

PUBLIC UTILITY DISTRICT NO. 1 *of* CHELAN COUNTY
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April 14, 2008

VIA ELECTRONIC FILING

Honorable Kimberly D. Bose, 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:

On February 28, 2005, the 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) filed plans to implement the Reasonable and Prudent Measures and associated Terms and Conditions for bull trout (Bull Trout Plans) per each respective Project under respective Articles 414 and 411 with the Federal Energy Regulatory Commission (Commission).[1] The Commission approved the Bull Trout Plans on April 19, 2005.[2]

The Bull Trout Plans were prepared in consultation with the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service (NOAA Fisheries), the Washington Department of Fish and Wildlife, and other interested Indian tribes and parties. The Plans included provisions for the annual report required by Article 415[3] under the Rock Island Project and Article 412 under the Rocky Reach Project.

In accordance with Articles 415 and 412, Chelan PUD respectfully submits the 2007 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) on the

1 Orders Amending License issued June 21, 2004, at 107 FERC ¶ 61,282 and 61,281.
2 Orders Amending License issued April 19, 2005, at 111 FERC ¶ 62,070 and 62,071.
3 In the Rock Island Project Orders at 107 FERC ¶ 61,282 and 111 FERC ¶ 62,070, they incorrectly cite Article 412 under the newly created license Article 414. Article 412 is referenced under the Rocky Reach Project Order at 107 FERC ¶ 61,281. The correct article for the Rock Island Project is Article 415.

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.

As background, the HCPs are intended to be comprehensive and long-term management plans to protect five species of Columbia River steelhead and salmon (Plan Species) in compliance with the Endangered Species Act (ESA). The HCPs were signed by Chelan PUD, FWS, NOAA Fisheries, Washington Department of Fish and Wildlife, the Confederated Tribes of the Colville Indian Reservation and the Confederated Tribes and Bands of the Yakama Nation. NOAA Fisheries issued incidental take permits (ITPs) to Chelan PUD for the respective project operations and the establishment of the Tributary Conservation Plan and the Hatchery Compensation Plan, in accordance with the HCPs and FERC's authorization for the construction of a small turbine unit in the attraction water conduit of the spillway entrance of the adult fishway. On June 21, 2004, the Commission approved the license amendments incorporating the HCPs into the current licenses stating that the HCPs are in the public interest because the HCPs will put into place a program likely to assist in the recovery of listed salmon and to help prevent other salmon species from becoming listed.[4]

Prior to FERC approving the HCPs and amending the project licenses, FWS formally consulted with FERC under section 7 of the ESA regarding the effects on bull trout and proposed bull trout critical habitat. Although bull trout were not included in the HCPs as Plan species, there is a strong relationship to the HCPs because the measures included in the HCPs for Plan Species also benefit bull trout. Three years of prior bull trout studies (2001-2004) at Rocky Reach and Rock Island projects indicate that adult bull trout successfully pass upstream and downstream through the Project. We presume that the HCP provisions for downstream passage of anadromous species will also benefit juvenile bull trout passage. Similarly, the HCP tributary protection and enhancement projects will provide benefits to both bull trout and HCP Plan Species.

On May 11, 2004, the FWS issued a No Jeopardy biological opinion and ITS finding that the implementation of the HCPs was not likely to jeopardize the continued existence of the Columbia River distinct population segment of bull trout and was not likely to destroy or adversely modify proposed critical habitat for bull trout. The subsequent final critical habitat designation for bull trout by the FWS did not include waters in Rocky Reach or Rock Island reservoirs, or in any tributaries flowing into the reservoirs. Finally, the Bull Trout Plans were developed to address the requirements of the respective ITS.

Chelan PUD filed its Comprehensive Settlement Agreement on March 20, 2006, under the relicensing process of its Rocky Reach Project. The HCPs have an integral relationship to the relicensing process because of the benefits of the HCPs to Plan species and bull trout. Additionally, Chelan PUD and the signatories to the Rocky Reach HCP filed the HCP with FERC as part the Commission's regulatory review of the relicensing proceeding. The agency parties agreed that the HCPs will constitute their license recommendations and conditions under

[4] Master Order at 59,107 FERC 61,280.

the Federal Power Act sections 10(a), 10(j), and 18. However, FERC will evaluate the inclusion of the HCP in the Rocky Reach license as part of the relicensing process.[5]

Please forward any questions regarding this filing or requests for additional information to the FERC Compliance Manager, Chelan PUD, 327 North Wenatchee Avenue, Wenatchee, Washington 98801.

Sincerely,

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

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

Attachments: 2007 Annual Report

[5] FERC recognized in its Master Order approving the incorporation of the HCPs into the current licenses that the Commission would need to examine whether the HCPs should be included in any new license to Chelan PUD. "[O]ur approval of the Rocky Reach HCP in this proceeding will undoubtedly influence our decision on that issue, but the FPA requires us to fully consider all evidence and arguments presented in the relicense proceeding on this and any other issues, and we shall do so." Master Order at 20.

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

Annual Report

ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145

ROCK ISLAND HYDROELECTRIC PROJECT
FERC Project No. 943

April 11, 2008

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 identifying 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, at the conclusion of 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), the USFWS issued a Biological and Conference Opinion (Opinion) on the license amendments to incorporate the HCPs into the existing federal operating licenses. The Opinion analyzed potential effects of HCP 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. Finding existing protections adequate, the USFWS designated no Critical Habitat in the mid-Columbia River in the vicinity of Rock Island and Rocky Reach reservoirs, or tributaries to these reservoirs.

In its 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). Chelan PUD developed the BTMP with review and input from various agencies and relevant tribes including the U.S. Fish and Wildlife (USFWS), National Marine Fisheries Service (NMFS), Washington Department of Fish and Wildlife (WDFW), the Colville Confederated Tribes (CCT), the Yakama Nation (YN), and the Columbia River Inter-Tribal Fish Commission (CRITFC). Throughout the remaining term of the Rocky Reach and Rock Island licenses, the BTMPs will be the guiding documents to implement goals for monitoring and minimizing potential adverse effects on bull trout related to Project operations and facilities. Specific goals and objectives to monitor, protect, and enhance bull trout resources related to the Rocky Reach and Rock Island projects are found in Sections 4.1 and 4.2. of the BTMPs.

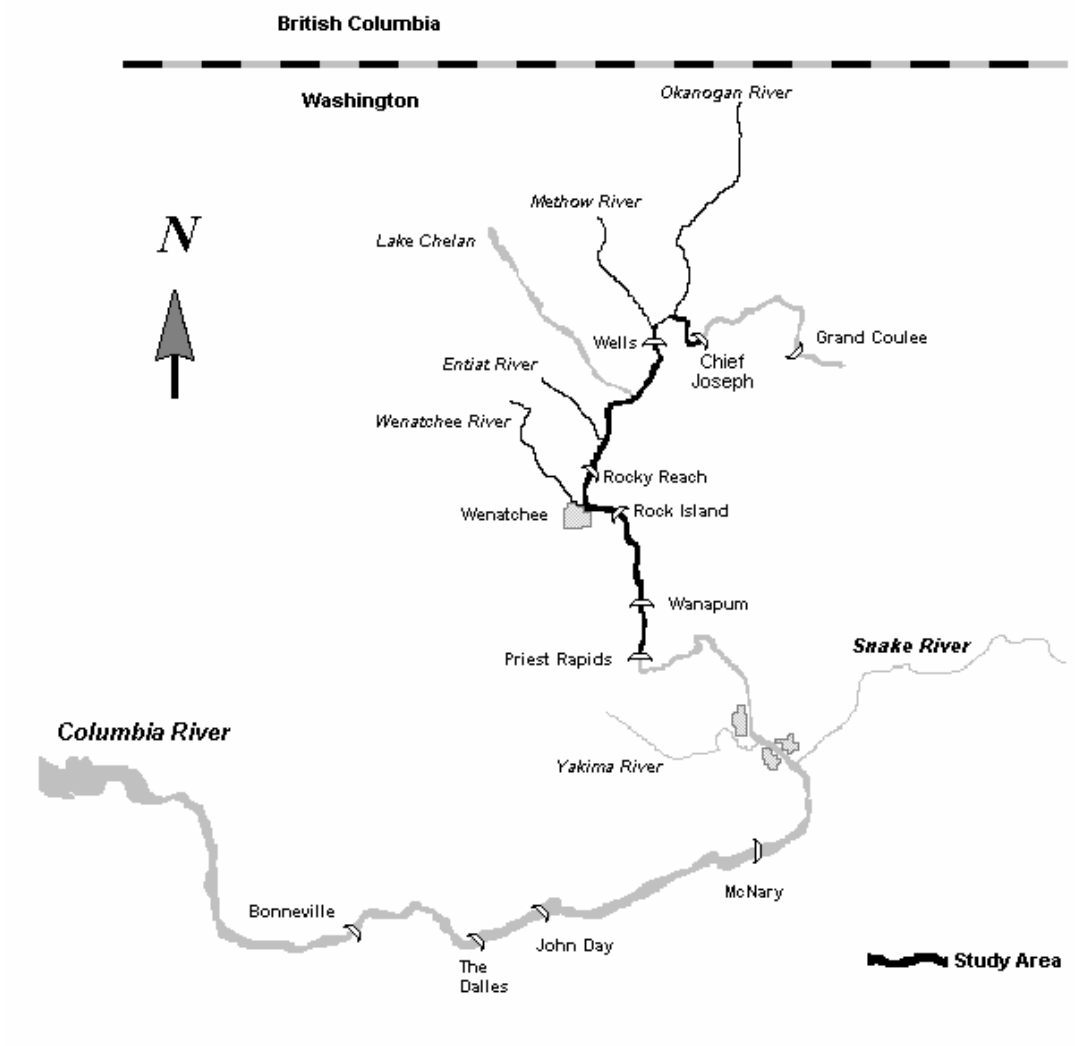

Figure 1: Study Area for Assessing Migration Patterns of Bull Trout in the mid-Columbia River.

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 – 2008.

On June 21, 2004 the Rocky Reach and Rock Island FERC licenses were each amended to incorporate the Project's HCP into their respective licenses to protect mid-Columbia anadromous salmon and steelhead. Benefits to other aquatic species, such as bull trout, are expected to occur through implementation of measures required in the HCPs.

This annual report is a requirement of the Rocky Reach and Rock Island Project licenses, as part of the BTMP for each Project. It provides a summary of the results of Chelan PUDs implementation of required reasonable and prudent measures, their associated terms and conditions, and for monitoring and protecting bull trout in the Rocky Reach and Rock Island Project areas in 2007. Monitoring of incidental take of bull trout due to operations of both Projects will continue through June 2008. A final report will be issued in 2009 summarizing incidental take for the three year monitoring period, May 2005 through June 2008, and completion of Reasonable and Prudent Measures and associated Terms and Conditions.

SECTION 2: BIOLOGICAL OPINION MEASURES

The following is a summary of the measures contained in the USFWS Opinion. Chelan PUD is implementing these measures for the Rocky Reach and Rock Island projects, 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 descaling 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

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

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

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 2007, Chelan PUD completed the third year of a three-year study to satisfy the requirements of the USFWS Opinion for bull trout monitoring and incidental take determination (Stevenson et al. 2006, 2007, and 2008). The results for the 2007 calendar year are presented in Stevenson et al. (2008) (Appendix A). Incidental take monitoring will continue through June 2008 at both Rocky Reach and Rock Island projects, as specified in the BTMPs. This annual report summarizes Chelan PUD's third year of 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 agree that at this time (2007) it is 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. At this time, it is not feasible to assess the effects of Rocky Reach Dam on passage of juvenile bull trout. However, in the BTMP, Chelan PUD developed a juvenile bull trout PIT-tag program to passively monitor upstream movements of juvenile bull trout past Rocky Reach Dam, and if possible, monitor incidental take of the fish during these movements. For the third year in 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.

Chelan PUD is also providing voluntary assistance to the USFWS to monitor movements of juvenile bull trout by providing PIT tags and tagging needles to enable USFWS to tag juveniles that are incidentally captured in its smolts traps in the Entiat River and Peshastin Creek basin. In 2007, Chelan PUD provided 100 PIT tags to the USFWS for this purpose. The USFWS did not report how many bull trout it tagged in 2007 at its smolt trap facilities. Chelan PUD will continue to assist the USFWS with its monitoring and coordination for bull trout in the Entiat Basin by providing the USFWS with PIT tags in 2008 to increase the sample size of tagged juvenile bull trout (R.D. Nelle, USFWS, pers. comm., 2007). This may help the USFWS to

determine how and when bull trout move from the Entiat River into the mainstem Columbia and their movement within the Columbia as fish pass hydroelectric projects.

The Rocky Reach Dam juvenile fish bypass operated from April 1, 2007 to August 31, 2007. 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 2007, two juvenile bull trout (267 mm, 81.0 g, and 180 mm, 49.0 g) were captured on April 18, and May 22. Only one fish was PIT tagged because the other had a visible fungus on its caudal fin. A tissue sample was also collected from the single PIT tagged fish for genetic analysis. Both fish were released downstream, alive in otherwise good condition. In 2007, no PIT tagged juvenile bull trout were detected in the fishways at Rocky Reach or Rock Island dams (PITAGIS database, SLH tag ID, 2007).

As part of the monitoring and evaluation for juvenile bull trout passage, Chelan PUD is capturing digital photographs of any juvenile or sub-adult bull trout that pass Rocky Reach Dam via the adult fishway during normal fish counting periods, and off-season counting periods. These photographs allow for observation and assessment of juvenile bull trout as they migrate upstream past Rocky Reach dam. In 2007 a total of 77 bull trout ascended the Rocky Reach fishway, 6 juvenile bull trout (305 mm or under in length) and 71 adult bull trout (> 305 mm), during the normal anadromous fish counting period. These photographs show bull trout that appear to be in excellent physical condition. The digital photographs are stored for review by the USFWS.

The Rocky Reach fishway was dewatered for required annual inspection and major attraction water pump (AWS) overhaul from 10 January 2007 to 3 March, 2007. After water-up on 4 March, no bull trout passed the project from 4 March to April 13, 2007 prior to the normal anadromous fish counting period. Chelan PUD has now completed three years of "off-season" bull trout passage counts at Rocky Reach, satisfying the one year requirement in the 2004 USFWS Biological Opinion. Because few or no fish tend to pass the project after the fishway is re-watered after the maintenance period, the ladder schedule in the off-season at Rocky Reach does not appear to affect any desire by bull trout to pass the project during cold winter months.

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 2007.

Bull Trout Monitoring and Evaluation Program

Chelan PUD's bull trout monitoring and evaluation program was implemented for the first year of study on May 16, 2005. This annual report summarizes result from the third year (2007) of bull trout monitoring, including bull trout passage, behavior, and incidental take (no take observed in 2007) from 1 January, 2007 to 31 December, 2007. Some fish observations made in 2008 are included in the 2007 annual report (Appendix A) to clarify important behavior or final locations of radio tagged fish. A final report will be submitted to the FERC and USFWS bull trout incidental take monitoring from 1 January to 30 June 2008.

During the 2007 tagging period (16 May to 29 June), a total of 16 bull trout were tagged and released upstream of Rocky Reach Dam. Methods of trapping and tagging in 2007 were identical to those described in BioAnalysts, Inc. (2002 and 2004) and Stevenson, et al. (2006 and 2007). Therefore, they will not be described again here.

All bull trout trapped and tagged in 2007 appeared healthy and fully recovered at the time of release. Of the 19 bull trout released in 2007, all were subsequently detected at some location during the course of monitoring (Appendix A, Stevenson et al, 2008). Only one transmitter from this group of fish was later recovered in Peshastin Creek, a tributary to the Wenatchee River. Telemetry systems operating during this time include the tailraces, entrances and exits of the Rocky Reach and Rock Island fishways, and in the Wenatchee and Entiat rivers at R.K. 12.5 and 4.8, respectively. In addition to these systems, the District employed both aerial and boat surveys, and has shared and received multiple sets of telemetry data from the USFWS and Douglas PUD summarizing detections of bull trout in tributary basins and passage events at Wells Dam.

Of the 16 fish tagged and released upstream of Rocky Reach Dam in 2007, 13 fish migrated upstream and entered the Entiat River, and three fish migrated past Wells Dam and entered the Methow River. All fish resided in tributaries for varying lengths of time. There were no observations which suggest that upstream migration through Rocky Reach Dam interfered with bull trout finding and entering a spawning tributary. Of all fish tagged in 2007, and those tagged in 2005 and 2006, that moved through the fishway (total of 27 fish) 20 fish entered the Entiat River by June 29 or earlier, and the remaining 7 bull trout traveled directly to Wells Dam by June 14 or earlier. Multiple detections for each of these fish were made during both aerial and boat surveys by Chelan PUD (Stevenson et al 2007, Appendix A), and mobile ground surveys conducted by the USFWS in 2007 (R.D. Nelle and Mark Nelson, USFWS, personal communication, 2007a).

By the conclusion of the annual monitoring period (31 December, 2007), a total of 11 fish made 11 upstream passage events at Rocky Reach Dam (Table 5 of Appendix A). Of these 11 fish, two were tagged in 2005 and 9 in 2006. The fishway migration rates for these fish to various locations are shown in Tables 5 of Appendix A.

To clarify fish behavior, we classified all passage events at Rocky Reach into one of two time periods (Table 9 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 9 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. Bull trout passage may be both upstream and downstream through the Projects during this period which typically begins in late October to early November.

A total of 13 downstream passage events occurred at Rocky Reach during the 2007 monitoring period (Table 9 of Appendix A). Ten of these fish moved downstream through turbines, one

through the spillway, one through the juvenile bypass system after being guided by the vertical barrier screens in turbine unit 1, and one fish through an unknown route. Subsequent detections for each of these fish verified that no mortality (incidental take) occurred during passage through turbines or any other route at the dam (Stevenson et al 2008; Appendix A). None of 13 downstream movements was a "fallback" event and no mortality of bull trout was observed in 2007. Additionally, none of the 16 bull trout tagged and released above the dam in 2007 fell back through the Project after release.

During the course of the monitoring period, Chelan PUD monitored "take" by using passage route detections (all possible routes) at the dam, bi-weekly mobile surveys in the reservoirs, and monthly aerial surveys 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 2007 monitoring period, four SCUBA dive surveys were conducted.

All 16 bull trout tagged in May and June 2007 at Rocky Reach still remain active and at large within the Columbia or its tributaries as of March 2008. Eleven total transmitters were recovered in 2007 from fish tagged in 2005 and 2006 at both projects. Four of these tags were recovered in the Columbia, seven in tributaries. Only two of the five fish whose carcasses were found passed a hydro project at some point in time. Based on subsequent detections, it was impossible to speculate as to the final fate of these fish.

Identification of Bull trout Core Areas and Local Populations

Another component of the Monitoring and Evaluation Program is to assist the USFWS in identifying the core areas and local populations of bull trout potentially affected by Rocky Reach Dam. To meet this objective, Chelan PUD collected tissue samples from all 16 adult bull trout radio tagged at Rocky Reach Dam in 2007. Chelan PUD followed protocols provide by the USFWS Abernathy Lab for taking the genetic tissue samples. Tagging is completed so no additional samples will be collected in 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 tissue samples will be delivered to the USFWS Central Washington Field Office in Wenatchee Washington.

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

From 2005 through 2007, Chelan PUD compiled daily reservoir inflow patterns (mainstem inflow plus tributary inflow), and hourly reservoir surface elevation data for Rocky Reach Reservoir to determine the possibility of stranding or entrapment in the single off-channel area (Daroga Park swimming area) in Rocky Reach Reservoir. This area is approximately 10 to 12 surface acres in size and has two inlets/outlets. Because Rocky Reach is a run of river hydro project (has minimal storage and daily outflow generally equals daily inflow), it has relatively stable water surface elevations and remains mostly full (full pool is 707 feet msl) throughout the year. The reservoir remains within two feet (705 feet msl) of full 90% of the time and within three feet of full nearly 100% of the time (Rocky Reach headwater duration curves, Appendix 2). As such, the Daroga park off-channel area is always retains two water connections to the main river channel and does not dewater; no stranding or entrapment of bull trout can occur. This area

comprises a small portion of the total surface area of Rocky Reach Reservoir. Review of all radio-telemetry detections for three years from 2005 through 2007 indicate that adult bull trout spend most of their time in deeper water habitats in the reservoirs, and no bull trout have ever been observed in the Daroga Park swimming area.

Adult Upstream 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, 2007), and during the off-season period from 1 January to 14, 2007 (no counts or photos were taken during repair and maintenance of the fishway). 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, 2007. A total of 77 bull trout were observed ascending the Rocky Reach Dam fishway during this time period in 2007 (Figure 3, Appendix A).

3) Chelan PUD maintained the adult fishway in accordance with current anadromous fish criteria in 2007.

4) Chelan PUD continued fishway counts for bull trout into the off-season period (March and April) during 2007; from 10 January to 3 March the fishway was out of service for required annual inspection, maintenance, and AWS pump overhaul. The Fishway returned to service on 3 March. No bull trout passed between 4 March and 13 April, 2007.

5) Chelan PUD conducted feasibility of video monitoring the adult separator at the Rocky Reach Juvenile Fish Bypass sampling facility in 2003 and 2004 to enable documentation of adult salmon, steelhead, and bull trout if they enter the bypass system during juvenile sampling operations. Video taping in the sampling facility is difficult due to low light conditions and the downward camera angle that captures a dorsal view of the fish, but does not allow clear view of species defining features present on the side of the fish (color, spotting patterns, anal and caudal fin shapes, outline of upper and lower jaw features) to positively identify the fish. Mounting of the camera from inside the flume was deemed infeasible due to changes in water flow and potential injury to ESA listed juvenile salmon and steelhead.

Multiple telemetry receivers are installed at the entrance to the juvenile bypass system, and within the intake screen system of turbine units 1 and 2 at Rocky Reach. These intake screens guide smolts and other fish into the juvenile bypass system. One radio-tagged adult bull trout was verified to have entered and passed through the Rocky Reach juvenile bypass system in 2007, via the stationary bar screens in turbine unit 1. This fish did not enter the juvenile sampling facility where the adult separator bar structure is in place.

The video camera is still installed and used everyday at the juvenile bypass. No bull trout were observed in 2007 crossing the adult separator bars during sampling from 0800 to 1130 hours in the juvenile fish bypass.

6) In 2007, 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 passage data was compiled in 2007 and is reported in Stevenson, et al., 2007 (Appendix A). Upstream passage occurs at Rocky Reach Dam during all hours of the day, but is somewhat higher from early morning hours through early afternoon. Passage trends do not appear to be correlated with any specific operation of the dam. Data will be collected through June 2008 to evaluate passage for the final report in 2009.

Participation in USFWS Recovery Plan

Chelan PUD is an active member of the USFWS Upper Columbia Bull Trout Recovery Team and has participated in all of the USFWS Recovery Plan meetings. Chelan PUD is voluntarily assisting the USFWS to develop baseline data on movement of juvenile bull trout within the Entiat River though PIT tag monitoring, and is assisting the USFWS by making aerial telemetry surveys over the Methow Basin to locate bull trout tagged by the USFWS. Although the USFWS recovery plan meetings are on hold, Chelan PUD will participate in all future meetings once the USFWS reconvenes its recovery team. Chelan met with USFWS biologists three times in 2007 to discuss coordinate on radio tag locations of bull trout in the mainstem Columbia and associated tributaries (Wenatchee, Entiat, Methow) in the study area.

Tributary Habitat Enhancement

(Consider collecting and hauling LWD)

In 2007, the *Entiat PUD Canal Juvenile Habitat Enhancement* was completed. This project installed large woody debris into a rock cross-vane in the mainstem Entiat River upstream of the canal intake to divert flow into a side channel. Large wood was also anchored inside the channel to enhance juvenile holding are areas and cover. This project is part of a larger effort to develop juvenile salmonid rearing habitat in a side-channel to the Entiat River. Two more large wood projects are planned for 2008 in tributaries to Rocky Reach and Rock Island reservoirs.

Incidental Take Permit

In 2007, no incidental take was observed at Rocky Reach Dam in 2005, 2006 or 2007) at the dam or within Rocky Reach Reservoir as a result of dam passage or reservoir operations.

3.1.2 Reasonable and Prudent Measures

RPM 1.

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

In 2007, Chelan PUD collected passage data for adult bull trout that moved upstream and downstream past Rocky Reach Dam (Figure 1 & 2; Table 8-10, Appendix A). In 2007, no identifiable effects were observed in terms of migration to reach spawning areas or reductions in foraging areas. Data will continue to be collected to evaluate potential impediments to upstream or downstream passage. Of the 16 bull trout tagged and released at Rocky Reach Dam in 2007, all fish entered either the Entiat River (13) or the Methow River (3). No impediments were observed that precluded fish from passing the Project or entering a tributary. All fish entered tributaries in the month of June. The latest date of entry into a tributary by any fish was June 29, months before initiation of the bull trout spawning period in September-October.

RPM 2.

(M&E program; 1-4)

In 2007, 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 2007. A total of 24 upstream and downstream passage events by tagged bull trout occurred at Rocky Reach Dam in 2007. Chelan PUD observed no deleterious effects on tagged bull trout for either up or downstream passage. All fish that were tagged and released, or that passed upstream of Rocky Reach Dam from Rock Island reservoir, during spawning migrations, successfully entered a tributary (all by June 29) well before the start of the spawning period in September-October (Table 8, Appendix A). Chelan PUD will continue to collect passage data on radio-tagged bull trout to evaluate and possible passage effects through June 2008.

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 9 and 10 Appendix A). In 2007, tagged bull trout made 17 downstream movements through Rocky Reach Dam; no tags were detected stationary following these events and no fish mortality was verified to have occurred. No fall back occurred after an upstream passage event. Chelan PUD will continue to monitor turbine and Project passage by radio-tagged bull trout through June 2008.

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

Chelan PUD implemented the bull trout Monitoring and Evaluation Program in 2005. In 2006, Chelan PUD continued to implement the M&E program measures for Rocky Reach.

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. 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 2007, and will continue through June 2008.

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. Although the USFWS currently has recovery plan meetings on hold, Chelan PUD will participate in all future meetings once the USFWS reconvenes the recovery team.

3) *TDG monitoring and 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 2005-2007 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 who developed the BTMP at Rock Island agree that in 2007, no method exists to collect a sufficient sample size of sub-adult bull trout 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. In the Rock Island BTMP, Chelan PUD developed a juvenile bull trout PIT-tag program 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 2007, two juvenile bull trout were captured in the smolt bypass trap at Rock Island Dam. Both fish were PIT tagged and a tissue sample was collected for genetic analysis. Ten juvenile bull trout were captured, PIT tagged, and tissue sampled in 2007 at the Chiwawa River smolt trap, a Wenatchee River tributary. Since 2005, 28 juvenile bull trout have been PIT tagged at this location. Two juvenile bull trout were tagged in 2007 at the Wenatchee River trap below Lake Wenatchee, and two were PIT tagged at the smolt trap in the Wenatchee River at Monitor. These four fish were tagged and tissue sampled for genetic analysis. No juvenile bull trout were reported captured in adult broodstock traps in the basin (Chiwawa River, Tumwater Dam, Dryden Dam) in 2007. None of these tagged juvenile bull trout were detected at either Rock Island or Rocky Reach Dam fishways where PIT detections systems are in place.

As part of the monitoring and evaluation for juvenile bull trout passage in 2007, Chelan PUD is captured digital photographs of all juvenile or sub-adult bull trout that passed Rock Island Dam

via the adult fishways during normal fish counting periods, and during off-season periods when anadromous fish counts are not normally conducted. 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 2007 off-season counting period 1 January to 14 April, no juvenile or adult bull trout ascended the Rock Island fishways. Chelan PUD has conducted off-season bull trout counts for three years, 2005-2007 and thus has completed the USFWS BiOp requirement for 1 year of counting.

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 2006 to complete this plan. A third year of monitoring and elevations activities called for in the BTMP was completed in 2007.

Bull Trout Monitoring and Evaluation Program

Results of bull trout passage and behavior are summarized here from the beginning of the study period 1 January, 2007 to 31 December, 2007. We note, however, that some observations from early 2008 may be included within this report (Appendix A) if the observations help to clarify fish behavior or fish locations relevant to movement documented in 2007.

During the 2007 tagging period (15 May to 30 June), a total of three bull trout were tagged and released upstream of Rock Island Dam. Genetic samples were taken from these fish for analysis by USFWS. Methods of tagging were identical to those described in BioAnalysts, Inc. (2002 and 2004) and Stevenson et al. (2006, 2007). During the tagging period, no mortalities associated with the tagging procedure occurred. All fish appeared healthy and fully recovered at the time of release.

All three bull trout tagged and released in 2007 were detected at other locations during the course of monitoring in 2007. The transmitter from one of these fish (code 101) was later recovered in Peshastin Creek (tributary to Wenatchee River) without a fish carcass by USFWS biologists. The final fate of this fish remains unknown. Telemetry systems deployed during 2007 included the tailraces, entrances and exits of the Rock Island fishways, and the Wenatchee and Entiat rivers at R.K. 12.5 and 4.8, respectively. In addition to these systems, Chelan PUD employed aerial and boat surveys, and has received information from the USFWS (for fish residing in tributaries) and Douglas PUD (for Wells Dam) regarding the detection of fish tagged at Rock Island and Rocky Reach.

Of the three fish that were tagged and released upstream of Rock Island Dam in 2007, all three entered the Wenatchee River and resided within that system for varying lengths of time (Table 3 of Appendix 1). One of these two fish entered Peshastin Creek (tributary of the Wenatchee River); its transmitter was recovered on 14 August in thick brush along the river bank, but no carcass was found. The other two fish that entered the Wenatchee River in 2007 remain active and at large (Stevenson et al. 2008, Appendix A).

By the end of the 2007 study period, a total of 64 of the 86 fish tagged since 2005 remain at large in the Columbia River or its tributaries. One transmitter was recovered in Rock Island Reservoir in 2007 for a previous years tag group. Of the 22 tags recovered in all areas since 2005, only five have been recovered in the Columbia River. No incidental take was observed or verified for any of these fish. The transmitter recovery rate observed Chelan PUD's work is similar to that observed in other bull trout studies. Of the 25 bull trout tagged in the fall of 2003 by the USFWS, 4 transmitters (16.0%) were recovered (R.D. Nelle, USFWS, pers comm., 2005). During the 2002 bull trout study funded by the mid-Columbia PUDs, 35.0% of the transmitters (14 of 40 bull trout) were recovered at some point after release, with only one carcass being recovered (BioAnalysts, Inc. 2004).

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 the three adult bull trout radio tagged at Rock Island Dam in 2007. Chelan PUD followed protocols provided by the USFWS Abernathy Lab for taking the tissue samples. Three years of radio-tagging have been completed, with genetic samples taken on each fish, and therefore no more genetic samples will be taken in 2008. Chelan PUD will the fund genetic analysis of the tissue samples to help determine the origin of these fish. The 2007 tissue samples will be delivered to the USFWS Central Washington Field Office in Wenatchee Washington. All tagging and genetic analysis work is completed for the 3-year study period.

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

Chelan PUD compiled daily reservoir inflow patterns for Rock Island (Rocky Reach discharges plus tributary inflow to Rock Island Reservoir), and hourly reservoir surface elevation data for Rock Island Reservoir in 2007. Three years of hourly forebay elevations (headwater elevations) for Rock Island Reservoir from 2005 through 2007 were used to determine if potential exists to strand or entrap bull trout in any off-channel area in the reservoir as a result of Project operations. Only one location exists in the Rock Island Reservoir (Walla Wall Point Park swimming area) that contains an off-channel area. This swimming area is connected to the mainstem Columbia via both an inlet and outlet, and is about three surface acres in size. The area stays watered continually and has never gone dry; water connectivity to the mainstem is always present due to Rock Island's stable reservoir elevations, and therefore no stranding or entrapment can take place. Rock Island Dam's maximum forebay elevation is 613 feet msl. Rock Island reservoir fluctuates very little, and inflow to the project closely approximates outflow in a 24-hour day (i.e. run of river project). For all hours from 2005 through 2007, the Project's reservoir maintained an elevation at or above 612.6 feet 98.5 percent of the time (Rock Island headwater duration curves, 2005-2007, Appendix C). Intensive radio-telemetry tracking surveys over this three year period did not detect any of the 86 tagged bull trout using the Walla Walla Point swimming area. Back water or side channel areas represent a very small percentage of the total surface area of Rock Island Reservoir. Adult bull trout do not appear to use the park swimming area and stranding or entrapment of juvenile bull trout is not possible.

<u>Adult Passage Monitoring</u>

1) Chelan PUD conducted normal, in-season fishway counts for bull trout in 2007 from 14 April through 14 November at Rock Island. A total of 46 bull trout ascended the three fishways collectively in 2007, with 25 ascending the left fishway, none the center fishway, and 21 the right fishway (Figure 2, Appendix A). Digital photographs of each fish, showing the timing of each passage, have been stored and are available for review by the USFWS.

2) In 2007, 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 staggered between 1 January and 4 March, 2007. During this period, ladders were dewatered and serviced one at time in rotation, while the other two ladders remained in operation. Fish passage is always available at Rock Island through two of three ladders. This maintenance rotation is consistent with the service that occurs each year for the three Rock Island Dam fishways.

3) Chelan PUD conducted off-season fishway video counts for bull trout during spring 2007. Off-season video counting was conducted in the Rock Island fishways during the winter period from January 1, through April 14, 2007. No bull trout ascended Rock Island Dam fishways during these periods in 2007. All off-season counting requirements are completed at Rock Island.

4) In 2007, 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 1 & 2). Bull trout are 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 passage and any specific project operation at Rock Island Dam. Fish passage data and operations data will again be collected through June 2008 to complete three full years of monitoring.

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. Although recovery plan meetings are currently on hold, Chelan PUD will participate in all future meetings once the USFWS reconvenes the recovery team.

Tributary Habitat Enhancement

(Consider collecting and hauling LWD)

In 2006, Chelan PUD collected an estimated 100 metric tons of 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 by the committees.

Incidental Take Permit

In 2007, no incidental take of radio-tagged bull trout during upstream or downstream passage occurred as a result of operations at Rock Island Dam or as a result of operations within Rock

Island Reservoir. Of the three bull trout tagged in 2007 at Rock Island, one transmitter was recovered in thick brush above the high water mark in Peshastin Creek (outside the monitoring study area), a tributary to the Wenatchee River. No carcass was found.

3.2.2 Reasonable and Prudent Measures

RPM 1.

Chelan PUD collected passage data for adult bull trout that moved upstream and downstream past Rock Island Dam. Fishway passage times and migration metrics at Rock Island Dam are shown in Table 6 of Appendix A. Data will again be collected through June 2008 to continue monitoring for impediments to upstream or downstream passage. All three bull trout tagged and released at Rock Island Dam in 2007 entered the Wenatchee River (Stevenson et al., 2008 in Appendix A). No impediments were observed that precluded bull trout from passing the Project or finding and entering a tributary. All three fish tagged at Rock Island 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 2007 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 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 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. Nothing more is required on this task.

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

Chelan PUD is monitoring entrainment of radio tagged bull trout at Rock Island to identify potential negative effects that may occur. In 2007, only four bull trout moved downstream of Rock Island Dam. One of these fish moved downstream through spillway 1 in July, and the other three through an unknown route; telemetry systems were present and operating but failed to detect the route of downstream passage. Three of these fish are still alive and at large. The transmitter for the other fish was recovered in the tailrace below Rock Island, following multiple detections at various locations in the tailrace. No carcass was found with the transmitter and hence no clarification of its fate can be made. Because if the fishes different locations in fast water in the tailrace over several days time, we believe the fish was not injured going through the project, and may have ultimately lost its transmitter. All other fish were later detected on multiple occasions in different locations of the Wenatchee River. Chelan PUD will continue to monitor passage and incidental take at Rock Island through June 2008.

3. *(Develop comprehensive M&E program).*
The Monitoring and Evaluation program is in place at Rock Island Dam and reservoir. Measures contained in the Rock Island Comprehensive Bull Trout Management Plan are ongoing and will continue through June 2008.

4. *(Interim measures).*
Interim period measures were addressed and completed in the 2005 Interim Annual Report (Chelan PUD 2004). Nothing more is required under the interim measures.

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. Nothing more was required on this recommendation.

2. *(Participate in Recovery Plan).*
The USFWS held no ESA Recovery Plan meetings in 2007. 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 installed two more over/under spill gate structures at Rock Island Dam in 2007 for a total of three. 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 previous gates. These devices show promising reductions in TDG uptake during fish spill. Few TDG exceedences occurred in 2007 downstream of Rock Island Dam. Fish passage survival tests in 2007 showed no negative effects on fish when passing through these gates. Survival of yearling Chinook salmon in 2007 was higher than previous years tested with the over/under gates installed.

SECTION 4: CONCLUSIONS

Based on the data collected through 31 December, 2007, we report the following conclusions for bull trout monitoring at Rocky Reach and Rock Island dams and reservoirs:

1. Sixteen bull trout were tagged at Rocky Reach Dam and three at Rock Island Dam in 2007. These fish made successful upstream passages at the dams since the fish were captured at the top of the fishways at both projects, within just a few feet of the exit to the forebay. All fish were in excellent condition. During the fish counting season, 77 bull trout passed upstream of Rocky Reach dam via the adult fishway, and 46 passed Rock Island.

2. During the 2007 telemetry monitoring period from 1 January – 31 December, 20 bull trout were responsible for 30 total passage events at the Projects; 24 passage events occurred at Rocky Reach Dam and 6 at Rock Island Dam. For these passage events, no mortality attributable to dam passage or reservoir operations was observed in 2007.

3. Radio-tagged bull trout made 13 upstream passages and 17 downstream passages in 2007: Eleven fish migrated upstream through Rocky Reach Dam and two moved upstream through Rock Island Dam during the upstream migration period. Thirteen downstream movements occurred at Rocky Reach and four at Rock Island. Downstream passages were verified through powerhouses and spillways at both Projects and the juvenile fish bypass system at Rocky Reach. Three of the four transmitters in fish that moved downstream at Rock Island are still active and at large.

4. A total of 11 transmitters and four verified carcasses were recovered in the 2007 monitoring period. Of these transmitters, two were recovered in the Entiat River Basin, three in the Methow River Basin, one in the Wenatchee River Basin, and four in the Columbia River (two in Rocky Reach, one in Rock Island reservoir, and one in Wanapum reservoir below Rock Island Dam.

5. No fall back or undesired “entrainment” appeared to have occurred at Rocky Reach or Rock Island in 2007 after fish moved upstream through the fishways.

6. Of the 19 bull trout tagged at Rocky Reach and Rock Island dams during the 2007 study period, 18 remain at large within the Columbia River, or within the Wenatchee, Entiat, or Methow rivers.

7. 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 2007 monitoring period. Stranding or entrapment of bull trout does not occur at Rocky Reach or Rock Island reservoirs because Project operations maintain stable reservoir elevations and off-channel areas contain inlets and outlets that remain connected to the mainstem Columbia under all reservoir operations.

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APPENDIX A:

MOVEMENT OF RADIO-TAGGED BULL TROUT THROUGH ROCKY REACH AND ROCK ISLAND DAMS AND RESERVOIRS, 2007

MOVEMENTS OF RADIO-TAGGED BULL TROUT THROUGH ROCKY REACH AND ROCK ISLAND DAMS AND RESERVOIRS: 2007

Submitted To:
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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 Opinion, issued in May 2004, and the USFWS draft bull trout recovery plan. 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.

During the period 14 April to 14 November 2007, a total of 77 bull trout were observed ascending and passing the Rocky Reach Dam fishway. At Rock Island Dam, a total of 46 bull trout ascended the fishways. In 2007, a total of 16 bull trout were tagged and released upstream of Rocky Reach Dam and three upstream of Rock Island Dam.

All 19 bull trout tagged and released in 2007 were later detected during the course of monitoring. Of the three fish tagged and released upstream of Rock Island Dam, two entered the Wenatchee River and resided there for varying lengths of time. The third fish first traveled to Rocky Reach Dam and eventually migrated up the Wenatchee River. Of the 16 fish released upstream of Rocky Reach Dam, three traveled to the Methow Basin, one fish was detected at Wells Dam but returned to the Entiat River, and 12 traveled directly into the Entiat River basin.

Consistent with the 2006 bull trout study, we assessed bull trout migration rates past both dams. In sum, migration rates in 2007 were based on two upstream passage events at Rock Island Dam and 11 upstream passage events at Rocky Reach Dam. For the Rock Island fish, the median Tailrace, Cycling, Fishway, and Project migration rates were 0.26, 9.62, 0.27, 10.16 days, respectively. At Rocky Reach Dam, the median Tailrace,

Cycling, Fishway, and Project migration rates were 0.09, 2.08, 0.23, and 2.73 days, respectively.

During the 2007 study period, 20 bull trout were responsible for a total of 30 passage events, with 24 occurring at Rocky Reach Dam and six at Rock Island Dam. Of those passage events, 13 were the result of fish migrating upstream through the fishways and 17 were the result of fish passing downstream through a spillway, turbine unit, or fish bypass system. Of the 17 downstream passage events, four occurred at Rock Island Dam, and 13 at Rocky Reach Dam. For the fish passing downstream of Rock Island Dam, one passed downstream through the spillway, and the other three through unidentified routes. At Rocky Reach Dam, a total of 10 bull trout passed downstream through turbines, one through the spillway, one through the juvenile bypass system after being guided by the stationary intake screens in Unit 1, and one through an unidentified route. For these 17 downstream passage events, and the 13 upstream passage events (2 at Rock Island and 11 at Rocky Reach), subsequent detections for each fish verified that no mortality occurred during passage at the dams or as a result of reservoir operations.

A total of 11 transmitters were recovered in 2007. Five were recovered with no carcass present, five transmitters were recovered with carcasses, and one transmitter was recovered with inconclusive evidence as to carcass presence. Of the 11 transmitters recovered, four were in the Columbia River, two in the Entiat River, one in the Twisp River, one in the Mad River, one in Peshastin Creek, one in Foggy Dew Creek, and one in the Methow River. Only two of the recovered transmitters were from fish that had migrated past a Chelan PUD dam. One fish migrated downstream of Rock Island Dam and the other migrated downstream of Rocky Reach Dam through turbine 7 and back upstream through the fishway.

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 radio-telemetry 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 Opinion, issued in May 2004, and the USFWS draft bull trout recovery plan. 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 third year of a multi-year study, we only summarize results for the third year, collected from 1 January 2007 to 31 December 2007. Some information

collected after December 2007 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 and behavior. 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 (R.K. 693.8).
- From the southern tip of Quilomene Island to the Ringold Fish Hatchery (R.K. 570.5).
- Wells Dam tailrace and forebay (data were provided by Douglas PUD).
- The Wenatchee River, Peshastin Creek, Ingalls Creek, Chiwawa River, 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, the 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 2007 Bull Trout Migration

During the period 14 April to 14 November 2007, a total of 77 bull trout were observed ascending the Rocky Reach Dam fishway. At Rock Island Dam, a total of 46 bull trout ascended the fishways; 25 ascended the left fishway, 0 the center, and 21 the right 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 2007, bull trout passage at Rocky Reach Dam was the lowest observed during any year for the period 2000 to 2007. At Rock Island Dam, bull trout passage was slightly up from 2006, but still lower than years 2000-2005 (Table 1 and Figure 3). Although bull trout numbers passing the projects in 2007 is generally lower than previous years, passage in 2007 is within the annual range of variability observed since bull trout counts at the dams first began.

2.0 Methods

Methods used in 2007 were consistent with those used during the 2001-2003 and 2005-2006 study periods. Specifically, methods used to capture, handle, tag, release, and monitor bull trout were nearly identical to those used previously (BioAnalysts 2002 and 2004; and Stevenson et al. 2006). 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 2007. At Rocky Reach Dam, we used the same upstream release location as before. This 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 site was about 1.6 km further upstream than the previous release site

Telemetry methods used to monitor tagged fish in 2007 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 R.K. 12.5 and R.K. 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).

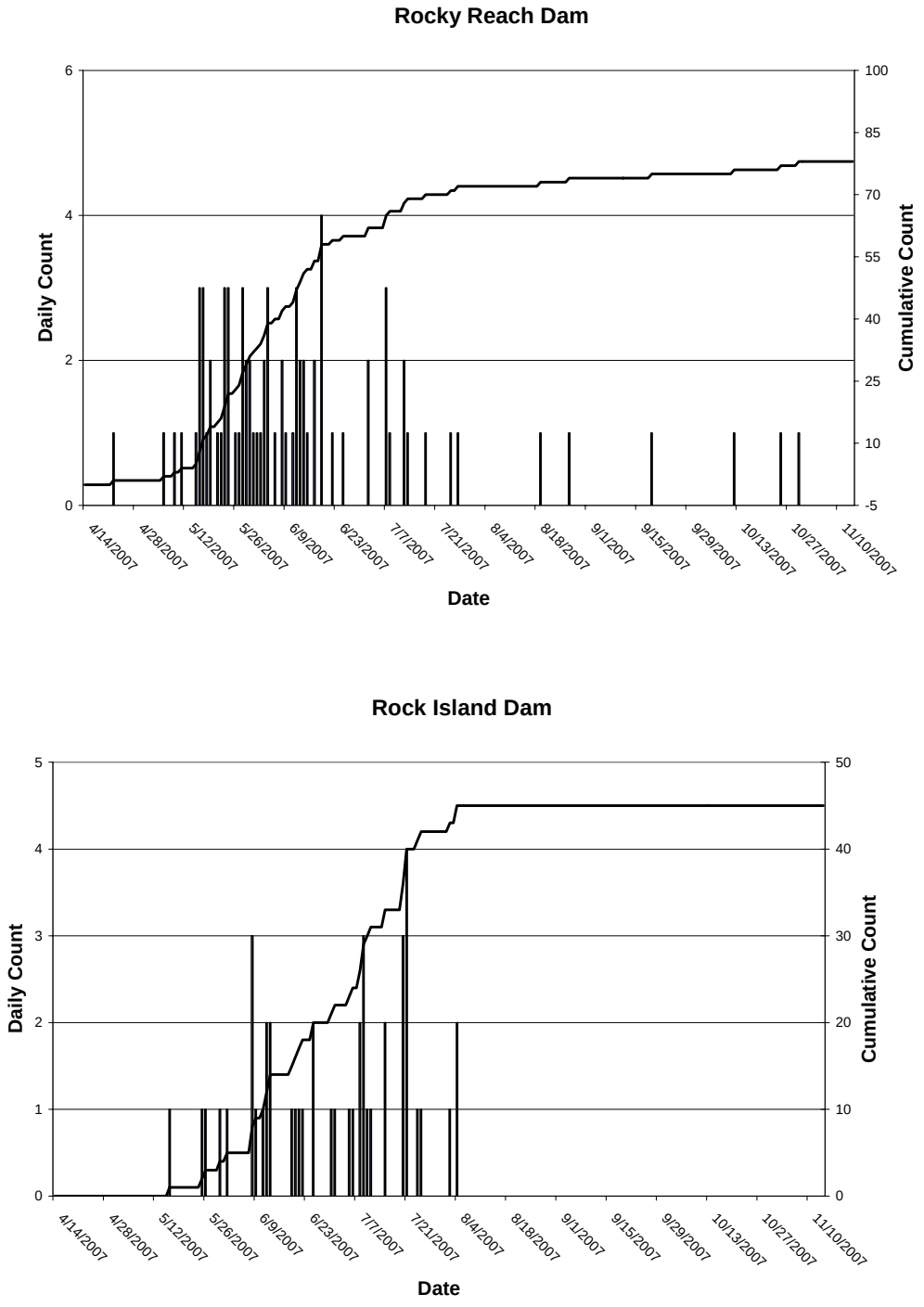
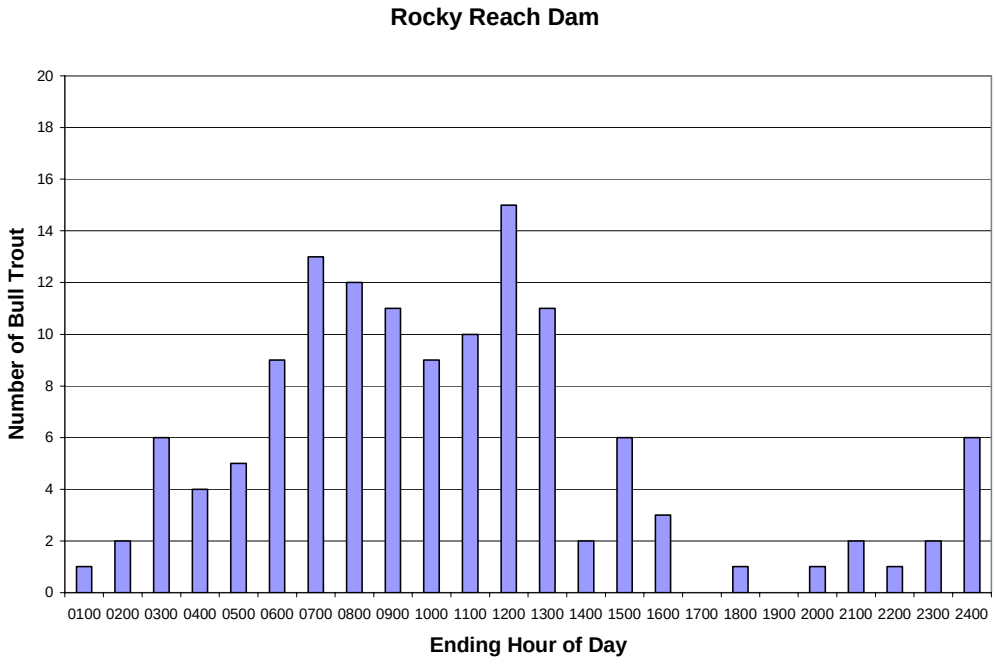


Figure 2. Daily and cumulative bull trout counts at Rocky Reach and Rock Island dams during the period 14 April to 14 November 2007.



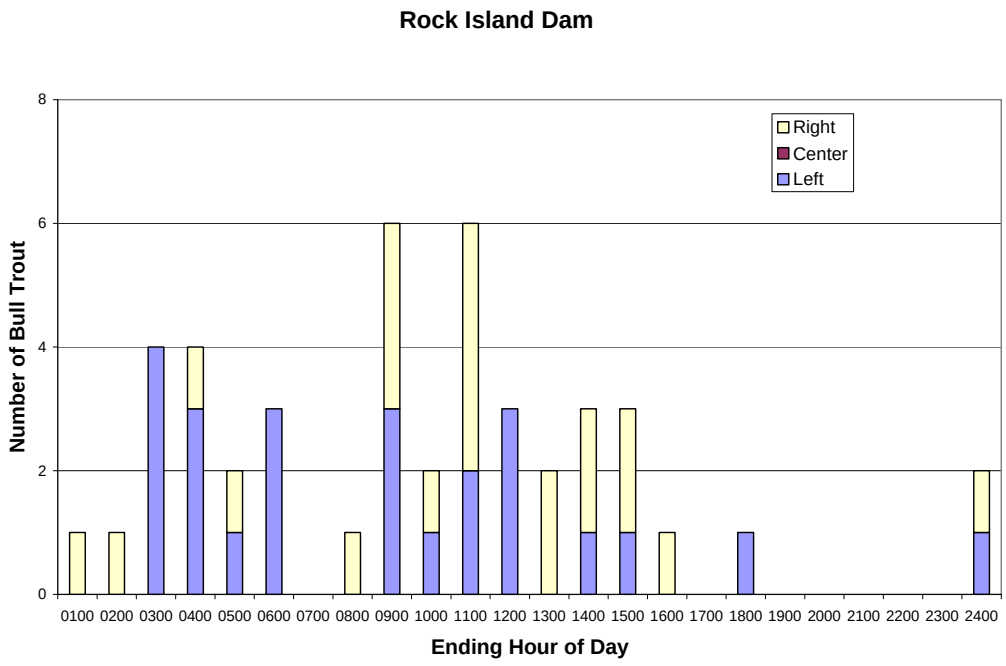


Figure 3. Diel timing of bull trout passage at Rocky Reach and Rock Island dams during the period 14 April to 14 November 2007.

Table 1. Annual bull trout passage at Rocky Reach and Rock Island dams during the period 14 April to 14 November 2000-2007.

	Rock Island				
Year	**Left**	**Center**	**Right**	**Rock Island Total**	**Rocky Reach Total**
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	25	0	21	46	77

Figure 4.

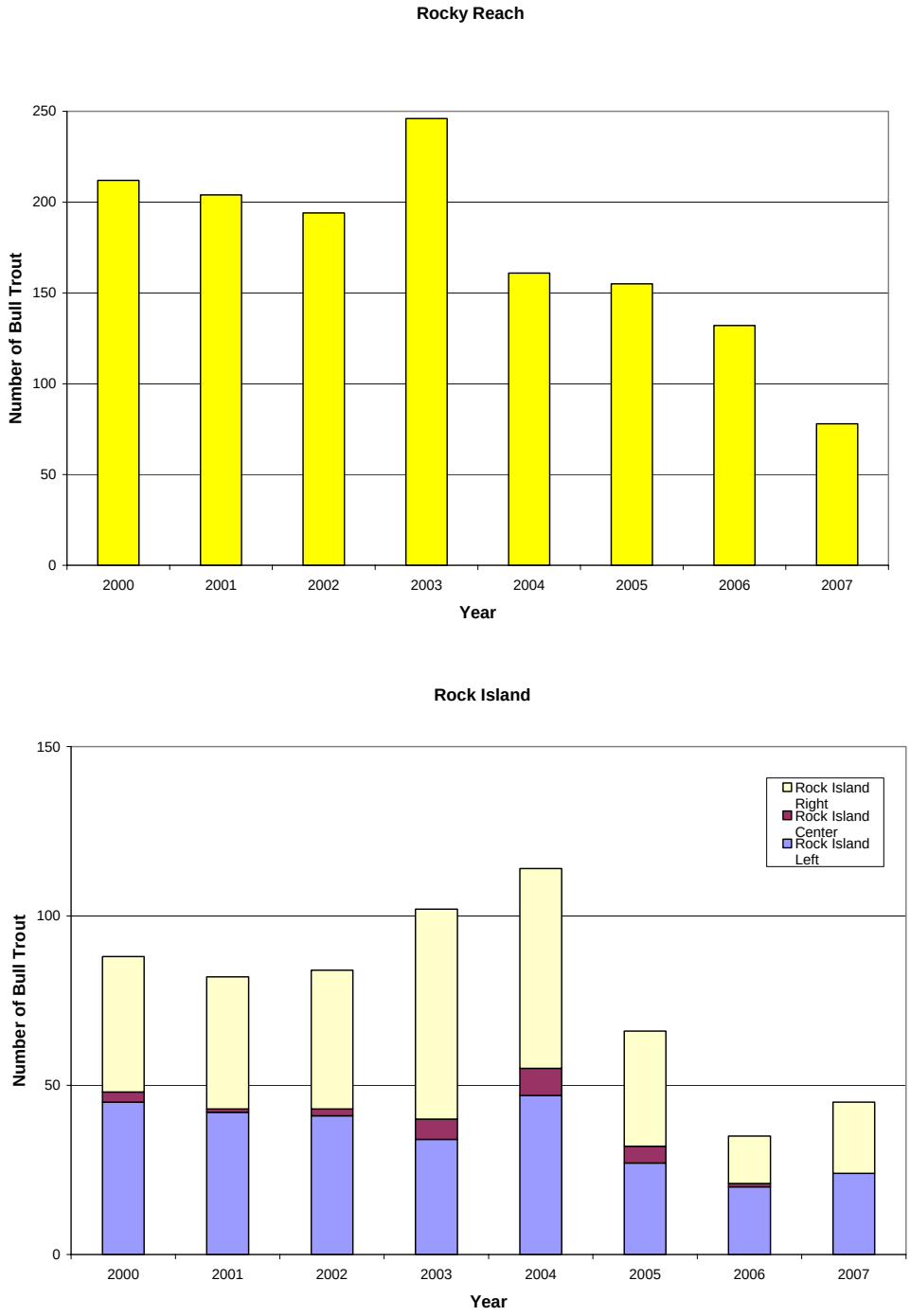


Figure 5. Annual bull trout passage at Rocky Reach and Rock Island dams during the period 14 April to 14 November 2000-2007.

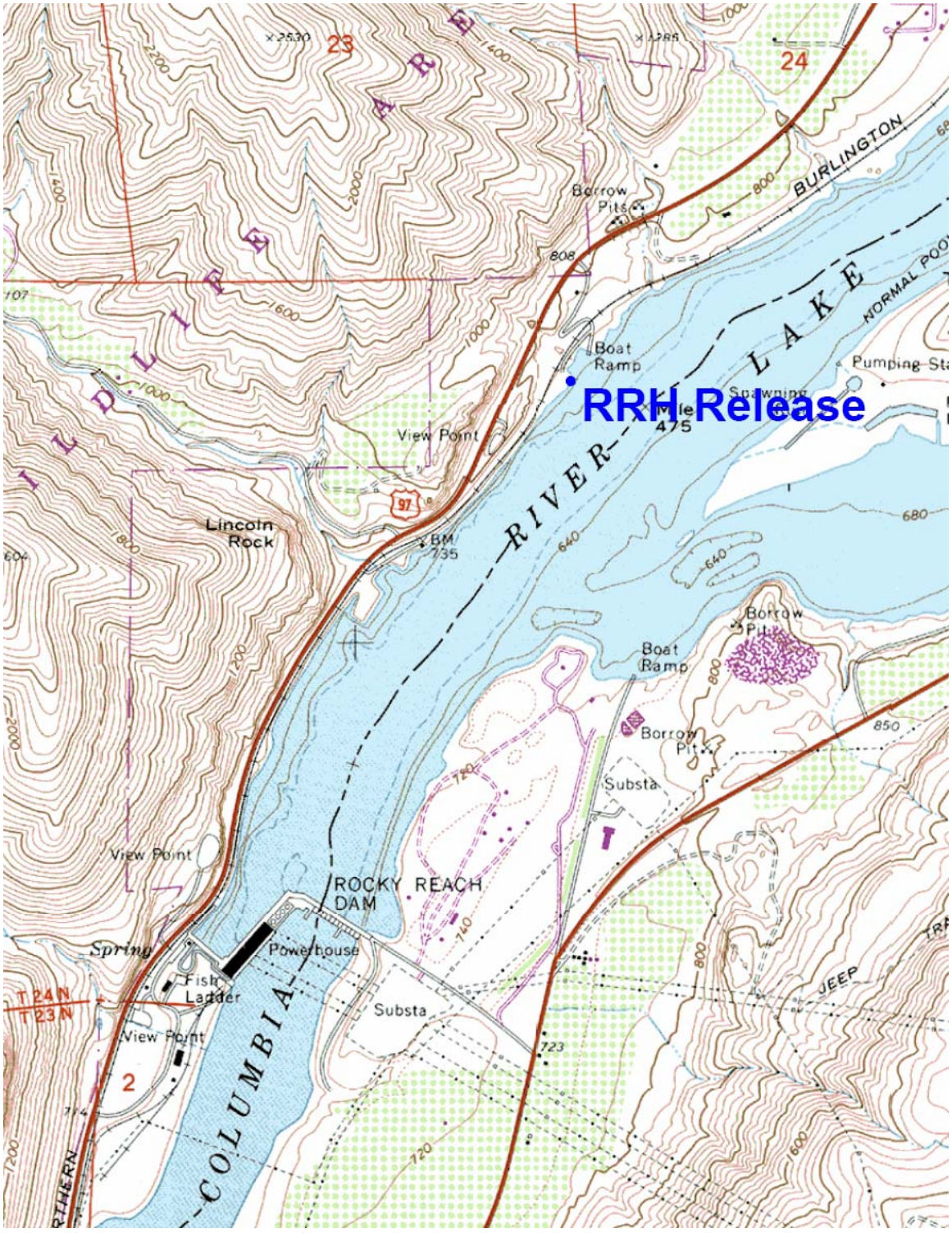


Figure 6. Release location for bull trout upstream of Rocky Reach Dam during the 2007 study period.

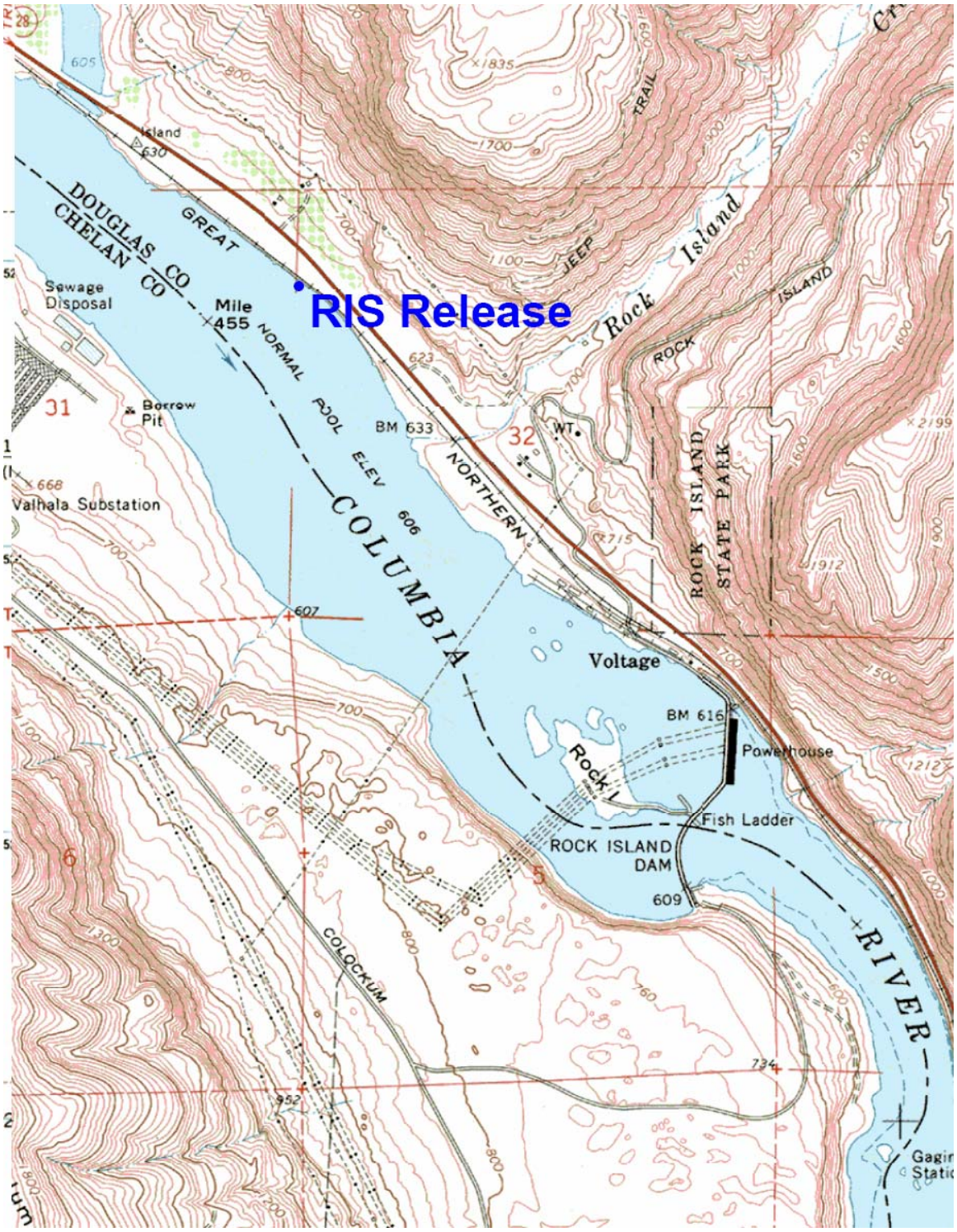


Figure 5. Release location for bull trout upstream of Rock Island Dam during the 2007 study period.

3.0 Results and Discussion

3.1 Trapping and Tagging Activities

In 2007, a total of 16 bull trout were tagged and released upstream of Rocky Reach Dam and 3 upstream of Rock Island Dam (Tables 2 and 3). The proposed tagging period for this study was 14 May to 29 June.

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 in 2007 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. The smallest fish tagged in 2007 was at Rock Island Dam and it was 40.0 cm in length.

Our goal at Rocky Reach Dam was to tag 30 bull trout. In an effort to collect a representative sample, we established weekly tagging targets based on the upstream run timing of bull trout at the dam. The weekly targets were calculated from historical passage data at Rocky Reach Dam during the period 2000-2006 (Table 4; Figure 6). Because we tagged fewer fish than what was desired during the first week of sampling, we altered our strategy and planned to tag all fish of suitable size that migrated upstream of the dam. However, by the end of the fourth week we were 13 fish behind our pre-determined goal. This resulted in only 16 bull trout being captured and tagged during the 2007 period. The median length and weight of the 16 bull trout tagged at Rocky Reach Dam was 61.3 cm and 2,649.5 g, respectively (Table 2). Our goal at Rock Island Dam was to tag 15 bull trout during the period 14 May to 29 June. Because we were unable to achieve weekly tagging goals at Rock Island Dam in previous years, we did not establish weekly targets in 2007. We were only able to tag a total of 3 bull trout at Rock Island Dam in 2007 (Table 3). The median length and weight of bull trout tagged at Rock Island Dam was 49.5 cm and 1,138.5 g, respectively (Table 3).

No mortalities associated with the tagging procedure occurred during the tagging period. All fish appeared healthy and fully recovered at the time of release.

Table 2. Summary of bull trout tagged at Rocky Reach Dam in 2007. All fish were released about 2.3 km upstream of the dam near the west shore. Winter residence is defined as the tributary that each tagged fish entered without subsequent entry into another tributary of the Columbia River.

	Release			Location of Winter Residence	
Code	**Date/Time**	**Length (cm)**	**Weight (g)**	**Basin**	**River**
111	5/16/2007 16:18	59.0	2,576.0	Methow	Early Winters Creek
112	5/17/2007 15:56	64.0	3,897.0	Entiat	Entiat River
113	5/18/2007 11:09	55.0	2,114.0	Entiat	Mad River
114	5/21/2007 17:17	69.0	4,006.0	Entiat	Entiat River
115	5/24/2007 14:02	68.5	4,157.0	Methow	Twisp River
116	5/29/2007 13:02	65.0	3,547.0	Methow	Twisp River
117	5/29/2007 15:25	71.0	4,422.0	Entiat	Entiat River
118	6/1/2007 9:31	61.5	2,619.0	Entiat	Entiat River
119	6/4/2007 15:36	61.5	3,005.0	Entiat	Mad River
120	6/4/2007 18:29	61.0	2,579.5	Entiat	Entiat River
121	6/12/2007 9:54	61.5	2,423.0	Entiat	Mad River
122	6/12/2007 11:32	50.0	1,641.5	Entiat	Entiat River
123	6/12/2007 13:26	43.0	1,128.0	Entiat	Entiat River
124	6/13/2007 12:55	58.5	2,680.0	Entiat	Entiat River
125	6/19/2007 13:12	55.0	2,165.0	Entiat	Entiat River
126	6/19/2007 15:27	60.0	2,979.0	Entiat	Entiat River
	Mean:	60.2	2,871.2		
	Median:	61.3	2,649.5		
	Minimum:	43.0	1,128.0		
	Maximum:	71.0	4,422.0		

Table 3. Summary of bull trout tagged at Rock Island Dam in 2007. All fish were released about 2.6 km upstream of the dam near the east shore. Winter residence is defined as the tributary that each tagged fish entered without subsequent entry into another tributary of the Columbia River.

	Release			Location of Winter Residence	
Code	**Date/Time**	**Length (cm)**	**Weight (g)**	**Basin**	**River**
101	5/30/2007 12:49:00	51.5	---	Wenatchee	Peshastin Creek
102	6/12/2007 16:16:00	40.0	910.0	Wenatchee	Wenatchee River
103	6/13/2007 10:16:00	49.5	1,367.0	Wenatchee	Wenatchee River
	Mean:	47.0	1,138.5		
	Median:	49.5	1,138.5		
	Minimum:	40.0	910.0		
	Maximum:	51.5	1,367.0		

Table 4. The average weekly total number of bull trout passing Rocky Reach Dam during the period 2000 to 2006 and the target number of bull trout to be tagged at the dam in 2007.

	Week	2000-2006 Weekly Total	Percent of Total	Estimate	Target
14-May	1	125	13.1%	3.9	4
21-May	2	244	25.5%	7.6	8
28-May	3	219	22.9%	6.9	7
4-Jun	4	136	14.2%	4.3	4
11-Jun	5	107	11.2%	3.4	3
18-Jun	6	69	7.2%	2.2	2
25-Jun	7	57	6.0%	1.8	2
Total:		957	100.0%	30.0	30

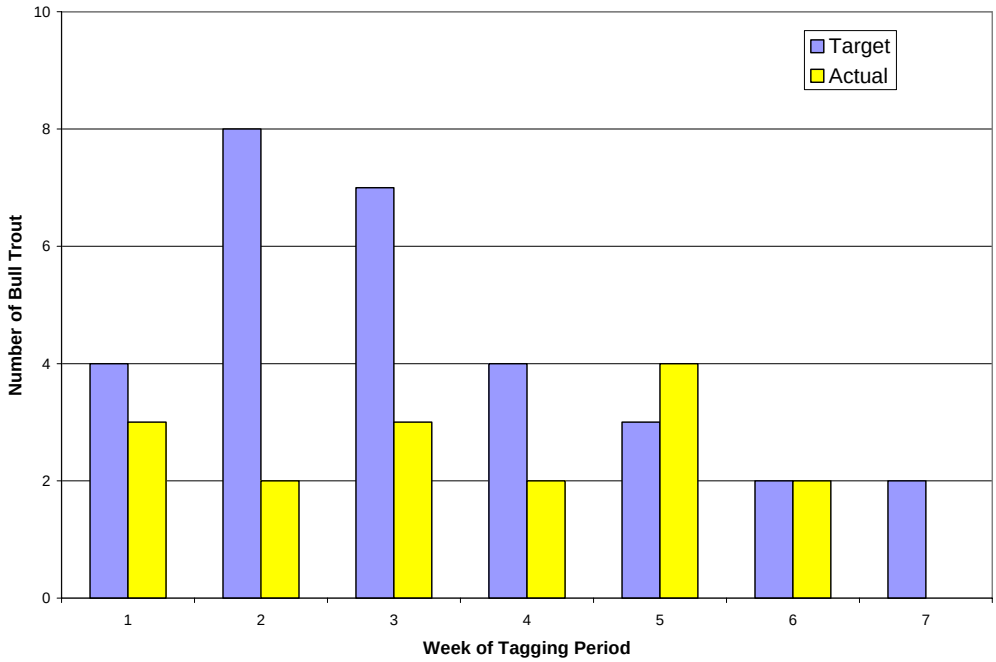


Figure 6. The target number and actual number of bull trout tagged at Rocky Reach Dam in 2007.

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).

3.3 General Observations

Of the 19 bull trout tagged and released in 2007, all were later detected during the course of monitoring. The three fish tagged and released upstream of Rock Island Dam traveled to the Wenatchee River basin shortly after release. One fish traveled directly to the Wenatchee River and then into Peshastin Creek where the transmitter was recovered on 14 August downstream of the Peshastin Irrigation District diversion dam (RK 3.2). The second entered the Wenatchee River in late June and has not been detected since then. The last fish migrated to the Rocky Reach Dam tailrace, returned to the Wenatchee River (spending 24 days in this tributary), and then returned to the Wanapum pool.

Of the 16 fish released upstream of Rocky Reach Dam, 13 entered and resided within the Entiat Basin; ten resided within the mainstem Entiat River, and three in the Mad River (Table 2). All ten fish in the Entiat River resided upstream of Preston Creek (R.K. 37.2).

Only three of the bull trout released upstream of Rocky Reach Dam did not enter the Entiat Basin. These three fish migrated upstream past Wells Dam and entered the Methow River (Table 2). One fish resided in Early Winters Creek and was last detected at RK 12.5 on 14 September. The other two fish traveled up the Twisp River to RK 36.0 and RK 48.0.

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 and 2006 annual reports (Stevenson et al. 2006 and 2007). 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 last detection as the fish exited the fishway.

In addition to the 19 bull trout tagged and released in 2007, two bull trout tagged in 2005 and nine tagged in 2006 were also detected migrating upstream of Rocky Reach or Rock Island dams during the 2007 study period. We included these fish in our assessment of migration rates through projects. In sum, therefore, migration rates in 2007 were based on 11 upstream passage events at Rocky Reach Dam (Table 5) and two upstream passage events at Rock Island Dam (Table 6).

Two fish (Codes 151 and 188) that migrated upstream of Rock Island Dam in 2007 also migrated upstream of Rocky Reach Dam and therefore were included in both data sets (Table 5). The median Tailrace Residence Time, Fishway Cycling, Fishway Migration, and Project Migration for those fish at Rock Island Dam were 0.26, 9.62, 0.27, and 10.16 days, respectively. It should be noted, however, that the small sample size of two fish may not be representative of the population as a whole. The code 151 fish had an extended Fishway Cycling Time of 18.40 days, which increases the overall median Project Migration time. In 2001, for example, three tagged bull trout migrated through the Rock Island fishway with a median travel time from tailrace to exit of 2.28 days (BioAnalysts, 2002). This median travel time (2.28 days) is similar to the total migration time of 1.38 days for the code 188 fish.

As noted above, 11 fish, representing 11 passage events, migrated upstream through Rocky Reach Dam in 2007 (Table 5). Of those 11 fish, two were tagged in 2005 and nine in 2006. None of the bull trout tagged in 2007 migrated upstream through Rocky Reach Dam. For all 11 passage events occurring at Rocky Reach Dam in 2007, the median Tailrace, Cycling, Fishway and Project migration rates were 0.09, 2.08, 0.23, and 2.73 days, respectively (Table 5). It is interesting to note that the median fishway migration time for 2007 is identical to the median fishway time for the 16 passage events in 2006.

Table 5. Migration rate metrics for bull trout passing Rocky Reach Dam, 2007.

	Migration Rate (days)			
Code	**Tailrace Time**	**Fishway Cycling**	**Fishway Migration**	**Project Migration**
40	---	0.40	0.74	---
45	0.15	1.97	0.23	2.35
151	0.05	2.08	0.29	2.41
166	0.21	4.94	0.19	5.34
173	0.04	1.86	0.16	2.06
175	0.25	10.72	0.25	11.22
178	0.04	4.06	0.26	4.36
181	0.05	2.76	0.50	3.32
184	0.03	2.91	0.12	3.05
188	0.14	1.33	0.23	1.70
190	0.26	1.14	0.20	1.60
Mean:	0.12	3.11	0.29	3.74
Median:	0.09	2.08	0.23	2.73
Minimum:	0.03	0.40	0.12	1.60
Maximum:	0.26	10.72	0.74	11.22

Table 6. Migration rate metrics for bull trout passing Rock Island Dam, 2007.

	Migration Rate (days)			
Code	**Tailrace Time**	**Fishway Cycling**	**Fishway Migration**	**Project Migration**
151	0.06	18.40	0.47	18.93
188	0.46	0.84	0.07	1.38
Mean:	0.26	9.62	0.27	10.16
Median:	0.26	9.62	0.27	10.16
Minimum:	0.06	0.84	0.07	1.38
Maximum:	0.46	18.40	0.47	18.93

3.5 Inriver Upstream Migration Rates

As discussed previously, all three of the bull trout released upstream of Rock Island Dam in 2007 entered the Wenatchee River where they resided for varying lengths of time (Table 3). One fish, however, migrated from the release site upstream to the Rocky Reach Dam tailrace before dropping back and entering the Wenatchee River (code 102). In addition to these fish, two other fish that migrated upstream of Rock Island Dam (codes 151 and 188) also migrated upstream to Rocky Reach Dam. For the two fish that migrated from the Rock Island release site directly to the Wenatchee River site (codes 101 and 103), the median migration time was 9.20 days, and the median date of tributary entrance was 15 June (Table 7). For the three fish that migrated from Rock Island Dam to Rocky Reach Dam (codes 102, 151 and 188), the median migration time was 1.54 days.

As previously stated, 16 bull trout were tagged and released upstream of Rocky Reach Dam in 2007. In addition, two fish from the 2005 tagging group and nine fish from the 2006 tagging group migrated upstream of Rocky Reach Dam. Therefore, in sum, 27 bull trout were either released upstream of Rocky Reach Dam or exited the Rocky Reach fishway. For those 27 fish, we calculated the migration times to either the Entiat River site (R.K. 4.8) or Wells Dam (R.K. 829.0). For the 20 fish that migrated into the Entiat River, the median migration time between either the Rocky Reach fishway exit or the release site to the Entiat River site was 11.37 days. Furthermore, the median date of tributary entrance was 17 June. For the seven fish that migrated upstream to Wells Dam, the median migration time between the Rocky Reach fishway exit or the release site to the Wells Dam tailrace was 2.78 days (Table 8).

The relative migration rates to these two locations may seem counter intuitive; that is, one would expect it to take longer for a bull trout to travel from Rocky Reach Dam to Wells Dam (total of 66.6 kilometers) than from Rocky Reach Dam to R.K. 4.8 on the Entiat River (total of 20.9 kilometers). However, this was 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 reach spawning grounds in a timely manner (BioAnalysts 2004).

Further analysis of the in-river migration data for fish migrating upstream of Rocky Reach Dam revealed that estimates may vary for fish released immediately upstream of the dam after tagging compared to fish that migrate upstream of Rocky Reach Dam and exit the fishway. For fish tagged and released upstream of the dam in 2007 (codes 111 to 126 in Table 8), the median migration rate to the Entiat River site and Wells Dam are greater than that for fish that were tagged in previous years and exited the Rocky Reach Dam fishway (remaining codes in Table 8). For fish tagged and released in 2007, the median travel times to the Entiat River site and Wells Dam were 11.87 and 3.05 days, respectively. For fish tagged in previous years, the median travel times from the Rocky Reach exit to the Entiat River site and Wells Dam were 8.14 and 2.11 days, respectively.

A similar observation was made for fish tagged and released downstream of Rocky Reach Dam compared to fish migrating upstream from the Rock Island Reservoir during the previous telemetry study (2001-2003; BioAnalysts, Inc. 2004). In that study, however, the metric of comparison was the length of time tagged fish spent in the tailrace of Rocky Reach Dam. Fish released downstream of the dam after surgery required longer to migrate upstream and enter the fishway of the dam compared to in-river migrating fish (BioAnalysts, Inc. 2004). These observations collectively indicate that some of the migration time may be an artifact of recovery following the tagging procedure. Due to the small sample size of fish tagged at and passing Rocky Reach Dam in 2007, a more robust evaluation is not possible at this time. However, this issue will be investigated further and reported in the final 2009 report.

Table 7. The migration rate of current or previously tagged bull trout passing or released at Rock Island Dam to either the Wenatchee River telemetry site or the tailrace of Rocky Reach Dam, 2007.

Release or Exit		1st Detection at:		Migration Rate (days)	
Code	**Date/Time**	**Wenatchee R.**	**RRH Dam**	**To Wen. R.**	**To RRH Dam**
101	5/30 12:49	6/11 1:25	---	11.53	---
102	6/12 16:16	---	6/17 10:45	---	4.77
103	6/13 10:16	6/20 7:09	---	6.87	---
151	6/11 9:03	---	6/12 6:51	---	0.91
188	6/8 15:49	---	6/10 4:45	---	1.54
			Mean:	9.20	2.41
			Median:	9.20	1.54
			Minimum:	6.87	0.91
			Maximum:	11.53	4.77

Note: Tagged and released at Rock Island Dam in 2007, the code 102 fish ultimately migrated into the Wenatchee River after first travelling to Rocky Reach Dam. Therefore, we have assessed its migration rate to Rocky Reach Dam and not the Wenatchee River.

Table 8. The migration rate of current or previously tagged bull trout passing or released upstream of Rocky Reach Dam to either the Entiat River telemetry site or the tailrace of Wells Dam, 2007.

	Release or Exit	1st Detection at:		Migration Rate (days)	
Code	Date/Time	Entiat R.	Wells Dam	To Entiat R.	To Wells Dam
111	5/16 16:18	---	5/19 23:46	---	3.31
112	5/17 15:56	---	5/19 18:59	---	2.13
113	5/18 11:09	6/11 10:59	---	23.99	---
114	5/21 17:17	6/11 11:10	---	20.75	---
115	5/24 14:02	---	5/27 9:02	---	2.79
116	5/29 13:02	---	6/2 19:57	---	4.29
117	5/29 15:25	6/10 16:03	---	12.03	---
118	6/1 9:31	6/19 2:13	---	17.70	---
119	6/4 15:36	6/17 22:34	--	13.29	---
120	6/4 18:29	6/16 11:45	---	11.72	---
121	6/12 9:54	6/21 21:33	---	9.49	---
122	6/12 11:32	6/21 22:49	---	9.47	---
123	6/12 13:26	7/1 20:49	---	19.31	---
124	6/13 12:55	6/21 11:57	---	7.96	---
125	6/19 13:12	6/29 21:38	---	10.35	---
126	6/19 15:27	6/27 22:04	---	8.28	---
40	5/22 17:54	6/14 22:48	---	23.20	---
45	6/23 0:35	6/26 22:55	---	3.93	---
151	6/14 16:44	6/18 15:07	---	3.93	---
166	5/17 16:56	5/22 14:45	---	4.91	---
173	5/19 14:29	5/30 23:12	---	11.36	---
175	6/13 12:47	6/17 13:43	---	4.04	---
178	6/4 13:17	6/15 22:29	---	11.38	---
181	5/24 18:06	6/12 19:31	---	19.06	---
184	7/2 11:20	---	7/4 9:03	---	1.90
188	6/11 21:40	---	6/14 16:20	---	2.78
190	6/8 14:46	---	6/10 17:31	---	2.11
Estimates for fish tagged in 2007			**Mean:**	13.69	3.13
			Median:	11.87	3.05
			Minimum:	7.96	2.13
			Maximum:	23.99	4.29
Estimates for fish tagged in 2005 or 2006			**Mean:**	10.23	2.27
			Median:	8.14	2.11
			Minimum:	3.93	1.90
			Maximum:	23.20	2.78
Estimates for all 27 fish			**Mean:**	12.31	2.76
			Median:	11.37	2.78
			Minimum:	3.93	1.90
			Maximum:	23.99	4.29

3.6 Upstream or Downstream Passage Events

During the 2007 study period, 20 bull trout were responsible for a total of 30 passage events, with 24 occurring at Rocky Reach Dam and six at Rock Island Dam (Table 9). Of those passage events, 13 were the result of fish migrating upstream through the fishways and 17 were the result of fish passing downstream through a spillway, powerhouse, or juvenile bypass system. Of the 17 downstream passage events, four occurred at Rock Island Dam, and 13 at Rocky Reach Dam. For the fish passing downstream of Rock Island Dam, one passed downstream through Spillbay 1, and three through an unidentified route (although the routes of passage were monitored, some fish were able to pass the project undetected). At Rocky Reach Dam, a total of ten fish passed downstream through turbines, one through the spillway, one through the juvenile bypass system, and one through an unidentifiable route (Table 10). The fish guided by the Juvenile Bypass System was detected in the transport pipe at a "point of no return" as it was transported through the pipe to the tailrace.

We classified all of the passage events into one of two time periods. The first time period represented what was viewed as typical upstream migration. During this time period (spring and early summer) bull trout typically migrated upstream through the Columbia River and entered tributaries. Passage events at the dams usually entailed movement upstream through the fishways. However, as can be seen by the behavior of a few fish (i.e., codes 23, 25, and 45), downstream movement during this period also occurred at various times and entailed passage through the spillway, powerhouse, or juvenile bypass system. For those fish, only the code 45 fish re-ascended the Rocky Reach fishway and migrated upstream of the project (into the Entiat Basin). For the other two fish, the code 23 fish is currently downstream of Rock Island Dam and the code 25 fish is residing between Rock Island Dam and the Wenatchee River confluence. The upstream migration period typically concludes by the end of July at both projects. During this period, a total of 13 bull trout passed upstream of Rocky Reach and Rock Island dams (11 at Rocky Reach and 2 at Rock Island).

The second time period for bull trout movement past the dams is marked by either up or downstream passage after exodus from the tributaries. This period typically begins around the first of October and extends through December. During this period, a total of 10 bull trout passed Rocky Reach and three at Rock Island. It should be noted that not all fish migrated upstream or downstream through hydroelectric projects during these periods. For example, it was not uncommon for fish to reside within the Rocky Reach reservoir, migrate upstream into the Entiat River and reside there for some time, and then migrate back into Rocky Reach reservoir.

Of the 13 upstream passage events, all fish successfully entered tributaries after exiting the fishway. Of the 19 total fish tagged in 2007, all eventually entered a tributary (3 in the Wenatchee Basin, 3 in Methow Basin, and 13 in the Entiat Basin).

Table 9. Summary of all bull trout passage at Rock Island and Rocky Reach dams, 2007. An "X" indicates passage during the expected upstream (Apr-Jul) or downstream (Oct-Dec) migration seasons.

	Upstream Migration				After Tributary Exodus			
	Rock Island		Rocky Reach		Rock Island		Rocky Reach	
Code	Down	Up	Down	Up	Down	Up	Down	Up
23	7/25/07		7/21/07					
25			5/13/07					
31					X			
40				X				
45			6/4/07	X				
102					X			
112							X	
113							X	
114							X	
123							X	
126							X	
151		X		X	X		X	
166				X			X	
173				X				
175				X			X	
178				X				
181				X			X	
184				X				
188		X		X				
190				X			X	

Table 10. Summary of downstream bull trout passage at Rock Island and Rocky Reach dams, 2007.

Code	Date	Location	Dam
23	7/25/2007 2:41:00	Spillbay 1	RIS
31	Unknown	Unknown	RIS
102	Unknown	Unknown	RIS
151	Unknown	Unknown	RIS
23	7/21/2007 15:48:56	Spillbay 6	RRH
25	5/13/2007 7:24:04	Turbine 1	RRH
45	6/4/2007 12:24:39	Juvenile Bypass System[1]	RRH
112	10/2/2007 15:23:03	Turbine 8	RRH
113	12/9/2007 19:09:05	Turbine 3	RRH
114	10/5/2007 7:50:41	Turbine 10	RRH
123	Unknown	Unknown	RRH
126	11/4/2007 18:09:40	Turbine 10	RRH
151	Unknown	Turbine 1, 5, 6, 7, 8, 9, 10, or 11[2]	RRH
166	11/15/2007 23:23:54	Turbine 1, 3, or 5[2]	RRH
175	10/23/2007 0:00:00	Turbine 1, 2, 3, 4, 5, 6, 8, 10, or 11[2]	RRH
181	12/3/2007 10:28:18	Turbine 3	RRH
190	3/29/2007 9:16:31	Turbine 7	RRH

Notes: [1] The Juvenile Bypass System (JBS) consists of two collection components; the surface collector and the stationary bar screens located in the turbine intakes of Units 1 and 2. The code 45 fish was guided into the JBS by the screens in Turbine Unit 1, and was passed downstream into the tailrace of Rocky Reach Dam. [2] The determination of units in operation was based on the known time span of bull trout passage through the powerhouse.

3.7 Mortality

At the conclusion of the 2007 study period, a total of 86 bull trout have been tagged during the period of 2005-2007. Of those, 22 tagged bull trout (25.6%) have either perished or shed their tags (Stevenson et al. 2006 and 2007). That percent 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; mostly 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 11 summarizes all documented transmitter and carcass recoveries as of 2 March 2008 for all bull trout tagged from 2005-2007. Of the 22 recovered transmitters, 13 have either been recovered during the 2005 and 2006 study periods, or during the first part of 2007. Those recoveries have been discussed in detail in the 2005 and 2006 annual reports (Stevenson et al. 2006 and 2007) and, therefore, will not be discussed here.

Table 11. Summary of all documented transmitter and carcass recoveries through 8 November 2007.

Code	Date of Recovery	Location	Carcass Recovered?
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
153	2/20/2007	Entiat River	No
154	9/19/2006	Icicle Creek	No
171	11/8/2007	Methow River	Yes
172	10/18/2006	Entiat River	Yes
177	9/12/2007	Foggy Dew Creek	Yes
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

Notes: 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.

In addition to those 13 fish, nine others were recovered during the 2007 study period. Of those recoveries in 2007, only two fish migrated either up or downstream of a Chelan PUD project in 2007 (codes 31 and 190). For both fish, post-passage detection histories indicate that mortality was not associated with dam passage. Collectively, of the 22 transmitters recovered since tagging began in 2005, five have been recovered in the Columbia River, seven in the Entiat River, four in the Mad River, and one in each of the Methow River, Twisp River, Peshastin Creek, Foggy Dew Creek, Snow Creek, and Icicle Creek. Therefore, 22.7% of tag recoveries have been in the mainstem Columbia River and 77.3% in tributary systems of the Columbia River.

The following is a summary of the nine transmitters recovered in 2007 that have not been addressed in previous reports.

Columbia River Mainstem Tag Recoveries

The transmitter and carcass of the code 26 fish was recovered 9 May 2007 in the Columbia River, about 0.8 km downstream of the George Seller Bridge in Wenatchee. The carcass and transmitter were recovered on shore below the high water mark of the river. Due to the extent of deterioration of the carcass, the cause of mortality could not be determined. This fish did not pass any hydro project in 2007.

The code 31 fish was tagged at Rocky Reach Dam on 31 May 2005. It migrated upstream through Wells Dam and entered the Methow River on 27 June 2005. It was then detected on the spawning grounds by USFWS personnel in Wolf Creek. This fish overwintered in Wolf Creek during 2005-2006. On 30 May 2006 the fish exited the Methow River and migrated downstream through Rocky Reach on 4 July 2006 and entered the Wenatchee River on 30 August 2006. It exited the Wenatchee River on 4 November 2006 and was detected during an aerial survey on 11 January 2007 in the Rock Island Reservoir. It again entered the Wenatchee River and remained there for eight days between 3 July and 11 July 2007. This fish then migrated downstream through Rock Island Dam where it was detected in the tailrace for four days. The tag was detected during an aerial flight on 5 September, and the transmitter was recovered six days later in some rocks on shore, but below the high water mark. Due to the high velocities at the location of detection and subsequently the location of recovery of the transmitter, we do not suspect that this fish perished as a result of passing Rock Island Dam. Had it died or been injured during dam passage, we believe the fish would probably have ended up further downstream. Regardless, due to the fact that no carcass was recovered, it is not possible to determine the fate of this fish.

Using SCUBA, the transmitter of the code 189 fish was recovered in the Columbia River on 4 April, just downstream of the Entiat River confluence. Remains of a fish were found at the time of the recovery. However, because of very poor visibility at the recovery site, it was not possible to say that the remains were associated with the transmitter or that the remains were that of a bull trout. Unfortunately, the carcass was lost during the recovery effort, and could not be retrieved. This fish was tagged on 25 June 2006, and resided within the Entiat Basin during the fall of 2006 upstream of Preston Creek. This fish did not pass any hydro project between the time of tagging and recovery.

Entiat River Basin Recoveries

The code 44 fish was tagged on 6 June 2005 at Rocky Reach Dam. It was detected at Wells Dam on 30 June 2005 and overwintered in the Columbia River. On 25 May 2006 it entered the Methow River and then exited on 10 November 2006. This fish migrated downstream through Wells Dam on 17 November 2006 and entered the Entiat River. Four aerial surveys conducted between 20 December 2006 and 3 April 2007 detected the code 44 fish in the Entiat River (RK 0.8). The transmitter was recovered near RK 0.8 on 4 April, 2007. A carcass was also recovered; however, the fate of the fish could not be determined because of the extensive deterioration of the carcass.

The code 185 fish was tagged on 12 June 2006 at Rocky Reach Dam. It entered the Entiat River on 24 June 2006. Subsequent aerial surveys conducted in April, July and September of 2007 detected this fish in the Mad River. The transmitter for this fish was recovered in the Mad River at RK 16.9 on a dry streambank within a logjam. No carcass was recovered with the transmitter.

Wenatchee River Basin Recoveries

The transmitter for the code 101 fish was recovered in Peshastin Creek at RK 3.2, a tributary to the Wenatchee River. This fish entered the Wenatchee River on 11 June and was detected during an aerial survey conducted 3 July off the mouth of Peshastin Creek in the Wenatchee River. The transmitter was recovered on 14 August by USFWS personnel. The transmitter was found on the bank in heavy vegetation with no carcass present.

Methow River Basin Recoveries

The code 171 fish was tagged at Rocky Reach Dam on 25 May 2006. After release, it overwintered in the Methow Basin and then resided within the mainstem Columbia River downstream of Wells Dam both years following release. In 2007, USFWS personnel detected the fish in Early Winters Creek on 14 September and in the Methow River upstream of Mazama on 24 October. The transmitter was recovered in the Methow River (RK 107.9) by USFWS personnel on 8 November 2007. The carcass was recovered on the bank with evidence of scavenging.

The code 177 fish was tagged on 30 May 2006. After release, it was first detected at Wells Dam on 8 June 2006. USFWS personnel detected it in the Methow River (near Gold Creek) on 6 June 2006. An aerial survey on 5 September 2007 located the transmitter at RK 7.2 on Foggy Dew Creek (a tributary to Gold Creek). A deteriorated carcass along the waterline was recovered on 12 September 2007 along with the transmitter.

The code 190 fish was tagged on 29 June 2006 at Rocky Reach Dam. After a winter residence in the Columbia River, it migrated downstream of Rocky Reach on 29 March 2007. On 8 June 2007, it exited the Rocky Reach fishway and arrived at Wells Dam on 10 June 2007. It was then detected in the Methow River on 16 June 2007. The transmitter for code 190 was recovered upstream of a dry reach in the Twisp River (RK 45.0) on 1 November 2007 by USFWS personnel. The transmitter and one bone were recovered on the bank with evidence of scavenging and/or predation. This location was within 50 meters of an unknown mammal den.

3.8 Conclusions

Based on the data collected during the period 1 January 2007 through 31 December 2007, we offer the following conclusions:

1. During the 2007 study period, two fish tagged in 2006 migrated upstream past Rock Island Dam; one ascended the right bank ladder, the other ascended the left bank ladder. For those fish, the median Tailrace, Fishway Cycling, Fishway Migration, and Project Migration times were 0.26, 9.62, 0.27 and 10.16 days, respectively.

2. Of the two fish that migrated upstream of Rock Island Dam, plus three others that were tagged at that project in 2007, two migrated directly to and entered the Wenatchee River. For those fish, the median migration rate from either a ladder exit or the release site to the Wenatchee River site (RK 12.5) was 9.20 days. For the other three fish that migrated to Rocky Reach Dam, the median migration time between those locations was 1.54 days.

3. At Rocky Reach Dam in 2007, a total of 11 fish migrated upstream past the dam through the fishway. Nine of those fish were tagged in 2006 and two in 2005. For those 11 fish, the median Tailrace, Fishway Cycling, Fishway Migration, and Project Migration times were 0.09, 2.08, 0.23 and 2.73 days, respectively.

4. A total of 27 tagged bull trout were tracked after moving upstream of Rocky Reach Dam in 2007 (11 tagged in previous years that ascended the fishway plus 16 trout tagged and released upstream of the dam). Of those fish, 20 migrated to and entered the Entiat River. The median time between the ladder exit or release site to the Entiat River site (RK 4.8) was 11.37 days. The other seven fish migrated directly to Wells Dam. The median migration time between Rocky Reach and Wells Dam was 2.78 days.

5. Of the 13 upstream passage events made by bull trout at either Rock Island or Rocky Reach dams in 2007, no fallback events occurred at either project.

6. Of the 19 bull trout tagged in 2007, three entered and resided within the Wenatchee Basin after release (all three were tagged at Rock Island Dam), 13 resided within the Entiat Basin, and three migrated upstream of Wells Dam and resided within the Methow Basin.

7. A total of 17 downstream passage events occurred during the 2007 study period, with 13 occurring at Rocky Reach Dam and four at Rock Island Dam. Of those 17 passage events, two fish went through a spillway, eight fish through a powerhouse unit, six through unknown routes, and one was guided by the stationary screens in Unit 1 at Rocky Reach Dam and successfully passed the dam through the Juvenile Bypass System. No injury or mortality to bull trout was observed as a result of passing through any route at either Rocky Reach or Rock Island dams.

8. During the 2007 study period, a total of 11 transmitters were recovered along with five carcasses. For all five fish that were recovered (two of which passed either Rocky Reach or Rock Island dams), the cause of mortality could not be ascertained. Furthermore, for the two fish that did pass a project, mortality could not be associated with dam passage.

9. Collectively, a total of 22 transmitters have been recovered since tagging began in 2005. Of those, five have been recovered in the Columbia River, seven in the Entiat River, four in the Mad River, and one in each of the Methow River, Twisp River, Peshastin Creek, Foggy Dew Creek, Snow Creek, and Icicle Creek. Therefore, 22.7% of tag recoveries have been in the mainstem Columbia River and 77.3% in tributary systems of the Columbia River.

10. Of the 19 bull trout tagged at Rock Island and Rocky Reach dams during the 2007 study period, 18 still remain active within the Columbia River or within its tributaries. One tag was recovered from the 2007 tagging group (code 101). This fish did not migrate past any dam, but it did enter the Wenatchee River. The transmitter for this fish was later recovered in Peshastin Creek.

4.0 Acknowledgements

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5.0 References

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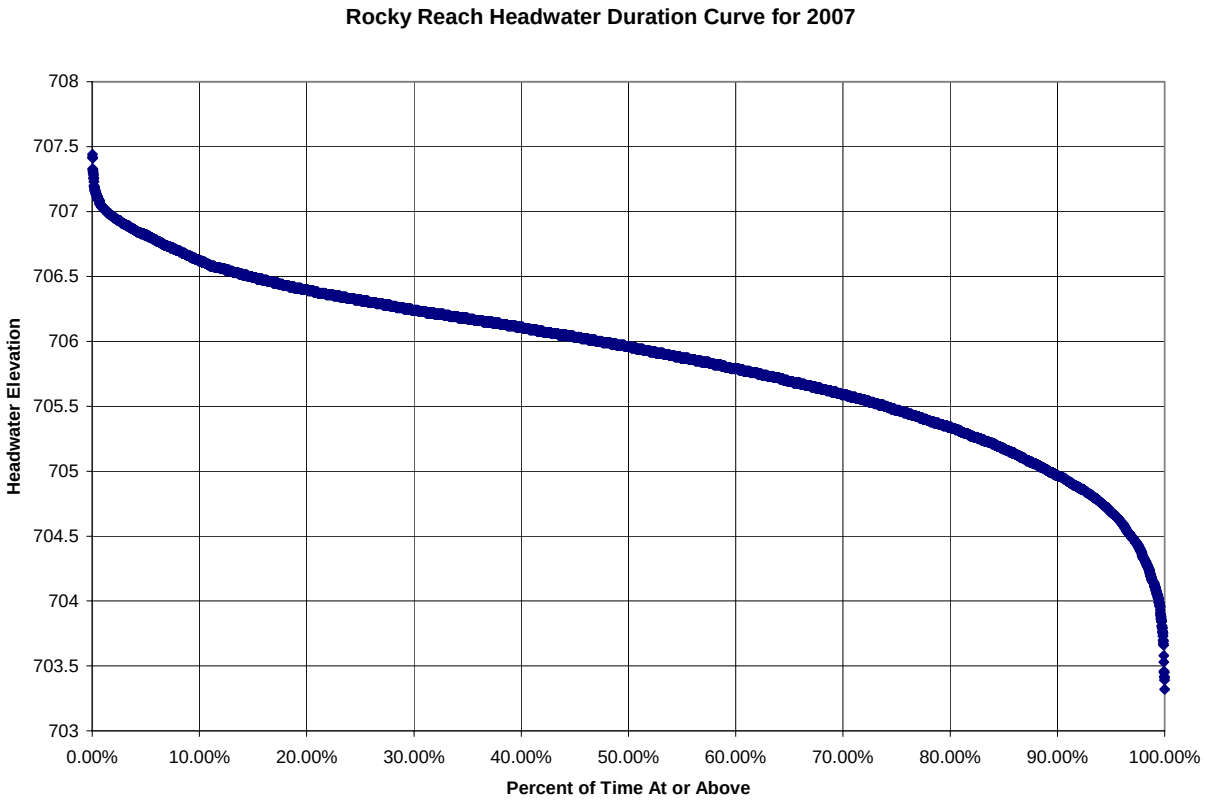
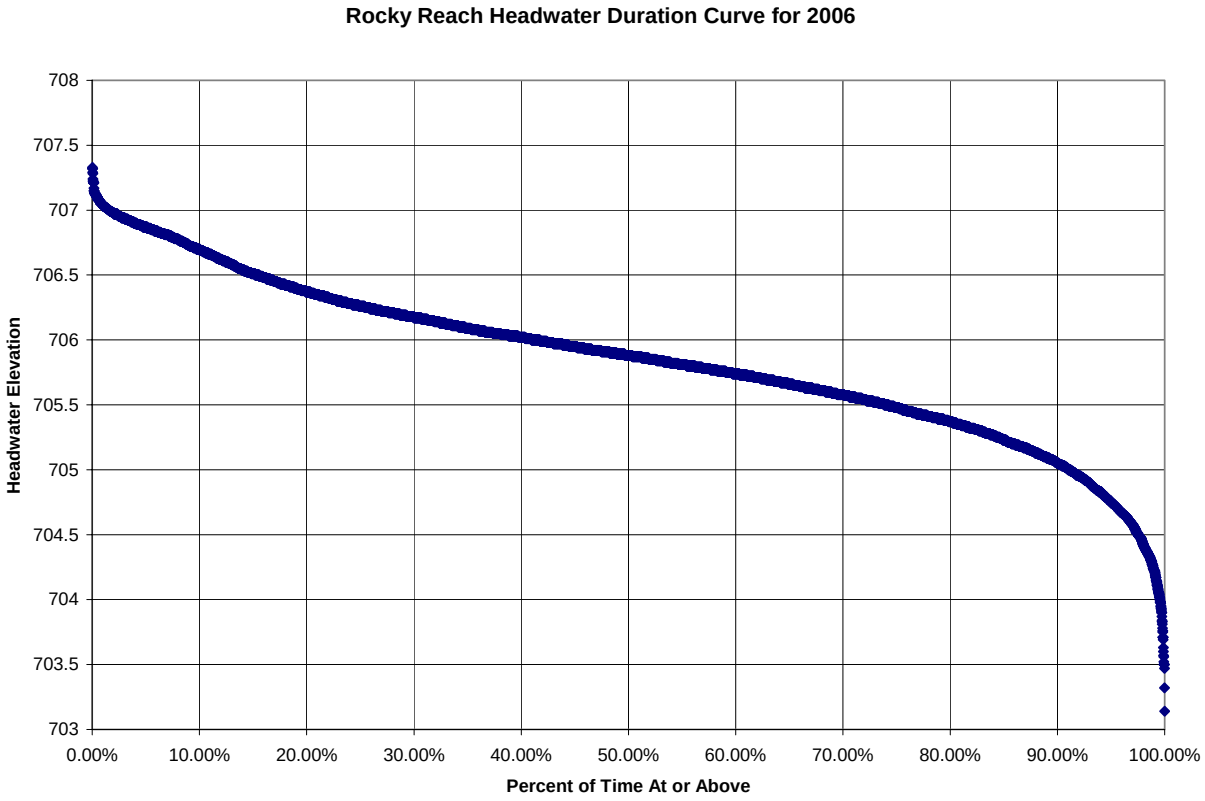
APPENDIX B:

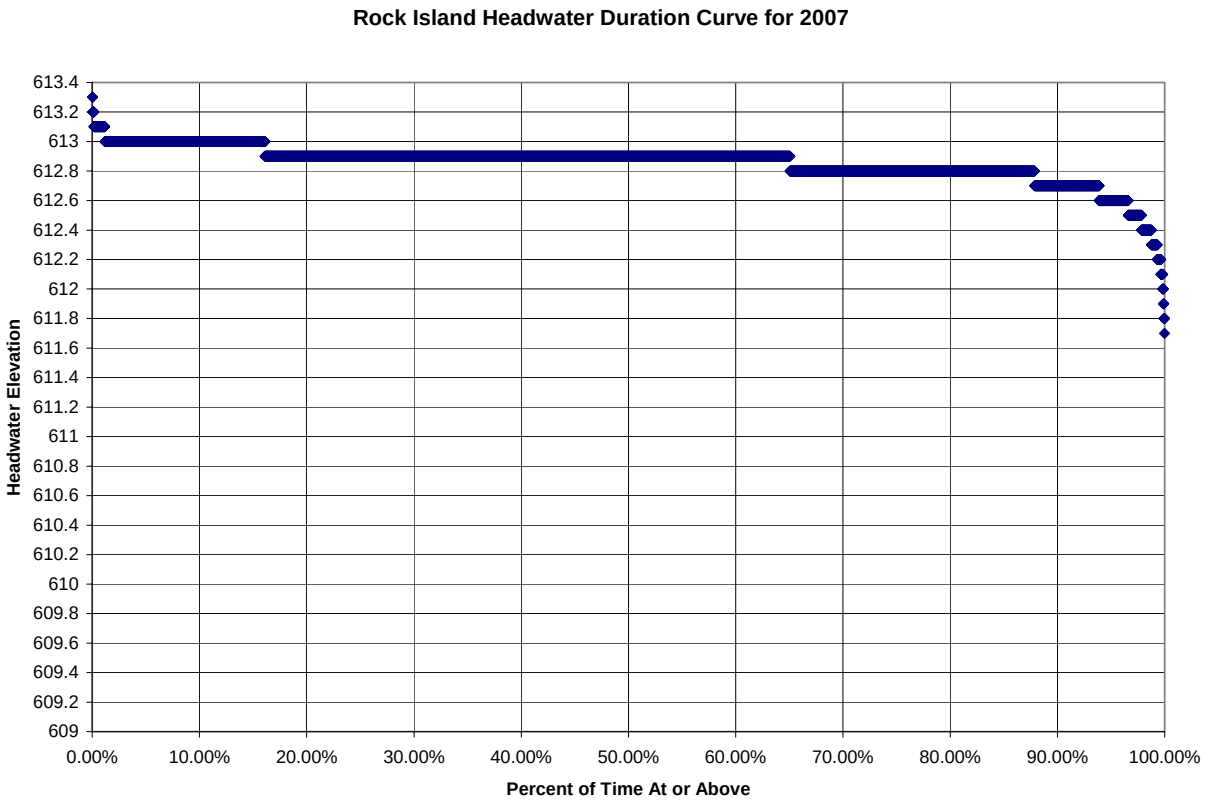
ROCKY REACH RESERVOIR HEADWATER DURATION CURVES, 2005-2007



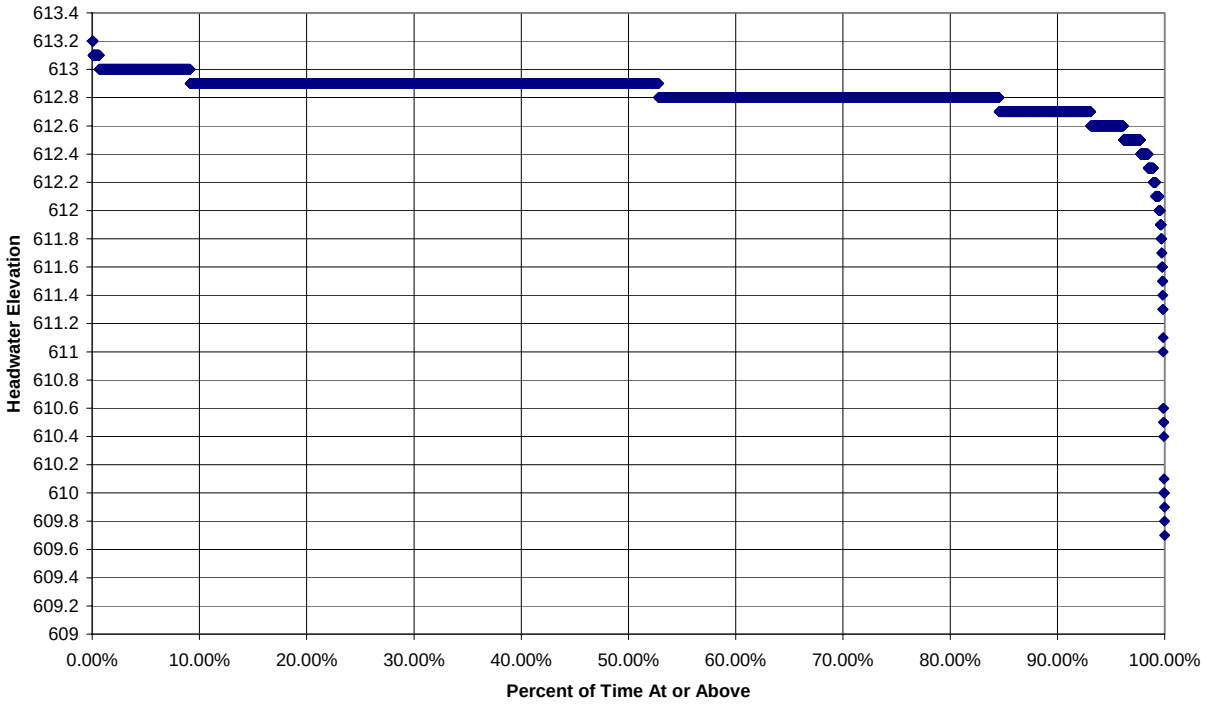

Rocky Reach Headwater Duration Curve for 2006
Headwater Elevation
708
707.5
707
706.5
706
705.5
705
704.5
704
703.5
703
0.00%
10.00%
20.00%
30.00%
40.00%
50.00%
60.00%
70.00%
80.00%
90.00%
100.00%
Percent of Time At or Above

APPENDIX C:

ROCK ISLAND RESERVOIR HEADWATER DURATION CURVES, 2005-2007



Rock Island Headwater Duration Curve for 2006



Rock Island Headwater Duration Curve for 2005