# ANNUAL REPORT OF OPERATIONS

# FISH FACILITIES: 2010

Public Utility District No. 1 of Douglas County
1151 Valley Mall Parkway
East Wenatchee, Washington
98802-4497

Wells Hydroelectric Project
F.E.R.C. Project No. 2149

March 2011

# FISH FACILITIES OPERATIONS ANNUAL REPORT FOR 2010

## WELLS HYDROELECTRIC PROJECT NO. 2149

## Located on the Columbia River at River Mile 515.6

## I. FISH COUNT AND RIVER CONDITIONS

**A.** Enumeration of adult salmon and steelhead using fish ladders at Wells Dam began on May 1 and continued through November 15. Counting was accomplished by reviewing digital video records of fish passing ladder windows. Monthly counts of each species for 24-hour and 16-hour count periods in 2010 are included in Tables 1 and 2, respectively. Table 3 shows the nighttime percent of total passage of adult salmon and steelhead. Adult steelhead, and spring and summer Chinook, and coho salmon were removed from the ladders for broodstock and are not included in the count summaries of Tables 1 and 2, but are listed in Table 4. Attachment A shows the 24-hour fish passage (0000-2400 PST) at Wells Dam by species by day from May 1 through November 15th. Attachment B shows the annual ladder counts of salmon and steelhead (16-hour count) at Wells Dam from 1967 through 2010. For comparison, Attachment C shows the 24-hour count totals for the years 1998 through 2010 (24-hour counts commenced in 1998).

**B.** Bull trout (*Salvelinus confluentus*) passage records were first initiated at Wells Dam in 1999. In 2010, 44 migratory-sized bull trout were counted between May 1 and November 15 (see Attachment A). Starting in the winter of 2004-2005, Public Utility District No. 1 of Douglas County (Douglas PUD), following a request from the U.S Fish and Wildlife Service (USFWS), has also been conducting winter bull trout counts (November 16 – April 30). During the past six years of winter bull trout counting, no bull trout have been observed using the fish ladders at Wells Dam.

**C.** Adult lamprey (*Lampetra tridentata*) passage records were first initiated at Wells Dam in 1995. Lamprey counts were recorded from May 1 through November 15, 2010, and two lamprey were counted during that period. Daily passage numbers are shown in (see Attachment A).

## II. PROJECT OPERATIONS

### A. Adult Fish Passage Facilities

The adult fish passage facilities were operated using the criteria documented in the Wells Habitat Conservation Plan (HCP), and in cooperation with the Fisheries Agencies and Tribes (See HCP Section 15, Appendix A: Adult Fish Passage Plan). Information from several years of radio-telemetry studies with both salmon and steelhead at Wells Dam showed that fishway passage time was reduced by closing the side entrance at both east and west fishways. Based upon approval of the Joint Fisheries Parties, who serve on the Wells HCP Coordinating Committee, a decision was made in 2001 to change the fishway-operation criteria at Wells Dam including the closure of the side entrance on each ladder and increasing the opening of the end gates from a six-foot opening to an eight-foot opening.

Routine inspection and maintenance was performed on the west fishway from January 14 through February 3, 2010 (inspection and bi-annual maintenance) and the 16th through the 29th of December 2010 (inspection and annual maintenance), and on the east fishway from December 22, 2009 through January 5, 2010 (inspection and annual maintenance). Both fishways operated at criteria throughout the fish passage assessment period, except on July 21, auxiliary water supply flow to both fishways was turned off (one fishway at a time) to install DIDSON cameras at both fishway entrances for a study of lamprey entrance efficiency that was approved by the HCP Coordination Committee.

## B. Juvenile Bypass Facilities

The juvenile bypass facilities at Wells Dam are designed to attract downstream-migrating fish to surface passage through spill bays instead of through deep-water turbine intakes. The hydrocombine design of Wells Dam incorporates the spillway and powerhouse components of the dam into a single 1,130-foot-long section, where all flow through the dam must pass. Five spill bays (numbers 2, 4, 6, 8 and 10), located above paired turbine intakes, are equipped with bypass flow barriers and baffles. Because of the hydrocombine design, flow through the turbine intakes attracts juvenile salmonid migrants to the bypass facilities, where they are further attracted by water velocities at slotted bypass baffles and pass the project with a small volume of bypass spill.

Based upon the approval of the HCP Coordinating Committee, the spring bypass season started on April 12th at 0000 hours and ran continuously through June 13th at 2400 hours. Spring bypass operations utilized a total volume of 943 thousand acre-feet (KAF), or 7.0 percent of total project discharge volume.

Based upon the approval of the HCP Coordinating Committee, summer bypass operations began on June 14th at 0000 hours and ran until August 26th at 2400 hours, for a total of 74 days. Summer bypass operations utilized 1,156.5 KAF, or 6.2 percent of the total discharge volume.

The initiation and termination of the Wells bypass in 2010 was guided by the Wells HCP Coordinating Committee. Operation of the bypass system was strictly guided by the Bypass Operating Plan contained within Section 4.3 of the Wells HCP Agreement. The initiation and termination dates for the bypass system in 2010 were based upon 21 years of hydroacoustic and 14 years of species composition information collected on run patterns of juvenile hatchery and wild salmonids at Wells Dam. Based upon an analysis of the run-timing information at Wells Dam, the HCP Coordinating Committee agreed to initiate the Wells bypass system on April 12th. The analysis indicated that on average initiating the bypass system on April 12th would provide a non-turbine passage alternative for 95.5 percent of the spring emigrants. Similarly, shutting down the bypass system on August 26th, on average would provide bypass operation for 95 percent of the summer emigrants.

## III. WATER QUALITY

### A. Temperature Monitoring at Wells Dam

Daily water temperature and total dissolved gas readings from April through September, 2010, are provided in Attachment D. Historically, water-temperature data were collected at the turbine cooling-water intake at Unit 5. A comparative analysis of water temperature data collected from the cooling-water intake and data collected in the Wells forebay and tailrace indicated that the historical water temperature sampling site (cooling water pipe) was recording temperatures several degrees Fahrenheit higher than river water temperatures collected at the two in-water monitoring stations. Since 2003, water temperatures have been measured at the intake for the fish-ladder attraction-flow pumps located in the tailrace of Wells Dam.

### B. Total Dissolved Gas Monitoring at Wells Dam

The Wells Project was operated in 2010 according to the 2010 Wells Hydroelectric Project Gas Abatement Plan (GAP) that was a modified version of the original GAP developed in 2009. The 2009 GAP, which was approved by the Washington State Department of Ecology (Ecology) on February 28th, 2009, described operational measures intended to meet state water quality standards for TDG.

The Wells Project 2009 GAP introduced the latest numerical model developed by the University of Iowa's IIHR-Hydroscience and Engineering Hydraulic Research Laboratories. The two-phase flow computational fluid dynamics tool was used to predict hydrodynamics of TDG distribution within the tailrace of Wells Dam and further identify operational configurations that would minimize TDG production at the project. In an April 2009 report, the model demonstrated that Wells Dam can be operated to meet the TDG fish-spill waiver standards during the passage season with flows up to "7Q-10 levels" (246,000 cfs). Engineers determined that the most benign spillway operation at the Wells Project was the use of a concentrated spill pattern through Spillbay No. 7 and surplus flow volume through other spillbays in a defined pattern. These preferred TDG operating conditions create surface-oriented flows by engaging submerged spillway lips below the ogee, thus increasing degasification at the tailrace surface, decreasing supersaturation at depth, and preventing high-TDG waters from bank attachment. These principles were the basis of the 2009 Wells Project Spill Playbook and were fully implemented for the first time during the 2009 fish passage (spill) season as part of the GAP. The 2010 GAP and Spill Playbook was approved by Ecology on April 9, 2010 and amended on July 1, 2010.

Although the 2010 water year was characterized as having a below average snow pack, it was unique runoff season that had a relatively short high-water event in June due a set of unusual storm events that caused high run-off conditions throughout the Columbia River basin. Coupled with variable wind generation and its impacts on FCRPS operational flexibility and low electricity demand due to cool weather, relatively higher levels of involuntary spills occurred at projects upstream of Wells Dam. This resulted in abnormally high forebay TDG values at Wells Dam and resulted in a number of observed exceedances of the 125% hourly and 12C-High daily values both in the Wells Dam tailrace and Rocky Reach forebay. In response to the June exceedances, Douglas PUD amended the GAP and implemented in-season changes to its spill

operations at the project resulting in improved TDG performance with no observed exceedances of the tailrace TDG criteria after the changes were implemented on July 1st.

At Wells Dam, river flows in June were approximately 4% higher than the 16-year average, and June was the only month in 2010 where monthly flows were greater than the 16-year average. During the latter half of June and early July, incoming flows to Wells Dam were often above 200 kcfs and on nine occasions, hourly flows exceeded the 7Q-10 value of 246 kcfs. Incoming TDG levels during this time period consistently ranged between 110-114% as Chief Joseph Dam spilled higher volumes of water. The outage of Turbine Unit 7 for generator rebuild at Wells Dam reduced generating capacity thereby increasing the need to spill. Outage of Unit 7 likely also contributed to higher TDG by not supporting the surface jet for spill discharged from spillbay 7. These factors, combined with minimal load requirements, high flow volumes and relatively high incoming TDG resulted in three exceedances of the 125% hourly criterion and four exceedances of the 12C-High 120% criterion in the Wells Dam tailrace, and eight exceedances of the 12C-High 115% criterion in the Rocky Reach Forebay despite implementation of the Spill Playbook.

In response to the observed exceedances, Douglas PUD implemented in-season changes to the 2010 Spill Playbook. Specifically, the amended Spill Playbook stated that when spill levels are expected to reach the 53 kcfs threshold, the Juvenile Bypass System barriers in spillbay 6 should be removed in order to remain in compliance with the TDG criteria in the Wells Dam tailrace and Rocky Reach Dam forebay (the previous threshold for removal was 96 kcfs). After July 1st, when spill approached the 53 kcfs criteria, the bypass barriers were removed and the excess spill was directed through spillbays 6 and 7 rather than through spillbays 5 and 7, compacting the spill pattern to reduce the surface area of the air-water interface between spillbay flows and the subsequent potential for lateral mixing and air entrainment. After implementation of the modified spill playbook on July 1st, eight additional events of high incoming TDG were observed (>113%) at Wells Dam with incoming TDG regularly exceeding 110%, yet no exceedances occurred in the Wells Dam tailrace or the Rocky Reach forebay, confirming the efficacy of the operational changes.

Total Dissolved Gas (TDG) data are reported for both the forebay and tailwater as the 12-hour high continuous average (12C-High) in percent TDG (see Attachment D)

## IV. FISH PRODUCTION

The Washington Department of Fish and Wildlife (WDFW) manages the commercial, sport, and non-game fish and wildlife resources of the State of Washington. The Wells and Methow hatcheries are owned and funded by Douglas PUD, and operated by WDFW, and WDFW personnel provided the information on summer/fall Chinook and steelhead production at the Wells Hatchery (Table 5) and spring Chinook production at the Methow Hatchery (Table 6) through 2010.

## V. FISH STUDIES AND PROGRAMS

Douglas PUD funded several fish-related studies and programs during 2010. A summary of each follows.

### A. Wells 2010 Survival Verification Study

In the spring of 2010, Douglas PUD conducted the Wells HCP required 10-year Survival Verification Study (SVS) at the Wells Project. The Wells HCP Coordinating Committee selected yearling summer Chinook to represent juvenile yearling Chinook and steelhead for the 2010 study.

The primary goal of the study was to precisely estimate the survival of PIT-tagged yearling Chinook migrating through the Wells Project. Fish were released at three locations: above Wells Dam at the mouths of the Okanogan (Rkm 870) and Methow (Rkm 843) rivers and below Wells Dam, into the tailrace (Rkm 829.6). Chinook released at the mouths of the Okanogan and Methow rivers were pooled into one "reservoir" release group in an effort to mimic the proportional contribution of the two rivers to the overall spring smolt migration passing through the Project.

A total of 77,155 PIT-tagged Chinook were released during this study during the months of April and May. Fish were released during fifteen replicate releases at each of the three specified release locations for a total of 45 releases. Each replicate release group at each of the three release sites was provided nearly identical rearing, collection, tagging, recovery, interrogations, and transportation exposures, to prevent unnecessary covariates in experimental methods and analyses.

Passive interrogation of study fish occurred at the PIT-tag detection systems installed at Rocky Reach, McNary, John Day, and Bonneville dams. Additionally, study fish were detected in the Columbia River estuary by a boat-towed PIT-tag trawl.

Survival through the Wells Project (reservoir, forebay, dam and tailrace) was estimated based upon the relative survival of treatment (Okanogan and Methow) and control (tailrace) release groups. The weighted average survival for yearling Chinook passing from river mouths to a point 300 m downstream of Wells Dam ˆwas 0.964 (SE= 0.0128) during 2010. The survival estimate generated for Chinook in 2010 was not significantly different from the average three-year survival estimate 0.962.

The results of the 2010 study confirmed that the Wells Project continues to achieve a high rate of survival for yearling Chinook and steelhead, even during the second lowest flow year in the past 25 years. The 4-year average estimate of survival used to determine the No Net Impact hatchery compensation levels has increased as a result of this study. The 3-year average mitigation goal was 3.8 percent based upon the 3-year average survival of 96.2 percent. The 4-year average survival used for determining the No Net Impact calculation is now 96.3 percent, with an associated hatchery compensation goal of 3.7 percent for yearling Chinook, steelhead and coho.

## B. Sockeye Salmon Enhancement

At the end of 2001, the Wells HCP Coordinating Committee agreed to shift the focus of Douglas PUD's sockeye responsibility from an experimental sockeye hatchery program located at Cassimer Bar to a water-management planning tool for the Canadian Okanagan River. Seasonal patterns of water releases from Okanagan Lake were found to adversely affect the production of both sockeye and kokanee. Douglas PUD worked with the Canadian fisheries parties to develop a model-based flow-management program for use as a decision-making tool by river managers for preventing or minimizing losses to sockeye and kokanee production. The Fish Water Management Tool (FWMT) is the model developed to allow both fish and water managers, collectively, to determine how releases of water would affect kokanee and sockeye resources, flood control, water-dependent recreation, and irrigators. During 2003, considerable effort was spent on the development of the FWMT and the estimation of physical and biological model parameters.

To determine if the FWMT model could improve water-release practices, retrospective analyses were performed during 2004 using historical monthly records collected over the previous twenty-five water years. The retrospective analyses indicated that the annual improvement in salmon egg-to-emergence survival from the implementation of the FWMT was on average 55 percent. According to the model, estimated smolt savings from using the FWMT were better in a wet year (75 percent) rather than a dry year (38 percent) because of the avoidance of egg scour. The best results from the FWMT retrospective analyses demonstrated a 443 percent improvement in salmon survival during one historic water year. In all years the FWMT provided greater than the 7 percent required mitigation for juvenile sockeye losses at Wells Dam. On October 5, 2004, the Parties to the Wells HCP via the Hatchery Committee approved the FWMT program as fulfilling Douglas PUD's sockeye hatchery mitigation responsibility for unavoidable losses of juvenile sockeye at Wells Dam.

2010 was the sixth year that the FWMT was used by Canadian fisheries and water managers to guide water-release decisions for the Canadian Okanagan River. Despite atypical climatic and hydrologic conditions experienced during the first six years of implementation, the Operational Team has managed river flows and lake levels with the FWMT in a manner that effectively minimized property damage and fisheries losses. The real-time performance of the FWMT has consistently exceeded expectations based upon the retrospective analyses performed in 2004.

## C. Adult Fishway PIT-Tag Detection System

The National Marine Fisheries Service's (NMFS) 2000 Biological Opinion required that Douglas PUD install adult PIT-tag detectors in the two adult fishways at Wells Dam. A PIT-tag detection system was installed in the winter of 2001-2002 and began collecting data during the 2002 adult migration. Analysis from tests of system performance indicated a detection efficiency of 99.9 percent.

Because the adult traps in each fishway are below the PIT-tag detection system, PIT-tagged fish diverted from the fishway at each trap were not monitored by the PIT-tag detection system. To increase the coverage of the system, additional PIT-tag detectors were installed in 2004 on the exit of each east and west fishway traps; the system on the trap on the west fishway was upgraded in 2008 to increase detection efficiency.

## D. Northern Pikeminnow Removal in the Wells Tailrace and Reservoir

Northern pikeminnow (*Ptychocheilus oregonensis*) are a major predator of juvenile salmonids in the Columbia Basin. As required by the Wells HCP, Douglas PUD continued the implementation of a program for removal of and data collection on northern pikeminnow from the Wells Project (tailrace and reservoir) in 2010. The pikeminnow-removal contractor used set-line gear to capture 19,082 northern pikeminnow in 2010. Of that total, 16,851 were at least 9 inches in fork length and 2,231 were less than 9 inches in fork length. These fish were captured during 4,618 hours of angling effort translating into an overall catch-per-unit-effort (CPUE) or fish-per-hour value of 4.3. Angling effort was determined by total hours spent to pull, check, and reset lines as well as travel and preparation time (tying hooks, assembling lines, etc.). More fish were captured in the Wells Reservoir, which includes the lower 1-mile section of the Methow River (9,814), than in Wells tailrace (9,268). From 1995 through 2010, the pikeminnow removal programs sponsored by Douglas PUD have resulted in the removal of approximately 212,000 pikeminnow from the Wells Project.

## E. Lamprey Passage Study

Douglas PUD conducted studies in 2009 and 2010 to investigate adult Pacific lamprey passage at Wells Dam. The studies assessed the effects of velocity reductions at fishway entrances on the attraction of adult lamprey to those entrances and their relative entrance success. During the fall of 2009, three entrance velocities (i.e., existing high, medium, and low) were assessed using Dual-frequency Identification Sonar (DIDSON) in a randomized-block design with the goal of identifying optimal hydraulic conditions conducive to attraction to and entry of adult lamprey into the fishways at Wells Dam. The study was repeated in 2010 using only the 1.5-feet and 1-foot differentials; results are pending.

Velocities at the fishway entrances were modulated by adjusting the water-surface elevations in the collection galleries relative to the tailrace water-surface elevation (referred to as the "head differential"); the normal operating head differential for the Wells fishway entrances is 1.5 feet. The HCP Coordinating Committee approved both the 2009 and 2010 velocity adjustments, concluding that the studies would not interfere with passage by adult salmonids (HCP Plan Species), and would provide valuable information regarding the behavior of lamprey at the fishway entrances. Results from the 2009 study demonstrated that a 1-foot head differential produced the most favorable velocities at the fishway entrances for lamprey attraction and entrance success. The 2010 study similarly demonstrated that a 1 foot differential is preferred by lamprey relative to a 1.5 foot differential. Salmonid entrance to the fishways was unaffected by the reduction in head differential from 1.5 feet to 1 foot.

## F. Measurement of Fishway Entrance Velocities

In June of 2010 the HCP Coordinating Committee requested that Douglas PUD conduct water velocity mapping at the entrances to the fishways at Wells Dam under the entrance conditions tested in the lamprey passage studies. The product velocity maps would identify whether entrance velocities were adequate for salmonid attraction and whether sufficient variation in velocities existed within the entrances so that lower velocity conditions were available for exploitation by lamprey.

Douglas PUD implemented a proposal from Northwest Hydraulic Consultants to measure

fishway entrance velocities using Acoustic Doppler Velocimeters (ADVs). Douglas PUD constructed a trolley frame to position the ADVs in the fishway entrance. The trolley frame was completed in December of 2010, and ADV measurements were conducted in March of 2011. A draft report of the test results is currently under review by Douglas PUD and will be presented to the HCP Coordinating Committee in June of July of 2011.

## G. Bull Trout Monitoring and Management Plan

During 2010, Douglas PUD continued to implement the Wells Bull Trout Monitoring and Management Plan (Bull Trout Plan) based upon the plan approved by the USFWS and the Federal Energy Regulatory Commission (FERC) in 2005. The goal of the Bull Trout Plan is to identify, develop, and implement measures to monitor and address potential project-related impacts on bull trout (*Salvelinus confluentus*) associated with the operations of the Wells Hydroelectric Project and associated facilities (Douglas PUD 2004). The Bull Trout Plan was prepared and implemented to meet monitoring requirements stipulated in a USFWS Biological Opinion regarding implementation of the Wells HCP. The USFWS Biological Opinion monitoring requirements were also incorporated by the FERC into the existing Wells Project license in 2004. The Bull Trout Plan was developed in collaboration with the USFWS, NMFS, WDFW, the Colville Confederated Tribes, and the Yakama Nation, and was approved by the FERC.

The first objective of the Bull Trout Plan was to identify potential project-related impacts on upstream and downstream passage of adult bull trout (fish $\geq$ 400 mm in length) through Wells Dam and reservoir, and implement appropriate measures to monitor any incidental take of adult bull trout. To meet the first objective, radio-telemetry was used to monitor upstream and downstream passage, and off-season video counting was done in the Wells Project fishways during the winter. Between 2005 and 2008, 26 adult bull trout were trapped at Wells Dam and radio-tagged. Concurrent with the implementation of the Bull Trout Plan, the USFWS and Public Utility District No. 1 of Chelan County (Chelan PUD) radio-tagged and released 136 adult bull trout at other mid-Columbia River basin locations including the Methow River, and Rock Island and Rocky Reach dams (50 USFWS tags 2006-2008, 86 Chelan PUD tags 2005-2007).

From 2005 to 2008, 25 downstream passage events and 52 upstream passage events by 40 individual bull trout were recorded at Wells Dam. Of these, 17 downstream and 41 upstream passage events occurred within one year of tagging and release. Of all tags released from 2001 to 2004, there were 2 downstream passage events and 41 upstream passage events. Of these, 2 downstream and 38 upstream passage events occurred within one year of release. The take estimates for the Wells Project were based upon the number of unique upstream and downstream passage events that took place within one year of each bull trout being tagged and released. During the six-year study and eight years of monitoring, 19 downstream and 79 upstream passage events occurred at Wells Dam by radio-tagged bull trout within one year of release. Taking into account all observed passage events a total of 27 downstream and 93 upstream passage events took place at Wells Dam radio-tagged bull trout passed downstream through the turbines or spillways as no downstream passage events were recorded via the fishways. Out of the 19 downstream passage events that occurred within one year of tagging, no bull trout injury or mortality was observed at the Wells Project. Out of the 79 upstream passage events that

occurred within one year of tagging, no bull trout injury or mortality was observed at the Wells Project.

Upstream passage of adult bull trout through the fish ladders at Wells Dam has historically occurred between early May and late October, with peak passage typically occurring in May and June. During the 2005 and 2008 study, 214 adult bull trout were counted passing upstream through Wells Dam, and 24 percent (52) were radio-tagged.

Project operations did not appear to influence the movements of adult bull trout. Instead, passage events by adult bull trout appeared more closely associated with water temperature, photoperiod, and time of year, with rather predictable patterns of upstream and downstream movement. Because no take (injury or mortality) was observed during the study, there was no need to investigate how Project operations affected take at Wells Dam.

Forty-four bull trout were counted in the fishways at Wells Dam during 2010, and 82% of those observations were in the May-June period, with the last observation in late October 2010. This timing is consistent with past years, and indicates bull trout passage at the dam is a seasonal trend independent of Project operations. Since winter counts were initiated in 2005, no adult bull trout have been observed during the off-season fishway counting period (November 16 to April 30).

No upstream or downstream passage problems have been identified, either during the 2005-2008 telemetry studies, or subsequent passive monitoring efforts. Passage times upstream through the fishway appeared reasonable relative to the species' migration and spawn timing. Because no passage problems were identified during the study, there was no need to develop recommendations to change or modify the fishway operations at Wells Dam.

The second objective of the Bull Trout Plan was to assess project-related impacts on upstream and downstream passage of sub-adult bull trout (fish <400 mm in length). During the development of the Bull Trout Plan, stakeholders agreed that because of the inability to collect a sufficient sample size of sub-adult bull trout at Wells Dam, it was not feasible to assess sub-adult passage. However, when encountered at Wells Dam, or in tributary traps, sub-adult bull trout would be PIT-tagged. Douglas PUD provided funding, equipment, training, and coordination for the sub-adult bull trout PIT-tag program. From 2004 to July 2008, 67 sub-adult bull trout were PIT-tagged in the Methow River sub-basin during standard tributary smolt-trapping operations. From August 2008 to December 2009, 41 sub-adult bull trout were PIT-tagged at screw traps or hook-and-line remote sampling within the Methow Basin. WDFW personnel captured and PIT tagged 18 adult bull trout while hook-and-line sampling for residual steelhead in the Methow Basin from Dec 2009 to Jan 2011. Ninety-one adult bull trout were captured at the Twisp River weir in 2010 (length range 44-79 cm), 87 of which were subsequently PIT tagged and released back into the Twisp River upstream of the Twisp Weir (the other four adult bull trout had been previously PIT-tagged). Douglas PUD operated PIT-tag detection systems year-round within the Wells Dam fishways during the study period (2005 to the present) and no PIT-tagged sub-adult bull trout have been detected. Additionally, sub-adult bull trout were to be PIT-tagged opportunistically when encountered at the Wells Project; however, to date no sub-adult bull trout have been encountered at Wells Dam.

Off-season (November 16 to April 30) video monitoring of the Wells Dam fishways for sub-adult bull trout was conducted during each of the years of this study including the winter of 2004 and 2005 as required by the Bull Trout Plan. Additionally, no sub-adult bull trout have been observed utilizing the fishways at Wells Dam during the winters of 2006 through 2010.

The third objective was to investigate the potential for sub-adult entrapment or stranding in off-channel or backwater areas of Wells Reservoir. Field surveys were conducted at potential bull trout stranding sites during a period of low reservoir elevation. High resolution bathymetric information, reservoir elevations, backwater curves, and inflow patterns were used to identify potential stranding sites for the survey. No stranded or entrapped bull trout of any size were found during the field surveys conducted in 2006 and 2008. No surveys were conducted during 2005, 2007, 2009, or 2010 because river operations were not low enough to warrant a survey.

The fourth objective of the Bull Trout Plan was to identify the core areas and local populations of bull trout that utilize the Wells Project. Data from radio-tagged bull trout tracked during the 2005 to 2008 study period were analyzed along with data from the 2001 to 2004 study. Bull trout that pass Wells Dam (either upstream or downstream) migrated into the Methow, Entiat, and Wenatchee rivers during the spawning period. Observed tributary entrances of bull trout detected at Wells Dam from 2005 to 2008 were 86 percent Methow River, 10 percent Entiat River, and 2 percent Wenatchee River. Genetic samples of all fish tagged at Wells Dam were submitted to the USFWS for analysis.

In summary, since monitoring began in 2001, no mortality or injury has observed for bull trout passing through the Wells Project. No incidental take of bull trout has been observed at the Wells Project, and the Wells Project is presumed to be within the incidental take levels authorized by the USFWS Biological Opinion Incidental Take Statement (USFWS 2004).

## VI. EXPENSES for the 2010 Calendar Year

### A. Fish Passage and Production Facilities and Non-study Expenses

| | | Total Costs | Minus Credits[1] |
|---|---|---|---|
| 1. | Operation of District Wells Hatchery a/c 537.2, 545.34 | $1,390,241 | $1,277,241 |
| 2. | Supervision of Fish & Game Facilities a/c 537.3 | $326,032 | $326,032 |
| 3. | Operation of District Methow Hatchery a/c 537.7, 545.5 | $969,827 | $141,897 |
| 4. | Fish Management a/c 537.9, 545.8 | $799,674 | $799,674 |
| 5. | Maintenance of District Fish Facilities a/c 545.2 | $66,005 | $66,005 |
| 6. | Maintenance Miscellaneous Fish Related a/c 545.6 | $1,916 | $1,916 |
| 7. | Annual Debt Service on Fish and Game Plant | $3,828,764 | $3,828,764 |
| | Totals | $7,382,762 | $6,441,529 |

[1]Actual costs to Douglas PUC calculated according to the terms of existing hatchery sharing agreements

### B. Licensee Fisheries Study Costs

| | | |
|---|---|---|
| 1. | Fish Studies a/c 537.5 | $1,965,880 |
| 2. | Fish Studies – Methow a/c 537.6 | $691,391 |
| | Total | $2,657,271 |

**Table 1.** 2010 Wells Dam fish counts (24-hour count period) summarized by month.

| | Chinook Salmon | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | All | | | Steelhead | | |
| Month | Adults | Jacks | Adults | Jacks | Adults | Jacks | A+J | Coho | Sockeye | Hatchery | Wild | Total |
| May | 6,428 | 459 | | | | | 6,887 | | | 18 | 77 | 95 |
| June | 1,168 | 202 | 306 | 12 | | | 1,688 | | 3,565 | 9 | 25 | 34 |
| July | | | 21,403 | 797 | | | 22,200 | | 285,390 | 612 | 473 | 1,085 |
| August | | | 5,343 | 1,089 | 160 | 239 | 6,831 | | 2,766 | 2,539 | 1,985 | 4,524 |
| September | | | | | 2,032 | 615 | 2,647 | 109 | 34 | 3,152 | 2,083 | 5,235 |
| October | | | | | 819 | 244 | 1,063 | 876 | 11 | 916 | 665 | 1,581 |
| November | | | | | 135 | 12 | 147 | 249 | | 179 | 196 | 375 |
| Totals | 7,596 | 661 | 27,052 | 1,898 | 3,146 | 1,110 | 41,463 | 1,234 | 291,766 | 7,425 | 5,504 | 12,929 |
| Totals A+J | 8,257 | | 28,950 | | 4,256 | | | | | | | |

Chinook counted per WDFW conversion dates: Spring Chinook May 1 - June 28; Summer Chinook June 29 - August 28; Fall Chinook August 29 - November 15

**Table 2.** 2010 Wells Dam fish counts (16 hour count period [0400 - 2000 PST]) summarized by month.

| | Chinook Salmon | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | All | | | Steelhead | |
| Month | Adults | Jacks | Adults | Jacks | Adults | Jacks | A+J | Coho | Sockeye | Hatchery | Wild |
| May | 6,256 | 445 | | | | | 6,701 | | | 17 | 70 |
| June | 1,092 | 192 | 193 | 3 | | | 1,480 | | 3,133 | 8 | 21 |
| July | | | 20,749 | 778 | | | 21,527 | | 24,9554 | 582 | 442 |
| August | | | 4,816 | 923 | 148 | 208 | 6,095 | | 2,356 | 2,367 | 1,894 |
| September | | | | | 1,870 | 490 | 2,360 | 98 | 30 | 2,793 | 1,816 |
| October | | | | | 703 | 221 | 924 | 722 | 10 | 807 | 574 |
| November | | | | | 118 | 7 | 125 | 176 | | 146 | 159 |
| Total | 7,348 | 637 | 25,758 | 1,704 | 2,839 | 926 | 39,212 | 996 | 255,083 | 6,720 | 4,976 |
| Totals A+J | 7,985 | | 27,462 | | 3,765 | | | | | | |

**Table 3.** 2009 Wells Dam fish counts summarized by percentage of night passage (% observed between 000 - 0400 and 2000 – 2400, PST)

| | Chinook Salmon | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Spring | | Summer | | Fall | | All | | | Steelhead | |
| Month | Adults | Jacks | Adults | Jacks | Adults | Jacks | A+J | Coho | Sockeye | Hatchery | Wild |
| May | 3% | 3% | | | | | 3% | | | 6% | 9% |
| June | 7% | 5% | 37% | 75% | | | 12% | | 12% | 11% | 16% |
| July | | | 3% | 2% | | | 3% | | 13% | 5% | 7% |
| August | | | 10% | 15% | 8% | 13% | 11% | | 15% | 7% | 5% |
| September | | | | | 8% | 20% | 11% | 10% | 12% | 11% | 13% |
| October | | | | | 14% | 9% | 13% | 18% | 9% | 12% | 14% |
| November | | | | | 13% | 42% | 15% | 29% | | 18% | 19% |
| Total | 3% | 4% | 5% | 10% | 10% | 17% | 5% | 19% | 13% | 9% | 10% |

**Table 4.** Fish trapped from the ladders at Wells Dam and retained for broodstock and thus not included in the ladder counts in 2010.

| Species | Chinook | Steelhead | Coho | Total |
|---|---|---|---|---|
| Number retained | 593 | 367 | 254 | 571 |

**Table 5.** Production from the Wells Hatchery in 2010

| | Summer Chinook | Summer Steelhead |
|---|---|---|
| Adults spawned in 2010 | 1,183 | 301[1] |
| Eggs taken, 2010 | 2,268,280 | 719,097 |
| Eggs transferred, 2010 | 1,025,880 | 62,560[2] |
| Eggs transferred for Lake Chelan release, 2010 | 170,200 | NA |
| Juveniles transferred (Ringold FH) | NA | 166,337[3] |
| Juveniles released, 2008 brood | 336,881 | NA |
| Juveniles released, 2009 brood | 471,286 | 394,417 |

1. Adult steelhead collected at Wells Dam for broodstock are held until spawning during the following year. Steelhead spawned in 2010 (designated 2010 brood) were actually collected in 2009.
2. Transfer to the Winthrop National Fish Hatchery
3. Steelhead fry transferred to Ringold Hatchery.

**Table 6.** Spring Chinook production from the Methow Hatchery in 2010

| | Twisp R. | Chewuch R. | Methow R. |
|---|---|---|---|
| Adults trapped, 2010 brood | 89 | 272[1] | |
| Adults spawned, 2010 brood | 54 | 272 | |
| Eggs taken, 2010 brood | 108,000 | 544,000 | |
| Juveniles released, 2008 brood | 78,656 | 260,344 | 201,290[2] |

1. All non-Twisp fish were categorized as Methow-Composite (MetComp).
2. Methow River releases include 175,699 released directly from the Methow Hatchery in mid April, and 25,591 released to the Yakama Nation for acclimation in their Biddle Pond remote-acclimation site off of Wolf Creek, tributary to the Methow River upstream of the Methow Hatchery. The Yakama Nation reported no mortalities from that release group.

**Attachment A**. Wells Dam daily fish passage (24-hour count) for May 2010.

| | Chinook | | | | Steelhead | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **Adults** | **Jacks** | **Coho** | **Sockeye** | **Ad-clipped** | **Ad-present** | **Lamprey** | **Bull Trout** |
| 1 | 200 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 47 | 1 | 0 | 0 | 0 | 7 | 0 | 0 |
| 3 | 34 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| 4 | 7 | 0 | 0 | 0 | 3 | 5 | 0 | 0 |
| 5 | 20 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| 6 | 399 | 15 | 0 | 0 | 1 | 0 | 0 | 0 |
| 7 | 288 | 5 | 0 | 0 | 2 | 3 | 0 | 0 |
| 8 | 147 | 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 210 | 24 | 0 | 0 | 0 | 6 | 0 | 0 |
| 10 | 138 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 11 | 94 | 2 | 0 | 0 | 0 | 3 | 0 | 0 |
| 12 | 231 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 13 | 545 | 27 | 0 | 0 | 2 | 9 | 0 | 0 |
| 14 | 190 | 10 | 0 | 0 | 0 | 3 | 0 | 2 |
| 15 | 212 | 5 | 0 | 0 | 0 | 4 | 0 | 0 |
| 16 | 564 | 12 | 0 | 0 | 1 | 2 | 0 | 0 |
| 17 | 432 | 8 | 0 | 0 | 0 | 2 | 0 | 0 |
| 18 | 438 | 29 | 0 | 0 | 0 | 0 | 0 | 1 |
| 19 | 159 | 6 | 0 | 0 | 2 | 1 | 0 | 1 |
| 20 | 301 | 7 | 0 | 0 | 1 | 1 | 0 | 1 |
| 21 | 432 | 35 | 0 | 0 | 3 | 0 | 0 | 1 |
| 22 | 154 | 6 | 0 | 0 | 0 | 6 | 0 | 0 |
| 23 | 145 | 18 | 0 | 0 | 1 | 5 | 0 | 0 |
| 24 | 63 | 10 | 0 | 0 | 0 | 2 | 0 | 0 |
| 25 | 112 | 22 | 0 | 0 | 0 | 1 | 0 | 1 |
| 26 | 173 | 32 | 0 | 0 | 0 | 5 | 0 | 0 |
| 27 | 186 | 35 | 0 | 0 | 0 | 0 | 0 | 1 |
| 28 | 136 | 41 | 0 | 0 | 0 | 1 | 0 | 2 |
| 29 | 39 | 20 | 0 | 0 | 0 | 1 | 0 | 1 |
| 30 | 231 | 36 | 0 | 0 | 0 | 2 | 0 | 1 |
| 31 | 101 | 31 | 0 | 0 | 1 | 1 | 0 | 2 |
| **Totals** | **6,428** | **459** | **0** | **0** | **18** | **77** | **0** | **14** |

**Attachment A (continued)**. Wells Dam daily fish passage (24-hour count) for June 2010.

| | Chinook | | | | Steelhead | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **Adults** | **Jacks** | **Coho** | **Sockeye** | **Ad-clipped** | **Ad-present** | **Lamprey** | **Bull Trout** |
| 1 | 27 | 14 | 0 | 0 | 1 | 2 | 0 | 2 |
| 2 | 52 | 24 | 0 | 0 | 0 | 0 | 0 | 1 |
| 3 | 27 | 12 | 0 | 0 | 0 | 0 | 0 | 2 |
| 4 | 140 | 21 | 0 | 0 | 1 | 0 | 0 | 0 |
| 5 | 17 | 9 | 0 | 0 | -2 | 0 | 0 | 0 |
| 6 | 31 | 5 | 0 | 0 | 0 | 2 | 0 | 1 |
| 7 | 7 | 8 | 0 | 0 | 0 | 2 | 0 | 0 |
| 8 | 19 | 7 | 0 | 0 | 0 | 1 | 0 | 2 |
| 9 | 49 | 7 | 0 | 0 | 0 | 1 | 0 | 1 |
| 10 | 38 | 7 | 0 | 0 | 0 | 0 | 0 | 2 |
| 11 | 28 | 6 | 0 | 0 | 0 | 1 | 0 | 1 |
| 12 | 8 | 7 | 0 | 2 | 0 | 0 | 0 | 0 |
| 13 | 34 | 8 | 0 | 5 | 0 | 0 | 0 | 0 |
| 14 | 17 | 4 | 0 | 4 | 0 | 0 | 0 | 0 |
| 15 | 43 | 5 | 0 | 4 | 0 | 0 | 0 | 0 |
| 16 | 13 | 6 | 0 | 5 | 0 | 0 | 0 | 0 |
| 17 | 15 | 4 | 0 | 8 | 0 | 1 | 0 | 0 |
| 18 | 22 | 3 | 0 | 17 | 0 | 2 | 0 | 1 |
| 19 | 40 | 5 | 0 | 20 | 0 | 0 | 0 | 1 |
| 20 | 12 | 4 | 0 | 18 | 1 | 0 | 0 | 0 |
| 21 | 27 | 1 | 0 | 37 | 0 | 1 | 0 | 0 |
| 22 | 40 | 8 | 0 | 52 | 0 | 0 | 0 | 0 |
| 23 | 37 | 6 | 0 | 57 | 0 | 2 | 0 | 0 |
| 24 | 56 | 6 | 0 | 136 | 1 | 1 | 0 | 0 |
| 25 | 59 | 1 | 0 | 100 | 0 | 1 | 0 | 1 |
| 26 | 52 | 3 | 0 | 186 | 0 | 1 | 0 | 0 |
| 27 | 116 | 1 | 0 | 343 | 0 | 0 | 0 | 2 |
| 28 | 142 | 10 | 0 | 585 | 5 | 2 | 0 | 3 |
| 29 | 101 | 9 | 0 | 757 | 0 | 3 | 0 | 1 |
| 30 | 205 | 3 | 0 | 1,229 | 2 | 2 | 0 | 1 |
| **Totals** | **1,474** | **214** | **0** | **3,565** | **9** | **25** | **0** | **22** |

**Attachment A (continued)**. Wells Dam daily fish passage (24-hour count) for July 2010.

| | Chinook | | | | Steelhead | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **Adults** | **Jacks** | **Coho** | **Sockeye** | **Ad-clipped** | **Ad-present** | **Lamprey** | **Bull Trout** |
| 1 | 212 | 10 | 0 | 1,532 | 1 | 3 | 0 | 0 |
| 2 | 185 | 9 | 0 | 2,532 | 1 | 3 | 0 | 0 |
| 3 | 791 | 22 | 0 | 6,366 | 0 | 4 | 0 | 0 |
| 4 | 548 | 19 | 0 | 13,341 | 8 | 6 | 0 | 0 |
| 5 | 598 | 10 | 0 | 14,945 | 7 | 3 | 0 | 0 |
| 6 | 601 | 8 | 0 | 18,276 | 0 | 3 | 0 | 0 |
| 7 | 1,192 | 4 | 0 | 22,577 | 10 | 2 | 0 | 0 |
| 8 | 1,149 | 28 | 0 | 22,989 | 10 | 12 | 0 | 1 |
| 9 | 1,075 | 33 | 0 | 19,902 | 6 | 10 | 0 | 0 |
| 10 | 953 | 72 | 0 | 19,416 | 11 | 11 | 0 | 2 |
| 11 | 1,115 | 22 | 0 | 20,463 | 12 | 13 | 0 | 0 |
| 12 | 921 | 11 | 0 | 20,331 | 8 | 10 | 0 | 1 |
| 13 | 865 | 36 | 0 | 15,247 | 18 | 8 | 0 | 0 |
| 14 | 1,112 | 19 | 0 | 11,345 | 18 | 24 | 0 | 1 |
| 15 | 641 | 18 | 0 | 9,980 | 12 | 10 | 0 | 0 |
| 16 | 497 | 24 | 0 | 8,298 | 19 | 13 | 0 | 1 |
| 17 | 1,208 | 69 | 0 | 8,654 | 28 | 20 | 0 | 0 |
| 18 | 777 | 13 | 0 | 6,840 | 10 | 8 | 0 | 0 |
| 19 | 443 | 26 | 0 | 7,718 | 25 | 22 | 0 | 0 |
| 20 | 935 | 79 | 0 | 3,018 | 27 | 19 | 0 | 0 |
| 21 | 1,044 | 31 | 0 | 9,915 | 46 | 20 | 0 | 0 |
| 22 | 701 | 36 | 0 | 4,844 | 15 | 17 | 0 | 0 |
| 23 | 1,221 | 34 | 0 | 3,687 | 32 | 3 | 0 | 0 |
| 24 | 468 | 2 | 0 | 3,436 | 33 | 28 | 0 | 0 |
| 25 | 372 | 13 | 0 | 2,271 | 27 | 31 | 0 | 0 |
| 26 | 222 | 7 | 0 | 1,861 | 25 | 20 | 1 | 0 |
| 27 | 454 | 21 | 0 | 1,413 | 47 | 29 | 0 | 0 |
| 28 | 153 | 28 | 0 | 908 | 23 | 12 | 0 | 0 |
| 29 | 247 | 24 | 0 | 1,310 | 44 | 25 | 0 | 0 |
| 30 | 538 | 45 | 0 | 1,069 | 55 | 40 | 0 | 0 |
| 31 | 165 | 24 | 0 | 906 | 34 | 44 | 0 | 0 |
| **Totals** | **21,403** | **797** | **0** | **285,390** | **612** | **473** | **1** | **6** |

**Attachment A (continued)**. Wells Dam daily fish passage (24-hour count) for August 2010.

| | Chinook | | | | Steelhead | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **Adults** | **Jacks** | **Coho** | **Sockeye** | **Ad-clipped** | **Ad-present** | **Lamprey** | **Bull Trout** |
| 1 | 277 | 68 | 0 | 611 | 76 | 36 | 0 | 0 |
| 2 | 304 | 118 | 0 | 489 | 86 | 49 | 0 | 0 |
| 3 | 114 | 106 | 0 | 304 | 36 | 36 | 0 | 0 |
| 4 | 111 | 75 | 0 | 192 | 45 | 52 | 0 | 0 |
| 5 | 498 | 39 | 0 | 206 | 86 | 77 | 0 | 0 |
| 6 | 249 | 54 | 0 | 184 | 98 | 88 | 0 | 0 |
| 7 | 133 | 22 | 0 | 130 | 52 | 13 | 0 | 0 |
| 8 | 358 | 28 | 0 | 156 | 114 | 64 | 0 | 0 |
| 9 | 242 | 93 | 0 | 86 | 71 | 80 | 0 | 0 |
| 10 | 189 | 45 | 0 | 53 | 99 | 85 | 0 | 0 |
| 11 | 248 | 28 | 0 | 72 | 90 | 73 | 0 | 0 |
| 12 | 271 | 31 | 0 | 20 | 75 | 52 | 0 | 0 |
| 13 | 171 | 27 | 0 | 36 | 76 | 70 | 0 | 0 |
| 14 | 96 | 46 | 0 | 29 | 52 | 58 | 0 | 0 |
| 15 | 186 | 52 | 0 | 17 | 67 | 50 | 0 | 0 |
| 16 | 272 | 52 | 0 | 32 | 150 | 129 | 0 | 0 |
| 17 | 244 | 57 | 0 | 17 | 142 | 93 | 0 | 0 |
| 18 | 287 | 53 | 0 | 35 | 142 | 129 | 0 | 0 |
| 19 | 96 | 37 | 0 | 15 | 92 | 65 | 0 | 0 |
| 20 | 106 | 19 | 0 | 17 | 72 | 68 | 0 | 0 |
| 21 | 66 | 24 | 0 | 6 | 55 | 39 | 0 | 0 |
| 22 | 113 | 37 | 0 | 11 | 62 | 42 | 0 | 0 |
| 23 | 47 | 55 | 0 | 4 | 53 | 54 | 0 | 0 |
| 24 | 70 | 59 | 0 | 10 | 77 | 80 | 0 | 0 |
| 25 | 188 | 22 | 0 | 4 | 139 | 96 | 0 | 0 |
| 26 | 125 | 24 | 0 | 8 | 129 | 91 | 0 | 0 |
| 27 | 40 | 34 | 0 | 4 | 38 | 31 | 0 | 0 |
| 28 | 242 | 56 | 0 | 6 | 74 | 64 | 0 | 0 |
| 29 | 88 | 69 | 0 | 2 | 76 | 55 | 0 | 0 |
| 30 | 39 | 47 | 0 | 6 | 43 | 31 | 0 | 0 |
| 31 | 33 | 36 | 0 | 4 | 72 | 35 | 0 | 0 |
| **Totals** | **5,503** | **1,328** | **0** | **2,766** | **2,539** | **1,985** | **0** | **0** |

**Attachment A (continued)**. Wells Dam daily fish passage (24-hour count) for September 2010.

| | Chinook | | | | Steelhead | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **Adults** | **Jacks** | **Coho** | **Sockeye** | **Ad-clipped** | **Ad-present** | **Lamprey** | **Bull Trout** |
| 1 | 64 | 66 | 0 | 5 | 118 | 49 | 0 | 0 |
| 2 | 71 | 38 | 0 | 1 | 81 | 53 | 0 | 0 |
| 3 | 89 | 20 | 0 | 4 | 122 | 92 | 0 | 0 |
| 4 | 188 | 30 | 0 | 4 | 79 | 66 | 0 | 0 |
| 5 | 186 | 29 | 2 | 1 | 72 | 39 | 0 | 0 |
| 6 | 122 | 21 | 0 | 1 | 101 | 70 | 0 | 0 |
| 7 | 87 | 9 | 0 | 1 | 101 | 64 | 0 | 0 |
| 8 | 104 | 15 | 0 | 2 | 106 | 69 | 0 | 0 |
| 9 | 97 | 24 | 0 | 2 | 110 | 58 | 0 | 0 |
| 10 | 44 | 19 | 0 | 2 | 125 | 59 | 0 | 0 |
| 11 | 70 | 23 | 0 | 1 | 102 | 53 | 0 | 0 |
| 12 | 60 | 11 | 0 | 1 | 105 | 58 | 0 | 0 |
| 13 | 40 | 18 | 0 | 1 | 126 | 69 | 0 | 0 |
| 14 | 25 | 8 | 0 | 0 | 52 | 40 | 0 | 0 |
| 15 | 51 | 21 | 0 | 1 | 127 | 78 | 0 | 0 |
| 16 | 52 | 15 | 1 | 1 | 123 | 68 | 0 | 0 |
| 17 | 80 | 19 | 0 | 1 | 175 | 110 | 0 | 0 |
| 18 | 71 | 21 | 1 | 0 | 142 | 133 | 0 | 0 |
| 19 | 67 | 15 | 0 | 0 | 134 | 94 | 0 | 0 |
| 20 | 46 | 9 | 2 | 1 | 103 | 61 | 0 | 0 |
| 21 | 19 | 18 | 5 | 0 | 72 | 53 | 0 | 0 |
| 22 | 45 | 8 | 13 | 1 | 149 | 133 | 0 | 0 |
| 23 | 74 | 21 | 4 | 1 | 125 | 101 | 0 | 0 |
| 24 | 59 | 32 | 3 | 0 | 123 | 90 | 0 | 0 |
| 25 | 23 | 30 | 7 | 2 | 77 | 89 | 0 | 0 |
| 26 | 92 | 30 | 15 | 0 | 105 | 76 | 0 | 0 |
| 27 | 31 | 13 | 10 | 0 | 61 | 25 | 0 | 0 |
| 28 | 11 | 11 | 3 | 0 | 59 | 24 | 1 | 0 |
| 29 | 38 | 8 | 19 | 0 | 69 | 40 | 0 | 0 |
| 30 | 26 | 13 | 24 | 0 | 108 | 69 | 0 | 0 |
| **Totals** | **2,032** | **615** | **109** | **34** | **3,152** | **2,083** | **1** | **0** |

**Attachment A (continued)**. Wells Dam daily fish passage (24-hour count) for October 2010.

| | Chinook | | | | Steelhead | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **Adults** | **Jacks** | **Coho** | **Sockeye** | **Ad-clipped** | **Ad-present** | **Lamprey** | **Bull Trout** |
| 1 | 25 | 11 | 12 | 1 | 61 | 50 | 0 | 0 |
| 2 | 39 | 9 | 40 | 1 | 78 | 48 | 0 | 0 |
| 3 | 66 | 4 | 27 | 0 | 61 | 35 | 0 | 0 |
| 4 | 16 | 24 | 17 | 0 | 44 | 25 | 0 | 0 |
| 5 | 32 | 15 | 14 | 0 | 56 | 25 | 0 | 0 |
| 6 | 33 | 3 | 28 | 0 | 39 | 35 | 0 | 0 |
| 7 | 33 | 16 | 16 | 0 | 46 | 27 | 0 | 0 |
| 8 | 17 | 11 | 16 | 0 | 49 | 45 | 0 | 0 |
| 9 | 24 | 10 | 12 | 0 | 29 | 36 | 0 | 0 |
| 10 | 36 | 15 | 21 | 0 | 60 | 41 | 0 | 0 |
| 11 | 8 | 3 | 10 | 0 | 20 | 9 | 0 | 0 |
| 12 | 16 | 2 | 12 | 0 | 27 | 15 | 0 | 0 |
| 13 | 23 | 10 | 30 | 1 | 42 | 18 | 0 | 0 |
| 14 | 22 | 13 | 40 | 1 | 39 | 37 | 0 | 0 |
| 15 | 54 | 12 | 39 | 2 | 37 | 47 | 0 | 1 |
| 16 | 30 | 4 | 45 | 0 | 29 | 19 | 0 | 0 |
| 17 | 35 | 14 | 40 | 1 | 24 | 28 | 0 | 0 |
| 18 | 26 | 9 | 17 | 0 | 6 | 9 | 0 | 0 |
| 19 | 17 | 6 | 10 | 1 | 8 | 5 | 0 | 0 |
| 20 | 10 | 10 | 20 | 0 | 4 | 8 | 0 | 0 |
| 21 | 63 | 7 | 34 | 0 | 32 | 12 | 0 | 0 |
| 22 | 38 | 4 | 25 | 0 | 11 | 4 | 0 | 0 |
| 23 | 30 | 4 | 19 | 0 | 13 | 7 | 0 | 0 |
| 24 | 45 | 11 | 43 | 1 | 20 | 12 | 0 | 0 |
| 25 | 19 | 3 | 27 | 1 | 7 | 6 | 0 | 0 |
| 26 | 19 | 2 | 37 | 1 | 17 | 13 | 0 | 0 |
| 27 | 15 | 3 | 43 | 0 | 19 | 15 | 0 | 0 |
| 28 | 5 | 8 | 39 | 0 | 10 | 6 | 0 | 0 |
| 29 | 17 | 1 | 50 | 0 | 8 | 13 | 0 | 1 |
| 30 | 3 | 0 | 41 | 0 | 8 | 9 | 0 | 0 |
| 31 | 3 | 0 | 52 | 0 | 12 | 6 | 0 | 0 |
| **Totals** | **819** | **244** | **876** | **11** | **916** | **665** | **0** | **2** |

**Attachment A (concluded)**. Wells Dam daily fish passage (24-hour count) for November 1-15, 2010.

| | Chinook | | | | Steelhead | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **Adults** | **Jacks** | **Coho** | **Sockeye** | **Ad-clipped** | **Ad-present** | **Lamprey** | **Bull Trout** |
| 1 | 29 | 4 | 40 | 0 | 10 | 10 | 0 | 0 |
| 2 | 10 | 0 | 37 | 0 | 11 | 12 | 0 | 0 |
| 3 | 22 | 0 | 26 | 0 | 17 | 23 | 0 | 0 |
| 4 | 6 | 1 | 27 | 0 | 16 | 21 | 0 | 0 |
| 5 | 16 | 4 | 22 | 0 | 13 | 22 | 0 | 0 |
| 6 | 16 | 1 | 9 | 0 | 10 | 14 | 0 | 0 |
| 7 | 7 | 0 | 12 | 0 | 12 | 11 | 0 | 0 |
| 8 | 8 | 2 | 13 | 0 | 5 | 12 | 0 | 0 |
| 9 | 4 | 0 | 17 | 0 | 9 | 9 | 0 | 0 |
| 10 | 2 | 0 | 13 | 0 | 17 | 21 | 0 | 0 |
| 11 | 2 | 0 | 10 | 0 | 16 | 15 | 0 | 0 |
| 12 | 3 | 0 | 7 | 0 | 23 | 10 | 0 | 0 |
| 13 | 6 | 0 | 6 | 0 | 7 | 8 | 0 | 0 |
| 14 | 2 | 0 | 5 | 0 | 10 | 3 | 0 | 0 |
| 15 | 2 | 0 | 5 | 0 | 3 | 5 | 0 | 0 |
| **Totals** | **135** | **12** | **249** | **0** | **179** | **196** | **0** | **0** |

**Attachment B.** Wells Dam Annual Ladder Counts of Salmon and Steelhead for a 16-hour Daily Count Period (1967-2010)

| Year | Chinook Spring | Chinook Summer | Chinook Fall | Chinook Trapped | Chinook Total | Coho[1] | Sockeye | Steelhead | Steelhead Trapped | Steelhead Total | Total Salmonids | Count Dates Include: |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1967 | 1,157 | 12,504 | 2,732 | 2,004 | 18,397 | 255 | 113,232 | 1,474 | 171 | 1,645 | 133,529 | 5/21-11/19 |
| 1968 | 4,931 | 8,922 | 2,623 | 2,277 | 18,753 | 221 | 81,530 | 2,112 | 413 | 2,525 | 103,029 | 5/01-11/15 |
| 1969 | 3,599 | 6,846 | 2,929 | 2,873 | 16,247 | 29 | 17,352 | 1,391 | 530 | 1,921 | 35,549 | 5/01-11/15 |
| 1970 | 2,670 | 8,003 | 4,388 | 1,745 | 16,806 | 62 | 50,667 | 1,597 | 399 | 1,996 | 69,531 | 5/01-11/15 |
| 1971 | 3,168 | 5,988 | 2,030 | 1,793 | 12,979 | 161 | 48,172 | 3,782 | 358 | 4,140 | 65,452 | 4/30-11/15 |
| 1972 | 3,616 | 4,141 | 2,419 | 1,694 | 11,870 | 665 | 33,398 | 1,894 | 354 | 2,248 | 48,181 | 4/30-11/15 |
| 1973 | 2,937 | 5,052 | 2,650 | 2,088 | 12,727 | 331 | 37,178 | 1,820 | 627 | 2,447 | 52,683 | 4/30-11/15 |
| 1974 | 3,420 | 4,567 | 1,114 | 2,893 | 11,994 | 112 | 16,716 | 580 | 260 | 840 | 29,662 | 5/01-10/31 |
| 1975 | 2,225 | 8,522 | 3,806 | 3,253 | 17,806 | 25 | 22,286 | 517 | 227 | 744 | 40,861 | 5/01-10/31 |
| 1976 | 2,759 | 7,901 | 3,843 | 2,518 | 17,021 | 99 | 27,619 | 4,664 | 337 | 5,001 | 49,740 | 5/01-11/15 |
| 1977 | 4,211 | 7,527 | 3,260 | 2,628 | 17,626 | 68 | 21,973 | 5,282 | 355 | 5,637 | 45,304 | 5/01-11/15 |
| 1978 | 3,615 | 6,419 | 1,336 | 2,259 | 13,629 | 77 | 7,458 | 1,621 | 356 | 1,977 | 23,141 | 5/01-10/31 |
| 1979 | 1,103 | 10,080 | 1,108 | 2,352 | 14,643 | 63 | 22,655 | 3,695 | 367 | 4,062 | 41,423 | 5/01-11/16 |
| 1980 | 1,182 | 4,892 | 709 | 1,827 | 8,610 | 82 | 26,573 | 3,443 | 372 | 3,815 | 39,080 | 5/01-11/22 |
| 1981 | 1,935 | 4,276 | 686 | 1,533 | 8,430 | 26 | 28,234 | 4,096 | 650 | 4,746 | 41,436 | 5/01-11/22 |
| 1982 | 2,401 | 3,349 | 2,064 | 700 | 8,514 | 357 | 19,005 | 7,984 | 590 | 8,574 | 36,450 | 5/01-11/22 |
| 1983 | 2,869 | 2,821 | 1,150 | 942 | 7,782 | 82 | 27,925 | 19,525 | 670 | 20,195 | 55,984 | 5/01-11/30 |
| 1984 | 3,280 | 5,941 | 1,812 | 1,094 | 12,127 | 104 | 81,054 | 16,632 | 690 | 17,322 | 110,607 | 5/01-11/25 |
| 1985 | 5,257 | 4,456 | 2,097 | 1,689 | 13,499 | 72 | 53,170 | 19,867 | 750 | 20,617 | 87,358 | 5/01-11/22 |
| 1986 | 3,150 | 4,178 | 1,143 | 1,118 | 9,589 | 87 | 34,876 | 13,303 | 650 | 13,953 | 58,505 | 5/01-11/14 |
| 1987 | 2,344 | 3,142 | 3,253 | 1,275 | 10,014 | 42 | 39,948 | 5,493 | 603 | 6,096 | 56,100 | 5/01-11/13 |
| 1988 | 3,036 | 2,775 | 1,935 | 1,364 | 9,110 | 75 | 33,980 | 4,401 | 651 | 5,052 | 48,217 | 5/01-10/31 |
| 1989 | 1,740 | 3,333 | 1,435 | 2,147 | 8,655 | 14 | 15,895 | 4,600 | 716 | 5,316 | 29,880 | 5/01-10/31 |
| 1990 | 981 | 3,354 | 749 | 1,109 | 6,193 | 32 | 7,597 | 3,815 | 735 | 4,550 | 18,372 | 5/01-11/07 |
| 1991 | 779 | 2,028 | 827 | 1,525 | 5,159 | 21 | 27,492 | 7,751 | 726 | 8,477 | 41,149 | 5/01-11/15 |
| 1992 | 1,623 | 1,967 | 1,503 | 895 | 7,980 | 28 | 41,844 | 7,027 | 658 | 7,685 | 57,537 | 5/01-11/15 |
| 1993 | 2,444 | 3,603 | 1,228 | 1,780 | 9,055 | 19 | 28,038 | 2,494 | 633 | 3,127 | 40,239 | 5/01-11/16 |
| 1994 | 257 | 4,891 | 3,017 | 2,287 | 10,452 | 3 | 1,662 | 2,163 | 620 | 2,783 | 14,900 | 5/01-11/15 |
| 1995 | 103 | 3,076 | 1,229 | 2,164 | 6,572 | 6 | 4,801 | 942 | 619 | 1,561 | 12,940 | 5/01-11/15 |
| 1996 | * | 2,389 | 917 | 1,665 | 4,971 | 4 | 17,703 | 4,128 | 509 | 4,637 | 27,315 | 5/01-11/15 |
| 1997 | 971 | 2,721 | 766 | 1,655 | 6,113 | 8 | 25,754 | 4,107 | 630 | 4,737 | 36,612 | 5/01-11/15 |
| 1998 | * | 3,799 | 1,067 | 1,559 | 6,425 | 0 | 4,135 | 2,520 | 460 | 2,980 | 13,540 | 5/01-11/15 |
| 1999 | 345 | 7,787 | 2,548 | 938 | 11,618 | 224 | 12,388 | 3,504 | 416 | 3,920 | 28,150 | 5/01-11/15 |
| 2000 | 2,435 | 9,673 | 3,049 | 1,327 | 16,484 | 0 | 53,351 | 5,575 | 369 | 5,944 | 75,779 | 5/01-11/15 |
| 2001 | 10,414 | 35,990 | 8,634 | 556 | 55,594 | 473 | 64,819 | 16,251 | 392 | 16,643 | 137,529 | 5/01-11/15 |
| 2002 | 7,098 | 59,540 | 5,573 | 556 | 72,767 | 104 | 9,594 | 8,253 | 373 | 8,626 | 91,091 | 5/01-11/15 |
| 2003 | 4,480 | 43,480 | 7,397 | 556 | 55,913 | 137 | 24,684 | 8,721 | 374 | 9,095 | 89,829 | 5/01-11/15 |
| 2004 | 2,493 | 31,172 | 5,265 | 558 | 39,488 | 234 | 64,959 | 7,825 | 452 | 8,277 | 112,958 | 5/01-11/15 |
| 2005 | 4,831 | 30,842 | 3,110 | 563 | 39,346 | 273 | 46,891 | 6,331 | 417 | 6,748 | 93,258 | 5/01-11/15 |
| 2006 | 3,996 | 26,345 | 4,658 | 575 | 35,574 | 399 | 18,880 | 5,877 | 368 | 6,245 | 61,098 | 5/01-11/15 |
| 2007 | 2,543 | 15,866 | 2,356 | 521 | 21,286 | 2,033 | 19,106 | 6,574 | 379 | 6,953 | 49,378 | 5/01-11/15 |
| 2008 | 2,739 | 20,954 | 5,788 | 415 | 29,896 | 925 | 145,067 | 8,622 | 370 | 8,992 | 207,924 | 5/01-11/15 |
| 2009 | 7,932 | 28,148 | 5,914 | 473 | 41,994 | 2,415 | 116,964 | 23,578 | 367 | 23,945 | 185,791 | 5/01-11/15 |
| 2010 | 7,985 | 27,462 | 3,765 | 593 | 39,212 | 996 | 255,083 | 11,696 | 367 | 12063 | 307,354 | 5/01-11/15 |
| Mean | 3,002 | 11,006 | 2,700 | 1,529 | 18,144 | 243 | 37,131 | 6,182 | 488 | 6,670 | 62,723 | |
| Gmean | 2,200 | 6,999 | 2,158 | 1,320 | 14,126 | 43 | 26,533 | 4,299 | 462 | 4,916 | 51,144 | |

Chinook counts include jacks. WDFW counting dates: spring Chinook, May1-June 28; summer Chinook, June 29-August 28; Fall Chinook, August 29-November 15.

*All spring Chinook were trapped for broodstock at Wells Dam; 387 in 1996, and 363 in 1998.

[1]Does not include numbers of coho trapped at Wells Dam by the Yakama Nation for hatchery broodstock; 254 in 2010.

**Attachment C.** Wells Dam Annual Ladder Counts of Salmon and Steelhead for a 24-hour Daily Count Period from 1998-2010.

| Year | Chinook Spring | Chinook Summer | Chinook Fall | Chinook Trapped | Chinook Total | Coho[1] | Sockeye | Steelhead | Steelhead Trapped | Steelhead Total | Total Salmonids | Count Dates Include |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | * | 4,108 | 1,200 | 1,582 | 6,890 | 0 | 4,669 | 2,984 | 460 | 3,444 | 15,003 | 5/01-11/15 |
| 1999 | 345 | 7,787 | 2,548 | 938 | 11,618 | 224 | 12,388 | 3,504 | 416 | 3,920 | 28,150 | 5/01-11/15 |
| 2000 | 2,587 | 10,156 | 3,418 | 1,327 | 17,488 | 0 | 59,944 | 6,280 | 369 | 6,649 | 84,081 | 5/01-11/15 |
| 2001 | 10,871 | 38,126 | 9,591 | 556 | 59,144 | 612 | 74,490 | 18,528 | 392 | 18,920 | 153,166 | 5/01-11/15 |
| 2002 | 7,626 | 62,623 | 6,472 | 556 | 77,277 | 132 | 10,768 | 9,478 | 373 | 9,851 | 98,028 | 5/01-11/15 |
| 2003 | 4,702 | 46,391 | 8,253 | 556 | 59,902 | 168 | 28,977 | 9,963 | 374 | 10,337 | 99,384 | 5/01-11/15 |
| 2004 | 4,793 | 32,847 | 5,777 | 558 | 43,975 | 291 | 78,053 | 9,317 | 452 | 9,769 | 132,088 | 5/01-11/15 |
| 2005 | 4,996 | 31,763 | 3,461 | 563 | 40,783 | 348 | 55,559 | 7,203 | 417 | 7,620 | 104,310 | 5/01-11/15 |
| 2006 | 4,376 | 27,196 | 5,043 | 575 | 37,190 | 409 | 22,075 | 6,674 | 368 | 7,042 | 66,716 | 5/01-11/15 |
| 2007 | 2,793 | 16,817 | 2,670 | 521 | 22,801 | 2,432 | 22,273 | 7,500 | 379 | 7,879 | 55,385 | 5/01-11/15 |
| 2008 | 3,134 | 22,435 | 6,423 | 415 | 32,407 | 1,191 | 165,334 | 9,808 | 370 | 10,178 | 209,110 | 5/01-11/15 |
| 2009 | 8,174 | 29,525 | 6,326 | 473 | 44,498 | 2,989 | 134,937 | 25,422 | 367 | 25,789 | 208,213 | 5/01-11/15 |
| 2010 | 8,257 | 28,950 | 4,256 | 593 | 42,056 | 1,234 | 291,766 | 12,929 | 367 | 13,296 | 348,352 | 5/01-11/15 |

Chinook counts include jacks. WDFW counting dates: spring Chinook, May1-June 28; summer Chinook, June 29-August 28; Fall Chinook, August 29-November 15.

*All spring Chinook were trapped for broodstock at Wells Dam; 387 in 1996, and 363 in 1998.

[1]Does not include numbers of coho trapped at Wells Dam by the Yakama Nation for hatchery broodstock; 254 in 2010.

**Attachment D.** Wells Dam Daily Water Quality Report, 2010

| | April | | | May | | | June | | | July | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TDG% | | | TDG% | | | TDG% | | | TDG% | |
| | Temp (C) | Forebay | Tailrace | Temp (C) | Forebay | Tailrace | Temp (C) | Forebay | Tailrace | Temp (C) | Forebay | Tailrace |
| Day | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean |
| 1 | 5.8 | . | . | 7.3 | 104.0 | 105.0 | 11.2 | 105.3 | 107.0 | 14.1 | 110.6 | 116.1 |
| 2 | 5.7 | . | . | 7.9 | 104.1 | 105.4 | 11.2 | 105.6 | 107.4 | 14.1 | 111.8 | 115.4 |
| 3 | 5.6 | . | . | 8.1 | 104.5 | 105.9 | 11.2 | 105.4 | 106.8 | 14.0 | 112.6 | 114.2 |
| 4 | 5.5 | . | . | 7.6 | 103.1 | 104.6 | 11.3 | 105.2 | 106.9 | 14.2 | 111.1 | 112.3 |
| 5 | 5.8 | . | . | 7.2 | 102.4 | 104.2 | 11.5 | 104.8 | 106.4 | 14.6 | 110.5 | 112.0 |
| 6 | 5.8 | . | . | 7.3 | 102.7 | 104.2 | 11.8 | 104.9 | 106.0 | 14.5 | 109.8 | 111.4 |
| 7 | 5.9 | . | . | 7.5 | 102.5 | 104.1 | 12.0 | 105.0 | 106.5 | 14.5 | 110.6 | 111.6 |
| 8 | 6.1 | . | . | 7.5 | 102.7 | 104.1 | 12.0 | 105.1 | 106.9 | 14.9 | 111.6 | 112.7 |
| 9 | 6.1 | . | . | 7.7 | 103.7 | 105.0 | 11.8 | 109.3 | 110.3 | 14.8 | 112.7 | 114.7 |
| 10 | 6.3 | . | . | 8.2 | 105.0 | 105.9 | 11.8 | 110.0 | 112.6 | 15.0 | 113.5 | 114.6 |
| 11 | 6.2 | . | . | 8.5 | 104.9 | 106.2 | 12.1 | 111.2 | 113.6 | 15.6 | 113.1 | 114.2 |
| 12 | 6.3 | . | . | 8.8 | 104.4 | 105.9 | 12.3 | 111.4 | 113.8 | 15.9 | 113.3 | 114.2 |
| 13 | 6.5 | . | . | 9.0 | 105.0 | 106.7 | 12.7 | 108.1 | 109.8 | 15.9 | 111.0 | 112.9 |
| 14 | 6.6 | . | . | 9.4 | 105.1 | 106.7 | 13.0 | 112.2 | 113.2 | 15.7 | 109.6 | 111.2 |
| 15 | 6.7 | . | . | 9.7 | 105.2 | 106.7 | 12.8 | 107.0 | 109.5 | 15.7 | 110.8 | 114.8 |
| 16 | 6.8 | . | . | 10.0 | 105.6 | 106.7 | 12.5 | 105.8 | 112.1 | 15.6 | 111.2 | 112.6 |
| 17 | 6.9 | . | . | 10.2 | 106.1 | 107.1 | 12.0 | 106.0 | 111.4 | 15.7 | 111.7 | 113.3 |
| 18 | 7.2 | . | . | 10.1 | 105.7 | 107.3 | 12.1 | 110.3 | 113.8 | 16.1 | 112.6 | 113.7 |
| 19 | 7.2 | 100.8 | 94.8 | 10.2 | 104.7 | 106.0 | 12.3 | 111.6 | 114.8 | 16.5 | 112.3 | 113.1 |
| 20 | 7.2 | 108.1 | 105.5 | 10.0 | 104.9 | 106.4 | 12.9 | 112.3 | 113.9 | 16.8 | 112.1 | 113.1 |
| 21 | 7.3 | 108.1 | 106.1 | 9.9 | 103.8 | 105.4 | 13.0 | 108.6 | 110.4 | 16.6 | 112.7 | 113.7 |
| 22 | 7.4 | 107.4 | 106.2 | 9.8 | 104.8 | 106.3 | 13.0 | 110.5 | 119.8 | 16.6 | 113.2 | 114.4 |
| 23 | 7.5 | 106.5 | 107.2 | 10.0 | 105.0 | 106.7 | 12.9 | 110.7 | 116.6 | 16.8 | 111.8 | 113.3 |
| 24 | 7.6 | 105.6 | 107.2 | 10.2 | 105.0 | 106.5 | 13.5 | 113.3 | 119.1 | 17.3 | 110.5 | 111.9 |
| 25 | 7.8 | 104.3 | 108.3 | 10.1 | 104.7 | 106.1 | 13.6 | 111.0 | 115.2 | 17.5 | 112.0 | 112.8 |
| 26 | 7.9 | 104.8 | 109.2 | 10.1 | 105.2 | 106.6 | 13.8 | 110.9 | 117.3 | 17.9 | 112.8 | 113.6 |
| 27 | 7.7 | 106.7 | 109.3 | 10.0 | 104.5 | 106.2 | 13.7 | 111.5 | 119.3 | 17.4 | 113.4 | 115.0 |
| 28 | 7.4 | 106.5 | 108.9 | 10.2 | 104.0 | 105.7 | 13.8 | 112.2 | 116.3 | 17.1 | 112.5 | 114.6 |
| 29 | 7.2 | 105.3 | 107.8 | 10.3 | 103.5 | 105.4 | 14.0 | 113.2 | 119.7 | 17.0 | 111.8 | 113.4 |
| 30 | 7.0 | 103.6 | 107.1 | 10.7 | 103.9 | 105.8 | 14.1 | 110.0 | 114.8 | 17.5 | 111.9 | 113.6 |
| 31 | . | . | . | 11.0 | 104.9 | 106.4 | . | . | . | 17.8 | 112.0 | 113.7 |
| **Mean** | 6.7 | 105.6 | 106.5 | 9.2 | 104.4 | 105.9 | 12.5 | 109.0 | 112.4 | 15.9 | 111.8 | 113.5 |

**Attachment D (continued).** Wells Dam Daily Water Quality Report, 2010

| | August | | | September | | | October | | |
|---|---|---|---|---|---|---|---|---|---|
| | | TDG% | | | TDG% | | | TDG% | |
| | Temp (C) | Forebay | Tailrace | Temp (C) | Forebay | Tailrace | Temp (C) | Forebay | Tailrace |
| Day | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean |
| 1 | 17.9 | 111.1 | 112.8 | 18.3 | 103.8 | 104.1 | 18.9 | 100.7 | 101.3 |
| 2 | 18.0 | 110.7 | 112.4 | 18.2 | 103.5 | 103.4 | 19.1 | . | . |
| 3 | 18.0 | 111.1 | 112.9 | 18.3 | 104.2 | 104.0 | 19.2 | . | . |
| 4 | 17.8 | 110.4 | 112.5 | 18.4 | 106.4 | 105.8 | 19.1 | . | . |
| 5 | 17.6 | 110.5 | 111.7 | 18.3 | 105.9 | 105.6 | 18.8 | . | . |
| 6 | 17.3 | 112.5 | 113.7 | 18.5 | 104.6 | 104.9 | 18.7 | . | . |
| 7 | 17.6 | 111.2 | 112.7 | 18.4 | 103.4 | 103.6 | 18.6 | . | . |
| 8 | 17.9 | 109.8 | 110.9 | 18.3 | 103.6 | 103.6 | 18.4 | . | . |
| 9 | 18.1 | 110.4 | 111.3 | 18.3 | 104.5 | 104.3 | 18.3 | . | . |
| 10 | 18.2 | 110.3 | 111.6 | 18.2 | 104.6 | 104.8 | 18.3 | . | . |
| 11 | 18.2 | 109.5 | 111.2 | 18.2 | 104.2 | 104.1 | 18.0 | . | . |
| 12 | 18.2 | 109.5 | 111.1 | 18.3 | 104.6 | 104.1 | 17.8 | . | . |
| 13 | 17.7 | 110.1 | 111.7 | 18.2 | 104.5 | 104.4 | 17.8 | . | . |
| 14 | 18.2 | 108.6 | 110.1 | 18.2 | 105.6 | 105.3 | 17.7 | . | . |
| 15 | 18.6 | 108.4 | 110.0 | 18.4 | 106.3 | 105.5 | 17.6 | . | . |
| 16 | 18.8 | 109.5 | 110.4 | 18.5 | 106.0 | 105.7 | 17.3 | . | . |
| 17 | 18.7 | 110.3 | 111.8 | 18.6 | 105.8 | 105.8 | 17.1 | . | . |
| 18 | 18.5 | 110.2 | 112.2 | 18.5 | 105.6 | 105.8 | 17.0 | . | . |
| 19 | 18.7 | 109.0 | 110.8 | 18.6 | 106.2 | 106.4 | 16.8 | . | . |
| 20 | 18.7 | 108.6 | 109.5 | 18.5 | 105.6 | 105.9 | 16.7 | . | . |
| 21 | 18.8 | 107.7 | 109.0 | 18.6 | 104.0 | 104.5 | 16.6 | . | . |
| 22 | 18.8 | 106.5 | 107.1 | 18.4 | 102.8 | 103.4 | 16.4 | . | . |
| 23 | 19.1 | 105.4 | 106.3 | 18.3 | 103.0 | 103.3 | 16.3 | . | . |
| 24 | 18.7 | 105.0 | 106.0 | 18.1 | 101.5 | 101.9 | 16.2 | . | . |
| 25 | 18.8 | 106.6 | 108.0 | 18.1 | 100.9 | 100.7 | 16.0 | . | . |
| 26 | 18.7 | 107.4 | 109.8 | 18.2 | 101.8 | 101.4 | 15.7 | . | . |
| 27 | 18.1 | 107.3 | 109.0 | 18.3 | 102.1 | 102.0 | 15.6 | . | . |
| 28 | 18.1 | 106.6 | 108.2 | 18.5 | 102.2 | 102.5 | 15.5 | . | . |
| 29 | 18.3 | 106.7 | 107.9 | 18.7 | 101.3 | 101.5 | 15.4 | . | . |
| 30 | 18.6 | 105.7 | 107.3 | 18.4 | 101.1 | 101.3 | 15.4 | . | . |
| 31 | 18.6 | 104.4 | 104.7 | . | . | . | 15.2 | . | . |
| **Mean** | 18.3 | 108.7 | 110.1 | 18.3 | 104.0 | 104.0 | 17.3 | | |