-tagged fish were observed passage at Rock Island Dam in 2008. Both of these fish moved upstream through a fishway and Rock Island (one through the right bank and one through the left bank fishway); and then continued on to pass upstream of Rocky Reach Dam (one 20-May; one 5-June). One of these two fish, Code 151, was tagged on 18 May 2006 at Rock Island Dam. This fish was tagged in 2006 and monitored for nearly three years continuously; it has passed both upstream and downstream of Rock Island and Rocky Reach dams multiple times without observed injury, mortality or difficulties of any kind. In 2008 after passing upstream past both Rock Island and Rocky Reach, this fish resided in the upper Entiat River during the fall spawning period. After the spawning period, it then exited the Entiat River and re-entered Rocky Reach Reservoir above Rocky Reach Dam. Later in November, this bull trout passed downstream through the powerhouse at Rocky Reach and entered Rock Island Reservoir. It has been since been detected multiple times during mobile surveys moving about freely in Rock Island Reservoir.

### *Identification of Bull trout Core Areas and Local Populations*

To assist the USFWS in identifying the core areas and local populations of bull trout potentially affected by Rock Island Dam, Chelan PUD collected tissue samples from all radio-tagged adult bull trout at Rock Island Dam, 2005-2007. No genetic samples were taken in 2008. All tissue samples collected from bull trout associated with Rock Island Project have been sent to the USFWS Abernathy, WA genetics lab. As of January 2009, no samples have been analyzed from Chelan PUD's bull trout study in 2001-2003 or from those samples submitted in 2005-2007. Chelan PUD will fund genetic analysis of the tissue samples to help determine the tributary origin of these fish if this analysis is ever completed by the USFWS. All tagging and genetic analysis work is completed for the study period, 2005 through 2008.

### *Determine potential for stranding or entrapment of bull trout in Rock Island Reservoir*

This task was completed for Rock Island in 2008 and reported the USFWS and FERC in Chelan PUD's 2008 monitoring report (Chelan PUD 2008). No stranding or entrapment of adult or juvenile bull trout has ever been observed in Rock Island Reservoir. Due to very minor reservoir drafts for very short durations, the likelihood a trapping or stranding event is very low to none. All backwater areas in the Rock Island Reservoir remain watered and contain a channel outlet, at all reservoir elevations that occur at Rock Island.

### Adult Passage Monitoring

1) Chelan PUD conducted normal, in-season fishway counts for bull trout in 2008 from 14 April through 14 November at Rock Island. A total of 36 bull trout ascended the three fishways collectively in 2008, with 20 ascending the left fishway, one the center fishway, and 15 the right fishway (Appendix A, Table 1). Digital photographs of each fish, showing the timing of each passage, have been stored and are available for review by the USFWS.

2) In 2008, Chelan PUD maintained the adult fishways at Rock Island Dam in accordance with current anadromous fish criteria. All three fishways at Rock Island underwent annual service and maintenance on a rotating schedule between 1 January and 2 March, 2008. During this period, ladders were dewatered and serviced one at a time in rotation, while the other two ladders remained in operation. Fish passage is always available at Rock Island through at least two ladders during the fishway maintenance period. This maintenance rotation is utilized each year during while service is performed on the three Rock Island Dam fishways.

3) In 2008, Chelan PUD compiled hourly project operations data to conduct an analysis intended to evaluate whether trends in upstream bull trout passage at Rock Island Dam correlates with hourly or daily reservoir operations. Hourly, daily, and annual fishway passage data for bull trout is shown in Appendix A (Figures 2; Table 3-4). Bull trout were observed passing all through the day, and although more fish pass in the afternoon and evening hours, there does not appear to be a correlation between diel or seasonal passage, and any specific project operation at Rock Island Dam.

### Participation in USFWS Recovery Plan

Chelan PUD is a member of the USFWS Upper Columbia Bull Trout Recovery Team and has participated in all of the USFWS Recovery Plan meetings for the Mid-Columbia. Chelan PUD attended the USFWS 5-year Bull Trout Status Review meeting in Wenatchee, WA in July 2008. No other meetings were held.

### Tributary Habitat Enhancement

*(Consider collecting and hauling LWD)*

In 2006-2008 Chelan PUD collected wood debris from accumulations brought down river to Rock Island and Rocky Reach Dams from high flow events in tributaries. Large woody debris (LWD) pieces are still available for the HCP Tributary Committees (Wells, Rocky Reach, and Rock Island) use when LWD projects are implemented.

### Incidental Take Permit

#### Incidental Take Monitoring and Incidental Take Calculation

In 2008, no incidental take was observed for any upstream or downstream passage routes at Rock Island Dam, or during any reservoir operation for the Project. For the full three-year monitoring period from May 2005 through June 2008, ***no incidental take was observed*** at the dam or within Rocky Island Reservoir as a result of dam passage or reservoir operations. Only one transmitter was recovered in Rock Island Reservoir (2007) over the course of the three-year monitoring period (Table 5). No sign of any carcass was found with the 2007 transmitters so the tag could

have been shed by a fish that was alive. This is known to occur, especially with radio-transmitters that remain in the fish for long periods of time, and through the spawning period.

Table 5. Annual number of adult bull trout tagged, location and number of radio-tag recoveries from all tagged fish, and incidental take events observed at the Rock Island Project, 2005-2008.

| Year | Number of Fish tagged | Tags found in tributaries | Tags found In Project Area | Incidental Take |
|------|-----------------------|---------------------------|----------------------------|-----------------|
| 2005 | 8                     | 3                         | 0                          | 0               |
| 2006 | 4                     | 1                         | 0                          | 0               |
| 2007 | 3                     | 2                         | 1                          | 0               |
| 2008 | 0                     | 1                         | 0                          | 0               |

### ***3.2.2 Reasonable and Prudent Measures***

#### **RPM 1.**

In 2008, Chelan PUD collected passage data for adult bull trout that moved upstream and past Rock Island Dam. No tagged fish moved downstream of Rock Island in 2008. Fishway passage times and migration metrics at Rock Island Dam are shown in Table 4 and Table 5 of Appendix A. No impediments were observed that precluded bull trout from passing the Rock Island Project or finding and entering a tributary after passing the dam. The two fish that passed Rock Island in 2008 entered the Wenatchee River before initiation of the bull trout spawning period in September-October.

#### **RPM 2.**

*(M&E program; 1-4)*

Chelan PUD continued to monitor bull trout under the M&E program in 2008 to: 1) detect adverse effects resulting from the operations of Rock Island Dam and activities associated with the Rock Island HCP; 2) to assess the actual level of incidental take in comparison with the anticipated incidental take level issued in the USFWS biological opinion; 3) detect when the level of anticipated incidental take is exceeded; and 4) determine the effectiveness of reasonable and prudent measures and their implementing terms and condition, and monitor the abundance, distribution and timing of adult and juvenile bull trout utilizing Rock Island Dam and its associated reservoir system. The monitoring and evaluation plans contained in the Rock Island BTMP, and reported on here, are designed to address the measures above.

### ***3.2.3 Terms and Conditions***

#### ***1. (Prioritized list of M&E for passage effects).***

Chelan PUD completed the Rock Island Bull Trout Management Plan (Chelan PUD 2005b), on February 25, 2005, and submitted it to FERC and USFWS on February 28, 2005. The BTMP was implemented for a fourth year in 2008. Dam passage monitoring and reservoir tracking will continue for fish that have active tags through June 2009.



2. (Prioritized list of M&E for entrainment effects).

Chelan PUD monitored all volitional downstream movement by radio-tagged bull trout and “entrainment” of bull trout through turbines at Rock Island to identify potential negative effects that could occur. In 2008, no bull trout moved downstream of Rock Island Dam, therefore no volitional downstream passage or entrainment through turbines occurred. For the three years 2005-2008 at Rock Island, no “entrainment” (where fish migrate up stream through the fishway and then are entrained immediately downstream through the powerhouse) occurred. Table 6 shows the number of downstream passages made by radio-tagged adult bull trout, for all routes, in years 2005-2008.

Table 6. Summary of downstream passages made by tagged adult bull trout through each passage route at Rock Island Dam, 2005-2008. No incidental take was observed for any downstream passage.

| Year | Turbine | Spillway | PH 2 Gatewell<br>Juvenile<br>Collection Trap | Unknown | Incidental<br>Take |
|------|---------|----------|--|---------|--------------------|
| 2005 | 2       | 0        | 0  | 0       | 0                  |
| 2006 | 2       | 0        | 0  | 1       | 0                  |
| 2007 | 0       | 1        | 0  | 3       | 0                  |
| 2008 | 0       | 0        | 0  | 0       | 0                  |

3. (Develop comprehensive M&E program).

The Rock Island Comprehensive BTMP has been implemented at the Rock Island Project for four years, 2005-2008. Measures contained in the Rock Island BTMP will continue through June 2009. Incidental Take monitoring is completed for the three year period June 2005 through June 2008. No Incidental Take has been identified for fish passing upstream through fishways or downstream through powerhouse turbines. From July 2008 through June 2009, Chelan PUD will continue to conduct bull trout passage monitoring at the dams and tracking for those fish with operating radio tags to assist USFWS bull trout coordination

**3.2.4 Conservation Recommendations**

1. (Collaborative process for developing M&E plans).

The Rock Island BTMP (M&E Plan) was completed under a collaborative process in 2005. No work was required to develop the plans in 2008.

2. (Participate in Recovery Plan).

Chelan PUD attended a 5-year ESA Status Review for bull trout that was held by the USFWS in July 2008. Chelan PUD remains a member of the recovery plan team and will participate in future meetings when the USFWS reconvenes its recovery planning.

3. *(M&E for Total Dissolved Gas, TDG)*

Chelan PUD utilized 3 new and 6 existing specialized spill gates in 2008 at Rock Island to reduce TDG created by fish spill. These structures are designed to reduce TDG uptake from spill water, and provide the same level of fish passage attraction and passage survival as the overflow spill gates. The spillway survival for yearling Chinook salmon, sockeye salmon, and steelhead trout smolts in 2008 was approximately 100 percent during a 40-day juvenile survival study at Rock Island Dam. We expect the same high survival for bull trout passing through the spillways also.

## ***SECTION 4: CONCLUSIONS***

Based on the data collected through 31 December, 2008, we report the following conclusions for bull trout monitoring at Rocky Reach and Rock Island dams and reservoirs:

1. As planned in 2008, no bull trout were radio-tagged at Rocky Reach Dam or Rock Island Dams. Chelan PUD monitored fish locations and dam passage events for all previously tagged fish at both Projects in 2008. Between April 14 and November 14, 2008, 104 bull trout (eight tagged; 96 untagged) utilized the adult ladder to successfully pass Rocky Reach dam, and 36 bull trout (two tagged; 24 untagged) utilized the three fish ladders at Rock Island Dam to successfully pass the Project. Digital photos of each bull trout passing the counting window at the top of each fishway verified that each fish was in good condition and successfully exited the top of each fishway.
2. During the 2008 telemetry monitoring period from 1 January – 31 December, 32 tagged bull trout were detected. For both Projects combined, 13 tagged bull trout were responsible for 13 total passage events: Of those, 11 passage events occurred at Rocky Reach Dam, and two at Rock Island Dam. No mortality occurred during these dam passage events or reservoir operations in 2008.
3. Tagged bull trout made 10 upstream passages and three downstream passages in 2008. Eight fish migrated upstream through Rocky Reach Dam and two moved upstream through Rock Island Dam. Three fish moved downstream of Rocky Reach through turbine units after exiting the Entiat Basin in November-December 2008, following the spawning period. All three fish were tracked and detected in Rock Island Reservoir the day following their downstream turbine passage and on multiple surveys later in the year, verifying their continued survival.
4. A total of eight radio-tags were recovered in the 2008 during the monitoring period - none were from fish that had passed either upstream of downstream of Rocky Reach or Rock Island in 2008. No carcasses were recovered with the tags. Of these transmitters, five were recovered in the Upper Entiat River, one in the Methow River, one in the Peshastin Creek (Wenatchee R. Basin), and one in the Columbia River.
5. Of the 86 bull trout tagged at Rocky Reach and Rock Island dams through the 2005- 2007 study period, 30 tags have been recovered leaving a total of 56 radio-tags at large within the Columbia River, or within the Wenatchee, Entiat, or Methow rivers. Of all tags recovered 2005-2008, 80% (24) were recovered in tributaries, 6.6% (2) in Rocky Reach Reservoir, 3.3% (1) in Rock Island Reservoir Columbia, and 6.6% (2) in reservoirs downstream of Rock Island (one in Wanapum reservoir; one in Priest Rapids Reservoir).
6. During monitoring at both Rocky Reach and Rock Island dams from 2005-2008, no fall back or undesired “entrainment” appeared to have occurred at Rocky Reach or Rock Island after fish moved upstream through the fishways and entered the forebay.

7. Analyses on three years of reservoir elevation data (2005-2007), review existing backwater areas available at observed max/min forebay elevations, and three years of radio tracking data for tagged bull trout, showed that bull trout can neither be trapped or stranded in any back backwater areas within Rocky Reach and Rock Island reservoirs. No radio-tagged bull trout were ever found in backwater areas during more than 120 mobile tracking surveys over six year period, 2001-2003, and 2005-2008.
8. No incidental take was observed to occur at either Rock Island or Rocky Reach dams for any upstream or downstream passage route or within either reservoir during the 2005-2008 monitoring period (Tables 1-4).
9. No bull trout were injured or killed during predator control programs (pikeminnow) at the Rock Island or Rocky Projects during the 2005-2008 monitoring periods.

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***APPENDIX A:***

***MOVEMENT OF RADIO-TAGGED BULL TROUT THROUGH ROCKY REACH  
AND ROCK ISLAND DAMS AND RESERVOIRS, 2008***







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**MOVEMENTS OF RADIO-TAGGED BULL TROUT THROUGH ROCKY REACH AND ROCK ISLAND  
DAMS AND RESERVOIRS: 2008**

*Submitted To:*  
**Steve Hemstrom**  
**Chelan County Public Utility District**  
**327 N. Wenatchee Ave.**  
**Wenatchee, WA 98801**



*Prepared by:*  
**John R. Stevenson**  
**Dennis J. Snyder**  
*and*  
**Steve J. Mallas**

**BioAnalysts, Inc.**  
**16541 Redmond Way, #339**  
**Redmond, WA 98052**

**March 24, 2009**



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## **Executive Summary**

The relicensing process for the Rocky Reach Hydroelectric Project brought fisheries agencies, tribes, and interested parties together in a Natural Resources Working Group (NRWG) that provided opportunities for comprehensive review of current and future management priorities for fish resources potentially impacted by project operations. The NRWG was established to identify issues, develop study plans, review study reports, and develop long-term management plans for fish and wildlife species. As such, Chelan PUD, in conjunction with the NRWG, developed Comprehensive Bull Trout Management Plans (BTMP) for both Rock Island and Rocky Reach dams.

The goal of the BTMPs is to identify, develop, and implement measures to monitor and address ongoing impacts on bull trout resulting from project operations and facilities in a manner consistent with the U.S. Fish and Wildlife Service (USFWS) Biological Opinions issued in May 2004 for the Anadromous Fish Agreements and Habitat Conservation Plans (HCP) at Rocky Reach and Rock Island dams. The BTMPs are also consistent with subsequent agreements, such as the February 2009 Settlement Agreement (SA) on Rocky Reach's proposed new Federal Energy Regulatory Commission (FERC) license; and with tasks outlined in the USFWS draft bull trout recovery plan for the Upper Columbia River Recovery Unit. The BTMP measures are designed specifically to meet the following objectives: 1) monitor incidental take associated with Project dams and reservoirs; 2) identify and address any negative, ongoing, project-related impacts on adult bull trout passage; 3) investigate potential project-related impacts on upstream and downstream passage of sub-adult bull trout through Rock Island and Rocky Reach dams and reservoirs; and 4) investigate the potential for sub-adult entrapment or stranding in off-channel or backwater areas of Rock Island and Rocky Reach reservoirs as a result of project operations. This study was developed to address the first objective of the BTMPs and has been ongoing continuously since 2005.

During the period 14 April to 15 November 2008, a total of 104 bull trout were observed ascending the Rocky Reach Dam fishway. At Rock Island Dam, a total of 36 bull trout ascended the three separate fishways. Consistent with the original study design, no bull trout were tagged during the 2008 study period. Instead, fish tagged during the 2005-2007 study periods were monitored and provided data on survival and various metrics of passage at Rocky Reach and Rock Island dams. During the first three years of study, a total of 86 bull trout were tagged, with 38, 29, and 19 fish tagged in 2005, 2006, and 2007, respectively. Furthermore, of those 86 bull trout, 15 were tagged and released at Rock Island Dam and 71 at Rocky Reach Dam. All fish were tagged with radio transmitters having a two-year battery life expectancy.

Of the 86 bull trout tagged during the period of 2005 to 2007, a total of 32 tagged fish were detected during the 2008 period. Consistent with the previous years of bull trout study, we assessed bull trout migration rates past both dams. In sum, migration rates in 2008 were based on two upstream passage events at Rock Island Dam and eight upstream passage events at Rocky Reach Dam. For the Rock Island fish, median Project Migration rate was 0.43 days, which was the only migration metric that could be estimated at Rock Island Dam in 2008. At Rocky Reach

Dam, the median Tailrace, Cycling, Fishway, and Project Migration rates were 0.14, 4.45, 0.32, and 3.53 days, respectively.

In addition to passage rates at Rocky Reach and Rock Island dams, we assessed in-river migration rates between projects and between projects and various tributaries. For the two fish that migrated upstream of Rock Island Dam, both passed Rocky Reach Dam. Their median migration time between dams was 2.35 days. Of the eight tagged trout that migrated upstream of Rocky Reach Dam (including the two from Rock Island Dam), five entered the Entiat River. Their median migration rate from Rocky Reach to the Entiat River site (RK 4.8) was 10.95 days.

During the 2008 study period, eight bull trout were responsible for a total of 13 passage events, with 11 occurring at Rocky Reach Dam and two at Rock Island Dam. Of those passage events, ten were the result of fish migrating upstream through the fishways and three were the result of fish passing downstream through a spillway, turbine unit, or fish bypass system. All three of the downstream passage events occurred at Rocky Reach Dam and all were through the powerhouse; one through turbine Unit 4, another through turbine Unit 3, and the third through an unspecified turbine unit. Subsequent detections of each of these three fish verified that no mortality occurred during passage at the dams or as a result of reservoir operations.

A total of eight transmitters were recovered in 2008. Of those, seven were recovered with no carcass present and one was recovered in the vicinity of a badly decomposed carcass. It is unknown if the carcass was a bull trout. Of the eight transmitters recovered, five were in the Entiat River, one in the Columbia River, one in the Methow River, and one in Peshastin Creek. None of the recovered transmitters were from fish that had migrated past Rocky Reach or Rock Island dams in 2008.





## 1.0 Introduction

Bull trout were coterminously listed as threatened under the ESA on 1 November 1999 (64 FR 58910). Because these fish can be affected by the operation of hydro-projects owned and operated by Chelan, Douglas, and Grant PUDs (Mid-Columbia PUDs), the Mid-Columbia PUDs initiated a radiotelemetry study in 2001 to assess the potential effects of their projects on bull trout passage. Radio tags were inserted into adult-sized bull trout collected at three Mid-Columbia River dams. These fish were tracked to describe their movements and migration patterns within the mid-Columbia basin. As part of the study, a total of 79 bull trout were tagged in 2001 and 2002, with 15 fish tagged at Rock Island Dam, 45 at Rocky Reach, and 19 at Wells Dam. About half of the fish were released upstream of the dam where they were captured, while the other half were released downstream of the respective dam. The radiotelemetry study identified no adverse effects on movement or survival of tagged bull trout (BioAnalysts 2002 and 2004). Furthermore, there were no documented cases of tagged bull trout being injured during upstream or downstream passage through Rock Island or Rocky Reach dams.

During the period of study, Chelan PUD began baseline work to initiate the federal relicensing process for Rocky Reach Dam. The relicensing process for the Rocky Reach Hydroelectric Project brought fisheries agencies, tribes, and interested parties together in a Natural Resources Working Group (NRWG) that provided opportunities for comprehensive review of current and future management priorities for fish resources potentially impacted by project operations. The NRWG was established to identify issues, develop study plans, review study reports, and develop long-term management plans for fish and wildlife species. As such, Chelan PUD, in conjunction with the NRWG, developed Comprehensive Bull Trout Management Plans (BTMP) for both Rock Island and Rocky Reach dams.

The goal of the BTMPs is to identify, develop, and implement measures to monitor and address ongoing impacts on bull trout resulting from project operations and facilities in a manner consistent with the U.S. Fish and Wildlife Service (USFWS) Biological Opinions, issued in May 2004 and February 2009; and the USFWS draft bull trout recovery plan for the Upper Columbia River Recovery Unit. The BTMP measures are designed specifically to meet the following objectives: 1) monitor incidental take associated with project dams and reservoirs; 2) identify and address any negative ongoing project-related impacts on adult bull trout passage; 3) investigate potential project-related impacts on upstream and downstream passage of sub-adult bull trout through Rock Island and Rocky Reach dams and reservoirs; and 4) investigate the potential for sub-adult entrapment or stranding in off-channel or backwater areas of Rock Island and Rocky Reach reservoirs as a result of project operations. This study was developed to address the first objective of the BTMPs and has been ongoing since 2005.

Although this was the fourth year of a multi-year study, we only summarize results for the fourth year, 1 January 2008 to 31 December 2008. Some information collected after December 2008 is presented to clarify behavior observations. A final report in 2009 will summarize results for bull trout monitoring through June of 2009.

## ***1.1 Study Objectives***

Specific objectives of the field studies were to:

- Assess mortality of tagged bull trout that migrate upstream or downstream through Rock Island and Rocky Reach dams, identified by the location of passage (i.e., the adult fishway, the powerhouse, spillway, or juvenile bypass facility).
- If mortality is identified, consult with the USFWS to determine if the cause of mortality was associated with the operation of the Projects.
- Describe the movements and migrations of bull trout at Rocky Reach and Rock Island dams and within their reservoirs.

## ***1.2 Study Area***

For this project, the primary study area encompassed the mainstem Columbia River from a point 1,000 feet downstream of Rock Island Dam to a point 1,000 feet downstream of Wells Dam. This corresponds to the reach of Columbia River in which Chelan PUD is required to measure the incidental take of bull trout. On occasion, we also tracked fish outside the primary study area to confirm fish movement, locations, and behavior. Fish locations outside the primary study area include:

- The stretch of Columbia River from a point 1,000 feet downstream of Rock Island Dam to the southern tip of Quilomene Island (RK 693.8).
- From the southern tip of Quilomene Island to the Ringold Hatchery (RK 571.3).
- Wells Dam tailrace and forebay (data were provided by Douglas PUD).
- The Wenatchee River, Peshastin Creek, and Icicle Creek.
- The Entiat (from its confluence to Entiat Falls) and Mad (from its confluence to Maverick Saddle) rivers.
- The Methow River (from its confluence to about Methow Pass), Wolf Creek, Early Winters Creek, Lost River, Twisp River, Chewuch River, Lake Creek, and Robinson Creek.

Consistent with the study design, mobile surveys outside the primary study area were not performed on a regular basis. These areas were only surveyed if a tagged fish had not been detected for some time in the primary sampling area and it was suspected to be in a particular stream. Also, as part of our effort to coordinate studies between the USFWS and PUDs, we surveyed the Methow and Entiat basins to assist the USFWS with the monitoring of their tagged bull trout. Various study tasks and telemetry data have been routinely shared between Chelan PUD, the USFWS, and Douglas PUD.

### **1.3 2008 Bull Trout Migration**

During the period 14 April to 15 November 2008, a total of 104 bull trout were observed ascending the Rocky Reach Dam fishway. At Rock Island Dam, a total of 36 bull trout ascended the fishways; 20 ascended the left bank fishway, one the center, and 15 the right bank fishway (Chelan PUD, unpublished data). Figure 1 summarizes the daily and cumulative passage of bull trout at the two projects and Figure 2 summarizes the diel passage of bull trout at both dams.

In 2008, bull trout passage at Rocky Reach Dam was the second lowest observed during any year for the period 2000 to 2008, but increased 33% from the low observed in 2007. At Rock Island Dam, bull trout passage was down 20% from 2007, but was greater than the lowest passage observed in 2006. Although bull trout numbers passing the projects in 2008 were generally lower than previous years, passage in 2008 was within the annual range of variability observed since bull trout counts at the dams first began (Table 1 and Figure 3).

## **2.0 Methods**

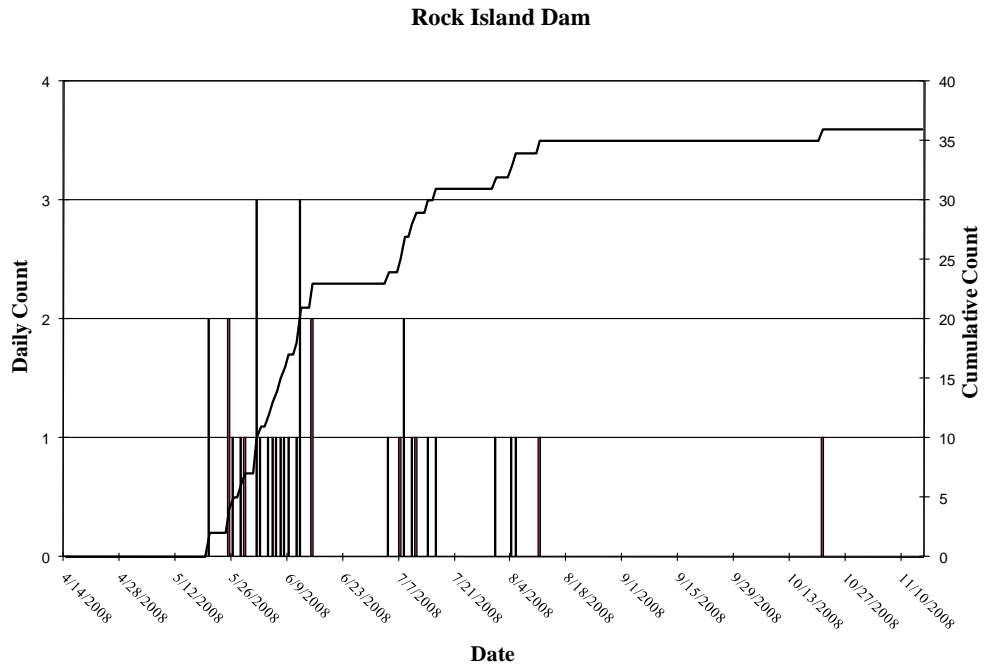
Methods used in 2008 to monitor bull trout were consistent with those used during the 2001-2003 and 2005-2007 study periods. While no bull trout were tagged in 2008, bull trout tagged during the period of 2005 to 2007 were monitored to provide various metrics of passage. For those fish, methods used to capture, handle, tag, release, and monitor bull trout were consistent from year to year (BioAnalysts 2002 and 2004; and Stevenson et al. 2006, 2007, and 2008). The only notable differences between the early and later study periods involved release locations. During the 2001-2003 study period, fish were released both upstream and downstream of Rocky Reach and Rock Island dams. Only upstream releases were made in 2005-2007. At Rocky Reach Dam, the release site was located about 2.3 km upstream of the dam near the west shore (Figure 4). At Rock Island Dam in 2006 and 2007, we moved the release location about 2.6 km upstream of the dam near the east shore (Figure 5). This modification was implemented to allow fish to recover from anesthesia and surgery upstream of forebay flows. This site was about 1.6 km further upstream than the previous release site.

Telemetry methods used to monitor tagged fish in 2008 were identical to previous studies. Tailraces at both Rocky Reach and Rock Island dams were monitored with aerial telemetry systems. All ladder entrances at the dams were monitored with underwater antennas. Underwater antennas also monitored various critical locations within each fishway. A series of underwater antennas monitored the weirs leading to the fishway exits as well as the exits themselves. To assess downstream movement of bull trout, all turbine intakes, spillbays, and fish bypass structures were monitored with underwater antennas.

As in previous studies, we monitored the Wenatchee and Entiat rivers with aerial systems at RK 12.5 and RK 4.8, respectively.

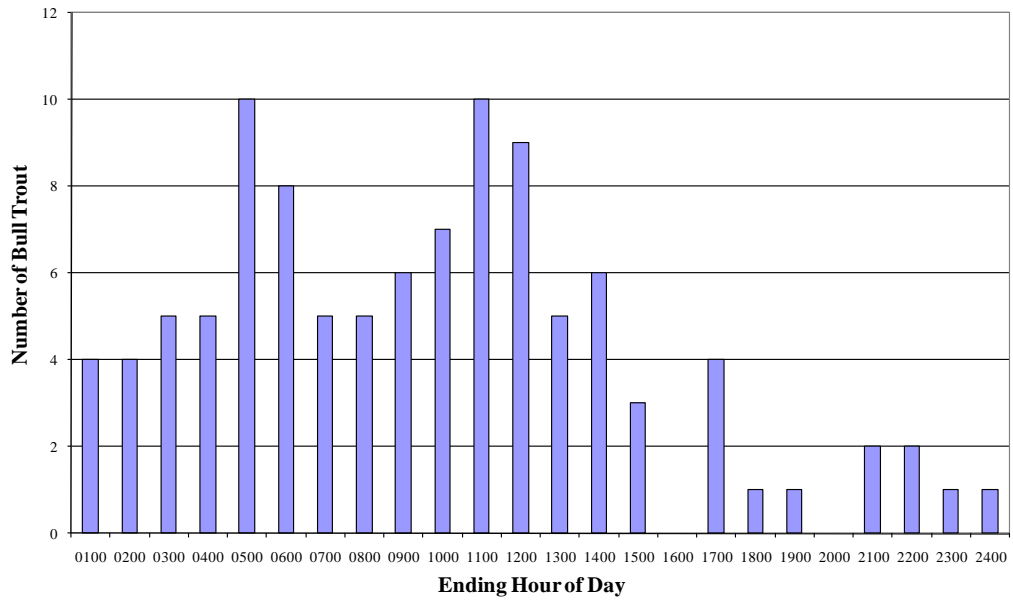
In addition to the fixed-telemetry sites identified above, we conducted aerial and boat surveys on a bi-weekly basis, alternating methods for each survey. For a detailed description of the telemetry systems used, as well as the mobile surveys, see BioAnalysts (2002 and 2004).

To assess potential mortality of bull trout that passed either Rock Island or Rocky Reach Dam, we used a number of tools and techniques developed specifically for this project. Mobile survey data were processed through a program developed by the University of Washington to determine the distance traveled by individual fish between surveys. If the distance was less than 400 m, the detection history of that fish was reviewed. If the fish in question had passed either upstream or downstream of Rock Island or Rocky Reach dams, then an attempt was made to either recover the fish, the transmitter, or verify that the fish was alive. Recovery of fish in the Columbia River relied on Scuba diving, while recovery within tributaries relied either on snorkeling or wading.

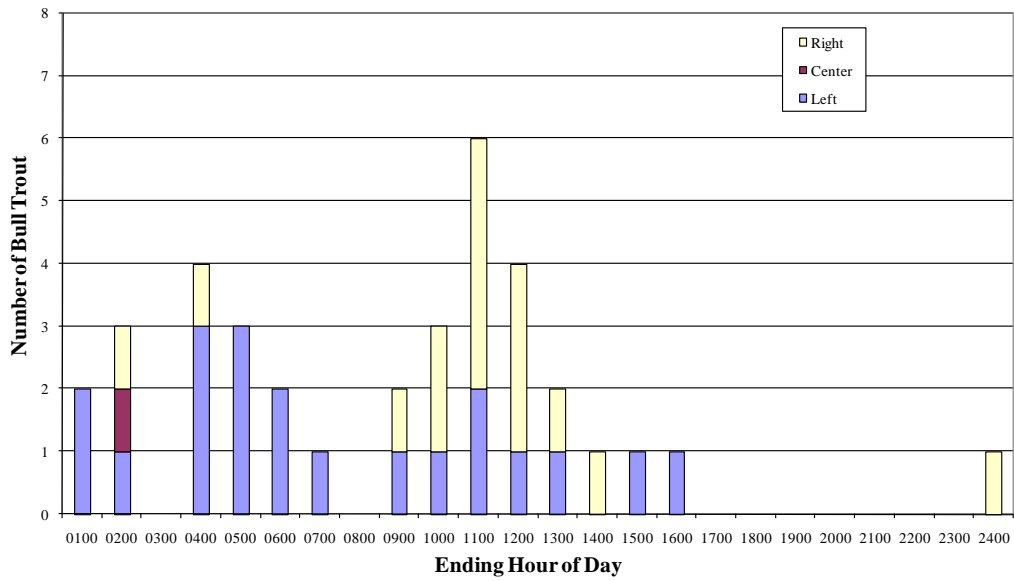


**Figure 2.** Daily and cumulative bull trout counts at Rocky Reach and Rock Island dams during the period of 14 April to 15 November 2008.

### Rocky Reach Dam



### Rock Island Dam

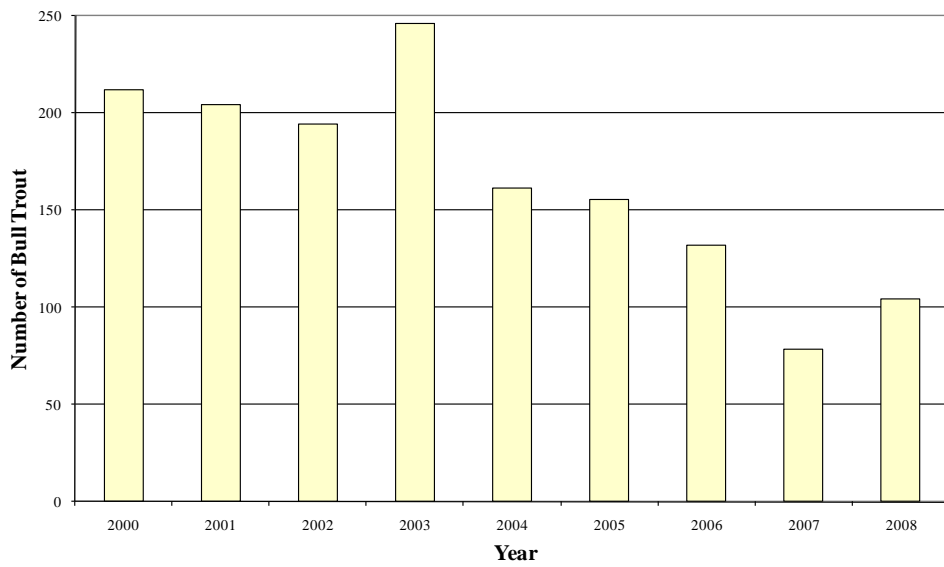


**Figure 3.** Diel timing of bull trout passage at Rocky Reach and Rock Island dams during the period of 14 April to 15 November 2008.

Table 1. Annual bull trout passage at Rocky Reach and Rock Island dams during the period of 14 April to 14 November 2000-2007. Bull trout passage in 2008 was for the period of 14 April to 15 November.

| <b>Year</b> | <b>Rock Island</b> |               |              | <b>Rock Island Total</b> | <b>Rocky Reach Total</b> |
|-------------|--------------------|---------------|--------------|--------------------------|--------------------------|
|             | <b>Left</b>        | <b>Center</b> | <b>Right</b> |                          |                          |
| 2000        | 45                 | 3             | 40           | 88                       | 212                      |
| 2001        | 42                 | 1             | 39           | 82                       | 204                      |
| 2002        | 41                 | 2             | 41           | 84                       | 194                      |
| 2003        | 34                 | 6             | 62           | 102                      | 246                      |
| 2004        | 47                 | 8             | 59           | 114                      | 161                      |
| 2005        | 27                 | 5             | 34           | 66                       | 155                      |
| 2006        | 20                 | 1             | 14           | 35                       | 132                      |
| 2007        | 24                 | 0             | 21           | 45                       | 78                       |
| 2008        | 20                 | 1             | 15           | 36                       | 104                      |

### Rocky Reach



### Rock Island

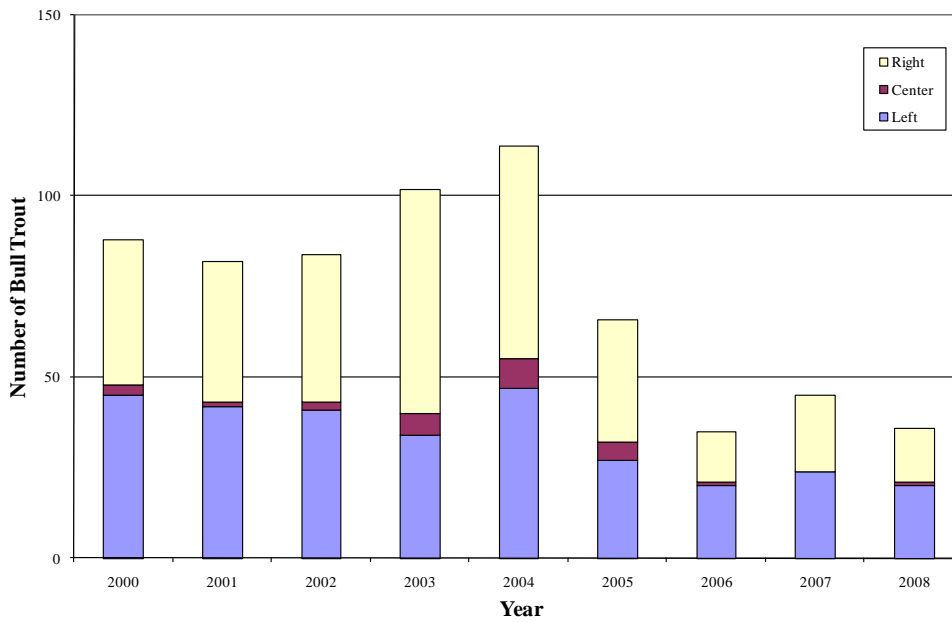
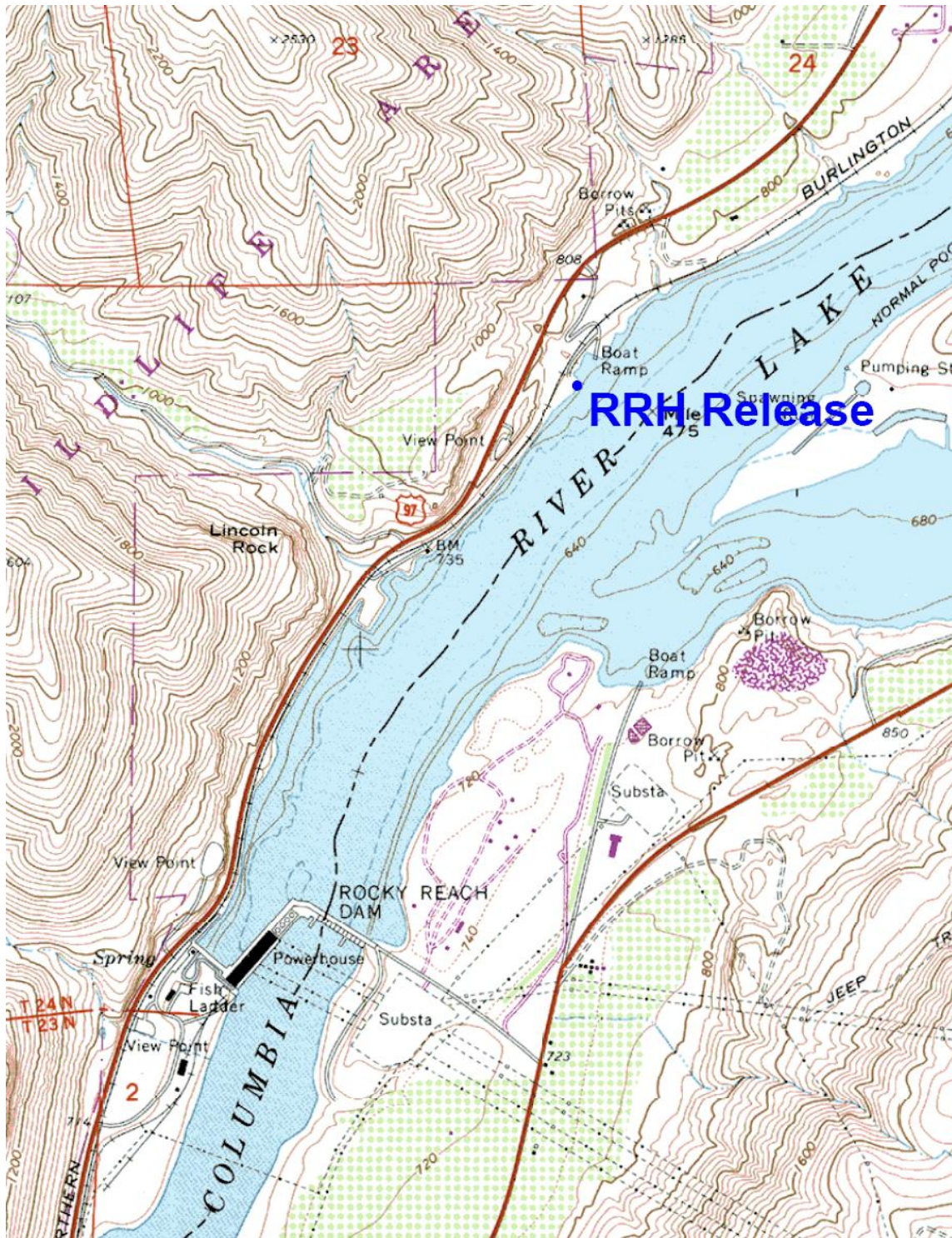
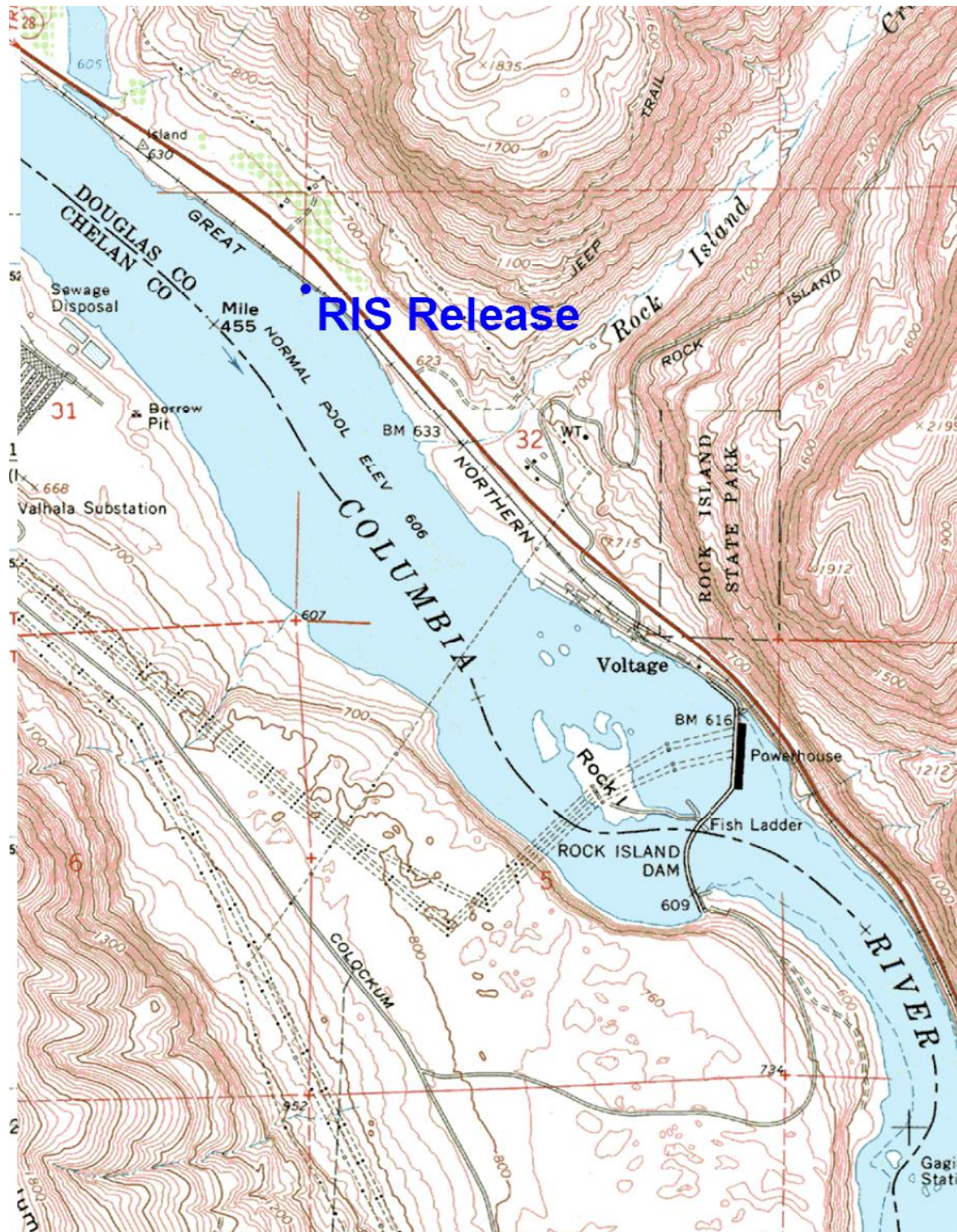


Figure 4. Annual bull trout passage at Rocky Reach and Rock Island dams during the period of 14 April to 14 November 2000-2007. Bull trout passage in 2008 was for the period of 14 April to 15 November.





**Figure 5.** Release location for bull trout upstream of Rocky Reach Dam during the 2005 to 2007 study period.



**Figure 6.** Release location for bull trout upstream of Rock Island Dam during the 2005 to 2007 study period.

## **3.0 Results and Discussion**

### ***3.1 Trapping and Tagging Activities***

As discussed previously, no bull trout were tagged in 2008. Instead, fish tagged during the period of 2005 to 2007 and still alive with active transmitters were monitored to assess survival and provide metrics of passage at Rock Island and Rocky Reach dams. During the 2008 study period, a total of 32 fish were detected. Of those fish, two were tagged in 2005, 13 in 2006, and 17 in 2007. Furthermore, of the fish detected in 2008, three were tagged and released at Rock Island Dam and the other 29 fish were tagged and released at Rocky Reach Dam (Table 2).

Since no bull trout were tagged in 2008, we will not present data for all of the fish tagged during the period of 2005 to 2007. Instead, we refer the reader to Stevenson et al. (2006, 2007, and 2008). However, the following is a brief overview of the tagging strategies employed. We considered two, size-related variables when selecting fish for tagging. The first related to the relative weight of the transmitter compared to the weight of the fish (as weighed in air). To minimize potential impacts associated with surgical implantation of a transmitter into the body of a fish, we used the 2% criterion developed by Winter (1983). Following this criterion, it was possible to tag fish as small as 320 g. This was not an issue, however, because the smallest trout tagged was 910.0 g. The second variable considered was fish length. Based on previous years of study, we have observed that fish less than 40 cm in length (fork measurement) do not appear to adequately accommodate the transmitters used in this study, even though these smaller fish may meet the 2% criterion of Winter (1983). We therefore limited the size of fish to be tagged to 40 cm or larger. During the years of tagging, the smallest fish tagged measured 40.0 cm in length.

### ***3.2 Transport and Release***

Transport and release protocols were similar to those used in previous years (see BioAnalysts 2002, 2004, and Stevenson et al. 2006 for details).

**Table 2.** Summary of bull trout winter residence for fish detected during the 2008 study period. Winter residence is defined as the tributary that each tagged fish entered without subsequent entry into another tributary of the Columbia River. RRH = Rocky Reach Dam; RIS = Rock Island Dam.

| Code             | Tagging Location | Release Date/Time | Length (cm) | Weight (g) | Location of 2008 Winter Residence |              |
|------------------|------------------|-------------------|-------------|------------|-----------------------------------|--------------|
|                  |                  |                   |             |            | Basin                             | River        |
| 29 <sup>1</sup>  | RRH              | 5/30/2005 18:28   | 53.5        | 1,853.0    | Columbia                          | Columbia     |
| 38               | RRH              | 6/7/2005 16:32    | 49.5        | 1,384.0    | Entiat                            | Entiat       |
| 102              | RIS              | 6/12/2007 16:16   | 40.0        | 910.0      | Columbia                          | Columbia     |
| 103 <sup>2</sup> | RIS              | 6/13/2007 10:16   | 49.5        | 1,367.0    | ---                               | ---          |
| 111 <sup>2</sup> | RRH              | 5/16/2007 16:18   | 59.0        | 2,576.0    | Methow                            | Methow       |
| 112 <sup>3</sup> | RRH              | 5/17/2007 15:56   | 64.0        | 3,897.0    | Columbia                          | Columbia     |
| 113              | RRH              | 5/18/2007 11:09   | 55.0        | 2,114.0    | Entiat                            | Mad          |
| 114              | RRH              | 5/21/2007 17:17   | 69.0        | 4,006.0    | Entiat                            | Upper Entiat |
| 116 <sup>3</sup> | RRH              | 5/29/2007 13:02   | 65.0        | 3,547.0    | Columbia                          | Columbia     |
| 117              | RRH              | 5/29/2007 15:25   | 71.0        | 4,422.0    | Entiat                            | Upper Entiat |
| 118              | RRH              | 6/1/2007 9:31     | 61.5        | 2,619.0    | Entiat                            | Upper Entiat |
| 119 <sup>2</sup> | RRH              | 6/4/2007 15:36    | 61.5        | 3,005.0    | ---                               | ---          |
| 120              | RRH              | 6/4/2007 18:29    | 61.0        | 2,579.5    | Entiat                            | Upper Entiat |
| 121              | RRH              | 6/12/2007 9:54    | 61.5        | 2,423.0    | Entiat                            | Mad          |
| 122              | RRH              | 6/12/2007 11:32   | 50.0        | 1,641.5    | Entiat                            | Entiat       |
| 123              | RRH              | 6/12/2007 13:26   | 43.0        | 1,128.0    | Entiat                            | Upper Entiat |
| 124              | RRH              | 6/13/2007 12:55   | 58.5        | 2,680.0    | Entiat                            | Upper Entiat |
| 125 <sup>3</sup> | RRH              | 6/19/2007 13:12   | 55.0        | 2,165.0    | Entiat                            | Upper Entiat |
| 126 <sup>3</sup> | RRH              | 6/19/2007 15:27   | 60.0        | 2,979.0    | Columbia                          | Columbia     |
| 151              | RIS              | 5/18/2006 10:20   | 57.0        | 2,299.5    | Entiat                            | Upper Entiat |
| 166              | RRH              | 5/17/2006 10:22   | 64.5        | 3,392.0    | Entiat                            | Upper Entiat |
| 167              | RRH              | 5/17/2006 12:43   | 72.0        | 4,162.5    | Entiat                            | Upper Entiat |
| 168 <sup>2</sup> | RRH              | 5/25/2006 15:25   | 70.0        | 4,167.0    | ---                               | ---          |
| 169 <sup>2</sup> | RRH              | 5/25/2006 15:26   | 59.0        | 2,736.0    | ---                               | ---          |
| 174              | RRH              | 5/26/2006 13:49   | 58.5        | 2,752.0    | Columbia                          | Columbia     |
| 175 <sup>3</sup> | RRH              | 5/26/2006 15:03   | 59.0        | 2,632.0    | Columbia                          | Columbia     |
| 178 <sup>2</sup> | RRH              | 5/30/2006 13:36   | 52.5        | 1,674.5    | Entiat                            | Upper Entiat |
| 179 <sup>2</sup> | RRH              | 5/30/2006 14:53   | 60.0        | 2,481.5    | Entiat                            | Upper Entiat |
| 181 <sup>4</sup> | RRH              | 6/1/2006 11:19    | 53.5        | 1,864.0    | Wenatchee                         | Wenatchee    |
| 183 <sup>2</sup> | RRH              | 6/2/2006 16:29    | 54.0        | 1,796.0    | Entiat                            | Upper Entiat |
| 187              | RRH              | 6/16/2006 11:20   | 55.0        | 1,929.0    | Entiat                            | Mad          |
| 188 <sup>3</sup> | RRH              | 6/22/2006 15:19   | 45.0        | 1,039.5    | Methow                            | Wolf Creek   |
|                  |                  | <b>Mean:</b>      | 57.7        | 2,506.9    |                                   |              |
|                  |                  | <b>Median:</b>    | 58.8        | 2,528.8    |                                   |              |
|                  |                  | <b>Minimum:</b>   | 40.0        | 910.0      |                                   |              |
|                  |                  | <b>Maximum:</b>   | 72.0        | 4,422.0    |                                   |              |

<sup>1</sup>This transmitter may have expired after the fish passed upstream of Rocky Reach Dam on 25 May, 2008.

<sup>2</sup>Transmitter recovered in 2008.

<sup>3</sup>Transmitter is motionless and it is presumed that the fish has died, or the transmitter was shed. However, the transmitter has not been recovered.

<sup>4</sup>Brief residence in the Wenatchee River from 25 July to August 16, 2008.

### **3.3 General Observations**

Of the 32 bull trout detected in 2008, only eight were detected either migrating upstream or downstream of Rock Island and Rocky Reach dams. Two fish migrated upstream of Rock Island Dam after residing within the Wanapum reservoir near the resort community of Crescent Bar (RK 708) during the early period of 2008. Those two fish, along with six others, migrated upstream of Rocky Reach Dam (Tables 3 and 4).

Of the eight tagged trout that migrated upstream of Rocky Reach Dam, five entered the Entiat River where they resided for some time during the 2008 spawning period. Of the three fish that did not enter the Entiat River, the transmitter of one (Code 29) may have expired shortly after passing upstream of Rocky Reach Dam. The code 29 fish was tagged 30 May 2005, and therefore, its transmitter was well beyond its two-year operating life expectancy at the point of last detection at Rocky Reach Dam. Its subsequent location remains unknown. The other two fish remained within the mainstem Columbia River. One of those (Code 102) migrated upstream to a point within 350 m of Wells Dam and later migrated downstream and took up residence about 4.2 km downstream of the confluence of the Chelan River. The third fish (Code 174) was detected within 2.7 km of Wells Dam on 26 June 2008 during an aerial survey, with no subsequent detections. However, Douglas PUD terminated the monitoring of telemetry equipment at Wells Dam on 24 June 2008. It is possible that this fish migrated upstream of Wells Dam and went undetected because of limited aerial surveys conducted upstream from the project. Of the five bull trout that migrated upstream of Rocky Reach Dam and entered the Entiat Basin, one entered the Mad River and was later detected between Camp 9 and the Pine Flat Campground. The other four migrated upstream within the Entiat River to Box Canyon (RK 47.2).

Of the 32 fish detected in 2008, we believe the transmitter of the Code 29 fish failed shortly after the fish migrated upstream of Rocky Reach Dam. The transmitters of eight others were recovered and six others have remained motionless suggesting either that the fish have died or the transmitters were shed (Table 2). Thus a total of 15 fish are no longer part of the study group. For the remaining ten bull trout, five were detected in the upper Entiat River in the vicinity of Box Canyon, two were detected in the Entiat River (one last detected at RK 1.6 and the other at RK 4.8), one in the Wenatchee River near the town of Peshastin, and two in the Mad River (both in the vicinity of Camp 9).

### **3.4 Migration Times at Rock Island and Rocky Reach Dams**

The metrics used to assess bull trout migration rates past dams are the same as those reported in the 2005, 2006, and 2007 annual reports (Stevenson et al. 2006, 2007, and 2008). The following are definitions of indices used in this and past reports:

- **Tailrace Residence Time** – The elapsed time between the first detection by the aerial tailrace array and the first detection within any of the entrances to the fishway.
- **Fishway Cycling Time** – The elapsed time between the first detection within any of the fishway entrances and the final detection as the fish enters the fishway.
- **Fishway Migration Rate** – The elapsed time between the detection at the time of final entry into the fishway and the first detection as the fish exited the fishway.
- **Project Migration Rate** – The sum of the Travel Time through the Tailrace, the Fishway Cycling Time, and the Fishway Migration Rate, which is also the elapsed time between the first detection by the tailrace array and the first detection as the fish exited the fishway.

In sum, migration rates in 2008 were based on eight upstream passage events at Rocky Reach Dam (Table 3) and two upstream passage events at Rock Island Dam (Table 4). Unfortunately, because of a delay in the completion of annual maintenance of some of the telemetry equipment, some telemetry systems at both Rocky Reach and Rock Island dams were inoperable at the time some of the fish migrated upstream of the project. Therefore, for some fish we were not able to calculate all metrics of passage. However, the tailrace and exit systems were operating during all passage events, providing at least project migration rates.

Two fish (Codes 102 and 151) that migrated upstream of Rock Island Dam in 2008 also passed Rocky Reach Dam and therefore were included in both data sets (Tables 3 and 4). Because some telemetry systems were down at the time one of the two fish migrated upstream of Rock Island Dam, we can only report the median Project Migration for those fish, which was 0.43 days (Table 4).

For all eight passage events occurring at Rocky Reach Dam in 2008, the median Tailrace, Cycling, Fishway, and Project migration rates were 0.14, 4.45, 0.32, and 3.53 days, respectively (Table 3).

**Table 3.** Migration-rate metrics for bull trout passing Rocky Reach Dam, 2008.

| <b>Migration Rate (days)</b> |                      |                        |                          |                          |
|------------------------------|----------------------|------------------------|--------------------------|--------------------------|
| <b>Code</b>                  | <b>Tailrace Time</b> | <b>Fishway Cycling</b> | <b>Fishway Migration</b> | <b>Project Migration</b> |
| 29                           | ---                  | ---                    | ---                      | 5.24                     |
| 102                          | 0.17                 | 0.10                   | 0.66                     | 0.93                     |
| 113                          | 0.07                 | 4.45                   | 0.32                     | 4.84                     |
| 114                          | 0.05                 | 0.10                   | 2.07                     | 2.22                     |
| 123                          | 0.14                 | 8.35                   | 0.25                     | 8.74                     |
| 151                          | ---                  | ---                    | ---                      | 2.13                     |
| 166                          | ---                  | ---                    | ---                      | 0.35                     |
| 174                          | 1.20                 | 5.71                   | 0.24                     | 7.15                     |
| <b>Mean:</b>                 | 0.33                 | 3.74                   | 0.71                     | 3.95                     |
| <b>Median:</b>               | 0.14                 | 4.45                   | 0.32                     | 3.53                     |
| <b>Minimum:</b>              | 0.05                 | 0.10                   | 0.24                     | 0.35                     |
| <b>Maximum:</b>              | 1.20                 | 8.35                   | 2.07                     | 8.74                     |

**Table 4.** Migration-rate metrics for bull trout passing Rock Island Dam, 2008.

| <b>Migration Rate (days)</b> |                      |                        |                          |                          |
|------------------------------|----------------------|------------------------|--------------------------|--------------------------|
| <b>Code</b>                  | <b>Tailrace Time</b> | <b>Fishway Cycling</b> | <b>Fishway Migration</b> | <b>Project Migration</b> |
| 102                          | 0.04                 | 0.02                   | 0.23                     | 0.29                     |
| 151                          | ---                  | ---                    | ---                      | 0.56                     |
| <b>Mean:</b>                 | ---                  | ---                    | ---                      | 0.43                     |
| <b>Median:</b>               | ---                  | ---                    | ---                      | 0.43                     |
| <b>Minimum:</b>              | ---                  | ---                    | ---                      | 0.29                     |
| <b>Maximum:</b>              | ---                  | ---                    | ---                      | 0.56                     |

### ***3.5 Inriver Upstream Migration Rates***

As discussed previously, both of the bull trout that migrated upstream of Rock Island Dam in 2008 passed Rocky Reach Dam. For those two fish (codes 102 and 151), the median migration time between the two dams was 2.35 days (Table 5).

Of the eight fish that migrated upstream of Rocky Reach Dam, five were subsequently detected at the Entiat River fixed-telemetry site (RK 4.8). For those fish, the median migration time between the Rocky Reach fishway exit and the Entiat River site was 10.95 days. Furthermore, the median date of detection at the Entiat River telemetry site was 14 June (Table 6).

As discussed in past reports (Stevenson et al. 2006, 2007, and 2008), the migration rate between the Rocky Reach fishway exit and the Entiat River site may seem excessive, given migration rates between Rock Island and Rocky Reach dams, and between Rocky Reach and Wells dams. However, this is not the case. On a number of occasions, mobile surveys conducted independently by Chelan PUD and the USFWS have identified tagged bull trout holding at the Entiat River confluence as well as in pools downstream of the Entiat River fixed-telemetry site (Chelan PUD, unpublished data; Mark Nelson, USFWS, personal communication). The reason why bull trout tend to stage near or within the lower Entiat River is unknown. Regardless of the reason, bull trout appear to have adequate time to find spawning tributaries after passing Rocky Reach or Rock Island dams, and appear to reach spawning grounds in those tributaries in a timely manner (BioAnalysts 2004).

### ***3.6 Upstream or Downstream Passage Events***

During the 2008 study period, eight bull trout were responsible for a total of 13 passage events, with 11 occurring at Rocky Reach Dam and two at Rock Island Dam (Table 7). Of those passage events, ten were the result of fish migrating upstream through the fishways and three were the result of fish passing downstream of Rocky Reach Dam through the powerhouse. For the three fish passing downstream of Rocky Reach Dam, the route of passage could be determined for only two fish. One migrated downstream through turbine Unit 4 and the other through turbine Unit 3. The route of passage for the third fish could not be ascertained. However, since neither the spillway, nor the juvenile bypass system was operational during the window of passage, and the fish was not detected within the fishway, we conclude that the fish passed through the powerhouse (Table 8).



**Table 5.** The migration rate of bull trout passing Rock Island Dam to either the Wenatchee River telemetry site or the tailrace of Rocky Reach Dam, 2008.

| Code | Exit Rock Island   | 1 <sup>st</sup> Detection at: |                    | Migration Rate (days) |            |
|------|--------------------|-------------------------------|--------------------|-----------------------|------------|
|      | Date/Time          | Wenatchee R.                  | RRH Dam            | To Wen. R.            | To RRH Dam |
| 102  | 6/5/2008 18:18:31  | ---                           | 6/8/2008 13:03:52  | ---                   | 2.78       |
| 151  | 5/20/2008 22:42:45 | ---                           | 5/22/2008 20:34:50 | ---                   | 1.91       |
|      |                    |                               | <b>Mean:</b>       | ---                   | 2.35       |
|      |                    |                               | <b>Median:</b>     | ---                   | 2.35       |
|      |                    |                               | <b>Minimum:</b>    | ---                   | 1.91       |
|      |                    |                               | <b>Maximum:</b>    | ---                   | 2.78       |

**Table 6.** The migration rate of tagged bull trout passing Rocky Reach Dam to either the Entiat River telemetry site or the tailrace of Wells Dam, 2008.

| Code | Exit Rocky Reach   | 1 <sup>st</sup> Detection at: |                 | Migration Rate (days) |              |
|------|--------------------|-------------------------------|-----------------|-----------------------|--------------|
|      | Date/Time          | Entiat R.                     | Wells Dam       | To Entiat R.          | To Wells Dam |
| 113  | 6/20/2008 4:37:16  | 7/2/2008 22:10:15             | ---             | 12.73                 | ---          |
| 114  | 6/2/2008 12:55:48  | 6/8/2008 18:25:29             | ---             | 6.23                  | ---          |
| 123  | 6/12/2008 23:32:29 | 6/23/2008 22:21:02            | ---             | 10.95                 | ---          |
| 151  | 5/27/2008 19:05:42 | 6/7/2008 23:17:19             | ---             | 11.17                 | ---          |
| 166  | 5/26/2008 17:29:39 | 5/28/2008 10:38:00            | ---             | 1.71                  | ---          |
|      |                    |                               | <b>Mean:</b>    | 8.56                  | ---          |
|      |                    |                               | <b>Median:</b>  | 10.95                 | ---          |
|      |                    |                               | <b>Minimum:</b> | 1.71                  | ---          |
|      |                    |                               | <b>Maximum:</b> | 12.73                 | ---          |

**Table 7.** Summary of all bull trout passage at Rock Island and Rocky Reach dams, 2008. An “X” indicates passage during the expected upstream (Apr-Jul) or downstream (Oct-Dec) migration seasons.

| Code | Upstream Migration |    |             |    | After Tributary Exodus |    |             |    |
|------|--------------------|----|-------------|----|------------------------|----|-------------|----|
|      | Rock Island        |    | Rocky Reach |    | Rock Island            |    | Rocky Reach |    |
|      | Down               | Up | Down        | Up | Down                   | Up | Down        | Up |
| 29   |                    |    |             | X  |                        |    |             |    |
| 102  |                    | X  |             | X  |                        |    |             |    |
| 113  |                    |    |             | X  |                        |    | X           |    |
| 114  |                    |    |             | X  |                        |    | X           |    |
| 123  |                    |    |             | X  |                        |    |             |    |
| 151  |                    | X  |             | X  |                        |    | X           |    |
| 166  |                    |    |             | X  |                        |    |             |    |
| 174  |                    |    |             | X  |                        |    |             |    |

**Table 8.** Summary of downstream bull trout passage at Rocky Reach Dam, 2008.

| Code | Date                  | Location                          | Dam |
|------|-----------------------|-----------------------------------|-----|
| 113  | 12/3/2008 21:41:14 PM | Turbine 4                         | RRH |
| 114  | 11/6/2008 18:16:55 PM | Turbine 3                         | RRH |
| 151  | Unknown               | Powerhouse - Turbine Unit Unknown | RRH |

**Note:** The code 151 fish was detected in the Rocky Reach forebay on 11/25/2008 at 12:53:19 (at the fishway exit). Subsequently, it was detected by the tailrace array on 11/26/2008 at 01:00:37. During the period of downstream passage, the juvenile bypass and spillway structures were not operating. Therefore, the only potential route of passage was the powerhouse (the fishway was monitored, and passage did not occur through this route).

### 3.7 *Mortality*

A total of 86 bull trout were tagged during the period of 2005-2007. Of those, 30 tagged bull trout (34.9%) have either perished or shed their tags (Stevenson et al. 2006, 2007, and 2008). That percentage is similar to observations made by other researchers. For example, of the 20 bull trout tagged and released from Wells Dam during 2006-2007 by Douglas PUD, seven transmitters (35.0%) were recovered (unpublished data, USFWS). During the 2001-2002 bull trout study funded by the Mid-Columbia PUDs, 35.0% of the transmitters (14 of 40 bull trout tagged in 2002) were recovered following initial release into the mainstem Columbia River. Most were found in tributaries (78.6%). Of those recoveries, only one carcass was found (BioAnalysts 2004).

It is important to note that potential fish mortality in the tributaries or the mainstem Columbia River based on recoveries of tags may not accurately represent true mortality. In radiotelemetry research, estimates of mortality are often based on the recovery of individual radio-transmitters. The recovery probability for any transmitter is based on the ability of the researcher to both locate the transmitter and recover it. Simply put, if a transmitter is shed or the fish dies in deep water where the transmitter cannot be detected or recovered, the fish will not be included in the mortality estimate. Conversely, if a transmitter is recovered without a carcass, the fish may be erroneously classified as dead, when in reality the transmitter may have been shed by a surviving fish. Finally, the mortality estimate is based both on sampling effort and the ability of individuals to recover a transmitter. Both factors may vary from one study to another.

Table 9 summarizes all documented transmitter and carcass recoveries as of 28 February 2009 for all bull trout tagged from 2005-2007. Of the 30 recovered transmitters, 22 were recovered during the 2005, 2006, and 2007 study periods. Those recoveries were discussed in detail in previous annual reports (Stevenson et al. 2006, 2007, and 2008) and will not be discussed here.

Of the eight recoveries in 2008, none of the fish migrated either upstream or downstream of a Chelan PUD project in 2008. Furthermore, none of the recoveries included the collection of fish remains at the time the transmitters were recovered. Collectively, of the 30 transmitters recovered since tagging began in 2005, six have been recovered in the Columbia River, 12 in the Entiat River, four in the Mad River, two in each of the Methow River and Peshastin Creek, and one in each of the Twisp River, Foggy Dew Creek, Snow Creek, and Icicle Creek. Therefore, 20% of tag recoveries have been in the mainstem Columbia River and 80% in tributaries of the Columbia River.

The following is a summary of the eight transmitters recovered in 2008 that have not been addressed in previous reports.

**Table 9.** Summary of all documented transmitter and carcass recoveries through 28 February 2009.

| <b>Code</b> | <b>Date of Recovery</b> | <b>Location</b>    | <b>Carcass Recovered?</b> |
|-------------|-------------------------|--------------------|---------------------------|
| 2           | 10/6/2005               | Mad River          | No                        |
| 4           | 10/6/2005               | Mad River          | Yes                       |
| 5           | 10/4/2005               | Snow Creek         | No                        |
| 6           | 9/6/2006                | Columbia River     | No                        |
| 18          | 10/25/2005              | Mad River          | Yes                       |
| 26          | 5/9/2007                | Columbia River     | Yes                       |
| 31          | 9/11/2007               | Columbia River     | No                        |
| 33          | 10/24/2005              | Upper Entiat River | No                        |
| 36          | 10/28/2005              | Upper Entiat River | No                        |
| 37          | 10/28/2005              | Upper Entiat River | Yes                       |
| 39          | 9/21/2006               | Upper Entiat River | No                        |
| 44          | 4/4/2007                | Entiat River       | Yes                       |
| 101         | 8/14/2007               | Peshastin Creek    | No                        |
| 103         | 3/31/2008               | Peshastin Creek    | No                        |
| 111         | 10/3/2008               | Methow River       | No                        |
| 119         | 3/5/2008                | Columbia River     | Inconclusive              |
| 153         | 2/20/2007               | Entiat River       | No                        |
| 154         | 9/19/2006               | Icicle Creek       | No                        |
| 168         | 4/23/2008               | Upper Entiat River | No                        |
| 169         | 4/23/2008               | Upper Entiat River | No                        |
| 171         | 11/8/2007               | Methow River       | Yes                       |
| 172         | 10/18/2006              | Entiat River       | Yes                       |
| 177         | 9/12/2007               | Foggy Dew Creek    | Yes                       |
| 178         | 12/2/2008               | Upper Entiat River | No                        |
| 179         | 12/2/2008               | Upper Entiat River | No                        |
| 183         | 12/2/2008               | Upper Entiat River | No                        |
| 185         | 10/2/2007               | Mad River          | No                        |
| 186         | 1/10/2007               | Columbia River     | No                        |
| 189         | 4/4/2007                | Columbia River     | Inconclusive              |
| 190         | 11/1/2007               | Twisp River        | Yes                       |

**Note:** For the code 189 transmitter, remains of a fish were uncovered at the time of the search. However, due to zero visibility, it was impossible to say positively that the remains were associated with the transmitter. Furthermore, it was not possible to identify the fish as to species.

## **Columbia River Mainstem Tag Recoveries**

The transmitter of the Code 119 fish was recovered on 5 March 2008 in the Columbia River about 15 m from the east shore, near the town of Orondo, Washington. The transmitter was recovered in about 2 m of water. The head and backbone of a fish was also recovered in the vicinity of the transmitter. However, because of extensive deterioration of the carcass, it was not possible to determine conclusively that the carcass belonged to Code 119 or was even a bull trout. The fish with Code 119 left the Entiat River on 9 November 2007, was detected near the Entiat River confluence on 17 December 2007, and resided within the Columbia River until the transmitter was recovered on 5 March 2008.

## **Entiat River Basin Recoveries**

The transmitter of the Code 168 fish was recovered on 23 April 2008 in the Entiat River just downstream of Box Canyon (RK 47.2). This fish was tagged and released on 18 May 2006 at Rocky Reach Dam. On 3 June 2006 this fish entered the Entiat River and was detected in the Upper Entiat River at RK 46.7 in the Box Canyon region. The transmitter of this fish was detected during several aerial surveys since December 2006, with no detection history indicating that the fish ever left the area. At the time the transmitter was recovered, no carcass was found. The transmitter was recovered in about 1 m of water and was wedged between two rocks. Based on the detection history of the transmitter, we believe that this fish had died or the transmitter was shed several months before the transmitter was recovered. The recovered transmitter showed scuff marks indicating that it may have tumbled some distance down the river.

The code 169 transmitter was recovered on 23 April 2008 in the Entiat River at RK 46.9 near the Lake Creek Campground, about 200 m downstream of the foot bridge. This fish was tagged and released on 25 May 2006 at Rocky Reach Dam and entered the Entiat River on 22 June 2006. After entering the Entiat River, this fish was detected near Box Canyon on September 2006. The transmitter was recovered on the left bank wedged between two rocks. No carcass was present. As with the Code 168 transmitter, this transmitter was also scuffed indicating that it had tumbled down the river during higher flows.

The transmitter of the Code 178 fish was recovered by USFWS personnel on 2 December 2008 in the Entiat River at RK 43.6. This fish was tagged and released at Rocky Reach Dam on 30 May 2006 and entered the Entiat River on 21 June 2006. Later this fish migrated out of the Entiat Basin and moved downstream of Rocky Reach Dam, where it resided within the Rock Island reservoir in early 2007. The fish migrated upstream of Rocky Reach Dam (exiting the fishway on 4 June, 2007), and subsequently entered the Entiat River on 15 June 2007. Aerial surveys indicate that this fish was in the upper Entiat since January 2008. At the time of recovery, the transmitter antenna was missing and there was a hole in the transmitter casing (Mark Nelson, USFWS, personal communication). The transmitter was recovered without a carcass and was buried beneath about 20 cm of gravel.

The transmitter of the Code 179 fish was recovered 2 December 2008 in the Entiat River at RK 46.7. The fish was tagged and released at Rocky Reach Dam on 30 May 2006. After release, the fish was detected at the Entiat River fixed-telemetry site on 21 June 2006 and was subsequently detected within the Upper Entiat River during six mobile surveys. We detected no movement of the tag during a 23 April 2008 recovery effort, suggesting that the fish had died or shed the tag. Although we were unable to retrieve the transmitter at that time, it appeared to be lodged under a boulder downstream of Box Canyon. When the transmitter was finally recovered by USFWS personnel, it was located further downstream, suggesting that it had been dislodged by high flows during spring run-off.

The transmitter of the Code 183 fish was recovered in Box Canyon on the Entiat River on 2 December 2008, where it had resided since entering the Entiat River on 2 June 2006. The transmitter was found buried under about 15 cm of gravel by USFWS personnel. No carcass was recovered.

### **Wenatchee River Basin Recoveries**

The transmitter of the Code 103 fish was recovered in Peshastin Creek (RK 8.6), a tributary to the Wenatchee River. The fish was tagged and released on 13 June 2007 at Rock Island Dam and entered the Wenatchee River on 20 June 2007. The transmitter was found on the right bank within the high water mark about 3 m from the main channel. No carcass was present at the time of recovery.

### **Methow River Basin Recoveries**

The transmitter of the Code 111 fish was recovered in the Lower Methow River at RK 4.8 on 3 October 2008. The fish was tagged and released at Rocky Reach Dam on 16 May 2007. Following release, the fish migrated upstream of Wells Dam and later entered the Methow River on 3 June 2007. The transmitter was recovered by USFWS personnel in the lower Methow River buried beneath about 15 cm of gravel. No carcass was present.

### 3.8 *Conclusions*

Based on the data collected during the period 1 January 2008 through 31 December 2008, we offer the following conclusions:

1. During the 2008 study period, two tagged bull trout migrated upstream past Rock Island Dam; one ascended the right-bank ladder the other ascended the left-bank ladder. For those fish the median Project Migration time was 0.43 days.
2. Of the two fish that migrated upstream of Rock Island Dam, both migrated to Rocky Reach Dam. The median migration time between the two locations was 2.35 days.
3. At Rocky Reach Dam in 2008, a total of eight fish migrated upstream past the dam through the fishway (includes two fish that migrated upstream from Rock Island Dam). For those eight fish, the median Tailrace, Fishway Cycling, Fishway Migration, and Project Migration times were 0.14, 4.45, 0.32 and 3.53 days, respectively.
4. A total of eight tagged bull trout were tracked after moving upstream of Rocky Reach Dam in 2008. Of those fish, five entered the Entiat River. The median time between the ladder exit and the Entiat River site (RK 4.8) was 10.95 days. Of the three fish that did not enter the Entiat River, we believe the transmitter of one quit working (tag had already exceeded its battery life expectancy by a full year) shortly after passing Rocky Reach Dam. The other two fish were both detected in the vicinity of the Wells Dam tailrace. There is no evidence that either fish passed upstream of Wells Dam.
5. Of the ten upstream passage events made by bull trout at either Rock Island or Rocky Reach dams in 2008, there were no fallback events at either project.
6. A total of three downstream passage events occurred during the 2008 study period with all three occurring at Rocky Reach Dam. Of those three passage events, one fish went through turbine Unit 4, another through turbine Unit 3, and the third through an unspecified turbine unit. No injury or mortality to bull trout was observed as a result of passing through any route at the dam, as verified by subsequent detection histories.
7. During the 2008 study period, a total of eight transmitters were recovered. For seven of those recoveries, no carcasses were present. For the other fish, a carcass was recovered, but because of advanced decomposition, we could not be sure that the carcass was a bull trout or that the transmitter belonged to it. For the eight fish for which transmitters were recovered, none had passed either upstream or downstream of Rock Island or Rocky Reach dams in 2008.

8. Collectively, of the 30 transmitters recovered since tagging began in 2005, six have been recovered in the Columbia River, 12 in the Entiat River, four in the Mad River, two in each of the Methow River and Peshastin Creek, and one in each of the Twisp River, Foggy Dew Creek, Snow Creek, and Icicle Creek. Therefore, 20% of tag recoveries have been in the mainstem Columbia River and 80% in tributaries of the Columbia River.
9. Of the 32 bull trout detected at Rock Island, Rocky Reach, or anywhere within the study area in 2008, we believe 17 tagged fish still remain active within the Columbia River or within its tributaries.



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