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Via Electronic Filing

Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 1st Street N.E.
Washington, D.C. 20426

February 28, 2019

Subject: Wells Hydroelectric Project Total Dissolved Gas Abatement Plan 2018 Annual Report – License Article 401 (b)

Dear Secretary Bose:

Pursuant to Article 401(b) of the Federal Energy Regulatory Commission (FERC) license for the Wells Hydroelectric Project (Wells Project), the Public Utility District No. 1 of Douglas County (Douglas PUD) hereby submits the final Total Dissolved Gas Abatement Plan Annual Report (TDG Report) for calendar year 2018. Article 401(b) requires Douglas PUD to file an annual TDG Report with the FERC by February 28th during each year of the new license.

The final 2018 TDG Report is attached as Appendix A to this letter. A draft version of this 2018 TDG report was distributed to the Washington State Department of Ecology (Ecology) and all of the other parties to the Aquatic Settlement Agreement (ASA) including the United States Fish and Wildlife Service (USFWS), U.S. Bureau of Land Management (BLM), Washington State Department of Fish and Wildlife (WDFW), the Confederated Tribes of the Colville Reservation (CCT) and the Confederated Tribes and the Bands of the Yakama Nation (YN). No comments were received during the 30 day comment period. Following review, all parties present during the February 20, 2019 Aquatic SWG meeting approved the 2018 TDG Report, whereas Ecology signified their approval via email on the same day. The pre-filing consultation record supporting the review and approval of the 2018 TDG Report can be found in Appendix B.

The enclosed 2018 TDG Report is consistent with (1) the Water Quality Management Plan that is contained within the ASA, (2) Condition 6.7(2)(c)(iii) of Ecology's Clean Water Act section 401 Water Quality Certification (401 Certification), and (3) the National Marine Fisheries Service Endangered Species Act Incidental Take Statement (ITS) Reasonable and Prudent Measure No. 2 for the Wells Project.

If you have any questions or require further information regarding the enclosed report, please feel free to contact Andrew Gingerich at (509) 881-2323, andrewg@dcpud.org.

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Sincerely,

Shane Bickford
Natural Resources Supervisor

Enclosure:

1) Appendix A – Wells Hydroelectric Project Total Dissolved Gas Abatement Plan 2018 Annual Report

2) Appendix B – Pre-filing consultation record for the Wells Hydroelectric Project Total Dissolved Gas Abatement Plan 2018 Annual Report

Cc: Breean Zimmerman – Ecology, Union Gap
Scott Carlon – NMFS, Portland
Wells Aquatic Settlement Work Group
Tom Kahler – Douglas PUD
Andrew Gingerich – Douglas PUD

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APPENDIX A

WELLS HYDROELECTRIC PROJECT TOTAL DISSOLVED GAS ABATEMENT PLAN 2018 ANNUAL REPORT

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Wells Hydroelectric Project
Total Dissolved Gas Abatement Plan

2018 Annual Report

Public Utility District No. 1 of Douglas County
1151 Valley Mall Parkway
East Wenatchee, WA 98802-4331

Prepared for:

Washington Department of Ecology
1250 Alder St, Union Gap, WA 98903

And

Aquatic Settlement Work Group

February 2019

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1 INTRODUCTION

The 2018 Wells Hydroelectric Project (Wells Project) Gas Abatement Plan (GAP) was approved by the Washington State Department of Ecology (Ecology) on February 13, 2018 and subsequently submitted to the Federal Energy Regulatory Commission (FERC) on February 22, 2018. The GAP and its associated measures represent a long-term strategy to achieve compliance with the Washington State Water Quality Standard (WQS) criteria for total dissolved gas (TDG) in the Columbia River at the Wells Project while continuing to provide safe passage for downstream migrating juvenile salmonids. This annual report concludes the 2018 monitoring season and describes the background, operations, and results of GAP implementation at the Wells Project in 2018. In addition, this report contains TDG performance for the Wells Project during the 2018 fish passage season, and TDG performance outside of the fish passage season. Data summarized in this report includes monitoring from January 1, 2018 to December 31, 2018.

1.1 Project Description

The Wells Project is owned and operated by Public Utility District No. 1 of Douglas County (Douglas PUD) and is located at river mile (RM) 515.6 on the Columbia River in the State of Washington (Figure 1). Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (USACE), and 42 miles upstream from the Rocky Reach Hydroelectric Project, owned and operated by Public Utility District No. 1 of Chelan County. The nearest town is Pateros, Washington, which is located approximately 8 miles upstream of Wells Dam.

The Wells Project is the chief generating resource for Douglas PUD. It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. The hydrocombine is 1,130 feet long, 168 feet wide and has a top of dam elevation of 795 feet above mean sea level (msl). Upstream fish passage facilities are located on both sides of the hydrocombine.

The Methow and Okanogan rivers are tributaries of the Columbia River, which drain into the Wells Reservoir. The Wells Project boundary extends 1.5 miles up the Methow River and 15.5 miles up the Okanogan River. The surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre-feet at the normal maximum water surface elevation of 781 feet msl.

1.2 Fixed Monitoring Site Locations

Fixed monitoring stations (FMS) for TDG are located above and below Wells Dam. The forebay station (WEL) is located midway across the deck of Wells Dam (47° 56’ 50.28” N, 119° 51’ 54.78” W). The tailrace station (WELW) is located on the left bank of the Columbia River 2.6 miles downstream of Wells Dam (47° 54’ 46.86” N, 119° 53’ 45.66” W). In the spring of 2014, Douglas PUD installed a third FMS at

Washburn Island (WSBW; 48° 5' 17.15" N, 119°40' 33.82" W), located approximately 7 miles downstream of Chief Joseph Dam. Hach® or Hydrotech HYDROLAB MiniSonde (MS5) instruments equipped with TDG and temperature probes are deployed approximately 15 feet below normal surface water elevation and are calibrated monthly. Data from the three stations are automatically transmitted by radio to Wells Dam, stored, forwarded to the USACE, and posted to the Douglas PUD public webpage (www.dcpud.org). Weather data are recorded by Global Water, Inc. instrumentation, including an electronic barometer located on the deck of Wells Dam at 810 feet elevation. All three FMS are geographically represented by yellow pins in Figure 1.

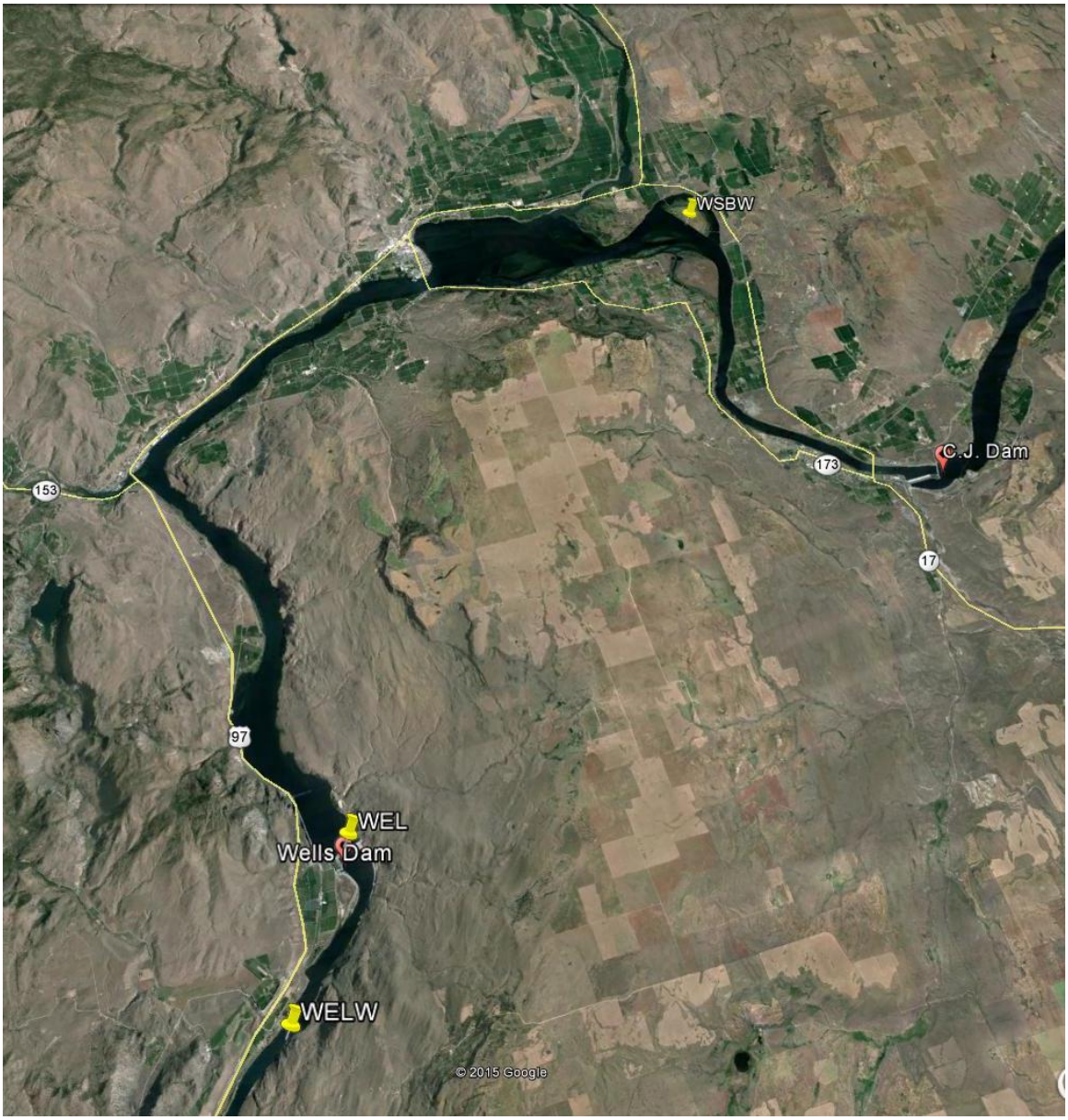

Figure 1. TDG fixed monitoring stations (yellow pins) above and below Wells Dam

1.3 Regulatory Framework

Washington Administrative Code (WAC) Chapter 173-201A identifies the WQS for surface waters in Washington State. Per the WQS, TDG measurements shall not exceed 110% saturation at any point of measurement in any state water body. The WQS provide for two exceptions to this rule: (1) for spill over dams to increase survival of downstream migrating juvenile salmon; and (2) during natural flood flows.

Ecology may approve an adjustment to the 110% upper criterion for TDG saturation during the outmigration of juvenile salmon; provided that spill aids in the survival of migratory fish. The TDG adjustment is considered by Ecology on a per-application basis and must be accompanied by an approved Gas Abatement Plan and biological monitoring plan (WAC 173-201A-200(1) (f) (ii)). On the Columbia and Snake rivers, the TDG exception for fish passage has three standards during the fish passage season: (1) TDG shall not exceed 125% saturation in the tailrace of the project as measured in any one-hour period; (2) TDG shall not exceed 120% saturation in the tailrace of the project based on the average of the twelve highest consecutive hourly readings (12C-High); and, (3) TDG shall not exceed 115% saturation in the forebay of the next downstream project based on the average of the twelve highest consecutive hourly readings. Natural flood flows are identified by periods in which river flow volume exceeds the highest seven consecutive day average observed during a ten-year period, called the 7Q-10 flow. The 7Q-10 flow for the Wells Project is 246,000 cubic feet per second (cfs), based on the hydrologic records from 1930 to 1998 and the USGS Bulletin 17B, “Guidelines for Determining Flood Flow Frequency” (Pickett et al. 2004). When river flow volume exceeds 7Q-10 flows, the WQS established in the WAC do not apply.

1.4 Gas Abatement Plan Approach

1.4.1 Operational

Based on the success of 2009 and 2010 operations associated with implementation of the Wells Project Spill Playbook (Spill Playbook), those operations were implemented between 2011 and 2018 with minor modification as described below.

In February 2011, Douglas PUD conducted an additional technical analysis of the 2010 Spill Playbook (after in-season changes) and confirmed that continued implementation would be appropriate for 2011 with additional minor modifications. Additional recommendations for 2011-2018 operations, from a TDG management perspective, included:

1. Minimize spill.
2. Forced Spill (≤ 53.0 kcfs). Switch the priority for forced spill less than 53 kcfs from spillbay 7 to spillbay 5 during the rebuild of turbine unit 7. Turbine units 4 and 5 were operational and should be operated to support spill from spillbay 5.

3. If spill exceeds 53 kcfs, or is predicted to exceed 40 kcfs for more than 8 hours, remove the Juvenile Bypass System (JBS) barriers in spillbay 6.

4. When spill exceeds 30 kcfs in spillbay 5 and JBS barriers have been removed in spillbay 6, shift at least 15.0 kcfs from spillbay 5 to spillbay 6 (i.e., 27.2 kcfs and 15.0 kcfs through spillbays 5 and 6, respectively). Support spill through spillbays 5 and 6 by operating turbine units 4, 5 and 6.

5. Reinstall the JBS barriers if total spill is predicted to remain below 40 kcfs for more than four days.

Modifications were based on previous adaptive operational results, model predictions, and operational contingencies, including the prolonged rebuild of turbine unit 7 at Wells Dam. In 2017 and 2018, the GAP recommended moving spill back to the spillbays above turbine unit 7 when forced spill exceeded 53 kcfs, since turbine unit 7 was returned to commercial operation and deemed sufficiently reliable to be operating throughout the juvenile fish bypass season. Using these modifications, Wells Dam has demonstrated high TDG compliance with the WAC and WQS.

1.4.2 Structural

No permanent structural modifications were proposed or conducted in the 2018 monitoring season. High flows in the first part of the bypass period required several removals and installations of bypass barriers at Wells Dam in 2018. With another early freshet in 2018, flow and involuntary spill volumes met the criteria for barrier removal by the third week of April, and the bypass barriers for Spillway 6 were removed on April 23. As the freshet peaked in mid-May, barriers were removed from Spillway 8 on May 10, Spillway 4 on May 11, and Spillway 10 on May 14. With flows and spill diminishing in the first week of June, the barriers were reinstalled in Spillway 4 on June 4, and spillways 8 and 10 on June 5. The bypass barriers for Spillway 6 were reinstalled a week later on June 12. Removal and reinstallation of the JBS barriers follows the requirements of the FERC approved Spill Playbook, Bypass Operating Plan and Wells Dam Emergency Action Plan (EAP).

1.4.3 Consultation

Beginning in 2016, Douglas PUD directs all correspondence related to TDG compliance to Ecology's Hydropower Projects Manager located in the Central Region Office (Union Gap, Washington 98903. In addition, Douglas PUD annually consults with the Aquatic Settlement Work Group (Aquatic SWG) and HCP Coordinating Committee (HCP CC) for specific TDG and WQS documents per Douglas PUD's 401 Certification and FERC license requirements.

2 OPERATIONS

2.1 Description of Fish-Passage Season Flow

The Wells Anadromous Fish Agreement and Habitat Conservation Plan (HCP) required Douglas PUD to provide juvenile fish bypass passage opportunities for greater than 95% of the downstream migrating

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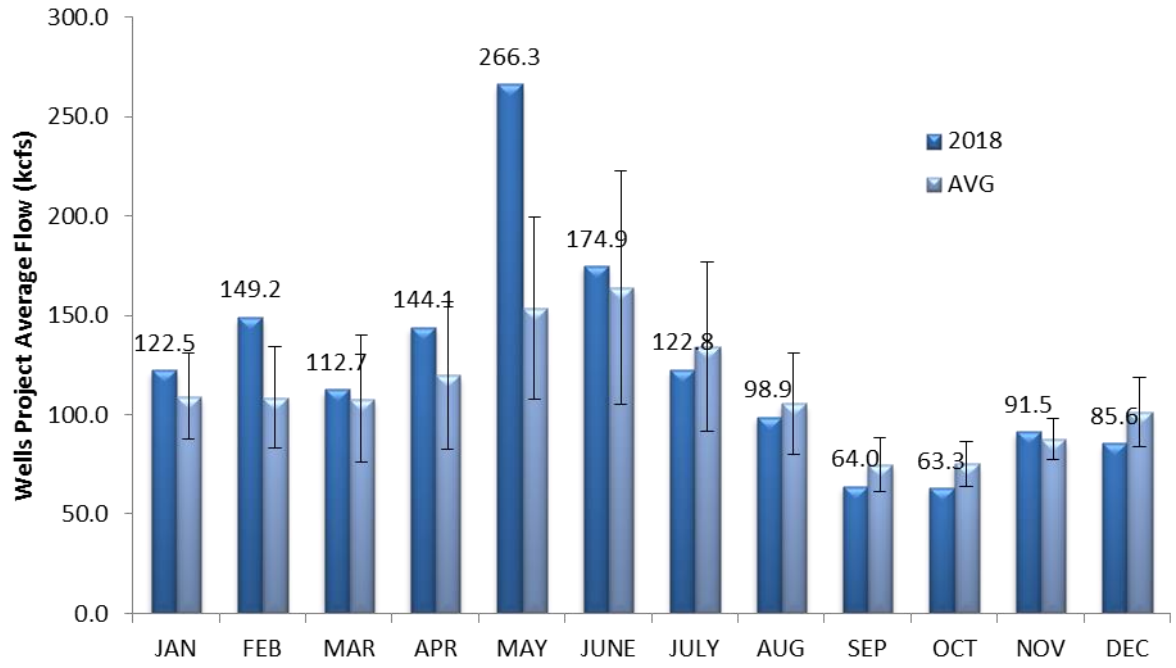
juvenile fish covered by the HCP (Plan Species). The HCP defined juvenile fish passage season starts April 1st and runs through August 31st of each year. Douglas PUD annually reviews fish passage statistics and uses that information to tune operation during subsequent years toward ensuring that greater than 95% of the juvenile outmigration is afforded a non-turbine passage route around Wells Dam. Based upon prior year information, the juvenile fish bypass was started on April 9 (0:00 hrs) and ended at midnight on August 19th. As required, TDG performance was monitored during this period and transmitted to the USACE, Northwest Division on a real-time basis (www.nwd-wc.usace.army.mil) and made available on Douglas PUD's public webpage (http://dcpud.org/wells-project/total-dissolved-gas-and-temperature-monitoring). Historical data continues to be available for download at both of these websites.

Data from 1969 to 2018 show that average monthly flows at Wells Dam range from a September low of 74.9 to a June high of 163.9 kcfs (Table 1; Figure 2). The ten year average shows higher flows in May through July compared to the historical means recorded during the same months. Flows at the run-of-river Wells Project are determined by upstream storage releases at the Grand Coulee Hydroelectric Project and Canadian storage projects, with typically less than 10% of the total river flow provided by the two rivers that flow into the Columbia River within the Wells Project (Okanogan and Methow Rivers).

Table 1. Monthly average river discharge (kcfs) from the Wells Project, 1969-2018.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2018	122.5	149.2	112.7	144.1	**266.3**	174.9	122.8	98.9	64.0	63.3	91.5	85.6	124.7
Average since 1969	109.1	108.7	107.8	119.8	153.6	163.9	134.2	105.6	74.9	75.3	87.7	101.2	111.3
Minimum since 1969	67.4	69.9	56.0	51.9	55.2	73.7	53.4	63.9	53.5	56.0	63.8	72.6	
Maximum since 1969	159.2	180.7	193.9	203.8	**266.3**	348.7	253.8	181.3	123.0	108.9	110.0	149.0	
10YR mean (2009-2018)	108.6	104.4	108.3	140.3	176.3	177.2	145.6	108.4	66.9	67.0	86.8	100.6	115.9

Observed flows in February 2018 were 40% higher than average flows recorded in the month since 1969 (149.2 kcfs vs 108.7 average since 1969; Table 1, Figure 2). While March and April 2018 flows approached average, May 2018 flows hit 266.3 kcfs, which was an observed monthly high since the Wells Project was commissioned in mid-year 1968 (Table 1, Figure 2). May flows were more than 70% higher than normal and more than twice as large as one standard deviation above the average. Flows in June through the balance of the year approached normal conditions (Figure 2). Peak or freshet flows were early, which represents a consistent observation that has occurred at Wells Dam over the last several years.



* December 2018 accounting check had not been completed at the time of this report development and therefore is considered prelimiary and subject to revision.

Figure 2. 2018 monthly flows compared to monthly average. Error bars on average monthly data are on standard deviation. Data label values above bars correspond to dark blue or 2018 data.

2.2 Fish Bypass Program

Wells Dam is a hydrocombine, where the spillbays are located directly above the turbine intakes. Research at Wells Dam in the mid-1980s demonstrated that a modest amount of spill could effectively guide a high proportion of downstream migrating juvenile salmon away from turbines and into a surface oriented bypass system. A JBS was subsequently developed at Wells in the late 1980s. The Wells Dam JBS was engineered based on biological research and hydraulic modeling, and utilizes constricting flow barriers deployed in five of the eleven spillbays to effectively attract and safely guide fish through the project. The Wells Project JBS has since proven to be the most efficient system on the mainstem

Columbia River, providing high levels of fish protection and survival that has met approval from various fisheries agencies and tribes (Skalski et al. 1996). The passage and survival performance measures contained within the FERC-approved HCP have been consistently exceeded, with a three-year project survival average of 96.2% for juvenile steelhead and Chinook salmon (Bickford et al. 2001). The results from a fourth year of survival study at Wells Dam in 2010 (Bickford et al. 2011) confirmed past study results by documenting survival through the entire Wells Project of 96.4% for juvenile spring migrating anadromous salmonids (see Section 3.1.2 below).

2.3 Fish Bypass Spill Quantities and Duration

The Wells Dam JBS uses up to 2,200 cfs of water for each of the five bypass/spillbays. Under normal conditions, the JBS will use roughly five to eight percent of the total river flow for fish guidance. The increased spill has a small influence on TDG production (~0-2%) while providing a safe and highly effective, non-turbine passage route for over 92% of the spring- and 96% of the summer-migrating juvenile salmonids. The HCP-defined juvenile fish migration period runs from April 1st to August 31st of each year. The HCP CC retains annual operating oversight that includes the potential to operate the JBS as early as April 1 and as late as August 31 to ensure that 95% of the spring and summer migration of juvenile salmonids are provided a safe, non-turbine passage route over Wells Dam. Any spill that occurs between April 1st and August 31st is deemed to have a beneficial effect on migrating juvenile salmonids.

From 2003 to 2011 the HCP CC directed the District to operate the JBS on a fixed schedule between April 12 and August 26 in an effort to provide a non-turbine passage route for at least 95% of the spring and summer migration of juvenile salmonids. In 2012, Douglas PUD evaluated past performance of the Wells Dam JBS operating dates relative to observed annual run timing (at the Rocky Reach Bypass) for both spring and summer migrants. With that data, a request was made to and granted by the HCP CC to revise the bypass operating dates in 2012 to start April 9 and end August 19. These dates were therefore used in 2012-2018 to operate the fish bypass system for migrating juvenile salmonids. Juvenile anadromous salmonids that pass Wells Dam before and after the bypass system is shut down for the year benefit from spill at the Project and therefore Douglas PUD annually develops a GAP and conducts biological and physical monitoring in order to obtain an Ecology approved TDG adjustment for the entire juvenile salmonid migration period (April 1st to August 31st).

3 IMPLEMENTATION RESULTS

3.1 Fisheries Management

3.1.1 Fish Passage Efficiencies

No new fish passage efficiency studies were conducted at the Wells Project in 2018. However, three years of bypass efficiency studies have shown the Wells Dam JBS to be the most efficient juvenile salmonid collection system in the Columbia River with fish passage efficiencies up to 92% for spring migrants and up to 96% for summer migrants (comprised of steelhead, spring Chinook, and sockeye salmon, and summer/fall Chinook salmon, respectively; Skalski et al. 1996).

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3.1.2 Survival Studies

No survival studies were conducted at the Wells Project in 2018. However, Douglas PUD is preparing for a 2020 survival verification study using spring migrating yearling Chinook salmon.

3.2 Biological Monitoring

The 2018 Wells Project GAP includes the National Marine Fisheries Service (NMFS) recommendation to sample for Gas Bubble Trauma (GBT) in juvenile salmon when hourly tailrace TDG levels exceed 125% saturation (NMFS 2000). Biological monitoring occurred at the Rocky Reach JBS on 17 days: May 11, 14-18, 21-25, 29, 31, June 1, 4-6. In total, 1,040 juvenile salmonids were examined for signs of GBT in eyes, caudal fins, anal fins, and dorsal fins. Fins were scored 0-4 where, "0" corresponded to no bubbles or GBT, "1" corresponded to 1-5% of fin or eye covered with GBT, "2" corresponded to 6-25% of fin or eye covered with GBT, "3" corresponded to 26-50% of fin or eye covered with bubbles, and "4" >50% of fin or eye covered with GBT.

Between May 11 and June 6, 326 Coho, 184 yearling Chinook, 144 subyearling Chinook , 296 sockeye, and 90 steelhead were examined for signs of GBT. GBT symptoms were observed very infrequently (<5% of fish) before May 15th. GBT expression, when found, was predominately observed in the caudal fins. Fish were most symptomatic during the middle to late May when TDG values in the Wells Tailrace were routinely above 130%. Higher TDG values were associated with flows at Wells Dam that exceeded both 7Q-10 criteria and powerhouse capacity. During the month of May average flows were >266 kcfs, which is beyond the 246 kcfs 7Q-10 value for the Project (Figure 2).

In previous years Douglas PUD biologists have observed high TDG values effecting coho in greater relative numbers than other juvenile salmonids. This trend continued in 2018 with coho showing the greatest severity of symptoms of GBT and at the lowest TDG levels, relative to other smolt species (Table 2). Sockeye and subyearling Chinook seemed to be the most resistant to GBT expression (Table 2).

3.1 Water Quality Forums

Douglas PUD has actively participated in regional water quality forums with Ecology, Washington Department of Fish and Wildlife, NMFS, Tribal Agencies, the U.S. Fish and Wildlife Service, the USACE, and other Mid-Columbia PUDs (i.e., Grant and Chelan counties). Specific forums include the Trans-boundary Gas Group, Columbia Basin meetings with Ecology, and the Sovereign Technical Team Water Quality Work Group. These meetings allow for regional coordination for monitoring, measuring, and evaluating water quality in the Columbia Basin and support ongoing Upper Columbia Treaty review analyses that will provide a foundation for Treaty negotiations between Canada and the U.S. Douglas PUD will continue its involvement in water quality meetings for further coordination with other regional water quality managers towards meeting TDG standards.

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Table 2. **Gas Bubble Trauma (GBT) Sampling at Rocky Reach Juvenile Bypass System in 2018 showing expression in caudal fins of fish examined on all sample days. Percentiles ranges (italicized font) correspond to the proportion of the eye or fin covered in GBT.**

	Count	% of fish presenting score
Subyearling Chinook	144	
Absent	136	94%
(1-5%)	7	5%
(6-25%)	0	0%
(26%-50%)	1	1%
(>50%)	0	0%
Yearling Chinook	184	
Absent	156	85%
(1-5%)	18	10%
(6-25%)	8	4%
(26%-50%)	2	1%
(>50%)	0	0%
Coho	326	
Absent	175	54%
(1-5%)	70	21%
(6-25%)	54	17%
(26%-50%)	27	8%
(>50%)	0	0%
Steelhead	90	
Absent	75	83%
(1-5%)	9	10%
(6-25%)	4	4%
(26%-50%)	2	2%
(>50%)	0	0%
Sockeye	296	
Absent	263	89%
(1-5%)	31	10%
(6-25%)	2	1%
(26%-50%)	0	0%
(>50%)	0	0%
Grand Total	1040	

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3.2 Physical Monitoring

3.2.1 Overview

TDG monitoring at the Wells Project has occurred since 1984 when forebay stations were first established. TDG monitoring in the tailrace of Wells Dam began in 1997 by actively collecting data at four points across the width of the river. Based on these data, the location for a FMS was established in 1998. Subsequent analysis verified that both monitoring station locations are appropriate and representative of mixed river condition, particularly during high flows (EES et al. 2007; Politano et al. 2009). TDG monitoring at the Wells Project currently occurs year round as required by Douglas PUD's Wells Project 401 Water Quality Certification (401 Certification). As required by Douglas PUD's Quality Assurance Project Plan for TDG, FMS sensors are serviced and calibrated at least once per month or sooner if calibration issues are observed in the data.

In 2014, an additional reservoir monitoring station was installed at Washburn Island (RM 537.5) to collect TDG data representative of water quality entering the Wells Project from Chief Joseph Dam. The current Chief Joseph Dam tailwater station (CHQW) minisonde TDG sensor is deployed along the right bank of the Columbia River, 0.75 miles downstream from the dam. The river right location of the USACE TDG sensor precludes it from collecting bulk flow data, and instead the sensor monitors spillbay water disproportionally. Under some conditions, water coming from Chief Joseph Dam spillbays is of lower TDG concentration than the powerhouse. For example, when the Chief Joseph Dam forebay has high concentrations of TDG (e.g. greater than 120%) as a result of high spill volumes from Grand Coulee Dam and limited degassing through Rufus Woods Reservoir, water sent through the spillbays at Chief Joseph Dam may actually be stripped of gas via the spill deflectors. However, powerhouse TDG concentrations are essentially identical to those in the forebay and can be missed by the CHQW sensor since powerhouse flows orient to river left rather than river right where the TDG sensor resides. As a result of the CHQW location and the orientation of spill and powerhouse flows, bulk flows leaving the federal system and entering the Wells Project are not accurately monitored. The Washburn Island location installed and operated by Douglas PUD allows water quality managers and the Aquatic SWG Parties to:

1) Better understand TDG degassing in the Wells Project and expected TDG saturation in the Wells forebay.

2) Assure data quality at the Wells forebay TDG sensor since Washburn Island TDG values should correlate predictably with Wells forebay TDG values. Based on the comparison of the sensors at these two locations, technicians can ensure reliable data collection by scheduling sensor servicing when data appears to be erroneous.

3) More accurately assess TDG production from the federal power system upstream of Wells Dam, which may support improved management towards minimizing TDG production in the Columbia River.

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3.2.2 Data Evaluation and Analyses

Hourly TDG monitoring data were retrieved from the USACE, Northwest Division for three monitoring locations: the forebay of Wells Dam (WEL), tailrace of Wells Dam (WELW), and forebay of Rocky Reach Dam (RRH) or from the DCPUD.org dataset. The data were partitioned to include only readings obtained during the fish passage season (April 1 to August 31). Data were stratified by monitoring site, ascending date, and ascending time. The Ecology-approved 12C-High method was used to obtain TDG measurements for comparison to numeric criteria and evaluation of compliance.

3.3 TDG Compliance

Outside of the fish passage season the TDG criterion in the Wells Tailrace is 110% (January – March and September – December). Additionally, there were three compliance criteria for the 2018 fish passage adjustment that must be met in association with operation at the Wells Project as described in the 2018 GAP:

1) Average TDG in the tailrace cannot exceed 125% for one hour or

2) 120% for 12 continuous hours (12C-High), and

3) TDG in the downstream Rocky Reach Forebay cannot exceed 115% (12C-High).

These compliance criteria are waived when flows exceed the 7Q-10 value for the Wells Project (246 kcfs). For more information refer to WAC 173-201A-200.

3.3.1 Non-Fish Passage Season Compliance (Wells Tailrace 110%)

Per the Douglas PUD FERC Operating License and 401 Certification, in August 2013 Douglas PUD started collecting TDG data during the non-fish passage season. Non-spill flows at Wells Dam (through the turbine units and fishways) generate little to no additional dissolved gas. Spill outside the fish passage adjustment period is uncommon. However, in February and March of 2018 the drafting of Grand Coulee in preparation for accommodating a large Canadian snowpack produced seasonally abnormal flows at Wells Dam (Figure 2). In addition, for much of February and March Wells Dam was an eight-unit plant (of ten), with two units out for service (1 for complete rebuild, and one for biannual maintenance). Taking units offline reduces Douglas PUD's ability to respond to higher flows. Each unit reduction reduces powerhouse capacity by approximately 10% or 20 kcfs. Reductions in unit capacity, therefore, increase the likelihood of forced spill. Traditionally, Douglas PUD schedules biannual maintenance during February to March and September to October when flows are at their lowest (Figure 2). Taken together there were six and five days in the spring and fall respectively where the 110% TDG standard was exceeded (Figure 3).

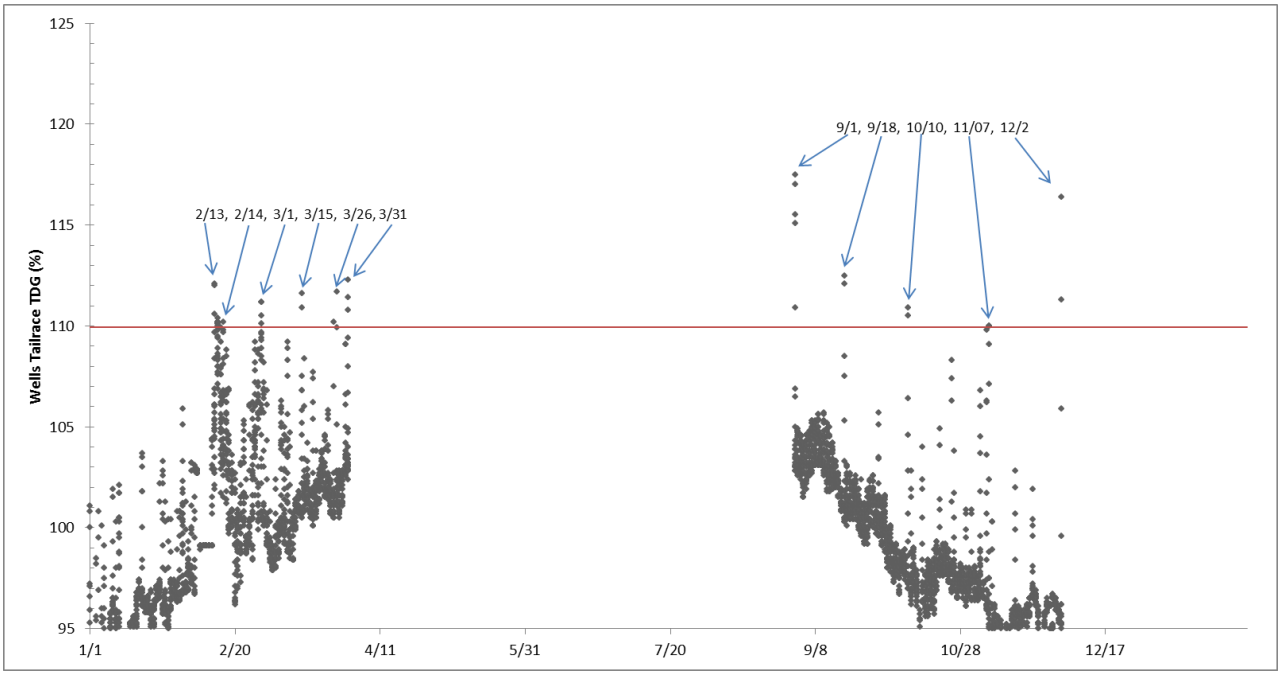

Figure 3. Hourly TDG data for the Wells Tailrace during the non-fish bypass season in 2018. The red line denotes the 110% TDG concentration. Values above the red line represent exceedances of the standard.

3.3.2 Fish Passage Season Compliance

Wells Tailrace 125% hourly standard

There were 28 days that had observed hourly averages of 125% or greater in the Wells Dam Tailrace during the 2018 bypass period. However, 21 of those days occurred during a period when flows at Wells Dam averaged 283 kcfs (May 10 to May 31) and therefore were removed from exceedances (above 7Q-10 of 246 kcfs). As such, 7 days had hourly averages that were over 125% in the Wells Dam Tailrace (Table 3). For the exceedances that occurred June 1-4, incoming TDG concentrations averaged >117%. Currently, there is no exemption for TDG violations when incoming water is out of compliance, but high TDG concentrations in the Wells forebay limits Douglas PUD's ability to send complaint water downstream of Wells Dam.

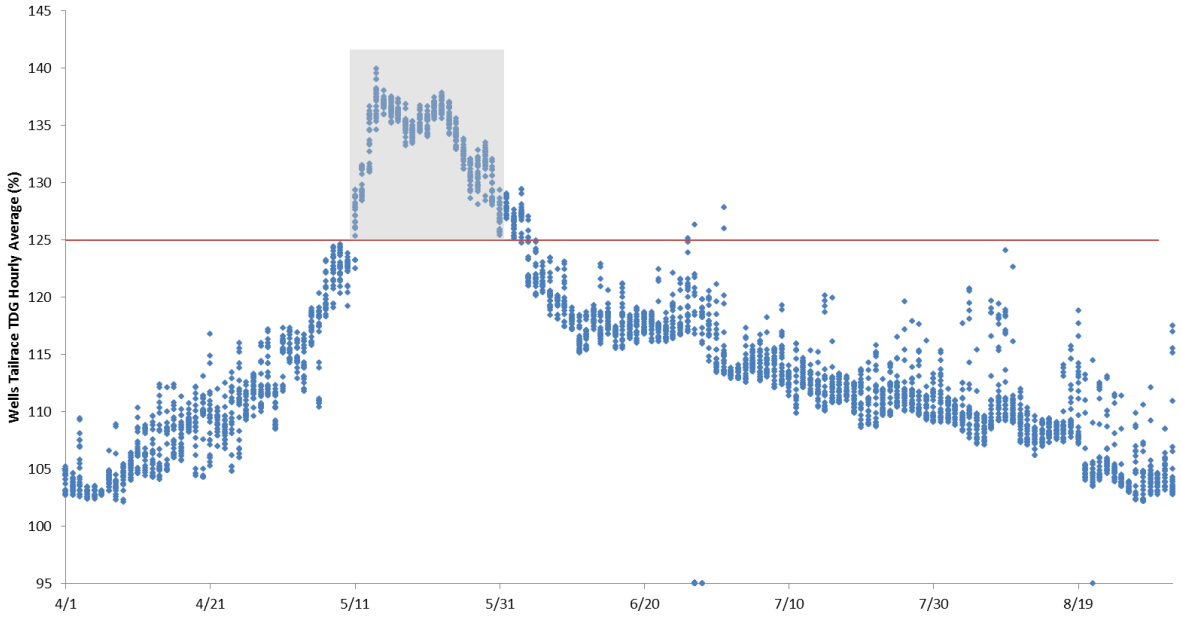

Figure 4. TDG compliance below Wells Dam using the 125% hourly average calculation. Data shown is exclusive to the fish bypass period of 2018. The red line denotes the compliance threshold. The gray box illustrates the period at Wells Dam when flows were exceeding the 7Q-10 flood flows of 246 kcfs.

Wells Tailrace 120% 12C-High standard

There were 37 days that had observed 12C-high values of 120% or greater in the Wells Dam Tailrace during the 2018 bypass period. However, 25 of those days occurred between May 7 and May 31 when flows at Wells Dam averaged >277 kcfs and therefore were removed from exceedances (above 7Q-10 of 246 kcfs). As such, 12 days had observed 12C-high values at or above 120% in the Wells Dam Tailrace. Currently, there is no exemption for TDG violations when incoming water is out of compliance; however incoming TDG was well above state standards during many of these 12C-High violations that were observed in the Wells Dam Tailrace.

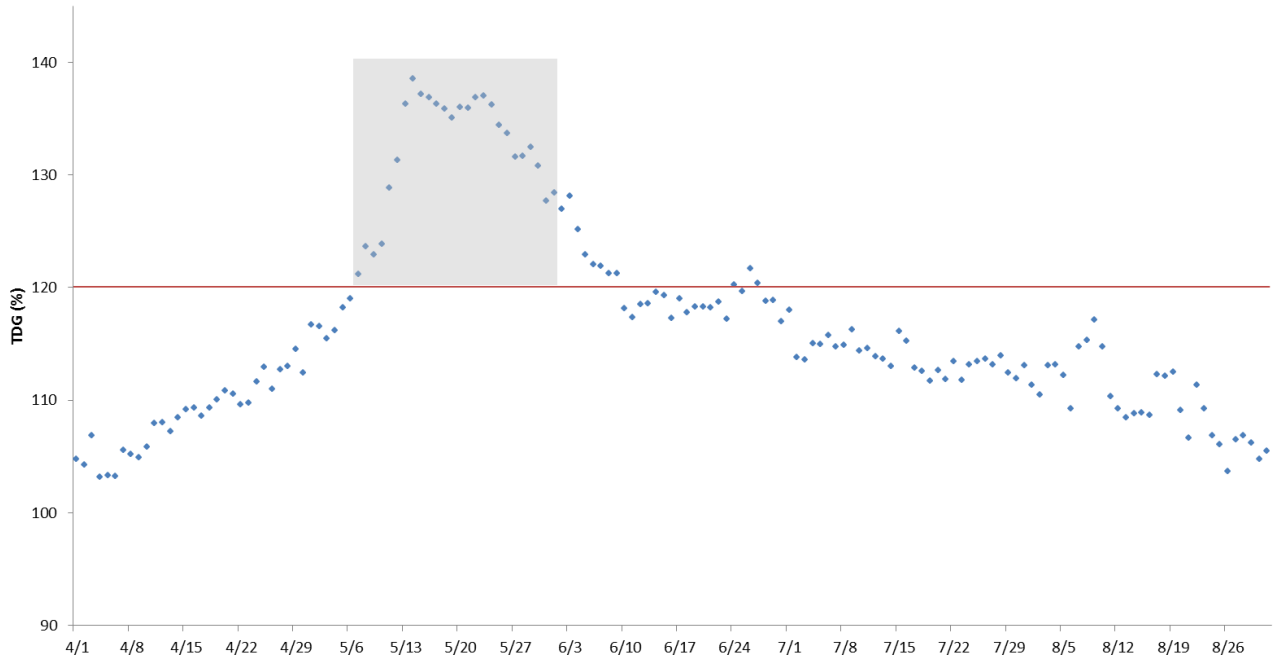

Figure 5. TDG compliance below Wells Dam using the 120% 12C-high calculation. Data shown is exclusive to the fish bypass period of 2018. The Redline denotes the compliance threshold. The gray box illustrates the period at Wells Dam when flows were exceeding the 7Q-10 flood flows of 246 kcfs.

Rocky Reach Forebay 115% 12C-High standard

There were 59 days that had observed 12C-high values of 115% or greater in the Rocky Reach Forebay during the 2018 bypass period. However, 23 of those days occurred during a 16 day period when flows at Wells Dam exceeded 7Q-10 flows. As such, 36 days had observed 12C-high values at or above 115% in the Rocky Reach Forebay. The majority of these exceedances occurred between 6/1 and 7/1, when incoming TDG concentrations (water from the FCRPS above Wells Dam) averaged 112.8%. Since Douglas PUD is required to operate the fish bypass system at Wells Dam, which uses moderate amounts of spill, receiving water that is already supersaturated reduces Douglas PUD's ability to remain compliant in the Rocky Reach Forebay.

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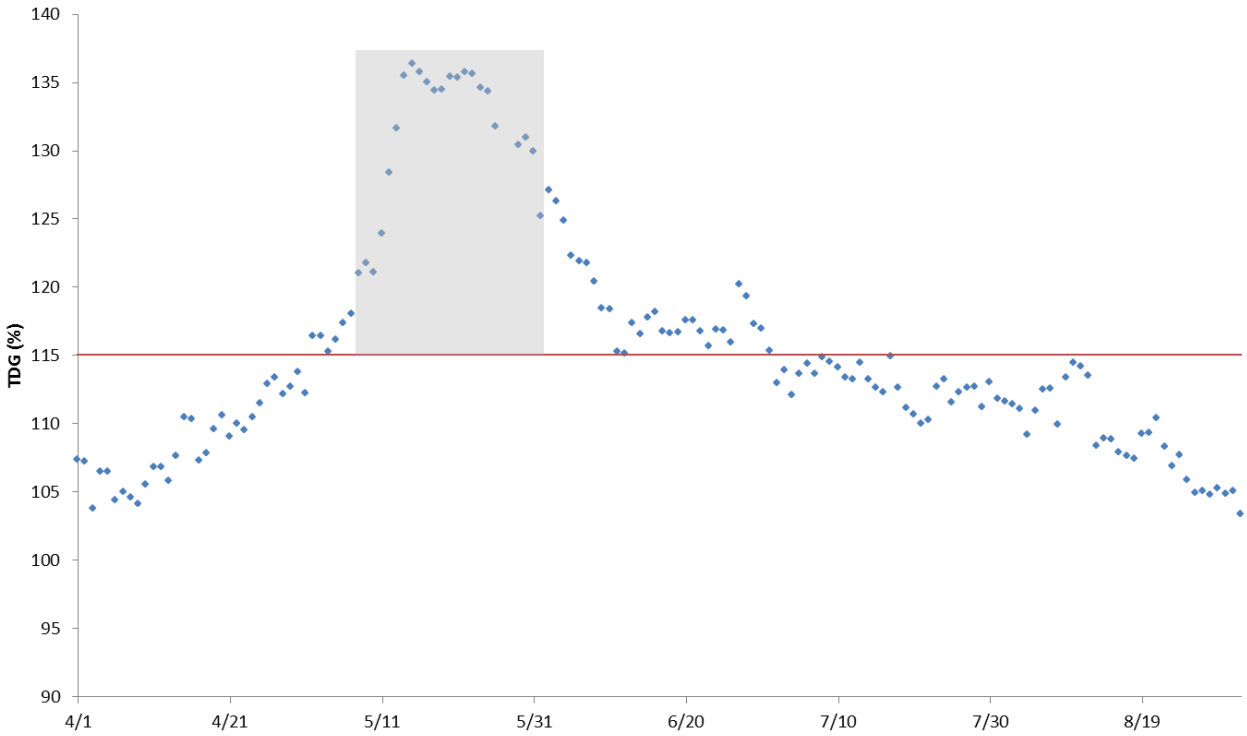

Figure 6. TDG compliance in the Rocky Reach Dam Forebay using the 115% 12C-high calculation. Data shown is exclusive to the fish bypass period of 2018. The red line denotes the compliance threshold. The gray box illustrates the period at Wells Dam when flows were exceeding the 7Q10 flood flows of 246 kcfs.

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3.3.3 Yearly TDG Compliance Summary

The following table summarizes TDG compliance at the Well Project for the entire 2018 season.

Table 3. 2018 TDG compliance summary.

	Compliance
Wells Tailrace 125% hourly standard	
Days out of compliance	7*
Fish passage season	153
DCPUD compliance	**95.4%**
Wells Tailrace 120% 12C-High standard	
Days out of compliance	12*
Fish passage season	153
DCPUD compliance	**92.2%**
Rocky Reach Forebay 115% 12C-High standard	
Days out of compliance	36*
Fish passage season	153
DCPUD compliance	**76.4%**
Wells Tailrace 110% (Non-fish passage season standard)	
Days out of compliance	11
Non-fish passage season	212
DCPUD compliance	**94.8%**

*Incoming TDG conditions were not factored into compliance statistics above.

4 DISCUSSION OF GAS ABATEMENT MEASURES

4.1 Water Quality Attainment Plan Activities

As required by the Wells Project 401 Certification, Douglas PUD developed a Water Quality Attainment Plan (WQAP) that was approved by Ecology and the FERC in 2013. The WQAP provides a detailed strategy for achieving compliance with the TDG state WQS within a required ten-year timeframe (i.e., compliance schedule). The compliance schedule outlines a step-wise approach toward meeting compliance with the TDG WQS. In 2018 (Year 5), the WQAP called for continued adaptive management and implementation of the Spill Playbook, biological monitoring (i.e., GBT monitoring in biota, as needed), and the identification of key Project operating parameters that could be used towards developing a database that would house fine-scale operation data. Future year's data would be used to identify fine-scale operation changes that might improve TDG compliance. Finally, year 5 of the WQAP schedule discussed revisiting model assumptions that were used during relicensing studies that were associated with TDG compliance.

Although allowable by the WQAP no modifications were made to the Spill Playbook, and biological monitoring (i.e., GBT monitoring in biota, as needed) continued in 2018, since Douglas PUD does not have evidence that these aspects of the Implementation Plan are not performing.

In the spring of 2016 (year 3) Douglas PUD reviewed Wells Project operations data collection with Wells Dam Hydro Operations staff and the Information Systems Department. The objective of this analysis was to conduct a comprehensive evaluation of both operational and structural data collection that could ultimately improve compliance with the TDG WQS criteria. A fine-scale spill-data collection database was completed in 2017 (year 4). New data includes spillbay "openness" indication on nine of the 11 spillways (most frequently used). In addition, a new energy accounting system was developed in 2017. This new data collection process should allow for Douglas PUD to collect robust operations data over the balance of the WQAP. This new data can be used for subsequent modeling, if necessary, and towards improving compliance. As of 2017 and 2018, data was being collected to meet the schedule of the WQAP Implementation Plan.

The IIHR TDG model suite (i.e., rigid lid and VOF models) developed during the Wells Project relicensing process in 2008 was operated under a set of assumptions (as required for all quantitative predictive models) for hydrodynamic characteristics such as gas volume fraction, bubble size, various free-surface features, and incoming TDG levels. However, Douglas PUD has no data that supports improving or modifying model assumptions. Rather, over the last five years, spill volume seems to be the most important variable in determining TDG addition at Wells Dam. Improved turbine unit reliability and improved powerhouse capacity is expected to occur once the rebuild of the 10 units at Wells Dam is complete. Having ten units available is expected to improve TDG performance over the next five years, potentially allowing the District to become fully complaint with the WQS when flows are below 7Q-10 volumes. Since 2013 Wells Dam has never had ten units available, since at least one unit has been out for extended unit rebuild each year.

4.2 Operational

Flows at Wells Dam were well above normal in February and May followed by near normal conditions during the balance of the season (Table 1; Figures 2 & 7). High spring flows due to a wet and snowy February, drum gate maintenance at Grand Coulee, above average snowpack in the basins that influence runoff at Wells Dam, and a rapid spring melt in the month of May all contributed to an early spring freshet that was well above average. Specifically, average flows were above 266 kcfs during the month of May, which broke a 49 year record since the Wells Project was commissioned in the late 1960's. Normally scheduled biaanual mainteance in February and March contributed to high TDG production below Wells during the early spring season of 2018. Despite these constraints Wells Dam performed remarkably well by putting a minimum-generation constraint on all available units at Wells Dam and forcing Project participants to take all available generation. Maximzing generation and putting as much water though availble units minimizes involuntary spill and therefore reduced the production of TDG.

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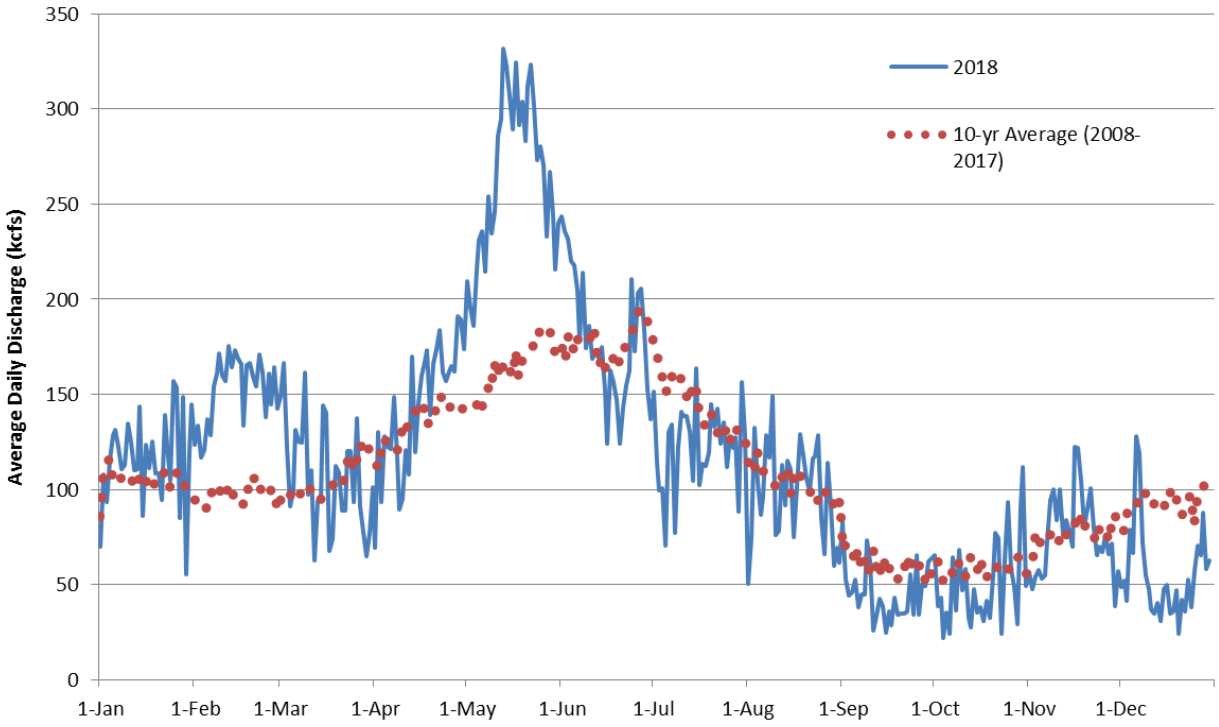

Figure 7. Average Daily flows at Wells Dam during 2018 relative to the ten year average.

4.3 Structural

No permanent structural modifications were proposed or completed during the 2018 monitoring season.

5 CONCLUSIONS

TDG performance at Wells Dam during the 2018 season was good considering the operational and snowpack challenges in the spring and the record setting flows in May 2018. Results support the continued implementation of the Spill Playbook to manage TDG production through operational means, and suggest future operational performance should result in even higher rates of compliance with TDG standards. Douglas PUD will put an emphasis on testing the Spill Playbook in years where ten units are available 95% of the time (normal reliability). The ongoing turbine rebuild project currently only provides 9 out of 10 units for operation during the peak hydrograph, thereby reducing the amount of water that can be passed through the powerhouse by approximately 15-20 kcfs and therefore makes compliance more challenging, since this water must be spilled. Despite this challenge Douglas PUD has maintained high TDG compliance with WQS. Douglas PUD will work closely with Ecology towards meeting year round TDG standards in subsequent years.

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6 REFERENCES

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APPENDIX B

PRE-FILING CONSULTATION RECORD FOR THE WELLS HYDROELECTRIC PROJECT TOTAL DISSOLVED GAS ABATEMENT PLAN 2018 ANNUAL REPORT

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NOTICE TO AQUATIC SETTLEMENT WORK GROUP TO REVIEW THE TOTAL DISSOLVED GAS ABATEMENT PLAN 2018 ANNUAL REPORT

20190301-5053 FERC PDF (Unofficial) 2/28/2019 5:57:58 PM

From: Kristi Geris <kgeris@anchorqea.com>
Sent: Friday, January 18, 2019 4:55 PM
To: Andrew Gingerich; Bao Le; Bob Rose; 'Bret Nine'; 'Chad Jackson'; Chas Kyger; Chris Sheridan; Donella Miller (mild@yakamafish-nsn.gov); Fortier, Ryan T (DFW); Jason McLellan; John Ferguson; Keith Hatch (Keith.Hatch@bia.gov); Keith Kirkendall (Keith.Kirkendall@noaa.gov); Kirk Truscott; Kristi Geris; Mark Peterschmidt (mape461 @ecy.wa.gov); Mary Mayo; Patrick Verhey (Patrick.Verhey@dfw.wa.gov); Paul Ward (warp@yakamafish-nsn.gov); Ralph Lampman (lamr@yakamafish-nsn.gov); Sean Goudy (gous@yakamafish-nsn.gov); Shane Bickford; Steve Hemstrom (steven.hemstrom@chelanpud.org); 'Steve Lewis'; Steve Parker; Zimmerman, Breean (ECY)
Subject: FW: 2018 GAP/TDG Report and 2019 Gas Abatement Plan and Bypass Operating Plan.
Attachments: 2019_01_18 Douglas Draft 2019 Wells Dam GAP and BOP.doc; 2019_01_18 Douglas Draft 2018 TDG GAP Annual Report.doc

Hi Aquatic SWG: please see the email below from Andrew and the attached draft 2018 GAP/TDG report and 2019 GAP/BOP, which are available for review with edits and comments due to Andrew by **Monday, February 11, 2019**.

The attached draft documents are also available for download from the Aquatic SWG Extranet site, under: Draft Documents > All by Mtg Date > 2/13/2018 (instructions below). Thanks! –Kristi ☺

Instructions:

To gain access to the Aquatic SWG Extranet Homepage, please use the following procedure:

* Visit: https://extranet.dcpud.net/sites/nr/aswg/
* Login using “Forms Authentication” (for non-Douglas PUD employees)

You should now be at the Aquatic SWG homepage.

If you encounter problems, or need a login username and password to access the site:
Please feel free to contact me, Andrew Gingerich, or Julene McGregor [jmcgregor@dcpud.org; (509) 881-2236] and we will gladly assist you with questions or issues.

Kristi Geris

ANCHOR QEA, LLC
kgeris@anchorqea.com
C 360.220.3988

From: Andrew Gingerich <andrewg@dcpud.org>
Sent: Friday, January 18, 2019 19:22
To: Kristi Geris <kgeris@anchorqea.com>
Cc: Tom Kahler <tomk@dcpud.org>
Subject: 2018 GAP/TDG Report and 2019 Gas Abatement Plan and Bypass Operating Plan.

Hi Kristi, as promised during this month’s Aquatic SWG call, please distribute the attached water quality documents to the technical reps within the Aquatic SWG. Please make sure that we include BIA, and BLM. Tom Kahler (cc’d) will coordinate the HCP CC review of the 2018 GAP and BOP too.

As we discussed on Jan. 9 2019 call, every year at this time Douglas PUD provides two documents to the Aquatic SWG for review, comment, and eventual approval. The first summarizes TDG compliance during the previous year (2018). The second document provides the methods used to provide safe and effective passage of juvenile salmonids, meet TDG criteria, and operate Wells Dam safely (2019 Gas Abatement Plan and Bypass Operating Plan). The latter of these documents get reviewed concurrently with the HCP CC per our 401 Certification and FERC license requirements. Specifically, these two documents are:

1. 2018 Annual TDG (GAP) Report
2. 2019 Gas Abatement Plan with Spill Playbook and Bypass Operating Plan

The second document is also required in order to obtain an Ecology's approved TDG adjustment during the 2019 bypass season (April-August). This adjustment facilitates high survival of downstream migrating fish during peak downstream migration. Both documents are attached for committee review and consideration. Douglas PUD is hoping to receive comments no later than Feb 11th . This schedule only allows for a three week review, which is shy of our normal and preferred 30 day review period. Unfortunately, these documents are always on a very tight schedule since data needed to complete the documents doesn't complete until December 31st . As such, we only have a couple weeks to get them complete and out for review, while still meeting the Feb 28 FERC deadline. I appreciate the timely review in advance.

As per usual, please let me know if you have questions.

Andrew Gingerich
Senior Aquatic Resource Biologist
Public Utility District No. 1 of Douglas County
1151 Valley Mall Parkway
East Wenatchee, WA 98802
Office: (509) 881-2323

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FINAL AQUATIC SETTLEMENT WORK GROUP ACTION ITEMS SHOWING APPROVAL OF TOTAL DISSOLVED GAS ABATEMENT PLAN 2018 ANNUAL REPORT

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FINAL

Conference Call Action Items

Aquatic Settlement Work Group

To: Aquatic SWG Parties

Date: February 21, 2019

From: John Ferguson, Chair (Anchor QEA, LLC)

Re: Final Action Items of the February 20, 2019 Aquatic SWG Conference Call

Below is a summary of Action Items from the Aquatic Settlement Work Group (SWG) meeting that was held in-person at Wells Dam in Azwell, Washington on Wednesday, February 20, 2019, from 9:15 a.m. to 3:00 p.m. Attendees are listed in Attachment A. These action items include the following:

I. Summary of Action Items

1. Kristi Geris will begin forwarding the Wells Dam fish salvage memorandums to the Aquatic SWG each year that Tom Kahler (Douglas PUD Wells Habitat Conservation Plan [HCP] Coordinating Committee Representative) provides annually to the Wells HCP Coordinating Committee (Item VII-5). *(Note: Geris forwarded the 2018/2019 salvage memorandums to the Aquatic SWG following the meeting on February 20, 2019.)*
2. The Aquatic SWG meeting on March 13, 2019, will be held by conference call (Item VII-1).

II. Summary of Decisions

1. Aquatic SWG members present approved the *Wells Hydroelectric Project Total Dissolved Gas Abatement Plan 2018 Annual Report* (Item VII-3). *(Note: Breean Zimmerman provided the Washington Department of Ecology's [Ecology's] approval of the report via email prior to the meeting on February 20, 2019.)*
2. Aquatic SWG members present approved the *2019 Total Dissolved Gas Abatement Plan Wells Hydroelectric Project FERC Project No. 2149* (Item VII-4). *(Note: Breean Zimmerman provided the Ecology's approval of the plan via email prior to the meeting on February 20, 2019.)*

III. Agreements

1. There were no agreements discussed during today's meeting.

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IV. Review Items

1. A draft 2019 Aquatic Settlement Agreement Action Plan was distributed to the Aquatic SWG by Kristi Geris on February 7, 2019. Douglas PUD will request approval of the plan during the Aquatic SWG meeting on March 13, 2019 (Item VII-5).
2. A draft Wells Fish Hatchery Brood Year (BY) 2019 White Sturgeon Rearing Plan was distributed to the Aquatic SWG by Kristi Geris on November 29, 2018. A revised draft plan was distributed to the Aquatic SWG by Geris on February 12, 2019. Douglas PUD will request approval of the plan during the Aquatic SWG meeting on March 13, 2019 (Item VII-6).

V. Documents Finalized

1. There are no documents that have been recently finalized.

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FINAL

Attachment A – List of Attendees

Name	Role	Organization
John Ferguson	Aquatic SWG Chairman	Anchor QEA, LLC
Kristi Geris	Administration/Technical Support	Anchor QEA, LLC
Andrew Gingerich	Aquatic SWG Technical Representative	Douglas PUD
Chas Kyger	Technical Support	Douglas PUD
RD Nelle	Technical Support	U.S. Fish and Wildlife Service
Patrick Verhey	Aquatic SWG Technical Representative	Washington Department of Fish and Wildlife
Laura Heironimus†	Aquatic SWG Alternate Representative	Washington Department of Fish and Wildlife
Jason McLellan	Aquatic SWG Technical Representative	Colville Confederated Tribes
Ralph Lampman	Aquatic SWG Technical Representative	Yakama Nation

Notes:
† Joined by phone

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WASHINGTON DEPARTMENT OF ECOLOGY EMAIL APPROVAL OF THE TOTAL DISSOLVED GAS ABATEMENT PLAN 2018 ANNUAL REPORT

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From: Zimmerman, Breean (ECY) <bzim461@ECY.WA.GOV>
Sent: Wednesday, February 20, 2019 8:40 AM
To: Kristi Geris; Andrew Gingerich; jferguson@anchorqea.com
Subject: RE: Aquatic SWG: 2/20 in-person mtg agenda + logistics

Hi Kristi, John, and Andrew,

Unfortunately, due to unforeseen circumstances I will not be at the site visit or at today's meeting. I have reviewed the 2018 GAP and the 2019 GAP & BOP. Ecology is prepared to provide an approval for these documents. Please let me know if this email will suffice as an approval or if you require something a little more formal.

Thank you,
Breean Zimmerman

From: Kristi Geris <kgeris@anchorqea.com>
Sent: Monday, February 4, 2019 5:44 PM
To: Andrew Gingerich (andrewg@dcpud.org) <andrewg@dcpud.org>; Bao Le <Bao.Le@hdrinc.com>; Bob Rose <rosb@yakamafish-nsn.gov>; 'Bret Nine' <bret.nine@colvilletribes.com>; Jackson, Chad S (DFW) <Chad.Jackson@dfw.wa.gov>; Chas Kyger <chask@dcpud.org>; Chris Sheridan <csherida@blm.gov>; Donella Miller (mild@yakamafish-nsn.gov) <mild@yakamafish-nsn.gov>; Fortier, Ryan T (DFW) <Ryan.Fortier@dfw.wa.gov>; Heironimus, Laura B (DFW) <Laura.Heironimus@dfw.wa.gov>; Jason McLellan <Jason.McLellan@colvilletribes.com>; John Ferguson <jferguson@anchorqea.com>; Keith Hatch (Keith.Hatch@bia.gov) <Keith.Hatch@bia.gov>; Keith Kirkendall (Keith.Kirkendall@noaa.gov) <Keith.Kirkendall@noaa.gov>; kirk.truscott@colvilletribes.com; Kristi Geris <kgeris@anchorqea.com>; Peterschmidt, Mark F. (ECY) <MAPE461@ECY.WA.GOV>; 'Mary Mayo' <marym@dcpud.org>; Verhey, Patrick M (DFW) <Patrick.Verhey@dfw.wa.gov>; Paul Ward (warp@yakamafish-nsn.gov) <warp@yakamafish-nsn.gov>; Ralph Lampman (lamr@yakamafish-nsn.gov) <lamr@yakamafish-nsn.gov>; Sean Goudy (gous@yakamafish-nsn.gov) <gous@yakamafish-nsn.gov>; Shane Bickford (sbickford@dcpud.org) <sbickford@dcpud.org>; Steve Hemstrom (steven.hemstrom@chelanpud.org) <steven.hemstrom@chelanpud.org>; 'Steve Lewis' <stephen_lewis@fws.gov>; Steve Parker <pars@yakamafish-nsn.gov>; Zimmerman, Breean (ECY) <bzim461@ECY.WA.GOV>
Cc: Jim Craig (jim_l_craig@fws.gov) <jim_l_craig@fws.gov>; RD_Nelle@fws.gov; Tracy Hillman <tracy.hillman@bioanalysts.net>
Subject: Aquatic SWG: 2/20 in-person mtg agenda + logistics

Hi Aquatic SWG: attached is the updated agenda for the rescheduled Aquatic SWG meeting on February 20, 2019, which will be held in-person at Wells Dam. Please let me know if there are any changes to your current RSVPs with the new schedule. Thanks! -kristi ☺

Attendee	Call-in	In-person		Staying for lunch?	Attending tour?
		Carpool from DPUD	Meet at Wells Dam Overlook		
Andrew Gingerich (DPUD)		x		Yes	Yes
Chas Kyger (DPUD)		x		Yes	Yes
Steve Lewis (USFWS)	unavailable			NA	NA
Patrick Verhey (WDFW)			x	Yes	Yes
Laura Heironimus (WDFW)	x			NA	NA
Breean Zimmerman (ECY)			x	No	No
Jason McLellan (CCT)			x	Yes	Yes

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Document Content(s)

Wells TDG GAP Annual Report for 2018 Final.PDF.....1-39