

## **Final Summary of 2014 Juvenile Fish Bypass Operations at Wells Hydroelectric Project February 19, 2015**

Douglas PUD operated the Wells bypass system in 2014 as guided by the Wells HCP Coordinating Committee-approved *2014 Bypass Operating Plan*. The plan was intended to provide non-turbine passage during 95 percent of the juvenile Plan Species migration passing Wells Dam. Bypass operations were initiated on April 9 at 00:00 hours, and operated continuously until terminated at 24:00 hours on August 19, for a total of 133 days.

The *2014 Bypass Operating Plan* included measures for complying with Federal Energy Regulatory Commission (FERC) requirements for maintaining minimum automatic-gate-opening capacity under the *Wells Project Emergency Action Plan* and Washington Department of Ecology requirements for compliance with total dissolved gas (TDG) standards as directed by the FERC-approved *Total Dissolved Gas Abatement Plan* for the Wells Project. Compliance with the requirements of both of these plans was achieved by systematic removal of bypass barriers under increasing discharge as described in the *2014 Bypass Operating Plan*. The strategy for compliance with Ecology's TDG standards included the concentration of spill through adjacent spillways at the center of Wells Dam and spilling over the discharge from active turbine units. To implement these compliance measures as described in the *2014 Bypass Operating Plan*, Douglas PUD removed bypass barriers from Spillway 4 on May 22 and reinstalled them on May 29.

Based on analysis conducted by John Skalski and Richard Townsend of Columbia Basin Research (Appendix A), Douglas PUD achieved the HCP requirement to provide bypass operations during 95 percent of the juvenile salmon and steelhead migration passing Wells Dam by providing bypass passage during 98.03 percent of the yearling Chinook migration, 99.75 percent of the steelhead migration, 100 percent of the Sockeye migration, 99.99 percent of the Coho migration, and 96.80 percent of the sub-yearling Chinook migration passing Wells Dam in 2014.

## **Appendix A**

### **Analysis of Proportion of Outmigration Affected by Bypass Operations at Wells Dam in 2014**

# Analysis of Proportion of Outmigration Affected by Bypass Operations at Wells Dam in 2014

Prepared for:

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# Introduction

Outmigration has been monitored at the juvenile sampling facility at Rocky Reach Dam for four stocks of salmonids (yearling and subyearling Chinook salmon, steelhead, and sockeye salmon) from 2005 onward. Coho salmon were added in 2013, using the detections at Rocky Reach Bypass of PIT-tagged fish. The proportions of each stock covered by the bypass operations at Wells Dam can be estimated using daily counts at Rocky Reach Dam, and adding the travel time from Wells to Rocky Reach dams. Table 1 has the average travel times based on Douglas PUD’s 2010 PIT-tag study for yearling Chinook salmon, and acoustic-tag studies for steelhead and sockeye salmon. Due to a dearth of PIT-tag or acoustic-tag studies performed with subyearling Chinook and coho salmon, travel time was assumed to be 2 days.

Table 1: Average travel times from Wells tailrace to Rocky Reach Dam.

Stock	Travel time
Yearling Chinook salmon	5 days
Subyearling Chinook salmon	2 days
Steelhead	2 days
Sockeye salmon	2 days
Coho salmon	2 days

This year, monitoring was extended 11 days at Rocky Reach under its Habitat Conservation Plan 10-year requirement. Estimates of daily passage reflect the additional daily monitoring. Plots of the annual cumulative proportion of the outmigration for spring migrants (yearling Chinook, steelhead, sockeye, and coho), and the subyearling Chinook in the summer had fairly consistent start and end dates at Rocky Reach (Figure 1). The timing of bypass operations for the spring outmigration at Wells from 2004 through 2011 was from 00:00 April 12<sup>th</sup> through 24:00 June 13<sup>th</sup> of each year for the “spring” spill season, and from 00:00 June 14<sup>th</sup> through 24:00 August 26<sup>th</sup> for the “summer” spill season. For 2012 and beyond, the Wells Habitat Conservation Plan (HCP) Coordinating Committee approved the modification of the timing of bypass operations at Wells Dam as follows: bypass operations commenced at 00:00 on April 9<sup>th</sup> and continued through 24:00 on August 19<sup>th</sup>. This current timing of bypass operations will continue annually, unless modified as a result of future investigations that demonstrate an inadequacy of these dates at providing bypass passage for 95% of the migrations of both spring- and summer-migrating Plan Species at Wells Dam.

# Results

The proportions of passage during the Wells bypass operations in 2014 were 99.75% for steelhead, 1.00% for sockeye salmon, 99.99% for coho salmon, 96.80% for subyearling Chinook salmon, and apparently 80.65% for yearling Chinook salmon. The 2014 results for steelhead, sockeye, coho, and

subyearling Chinook salmon were all consistent with historical trends, 2005–2012 (Table 2). The unusually low coverage percentage for yearling Chinook salmon (i.e., 80.65%) was due to the release of 385,000 yearling summer Chinook from the Entiat National Fish Hatchery and an early release of approximately 573,000 yearling summer Chinook from the Chelan River acclimation facility. Both of these releases occur downstream from Wells Dam, and thus do not represent the yearling Chinook passing Wells Dam. Analysis of PIT-tag detections of yearling Chinook at the Rocky Reach Juvenile Fish Bypass indicated similar compliance levels (82.99%) to those from bypass sampling, but also revealed distinct differences in passage-timing distributions for yearling Chinook originating above and below Wells. The dates on which the fifth percentile of the yearling Chinook migration passed Rocky Reach occurred on April 10<sup>th</sup> for fish originating downstream from Wells and on April 21<sup>st</sup> for those originating upstream of Wells, corresponding to Wells passage dates of April 5<sup>th</sup> and April 16<sup>th</sup>, respectively. Thus, when appropriately including only those fish originating upstream from Wells in the analysis, the April 9<sup>th</sup> start date for the Wells Bypass in 2014 achieved compliance with the 95% HCP mandate, providing bypass passage to 98.03% of the yearling Chinook migration. For yearling Chinook salmon in 2014, the start of the Wells bypass operations was 7 days earlier than necessary to achieve the  $\geq 95\%$  coverage (Table 3). Figure 1 illustrates the sudden, early spike in yearling Chinook salmon migration at Rocky Reach in 2014 that represents the arrival of fish originating from ENFH and the Chelan River, and also shows the curve generated from PIT-tag data including only fish originating above Wells Dam. Finally, for subyearling Chinook salmon the termination of the bypass operation in August 2014 was 4 days later than required to assure  $\geq 95\%$  coverage (Table 4).

To assess the effectiveness of the selected start date for bypass operations, Table 3 compares the start date for bypass operations each year with the date on which the 5<sup>th</sup> percentile of the cumulative yearling Chinook salmon outmigration passed Wells Dam that year.

Similarly, Table 4 compares the actual termination date for bypass operations with the date on which bypass operations covered 95% of the subyearling Chinook salmon outmigration. In each year, an earlier termination of bypass operations would have been possible without jeopardizing the achievement of the HCP standard of providing a bypass route for  $\geq 95\%$  of outmigrating subyearling Chinook salmon. During the ten years analyzed, the 95% HCP standard was achieved 4 to 32 days prior to the actual date on which bypass operations were terminated.

Table 2. Total proportion of each stock's migration affected by bypass operations (spring, summer) at Wells Dam, based on travel times from Wells Dam to Rocky Reach Dam, the cumulative proportion of the annual migration of each stock at Rocky Reach, and the start and stop dates of Wells bypass operations.

		Proportion passed		Annual migration proportion			
		2005	2006	2007	2008	2009	2010
Spring Outmigration	<b>Yearling Chinook Salmon</b>						
	prior to spring Bypass Ops period	0.0528	0.0259	0.0551	0.0025	0.0116	0.0067
	during spring Bypass Ops period	0.9455	0.9559	0.9154	0.9972	0.9827	0.9917
	during summer Bypass Ops period	0.0017	0.0182	0.0296	0.0002	0.0056	0.0016
	after Bypass Ops period	0	0	0	0	0	0
	<b>Total Covered by Bypass Ops</b>	<b>0.9472</b>	<b>0.9741</b>	<b>0.9449</b>	<b>0.9975</b>	<b>0.9884</b>	<b>0.9933</b>
		2011	2012	2013	<b>2014</b>		
	prior to spring Bypass Ops period	0.0085	0.0004	0.0171	<b>0.0197</b>		
	during spring Bypass Ops period	0.9910	0.9996	0.9823	<b>0.8064</b>		
	during summer Bypass Ops period	0.0005	0.0001	0.0006	<b>0.0012</b>		
	after Bypass Ops period	0	0	0	<b>0</b>		
	<b>Total Covered by Bypass Ops</b>	<b>0.9915</b>	<b>0.9996*</b>	<b>0.9829</b>	<b>0.9803*</b>		
	<b>Steelhead</b>	2005	2006	2007	2008	2009	2010
	prior to spring Bypass Ops period	0.0015	0.0101	0.0066	0.0009	0.0019	0.0045
	during spring Bypass Ops period	0.9903	0.9762	0.9887	0.9901	0.9965	0.9763
	during summer Bypass Ops period	0.0081	0.0137	0.0042	0.0089	0.0016	0.0188
	after Bypass Ops period	0	0	0.0004	0.0001	0	0.0004
	<b>Total Covered by Bypass Ops</b>	<b>0.9985</b>	<b>0.9899</b>	<b>0.9930</b>	<b>0.9990</b>	<b>0.9981</b>	<b>0.9951</b>
	2011	2012	2013	<b>2014</b>			
prior to spring Bypass Ops period	0.0190	0.0014	0.0079	<b>0.0021</b>			
during spring Bypass Ops period	0.9513	0.9885	0.9847	<b>0.9817</b>			
during summer Bypass Ops period	0.0297	0.0101	0.0074	<b>0.0158</b>			
after Bypass Ops period	0	0	0	<b>0.0004</b>			
<b>Total Covered by Bypass Ops</b>	<b>0.9810</b>	<b>0.9986</b>	<b>0.9921</b>	<b>0.9975</b>			
<b>Sockeye Salmon</b>	2005	2006	2007	2008	2009	2010	
prior to spring Bypass Ops period	0	0	0	0	0	0	
during spring Bypass Ops period	0.9983	0.9984	0.9998	0.9972	0.9957	0.9992	
during summer Bypass Ops period	0.0017	0.0016	0.0001	0.0028	0.0043	0.0008	
after Bypass Ops period	0	0	0	0	0	0	
<b>Total Covered by Bypass Ops</b>	<b>1.0000</b>	<b>1.0000</b>	<b>0.9999</b>	<b>1.0000</b>	<b>1.0000</b>	<b>1.0000</b>	
	2011	2012	2013	<b>2014</b>			
prior to spring Bypass Ops period	0	0	0	<b>0</b>			
during spring Bypass Ops period	0.9923	0.9995	0.9990	<b>0.9999</b>			
during summer Bypass Ops period	0.0077	0.0005	0.0009	<b>0.0001</b>			
after Bypass Ops period	0	0	0.0001	<b>0</b>			
<b>Total Covered by Bypass Ops</b>	<b>1.0000</b>	<b>1.0000</b>	<b>0.9999</b>	<b>1.0000</b>			

\*Proportions not summing to 1 are due to round-off error.

Table 2. Total proportion of each stock's migration affected by bypass operations (spring, summer) at Wells Dam (continued).

		Proportion passed		Annual migration proportion					
Spring Outmigration	<b>Coho Salmon</b>			2013		2014			
	prior to spring Bypass Ops period			0		<b>0.0001</b>			
	during spring Bypass Ops period			0.9910		<b>0.9984</b>			
	during summer Bypass Ops period			0.0090		<b>0.0015</b>			
	after Bypass Ops period			0		<b>0</b>			
	<b>Total Covered by Bypass Ops</b>			<b>1.0000</b>		<b>0.9999</b>			
Summer Outmigration	<b>Subyearling Chinook Salmon</b>	2005	2006	2007	2008	2009	2010		
	prior to spring Bypass Ops period	0	0	0	0	0	0		
	during spring Bypass Ops period	0.1937	0.1894	0.2136	0.1266	0.1029	0.5212		
	during summer Bypass Ops period	0.8022	0.8077	0.7847	0.8620	0.8882	0.4723		
	after Bypass Ops period	0.0041	0.0029	0.0017	0.0113	0.0089	0.0064		
	<b>Total Covered by Bypass Ops</b>	<b>0.9959</b>	<b>0.9971</b>	<b>0.9983</b>	<b>0.9887</b>	<b>0.9911</b>	<b>0.9936</b>		
		2011	2012	2013	2014				
	prior to spring Bypass Ops period	0	0	0	<b>0</b>				
	during spring Bypass Ops period	0.5628	0.5871	0.1670	<b>0.3529</b>				
	during summer Bypass Ops period	0.4331	0.4059	0.8263	<b>0.6151</b>				
	after Bypass Ops period	0.0041	0.0070	0.0067	<b>0.0320</b>				
<b>Total Covered by Bypass Ops</b>	<b>0.9959</b>	<b>0.9930</b>	<b>0.9933</b>	<b>0.9680</b>					

Table 3. A comparison of the actual start date for bypass operations at Wells Dam each year, versus the date on which the 5<sup>th</sup> percentile of the yearling Chinook salmon migration passed Wells Dam that year. Operations are assumed to begin at 00:00 for the date listed. “Proportion bypass ops would have covered” indicates the proportion of the migration that would have been provided a bypass passage route had bypass operations started at 00:00 on the date that the 5<sup>th</sup> percentile of the migration passed Wells Dam. “Bypass start date was...” indicates whether the bypass start date was earlier or later than the date on which the 5<sup>th</sup> percentile of the yearling Chinook migration passed Wells Dam, and by how many days.

Migration Year	Actual bypass start date	Cumulative proportion passed before 00:00	Proportion Covered by Bypass Ops	Date on which the 5 <sup>th</sup> percentile passed	Cumulative proportion passed before 00:00	Proportion bypass ops would have covered	Bypass start date was...
2005	April 12	0.0528	0.9472	April 11	0.0039	0.9961	1 day late
2006	April 12	0.0259	0.9741	April 18	0.0468	0.9532	6 days early
2007	April 12	0.0551	0.9449	April 9	0.0243	0.9757	3 days late
2008	April 12	0.0025	0.9975	May 3	0.0406	0.9594	21 days early
2009	April 12	0.0116	0.9884	April 19	0.0436	0.9564	7 days early
2010	April 12	0.0067	0.9933	April 22	0.0410	0.9590	10 days early
2011	April 12	0.0085	0.9915	April 15	0.0446	0.9554	3 days early
2012	April 9	0.0004	0.9996	April 15	0.0115	0.9885	6 days early
2013	April 9	0.0171	0.9829	April 10	0.0240	0.9760	1 days early
2014	April 9	0.0169	0.9803	April 16	0.0386	0.9614	7 days early

Table 4. A comparison of the actual stop date for bypass operations at Wells Dam each year, versus the stop date necessary to have covered at least 95% of the subyearling Chinook salmon outmigration that year. Operations are assumed to end at 24:00 for the date listed.

Migration Year	Actual Stop Date	Cumulative proportion passed by 11:59:59 PM	Date on or before the last 5% passed	Cumulative proportion passed by 11:59:59 PM (Bypass Ops would have Covered this Proportion)	# Days before actual date to get 95%
2005	August 26	0.9959	August 3	0.9525	23
2006	August 26	0.9971	August 2	0.9524	24
2007	August 26	0.9983	August 11	0.9538	15
2008	August 26	0.9887	August 19	0.9502	7
2009	August 26	0.9911	August 22	0.9709	4
2010	August 26	0.9936	August 10	0.9537	16
2011	August 26	0.9959	July 25	0.9528	32
2012	August 19	0.9930	July 29	0.9502	22
2013	August 19	0.9933	August 7	0.9592	12
2014	August 19	0.9696	August 15	0.9524	4



Figure 1. Passage dates at Rocky Reach Dam for spring and summer migrating stocks, 2005-2014. Cumulative proportions are based on the expanded counts obtained from sampling daily from 1 April – 31 August (or through 4 September in 2008 and 15 September in 2014).



