

RECLAMATION

Managing Water in the West

Cle Elum Dam Interim Fish Passage Operations 2006 Annual Report Storage Dam Fish Passage Study Yakima Project, Washington

Technical Series No. PN-YDFP-011



U.S. Department of the Interior
Bureau of Reclamation
Pacific Northwest Region
Boise, Idaho

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U.S. Department of the Interior

Mission Statement

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian tribes and our commitments to island communities.

U.S. Bureau of Reclamation

Mission Statement

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Appendix A

Excel file showing pit tag data

http://www.usbr.gov/pn/programs/ucao_misc/fishpassage/activities/pittagdata.xls

**Storage Dam Fish Passage Study
Yakima Project, Washington**

**Cle Elum Dam
Interim Fish Passage Operations
2006 Annual Report**

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Background

Objectives

The Bureau of Reclamation (Reclamation) is leading a cooperative investigation with the Yakama Nation (YN), state and Federal agencies, and others, to study the feasibility of providing fish passage at the five large storage dams of the Yakima Project. These dams—Bumping Lake, Kachess, Keechelus, Cle Elum, and Tieton—were never equipped with fish passage facilities. Four of the five reservoirs were originally natural lakes and historically supported Native American fisheries for sockeye salmon and other anadromous and resident fish.

Implementation of passage features at the dams has the potential to reintroduce sockeye salmon to the watershed; increase populations of upper basin steelhead, coho salmon, and Chinook salmon; restore life history and genetic diversity of salmon; and reconnect isolated populations of bull trout. Two species—bull trout and Mid-Columbia River steelhead—are listed under the Endangered Species Act (ESA).

The scope of the feasibility study is currently limited to the study of passage features at Cle Elum and Bumping Lake dams. Successful implementation of fish passage at Cle Elum and Bumping Lake dams could eventually lead to future detailed study of the other three dams (Kachess, Keechelus, and Tieton).

One component of the feasibility study is to provide interim (temporary, experimental) passage features at Cle Elum Dam to test the ability of juvenile salmonids to find the fish passage features and move out of the reservoir under their own volition. Uniquely marked fish will be monitored as they exit the reservoir, migrate downstream, and return as adults. The interim passage protocols use Passive Integrated Transponder (PIT) tags implanted in the test fish to monitor their movement through the system. PIT tag detectors located at Cle Elum, Prosser, McNary, and Bonneville dams will record the passage of these juveniles as they migrate downstream, and when they return as adults.

Results of these interim passage experiments over a period of 5 to 8 years will be used as one indicator of the feasibility of reintroducing anadromous fish species above the dam and reservoir.

Installation and Testing of PIT Tag System—2005

In the early spring of 2005, Reclamation completed construction of the interim (temporary, experimental) downstream juvenile fish passage facility at Cle Elum Dam. The passage features include a stop-logged overflow section and plunge pool installed in the second radial

gate bay from the left side of the spillway, and a temporary plywood and lumber framed flume built on the existing spillway. Two PIT tag detectors were installed in the flume by Biomark, Inc. The interim passage facility is designed to pass a maximum flow of about 400 ft³/s. The overflow section can pass flows whenever the reservoir pool is at least two feet above the spillway crest (elev. 2223).

Low reservoir levels in 2005 caused by drought conditions, precluded the planned release of 10,000 PIT tagged coho salmon smolts into the reservoir. Instead, the fish were released in April at several points downstream from Cle Elum Dam (1/3 below Cle Elum, 1/3 in Roza pool, and 1/3 below Roza). Cle Elum reservoir reached spillway crest elevation of 2223.00 on May 17, 2005. It rose to a maximum elevation of 2225.70 on May 26, 2005 and then dropped back below the spillway crest elevation on June 6, 2005. This very short period above the spillway crest combined with the low pool elevation, limited fish passage and PIT tag testing activities in 2005. Nevertheless, Reclamation was able to operate the passage flume for several days, and the YN and Biomark were able to test the functionality and efficiency of the PIT tag system by releasing several groups of PIT tagged coho salmon smolts directly into the flume on June 2 and 3, 2005.

The reservoir pool elevation limited flow in the passage flume to less than 100 ft³/s. Flow depth in the flume was only about 0.6 ft ± (flume designed for maximum flow depth of about 4 ft). The flume functioned properly with no vibration and minimal turbulence. Even under this low flow operating condition, the PIT tag detectors performed well. A total of about 1,800 smolts were released into the flume in various sized groups. The combined detection was over 97 percent on single groups of up to 5 fish released at once. More detail on installation and testing of the PIT tag system in 2005 is summarized in the report *Cle Elum Dam Juvenile PIT Tag Fish Bypass System Report, Technical Series No. PN-YDFP-004*, Bureau of Reclamation, Boise, ID, 2005.

Other Interim Passage Activities in 2005

The YN released 3,000 PIT tagged coho salmon parr into the Cle Elum River above Cle Elum reservoir in August 2005. The purpose of this release was to test rearing and overwintering survival, and outmigration in the spring of 2006. The PIT tag detectors were taken back to the laboratory for testing and adjustment. Modifications such as sun shades and spillway flow deflectors were installed at the detector locations and other modifications to monitoring and control equipment and other physical features were made.

Interim Passage Activities in 2006

Summary

In 2006, YN biologists released about 10,000 PIT tagged coho salmon smolts into the reservoir from a net pen located about ½ mile upstream from the spillway. Several hundred of these fish were recorded by the PIT tag detector in the spring of 2006 as they passed through the interim flume. About 5 percent of the fish counted were from the coho parr released the previous year. These preliminary results are encouraging and seem to confirm that the basic concept proposed for downstream passage may work to effectively move fish downstream. The biologists also released about 1,000 PIT tagged coho salmon smolts downstream from the dam as controls, and another 1,000 fish directly into the passage flume to check the efficiency of the PIT tag detectors.

Reservoir levels didn't reach spillway elevation until early June. This is late in the coho salmon season of migration, but did allow for 32 days of downstream passage and a reasonable testing both of the passage facility and the PIT tag detectors. The passage facilities were operated from June 6 through July 9, 2006, at which time pool elevations again dropped below spillway level.

Even though the period of operation was late in the season and of relatively short duration, 617 PIT tagged coho salmon smolts were recorded passing through the passage flume. Thirty of these fish were from the group of 3,000 coho salmon parr released in the summer of 2005 at Tucuala Lake in the Cle Elum River about 12.9 miles upstream from the reservoir. The remaining fish were from a group of 10,000 coho salmon smolts released into the reservoir in late May 2006, about ½ mile upstream from the dam. The coho salmon were late in their season of migration which normally is late winter or early spring.

Most of the PIT tagged coho salmon were detected during the period of June 16 to July 9, 2006; the prime time of travel was between 0600 hrs to 1200 hrs Zulu.

Flow depths of 18 to 24 inches were consistently maintained over the stoplogs as the reservoir levels changed. Reclamation operations staff reported that it is challenging to maintain fish passage flows at Cle Elum and meet target flows at Parker at the same time. At times, fish passage flows of $400 \text{ ft}^3/\text{s} \pm$ were a substantial part of the total releases from Cle Elum Dam. However, remote control enabled the operators to make good release patterns.

Interim passage stoplog operations went smoothly, although Reclamation staff resources were stretched thin because of Keechelus Dam refill operations. The stoplogs are functioning properly. There were no debris problems. Operation of the stoplogs to follow water surface levels as the reservoir filled and receded did put some strain on limited

operation and maintenance staff resources. The Project operators will try to maintain as much carry over in Cle Elum Reservoir as possible to help operations in 2007.

2006 Fish Passage Season Operations Log

Note: All times in the operations log are PST or PDT. However, the times noted in the PIT tag files are GMT or Zulu times (PST= GMT-8, PDT=GMT-7).

Abbreviations: SG = Slope Gage reading, AF = Acre-Feet

Lake Elevations and storage figures are from Hydromet files.

07/27/2005	Released 3,000 PIT tagged coho salmon smolts with TX1400ST Super Tags (3D9.1BFxxxxxxx) into Lake Tucquala in the upper Cle Elum drainage basin, 12.9 miles above Lake Cle Elum.
12/31/2005	Lake Elevation 2140.07 for 64,320 AF at 2400 hrs.
01/31/2006	Lake Elevation 2154.70 for 104,480 AF at 2400 hrs.
02/28/2006	Lake Elevation 2158.86 for 116,990 AF at 2400 hrs.
02/28/2006	Implanted approximately 12,000 coho salmon smolts at Prosser, with TX1400SGL PIT tags (3D9.257xxxxxxx).
03/31/2006	Lake Elevation 2160.95 for 123,450 AF at 2400 hrs.
04/25/2006	Released 1000 PIT tagged coho salmon smolts below Cle Elum Dam at 1330 hrs.
04/30/2006	Lake Elevation 2178.12 for 180,700 AF at 2400 hrs.
05/02/2006	Built and installed net pen float on the south shore of Lake Cle Elum.
05/13/2006	Lake Elevation 2189.54 for 221,812 AF at 2400 hrs.
05/14/2006	Inspected and installed net in the net pen float in preparation for acclimation of PIT tagged coho salmon smolts.
05/22/2006	Lake Elevation 2208.74 at 0600 hrs. YN released into net-pen approximately one third of the 10,000 tagged fish available for Cle Elum Passage test.
05/23/2006	Lake Elevation 2210.72 at 0600 hrs. YN released into net-pen approximately two thirds of the 10,000 tagged fish available for Cle Elum Passage test.
05/24/2006	“Yakima River Aquatic Impact Work Sheet” filed with Yakima Field Office.
05/25/2006	At 0910 hrs, SG 2214.42
05/30/2006	Stop-logs placed in fish passage structure in bay 2 of spillway. 7 feet of stop-logs in each of the 3 positions (7-7-7) of the passage structure. PIT tag detector test to start on 06/06/2006.
05/31/2006	Lake Elevation 2221.45 for 351,660 AF at 2400 hrs.
06/02/2006	Lake Elevation 2223.00 for 358,490 AF at 0800 hrs. Note: Elevation 2223.00 is spillway crest elevation. Fish passage requires a <u>minimum</u> of 2 feet of depth above spillway crest.
06/05/2006	Added 2 stop-logs to each side (9-7-9).

06/06/2006	Lake Elevation 2229.97 for 389,822 AF at 0800 hrs. Pulled 1 stop-log (9-6-9). At 1105 hrs started PIT-tag detector testing with the updated PIT tag detectors. Fish were released either through a pipe to the fish flume or lowered by bucket into the flume. A couple of batches of fish were lowered directly into the lake above the fish passage structure. From 1105 hrs to 1308 hrs, released 265 tagged fish in 21 batches. PIT tag detectors 01 and 02 recorded a total of 192 tagged fish—72.45 percent of total released. Note: Detectors recorded eight tagged fish in the evening between the 06/06 and 06/07 tests. Seven of these were test fish released on 06/06. One tagged fish was from last year's release in the upper Cle Elum River.
06/07/2006	At 0700, SG 2231.50, Stop-logs at (11-6-11). Starting at 1025 hrs, continued on with PIT tag detector testing with a new circuit board installed in PIT tag detector 02. From 1025 hrs to 1142 hrs, released 248 tagged fish in 19 batches. PIT tag detectors 01 and 02 recorded a total of 204 tagged fish—82.25 percent of total released.
06/07/2006	At 1300 hrs, SG 2231.68, Added 1 stop-log at 1245 hrs, Stop-logs set at (11-7-11).
06/08/2006	At 0905 hrs, Added 1 stop-log each position (12-8-12).
06/09/2006	At 0845 hrs, SG 2234.20. At 0945 hrs, added stop-logs (13-9-13). At 0915 hrs, Net-pen was opened, and fish released to lake. Note: coho salmon smolts were fed before releasing to lake.
06/10/2006	At 0845 hrs, SG 2235.10, Added 1 stop-log each position (14-10-14).
06/11/2006	At 0808 hrs, SG 2235.90, Added 1 stop-log each position (15-11-15).
06/12/2006	At 0905 hrs, SG 2237.12, Added 1 stop-log each position (16-12-16).
06/13/2006	At 0830 hrs, SG 2238.50, at 0930 hrs, Stop-logs are set at (16-12-16). At 1040 hrs, set stop-logs to (15-14-15). At 1350 hrs, set stop-logs to (15-14.5-15). Note: 17 feet of stoplogs is maximum per position. Adjust plunge pool gate crest to 3.00 ft above spillway crest.
06/14/2006	At 0830 hrs, SG 2239.36
06/15/2006	At 0840 hrs, SG 2239.60
06/16/2006	At 0830 hrs, SG 2239.61
06/17/2006	na
06/18/2006	na
06/19/2006	na
06/20/2006	At 0910 hrs, SG 2239.61
06/21/2006	na
06/22/2006	na
06/23/2006	na
06/24/2006	na
06/25/2006	na
06/26/2006	na
06/27/2006	At 1130 hrs, SG 2239.60
06/28/2006	na
06/29/2006	At 1010 hrs, SG 2239.99

06/30/2006	At 0900 hrs, SG 2239.92, Pulled .5 stop-log. Set at (15-14-15)
06/30/2006	Lake Elevation 2239.81 for 436,040 AF at 2400 hrs.
07/01/2006	At 0845 hrs, SG 2239.74
07/02/2006	na
07/03/2006	At 0835 hrs, SG 2239.20
07/04/2006	At 0930 hrs, SG 2238.86
07/05/2006	na
07/06/2006	na
07/07/2006	At 1200 hrs Pulled stop-logs. Set at (13-12-13)
07/08/2006	na
07/09/2006	Lake Elevation 2236.60 for 420,700 AF at 1015 hrs. At 0845 hrs all stop-log positions set to (12-12-12)
07/09/2006	At 1020 hrs, Last detected PIT tagged smolt.
07/10/2006	na
07/11/2006	Lake Elevation 2235.26 for 414,382 AF at 0915 hrs. Fish passage closed for the year. No. 2 Spillway Radial Gate shut down at 0920 hrs.
07/31/2006	Lake Elevation 2209.86 for 302,240 AF at 2400 hrs.

Detailed Listing of PIT Tag Codes

An Excel spreadsheet lists all of the PIT tag codes read at Cle Elum Dam in 2006 (http://www.usbr.gov/pn/programs/ucao_misc/fishpassage/activities/pittagdata.xls). There are separate worksheets showing:

1. All tags read – (998)
2. Tags read only on 01 – (107)
3. Tags read only on 02 – (129)
4. Tags read by both readers – (381)
5. All unique tag codes – (617)

Thirty TX1400ST “Super Tags” were read in 2006. The codes for these tags are 3D9.1BFxxxxxxx. These tags are from the 3,000 PIT tagged coho salmon parr released into Lake Tucquala in the upper Cle Elum drainage basin in August 2005. Also, 587 TX1400SGL tags were read in 2006. The codes for these tags are 3D9.257Cxxxxxxx. These tags are from the 10,000 PIT tagged coho salmon smolts released from the Cle Elum net pen in June 2006.

Photos taken June 14, 2006



Photo 1. Flow over stoplogs



Photo 2. Plunge pool and entrance to flume



Photo 3. Flow from plunge pool into flume



Photo 4. Fish passage flume and PIT tag antennas



Photo 5. PIT tag antenna showing enclosure, sun shade, and spillways flow deflector



Photo 6. Fish passage flows and outlet works releases looking downstream



Photo 7. Fish passage flows and outlet works releases looking upstream

Interim Passage Activities Planned for 2007

Overview of 2007 Plan

The immediate priority of the interim passage study is to evaluate the interim infrastructure modifications and juvenile passage efficiency at Cle Elum Dam. The proposed FY 2007 activities are a continuation of the work done in the previous two fiscal years.

In 2007, YN biologists will tag 10,000 coho salmon smolts with PIT tags to evaluate downstream passage and survival. The smolts will be acclimated in a net pen in the reservoir about ½ mile upstream from the juvenile passage facility in March. The smolts will be released into the reservoir in April to assure that sufficient numbers of “physiologically-ready” migrant smolts are present to adequately test the facility. Another 1,000 smolts will be tagged into various sized groups and released directly into the passage flume at various flows throughout the season, to test the efficiency of the PIT tag antennas. Also, 1,000 marked fish will be released downstream from Cle Elum Dam to provide a comparison of survival and injury with the fish that are released into the reservoir.

A new activity in 2007 will include protocols to confirm that fish can safely pass over the entrance weir, pass through the plunge pool, and survive flume velocities of 25 to 35 ft/s with little or no physical injury. Balloon tags will be used to evaluate the survival and condition of the coho salmon smolts that pass through the interim flume. Deflated balloon tags will be attached to test fish that will be released at the top of the fish passage flume. The tags will

self-inflate after a 5-10 minute delay, which is long enough for the test fish to travel to the bottom of the flume and into the river below the dam. As the balloons inflate, the smolts will rise to the water surface downstream from the dam spillway. Biologists will then capture the fish and inspect them for signs of abrasion or other injuries that could be attributed to their journey through the passage facility.

Key Activities for 2007

Reclamation will regulate passage flow releases by adjusting stoplog and gate settings, and will control the electrical and electronic systems. Operation of the passage features will be closely coordinated with Reclamation's Yakima Project operations staff, the YN, and Biomark, Inc. The YN will carry out the following biological activities.

1. Manage the biological aspects of interim passage as the lead fisheries agency.
2. Develop Monitoring and Evaluation plans for interim passage activities.
3. Provide technical review of the interim passage facility including overall performance and fish health concerns.
4. Obtain hatchery coho salmon smolts, mark with PIT tags, and acclimate in net pens in Cle Elum Reservoir.
5. Release marked coho salmon smolts into Cle Elum Reservoir and downstream from the dam.
6. Conduct releases of coho salmon smolts directly into the interim passage flume to determine PIT tag antenna efficiency.
7. Conduct releases of coho salmon smolts directly into the interim passage flume and into the reservoir immediately above the overflow weir to evaluate potential for physical injury to the fish as they pass through the system.
8. Collect data. This will include bio-data from the release group, downloading PIT tag information from the Cle Elum site, and uploading to the Columbia River Basin PIT Tag Information System (PTAGIS).
9. Retrieve and interpret all available data from PTAGIS.
10. Assist Reclamation with producing an overall annual report on interim passage activities.
11. Attend Yakima Basin Aquatic Management and Science Conference and report on Cle Elum Interim Fish Passage activities.