

**Priest Rapids Project
Adult Fishways Improvements
Annual Report 2007**

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Prepared for
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December 2007

Executive Summary

On May 3, 2004, the National Marine Fisheries Service (NMFS - then referred to as NOAA Fisheries) issued its Biological Opinion of the effects (Biological Opinion) of the proposed action on listed species, in accordance with Section 7 of the Endangered Species Act of 1973 as amended (16 USC 1531 et seq.), regarding the Federal Energy Regulatory Commission's proposed action amending Public Utility District No. 2 of Grant County's (Grant PUD's) existing license for the Priest Rapids Hydroelectric Project (Project) to authorize implementation of an Interim Protection Plan for listed anadromous salmonids.

Reasonable and Prudent Alternative (RPA) Action 23 of the Biological Opinion (Priest Rapids Project Adult Fishway Improvements) requires Grant PUD to:

... investigate methods for improving hydraulic conditions in the Priest Rapids Project fishway collection channel, junction pool, and entrance pools. Assessment shall begin within 6 months of issuance of this Opinion and, if feasible, improvements will be implemented during the following season's ladder outage period. Schedule, design, and implementation shall be undertaken in consultation with the Priest Rapids Coordinating Committee and subject to NOAA Fisheries' approval.

The objective of this action is to provide effective fishway debris management, powerhouse collection channel velocities between 1.5 and 4.0 ft per second, and 1 to 1.5 ft of head across the fishway entrances for all modes of fishway operation. Recent changes in fishway operation make it possible that the collection channel junction pool objective may already be achieved. Minimally, velocity meter(s) shall be installed in easily observable locations that provide a reasonable representation of the average collection channel velocity at the Junction Pool.

Wanapum Dam's fishways have historically operated consistently within approved criteria. Priest Rapids Dam's fishways have historically borne operational challenges, namely insufficient water velocities through the collection channel. This report focuses on actions taken by Grant PUD in 2006 and in 2007 to improve Priest Rapids Dam's collection channel water velocities.

Through the manipulation of a weir at the left-bank fishway entrance in order to redistribute water within the lower fishway, Grant PUD has since 2005 effectively maintained the Priest Rapids Dam collection channel water velocity within criteria. Grant PUD will continue to operate the left-bank entrance weir in a manner that will maintain entrance differential and water velocity within set criteria, and will continue to maintain and operate the collection channel water velocity meter.

This annual report provides information describing improvements implemented at adult fishways at Wanapum and Priest Rapids dams in 2006 and 2007, as well as planned future operations.

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1.0 Introduction

Public Utility District No. 2 of Grant County, Washington (Grant PUD) owns and operates the Priest Rapids Hydroelectric Project (Project) located downstream of Vantage, WA along the Columbia River, which includes Wanapum and Priest Rapids dams. On May 3, 2004, the National Marine Fisheries Service (NMFS - then referred to as NOAA Fisheries) issued its Biological Opinion of the effects (Biological Opinion) of the proposed action on listed species, in accordance with Section 7 of the Endangered Species Act of 1973 as amended (16 USC 1531 et seq.), regarding the Federal Energy Regulatory Commission's proposed action amending Grant PUD's existing license for the Project to authorize implementation of an Interim Protection Plan for listed anadromous salmonids.

Reasonable and Prudent Alternative (RPA) Action 23 of the Biological Opinion (Priest Rapids Project Adult Fishway Improvements) requires Grant PUD to:

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Wanapum Dam fishways have historically operated consistently within approved criteria. The fishways at Priest Rapids Dam, however, have historically borne operational challenges, namely insufficient water velocities through the collection channel. This report focuses on actions taken by Grant PUD in 2006 and in 2007 to improve upon Priest Rapids Dam fishway collection channel water velocities.

1.1 Priest Rapids Dam Fishways Description

The east-bank adult fishway is the most complex of the two adult fishways at Priest Rapids Dam. It consists of a collection channel with one slotted entrance (LSE-2), a junction pool with one slotted entrance (LSE-4), a fish ladder with both overflow and submerged-orifice weirs, and an auxiliary-water supply pool (AWSP). The auxiliary water is provided via a gravity-intake gate (GIG) which draws water from the forebay on the east end of the monolith. The GIG and east-bank AWSP provide make-up water for both the east-bank lower fishway diffusion chambers and the west-bank AWSP. Make-up water for the upper fishway diffusion chambers is gravity-fed from the forebay via automated valves (LV-33 on the east, RV-9 on the west).

A cross-conduit traverses the toe of the monolith from the east-bank AWSP to the west-bank AWSP. This conduit provides water to the west-bank AWSP, which in turn supplies make-up

water to the diffusion chambers in the lower west-bank fishway. The west-bank fishway consists of one slotted entrance (RSE-1) and a fish ladder with both overflow and submerged-orifice weirs (Appendix A).

1.2 Wanapum Dam Fishways Description

Unlike the adult fishways at Priest Rapids Dam, the two fishways at Wanapum Dam operate independently of each other. The east-bank design consists of a collection channel along the length of the powerhouse with one slotted entrance (SE-3), an entrance channel with one slotted entrance (SE-2), a junction pool where the collection channel and entrance channel meet, an AWSP that provides make-up water for the lower ladder, and a fish ladder with both overflow and submerged-orifice weirs. Make-up water for the upper ladder is gravity fed from the forebay via an automated valve (LV-7). Make-up water for the mid-ladder is pumped to those diffusion chambers. (Note: SE-3 was moved from the west, terminal end of the collection channel to the location of the old orifice gate, OG-20, during the winter maintenance outage of 2004-2005. This was done to facilitate accessibility to fish upon completion of the Wanapum Future Unit Fish Bypass project.

The west-bank fishway consists of one slotted entrance (RSE-2), an AWSP that provides make-up water to the lower diffusion chambers, and a fish ladder with both overflow and submerged-orifice weirs. Make-up water for the upper ladder is gravity fed from the forebay via an automated valve (LV-9; Appendix B).

2.0 Standard Operating Criteria

Specific operating criteria must be maintained within the fishways during fish-passage season. These criteria are outlined in Table 1 and Table 2. A representative from the Fish Passage Center (FPC) or NOAA Fisheries performed monthly inspections of the fishways at Priest Rapids and Wanapum dams during the 2007 fish-passage season, April through November. During these inspections the representative spot-checked each point outlined on the inspection reports found in Appendix C and Appendix D. All the inspection reports from 2007 are included in these appendices. At the discretion of the FPC and NOAA Fisheries no fishway inspections were conducted in October 2007.

Table 1 Inspection Points and Operating Criteria for Priest Rapids Dam Fishways.

Inspection Point	Target	Required Criteria Range
LSE-4	1.5 ft. differential	1.0 – 2.0 ft. differential
LSE-2	1.2 ft. differential	1.0 – 2.0 ft. differential
RSE-1	1.5 ft. differential	1.0 – 2.0 ft. differential
Depths over ladder weirs	N/A	1.0 – 1.2 ft. differential
Collection channel velocity	2.0 ft./sec.	1.5 – 4.0 ft./sec.

Table 2 Inspection Points and Operating Criteria for Wanapum Dam Fishways.

Inspection Point	Target	Required Criteria Range
SE-3	1.5 ft. differential	1.0 – 2.0 ft. differential
SE-2	1.5 ft. differential	1.0 – 2.0 ft. differential
RSE-2	1.5 ft. differential	1.0 – 2.0 ft. differential
Depths over ladder weirs	N/A	1.0 – 1.2 ft. differential
Collection channel velocity	2.0 ft./sec.	1.5 – 4.0 ft./sec.

3.0 Actions Taken at Priest Rapids Dam, 2005 - 2006

Historically, the primary concern with fishway operations at Priest Rapids Dam has related to low water velocities through the collection channel. This is due, in part, to the installation of a slotted-entrance gate (LSE-4) in the left entrance weir-4 (LEW-4) slot on the east bank, designed to improve the entrance channel/tailwater differential. Operators have struggled with operating LEW-4 within differential criteria during low tailwater conditions. The installation of the slotted entrance alleviated this problem and allowed for reduced maintenance outage periods, as LEW-4 has no moving parts to repair or replace. However, LSE-4 requires significantly more flow than the old LEW-4/LEW-5 tandem-gate system (Figure 1). This results in reduced water flow through the collection channel, thereby reducing water velocities through the collection channel. LSE-4 was installed during the winter maintenance outage of 1998-1999 (Figure 2).



Figure 1 LSE-4 at Priest Rapids Dam, Columbia River mile 397.1, Washington, USA.



Figure 2 LSE-4 installation at Priest Rapids Dam, Columbia River mile 397.1, Washington, USA, winter 1998-1999.

3.1 2005

With the approval of NOAA Fisheries, Grant PUD test-operated the existing LEW-5 gate immediately upstream of LSE-4 in the spring of 2007 in an attempt to reduce the volume of water exiting LSE-4 and to force more water around the corner of the junction pool and into the collection channel. LEW-5 was raised to levels that maintained the LSE-4 target differential, while forcing more water into the collection channel. This resulted in the collection channel water velocity rising to the target level. Based on the results of this test, NOAA Fisheries recommended that Grant PUD continue to operate LEW-5 to meet both the collection channel velocity and slotted entrance targets. In the summer of 2005, Grant PUD automated the operation of LEW-5 based on trended operating data gathered by Priest Rapids operations, and experienced continued success with this entrance weir operation regime in 2006 and 2007.

3.2 2006

Low tailwater elevations and a gearbox malfunction led to unfavorable collection channel velocities in 2006. The left valve-6 (LV-6) gearbox malfunctioned during the early fishway operations season in 2006 and caused the valve to remain in the full open position, which introduced the valve's full capacity of water into the lower collection channel. This slowed water flow within the collection channel during periods of low tailwater because relatively little water input is required at the head of the collection channel at these times in order to create an acceptable flow differential along the length of the channel. Repairs were made to LV-6 during the next winter fishway outage.

Per Action 23 of the May 2004 Biological Opinion, Grant PUD installed a velocity meter in the collection channel at Priest Rapids Dam prior to April 15, 2006. Per NOAA Fisheries' request, the velocity meter is removable and is not a permanent fixture within the collection channel. Grant PUD installed a davit with a hand-operated crank that allows the velocity meter to be lowered into the midline of the collection channel when a reading is desired, then removed from the water when finished. This velocity meter was used at Priest Rapids Dam in the presence of NOAA Fisheries and FPC fishways inspectors throughout the 2006 and 2007 fishways operations seasons to determine collection channel water velocities at the bottom, mid-channel, and top cross-sections.

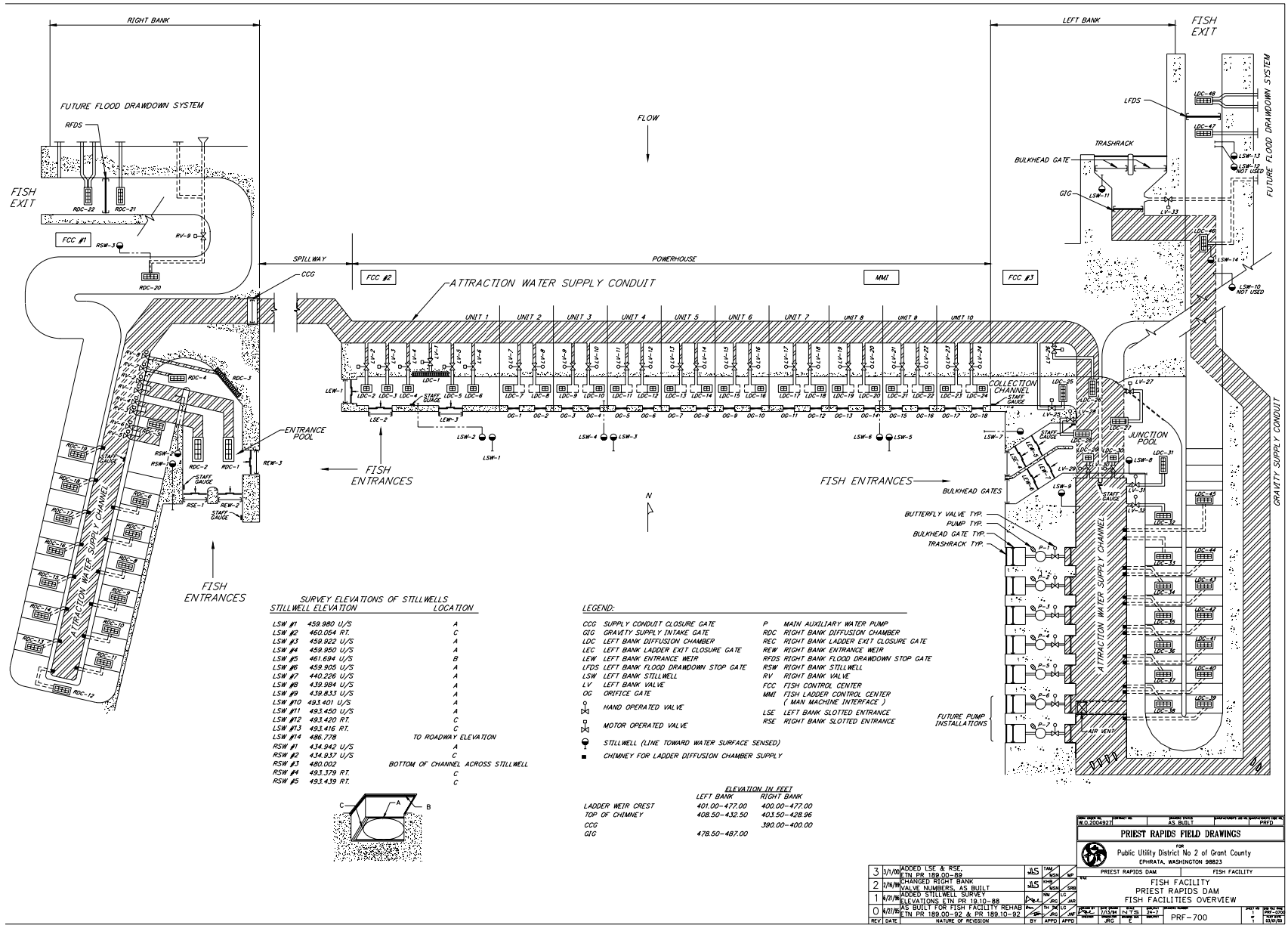
4.0 Actions Taken in 2007

Grant PUD continued to operate LEW-5 in a manner consistent with maintaining LSE-4 differentials and acceptable collection channel water velocities. All 2007 fishway inspections showed the collection channel and entrance differentials to be within operational criteria (Appendix C).

Grant PUD replaced the damaged water velocity meter cable and made operational modifications to the velocity meter's cranking mechanism to facilitate easier and safer operation prior to the beginning of the 2007 fish passage season.

Full preventative and maintenance treatments will be conducted on LV-6 and LV-5 during the winter 2007-2008 fishway maintenance outage. This will minimize the likelihood of a valve failure and will maximize the likelihood of the collection channel operating within criteria throughout the 2008 fish passage season.

Appendix A
Field Drawings of Priest Rapids Dam Fishways



SURVEY ELEVATIONS OF STILLWELLS

STILLWELL ELEVATION	LOCATION
LSW #1 459.980 U/S	A
LSW #2 460.054 RT	A
LSW #3 459.922 U/S	A
LSW #4 459.950 U/S	A
LSW #5 461.694 U/S	B
LSW #6 459.905 U/S	A
LSW #7 442.226 U/S	A
LSW #8 439.984 U/S	A
LSW #9 439.833 U/S	A
LSW #10 493.401 U/S	A
LSW #11 493.450 U/S	A
LSW #12 493.420 RT	C
LSW #13 493.416 RT	C
LSW #14 496.779	C
RSW #1 434.942 U/S	A
RSW #2 434.937 U/S	A
RSW #3 480.000	C
RSW #4 493.379 RT	C
RSW #5 493.439 RT	C

TO ROADWAY ELEVATION
BOTTOM OF CHANNEL ACROSS STILLWELL

- LEGEND:**
- CCC SUPPLY CONDUIT CLOSURE GATE
 - GIG GRAVITY SUPPLY INTAKE GATE
 - LDC LEFT BANK DIFFUSION CHAMBER
 - LEC LEFT BANK LADDER EXIT CLOSURE GATE
 - LEW LEFT BANK ENTRANCE WEIR
 - LFDS LEFT BANK FLOOD DRAWDOWN STOP GATE
 - LSW LEFT BANK STILLWELL
 - LV LEFT BANK VALVE
 - OC ORIFICE GATE
 - OH HAND OPERATED VALVE
 - MO MOTOR OPERATED VALVE
 - SW STILLWELL (LINE TOWARD WATER SURFACE SENSED)
 - CHIMNEY FOR LADDER DIFFUSION CHAMBER SUPPLY
 - P MAIN AUXILIARY WATER PUMP
 - RDC RIGHT BANK DIFFUSION CHAMBER
 - REC RIGHT BANK LADDER EXIT CLOSURE GATE
 - REW RIGHT BANK ENTRANCE WEIR
 - RFDS RIGHT BANK FLOOD DRAWDOWN STOP GATE
 - RSW RIGHT BANK STILLWELL
 - RV RIGHT BANK VALVE
 - FCC FISH CONTROL CENTER
 - MMI FISH LADDER CONTROL CENTER (MAN MACHINE INTERFACE)
 - LSE LEFT BANK SLOTTED ENTRANCE
 - RSE RIGHT BANK SLOTTED ENTRANCE

ELEVATION IN FEET

	LEFT BANK	RIGHT BANK
LADDER WEIR CREST	401.00-477.00	400.00-477.00
TOP OF CHIMNEY	408.50-432.50	403.50-428.96
CCC		390.00-400.00
GIG	478.50-487.00	

PRIEST RAPIDS FIELD DRAWINGS

Public Utility District No 2 of Grant County
EPHRATA, WASHINGTON 98823

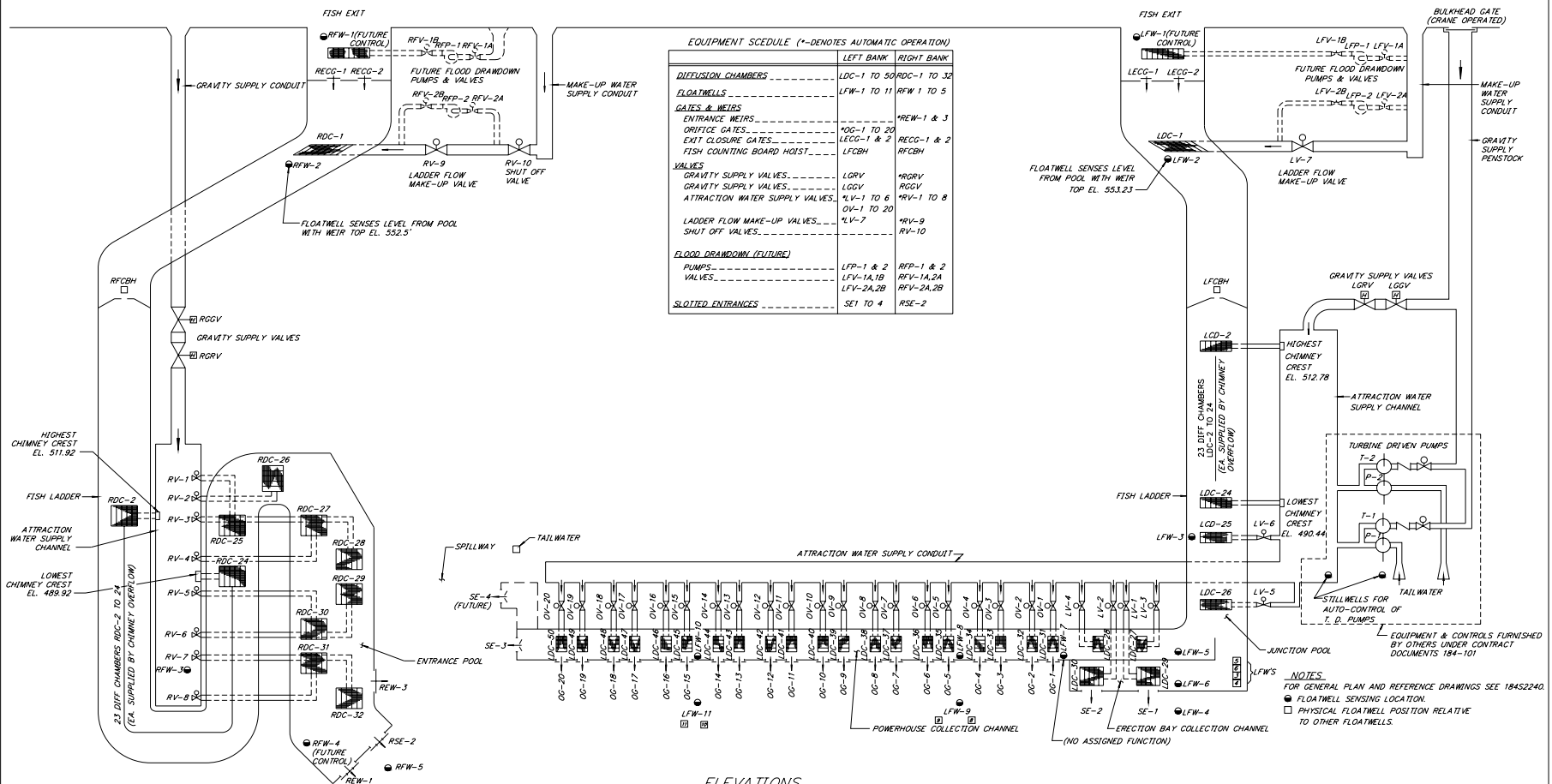
3	1/1/00	ADDED LSE & RSE, ELEV. PER 189.00-92	JLS	10/10/00	PRF
2	7/16/99	VALVE NUMBERS, AS BUILT	JLS	10/10/00	PRF
1	7/17/99	ROCKED STILLWELL SURVEY ELEVATIONS, ELEV. PER 18.10-88	JLS	10/10/00	PRF
0	7/17/99	AS BUILT FOR FISH FACILITY REHAB	JLS	10/10/00	PRF
		AS BUILT FOR FISH FACILITY REHAB ELEV. PER 189.00-92 & PR. 189.10-92	JLS	10/10/00	PRF

REV DATE: 10/10/00 NATURE OF REVISION: BY: APPD/APPD

Appendix B
Field Drawings of Wanapum Dam Fishways

RIGHT BANK FACILITIES

LEFT BANK FACILITIES



EQUIPMENT SCHEDULE (*--DENOTES AUTOMATIC OPERATION)

	LEFT BANK	RIGHT BANK
DIFFUSION CHAMBERS	LDC-1 TO 30	RDC-1 TO 32
FLOATWELLS	LFW-1 TO 11	RFW-1 TO 5
GATES & WEIRS		
ENTRANCE WEIRS		*REW-1 & 3
ORIFICE GATES	*MOC-1 TO 20	
EXIT CLOSURE GATES	LECC-1 & 2	RECC-1 & 2
FISH COUNTING BOARD HOIST	LFCBH	RFCBH
VALVES		
GRAVITY SUPPLY VALVES	LGRV	*RGRV
GRAVITY SUPPLY VALVES	LGGV	RGGV
ATTRACTION WATER SUPPLY VALVES	*LV-1 TO 6	*RV-1 TO 8
LADDER FLOW MAKE-UP VALVES	*LV-7	*RV-9
SHUT OFF VALVES		RV-10
FLOOD DRAWDOWN (FUTURE)		
PUMPS	LFP-1 & 2	RFV-1 & 2
VALVES	LFV-1A,1B	RFV-1A,2A
	LFV-2A,2B	RFV-2A,2B
SLOTTED ENTRANCES	SE-1 TO 4	RSE-2

ELEVATIONS

HEADWATER FLOATWELL	EL. 580.171	- MEASURED AT STANDPIPE ON MOUNTING PLATE
TAILWATER	EL. 528.642	
LFW-1	EL. 578.023	- AT TOP LEFT U/S CORNER AT DECK LEVEL
LFW-2	EL. 578.047	
LFW-3	EL. 527.441	
LFW-4	EL. 527.448	
LFW-5	EL. 527.451	
LFW-6	EL. 527.443	
LFW-7	EL.	
LFW-8	EL. 527.518	
LFW-9	EL. 527.489	
LFW-10	EL. 527.474	
LFW-11	EL. 527.495	

REVISED READINGS WERE DERIVED BY AVERAGING THE D/S & U/S FRAME OF THE FLOATWELL.

NOTES FOR GENERAL PLAN AND REFERENCE DRAWINGS SEE 184S2240.
 ● FLOATWELL SENSING LOCATION.
 ○ PHYSICAL FLOATWELL POSITION RELATIVE TO OTHER FLOATWELLS.

NO.	DATE	BY	DESCRIPTION	APP'D.
7	11/10/09	AS	CHANGE ACRONYMS PER ENG.	AS
6	11/10/09	AS	AS BUILT REAR SLOTTED ENTRANCE	AS
5	11/10/09	AS	REDRAWN ON AUTOCAD	AS

HARZA ENGINEERING COMPANY
 Public Utility District No. 2 of Grant County
 EPHRATA, WASHINGTON 98823

WAPANUM DAM DAM & FISHWAYS

FISH FACILITIES
 FUNCTIONAL LAYOUT & NOMENCLATURE

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Appendix C
Priest Rapids Dam Monthly Fishways Inspections Reports, 2007

Priest Rapids Dam - Fishway Inspection

Inspector/Agency:	Novak (NOAA)	Date:	4/26/2007	Time:	13:00
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River Information		
Water temperature:	47	° F
Total river flow:	162.2	kcfs
Turbidity:	10.1	feet

Control room information		
Control room forebay elevation:	486.5	feet
Control room tailwater elevation:	412.3	feet

Turbine Operations											
Turbine unit number:	10	9	8	7	6	5	4	3	2	1	Total generation
Megawatts generated:	0	0	0	0	56	56	56	56	56	56	336

Spillway Operations																						
Spillway discharge:	98.9						kcfs	Sluiceway (spillgate 22) flow:						0.97		kcfs						
Spillgate number:	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Feet open:	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	3.0	5.0	6.0	6.0	6.1	5.9	6.9	6.0	5.1	4.9	4.9	3.0	0.0

Ladder Water Supply		
Gravity intake gate opening:	5.5	feet
Number of pumps operating:	4/5	
Left bank supply pool water surface elevation:	418.9	feet
Right bank supply pool water surface elevation:	416	feet
Depth over right bank ladder weir:	1.1	feet
Depth over left bank ladder weir:	1.1	feet

Misc. Ladder Data		
Junction pool water surface elevation:	414	feet
Collection channel water surface elevation differential:	0 ^a	feet
Collection channel velocity:	1.8 ^b	feet per second
Fish counting:	24/7	hours per day
Right bank fishway exit pool elevation / debris condition	486.8/ok	feet/
Left bank fishway exit pool elevation / debris condition	486.7/ok	feet/

All read by staff gage, unless noted by electronic tape down (TD) or still well (SW)

Fishway entrances	Powerhouse Fishway Entrances		Spillway Fishway Entrance		
	LSE - 4	LSE-2		RSE-1	
	Entrance pool water surface elevation:	414		414.0	413.5
	Tailwater water surface elevation:	412.4		412.1 ^c	412 ^d
Fishway entrance head differential (feet):	1.6	1.9	1.5		

*** Remarks**
a) in the span of time between reading values at LSE-2 and LSE-4, the tailwater had dropped substantially, creating the false calculation that the collection channel velocity was 0. The collection channel differential by then was likely close to 0.2-0.3 ft. b) the cable for the velocity meter was being replaced during the inspection, and thus a "bubble" velocity measurement was used. The cable was replaced later in the day and readings were performed by 4:30pm. The readings are in the chart below. The depth of channel was 19.7ft and the average velocity from those three readings was 2.35 ft/s, which is well within criteria. c) reading was bouncy and tailwater was dropping fast. d) Tailwater on the right bank was extremely bouncy, varying up to 2 feet in either direction. Reading was very difficult, and 412 is an estimate, but could vary by several inches.

	rev.	seconds	v (ft/s)
surface	268	43.8	2.61
middle	215	34	2.69
bottom	147	36.3	1.74

Priest Rapids Dam - Fishway Inspection

Inspector/Agency: Bryan Nordlund, NMFS

Date: 5/16/2007

Time: 11:45 AM

River Information

Water temperature:	51	° F
Total river flow:	164	kcms
Turbidity:	7.5	feet

Control room information

Control room forebay elevation:	486.6	feet
Control room tailwater elevation:	421.4	feet

Turbine Operations

Turbine unit number:	10	9	8	7	6	5	4	3	2	1	Total generation
Megawatts generated:	76	73	73	76	76	76	75	76	76	76	753

Spillway Operations

Spillway discharge:	*14.6			kcms	Sluiceway (spillgate 22) flow:										*0		cfs					
Spillgate number:	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Feet open:	0	0	*full	*full	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ladder Water Supply

Gravity intake gate opening:	4.6	feet
Number of pumps operating:	4	
Left bank supply pool water surface elevation:	419.0	feet
Right bank supply pool water surface elevation:	416.2	feet
Depth over right bank ladder weir:	1.1	feet
Depth over left bank ladder weir:	1.0	feet

Misc. Ladder Data

Junction pool water surface elevation:	414.0	feet
*Collection channel water surface elevation differential:	0.2	feet
Collection channel velocity:	3.0	feet per second
Fish counting:	24/7	hours per day
Right bank fishway exit pool elevation / debris condition	486.9/ok	feet/
Left bank fishway exit pool elevation / debris condition	486.6/ok	feet/

Fishway entrances

	Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded		
	Powerhouse Fishway Entrances		Spillway Fishway Entrance
	LSE - 4	LSE-2	RSE-1
Entrance pool water surface elevation:	414.0	413.8	413.2
Tailwater water surface elevation:	412.2	411.8	411.7
Fishway entrance head differential (feet):	1.8	2.0	1.5

* Remarks

Valve stem near velocity meter was vibrating and was very loud - could be a deterrent to fish passage. Operators were notified and a fix will be investigated. Spillway was in a testing mode for prototype surface spillway study, per PRCC agreement. Gradient in collection channel was not up to criteria, but velocity through collection channel was very good - no change requested.

Priest Rapids Dam - Fishway Inspection

Inspector/Agency:	Bryan Nordlund, NMFS	Date:	6/12/2007	Time:	11:30 AM
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River Information		
Water temperature:	56	° F
Total river flow:	188	kcfs
Turbidity:	6.9	feet

Control room information		
Control room forebay elevation:	485.7	feet
Control room tailwater elevation:	414.2	feet

Turbine Operations											
Turbine unit number:	10	9	8	7	6	5	4	3	2	1	Total generation
Megawatts generated:	83	84	87	86	85	87	84	85	86	85	852

Spillway Operations																						
Spillway discharge:	*13.1			kcfs	Sluiceway (spillgate 22) flow:							*0		cfs								
Spillgate number:	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Feet open:	0	0	*full	*full	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ladder Water Supply		
Gravity intake gate opening:	6.1	feet
Number of pumps operating:	5	
Left bank supply pool water surface elevation:	421.3	feet
Right bank supply pool water surface elevation:	418.0	feet
Depth over right bank ladder weir:	1.0	feet
Depth over left bank ladder weir:	1.1	feet

Misc. Ladder Data		
Junction pool water surface elevation:	416.3	feet
*Collection channel water surface elevation differential:	0.4	feet
Collection channel velocity:	3.1	feet per second
Fish counting:	24/7	hours per day
Right bank fishway exit pool elevation / debris condition	485.6/ok	feet/
Left bank fishway exit pool elevation / debris condition	485.4/ok	feet/

Fishway entrances	Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded		
	Powerhouse Fishway Entrances		Spillway Fishway Entrance
	*LSE - 4	LSE-2	RSE-1
Entrance pool water surface elevation:	416.3	415.9	415.2
Tailwater water surface elevation:	415.0	414.1	413.7
Fishway entrance head differential (feet):	1.3	1.8	1.5

*** Remarks**
 Valve stem near velocity meter in collection channel was not vibrating as loud as last month, due to interim fix. Work order for permanent fix in process. Spillway was in a testing mode for prototype surface spillway study, per PRCC agreement. LSE-4 differential was not at preferred target, but was within acceptable range - tailwater was dropping, and I suspect the system was also in flux, which probably accounts for the off-target reading.

Priest Rapids Dam - Fishway Inspection

Inspector/Agency: Benner, FPC

Date: 7/25/2007

Time: 11:30

River Information		
Water temperature:	64	° F
Total river flow:	131.8	kcfs
Turbidity:	10.3	feet
Forebay elevation:	486.1	feet

Turbine Operations											
Turbine unit number:	10	9	8	7	6	5	4	3	2	1	Total generation
Megawatts generated:	63.4	63.7	67.8	66.9	67.4	67.7	65.1	65.3	65.3	67.3	595

Spillway Operations																						
Spillway discharge:	22				kcfs	Sluiceway flow:										cfs						
Spillgate number:	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Feet open:	0	2	40.7	41.2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ladder Water Supply		
Gravity intake gate opening:	4.4	feet
Left bank supply pool water surface elevation:	417.3	feet
Right bank supply pool water surface elevation:	414.3	feet
Depth over ladder weir:	1.1 (lft), 1.2 (rgh)	feet

Misc. Ladder Data		
Junction pool water surface elevation:	412.3	feet
Collection channel water surface elevation differential:	0.4	feet
Collection channel velocity:	2.85	feet per second
Fish counting:	24/7	hours per day

Fishway entrances				
Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded				
	Powerhouse Fishway Entrances			Spillway Fishway Entrance
	LSE - 4	LSE-2		RSE-1
Entrance pool water surface elevation:	411.8	411.8		410.8
Tailwater water surface elevation:	410.1	410.2		409.4
Fishway entrance head differential (feet):	1.7	1.6		1.4
Forebay exit pool water surface elevation:	486.3/ok			486.4/ok

Remarks
Velocities taken for one minute at each location
Bottom = 2.76 ft/s
middle = 2.93 ft/s
top = 2.87 ft/s
ave = 2.85
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C-4

Priest Rapids Dam - Fishway Inspection

Inspector/Agency: Benner, FPC

Date: 8/23/2007

Time: 10:50

River Information

Water temperature:	67	° F
Total river flow:	113.7	kcfs
Turbidity:	10.5	feet
Forebay elevation:	486	feet

Turbine Operations

Turbine unit number:	10	9	8	7	6	5	4	3	2	1	Total generation
Megawatts generated:	0	0	69.8	68.7	70.1	69.7	66.9	67.2	65.8	66.2	512

Spillway Operations

Spillway discharge:	22				kcfs				Sluiceway flow:				cfs									
Spillgate number:	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Feet open:	0	1.9	40.7	41.2	1.9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ladder Water Supply

Gravity intake gate opening:	4.9	feet
Left bank supply pool water surface elevation:	416.2	feet
Right bank supply pool water surface elevation:	414.2	feet
Depth over ladder weir:	1.1 (left), 1.2 (right)	feet

Misc. Ladder Data

Junction pool water surface elevation:	411.6	feet
Collection channel water surface elevation differential:	0.3	feet
Collection channel velocity:	2.75	feet per second
Fish counting:	24/7	hours per day

Fishway entrances

	Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded			
	Powerhouse Fishway Entrances			Spillway Fishway Entrance
	LSE - 4	LSE-2		RSE-1
Entrance pool water surface elevation:	411.3	410.6		411.3
Tailwater water surface elevation:	410	409.1		409.8
Fishway entrance head differential (feet):	1.3	1.5		1.5
Forebay exit pool water surface elevation:	486.1/ok			486.2/ok

Remarks

LSE 2 entrance poo staff gauge could not be read, had to use tape to get elevation. Asked GCPUD to clean staff gauge.

Velocities

upper = 2.8 ft/s

middle = 2.33 ft/s

lower = 3.13 ft/s

Average = 2.75 ft/s

Priest Rapids Dam - Fishway Inspection

Inspector/Agency: Benner, FPC

Date: 9/27/2007

Time: 1:40PM

River Information

Water temperature:	63.3	° F
Total river flow:	65.5	kcfs
Turbidity:	14.1	feet
Forebay elevation:	487.4	feet

Turbine Operations

Turbine unit number:	10	9	8	7	6	5	4	3	2	1	Total generation
Megawatts generated:	72	0	0	80	72	74	74	0	0	0	372

Spillway Operations

Spillway discharge:					kcfs				Sluiceway flow:				2800 cfs										
Spillgate number:	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
Feet open:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ladder Water Supply

Gravity intake gate opening:	0.5 feet
Left bank supply pool water surface elevation:	411.2 feet
Right bank supply pool water surface elevation:	409.1 feet
Depth over ladder weir:	1.1 (lft), 1.1 (rgh) feet

Misc. Ladder Data

Junction pool water surface elevation:	406.3 feet
Collection channel water surface elevation differential:	0.4 feet
Collection channel velocity:	2.5 feet per second
Fish counting:	24/7 hours per day

Fishway entrances

	Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded			
	Powerhouse Fishway Entrances		Spillway Fishway Entrance	
	LSE - 4	LSE-2	RSE-1	
Entrance pool water surface elevation:	406.3	405.9	405.8	
Tailwater water surface elevation:	404.9	404.6	404.4	
Fishway entrance head differential (feet):	1.4	1.3	1.4	
Forebay exit pool water surface elevation:	487.5		487.6	

Remarks

When adult trap runs, the staff gauge for the leftbank supply pool is hard to read- suggested that this staff gauge be moved slightly away from trap outfall

Velocity probe had electrical connection problems

Priest Rapids Dam - Fishway Inspection

Inspector/Agency: Benner, FPC

Date: 11/8/2007

Time: 10:00 AM

River Information		
Water temperature:	55	° F
Total river flow:	59.7	kcfs
Turbidity:	14.8	feet
Forebay elevation:	484.7	feet

Turbine Operations											
Turbine unit number:	10	9	8	7	6	5	4	3	2	1	Total generation
Megawatts generated:	57	0	0	57	58	58	58	57	0	0	348

Spillway Operations																						
Spillway discharge:					kcfs	Sluiceway flow:								600	cfs							
Spillgate number:	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Feet open:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Ladder Water Supply		
Gravity intake gate opening:	On seal	feet
Left bank supply pool water surface elevation:	411	feet
Right bank supply pool water surface elevation:	na	feet
Depth over ladder weir:	1.0 (left)	feet

Misc. Ladder Data	
Junction pool water surface elevation:	406.2 feet
Collection channel water surface elevation differential:	0.3 feet
Collection channel velocity:	2.3 feet per second
Fish counting:	24/7 hours per day

Fishway entrances			
	Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded		
	Powerhouse Fishway Entrances		Spillway Fishway Entrance
	LSE - 4	LSE-2	RSE-1
Entrance pool water surface elevation:	406.2	405.9	na
Tailwater water surface elevation:	404.7	404.5	na
Fishway entrance head differential (feet):	1.5	1.4	na
Forebay exit pool water surface elevation:	485.3		na

Remarks
Right bank fishway on orifice flow only- trying to get more female fish at left fishway in trap to supplement hatchery

Appendix D
Wanapum Dam Monthly Fishways Inspections Reports, 2007

Wanapum Dam - Fishway Inspection

Inspector/Agency:	Novak (NOAA)	Date:	4/26/2007	Time:	10:00
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River Information		
Water temperature:	46	° F
Total river flow:	158.6	kcfs

Control room information		
Control room forebay elevation:	570.2	feet
Control room tailwater elevation:	493.1	feet

Turbine Operations											
Turbine unit number:	1	2	3	4	5	6	7	8	9	10	total generation
Megawatts generated:	86	87	86	87	86	87	86	86	59	0	750

Spillway Operations													
Spillway discharge:	22	kcfs	Sluiceway flow:				2	kcfs					
Spillgate number:	1	2	3	4	5	6	7	8	9	10	11	12	
Feet open:	0	0	0	0	0	0	0	0	0	0	0	-23.9	

Ladder Water Supply			
Auxiliary water pump 1:		142	rpm
Auxiliary water pump 2:		110	rpm
Right Ladder	Fish Pump 1 Gates:	90	percent open
	Fish Pump 2 Gates:	81	percent open
	Gravity Regulating Valve	71	percent open
Left Ladder	Gravity Regulating Valve	0	percent open
Left bank supply pool water surface elevation:		501.0	feet
Right bank supply pool water surface elevation:		499.7	feet

Misc. Ladder Data		
Junction pool water surface elevation:	494.8	feet
Collection channel water surface elevation:	494.4	feet
Collection channel water surface differential:	0.4	feet
Collection channel velocity:	2.60 ^a	feet per second
Depth over left bank ladder weir:	1.1	feet
Depth over right bank ladder weir:	1.1	feet
Fish counting:	24/7	hours per day

All read by staff gage, unless noted by electronic tape down (TD) or still well (SW)

Fishway Entrances	Powerhouse Fishway Entrances				Spillway Fishway Entrance		
	LSE - 2		LSE-3		RSE-2		
	Entrance pool water surface elevation:	494.7	feet	494.3	feet	494.4	feet
	Tailwater water surface elevation:	493.3	feet	493.1	feet	492.9	feet
	Fishway entrance head differential:	1.4 ^b	feet	1.2	feet	1.5	feet
Forebay exit water surface elevation/ Debris condition:		570.0/ok				570.4/ok	

Remarks
 a) I missed this measurement during the inspection, however, Mike Nicholls took measurements on Friday at 2:30 pm, finding an average (surface) velocity of 2.60 ft/s. b) slightly below target of 1.5, but within criteria.

Digital and other readings:	GCPUD	USGS
Forebay	569.98	569.96
Tailwater	492.94	493.07

Electronic readings near LSE-2 and collection channel	Jcn. Pool	494.7
	coll. Channel	494.6
	entrance pool	494.7
	tailwater	493.1

Wanapum Dam - Fishway Inspection

Inspector/Agency:	Bryan Nordlund, NMFS	Date:	5/16/2007	Time:	2:45 PM
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River Information		
Water temperature:	50.3	° F
Total river flow:	164	kcfs

Control room information			
Control room forebay elevation:	570.4	feet	
Control room tailwater elevation:	49304	feet	

Turbine Operations											
Turbine unit number:	1	2	3	4	5	6	7	8	9	10	total generation
Megawatts generated:	86	87	87	87	88	86	87	86	86	unavailable	780

Spillway Operations													
Spillway discharge:	23.5	kcfs	Sluiceway flow:			0	cfs						
Spillgate number:	1	2	3	4	5	6	7	8	9	10	11	12	
Feet open:	0	1	2	1	2	1	2	1	1	0	0	0	

Ladder Water Supply			
Auxiliary water pump 1:	133	rpm	
Auxiliary water pump 2:	117	rpm	
Left gravity regulating valve:	75	percent open	
Right gravity regulating valve:	96	percent open	
Left bank supply pool water surface elevation:	501.4	feet	
Right bank supply pool water surface elevation:	499.8	feet	

Misc. Ladder Data		
Junction pool water surface elevation:	494.8	feet
Collection channel water surface elevation:	494.6	feet
*Collection channel water surface differential:	0.2	feet
Collection channel velocity:	3.1	feet per second
Depth over left bank ladder weir:	1.0	feet
Depth over right bank ladder weir:	1.1	feet
Fish counting:	24/7	hours per day

Fishway entrances						
Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded						
Powerhouse Fishway Entrances						
LSE - 2			LSE-3		Spillway Fishway Entrance	
					RSE-2	
Entrance pool water surface elevation:	494.8	feet	494.6	feet	494.5	feet
Tailwater water surface elevation:	493.5	feet	493.3	feet	493.0	feet
Fishway entrance head differential:	1.3	feet	1.3	feet	1.5	feet
Forebay exit water surface elevation/ Debris condition:	570.5/ok			570.6/some debris		

Remarks
 Gradient in collection channel was not up to criteria, but velocity through collection channel was very good - no change requested.

Wanapum Dam - Fishway Inspection

Inspector/Agency:	Bryan Nordlund, NMFS	Date:	6/12/2007	Time:	10:00 AM
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River Information		
Water temperature:	54	° F
Total river flow:	159	kcfs

Control room information			
Control room forebay elevation:	571.3	feet	
Control room tailwater elevation:	493	feet	

Turbine Operations											
Turbine unit number:	1	2	3	4	5	6	7	8	9	10	total generation
Megawatts generated:	90	91	91	90	90	90	90	90	90	unavailable	812

Spillway Operations													
Spillway discharge:	14	kcfs	Sluiceway flow:									2	cfs
Spillgate number:	1	2	3	4	5	6	7	8	9	10	11	12	
Feet open:	0	1	1	1	1	1	1	0	0	0	0	0	

Ladder Water Supply			
Auxiliary water pump 1:	140	rpm	
Auxiliary water pump 2:	118	rpm	
Left gravity regulating valve:	83	percent open	
Right gravity regulating valve:	81	percent open	
Left bank supply pool water surface elevation:	501.2	feet	
Right bank supply pool water surface elevation:	500.2	feet	

Misc. Ladder Data		
Junction pool water surface elevation:	494.7	feet
Collection channel water surface elevation:	494.7	feet
Collection channel water surface differential:	0.4	feet
Collection channel velocity:	3.5	feet per second
Depth over left bank ladder weir:	1.1	feet
Depth over right bank ladder weir:	1.0	feet
Fish counting:	24/7	hours per day

Fishway entrances						
Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded						
Powerhouse Fishway Entrances						
LSE - 2			LSE-3		Spillway Fishway Entrance	
					RSE-2	
Entrance pool water surface elevation:	494.7	feet	494.3	feet	494.3	feet
Tailwater water surface elevation:	493.3	feet	493.1	feet	493.0	feet
Fishway entrance head differential:	1.4	feet	1.2	feet	1.3	feet
Forebay exit water surface elevation/ Debris condition:	571.2/some debris			571.3/ok		

Remarks
No problems noted.

Wanapum Dam - Fishway Inspection

Inspector/Agency:	Benner, FPC
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Date:	7/25/2007
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Time:	9:15
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River Information		
Water temperature:	59.5	° F
Total river flow:	123	kcfs
Forebay elevation:	569.3	feet

Turbine Operations											
Turbine unit number:	1	2	3	4	5	6	7	8	9	10	total generation
Megawatts generated:	71.2	69.9	68.4	68.6	66.2	68.8	68.8	70.9	68.7	0	688

Spillway Operations												
Spillway discharge:	0		kcfs		Sluiceway flow:		1.7		cfs			
Spillgate number:	1	2	3	4	5	6	7	8	9	10	11	12
Feet open:	0	0	0	0	0	0	0	0	0	0	0	0

Ladder Water Supply		
Auxiliary water pump 1:	133	rpm
Auxiliary water pump 2:	120	rpm
Left gravity regulating valve:	0	percent open
Right gravity regulating valve:	68	percent open
Left bank supply pool water surface elevation:	499.4	feet
Right bank supply pool water surface elevation:	498.3	feet

Misc. Ladder Data		
Junction pool water surface elevation:	493.3	feet
Collection channel water surface elevation:	492.9	feet
Collection channel water surface differential:	0.4	feet
Collection channel velocity:	2.5	feet per second
Depth over ladder weir:	1.2 (left), 1.1 (right)	feet
Fish counting:	24/7	hours per day

Fishway entrances				
Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded				
	Powerhouse Fishway Entrances			Spillway Fishway Entrance
	LSE - 2	LSE-3		RSE-2
Entrance pool water surface elevation:	493.2	492.8		492.4
Tailwater water surface elevation:	491.7	491.4		491
Fishway entrance head differential (feet):	1.5	1.3		1.4
Forebay exit pool water surface elevation:	569.3/ok	569.3/ok		569.3/ok

Remarks	
LSE#3 Collection channel gauge needs cleaning	

Wanapum Dam - Fishway Inspection

Inspector/Agency:	Benner, FPC
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Date:	8/23/2007
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Time:	8:40 AM
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River Information		
Water temperature:	65.9	° F
Total river flow:	130.4	kcfs
Forebay elevation:	565	feet

Turbine Operations											
Turbine unit number:	1	2	3	4	5	6	7	8	9	10	total generation
Megawatts generated:	76	77	76	76	76	76	76	76	76	0	685

Spillway Operations													
Spillway discharge:	0.7		kcfs	Sluiceway flow:				700					cfs
Spillgate number:	1	2	3	4	5	6	7	8	9	10	11	12	
Feet open:	0	0	0	0	0	0	0	0	0	0	0	0	

Ladder Water Supply		
Auxiliary water pump 1:	128	rpm
Auxiliary water pump 2:	132	rpm
Left gravity regulating valve:	0	percent open
Right gravity regulating valve:	70	percent open
Left bank supply pool water surface elevation:	499.1	feet
Right bank supply pool water surface elevation:	488.2	feet

Misc. Ladder Data		
Junction pool water surface elevation:	493.4	feet
Collection channel water surface elevation:	493	feet
Collection channel water surface differential:	0.4	feet
Collection channel velocity:	4	feet per second
Depth over ladder weir:	1.1 (lft), 1.0 (rght)	feet
Fish counting:	24/7	hours per day

Fishway entrances				
Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded				
		Powerhouse Fishway Entrances		Spillway Fishway Entrance
		LSE - 2	LSE-3	RSE-2
Entrance pool water surface elevation:		493	493.3	492.7
Tailwater water surface elevation:		491.5	491.7	491.2
Fishway entrance head differential (feet):		1.5	1.6	1.5
Forebay exit pool water surface elevation:		564.8	564.8	565

Remarks	
LSE 2 collection channe; gauge needs cleaning, both left bank and right bank Fbay gauges need cleaning (but FB was lowewr than usual)	

Wanapum Dam - Fishway Inspection

Inspector/Agency:	Benner, FPC
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Date:	9/27/2007
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Time:	10:10 AM
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River Information		
Water temperature:	63.4	° F
Total river flow:	47.5	kcfs
Forebay elevation:	569.2	feet

Turbine Operations											
Turbine unit number:	1	2	3	4	5	6	7	8	9	10	total generation
Megawatts generated:	66	0	66	0	0	66	0	66	0	0	264

Spillway Operations														
Spillway discharge:	kcfs		Sluiceway flow:										1700	cfs
Spillgate number:	1	2	3	4	5	6	7	8	9	10	11	12		
Feet open:	0	0	0	0	0	0	0	0	0	0	0	0		

Ladder Water Supply		
Auxiliary water pump 1:	122	rpm
Auxiliary water pump 2:	118	rpm
Left gravity regulating valve:	0	percent open
Right gravity regulating valve:	64	percent open
Left bank supply pool water surface elevation:	495.1	feet
Right bank supply pool water surface elevation:	495.6	feet

Misc. Ladder Data		
Junction pool water surface elevation:	490.2	feet
Collection channel water surface elevation:	490	feet
Collection channel water surface differential:	0.2	feet
Collection channel velocity:	2.5	feet per second
Depth over ladder weir:	1.1 (lft), 1.1 (rght)	feet
Fish counting:	24/7	hours per day

Fishway entrances				
	Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded			
	Powerhouse Fishway Entrances		Spillway Fishway Entrance	
	LSE - 2	LSE-3	RSE-2	
Entrance pool water surface elevation:	490.1	489.9	489.8	
Tailwater water surface elevation:	488.3	488.5	488.3	
Fishway entrance head differential (feet):	1.8	1.4	1.5	
Forebay exit pool water surface elevation:	569.4	569.4	569.5	

Remarks
Need to clean entrance pool staff gauge at LSE#2, but did get a tape reading
Average velocity = 2.5 ft/s

Wanapum Dam - Fishway Inspection

Inspector/Agency: Benner, FPC

Date: 11/8/2007

Time: 8:30 AM

River Information

Water temperature:	54	° F
Total river flow:	79	kcfs
Forebay elevation:	565.8	feet

Turbine Operations

Turbine unit number:	1	2	3	4	5	6	7	8	9	10	total generation
Megawatts generated:	73	74	73	74	0	73	0	74	0	0	440

Spillway Operations

Spillway discharge:			kcfs			Sluiceway flow:	850		cfs			
Spillgate number:	1	2	3	4	5	6	7	8	9	10	11	12
Feet open:	0	0	0	0	0	0	0	0	0	0	0	0

Ladder Water Supply

Auxiliary water pump 1:	119	rpm
Auxiliary water pump 2:	115	rpm
Left gravity regulating valve:	0	percent open
Right gravity regulating valve:	63	percent open
Left bank supply pool water surface elevation:	494.7	feet
Right bank supply pool water surface elevation:	496.2	feet

Misc. Ladder Data

Junction pool water surface elevation:	489.5	feet
Collection channel water surface elevation:	489.4	feet
Collection channel water surface differential:	0.3	feet
Collection channel velocity:	≈2.0	feet per second
Depth over ladder weir:	1.1 (lft), 1.1 (rght)	feet
Fish counting:	24/7	hours per day

Fishway entrances

	Indicate whether staff gage (SG), electronic tape down (TD) or still well (SW) data is recorded		
	Powerhouse Fishway Entrances		Spillway Fishway Entrance
	LSE - 2	LSE-3	RSE-2
Entrance pool water surface elevation:	489.6	489.3	490.1
Tailwater water surface elevation:	487.9	487.8	488.6
Fishway entrance head differential (feet):	1.7	1.5	1.5
Forebay exit pool water surface elevation:	566	566	566

Remarks
