2012 Juvenile Fish Collection and Bypass Report
Little Goose Dam Juvenile Fish Facility

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Introduction

This report summarizes activities and results associated with the collection, transportation and bypass of out-migrating juvenile steelhead *Oncorhynchus mykiss*; Chinook salmon *Oncorhynchus tschawytscha*; sockeye salmon *Oncorhynchus nerka*; and coho salmon *Oncorhynchus kisutch* at Little Goose Dam (LGS) in 2012.

The juvenile fish collection and bypass system was watered-up on March 19 and operated to December 17. All fish collected from March 19 through May 2 were bypassed to the tailrace through the primary bypass flume or through the secondary bypass route. Fish were collected for transport to below Bonneville Dam from May 2 to October 31. Primary bypass resumed on October 31 and ended with dewatering of the system on December 17.

An estimated 3,216,218 juvenile salmonids were collected in 2012. Composition of juvenile salmonids included 1,498,506 yearling Chinook (46.4%), 667,289 sub-yearling Chinook (20.8%), 971,272 steelhead (30.2%), 25,835 sockeye (0.8%), and 53,316 Coho (1.7%). An estimated 2,536,122 (78.9%) were transported.

This report summarizes facts and data collected during the fish passage season by the United States Army Corps of Engineers (USACE) and Oregon Department of Fish and Wildlife (ODFW) Smolt Monitoring Program (SMP).

River Conditions

River Flows

A wet spring produced above average river flows for April and May followed by a dry summer that produced flows slightly below average for June through October (Table 1). The average daily flow past LGS was 59.1 kcfs, with a peak daily flow of 180.9 kcfs occurring on April 28, and a minimum flow of 12.5 kcfs occurring on September 29 (Figure 1). Average daily flows were measured above 90 kcfs for a total of 56 days all prior to June 10. As a result, the amount of woody debris was generally less than average. The major components of total flow at LGS were discharge through turbine units (powerhouse flow) and discharge over spillways (spill). Additional contributors to water releases were the fish passage structures and the navigation lock. Daily river flow, spill and water temperature measurements are provided in Appendix Table 1.

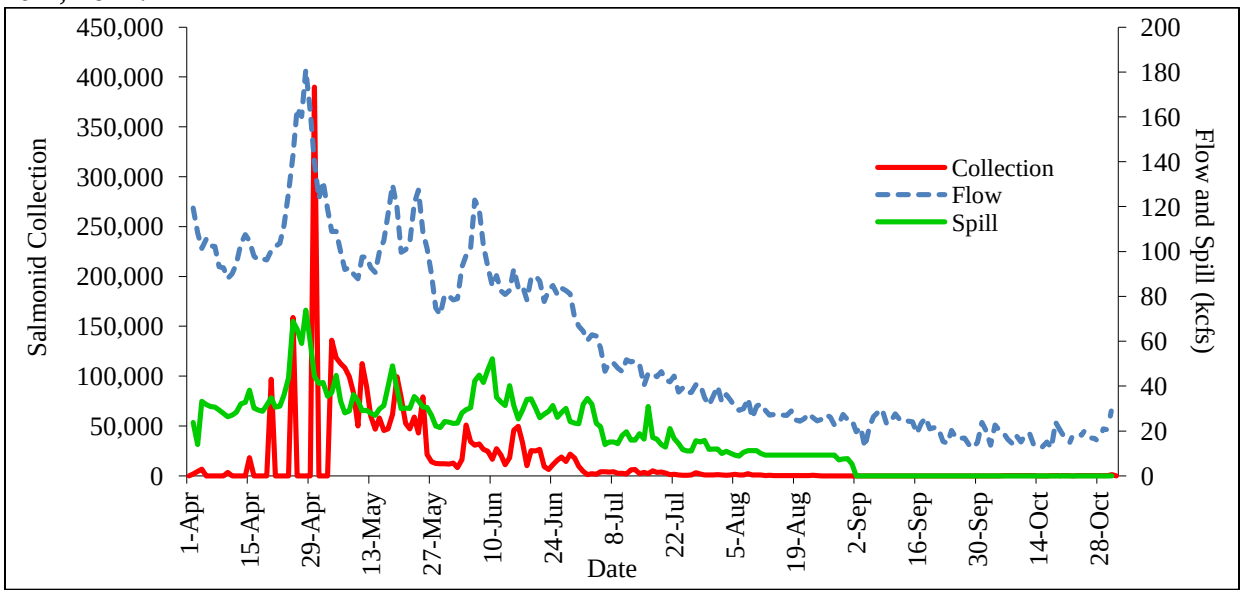
The early timing of high flows required the project to perform involuntary spill prior to the start of the fish passage season. Involuntary spill transitioned to “spill to support fish passage” in accordance with the 2012 Fish Operations Plan (FOP) on April 3 which continued through August 31. The spill target was 30% of total flow for both spring and summer spill periods. Actual spill levels varied to adaptively manage real-time operational requirements (fish research, fish passage, total dissolved gas, debris, navigation safety and/or powerhouse and transmission constraints). All variations of the spill mandates were coordinated through the Technical Management Team (TMT).

Table 1. Comparisons of average monthly flow and spill at Little Goose Dam JFF, 2007-2012.

Month	2007	2008	2009	2010	2011	2012	2007-2011 Average
				Flow (kcfs)			
Apr	45.40	52.67	84.50	40.28	103.34	113.60	65.24
May	77.39	110.90	111.04	64.83	133.19	102.07	99.47
Jun	46.55	124.86	109.48	124.58	163.98	87.38	113.89
Jul	31.62	57.39	50.43	49.51	93.50	46.35	56.49
Aug	23.74	35.79	32.02	29.81	42.07	28.38	32.40
Sep	17.95	22.70	21.84	22.62	33.61	21.09	23.74
Oct	18.43	19.64	21.26	18.97	26.58	18.09	20.97
				Spill (kcfs)			
Apr	13.26	13.26	24.48	11.41	30.08	36.99	18.50
May	23.39	23.39	31.13	19.40	81.37	32.28	35.74
Jun	13.98	13.98	30.88	40.91	73.32	31.86	34.61
Jul	9.50	9.50	15.09	14.83	28.54	17.89	15.49
Aug	8.54	8.54	10.11	9.40	14.00	9.52	9.95
Sep	0.34	0.34	0.20	0.18	0.39	0.18	0.29
Oct	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The average daily river temperature was 59.6 F. The maximum temperature of 69.1°F occurred on July 20, and measured below the five year average maximum of 70.2°F. The minimum temperature of 44.8°F was recorded on April 6, and measured slightly below the five year average minimum of 45.2°F. As per the Water Management Plan, river temperatures were tempered by scheduled water releases from Dworshak Reservoir. Water drafted from the Dworshak Reservoir averaged 11.3 kcfs at 45.3 F for the month of July, and 10.9 kcfs at 46.3 F for the month of August (Columbia River Dart). Temperatures recorded daily in the JFF averaged 66.7 F during July, and 67.6 F during August.

Figure 1. Total river flow, spill, and number of juvenile salmonids collected at Little Goose Dam, 2012.



Total Dissolved Gas (TDG) 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) coordinates 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. In 2012, TDG was monitored in the forebay from April 1–August 31 and in the tailwater year around.

The daily average TDG level in the Little Goose forebay from April 1 through August 31 was 111.2% saturation, ranging from 104.9% saturation on June 6 to 120.7% on April 29. The 115% saturation variance standard was exceeded four times from April 26 through April 30. The average daily percent saturation level in the forebay of Little Goose Dam during this interval was 117.2% saturation. The TDG level in the tailrace averaged 113.2% saturation from April 1 through August 31, ranging from 105.7% on August 29 to 124.0% on April 27. The 120% saturation variance was exceeded five times from April 24 to April 28, averaging 122.7% saturation during that interval.

Water clarity was measured during all adult fishway inspections. Measurements were taken in the adult fish ladder using a secchi disk lowered to a maximum depth of just over 6 feet. The fish ladder water supply is gravity fed from the forebay and was representative of river conditions. From April 1 through mid June measurements ranged from 1.2 feet to 4.2 feet. For the remainder of the season, measurements ranged from 4.2 to over 6.0 feet. Water clarity patterns were similar to previous years.

Fish Collection

Collection, Bypass and Transport

The juvenile fish collection facilities were watered up and placed in primary bypass on March 19. Collection for transport began on May 4 and continued to October 31. Of the 3,216,218 juvenile salmonids collected, 678,174 were bypassed and 2,536,122 were transported (Table 2). Prior to collection for transport, the facility was required to switch from primary bypass to secondary bypass from April 2 through April 4 to allow PSMFC and NOAA personnel to conduct tests on a new computer program for the PIT tag detection and diversion system. The facility also operated in secondary bypass on April 10, 15, 20, 25 and 30 for fish condition and GBT sampling. An estimated 678,135 smolts were collected on days when the facility operated in secondary bypass. An additional 39 salmonids (smolts and fry) were bypassed during the transport season due to small size or poor condition. Primary bypass resumed October 31 and continued until dewatering of the system on December 17. Daily collection and bypass numbers are provided in Appendix Table 1.

Daily barging and direct loading operations occurred from May 4 to May 28, alternate day barging occurred from May 30 to August 16. Fish collected for transport by barge were held in raceways or directly loaded into barges. Maximum fish holding time prior to transport varied from 24 to 48 hours. Barge transport time from Little Goose to the mid channel release point below Bonneville Dam was approximately two days.

Fish awaiting transportation by truck were held in tanks in the wet lab or loaded directly into the truck tank. Transport time by truck was approximately 6 hours to release at the Bonneville Juvenile Fish Facility flume or the Dalton Point Boat Ramp. Alternate day trucking

occurred from August 18 to October 31. From September 5 through October 7, due to low collection numbers, Lower Granite Dam (LGR) Fish Facility trucked LGS Fish. LGR transported a total of 632 fish from LGO of which approximately half (310) were transported on October 7. LGS resumed truck transport October 9 to October 31 as fish collections numbers increased. A total of 6,596 fish were trucked from Little Goose of which 11 died in-route. These included nine Chinook sub-yearlings unclipped, one Chinook sub-yearling clipped and one sockeye unclipped. These fish were predisposed with diseased and/or injury. Fish releases were performed at Dalton Point Boat Ramp for the last five truck trips due to high numbers of cormorants and gulls at the Bonneville juvenile fish facility flume outfall. All transportation activities were performed without incident. Daily barge and truck transport numbers are provided in Appendix Table 3.

Table 2. Annual collection, bypass, and transport activity at Little Goose Dam JFF, 2008-2012.

	Yearling Chinook		Sub-yearling Chinook		Steelhead		Coho	Sockeye		
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip/Unclip	Clip	Unclip	Total
Collection										
2008[1]	1,394,415	312,097	288,424	464,630	1,807,231	501,014	95,879	17,036	4,916	4,885,642
2009	1,315,352	404,911	333,313	519,124	1,935,602	582,074	59,544	19,992	13,678	5,183,590
2010	643,785	229,253	287,702	578,905	807,718	277,394	36,917	1,291	7,594	2,870,559
2011	1,125,551	323,791	232,116	508,188	868,702	263,726	41,631	3,487	20,869	3,388,061
2012	1,067,044	431,462	268,235	399,054	658,540	312,732	53,316	252	25,583	3,216,218
Bypass[2]										
2008	299,945	88,906	2,783	2,633	634,901	82,649	2,764	41	31	1,114,653
2009	531,880	220,144	2,180	7,121	1,160,734	299,337	2,825	1	5,825	2,230,047
2010	57,967	23,228	3	325	46,365	12,601	0	0	0	140,489
2011	56,672	46,496	1	92	216,725	21,908	401	0	5,227	347,522
2012	242,353	145,896	1	125	227,179	60,328	1,601	0	691	678,174
Truck										
2008	0	12	153	17,403	5	7	18	0	125	17,723
2009	0	2	123	2,753	3	4	300	1	18	3,204
2010	11	15	79	10,452	7	11	19	1	10	10,605
2011	1	16	59	10,680	8	22	277	2	77	11,142
2012	1	0	133	6,306	17	26	7	0	106	6,596
Barge										
2008	1,091,599	222,556	284,812	443,255	1,171,970	418,242	93,092	16,981	4,731	3,747,238
2009	782,309	184,253	328,224	505,511	774,611	282,643	56,372	19,975	7,793	2,941,691
2010	585,585	205,930	285,364	564,261	761,183	264,706	36,896	1,289	7,583	2,712,797
2011	1,067,450	276,919	230,973	494,558	651,617	241,734	40,943	3,480	15,416	3,023,090
2012	824,116	285,393	267,834	391,916	431,232	252,302	51,706	252	24,775	2,529,526
Total Transport										
2008	1,091,599	222,568	284,965	460,658	1,171,975	418,249	93,110	16,981	4,856	3,764,961
2009	782,309	184,255	328,347	508,264	774,614	282,647	56,672	19,976	7,811	2,944,895
2010	585,596	205,945	285,443	574,713	761,190	264,717	36,915	1,290	7,593	2,723,402
2011	1,067,451	276,935	231,032	505,238	651,625	241,756	41,220	3,482	15,493	3,034,232
2012	824,117	285,393	267,967	398,222	431,249	252,328	51,713	252	24,881	2,536,122

[1] Collection counts exclude fish passage estimates from limited sampling dates 4/1-4/27 2008.
[2] Bypass counts include fish provided for research, but don't include NOAA sort by code PIT tagged salmon or divert during sample pit tagged salmon.

The maximum daily estimated collection of 389,763 fish occurred on April 30 (secondary bypass) prior to collection for transport, and accounted for 12.1% of the season collection total (Table 3). The maximum daily collection during the transport season occurred May 4, and totaled 134,542 fish, or 5.3% of the transport collection total.

Table 3. Annual peak salmonid collection days and count by species group at Little Goose Dam JFF, 2008-2012.

	Yearling Chinook		Sub-yearling Chinook		Steelhead		Sockeye		Coho	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Season
2008	May 12 (104,404)	May 11 (17,002)	June20 (15,873)	June 25 (18,228)	May 11 (156,008)	May 11 (17,002)	May 23 (2,400)	May 26 (700)	May 22 (13,800)	May 11 (309,619)
2009	May 23 (65,408)	April 28 (23,601)	June 04 (25,720)	June 04 (37,214)	April 27 (180,448)	April 26 (57,600)	May 20, 23 (3,200)	May 7, 8, 23 (1,000)	May 23 (7,800)	April 27 (288,500)
2010	May 20 (71,700)	May 2 (21,200)	June 12 (33,456)	June 12 (46,507)	May 20 (96,600)	May 20 (29,800)	May 29 (300)	May 20 (2,200)	May 20 (4,000)	May 20 (222,600)
2011	May 13 (121,429)	May 13 (28,802)	June 04 (16,859)	June 04 (39,613)	May 18 (58,203)	May 18 (27,400)	May 22 (700)	May 12 (1,406)	May 20 (4,400)	May 13 (225,048)
2012	April 30 (176,464)	April 30 (76,835)	June 16 (25,750)	June 04 (23,025)	April 30 (104,051)	April 30 (29,612)	May 29 (150)	May 23 (3,000)	May 19 (4,200)	April 30 (389,763)

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 4,785 adult salmon or steelhead fallbacks occurred in 2012 (Table 4). Of these 4,759 were bypassed from the separator. The remaining 26 were small Chinook Jacks that passed through the separator bars and were collected in the sample and released back to the river. Daily numbers of adult fallbacks and fallback mortalities can be found in Appendix Table 4.

Table 4. Total Annual Adult Salmonid Fallbacks at Little Goose Dam JFF, 2008-2012.

Year	Adult Chinook	Jack/mini Chinook	Clip Steelhead	Unclip Steelhead	Sockeye	Coho	Total
2008	773	2,845	2,122	1,932	24	16	7,712
2009	1,192	1,372	2,997	2,131	11	35	7,738
2010	976	780	1,758	1,881	22	9	5,426
2011	1,683	1,020	1,996	1,549	17	14	6,280*
2012	1,064	1,077	1,215	1,399	9	21	4,785

*2011 total includes 1 Pink Salmonid.

There were 2,044 steelhead fallbacks in April, May and June (Table 5). Of these there were 668 clipped and 1,071 unclipped classified as out-migrating kelts. Due to their post spawned condition, kelts collected during the period accounted for the majority of fish in fair (59%), poor (63%) and dead (94%) condition. Table 6 lists the numbers of fish by species and condition categories.

Table 4. Monthly totals of fallbacks bypassed from separator at Little Goose Dam, 2012.

Month	Adult Chinook	Jack Chinook	Clip Steelhead	Unclip Steelhead	Sockeye	Coho	Total
April	0	0	195	215	0	0	410
May	150	1	575	834	0	0	1560
June	100	6	54	171	0	1	332
July	75	12	13	16	5	0	121
August	33	10	17	18	3	0	80
September	284	376	190	78	1	13	942
October	422	672	171	67	0	7	1,340
Total	1,064	1,077	1,215	1,399	9	21	4,785

Table 5. Condition of adult salmonids released at Little Goose Dam, 2012.

Fish	Chinook		Chinook Jack		Steelhead		Sockeye		Coho	
Condition[1]	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Total
Good	545	467	463	582	1,030	1,188	3	4	17	4,299
Fair	17	22	17	10	93	102	1	1	2	265
Poor	4	6	3	1	59	60	0	0	1	134
Dead	1	2	0	1	37	44	0	0	0	85
Total	567	497	483	594	1,215	1,399	4	5	21	4,785

[1] Condition ratings for live fish were determined subjectively based on the presence/absence and severity of fungus, headburn, fin wear, and other injuries.
Note: Table 6 does not separate post spawned "kelt" steelhead from pre-spawned healthier steelhead.

Other fish of particular interest that were bypassed back to the river from the separator included 7 bull trout, 17 adult pacific lamprey, and 10 white sturgeon. The 17 adult pacific lamprey removed from the separator in 2012 were transported to one mile above the dam and released. In addition, another 2 adult lamprey were removed from raceways and 32 adult lamprey collected in the sample were also transported and released above the dam.

Separator Efficiency

Separator efficiency is a measure of how effectively fish are separated by size. Smolts are separated to reduce stress and predation during raceway holding and barge transport. The spacing between the sorter bars allows smaller fish, primarily salmon smolts, to pass through the "A" side and larger fish, primarily steelhead to pass through the "B" side of the separator and into the respective sample tanks, raceways or barge holds. Table 7 gives efficiency, expressed as the percentage of each group passing through the desired side for 2008-2012. Efficiency rates are based on expanded sample counts.

Table 7. Annual juvenile salmonid separator efficiency (%) at Little Goose Dam JFF, 2008-2012.

	Yearling Chinook		Sub-yearling Chinook		Steelhead		Coho		Sockeye	
	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip
Year	A-side	A-side	A-side	A-side	B-side	B-side	A-side	A-side	A-side	A-side
2008	62.7	53.7	50.0	47.9	89.8	74.0	-----	38.6	52.0	30.9
2009	66.0	61.7	52.4	52.3	89.8	68.0	21.0	26.5	19.9	20.8
2010	69.8	68.3	57.4	54.8	87.8	69.4	15.1	28.0	12.8	43.1
2011	73.7	70.1	58.0	57.7	77.3	67.4	-----	32.9	22.6	38.3
2012	75.1	72.3	59.1	59.9	83.7	64.8	40.6	42.1	0.0	37.7

Note: Counts do not include sample mortalities.

In 2012, separator efficiency was highest for clipped steelhead with 83.7% entering the B-side of the separator (Table 7). Separator efficiency was lowest for clipped sockeye salmon at 0.0% entering the A-side of the separator. Separator efficiency was higher than in recent years for clipped (75.1%) and unclipped yearling Chinook (72.3%), and clipped (59.1%) and unclipped sub-yearling Chinook (59.9%). In 2012, 54.7% of all salmon and steelhead species passed through the A-side, compared to 52.9% in 2011, 44.1% in 2010, 38.2% in 2009, and 36.2% in 2008. In 2012, the overall species composition for steelhead was 30.2% of the collection total, compared to 33.4% in 2011, 37.9% in 2010, 48.6% in 2009, and 47.3% in 2008.

Sampling

The fish sampling system was operated without incident throughout the season. Sampling procedures followed the smolt monitoring guidelines developed by the Fish Passage Center and the USACE. Data collected and recorded daily were used for management of facility and fish transport operations in compliance with the Fish Passage Plan. Data were also transmitted daily to the FPC electronic database in support of the SMP.

All sample fish were examined to determine species, clip type, and the presence of marks or external tags. For Chinook salmon, age class was determined as sub-yearling or yearling. All yearling Chinook salmon smolts in the sample were examined for holdover fall Chinook salmon characteristics. All holdover fall Chinook salmon smolts were examined for coded wire tags, PIT tags, and Elastomer tags. All unclipped yearling and sub-yearling Chinook salmon, coho, and Sockeye salmon were scanned for coded wire tags. Yearling fall Chinook salmon were examined for characteristics typical of Lyons Ferry Hatchery fish.

Fish condition data were collected daily on a random subsample of 100 fish of the dominant species. Condition metrics included weight, length, descaling, injury, disease, predation, and "other" monitored conditions; specifically fin discoloration, pop eyes, fin hemorrhage, eye hemorrhage, and pink fin. Injury and descaling data were used by managers to assess passage conditions. Therefore, old injuries and healed descaling were not recorded during condition sampling. All additional, or "non-condition" sample fish were examined for descaling greater than 20%.

Pound counts (fish per pound) were measured daily during condition sampling from May 4 to October 31. On transportation days, weights were also measured on non-condition salmonids if the target number of 25 per group was not present in the condition sample. Weights were also recorded on all non-salmonid species on transportation dates from May 4 through August 14. After August 14, the sample rate was set at 100% and all non-salmonid species were removed from the sample and bypassed back to the river.

Table 8. Weekly sample as percent of collection total and sample totals at LGS JFF, 2012.

Week Ending	Weekly % Sampled (%)	Yearling Chinook Clip	Yearling Chinook Unclip	Sub-yearling Chinook Clip	Sub-yearling Chinook Unclip	Steelhead Clip	Steelhead Unclip	Sockeye Clip	Sockeye Unclip	Coho	Totals[1]
5-Apr	5.0	152	235	0	2	154	82	0	2	0	627
12-Apr	5.0	54	63	0	1	25	25	0	1	0	169
19-Apr	2.5	134	118	0	0	172	39	0	0	0	463
26-Apr	0.6	342	353	0	0	637	145	0	1	0	1,478
3-May	0.3	478	207	0	0	299	85	0	1	4	1,074
10-May	0.4	1,635	459	0	3	605	182	0	7	27	2,918
17-May	0.6	1,383	358	0	6	685	372	0	27	62	2,893
24-May	0.7	969	402	4	15	733	548	0	71	134	2,876
31-May	1.6	436	534	81	56	705	521	3	66	151	2,553
7-Jun	2.6	113	207	1,505	1,913	521	368	2	66	81	4,776
14-Jun	2.2	16	56	1,112	1,289	417	309	0	6	16	3,221
21-Jun	1.8	19	46	1,882	1,730	141	78	0	5	12	3,913
28-Jun	3.4	5	28	1,292	1,909	75	37	0	0	1	3,347
5-Jul	5.8	0	10	599	1,679	36	17	0	1	0	2,342
12-Jul	12.7	1	5	436	2,650	40	26	0	0	3	3,161
19-Jul	12.2	1	7	378	2,829	10	10	0	1	0	3,236
26-Jul	21.2	1	3	133	1,673	8	4	0	1	1	1,824
2-Aug	48.8	1	15	257	4,428	12	6	0	3	1	4,723
9-Aug	49.9	0	5	94	3,676	3	5	1	2	2	3,788
16-Aug	55.5	1	2	55	1,684	5	9	0	7	3	1,766
23-Aug	99.9	1	0	35	1,666	9	9	0	12	4	1,736
30-Aug	100.0	0	0	7	336	5	6	0	8	0	362
6-Sep	100.0	0	0	4	56	1	3	0	14	0	78
13-Sep	100.0	0	0	5	93	2	2	0	23	2	127
20-Sep	100.0	0	0	0	34	0	0	0	11	0	45
27-Sep	100.0	0	0	0	46	0	0	0	9	0	55
4-Oct	100.0	0	0	1	48	0	1	0	1	0	51
11-Oct	100.0	0	0	22	754	0	1	0	8	0	785
18-Oct	100.0	1	0	15	537	0	1	0	3	1	558
25-Oct	99.9	0	0	20	1,125	0	1	0	4	0	1,150
1-Nov	100.0	0	0	27	1,692	0	2	0	17	0	1,738
Total Sampled		5,743	3,113	7,964	31,930	5,300	2,894	6	378	505	57,833
Total Collection		1,067,044	431,462	268,235	399,054	658,540	312,732	252	25,583	53,316	3,216,218
% of Sample		10.2	5.5	14.1	54.2	9.4	5.1	<0.1	0.7	0.9	100.0
% of Coll.		0.5	0.7	3.0	8.0	0.8	0.9	2.4	1.5	0.9	1.8

[1]All research fish, GBT fish and sample mortality included in species group/clip type numbers.

Note: Little Goose JFF was in primary bypass mode, going to secondary bypass for 24 hour condition sampling on April 2,3,4, 10, 15,20,25, and 30. Collection for transport with daily 24 hour sampling began on May 3 at 0700 hours and ended October 31 at 0700 hours

A total of 57,833 juvenile salmonids were sampled during the season. This total included sample mortality and fish examined for GBT (Table 8). Prior to the start of the transport, twenty-four hour condition sampling occurred on April 2, 3, 4, 10, 15, 20, 25 and 30. During this period a total of 3,811 fish were sampled. Twenty-four hour collection for transport began at 0700 hours May 3 and ended at 0700 hours on October 31. A total of 54,022 fish were sampled from May 4 through October 31. Sample rates varied between 0.25% and 100% as fish numbers fluctuated to target an optimum sample of 300 to 500 smolts. After August 14, 2012, the sample rated remained at 100% an all fish entering the facility were sampled. The percentage of each species that was sampled was dependant on the timing of migration and the overall sample rate in effect at that time (Table 9).

Table 9. Annual percentage of total juvenile salmonids collected that were sampled at Little Goose Dam JFF, 2008-2012[1].

	Yearling Chinook		Sub-yearling Chinook		Steelhead		Sockeye		Coho	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Total
2008[1]	0.7	0.8	3.6	9.3	0.5	0.7	1.0	4.0	0.6	1.7
2009	0.7	0.8	2.7	6.3	0.5	0.7	19.9	20.8	2.5	1.4
2010	0.9	1.0	1.7	6.3	0.8	0.9	1.9	1.1	0.9	2.1
2011	0.6	0.8	2.8	6.9	0.7	0.8	2.3	1.8	1.7	1.8
2012	0.5	0.7	3.0	8.0	0.8	0.9	2.4	1.5	0.9	1.8

[1]Fish examined for GBT are not included. All other research fish and sample mortality are included in percentages

Fish Condition

Fish condition was monitored daily by SMP biologists and biological aids. The primary purpose for condition monitoring was to identify juvenile salmonids that were descaled or had other significant injuries incurred during passage at Little Goose Dam.

Descaling

A total of 55,767 fish were examined for descaling in 2012. The total rate of descaling was 0.9% for all species and clip types (Table 10). The median descaling rate for all species and clip types was 0.7% (Table 11).

A smolt was considered descaled if more than 20% of the scales were missing from either side of the fish with the scale removal area having rough texture, no slime coat present over the abrasion and no visible healing of the injury. Partial descaling was noted in fish with 6-19% of the scales missing from either side of the fish.

Of the 55,767 fish examined for descaling, 21,048 (37.7%) were examined during condition sampling and fish descaled greater than 20% were differentiated into two categories; descaling linked to passage and descaling from predation attempts. The rate of descaling linked to passage was 0.4%. Descaling from predation was used to designate descaling caused by birds, fish, and mammals. The rate of descaling linked to predation attempts was 0.6% from the total number examined for condition. Partial descaling was also noted on fish in the condition sample. The rate of partial descaling was 1.5%. The remaining 34,719 (62.3%) fish in the sample were examined exclusively for descaling greater than 20%. This non-condition sample made no distinction between passage descaling and predation descaling. The overall descaling rate in the non-condition sample was 0.8%.

Table 10. Annual descaling rates (%) for salmonids examined at Little Goose Dam JFF, 2008-2012.

	Yearling Chinook		Sub-yearling Chinook		Steelhead		Sockeye		Coho	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Totals
2008	1.0	0.7	0.5	0.7	0.6	0.4	0.6	1.1	0.2	0.7
2009	0.7	0.7	0.3	0.3	0.5	0.8	0.0	0.4	0.2	0.4
2010	0.5	0.3	0.3	0.3	0.3	0.2	0.0	0.0	0.6	0.3
2011	0.5	0.5	0.3	0.5	0.2	0.1	0.0	0.6	0.3	0.4
2012	1.0	0.6	0.5	0.9	0.8	1.4	0.0	1.9	0.6	0.9

Note: GBT sample numbers not included in descaling rate calculations

Overall weekly descaling rates per species and clip types can be seen in Table 11. It should be noted that in 2009, descaling linked to predation attempts was not included in the total descaling rate, while in 2010 through 2012, predator caused descaling was included.

In 2012, the highest descaling rate was observed on unclipped sockeye at 1.9%, followed by unclipped steelhead at 1.4% and clipped yearling Chinook at 1.0% (Table 11). In 2012, the average weekly descaling rate ranged from 0.0% to 5.5%. Weekly descaling rates were higher during May and June. We observed increased descaling intermittently throughout the season. In May and June, increased descaling seemed to coincide with peak migrations and high river discharge. Minor spikes in descaling occurred again in mid to late July and into August. Causes for these increases were not immediately apparent. Debris loads in the forebay were virtually non-existent in July. We observed a pulse of fish predation attempts in July and August which contributed to some descaling observed during this period. Beginning in September, sample numbers began to decline at LGS and totaled only 294 smolts for the entire month. Low sample numbers lead to variable descaling rates as a few descaled fish in the sample raised the rate. The weekly peak descaling rate occurred during the week ending September 27. Beginning with week ending October 11, fish collection increased and weekly totals ranged between 558 and 1,738. Fish condition during these four weeks was poor and numerous fish were observed with descaling associated with presumed columnaris disease, dam passage, and predation attempts by bird and fish. Daily descaling rates are provided in Appendix Table 2.

Other Injuries and Disease

A total of 21,048 smolts were examined for injuries in 2012. Of the total number examined, 984 individual injuries were observed or 4.6% of the smolts sustained one or more injuries. (Table 12).

The vast majority of injuries were observed on the fin(s) at 88.0%, followed by injury to the operculum (4.7%), body (3.6%), eye (2.1%) and head (1.6%). The highest rates of injury overall were observed in sub-yearling Chinook salmon, the lowest rates were observed in clipped sockeye and clipped coho (Table 12). However, condition sample size for these two species was extremely small at only five smolts each. The smolt groups and their individual injury rates in each of the five injury subcategories are shown in Table 13.

Data on the presence of disease symptoms were collected to provide relative information about fish health. Disease classifications included fungus, presumed columnaris, presumed BKD, body parasites, deformity, and other disease. The number of smolts affected by disease(s) in 2012 was 3.3% of the total number examined or 705 signs of disease, with some fish exhibiting multiple signs of disease. The total rate in 2012 was considerably less than the 7.0% observed in the previous two years. The most frequently observed disease in 2012 was presumed columnaris disease at 50.8% of the disease total, followed by body parasitism (33.3%), deformity (9.9%), body fungus (5.1%), other disease such as tumors or cysts (0.7%), and presumed BKD (0.1%).

Table 11. Weekly descaling rates (%) for salmonids examined at Little Goose Dam JFF, 2012.

Week Ending	Yearling Chinook Clip	Yearling Chinook Unclip	Sub-yearling Chinook Clip	Sub-yearling Chinook Unclip	Steelhead Clip	Steelhead Unclip	Sockeye Clip	Sockeye Unclip	Coho	Total[1]
5-Apr	0.67	1.72	-----	-----	0.00	1.22	-----	0.00	-----	0.97
12-Apr	0.00	0.00	-----	-----	0.00	0.00	-----	-----	-----	0.00
19-Apr	0.00	0.00	-----	-----	0.00	0.00	-----	-----	-----	0.00
26-Apr	0.35	0.34	-----	-----	0.54	0.00	-----	0.00	-----	0.39
3-May	0.45	1.05	-----	-----	0.00	0.00	-----	0.00	0.00	0.41
10-May	0.93	0.00	-----	-----	0.00	0.00	-----	0.00	3.85	0.56
17-May	1.42	1.16	-----	0.00	0.15	1.12	-----	0.00	0.00	1.01
24-May	1.10	0.51	0.00	0.00	1.00	0.74	-----	0.00	0.75	0.87
31-May	0.97	0.58	0.00	0.00	1.20	1.22	0.00	0.00	0.66	0.90
7-Jun	1.04	0.00	0.27	0.42	1.39	1.98	0.00	1.52	0.00	0.60
14-Jun	0.00	0.00	0.55	0.55	1.57	4.55	-----	0.00	0.00	1.03
21-Jun	0.00	0.00	0.22	0.42	1.46	1.33	-----	0.00	0.00	0.37
28-Jun	0.00	0.00	0.49	0.32	1.39	0.00	-----	-----	0.00	0.40
5-Jul	-----	0.00	0.69	0.43	0.00	0.00	-----	0.00	-----	0.48
12-Jul	0.00	0.00	0.95	0.39	0.00	0.00	-----	-----	0.00	0.46
19-Jul	0.00	0.00	0.81	0.59	0.00	0.00	-----	-----	-----	0.61
26-Jul	0.00	0.00	0.00	0.67	14.29	25.00	-----	0.00	0.00	0.72
2-Aug	0.00	6.67	0.00	0.78	16.67	0.00	-----	50.00	0.00	0.81
9-Aug	-----	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.30
16-Aug	-----	0.00	0.00	0.18	0.00	0.00	-----	0.00	0.00	0.17
23-Aug	0.00	-----	0.00	0.36	0.00	0.00	-----	8.33	0.00	0.40
30-Aug	-----	-----	0.00	0.91	20.00	16.67	-----	0.00	-----	1.41
6-Sep	-----	-----	25.00	0.00	0.00	0.00	-----	0.00	-----	1.30
13-Sep	-----	-----	0.00	0.00	0.00	0.00	-----	13.04	0.00	2.40
20-Sep	-----	-----	-----	0.00	-----	-----	-----	0.00	-----	0.00
27-Sep	-----	-----	-----	6.52	-----	-----	-----	0.00	-----	5.45
4-Oct	-----	-----	0.00	4.26	-----	0.00	-----	0.00	-----	4.00
11-Oct	-----	-----	0.00	3.33	-----	0.00	-----	0.00	-----	3.21
18-Oct	-----	-----	6.67	3.00	-----	0.00	-----	0.00	0.00	3.07
25-Oct	-----	-----	5.26	3.88	-----	0.00	-----	0.00	-----	3.89
1-Nov	-----	-----	3.70	4.39	-----	0.00	-----	5.88	-----	4.39
Total Exam	5,301	2,871	7,726	31,323	4,912	2,751	6	373	504	55,767
% Desc	0.98	0.59	0.45	0.93	0.79	1.38	0.00	1.88	0.60	0.87
Median	0.00	0.00	0.11	0.42	0.00	0.00	0.00	0.00	0.00	0.72

[1] Descaling figures do not include sample mortalities or fish examined for GBT.
[2] "-----" means species group not present in sample during this week.

Table 12. Annual body injury rates (%) for salmonids examined at Little Goose Dam, 2009-2012.

Years	Yearling Chinook Clipped	Yearling Chinook Unclip	Sub-yearling Chinook Clipped	Sub-yearling Chinook Unclip	Steelhead Clipped	Steelhead Unclip	Sockeye Clipped	Sockeye Unclip	Coho	Total
2009	0.2	0.3	0.2	0.2	0.3	0.3	0.0	1.2	0.3	0.2
2010	1.1	0.5	0.1	0.3	1.5	0.3	0.0	4.8	0.0	0.5
2011	0.7	1.4	0.6	1.7	1.9	1.8	0.0	3.6	0.9	1.5
2012	2.5	2.7	4.9	6.0	2.0	3.3	0.0	1.8	2.7	4.6

The highest percentage of disease was observed in unclipped steelhead followed by unclipped sub-yearling Chinook salmon. Sockeye and clipped coho had the lowest rates of disease from the condition subsample, but again, few of these fish occurred in the condition subsample. Nonetheless, they did not exhibit any signs of disease this season (Table 12).

Table 13 Percent of fish examined that were injured, had predation marks or had signs of disease by species and clip type at Little Goose Dam, 2012.

	Yearling Chinook		Sub-yearling Chinook		Steelhead		Coho		Sockeye		Total
	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip	
Injuries											
Head	0.0	0.0	0.0	0.1	0.2	0.3	0.0	0.4	0.0	0.0	<0.1
Eye	0.4	0.2	0.1	0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.1
Operculum	0.5	0.2	0.1	0.1	0.6	0.7	0.0	0.0	0.0	0.0	0.2
Body	0.2	0.2	0.1	0.1	0.2	0.7	0.0	0.4	0.0	0.0	0.2
Fin	1.5	2.3	4.7	5.8	1.0	1.5	0.0	1.9	0.0	1.8	4.1
Total Injury	2.5	2.7	4.9	6.0	2.0	3.3	0.0	2.7	0.0	1.8	4.6
Disease											
Fungus	0.2	0.2	<0.1	0.1	0.6	0.6	0.0	0.4	0.0	0.0	0.2
Columnaris	0.0	0.0	0.7	3.1	0.0	0.1	0.0	0.0	0.0	0.0	1.7
BKD	0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	<0.1
Parasites	0.4	0.9	0.8	0.9	0.8	5.8	0.0	0.4	0.0	0.0	1.1
Deformity	0.2	0.2	0.2	0.4	0.4	0.3	0.0	0.0	0.0	0.0	0.3
Disease Other	0.0	0.0	0.0	<0.1	<0.1	0.1	0.0	0.0	0.0	0.0	<0.1
Total Disease	0.8	1.3	1.6	4.5	1.9	6.9	0.0	0.8	0.0	0.0	3.3
Predation											
Bird	0.7	0.5	0.1	0.5	3.9	3.8	0.0	0.0	0.0	0.0	1.0
Fish	1.2	0.5	0.7	1.2	<0.1	0.2	0.0	0.0	0.0	0.0	0.9
Lamprey	<0.1	0.0	0.1	0.6	<0.1	0.2	0.0	0.0	0.0	0.0	0.4
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Predation	2.0	1.0	0.9	2.3	4.0	4.3	0.0	0.0	0.0	0.0	2.3
Other Condition											
Pop Eye	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	<0.1
Fin Hemorrhage	4.0	5.9	12.1	21.9	2.5	2.0	0.0	1.9	0.0	0.9	14.2
Pink Fin	6.4	5.7	14.9	32.1	7.3	10.6	0.0	3.8	0.0	1.3	21.2
Fin Discoloration	0.3	0.2	0.4	1.6	0.0	0.2	0.0	0.4	0.0	0.4	1.0
Eye Hemorrhage	0.4	0.4	0.1	<0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.1
Total Other	10.8	11.9	25.6	46.6	9.7	12.8	0.0	6.1	0.0	2.7	31.3
Total sample size	2,343	1,312	2,343	11,161	2,160	1,232	5	262	5	225	21,048

[1] Overall disease and injury rates are less than the sum of the individual categories because some individual fish had more than one injury or disease.

In accordance with SMP protocols bite marks indicative of predation attempts were recorded. We observed bite marks on a total of 474 individual fish or 2.3% of the 21,048 smolts examined for condition in 2012. We did not observe any smolts with multiple predation marks in 2012. The majority of the bite marks on smolts were bird bites at 44.3%, followed by fish bites (40.3%) and lamprey bites (15.4%). We did not observe any other bite marks, such as those left by a mink or river otter. Steelhead had the highest prevalence of bite marks, followed by unclipped yearling Chinook (Table 13). The highest occurrence of bird bite marks were on steelhead (Table 14). Bird bite observations on steelhead were most prevalent in May and June. No bite marks were observed on coho and sockeye.

Table 14. Annual bird bite rates (%) for salmonids examined at Little Goose Dam, 2007-2012.

	Yearling Chinook		Sub-yearling Chinook		Steelhead		Sockeye		Coho	
Year	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip	Clipped	Unclip		Total
2007	0.1	0.1	0.0	0.2	7.3	5.1	0.0	0.0	0.6	2.5
2008	0.8	0.5	0.0	0.4	4.4	3.2	1.9	0.6	1.7	1.2
2009	0.9	0.4	0.3	0.3	2.5	2.9	0.0	0.4	1.0	0.9
2010	0.8	0.0	0.5	0.2	3.0	2.7	0.0	0.0	0.7	0.7
2011	0.8	0.3	0.1	0.5	2.4	2.3	0.0	1.8	0.0	0.7
2012	0.7	0.5	0.1	0.5	3.9	3.8	0.0	0.0	0.0	1.0

Note- From 2006-2011, rates include only those fish in the sample that were examined for condition

The Other Conditions category included pop eye (exopthalmos), hemorrhaged fin, pink fin, discolored fin, and hemorrhaged eye. We recorded a total of 7,683 individual observations of other conditions. Approximately 31.3% of smolts in the condition subsample exhibited signs of this injury type (Table 13). Many smolts that we examined had multiple conditions in this group. For example, pink and hemorrhaged fins often occurred on the same individual fish though in different fins. Pink fins constituted the majority of the total other conditions observations at 58.1%, followed by hemorrhaged fin(s) (38.8%), fin discoloration (2.6%), eye hemorrhage (0.4%), and exopthalmos (0.1%). Sub-yearling Chinook had the highest individual rates of other conditions (Table 13).

Mortality

Mortality at the JFF included fish that entered the juvenile fish collection system dead as well as those that died at the facility. Mortality was recorded by location within the facility and was divided into total facility mortality (raceways, separator and sample) and sample mortality.

The rate of total facility mortality for salmonids was low this year at 0.06% from a total collection of 3,216,218 salmonids (Table 15). Mortality peaked on May 5 with 78 smolts and remained elevated for the following two days. Cause for the increase in mortality was not immediately apparent. Peak smolt collections occurred five days earlier and river discharge peaked seven days earlier (Figure 1). High flows with increased debris may have contributed to mortality. Daily mortality rates are provided in Appendix Table 2.

Table 15 Annual total facility mortality as a percentage of total collection at LGS JFF 2007-2012.

	Yearling Chinook		Sub-yearling Chinook		Steelhead		Sockeye		Coho		Pacific lamprey	
Year	Clip	Unclip	Clip	Unclip	Clip	Unclip	Clip	Unclip		Total	Ammocoete	Macropthalmia
2007	<0.1	0.1	0.1	0.1	<0.1	<0.1	0.1	0.4	<0.1	<0.1	-----	-----
2008	0.2	0.2	0.2	0.3	<0.1	<0.1	<0.1	0.6	<0.1	0.1	-----	-----
2009	<0.1	0.1	0.8	0.7	<0.1	<0.1	<0.1	0.3	<0.1	0.2	-----	-----
2010	<0.1	<0.1	0.8	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	-----	-----
2011	0.1	0.1	0.5	0.6	<0.1	<0.1	0.1	0.7	<0.1	0.2	0.7	0.2
2012	<0.1	<0.1	0.1	0.2	<0.1	<0.1	0.0	<0.1	0.0	<0.1	0.5	0.3

Note: Mortality rate for collected fish includes sample, raceway, and separator mortalities. Lamprey numbers are not included in totals.

The average weekly total facility mortality rate in 2012 ranged from less than 0.1% to 3.0%. The minimum rates of less than 0.1% occurred frequently during the months of April and May when mortalities that occurred represented a small proportion of the total collection.

Increased mortality rates occurred later in the season when collection numbers decreased and descaling, disease and injury rates increased. The maximum weekly mortality rate of 3.0% occurred during the week ending August 30 from a total weekly collection of 372 fish.

Beginning in 2011, all SMP sites were directed to report juvenile lamprey collections in more detail. Juvenile lamprey were enumerated as part of the daily sample. Sample numbers were expanded and added to totals from separator cleanouts to obtain a collection total. The number of Pacific lamprey sampled plus separator releases totaled 101 ammocoetes and 376 macropthalmia. These numbers expanded to an estimated season total of 1,903 Pacific lamprey ammocoetes, and 4,749 Pacific lamprey macropthalmia.

Lamprey numbers are not included in the overall salmonid mortality data in this report, but have been added to the mortality table (Table 15). The pacific lamprey ammocoete total mortality rate was 0.5% and pacific lamprey macropthalmia was 0.3%. We did not observe any notable peak in total facility mortality for either life stage of juvenile Pacific lamprey in 2012.

Incidental Species

The total incidental fish collection was determined by using the sample rate to expand the number of incidental fish in the sample and adding the number of incidental fish removed from the separator to the expanded sample count.

Incidental species were counted individually, except when handling large numbers of juvenile fish, such as american shad *Alosa sapidissima*, or siberian prawns *Exopalaemon modestus*. When the number of juvenile fish was too large to practically count each individual, a fish per gram calculation, which was obtained weekly for these species, was multiplied by the weight of the sampled species. All sampled incidental fish were returned to the river except for Siberian prawns. On 24 July 2007, Washington Department of Fish and Wildlife requested that all Siberian prawns encountered in the sample be euthanized and ODFW SMP biologists continued this practice during the 2012 fish passage season. All Siberian prawns were frozen and returned to the river at the end of the fish passage season

When the sample rate was less than 100%, incidental species collected were inadvertently transported along with the smolts. Therefore, incidental fish species were weighed and the average weight was applied to the expanded sample count to determine their contribution to transport loading densities.

The total incidental collection count in 2012 was 56,265 fish and crustaceans (Table 16). This total was 10.3% lower than 2011 and the lowest incidental count of the past five years. The majority of incidental fish and crustaceans collected were Siberian Prawns at 41.2%, juvenile shad 26.0%, macropthalmia and ammocoete stage pacific lamprey *Lampetra tridentate* 11.8%, smallmouth bass *Micropterus dolomieui* 4.3%, sandrollers *Percopsis transmontana* 4.3%, and sculpin *Cottus sp.* at 3.1%.

Table 16. Numbers of incidental species collected at Little Goose Dam JFF, 2008-2012

Common Name	Scientific Name	2008	2009	2010	2011	2012
American shad	*Alosa sapidissima*	69,925	25,388	18,803	2,122	14,614
Banded Killifish	*Fundus diaphanous*	13	17	213	14	61
Bass-Smallmouth	*Micropterus dolomieu*	15,503	5,092	4,150	3,691	2,442
Bass-Largemouth	*M. salmoides*	7	32	3	7	6
Bullhead	*Amierus sp.*	107	374	323	390	511
Bull trout	*Salvelinus confluentus*	5	5	9	7	2
Channel Catfish	*Ictalurus punctatus*	389	618	369	235	353
Chiselmouth	*Acrocheilus alutaceus*	13	15	14	72	2
Common carp	*Cyprinus carpio*	113	145	722	294	139
Crappie	*Pomoxis sp.*	363	1,076	318	86	687
Dace	*Rhinichthys sp.*	12	10	29	24	12
Goldfish	*Carassius auratus*	0	0	1	0	0
Kokanee	*Oncorhynchus nerka*	1	14	0	55	0
Lamprey Adult-Pacific	*L. tridentate*	144	125	11	63	32
Lamprey Ammocoete-Pacific	*L. tridentate*	1,839	5,126	1,650	6,584[1]	1,903
Lamprey Macropthalmia-Pacific	*L. tridentate*	12,532	88,415	57,802	11,108	4,749
Mountain Whitefish	*Prosopium williamsoni*	1,502	1,940	5,614	3,850	697
Northerrn Pikeminnow	*Ptychocheilus oregonensis*	61	565	73	72	52
Peamouth	*Mylocheilus caurinus*	1,820	2,798	6,057	7,631	1,077
Rainbow Trout	*O. mykiss*	112	17	99	12	2
Redside Shiner	*Richardsonius balteatus*	0	0	0	0	0
Sandroller	*Percopsis transmontana*	3,877	4,124	24,260	7,591	2,452
Sculpin	*Cottus sp.*	1,126	3,733	2,062	996	1,732
Siberian Prawn	*Exopalaemon modestus*	5,213	6,327	38,676	15,743	23,183
Sucker	*Catostomus sp.*	1,433	2,413	1,820	1,760	882
Sunfish[2]	*Lepomis sp.*	544	585	239	218	602
Tadpole Madtom	*Noturus gyrinus*	3	1	2	0	8
Walleye	*Stizostedion vitreum*	32	19	20	8	7
White Sturgeon	*Acipenser transmontanus*	10	5	11	12	15
Yellow Perch	*Perca flavescens*	28	46	14	55	43
Other		4	311	11	2	0
Total		116,731	149,336	163,375	62,702	56,265

Note- Numbers include expanded sample counts and separator releases

[1] Of the 6,584 ammocoetes collected in 2011, approximately 1,806 fish were not identified to species but were called Pacific lamprey based on the species composition of the sample.

[2] Sunfish include bluegill/pumpkinseed and warmouth.

Research

Gas Bubble Trauma Monitoring

Biological technicians from the Washington Department of Fish and Wildlife (WDFW) examined juvenile salmonids for the presence of gas bubble trauma (GBT). When fish numbers permitted, a maximum of 100 fish were sampled. Sampling occurred weekly, on Mondays, from April 9 to August 13, 2012. Sampling was designed to determine the relative proportion of migrating juvenile salmonids passing the dam that exhibited symptoms of GBT in the unpaired fins and eye.

A total of 1,715 smolts were examined for GBT in 2012. Of the fish examined, 37.1% were yearling Chinook salmon, 33.5% were sub-yearling Chinook salmon and 29.4% were

steelhead smolts. The total GBT rate for the 2012 season was 0.2%, considerably less than last year's rate of 1.2%, from a total sample size of 1,772 smolts. The majority of the GBT sample this year consisted of clipped smolts, with an overall trauma rate of 0.2% of 984 clipped fish examined, compared to unclipped smolts, with a rate of 0.1% of 731 unclipped fish examined. By comparison, last year the GBT sample was equally comprised of clipped and unclipped smolts and unclipped smolts exhibited a higher trauma rate than clipped smolts. Of all the smolts examined for GBT in 2012, unclipped sub-yearling Chinook and clipped steelhead exhibited the highest rates of gas trauma, each with a rate of 0.3% followed by clipped yearling Chinook with trauma rate of 0.2%. With the exception of 2011, when sub-yearling Chinook had the highest rate of gas trauma, steelhead have typically shown higher rates of gas trauma than any other smolt group in recent years.

Positive signs of gas bubble trauma were first detected on May 7 at a rate of 1.0% from 100 fish examined. The next positive was observed on May 21 at a rate of 1.0% from a sample size of 100 smolts and lastly, trauma was observed on July 9 at 1.2% from a sample size of 84 smolts. All three individual cases of gas bubble trauma in 2012 were mild with a ranking of 1 (1-5% bubble coverage of body region). The trauma occurred in the anal fin on two fish and the dorsal fin of the third fish. The mortality rate for GBT sampling this year was low at 0.2%.

Multi-Dam Performance Study of Juvenile Salmonid Passage and Survival Using Acoustic Telemetry

The purpose of this research was to conduct survival and dam passage studies to evaluate performance standards for yearling and sub-yearling Chinook salmon and juvenile steelhead through the lower Snake River dams. The project was initiated to support the 2008 FCRPS Biological Opinion RPA 52 (NOAA Fisheries 2008, NOAA Fisheries 2010) and the Memorandum of Agreement between the Treaty Tribes and Treaty Tribes-Action Agencies. This research project was performed by Battelle-Pacific Northwest Division, Pacific Northwest National Laboratory (PNNL).

Juvenile fish were collected at the Lower Monumental (LMN) Juvenile Fish Facility and were surgically implanted with both acoustic transmitters and passive integrated transponder (PIT) tags. Tagged fish were released at five locations within the study area, from upstream of LGS to below LMN. There were 33 acoustic receivers (hydrophones) deployed to track tagged fish at LGS. These hydrophones were deployed at turbine units, spillbays, and at the fish ladder exit. Fish release occurred from late April through mid July. Tracking, monitoring, data analysis and reporting occurred from late April through mid December.

NOAA Salmonid Riverine Survival

The separation by code diversion tank located at the JFF was not utilized by NOAA Fisheries personnel in 2012. The diversion system had previously been in operation for eleven consecutive seasons, targeting PIT tagged wild Snake River spring/summer Chinook salmon smolts. Data collected on diverted smolts were used to establish baseline information on natal stream productivity and the relationship between growth rates and parr-to-smolt survival.

The installation of the full flow PIT tag array in the bypass flume discontinued secondary bypass in favor for primary bypass operations through the month of April. This presented a lost opportunity for sort by code data collection. Consequently, NOAA researchers decided to

conduct sampling at Lower Granite Dam which operates in secondary bypass operations during this early season non-transport period.

Miscellaneous Monitoring

Zebra Mussel Monitoring

As in previous years, COE biologists continued to monitor the facility for zebra mussel *Dreissena polymorpha* infestation. The zebra mussel monitor is a piece of concrete suspended in the adult fish ladder near the ladder exit. No zebra mussels were observed during 2012.

Turbine Strainers

The USACE continued to monitor turbine unit strainers for the second consecutive year at Little Goose Dam. Strainers are located in the piping associated with the cooling water intake valve to each of the six turbine units. For the most part, strainers were inspected weekly for any fish entrapment, particularly juvenile lamprey and salmonids. The peak outmigration of juvenile lamprey appears to have occurred prior to collection for transport during the early season high freshet from March 1 through May 3. During this time 399 of the yearly total of 500 lamprey were collected from turbine unit strainers. Most of the 500 lamprey removed from the strainers were mortalities. The peak strainer collection of salmonids occurred between April 10 and May 9 when 29 of the yearly total of 42 salmonids were removed. All salmonid were mortalities. This strainer peak coincides with the collection peak period (Table 3).

Avian Predation Monitoring

Avian activity has been monitored and recorded at Little Goose Dam for many years. New bird protocols involving documenting bird behavior were established by the USACE Portland District, Bonneville Dam Fisheries Field Unit and implemented in 2012. Six specific zones were designated at the project to document bird observation locations and specific bird behavior including loafing/resting (on land or water), flyby, scavenging and predating. A total of nine bird species were of interest including, American white pelican, bald eagle, Caspian tern, double crested cormorant, great blue heron, grebe spp., merganser spp., osprey, and seagull spp.

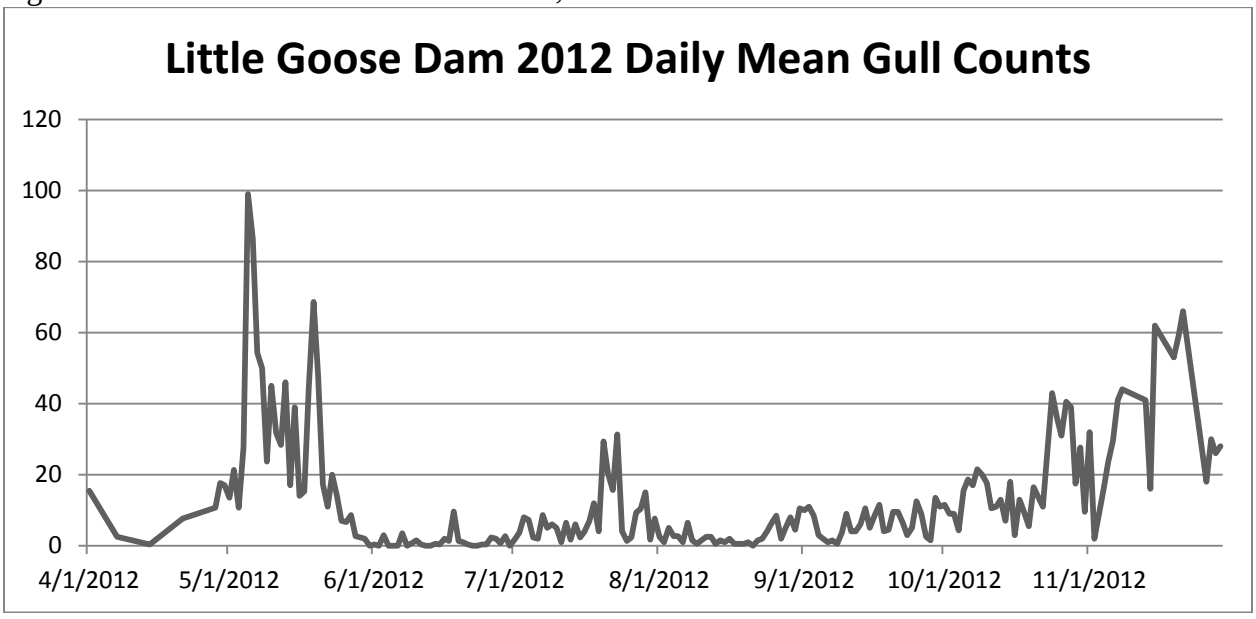
COE and ODFW personnel conducted avian surveys daily from April 1 through November 30. It was not required that the surveys be conducted at the same time, however, surveys were typically conducted early morning, mid day and mid afternoon during juvenile fishway inspections

The Fisheries Field Unit provided on-going training throughout the season to USACE and ODFW personnel. One of the main goals of the avian data collection process is to standardize bird survey methodologies amongst the eight FCRPS (Federal Columbia River Power System) hydro-projects and record the data in an interactive web and mobile data Portal. Survey results were entered into the new web/mobile data portal and results can be found at http://nwpnwwavian.rtrdatacloud.com/.

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 2012, APHIS bird hazing activities at Little Goose took place from April 2 through June 14. Gulls (*Larus spp.*) were observed throughout the entire year with the peak period recorded between May 2 and May 20 (Figure 2). This peak period occurred during hazing activities and counts approached 100 on May 5th. Beginning in September, gull numbers increased gradually in response to out-migrating juvenile shad.

Figure 2. Gull Counts at Little Goose Dam, 2012.



Double Crested Cormorants (*Phalacrocorax auritus)* numbers continued to be lower in 2012. Cormorants were observed throughout the year with 10 or less counted during surveys through July. Beginning in August, through the remainder of the season, cormorant counts increased to 20 or less. The increase appears to be in response to out-migration of juvenile shad. The majority of cormorants were counted within the area one half mile upstream and downstream of the dam. These numbers are far less than the 100 to 200 observed during prior years (2005-2008) during the same period. The decline from 2009 through 2011 may be the result of lethal take for research purposes. Approximately 45 Cormorants were taken in the fall/winter of 2007-08 and 2008-09.

American White Pelicans (*Pelecanus erythrorhynchos*) were again observed in 2012. Up to 13 pelicans were observed during counting surveys. In general, pelicans were observed from April to September but were most predominant in May and June with survey observations on 40 of the 60 days. Most counts ranged between 1 and 5 pelicans and the birds were mostly observed along the tailrace north shore area.

Other piscivorous bird species observed during the 2012 season include Western Grebes (*Aechmophorus occidentalis*) Belted Kingfisher (Ceryle alcyon) and Caspian Terns (*Sterna caspia*), Osprey (Pandion haliaetus**)** and Bald Eagle (Haliaeetus leucocephalus).

Facility Operations & Maintenance

Forebay Debris/Trashracks

Estimates of debris volume and location in the forebay were recorded daily during fishway inspections. Moderate accumulations of woody debris were present in the Little Goose forebay beginning in April and extending through July. The maximum amount of surface debris was reported on April 06 and measured approximately 4,800 square feet. The trash rack rake was repaired in 2012. A total of 457 cubic yards of woody debris was removed from trashracks and the water surface using the trash rack rake.

Spillway Weir

The spillway weir (SW) was placed into operation on April 3 in the low crest (618 ft. msl) position. Problems did arise during installation of the weir due to woody debris interfering with bulkhead placement. A special spill was performed to remove the debris to complete the installation. On May 31, the weir was changed to the high crest (622 ft. msl) position. On August 6, river discharge dropped below 35 kcfs and 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 2012, there were two reportable deviations, one on August 18 lasting 20 minutes and the second September 24 lasting 6.5 hours.

There were numerous scheduled and unscheduled turbine unit outages in 2012. Short term outages, less than 24 hours in duration were required to perform minor maintenance repairs, fish passage inspections and debris removal. Long term outages, greater than 24 hours are listed below.

Unit #1.
Planned outage starting on 6 February, 177 hours for install of Remedial Action Scheme (RAS) fiber optic cable

Unit #2.
1) Forced outage starting on 11 January, 35 hours in duration for exciter problems.
2) Planned outage starting on 6 February, 177 hours for install of RAS fiber optic cable
3) Forced outage on 1 June, 89 hours to repair head cover pumps
4) Forced outage on September 30 through December 31 for field ground problems coupled with planned outage for annual maintenance

Unit #3.
1) Planned outage occurred on 6 February, 177 hours for install of RAS fiber optic cable
2) Planned outage on 4 September, 269 hours for annual maintenance.
3) Forced outage on 27 October, 106 hours for governor control problems.
4) Forced outage on 13 November, 32 hours for governor control problems.
5) Planned outage on November 15 through December 31, exciter replacement and governor repair.

Unit #4.
1) Planned outage starting on 6 February, 177 hours for install of RAS fiber optic cable
2) Planned outage on 23 July, 1,614 hours, annual maintenance and exciter replacement

Unit#5.
1) Planned outage on 3 January, 81 hours for inspection.
2) Planned outage starting on 6 February, 177 hours for install of RAS fiber optic cable
3) Forced outage on 3 May, 42 hours for field grounding errors.
4) Planned outage on 7 August, 226 hours for annual maintenance.
5) Planned outage on 27 August, 87 hours for T2 Doble testing.
6) Planned outage on 1 October, 1,012 hours for exciter replacement.
7) Forced outage on 25 November, 131 hours for exciter failure.

Unit#6.
1) Forced outage continued 1 January, 669 hours to repair speed motor.
2) Forced outage on 29 January, 32 hours for field grounding issues.
3) Planned outage on 6 February, 177 hours for install of RAS fiber optic cable.
4) Planned/Forced outages on 30 June, 2,061 hours, exciter replacement, annuals, doble testing and exciter failures.
5) Forced outage on 28 October, 66 hours for exciter failure.
6) Forced outage on 5 December, 34 hours, exciter failure.
7) Forced outage on 10 – 17 December, intermittent exciter failure.

Extended-Length Submersible Bar Screens (ESBS)

In general, all ESBS performed satisfactorily without any notable discrepancies with the exception of the occasional cleaning brush that traveled past its set limit and had to be reset. Drawdown inspections across trashracks and ESBS/VBS were performed according to the FPP. All drawdown inspection measurements were within criteria throughout the season. Video inspections and manual operation inspections showed all screens to be operated within criteria throughout the fish passage season. All ESBS were observed to be in good clean operating condition after the fish passage season when placed in the raised position for winter maintenance.

Vertical Barrier Screens (VBS)

Scheduled inspections of the VBS were performed by underwater video camera on May 9 and 10. All inspections showed VBS in good operating condition. No other inspections were performed as a result of damage to the camera that kept it out of service through the remainder of the year.

Gatewells

Gatewells were checked for debris and oil contamination daily. As needed, debris was removed using a dip basket or grappling hook. In 2012, observation of minor oil traces was less than those in previous years. The source of the oil traces may be 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 1 to 3 times per 10 hour shift. Additional inspections and back flushing was performed in response to increased debris. Full-time night shifts were added when needed to operate and back-flush orifices to clear and prevent debris blockages. All orifice operations were manually performed throughout the year.

The orifices and collection channel were dewatered and removed from service on December 17. Fish salvage operations during the dewatering included releasing unharmed back to the river 50 adult steelhead, 250 juvenile lamprey (macropthalmia) 3 sculpins and 1 northern pikeminnow. Mortalities included 2 juvenile Chinook, 5 juvenile shad and 20 juvenile lamprey (macropthalmia) found the next day in the cleaning brush chain drive tracks.

Primary Dewaterer/Primary Bypass Pipe

The primary dewatering structure and components, for the most part, functioned adequately throughout the season. The upstream cleaning brush received major damage to the drive shaft and cleaning brush mount bracket during manual operation on November 4. It was unclear whether this was due to debris blockage or fatigue of the equipment itself. The failed brush and components did not interfere with safe passage of fish and remained in place until the end of the fish passage season. Repairs will be performed during the in-water season. 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.

The Primary bypass pipe terminal section located in the tailrace has broken loose from its support. This section of the pipe is being supported by two saddles that were installed in 2004. The saddle support design replaced a cable and collar support that failed at that time. One of the saddles was installed upside down to where the load was being supported by the u-bolts and flange instead of by the saddle. As a result, one side of the u-bolts has sheared off, and the other side is supporting the pipe with only three u-bolts intact. The outfall pipe support is in need of immediate attention before the remaining three U-bolts shear off the saddle causing the pipe to dislocate and fall to the bottom of the river.

Flume

The primary bypass flume functioned satisfactorily in 2012. 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. There were several minor spots of corrosion that were repaired.

Separator

The separator was operated similar to previous years. The water level was kept about 1 to 2 inches above the downstream end of the B-side separator bars. During the winter maintenance period, the interior and exterior surfaces of the separator were cleaned and refurbished.

Sample/PIT Tag System

The passive integrated transponder (PIT) tag controls, sensors, electronics, transmission and data analysis associated with diversion gates and sample gates were installed, monitored and serviced by the Pacific States Marine Fisheries Commission (PSMFC). Project COE personnel service and perform maintenance on hardware components. At Little Goose Dam, there are 11 PIT tag monitors located throughout the collection system. In 2012 the PIT-tag system performance and reliability was very good.

The sample gates are controlled by a Programmable Logic Controller (PLC) located near the "B" side sample gate. The PLC is accessed by a Panel View 600 (PV600) menu driven touch screen operator interface to control functions of the sample gates. In addition, there are overriding manual control switches to change operating modes of both sample gates and PIT-tag diversion gates. One mode of operation for the diversion gate is known as "Divert During Sample" (DDS).

At low sample rates ($\leq$20%), when large numbers of fish are passing through the system, the DDS setting is deactivated and turned to the "Off" position. 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 targeted PIT tagged fish, away from the sample during a sampling event. At sample rates greater than or equal to 20%, (low numbers of fish), the potential for sample bias is lower and the DDS system is set to "On" or activated. The DDS modes were changed by project biologists based on fish passage and sample rates. Changes typically occurred in the morning at approximately 0700 hours in correlation with the start of the new 24 hour sample day.

According to the PTAGIS event log, two minor deviations from the recommended settings occurred this year, both were less than 15 minutes and did not affect fish estimation numbers. Minor deviations that occurred during split sample changes, separator cleanouts and/or power outages were not included in these estimates. An automated log of state changes to the system, trouble reports and power outages affecting the PIT tag interrogation equipment in 2012 can be obtained at www.ptoccentral.org.

PIT Tag Detections

The PTAGIS database categorized all PIT tag detections based upon species, race, and clip type/rearing disposition. An additional "orphan" category was used for detections of PIT tagged fish for which the database contained no record of tagging and release. Data 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. The unknown category included final detections at locations that did not constitute an exit.

From April 1 through October 31, a total of 247,769 PIT tagged salmonids were detected within the juvenile collection/bypass system: 161,605 Chinook salmon, 1,593 coho salmon, 74,257 steelhead, 9,441 sockeye, and 873 orphans. Of this total, 84,247 smolts, or 34.0%, were routed to the river, 2,855 smolts, or 1.2%, were routed to the sample, 65,222 smolts, or 26.3%, were routed to transport areas and 95,445 smolts, or 38.5%, had unknown disposition as they were last detected at locations that did not constitute an exit from the facility. PIT tagged smolts 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 to a transport holding area when the facility operated in collection mode.

Barge Loading Operations

Barge loading and transport operations occurred from May 4 through August 16. All fish loading operations at LGS were performed satisfactorily. Two incidents involving barge maneuvering occurred. The first on May 22 when the barge was being positioned into mooring it struck the dock hard causing damage to the concrete flat top, side wall and timbers. The second occurred on 26, when the incoming tug and barge pushed hard against moored barge causing excessive pull on the floating mooring bits and causing a stern deadhead (cable hold) to part and fly through the air into the water.

Truck Loading Operations

Truck loading and transport operations occurred on alternate days from August 16 to October 1. From September 5 through October 7, due to low collection numbers, Lower Granite Fish Facility trucked Little Goose Fish. This "piggyback" operation delayed transport time for those fish transported from Lower Granite by approximately one hour. No problems were reported regarding piggyback operations. Little Goose resumed truck transport October 9 to October 31 as fish collections numbers increased. Fish transported by truck from Little Goose were transported in a mild saline solution of 1 mg/L to reduce stress and treat columnaris disease.

Facility Modifications

Several modifications were made prior to, during and after the 2012 season.

1. Pacific States Marine Fisheries Counsel updated PIT-tag software
2. Installed two air release valves, one at the raceway drain water hammer pipe and one at top of facility drain system under the adult fish release trough
3. Welded the B-side flume divider to remove the underside gap and prevent impingement and or escapement of small fish
4. Replaced flume shut-off gate at the primary dewater exit with new reinforced gate and screw gear operator
5. Installed expansion couplers on PIT tag fish routing pipe to allow for expansion and contraction thus preventing the pipe from parting and damage caused by rubbing

6. Replaced corroded air cylinder shafts on nine orifice valves
7. Replaced five staff gauges
8. Replaced the seal on the flume main switch gate
9. Installed 16 new 4" water supply valves at the JFF
10. Replaced the barge loading boom PVC slide coupler with an aluminum slide coupler
11. Rebuilt the hydraulic lift cylinder and upgraded hydraulic hoses and hose tenders
12. Rebuilt the adult fish release routing pipe and exit
13. Installed new countertop in technician control building

Recommendations

1. Install an automated electronic DDS mode change to prevent sampling and diversion errors
2. Continue to remove scale and rough edges in the facility flumes, tanks, and transition areas
3. Continue to write revisions and updates to the operations maintenance manual pertaining to new equipment and facility collection and transport procedures
4. Repair the emergency fish bypass/drain pipe outfall section. Install air and vaccumn release valves to prevent back blow of the drain system.
5. Continue to rebuild orifice valve cylinders.
6. Replace in-line air control 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.

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