ADULT AND JUVENILE FISH FACILITIES MONITORING REPORT
LITTLE GOOSE DAM – 2014

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Little Goose Dam
U.S. Army Corps of Engineers
April 2015

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Introduction

This report summarizes the operation and maintenance of the adult fish passage facility located at Little Goose Dam (LGS) from March 1, 2014 to February 28, 2015. The Adult fishway was in service from February 27, 2014 to January 7, 2015. Fish counting activities took place from April 1 to October 31, 2014 and a total of 354,626 salmonids were counted passing upstream through the adult fish ladder. The species counts were 147,578 chinook adults; 37,789 chinook jacks; 144,980 steelhead; 2,811 sockeye; 17,917 coho adults and 3,551 coho jacks. Additionally, 115 adult lamprey were counted migrating upstream at the adult fish counting window. A total of 125 fishway inspections were conducted by U.S. Army Corps of Engineers and Oregon Department of Fish and Wildlife biologists and technicians.

River Condition

Below average winter and spring precipitation preceded a hot and dry summer. The average daily flow past LGS was 47.6 kcfs. The maximum average daily flow of 140.0 kcfs occurred on May 26 and the minimum average daily flow of 12.5 kcfs occurred on September 25. Monthly average flows compared to the 10 year average are illustrated in Figure 1.

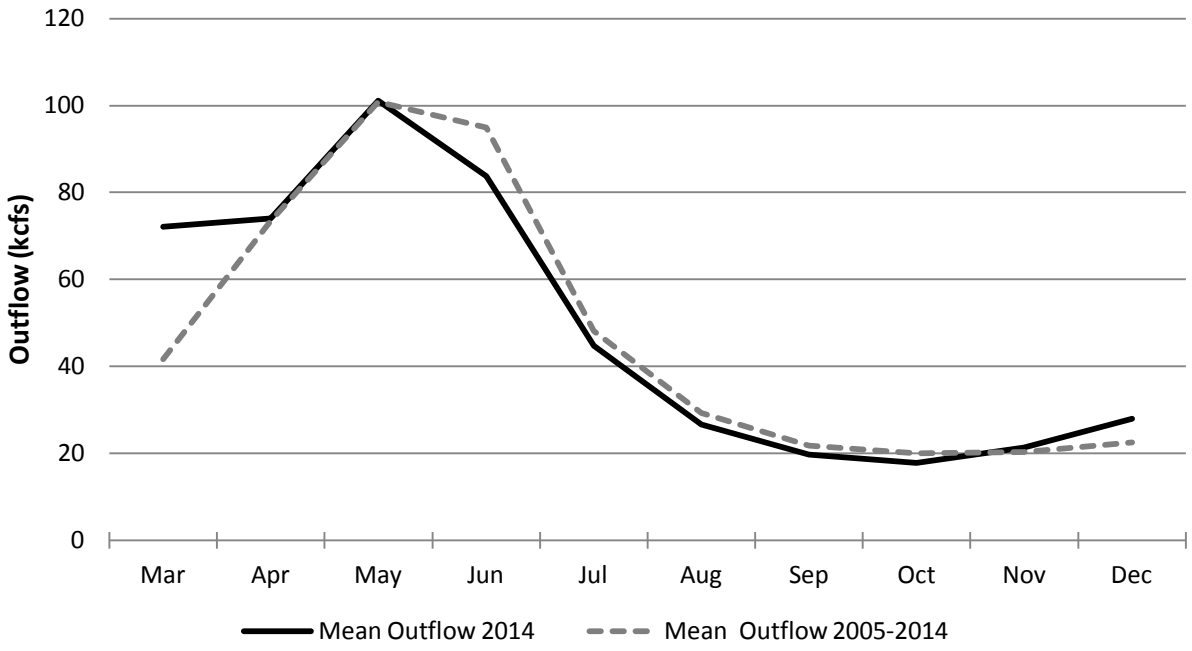

Figure 1. Little Goose Lock and Dam monthly outflow.

Spill to support fish out migration occurred from April 3 through August 31, 2014. Spill averaged 30.7% of total flow during this period. Flow decreased to below 33 kcfs on July 26 and spill was kept at a constant rate of 7.0 or 11.0 kcfs, whichever came closest to the 30% criteria, through August 31. The temporary spillway weir in spillway 1 was in service from April 3 to August 4.

Fish ladder water temperatures were recorded during fishway inspections and measured 45.3 ^{o}F on April 2 to a high of 69.6 ^{o}F on August 16. As per the Water Management Plan, river temperatures were tempered by scheduled water releases from Dworshak Reservoir. Supplemental flow from Dworshak averaged 11.4 kcfs at 44.6^{o}F for the month of July and 9.0 kcfs at 46.2^{o}F for the month of August (Columbia River Dart).

Water clarity was measured during adult fishway inspections. Measurements were taken in the adult fish ladder using a Secchi disc lowered to a maximum depth of just over 6 feet. The fish ladder water supply is gravity fed from the forebay and is representative of river conditions. Secchi disc measurements ranged from 1.1 feet to over 6.0 feet. There were two periods of turbid water and these occurred from March 10 – 18 and May 28 – 31 when measurements ranged from 1.1 – 1.8 feet.

In accordance with the FCRPS BIOP, Minimum Operating Pool (MOP) operations to enhance lotic conditions and improve fish migration occurred from April through August. Forebay elevations were maintained at MOP elevations (633-634 feet MSL), and all deviations from the FPP and FOP were coordinated through the Technical Management Team (TMT), as necessary, to meet real-time operational requirements.

Total Dissolved Gas data are automatically collected and transmitted to the Columbia River Operational and Hydromet Management System (CROHMS) hourly to provide information for spill and gas saturation management. The Reservoir Control Center (RCC) coordinated efforts to maintain dissolved gas saturation levels in accordance with the Washington State TDG Level Variance Standard of 120% saturation in the project tailwater or 115% in the forebay of the next project downstream as measured over 12 consecutive hours. The forebay TDG ranged from 103.3% on April 3 to 117.2% on June 1 and averaged 110.7% from April 3 through August 31. The forebay TDG levels at Lower Monumental Dam ranged from 102.8 on April 2 to 117.2% on May 12 and averaged 110.9% saturation for the same period.

Adult Fish Facility Description

The adult fish facility is located on the downstream side of the dam and functions to attract and pass adult migrating fish upstream over the dam. The facility consists of a fish ladder and a collection channel. The collection channel acts to both attract and route fish from across the tailrace to the fish ladder. Components of the collection channel system include two South Shore Entrances (SSE), two North Powerhouse Entrances (NPE), two North Shore Entrances (NSE), the collection channel itself, a fallout fence, a auxiliary water supply system, and an electronic monitoring and control system.

The pool-and-weir fish passage ladder is located on the south shore. It is approximately 1,000 feet long and rises a vertical distance of about 100 feet. The ladder begins at the junction pool near the SSE and leads upstream westward approximately 400 feet and switches backed

with a curve south and then east. It continues another 550 feet to the east where it passes under the dam's intake deck and exits into the forebay.

The viewing room and fish counting windows are located approximately 300 feet from the start of the ladder at the junction pool. The fish counting slot is 22" deep by 36" high by 48" wide. Underwater vertical fences called "Picketed Leads" guide and confine fish to pass through the counting slot.

The two SSE (SSE1 and 2) have overflow weirs that are normally open. The two NPE (NPE1 and 2) have overflow weirs and are normally open. NPE3, a lift gate entrance, was permanently closed with a concrete bulkhead in February 2011. The two north shore entrances (NSE1 and 2) are also overflow weirs and were normally open. NSE3, a lift gate entrance, was also permanently closed with a concrete bulkhead in 2011.

Additionally, ten floating orifice gates located in front of the powerhouse have been removed and permanently sealed with bulkheads. Floating orifice gates 1, 4, 6, and 10 have been closed since the 2000 fish passage season and floating orifice gates 2, 3, 5, 7, 8, and 9 have been closed since January 1996. Research has proved that adult fish attraction into the adult fish channel improved with these gates closed.

The adult collection channel begins at the NSE, passes under the spillway, past the NPE and fallout fence then continues along the base of the powerhouse, and terminates in the junction pool near the base of the ladder. A separate short channel connects the SSE to the junction pool and ladder. The fallout fence, consisting of a steel tube framework and wire mesh panels, is located in the channel near NPE1 and 2. It functions to prevent fish in the channel from leaving the channel and re-entering the tailrace via NPE.

The collection channel water is supplied from three sources. First, the fish ladder coupled with a diffuser (diffuser 13) supplies approximately 75 cubic cfs of water and flows via gravity into the channel. Second, three turbine-driven pumps (fish pumps) supply approximately 1,700-2,000 cfs of auxiliary water. The fish pumps move water from the tailrace into a head channel for which gravity forces water through 21 sluice gates and up through 20 diffusers located on the floor of the collection channel in front of the powerhouse, near the junction pool and lower end of the ladder. Third, 175-230 cfs of excess water from the primary dewater unit of the juvenile fish collection system also flows into the head channel and up through the floor diffusers.

An electronic computer interface system for operating and monitoring the adult fishway was put in service in March 1994. The Fishway System Control (FSC) monitors and controls the fishway. The FSC includes water elevation sensors for the fishway channel and for the tailrace near each entrance. All six-overflow weirs also have elevation sensors and controls.

An electronic water velocity meter (flowmeter) was added to the collection channel near the SSE in November 1997. The meter was programmed to measure subsurface water velocities near the junction pool and diffuser 2. Diffuser 2 (the largest of the water supplying diffusers) produced upwelling and non-laminar flows making measurements unreliable. The flowmeter

failed in spring of 2011 and was replaced with a hydrologic current meter. In 2013, subsurface water flow velocities were measured near the NPE approximately midpoint of collection channel where flows are more representative of the entire collection channel.

Fishway Modifications and Improvements

NSE 1 and NSE 2 weir gate operators failed in 2010. New gate operators were installed in January – February 2014.

Two Pit-tag antennas were installed at the fish counting station in February 2014. The antennas are housed in a molded fiberglass and fabricated to insert directly in the fish passage slot where fish are viewed for counting. The "PIT-tag Antenna" insert was required to be constructed slightly longer than the original counting slot. This resulted in small modifications to the bottom and side grating on both the upstream and downstream approaches to the slot. The approximate dimensions of the insert are 4 feet high, 22 inches deep and 5 feet long. The upstream and downstream depth of the antenna slot is 18 inches.

The counting window automatic cleaning brush was disconnected to prevent use and damage to the new structure. The brush cylinder stroke distance is too long, 6' and the required stroke movement is approximately 3.7' long. A new window brush system has been designed that will replace the brushes in the viewing and counting window. The counting window brush is designed to have a shorter stroke and fold out to clean the backboard. Installation of the new brushes have been scheduled for 2016.

Fish Passage and Fishway Activities

Research and Monitoring Activities

In 2014 a total of 354,626 salmonids were visually counted passing upstream through the adult fish ladder. The species counts were: 147,578 Chinook adults, 37,789 Chinook jacks, 144,980 steelhead, 2,811 sockeye, 17,917 coho, and 3,551 coho jacks. Additionally, 115 adult lampreys were counted migrating upstream through the adult fishway system.

Several monitoring activities involving the use of the adult fishway were in progress in 2014. These included:

- Normandeau Associates Inc. conducted fish counting activities from 0400 hours to 2000 hours from April 1 – October 31.

- University of Idaho performed adult salmon, steelhead and lamprey passage studies using radio-telemetry to estimate passage and survival conversion rates.

- As in previous years water temperature at the ladder exit was recorded on an hourly basis in an ongoing trend study in support of safe fish passage.

- Invasive species were monitored for with particular attention to Zebra Mussels and Quagga Mussels. Reports were submitted weekly to district.

Operations and Maintenance

The adult fishway facilities were in service from February 27, 2014 through January 7, 2015. Corps project biologists and Oregon Department of Wildlife biologists inspected the fishways for proper operating criteria on average, three times per week during fish passage season. The in-water maintenance period occurred from January 7 to February 27, 2014.

The fish ladder functioned adequately throughout the season. The air bubbler located at the ladder exit to push back debris performed well all season. Diffuser 13 functioned without incident and water level over the weirs maintained criteria. Picketed leads remained clear of debris and the counting window backboard was routinely cleaned throughout the season. Water clarity and temperature were measured during adult fish passage facility inspections near the fish counting window area. Water clarity was measured using a Secchi disc that was lowered to a maximum depth of just over 6 feet (see River Conditions).

The packing material in expansion joints has decomposed over the years and when water temperatures fall below 50°F, the ladder contracts and water leaks through these joints. When temperatures drop below freezing, large icicles form overhead and large patches of ice form on the ground below. Both are hazards to safe working conditions.

In 2013, NSE weir gate hoists were out of service and the weir gates were held fixed at 532.0 ft. The NSE weir gate hoists were installed and commission on February 27, 2014. On March 5, new targets were placed on NPE1, NPE2, and NSE1. The weir hoist cables were marked with tape in one foot elevation increments to confirm readings from the FSC board, and the system was placed in automatic mode. The FSC computer system was originally installed in 1994 and uses an antiquated DOS program and older computer. The computer readouts values were often incorrect during the season at which manual measurements were used. On September 17, 2012 the hard drive on the interface computer used to program parameters failed. Fortunately, the preset weir positions continued operate and meet the parameters for entire season. On March 13, 2014, the readings from the FSC board were found to be inaccurate. The weirs were taken out of automatic mode and operated manually for the rest of the season. A contract to upgrade the fishway control system is scheduled for the 2014/2015 winter maintenance period.

The hydrologic current meter was again used in 2013 to determine subsurface velocities in the adult collection channel. Measurements were taken monthly just downstream of the NPE before the channel enters under the spillway, approximately mid-point of the length of the channel. This position best measures laminar flows that represent the overall flow rates of the channel. Subsurface velocities were measured just below the surface, at mid-depth, and just above bottom and averaged. The subsurface velocities ranged between 1.5 and 3.4 feet per second (fps). Collection channel surface water velocities were measured using a floating stick or bubble that was timed over a distance and calculated into feet per second. Measurements ranged 1.1 and 2.3 fps near the SSE, 1.4 and 2.9 fps near the NPEs and 1.6 and 2.9 near the NSEs.

The adult fishway was removed from service on January 7, 2014 when the ladder was closed off. Fish salvaged from the ladder included 32 steelhead and 1 adult clipped steelhead. On January 27, 2015, the powerhouse section of the collection channel was dewatered. On January 28, 2015 the spillway section of the channel was dewatered. No fish were found during fish salvage operations for the powerhouse channel dewatering. Fish salvaged from dewatering the spillway section included five adult steelhead (1 UC, 4 C), two sockeye (2 C), one juvenile steelhead (1 C), three juvenile chinook (3C), and three pikeminnow. All live fish were released unharmed and in good condition to the tailrace.

Fish ladder maintenance included inspecting weirs and diffuser grating, removing debris, cleaning the picketed leads, servicing the window brush cleaning motors, cleaning lamp lenses and cleaning viewing windows. Collection channel maintenance included inspecting diffuser grating and supporting beams, and removing debris. Repairs to the fall-out fence were made in January 2006, 2007, February 2008, 2010, 2011 and 2012. New stainless steel welded mesh panels were installed in February 2013. Due to faulty installation procedures, most of the fall out fence panels partly or entirely broke free of the support frame. Eleven panels broke entirely free for the support frame of which 8 were recovered from the channel floor and three were not recovered. Repairs to the fence were again performed in January-February 2014. The panels were attached according to engineering specifications. Chain link fence was used in place of the three missing panels and remained in place through the 2014 season. Sluice gates that function to pass auxiliary supply water to the fish channel are in poor or non-operating condition. These gates are adjusted to position using a mobile electric operator. It has been reported that two of the 21 gates are removed. Many of the sluice gate indicator rods are bent and need replacing/repair. These gates and indicators need to be operational working condition to adjust correct gate position to provide the optimum water supply and flow criteria for adult fish passage.

Adult Fishway Inspections

Adult fishway inspections during the 2014 fish passage season were conducted by Corps fishery biologists and/or technicians and by natural resources specialists with the Oregon Department of Fish and Wildlife (ODFW). Inspections by the ODFW were done twice a week from April through October, generally on designated days. Inspections by the Corps were conducted weekly but on different days and at different times each week through October and conducted two to three times each week during March, November and December. Problems observed during an inspection were reported to the Project Biologist and/or the Dam Operator for appropriate action. Chronic problems with no immediate fix (e.g. inadequate weir depth at the NPE) were simply recorded. The more important problems are detailed below in the results section. All inspection data were entered into a computer spreadsheet that provided an indication as to whether operating criteria were met.

Inspection Results

The adult fish ladder section of the fishway which includes, differentials at the ladder exit, ladder weirs and counting station met criteria 99.2% or greater in 2014 (Table 1). The ladder exit trash rack and picketed leads remained relatively clean throughout the season. The air bubbler at the ladder exit was in service during the season and kept debris from collecting in front of exit area.

The collection channel continued to have mechanical problems but for the most part performed adequately throughout the season. NSE1 and 2 weirs meet depth criteria on 76 of the 117 inspections (Table 1). This was due to the fixed depth of the weirs at 532.0 feet. When tailrace water elevations lowered to below 538.0 feet the weir depth became slightly shallow and out of criteria. Both NPE1 and 2 weir depths met criteria 96.0% when coupled with on- sill criteria (Table 2). Low tailwater elevations will cause NPE weirs to bottom-out on sill elevation at 532 feet.

Surface water velocities measured near the south shore junction pool (S) and near the NSE (N) met criteria (1.5 – 4.0 fps) 84.1% and 98.3% respectively (Tables 1 and 2). Most of the out of criteria measurements of surface water velocities near the south shore junction pool occurred during two fish pump operations. As mentioned earlier, upwelling from diffuser 2 interferes with laminar flows.

Table 1. Summary of adult fishway inspections at Little Goose Dam, 2014. [1]

LITTLE GOOSE						Not Enough Depth		
Criteria and Locations	No. in Criteria/ No. on Sill/ No. of Inspections	% In Criteria/ % On Sill	No./% Within 0.01-0.1 Foot	No./% Within 0.11-0.2 Foot	No./% >0.2 Foot	No./% Within 0.01-0.1 Foot	No./% Within 0.11-0.2 Foot	No./% >0.2 Foot
Channel Velocities (S)	58	84.1	***	***	***	***	***	***
	***	***	***	***	***	***	***	***
	69							
Channel Velocities (N)	114	98.3	***	***	***	***	***	***
	***	***	***	***	***	***	***	***
	116							
Differentials								
Ladder Exit	125	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	125							
Ladder Weirs	124	99.2	0	0	1	0	0	0
	***	***	0.0	0.0	0.8	0.0	0.0	0.0
	125							
Counting Station	125	100.0	***	***	***	0	0	0
	***	***	***	***	***	0.0	0.0	0.0
	125							
South Shore	125	100.0	0	0	0	0	0	0
	***	***	0.0	0.0	0.0	0.0	0.0	0.0
	125							
North Powerhouse	123	99.2	0	0	0	0	0	1
	***	***	0.0	0.0	0.0	0.0	0.0	0.8
	124							
North Shore	113	96.6	0	2	1	1	0	0
	***	***	0.0	1.7	0.9	0.9	0.0	0.0
	117							
Weir Depths								
SSE-1	123	98.4	1	0	1	***	***	***
	Not Applic.	***	0.8	0.0	0.8	***	***	***
	125							
SSE-2	117	93.6	4	1	3	***	***	***
	Not Applic.	***	3.2	0.8	2.4	***	***	***
	125							
NPE-1	46	37.1	0	1	4	***	***	***
On Sill[2]	73	58.9	0.0	0.8	3.2	***	***	***
	124							
NPE-2	46	37.1	0	1	2	***	***	***
On Sill	73	58.9	0.0	0.8	1.6	***	***	***
	124							
NSE-1	76	65.0	2	5	34	***	***	***
	Not Applic.	***	1.7	4.3	29.1	***	***	***
	117							
NSE-2	76	65.0	2	5	34	***	***	***
	Not Applic.	***	1.7	4.3	29.1	***	***	***
	117							

[1] Data are from Appendix 1.
[2] "On sill" means the weir gate was bottomed out on its sill and within criteria at this location.

Table 2. LGS collection channel in-criteria rates 2010-2014.

Location	Collection Channel Success Rates - Annual Comparison				
	2010	2011	2012	2013	2014
Channel Surface Water Velocities					
Near Junction Pool (S)	83.2%	100.0%	80.6%	67.3%	84.1%
Near NSE (N)	99.1%	98.6%	99.0%	100.0%	98.3%
Channel Head Differentials					
SSE	97.6%	98.5%	98.4%	96.1%	100.0%
NPE	97.6%	95.5%	96.9%	89.8%	99.2%
NSE	81.6%	94.7%	95.3%	86.7%	96.6%
Channel Weir Depths					
SSE1	99.2%	94.7%	99.2%	100.0%	98.4%
SSE2	98.4%	93.2%	96.1%	98.4%	93.6%
NPE1 without on-sill criteria	33.6%	33.8%	33.3%	27.8%	37.1%
NPE1 with on-sill criteria	100.0%	95.5%	100.0%	100%	96.0%
NPE2 without on-sill criteria	28.0%	35.36%	17.8%	25.4%	38.7%
NPE2 with on-sill criteria	89.6%	97.0%	70.5%	34.1%	96.0%
NSE1	99.2%	78.2%	79.7%	47.3%	65.0%
NSE2	98.4%	78.2%	80.5%	47.3%	65.0%

[1] Data compiled from Appendix 1, previous monitoring report appendixes and inspection forms for the years 2010-2013.

Average tailrace elevations in 2014 were slightly lower than average at SSE and NPE and higher at NSE (Table 3). The lower elevations were due to low river flows and a short freshet. To enhance fish migration, reservoirs were drafted down to minimum operating pool (MOP) elevations from April through August. During MOP, Lake Herbert G. West was operated between 537.0 and 538.0 as measured at Lower Monumental Dam.

During inspections, tailrace water elevations were simultaneously collected at the FSC for the SSE, NPE and NSE locations. These readings usually varied from 0 to 3 tenths of a foot in height difference. The variations are caused by the upwelling of water being released from the turbine draft tube and the number of and/or sequence of turbine units operating.

Table 3. LGS average tailrace water elevations, 2009-2014

Location	Average Tailrace Water Elevations					
	2010	2011	2012	2013	2014	2009 – 2013 Average
SSE	538.48	538.91	538.67	538.27	538.46	538.59
NPE	538.40	538.66	538.52	538.22	538.42	538.49
NSE	538.40	538.45	538.38	538.05	538.48	538.39

Overall, average channel to tailwater head differentials in 2014 were lower than those recorded in 2010 -2013 (Table 4). Despite lower average head differentials in 2014, values were near the middle of the 1.0-2.0 foot differential criteria. In 2009 and 2010, NPE3 and NSE3 concrete lift gates were broken and water in the channel flowed out through the openings

reducing the channel to head differentials. Both gates were permanently sealed with concrete in February 2011.

Weir depths were similar in all years for the SSE and NPE but NSE's have increased in recent years due to fixed positions. In 2010 NSE-1 failed and the weir lowered to sill elevation and could only be recovered until after the fish passage season. Both NSE 1 and 2 were not operational during 2011, 2012 and placed at fixed positions at 531.5 feet in elevation. In 2013, NSE1 and 2 were placed at fixed position of 532.0 feet to compensate for two pump operation. New NSE weir gate hoists were installed and commission on February 27, 2014, which allowed the weirs to be adjusted.

Table 4. LGS adult fishway average differentials and weir depths 2010-2014.

Location	**Average Differential or Depth in Feet**					
Channel to Tailwater Differential	2010	2011	2012	2013	2014	2010 – 2013 Average
SSE	1.57	1.66	1.68	1.69	1.54	1.65
NPE	1.52	1.64	1.66	1.77	1.49	1.65
NSE	1.14	1.37	1.48	1.67	1.31	1.42
Weir Depth						
SSE-1	8.29	8.41	8.34	8.31	8.28	8.34
SSE-2	8.29	8.38	8.31	8.29	8.21	8.32
NPE-1	6.34	6.50	6.40	6.15	6.32	6.35
NPE-2	6.23	6.52	6.22	6.83	6.33	6.45
NSE-1	9.10	6.95	6.87	6.05	6.35	6.49
NSE-2	6.61	6.95	6.89	6.05	6.35	7.25

[1] Data includes weir gate in the raised position but not in the closed position.

Adult Fish Facility Recommendations

- Repair and/or replace ladder expansion joint seals
- Repair and/or replace collection channel sluice gates and indicator rods
- Continue to replace diffuser grating and supporting beams
- Replace the North Shore Rip Rap dike that protects the NSE entrance from turbulent water forces created by the north shore clockwise eddy.
- Repair or replace the Fishway Control System
- Rotate the rebuild of fish pump gear boxes to ensure the ability to run on three fish pumps
- Replace cleaning brush system for the counting room and viewing room windows

Juvenile Fish Facility

Facility Description

The Little Goose Juvenile Fish Facility was designed to bypass juvenile salmon and steelhead to the tailrace, or transport them by truck and barge below Bonneville Dam. The bypass system includes extended length submersible bar screens in the turbine intakes, vertical barrier screens, 12-inch diameter gatewell orifices, a 14-inch diameter gatewell orifice, a collection channel running the length of the powerhouse, a dewatering structure, two emergency bypass routes, and a corrugated metal flume.

The transport system includes a fish separator, fish distribution system, raceways, a sampling and marking building, truck and barge loading areas, and a passive integrated transponder (PIT) tag detection and diversion / bypass system. Untagged fish (without PIT tags) may also be bypassed from the transport system.

Facility Modifications

Several modifications were made prior to, during and after the 2014 season.

1. PSMFC installed a new PIT-tag detection system in the fish counting window slot in the adult ladder.
2. The counting window slot width was adjusted to a fixed 18-inch width.
3. Three holding tanks in the second floor wet lab at the Juvenile Fish Facility were relocated and re-plumbed to allow access to a ceiling mounted furnace.

Juvenile Fish Collection and Bypass

The juvenile fish bypass and collection facility was placed into primary bypass operations on March 17. Collection for transport began on May 1 at 0700 hours and ended on October 31 at 0700 hours. An estimated total of 3,755,596 salmonid smolts were collected for transport during this period. Of this total 3,744,814 smolts were barged, 7,967 were trucked, 71 were bypassed and 2,743 were facility mortalities.

During the month of April, prior to the start of the fish transport season, the facility was switched from primary to secondary bypass, for condition sampling and gas bubble trauma monitoring, every fifth day. An estimated total of 397,800 smolts entered the facility on sampling days in April. Of this total 397,771 were bypassed and 29 were facility mortalities. There are no passage estimates on dates when the facility was operated in primary bypass.

Transportation

A total of 4,153,395 smolts were collected during the 2014 season. Of those, 3,752,781 were transported, 397,842 were bypassed, and 2,772 were facility mortalities. Daily barging and direct loading operations occurred from May 2 to May 30, alternate day barging occurred from June 1 to August 16. Transportation by truck began on August 16 and ended on October 31.

Juvenile salmonids collected for transport were directly loaded into barge holds and truck tanks or were held in raceways and wet lab tanks prior to loading and transport. The maximum holding time prior to transport ranged from 24 to 48 hours. Barge transport time from Little Goose to the mid channel release point below Bonneville Dam was approximately two days. Barging accounted for approximately 99.8% of the smolts transported. The estimated species composition and clip type of the fish transported by barge was; clipped yearling chinook 37.6%, clipped steelhead 22.3%, unclipped subyearling chinook 12.1%, unclipped yearling chinook 9.6%, unclipped steelhead 8.4%, clipped subyearling chinook 7.4%, unclipped sockeye 1.2%, unclipped coho 1.1% and clipped sockeye 0.2%.

Transportation by truck to the release sites at the Bonneville Juvenile Fish Facility Flume took approximately six hours. Trucked Fish were transported in a saline solution of 1 to 2 mg/L of sodium chloride to reduce stress and treat presumed Columnaris disease. Of the 3,752,781 juvenile salmonids transported from Little Goose in 2014, 7,967 of them, or 0.2% of the total, were transported by truck. The species composition of salmonids transported by truck was; unclipped subyearling Chinook 94.4%, clipped subyearling Chinook 5.0%, combined steelhead 0.1%, unclipped sockeye 0.4% and unclipped yearling Chinook <0.1%. In 2014, all fish transport operations were performed without incident.

Fish bypassed during the transportation season, May 2 through October 31, included 69 Chinook and one sockeye fry, which were bypassed for continued growth, and one clipped steelhead bypassed due to apparent advanced disease.

The maximum daily estimated collection of 279,206 fish occurred on May 06 and accounted for 6.7% of the total season collection. The composition of the collection for that date was: Clipped Chinook 55.9%, clipped steelhead 24.4%, unclipped yearling Chinook 13.8%, unclipped steelhead 4.4%, unclipped sockeye 1.4% and unclipped coho 0.1%.

Adult Fallbacks

Fallbacks are adult salmonids that have migrated above the dam and have “fallen back” into the downstream juvenile fish collection and bypass system. Fallbacks collected at the separator were usually too large to pass between the separator bars and were released back to the river. Fallbacks were identified by species and fin clip and assessed for condition prior to being released.

A total of 4,724 adult salmon and steelhead fallbacks occurred in 2014. Of these 4,713 were bypassed from the separator. The remaining 11 were small Chinook jacks that passed through the separator bars and were collected in the sample and released back to the river.

There were 1,846 steelhead fallbacks in April, May and June. Of these there were 617 clipped and 768 unclipped which were classified as out-migrating kelts. Due to their post spawned condition, kelts collected during this period accounted for the majority of fish in fair (95%), poor (97%) and dead (98%) condition.

Other fish of particular interest that were bypassed back to the river from the separator included 4 bull trout, 57 adult pacific lamprey, and 26 white sturgeon. The 57 adult pacific

lamprey were transported to one mile above the dam and released. In addition, another 20 adult lamprey collected in the sample were also transported and released above the dam.

Juvenile Facility Operations & Maintenance

The juvenile fish bypass system was inspected at a minimum twice daily during the fish passage season. The juvenile bypass system and the collection facility were not heavily impacted by debris, equipment and components for the most part, met operational reliability and overall excellence in operations helped make 2014 an exceptional year for safe fish passage.

Forebay Debris/Trashracks

We estimated the surface area covered by debris and the location of that debris in the forebay daily during JFF inspections. On March 5, the trash sheer boom cable separated rendering the equipment ineffective. Consequently, any upriver debris, if not entirely entrained in the current during spill operations, passed through the project via turbine intakes or the juvenile collection system. Moderate to substantial accumulations of woody debris were present in the Little Goose forebay from May through June triggering various debris related issues within the juvenile collection system. A tear in a VBS screen associated with turbine unit 1 was discovered on May 13 triggering a forced outage of the turbine unit and dewatering of gatewell 1A; repairs to the screen were made without incident. Orifice blockages were numerous from early through mid-June. The USACE attempted to remove forebay debris June 18 using a variety of techniques including wrangling debris with a boat and swapping usage of turbine units to pull debris toward the spillbays. These attempts were marginally effective. Increased orifice rotation, gatewell dipping, and a separator cleanout were all necessary to decrease debris accumulations within the juvenile collection system this year. Debris accumulations began to taper off briefly, before they increased again, from late August through mid-September due to rising pool elevations resulting from the termination of MOP restrictions. However, the frequency and degree of blockages in the orifices and problems with failed equipment did not reoccur.

Spillway Weir

The spillway weir (SW) was placed into operation on April 3 in the high crest (622 ft. msl) position. On April 24, the process began to change the weir to the low crest (618 ft. msl) position because flows were projected to be above 80 kcfs for seven or more days. The change could not be made on April 24 due to high wind conditions. The change to low crest was completed at 10:10 on April 25. On June 17, the weir was returned to the high crest position at 11:00. On August 4 at 08:25, the weir was removed from service to “smooth-out” flows for the remainder of the passage season. There were no debris blockages during the operation of the weir.

Turbine Operation

Efforts were made to operate all turbine units within 1% limitation of best efficiency from April 1 to October 31. Best efficiency operations provide greatest fish passage survival through operating turbines. Deviations outside the 1% criteria are reportable if it occurs for more than 15 minutes in duration and/or there are 5 or more periods of at least 5 minutes during a single calendar day. In 2014, there were no reportable 1% violations.

There were numerous scheduled and unscheduled turbine unit outages during the fish passage season. Short term outages, less than 24 hours in duration were required to perform minor maintenance repairs, fish passage inspections and debris removal.

Extended-Length Submersible Bar Screens (ESBS)

All ESBS performed satisfactorily with only three exceptions. Brushes on Unit 4 ESBS were observed not working on May 15 and brushes on Unit 2 were not working on September 25 and October 20. In all cases, screen failures were reported and repaired in the same day. Drawdown inspections across trashracks and ESBS/VBS were performed according to the FPP. All drawdown inspections were measured within criteria throughout the season. Video inspections and manual operation inspections showed all screens in good operating condition throughout the fish passage season.

Vertical Barrier Screens (VBS)

Inspections of all VBS were performed by underwater video camera in the month of April. On April 2, a tear approximately 12 X 2 inches was found on the 1A VBS. All other inspections showed VBS in good operating condition.

Gatewells

Gatewells were checked for debris and oil contamination daily. As needed, debris was removed using a dip basket or grappling hook. In 2014, the occasional oil films were observed on the water surface in several gatewells similar to previous years. Most oil films appeared to be organic (animal or vegetative) in appearance while some appeared to be petroleum base and may have been produced, in part, from rain-washed oil/grease residue associated with mechanical equipment and vehicles.

Orifices and Collection Channel

The collection channel was operated throughout the season with 18 to 22 open orifices depending on forebay elevations. Orifices were inspected and/or back-flushed two to five times per day. All orifice operations were manually performed throughout the year.

The collection channel was dewatered and removed from service on December 16. Fish salvage operations during the dewatering included releasing unharmed back to the river an estimated 75 adult steelhead, one coho, three sculpin, one Chinook smolt, and 25 juvenile lamprey (macropthalmia).

Primary Dewaterer/Primary Bypass Pipe

The primary dewatering structure and components functioned adequately throughout the season. Inspection of the primary dewaterer and manual operation of the cleaning brushes was performed daily. As in past years, the excess water was diverted to the adult fish channel pump chamber throughout the season to improve adult fish attraction and migration.

Bypass Flume/Pipe

The primary bypass flume functioned satisfactorily in 2014. During winter maintenance 2010, the flume outfall was relocated from near shore to mid channel. The relocation extended the release site approximately 400 feet north into the river mid-channel. This new section of outfall is made of 36 inch corrugated metal pipe. The new point of release allows bypassed fish to migrate downstream with improved guidance. The flume was inspected during the winter maintenance period and observed in overall good condition and found free of obstructions and rough edges.

Separator

The separator was operated similar to previous years. The water level was kept about one to two inches above the downstream end of the B-side separator bars. In some years, the facility is placed in primary bypass mode for short periods during the transport season in order to clean debris out of the separator. On June 18, the facility was placed in primary bypass from 1000 to 1200 hours to clean debris out of the separator. There was no estimate of the number of fish bypassed during the cleanout operation. During the winter maintenance period, the interior and exterior surfaces of the separator were cleaned and refurbished.

Sample System/PIT Tag System

The PIT tag detection and diversion systems at the lower Snake and Columbia River dams are maintained and operated by the Pacific States Marine Fisheries Commission. PIT tagged salmonids have been monitored for movement and behavior in the Columbia and Snake Rivers since 1987. At Little Goose Dam, there are 11 PIT tag monitors located throughout the JFF.

In previous years, the state of the Divert During Sample (DDS) system was manually changed by USACE project biologists and technicians based upon fish passage and sample rates. However, the DDS system was upgraded during the winter maintenance period in 2012/2013 to allow for automatic changes of state per entry of the sample rate, while still retaining the ability to override the automation and change the system manually.

At low sample rates ($\leq$20%), when large numbers of fish are passing through the system, the DDS setting is deactivated. When the DDS is deactivated, the PIT tag slide gate will not open when the sampling system is engaged. This setting helps avoid potential sample bias caused by diverting large numbers of untagged fish along with the targeted PIT tagged fish

during a sampling event. At sample rates greater than or equal to 20%, (low numbers of fish passing through system), the potential for sample bias is lower and the DDS system is activated. An automated log of state changes to the system, trouble reports and power outages affecting the PIT tag interrogation equipment in 2013 can be obtained at www.ptagis.org.

DDS settings for the A and B side sample tanks followed recommendations for most of the season. Minor deviations typically occur daily at approximately 0700 as a result of equipment operation as the facility prepares for a new 24 hour sampling period. In addition, minor deviations occur as a result of split sample changes, separator cleanouts and/or power outages.

Pit Tag Detections

The passive integrated transponder (PIT) tag detection system records data on PIT tagged salmonids as they pass through the juvenile collection system. The PTAGIS database categorized all PIT tag detections based upon species, race, and clip/rearing type. An additional "orphan" category was used for detections of PIT tags for which the database contained no record of tagging and release. Fish dispositions were categorized based upon exit monitor detections: 1) to the river, 2) to transport holding areas, 3) to the smolt monitoring sample, and 4) unknown. This last category included final detections of PIT tagged fish at locations that did not constitute an exit from the facility.

From April 1 through October 31, a total of 152,910 PIT tagged fish were detected within the juvenile collection/bypass system: 88,347 Chinook salmon, 60,680 steelhead, 2,241 sockeye salmon, 799 orphans of unknown species/rearing type, 795 coho salmon, 47 Pacific lamprey, and one white sturgeon. Of the total number of detections, 73.1% or 111,813 fish were routed to the river, 26.8% or 40,936 fish were routed to transport areas, and 0.1% or 161 fish had unknown disposition as they were last detected at locations that did not constitute an exit from the facility. PIT tagged fish in the subsample were treated as the other fish in the sample and were either routed back to the river, if the facility was operating in secondary bypass mode, or routed to a transport holding area when the facility operated in collection mode. Approximately 0.5% of the PIT tagged fish detected at LGS in 2014, or 722 PIT tagged smolts, were routed to the sample this year; 91% were transported and 9% were returned to the river during pre-transport operations (April 1- May 1). Prior to the start of the transportation season, all PIT tagged fish were routed back to the river. Approximately 35.1% or 53,611 of the total PIT tagged fish detected in 2014 were detected prior to the start of collection for transportation.

Barge and Truck Loading Operations

Barge loading and transport operations occurred from May 2 through August 16. All fish loading and barge operations at LGS were performed satisfactorily. Truck loading and transport operations occurred on alternate days from August 18 to October 31. In previous years, due to high numbers of fish collected, Lower Granite Fish Facility trucked Little Goose Fish using the 3500 tanker. This "piggyback" operation delayed transport time for those fish transported from Lower Granite by approximately one hour. In 2014, Little Goose did not conduct any

piggybacking operations with Lower Granite. Fish transported by truck from Little Goose were transported in a mild saline solution of 1 to 2 mg/L to reduce stress and treat columnaris disease.

Avian Predation Deterrence

Springtime gull predation on juvenile salmon and steelhead at Little Goose has been significantly reduced since 1999 when the USDA Animal and Plant Health Inspection Service (APHIS) began bird hazing activities. Prior to 1999, 150 to 200 birds were common sight in the tailrace area during the smolt migration. On some days, up to 400 gulls were observed during the peak period in May. In 2014, APHIS bird hazing activities at Little Goose took place from April 7 through June 20. Additional hazing by project personnel using bird scare products including propane scare cannons, bird bangers and bird screamers continued intermittently through the remainder of the fish passage season. The water cannon located at the bypass outfall was used continuously throughout the season. Little Goose continued to use passive bird deterrent devices that included needle strips, bird wires and visual scare devices.

Juvenile Fish Facility Recommendations

1. Continue to write revisions and updates to the operations maintenance manual pertaining to new equipment and facility collection and transport procedures
2. Repair the trash/shear boom.
3. Install a new log boom between the floating guide wall and the trash/shear boom
4. Repair the emergency fish bypass/drain pipe outfall section. Install air and vacuum release valves to prevent back blow of the drain system.
5. Continue to rebuild orifice valve cylinders.
6. Replace all 72 in-line air control hand valves associated with the orifice valves and back-flushing operations.
7. Replace all 36 orifice push button electronic valve operators with manual 2-way valves.
8. Continue to remove scale and rough edges in the facility flumes, tanks, and transition areas
9. Compose a Standard Operating Procedures (SOP) for proper handling, collecting and transporting of Pacific adult lamprey from the JFF to their release site upstream of the dam. In addition, consider a similar SOP for the capturing, handling, and transporting of late season Pacific lamprey macropthalmia and metamorphosing Pacific ammocoete via truck.
10. Review protocols yearly to ensure effective communication between all parties during truck/barge loading, dewatering events, separator cleanouts, etc. This will ensure that fish are properly routed, flush water is available for fish transfer, and that there is sufficient water in holding tanks

Acknowledgements

Little Goose Dam Adult Fishway and Facilities was managed, inspected and maintained during 2013 by the following people:

O. Towns Burgess, Supervisory Fisheries Biologist, COE
Richard Weis, Assistant Fisheries Biologist, COE
James Brandon, Lead Biological Technician, COE

Ron Ashley, Maintenance Work Leader, COE
Floyd Hunt, Maintenance Worker, COE
Kreg Buryta, Maintenance Worker, COE

Anne Dowdy, Natural Resource Specialist, ODFW
Ruth Shearer, Natural Resource Specialist, ODFW

Pacific States Marine Fisheries Commission Personnel; Scott Livingston and Darren Chase.