FINAL

Water Quality Monitoring and Management Plan for the Wallowa Falls Hydroelectric Project - Report

(FERC No. P-308)

Grande Ronde River Basin

Wallowa County, Oregon

January 2021

Prepared by:

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1.0 Introduction

Federal Energy Regulatory Commission (FERC) issuance of a new license for the Wallowa Falls Hydroelectric Project (Project) triggered compliance with requirements under the associated Project Clean Water Act § 401 Certification conditions. As part of the 401 Certification conditions, a Water Quality Monitoring and Management Plan (WQMMP) for the Wallowa Falls Hydroelectric Project was created that addresses requirements under Sections 3(a), 3(b), 3(c) within the § 401 Certification. These Conditions state:

> ***Section 3(a):*** *Within ninety (90) days of issuance of the FERC license, PacifiCorp, in consultation with the Oregon Department of Environmental Quality (DEQ), must, as necessary to ensure consistency with these § 401 Certification Conditions, develop a Project Water Quality Monitoring and Management Plan (WQMMP). Upon approval, the WQMMP becomes part of these § 401 Certification Conditions for the Project for the purposes of any federal license or permit.*
>
> *The WQMMP must include: applicable dissolved oxygen (DO) and total dissolved gas (TDG) criteria; monitoring methodology; reporting schedule; and procedures for suspending operation during DO or TDG violations. PacifiCorp must measure DO at the outlet of the new Project tailrace continuously during Project operations for a one-time period of 90 days starting August 1st of the first year of operation of the realigned tailrace. PacifiCorp must download and evaluate DO data on a weekly basis. During Project operation, PacifiCorp must also measure TDG in the Project Tailrace outlet for a minimum of seventy-two (72) hours under lower flow conditions in August-September and higher flow conditions in June-July. Concurrent with DO and TDG measurements, PacifiCorp must also record flow and water temperature at the Project Tailrace outlet immediately upstream of the velocity barrier, as well as record power generation from the Project. PacifiCorp must report all DO, TDG, flow, water temperature and power generation data to DEQ within 90 days of the conclusion of the monitoring period.*
>
> ***Section 3(b):*** *If it is determined based on monitoring results, that Project operations are contributing to downstream violations of the applicable DO standard, TDG standard or the Antidegradation standard, PacifiCorp must follow the procedures in the WQMMP, including project shutdown, as necessary. If taking the actions described in the WQMMP do not correct the problem and allow water quality standards to be achieved, PacifiCorp must consult with DEQ to evaluate whether any modifications to the Project or Project operations can mitigate the impacts to water quality. If DEQ determines that such modifications can reverse such impacts, PacifiCorp must propose the modifications to DEQ, and following DEQ's approval, PacifiCorp must implement the approved modifications. PacifiCorp may operate the Project during the development and implementation of modifications if conditions allow water quality standards to be met. If it can be demonstrated that the DO and TDG criteria are being met, PacifiCorp can request approval to terminate monitoring of these parameters.*
>
> ***Section 3 (c):***
>
> i. *Procedures and measures that will be implemented to prevent monitoring equipment malfunctions;*

ii. *Procedures for identifying the occurrence and nature of any monitoring equipment malfunctions that may occur;*
iii. *Plan, schedule, and corrective measures that will be implemented to address monitoring equipment malfunctions;*
iv. *Procedures for notifying DEQ of the occurrence and nature of monitoring equipment malfunctions, corrective measures implemented, and recommencement of monitoring equipment operation.*
v. *Procedures and timelines for Project shutdown as may be necessitated by monitoring equipment malfunctions;*
vi. *Plan and schedule for maintenance and calibration of field test equipment.*

This Report and the information contained therein, details results from the data gathering period described above and stipulated within the Water Quality Monitoring and Management Plan for the Wallowa Falls Hydroelectric Project.

2.0 Study Area

The Wallowa Falls Hydroelectric Project is located on the East Fork Wallowa River approximately 11 miles outside of the City of Joseph in Northeastern Oregon. The Project (Figure 1) reservoir/forebay lies over 1,600 meters (m) above mean sea level (msl) and is approximately 0.2 surface acres (0.08 ha) in size and averages 5 feet (1.5 m) in depth. Because the Project operates as run of river, there is no measurable storage. Though no measurable storage is present in the forebay, habitat in this area is lacustrine, and given the shallow water depth no thermal stratification is present. Substrate in the forebay consists of deposited silt, sand, and other glacial fines.

Water diverted at the forebay travels through the flow line and penstock to the generating turbine in the Project powerhouse. Water exits the turbine and is discharged into an approximately 985-foot (300 m) long tailrace discharge channel that empties into the West Fork Wallowa River. This channel has an average wetted-width of 10 feet (3.1 m) and an average depth of one foot (0.3 m). The habitat type within the tailrace channel is dominated by high gradient riffle with very few pools.

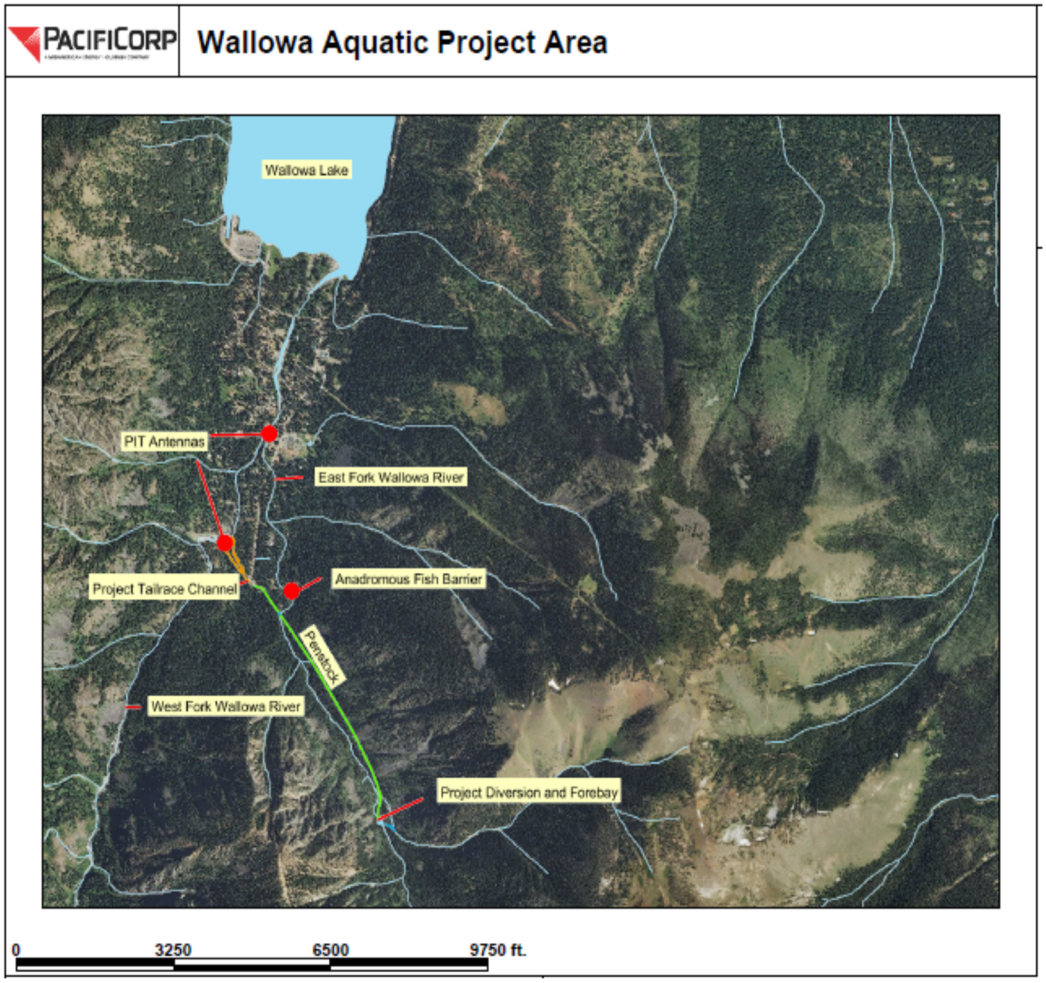


Figure 1. Wallowa Falls Hydroelectric Project.

3.0 Methods

3.1 Addressing requirements under §401 Certification Conditions Section 3(a):

Section 3(a) in the § 401 Certification Conditions contains various requirements for the criteria, monitoring methodology, and reporting schedule for the water quality parameters that were monitored (e.g. Temperature, Flow, Generation, Dissolved Oxygen, and Total Dissolved Gas) as well as procedures for suspending operations during dissolved oxygen (DO) or total dissolved gas (TDG) criteria violations.

The Project specific criteria for water quality standards of potential concern that were included in the WQMMP are shown in **Table 1**.

Table 1. Project temperature, DO, and TDG water quality criteria.

	August 15 through May 15	May 16 through August 14	Rule

Use	Bull trout/Kokanee spawning through fry emergence	Cold Water Aquatic Life	OAR 340-041-016 and Figure 151A
Temperature	12˚C/53.6˚F	12˚C/53.6˚F	OAR 340-041-0028
Dissolved Oxygen	a) Not less than 11.0 mg/L. If IGDO ≥ 8.0 mg/L the DO spawning criterion is 9.0 mg/L; b) where pressure, altitude or temperature preclude attainment of the 11.0 or 9.0 mg/L criteria, DO saturation must be at least 95 percent; c) Spatial median IGDO must be at least 8.0 mg/L.	Criterion is 8.0 mg/L. Where precluded by pressure, altitude or temperature, DO saturation must be at least 90 percent. At DEQ discretion, DO must not fall below 8.0 mg/L as a 30-day mean, 6.5 mg/L as a 7-day mean, and 6.0 mg/L as an absolute minimum.	OAR 340-041-0016
Total Dissolved Gas	Except when stream flow exceeds the ten-year, seven-day average flood, the concentration of TDG relative to atmospheric pressure at the point of sample collection may not exceed 110 percent saturation.	Except when stream flow exceeds the ten-year, seven-day average flood, the concentration of TDG relative to atmospheric pressure at the point of sample collection may not exceed 110 percent saturation.	OAR 340-041-0031

Monitoring activities occurred during two separate monitoring periods, a high-flow monitoring period and a low-flow monitoring period, each commenced immediately after commissioning of the realigned tailrace in early June 2020. The high-flow monitoring period entailed 72 hours of TDG monitoring during tailrace barrier initial high-flow operation in June-July. The low-flow monitoring period entailed another 72 hour period of TDG monitoring during tailrace barrier initial low-flow operation in August-September as well as DO monitoring for 90 days starting August 1.

Temperature:

For redundancy, two (2) temperature data loggers were placed in the water column in the Project tailrace immediately above and below the tailrace barrier. Temperature monitoring activities coincided with all TDG and DO monitoring events. The temperature data loggers were set to continuously record data in one-hour intervals. Temperature data loggers were purchased brand new from the manufacturer. Calibration was validated prior to deployment.

Hourly temperature data was converted to and reported as seven day averages of maximum daily temperatures.

Flow:

For redundancy, two (2) water depth loggers were used to establish a temporary flow measurement gage in the tailrace immediately above the barrier. The depth loggers were placed on the upstream side of the fish barrier and were vertically fixed. The vertical distance between the logger and the crest of the barrier was

measured and subtracted out of the depth data. This allowed PacifiCorp to gather data representing the depth of flow over the barrier. The depth of flow over the barrier was then used in a standardized weir-flow equation with the assigned discharge coefficient of the barrier to compute flow. Flow monitoring activities coincided with all TDG and DO monitoring events. The water depth data loggers were set to continuously record data in fifteen-minute intervals. Water depth loggers were purchased brand new from the manufacturer and calibration validated prior to deployment.

Generation:

Plant generation is remotely controlled, monitored and recorded using an SAP software "Pi" module. Continuous real-time monitoring of generation via Pi was conducted at the Hydro Control Center located in Ariel, Washington.

Dissolved Oxygen:

For redundancy and comparison purposes, two multiprobe water quality meters were used for measuring DO levels in the Project tailrace. The DO monitoring event began on August 1, 2020 following operational commencement of the realigned tailrace. Hourly DO measurements were taken within the water column below the new tailrace barrier for a one-time 90 day (low-flow monitoring) period. DO data was downloaded and evaluated on a weekly basis for the entire monitoring period. Barometric pressure data was also recorded on the same time interval and period as DO measurements in close vicinity to the DO meter. These barometric pressure and water temperature data will be used to compute DO saturation levels in case altitude, temperature, or pressure preclude attainment of the concentration-based (e.g. mg/L) DO criteria. Dissolved oxygen meters were calibrated and validated by the manufacturer prior to deployment.

Total Dissolved Gas:

For redundancy and comparison purposes, two multiprobe water quality meters were used for measuring TDG levels in the Project tailrace. Hourly TDG measurements were recorded in the Project tailrace at a location within 25 feet of the discharge to the West Fork Wallowa River. Barometric pressure data was also recorded on the same time interval and period as TDG measurements and within close vicinity to the TDG meter. TDG saturation levels were then computed as the ratio of aqueous TDG pressure to barometric pressure. There were two (2) separate monitoring periods; period one comprised of a 72-hour time block during July under higher flow conditions, while period two was conducted during August low flow conditions. Both monitoring periods recorded hourly TDG levels in the Project Tailrace outlet continuously for seventy-two (72) hours. TDG meters were calibrated prior to deployment following all prescribed manufacture calibration requirements.

4.0 Results

Temperature:

Hourly water temperature, in degrees Celsius, was recorded from the Wallowa Falls Project tailrace July 3, 2020 – October 31, 2020. 2857 hourly water temperature data points were recorded directly upstream of the tailrace barrier, and an additional 2857 hourly water temperature readings were also recorded from

directly downstream of the tailrace barrier. Hourly temperature readings were then converted to seven-day averages of daily maximum temperatures (7DADmax) for comparison to DEQ standards (Figure 2).

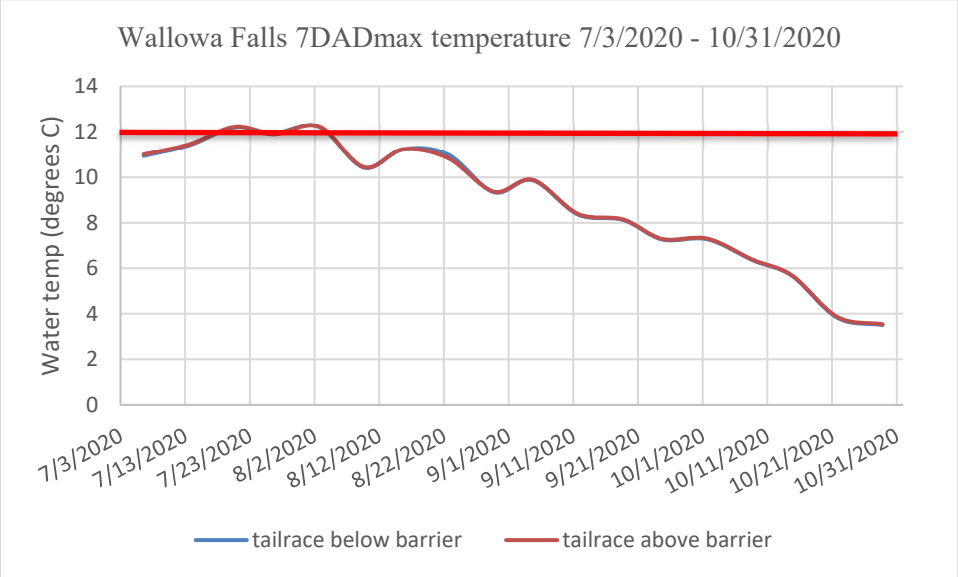


Figure 2. Hourly water temperature readings converted to 7DADmax from above and below the Wallowa Falls Project tailrace barrier. Solid red line is the state maximum standard for this waterway.

Flow:

Due to the shallow water and sedimentation issues from the newly dugout channel of the Project tailrace at the upstream side of the new tailrace barrier, data from the two vertically fixed pressure transducers was not usable during the survey period. Instead, a previously established correlation between flow in cubic feet per second (cfs) and generation was used to calculate flow (Figure 3) during the entire water quality survey period (July 3 – October 31).

Flow was calculated using the equation cfs = kW*0.0142 + 0.05. This equation was generated in 2010 by means of a flow meter tied in directly to the penstock while generation levels were specifically varied. Methodology of the testing procedure and subsequent generated flow equation can be found in the testing closeout Report in Appendix A of this Report.

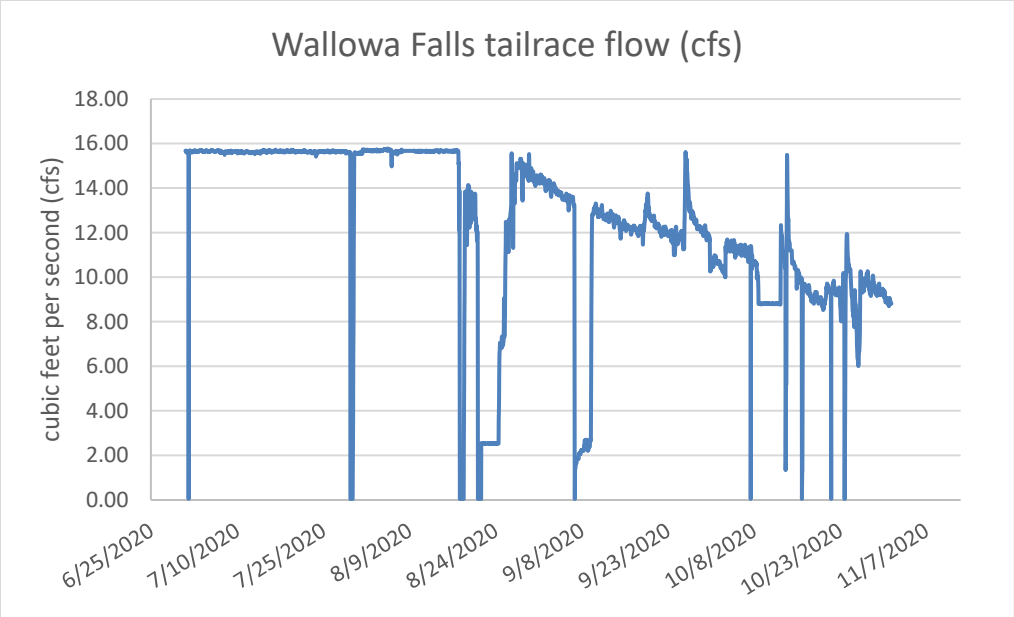


Figure 3. Hourly flow in cubic feet per second in the Wallowa Falls tailrace, July 3 – October 31, 2020.

Generation:

Hourly generation levels were recorded remotely in SAP via the software Pi for the time-period July 3, 2020 – October 30, 2020 (Figure 4).

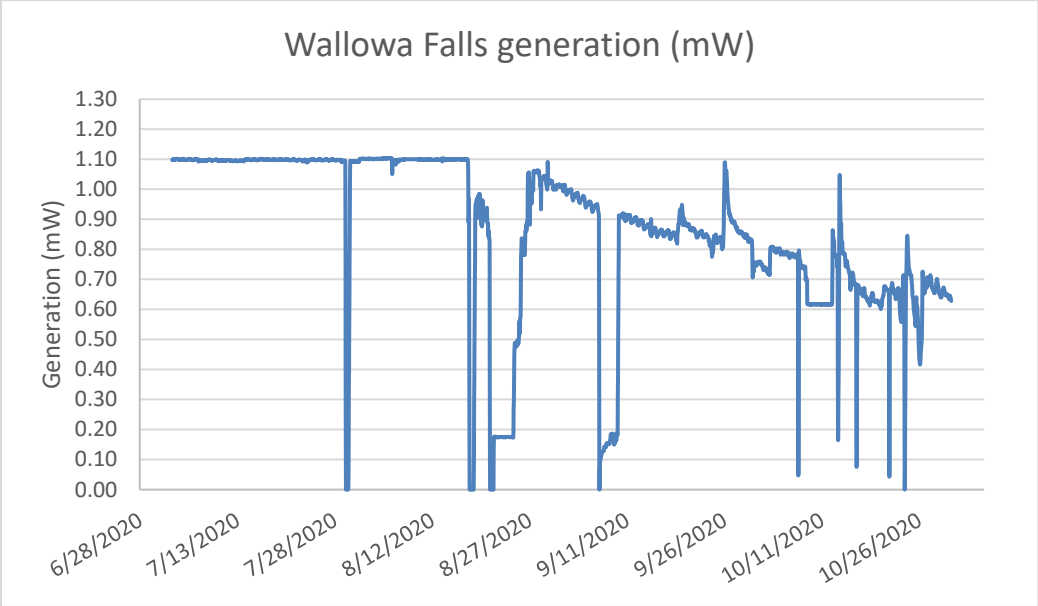


Figure 4. Hourly generation recorded in megawatt (mW) from the Wallowa Falls Hydroelectric Project.

Dissolved Oxygen:

Hourly dissolved oxygen in milligrams per liter (mg/l), as well as percent saturation, were recorded from directly downstream of the tailrace barrier within the Wallowa Falls Project tailrace from August 1, 2020 – October 30, 2020. For redundancy, two meters were set side by side in the water column. In all, 2182 hourly dissolved oxygen data points were recorded from each meter during the data collection time-period (Figures 5 & 6). Periods of low and non-generation caused the meters to dewater, be exposed to the air, and no longer collect accurate dissolved oxygen readings for that hourly data recording. This occurred for 131 data points (6% of total collected) during the data collection period. These 131 data points were removed from the data-set prior to graphical representation.

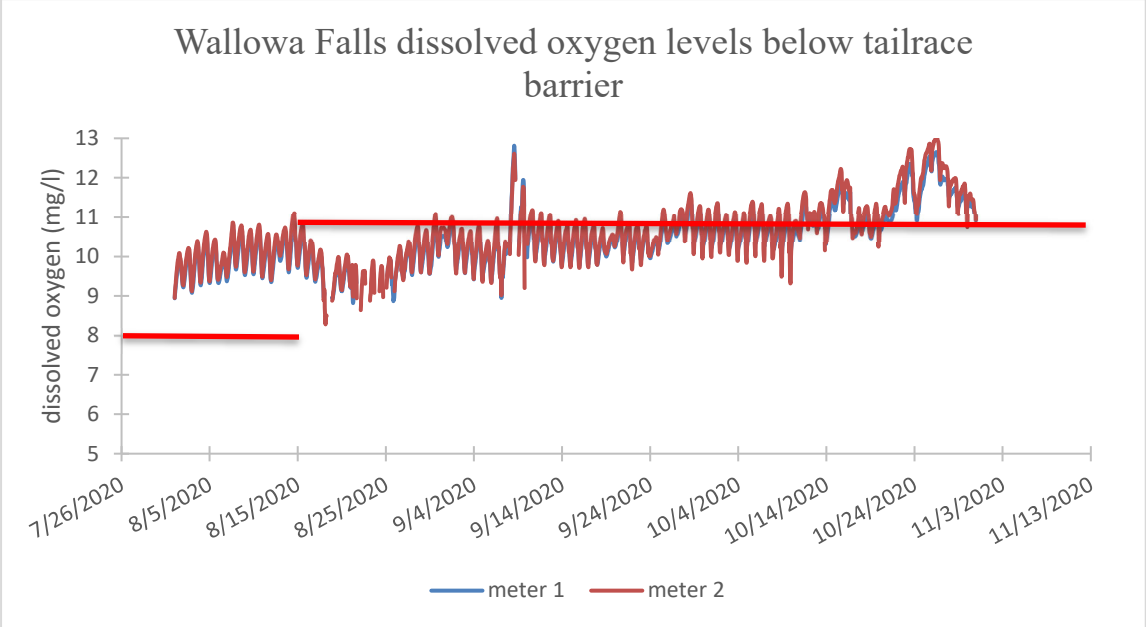


Figure 5. Dissolved oxygen in milligrams per liter from two separate meters below the barrier within the Wallowa Falls Project tailrace. Red bar stipulates DEQ seasonal minimum standards for this metric for this waterway.

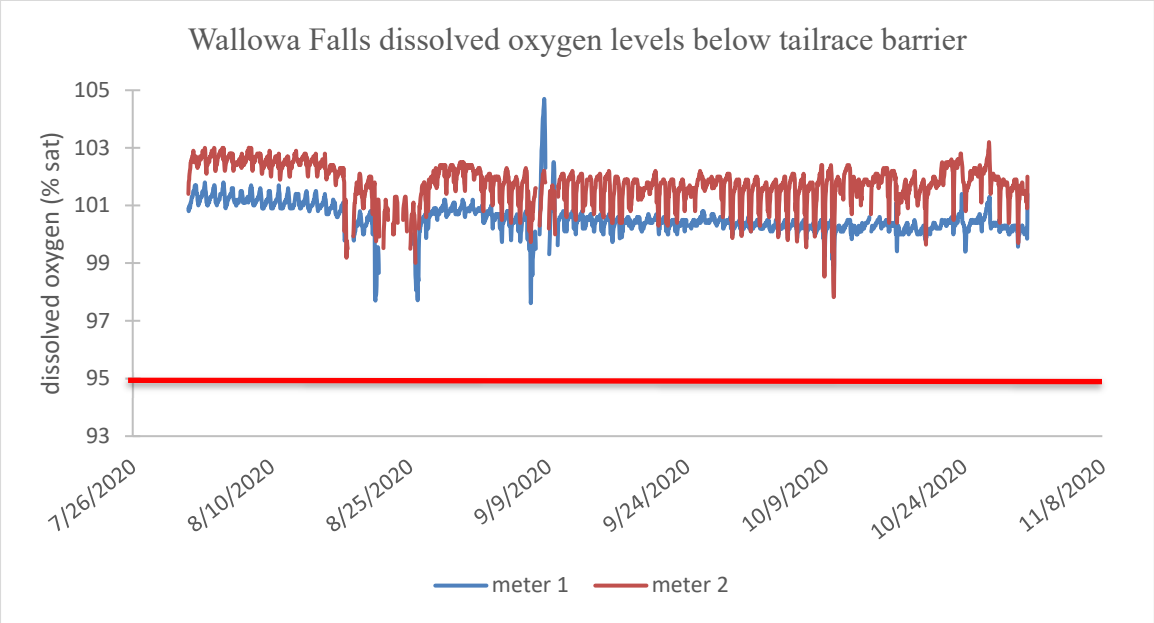


Figure 6. Dissolved oxygen levels recorded from two separate meters below the tailrace barrier within the Wallowa Falls Project tailrace in percent saturation. Red bar is DEQ minimum standard for this waterway.

Total Dissolved Gas:

Total dissolved gas measured in millimeters of mercury (mmHg) was recorded hourly for 72 continuous hours from below the tailrace barrier within the Wallowa Falls Project tailrace starting at 13:00 on August 3, 2020 and concluding at 12:00 on August 6, 2020, to fulfill high flow measurement requirements (Figure 7). For redundancy, two meters were set to record at the same time and rate and set on either side of the tailrace discharge plume below the tailrace barrier. Barometric pressure in mmHg was also recorded hourly during the same time period in conjunction with TDG in order to convert mmHg values into percent saturation [(TDG/BP)*100]. Percent saturation levels were used to assess waterway compliance with DEQ requirements.

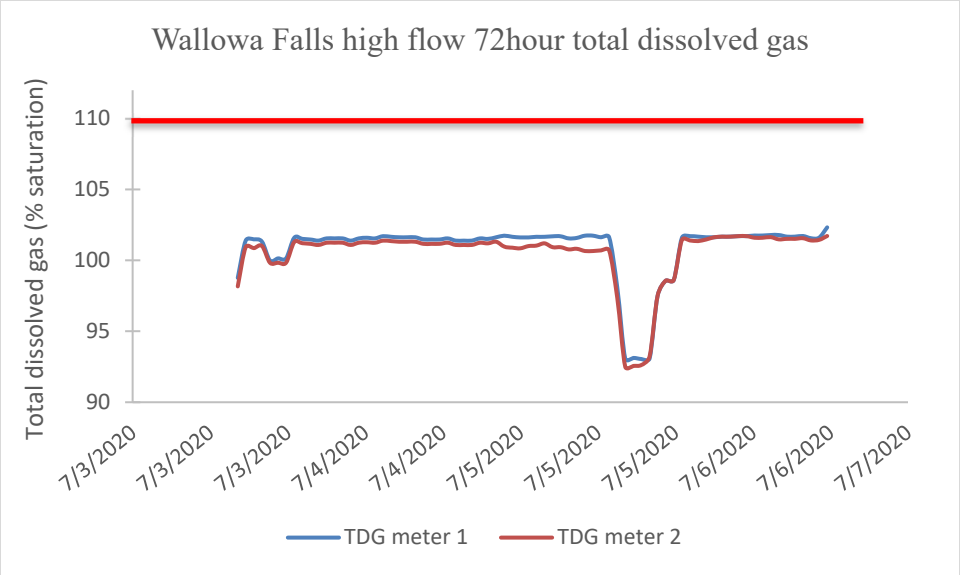


Figure 7. Hourly high flow TDG as measured from two separate meters deployed within the Wallowa Falls tailrace below the tailrace barrier 7/3/2020 – 7/6/2020. Red bar stipulates DEQ maximum of 110% TDG saturation.

TDG was again measured in the same location for an additional 72 continuous hours from below the tailrace barrier within the Wallowa Falls Project tailrace starting at 16:00 on August 8, 2020 and concluding at 15:00 on August 11, 2020, to fulfill low flow measurement requirements (Figure 8). For redundancy, two meters were set to record at the same time and rate and set on either side of the tailrace discharge plume below the tailrace barrier. Barometric pressure in mmHg was also recorded hourly during the same time period in conjunction with TDG in order to convert mmHg TDG values into percent saturation [(TDG/BP)*100]. Percent saturation levels were used to assess waterway compliance with DEQ requirements.

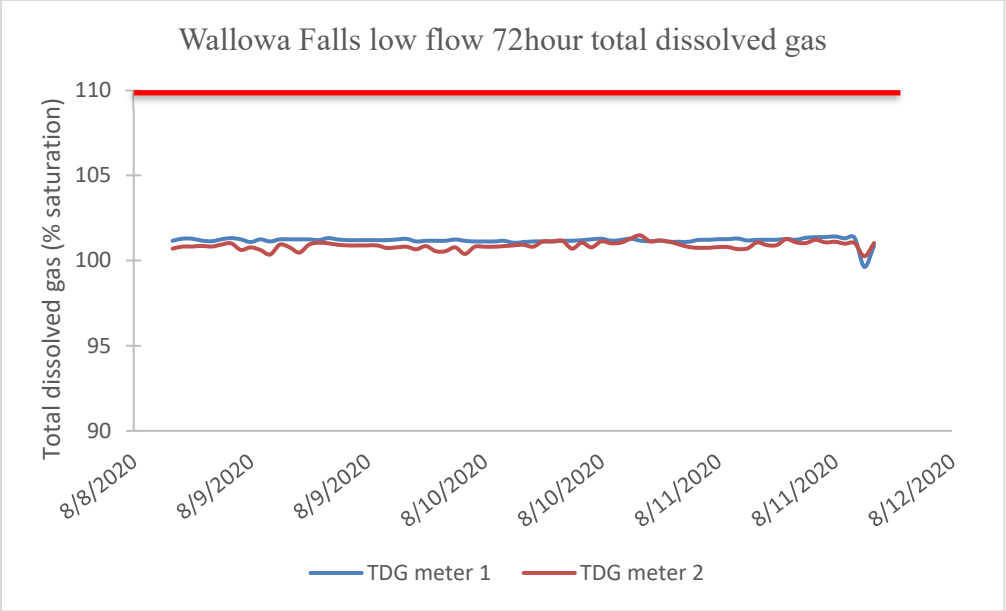


Figure 8. Hourly low flow TDG as measured from two separate meters deployed within the Wallowa Falls tailrace below the tailrace barrier 8/8/2020 – 8/11/2020. Red bar stipulates DEQ maximum allowance of 110% TDG saturation.

5.0 References

ODEQ. (2016). *Evaluation and Findings Report: 401 Water Quality Certification Wallowa Falls Hydroelectric Project.* Pendleton, OR. March 2016.

ODEQ. (2016). *Clean Water Act, § 401 Certification Conditions for the Wallowa Falls Hydroelectric Project, (FERC No. P-308) Grande Ronde River Basin, Wallowa County, Oregon.* Bend, OR. March 2016.

6.0 Comment Matrix

Agency	Comment	Utility Response

APPENDIX A

Wallowa Falls Flow Test – September 16, 2010

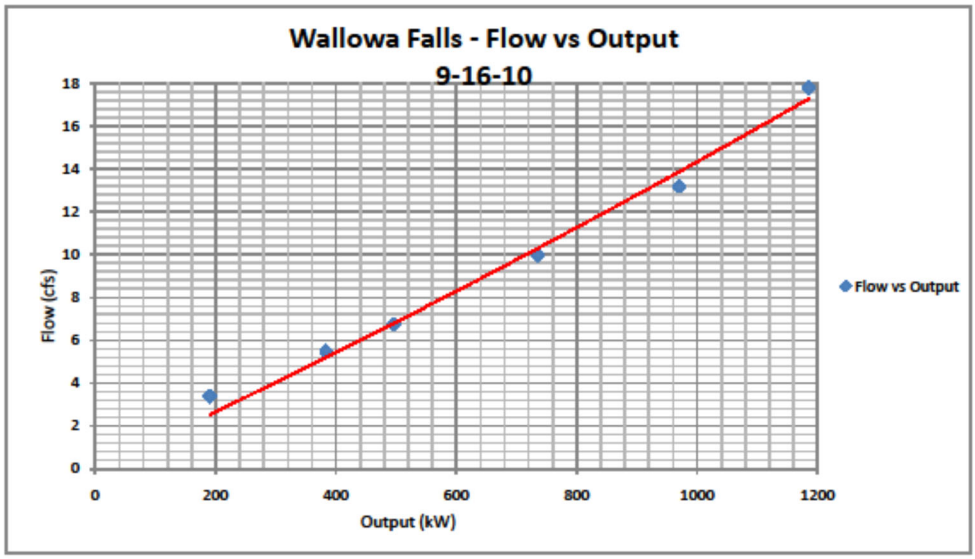
Relationship of Generation (kW) to Flow (cfs)

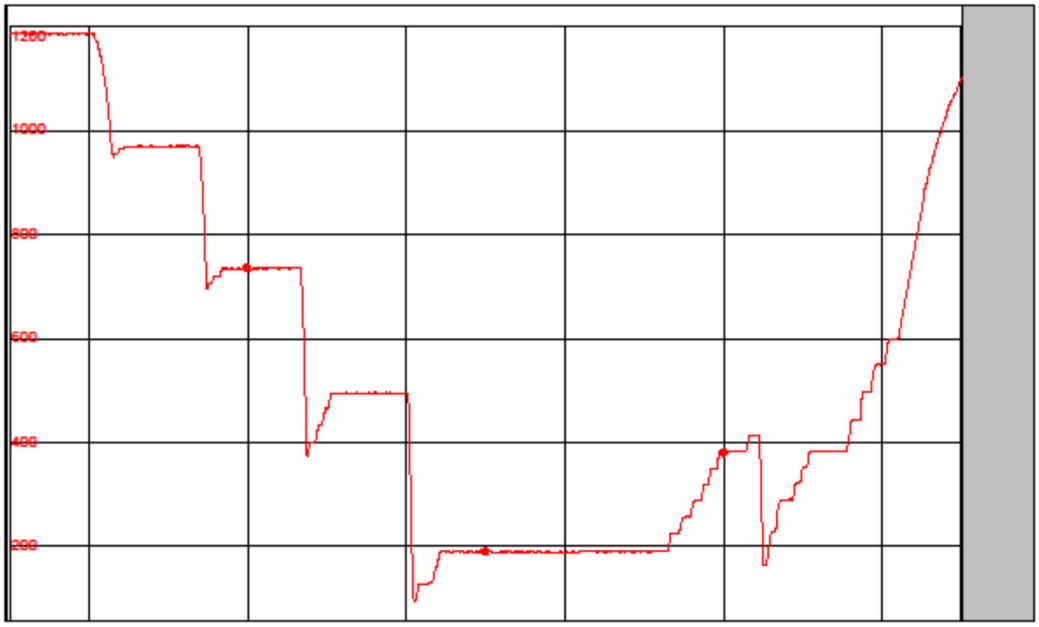
Wallowa Falls flow tests - September 16, 2010

Flow Meter: Panametrics PT868, s/n: 4202
Transducers - #30
V formation
Transducer spacing: 13.69"

Pipe O.D	16.0"
Pipe Thickness	.28"
Water temp - F	44 degrees

kW (from Pi)	cfs
1185.5	17.8
970	13.2
734.9	10
495.2	6.75
383.7	5.49
190.6	3.38

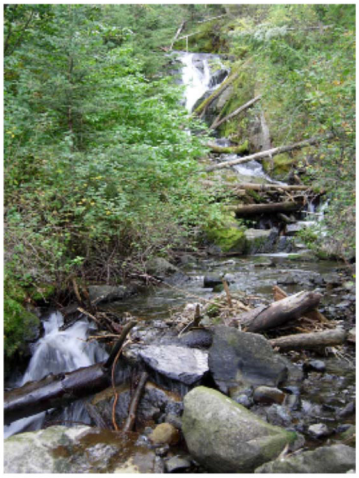




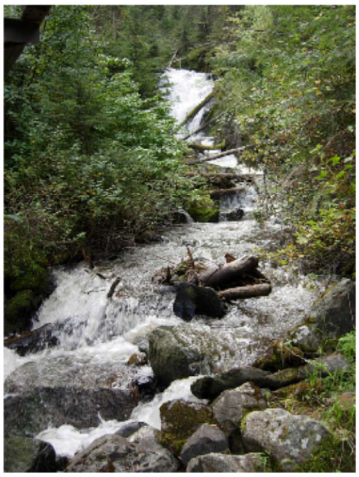
Pi Historian September 16, 2010 from 8:45 AM to 11:45 AM

Flow meter on pipe

Flow meter set-up – V formation



Without spill in creek next to trestle



With spill in creek next to trestle

Looking upstream

Looking downstream