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Memorandum

TO: Wells HCP Coordinating Committee

FROM: Tom Kahler, Shane Bickford, Douglas PUD

DATE: December 26, 2012

SUBJECT: Wells Dam 2013 Juvenile Fish Bypass Operating Plan

Anticipated Juvenile Migrants during the 2013 Juvenile Fish Bypass Period

The 2013 spring and summer outmigration of naturally produced juvenile HCP Plan Species at Wells Dam will consist of offspring of adults that spawned above Wells Dam during brood years (BY) 2011 and 2012 (Table 1). The spring migration will include juvenile spring Chinook, coho, sockeye, and steelhead, and summer/fall Chinook sub-yearlings will migrate during both spring and summer bypass operations.

Table 1. Ladder counts at Wells Dam of HCP Plan Species whose progeny are anticipated to migrate through the Wells Project during the 2013 bypass period. Juvenile steelhead migrate predominantly as yearlings from the Okanogan River and as age-2 and age-3 fish from the Methow River; thus, 2009, 2010, and 2011 steelhead adult counts are included (BY 2010, 2011, and 2012, respectively).

Species	Adult Migration Year	Ladder Count	Juvenile Migration
Spring Chinook	2011	8,122	Spring
Summer/Fall Chinook	2012	46,835	Summer
Coho	2011	5,796	Spring
Sockeye	2011	111,508	Spring
Summer Steelhead	2009	25,422	Spring
Summer Steelhead	2010	12,929	Spring
Summer Steelhead	2011	12,069	Spring

Scheduled hatchery releases above Wells Dam in 2013 include yearling spring Chinook from the Methow Fish Hatchery (495,000) and the Winthrop National Fish Hatchery (WNFH; 375,000). The WNFH also will release approximately 300,000 coho. Summer Chinook yearlings will be released from the Carlton (420,000) and Similkameen (620,000) acclimation ponds. Hatchery steelhead scheduled for release above Wells Dam include approximately 150,000 fish to the Methow Basin and 100,000 to the Okanogan Basin from Wells Hatchery, and 114,000 to the Methow Basin from WNFH. In general, the hatchery yearling Chinook, coho and steelhead are

scheduled for release after April 15th with Winthrop coho and Wells steelhead scheduled for release after April 20th. By mid-May, all of the yearling Chinook and coho will have been released. The steelhead releases have historically continued into late May.

2013 Juvenile Fish Bypass Operations

Operation of the bypass system throughout the 2013 season will follow the criteria contained within the Wells Dam Juvenile Dam Passage Survival Plan (Wells Juvenile Bypass Plan) found in Section 4.3 of the Wells HCP. One of the main goals of the Wells Juvenile Bypass Plan is to provide bypass operations for at least 95% of both the spring and summer migration of juvenile plan species.

From 2004 through 2011, the timing of the implementation of bypass operations was based upon an analysis of 21 years of hydroacoustic and 14 years of species composition information collected on juvenile run patterns at Wells Dam. From the data available to the Wells HCP Coordinating Committee in February 2004, they agreed that initiation of the Wells bypass system on April 12th and termination on August 26th would conservatively provide bypass operations for more than 95% of both the spring and summer migrations of juvenile Plan Species.

In 2011, Columbia Basin Research performed an analysis using seven years of passage data obtained from daily sampling at the Juvenile Sampling Facility of the Rocky Reach Juvenile Fish Bypass System to more accurately estimate the contemporary percentage of the migration of spring and summer migrants that passed during bypass operations at Wells Dam. From that analysis, the Wells HCP Coordinating Committee adjusted the starting and ending dates for bypass operations at Wells Dam, moving the starting date three days earlier to April 9 to cover early-migrating natural origin spring Chinook, and moving the ending date seven days earlier to August 19 to more accurately reflect the contemporary passage timing of the sub-yearling Chinook outmigration. Thus, for 2012, bypass operations at Wells Dam commenced at 00:00 on April 9 and ended at 24:00 hours on August 19. For accounting purposes, the end of the 2012 spring bypass season was June 13th at 24:00 hours and the beginning of the summer bypass season was June 14th at 00:00 hours.

Upon completion of the 2012 bypass season, Columbia Basin Research updated the original analysis that supported the decision by the Wells Coordinating Committee to adjust the dates of bypass operations. The updated analysis determined that the adjusted dates of bypass operations at Wells Dam in 2012 provided bypass passage for 99.96 percent of yearling Chinook, 99.86 percent of steelhead, 100 percent of sockeye, and 99.30 percent of subyearling Chinook. Based upon this high level of compliance with the HCP bypass operating criteria (exceeding the 95% bypass-passage criteria for all species), Douglas PUD proposes to commence operation of the bypass system starting at 00:00 on April 9 and to end operations at 24:00 hours on August 19. For accounting purposes, the 2013 spring bypass season will end on June 13th at 24:00 hours and the summer bypass season will begin on June 14th at 00:00 hours.

Dam safety emergency action planning, as required by the Federal Energy Regulatory Commission (FERC), calls for Douglas PUD to operate Wells Dam with sufficient automatic-gate-opening capacity in the spillways to pass the flow from a plant load rejection of up to 200 thousand cubic feet per second (kcfs), in addition to any concurrent initial spillway discharge.

Of the 11 spillways at Wells Dam, only spillways 3 through 9 have automated gate hoists. Thus, the seasonal installation of bypass barriers in spillways 2, 4, 6, 8 and 10, substantially reduces the automatic-gate-opening capacity of Wells Dam by reducing the capacity of each bypass spillway to 8.6 kcfs. Consequently, Douglas PUD must remove bypass barriers systematically when discharge estimates exceed certain flow thresholds, as per Table 2, sufficient to provide the necessary automatic-gate-opening flow capacity as described in the FERC-required Emergency Action Plan for the Wells Project (EAP, Appendix I). Decisions to remove bypass barriers for dam safety considerations will be made each Monday (or at other times as necessary) during the bypass period and will be based on weekly forecasts of combined discharge from Chief Joseph Dam and side-flows from the Okanogan and Methow rivers (from the National Weather Service Northwest River Forecast Center [NWRFC]; http://www.nwrfc.noaa.gov/stp/stp.cgi).

Table 2. Schedule for removal of spillway flow-barriers (bypass barriers) to accommodate flood flows and load rejections.

Inflow Forecast (kcfs)	Bypass Barriers Removed
Up to 200	None
200 – 240	Spillway 6
240 – 275	Spillways 6, 8
275 – 310	Spillways 4, 6, 8
310 – 350	Spillways 4, 6, 8, 10, & preset gates 10, 11 to spill excess of 312 kcfs
350 – 400	Spillways 4, 6, 8,10, & preset gates 1, 10, 11 to spill excess of 312 kcfs
400 – 450	All spillways (2, 4, 6, 8, 10)

Juvenile Fish Bypass Operations and Clean Water Act TDG Compliance

Seasonal bypass operations generally coincide with the spring freshet, an event during which operators of hydroelectric projects must cope with flows that often exceed the hydraulic capacity of their powerhouses. When flows exceed the hydraulic capacity of the generating units, water must be passed via the spillway in what is termed "involuntary spill." Involuntary spill increases the concentration of atmospheric gases in the water below hydroelectric projects, and can result in excessive levels of total dissolved gas (TDG) that may injure fish. To minimize the potential for fish injury, the Washington Department of Ecology (WDOE) imposes TDG standards on operators of hydroelectric projects.

Extensive study of spill operations at Wells Dam and modeling exercises at the University of Iowa provide the basis for the development of annual spill "playbooks" for operations at Wells Dam aimed at achieving the WDOE standards for TDG in the Wells tailrace. From modeling and physical-spill studies over the past several years, Douglas PUD has determined that concentrating spill through the middle of the spillway and supporting that concentrated spill with turbine discharge results in the most effective minimization of TDG in the Wells tailrace. Specifically, the best TDG performance is achieved when concentrating involuntary spill through Spillway 5, and allocating additional spill, beyond the capacity of Spillway 5, to Bypass Bay 6 and then to Spillway 7, up to a maximum of 43 kcfs per spillway.

To accomplish this TDG-minimizing pattern of concentrated spill requires the removal of the bypass barriers from at least one spillway during periods with excessive involuntary spill. The removal of the bypass barriers from one bypass bay takes approximately eight hours and requires

the use of a four-man mechanical crew and the powerhouse gantry cranes. To comply with the TDG standards below Wells, the bypass barriers must be removed from at least one spillway whenever involuntary spill exceeds 30 kcfs and one or both of the following conditions applies: 1) prolonged (> 8 hours) involuntary spill in excess of 40 kcfs is predicted (based on forecasted tributary inflows from the NWRFC and estimated discharge from Chief Joseph Dam provided by the US Army Corps of Engineers); or 2) total spill is predicted to exceed 53 kcfs, regardless of duration. Once involuntary spill of less than 40 kcfs, for a period of at least four days is predicted, the respective bypass barriers would be reinstalled. At river flows greater than 240 kcfs, bypass barriers would be removed from additional bypass bays as described above (see Table 2) and reinstalled sequentially as appropriate.

Juvenile Fish Bypass Contingency Plan

The failure of a gate-hoist cable in a bypass spillway at Wells Dam in late August 2010 provided the impetus for the development of a contingency plan for bypass operations during similar events that could occur in the future. Under the 2010 Juvenile Fish Bypass Contingency Plan (Bypass Contingency Plan), in the event of a failure of a bypass gate or other such accident or unanticipated mechanical failure that rendered impossible normal bypass operations, Douglas PUD's initial response would follow the Wells Juvenile Bypass Plan, shutting down associated turbine units as prescribed in Section 4.3 of the Wells HCP. However, high river discharge in 2011 and 2012 highlighted the need to incorporate the consideration of TDG into the Bypass Contingency Plan, and we have modified the plan accordingly.

During periods of high river discharge, mid-Columbia hydroprojects maximize powerhouse discharge to minimize spill and associated increases in TDG. Shutting down a turbine at Wells Dam when all other turbines are loaded would increase spill by 20 kcfs, which would also increase TDG. However, losing function of one bypass unit at Wells Dam affects two turbine units; thus, shutting down both turbine units associated with the malfunctioning bypass spillway would increase spill by 40 kcfs. Therefore, Douglas PUD has modified the Bypass Contingency Plan to avert unnecessary increases in TDG from shutting turbine-units due to a mechanical failure of the bypass system.

Section 4.3 of the Wells HCP directs Douglas PUD to shut down the turbine units adjacent to the bypass spillway that is not operating due to either a lack of water or an inability to operate the bypass spillway. Under the 2010 Bypass Contingency Plan, the associated turbine units would have remained inactive until personnel at Wells Dam could determine the cause of the bypass failure and the nature of and time required for the necessary repair. Under the new Bypass Contingency Plan, if shutting down the turbines would not threaten compliance with TDG standards, Douglas PUD would shut down the associated turbine units. However, if doing so would threaten compliance with TDG standards, Douglas PUD would not shut down the associated turbines but would instead direct spill through spillways adjacent to the affected turbine units in a manner that provides bulk flow for fish passage while minimizing TDG (Figure 1, Option 1). Douglas PUD would consult the Spill Playbook (see above) to select such spill configurations, and would spill at least 10 kcfs through selected spillways to engage the submerged flip-lip as a TDG minimization measure and to provide bulk flow for fish attraction to the surface passage route. In circumstances where turbine shutdown would not jeopardize TDG compliance, Douglas PUD would shut down the associated turbine units to evaluate and

repair the malfunction, but may then elect to move the bypass barriers from the inoperable bypass spillway to an adjacent, non-bypass spillway to obtain the use of an additional turbine unit (see Figure 1, options 2 and 3). The gate for that substitute bypass spillway would then be set at the standard 1-foot opening for bypass spillways and the adjacent turbine unit could be operated without constraints. This configuration would meet the intent of HCP Section 4.3 by providing bypass spill immediately adjacent to every operating turbine unit and would comply with the goal of the Total Dissolved Gas Abatement Plan.

During the repair of a bypass malfunction, Douglas PUD would daily reevaluate forecasts of Chief Joseph Dam discharge, tributary inflows, and TDG conditions, as well as repair progress, and determine which bypass option to implement.

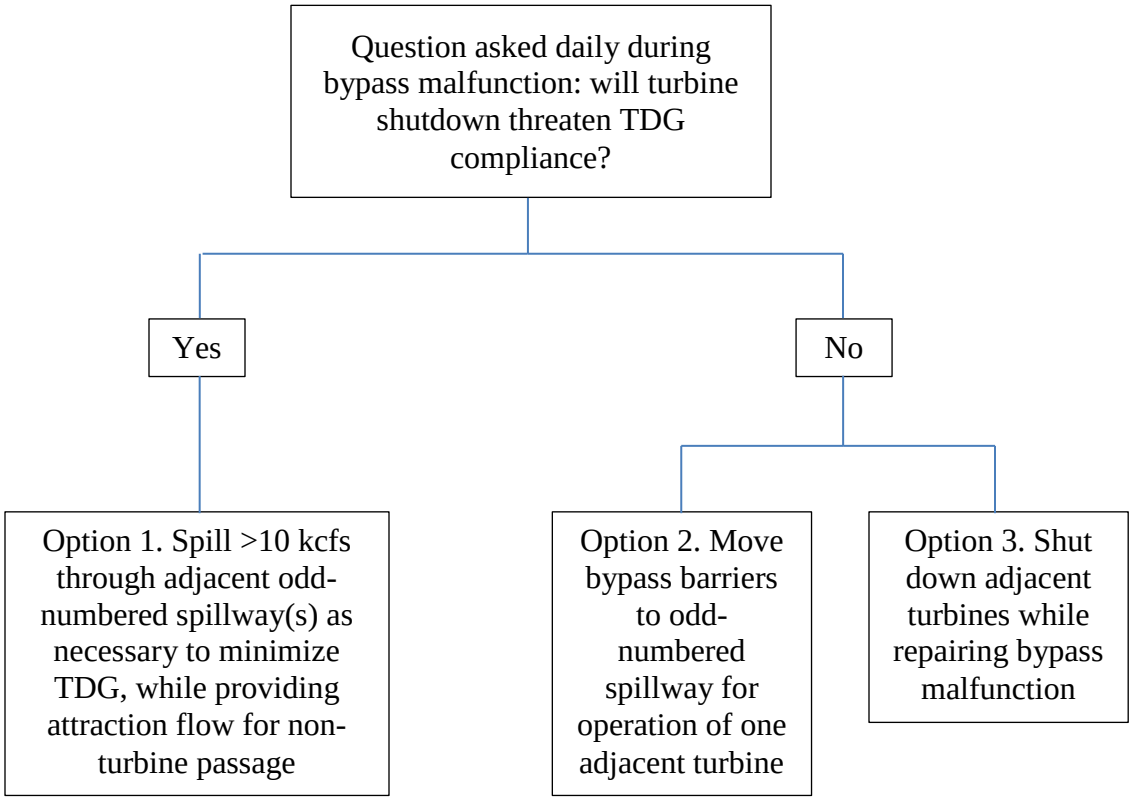

Figure 1. Evaluation flow chart for daily decisions regarding bypass, spill, and turbine operations during a bypass malfunction.