



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

(FERC No. P-308)

Grande Ronde River Basin

Wallowa County, Oregon

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1.0 Introduction

Upon Federal Energy Regulatory Commission (FERC) issuance of a license for the Wallowa Falls Hydroelectric Project (Project), PacifiCorp must comply with all requirements under the associated Project Clean Water Act § 401 Certification Conditions document. This document is considered the Water Quality Monitoring and Management Plan (WQMMP) for the Wallowa Falls Hydroelectric Project that addresses requirements under Sections 3(a), 3(b), 3(c) within the § 401 Certification Conditions which states:

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.*

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.

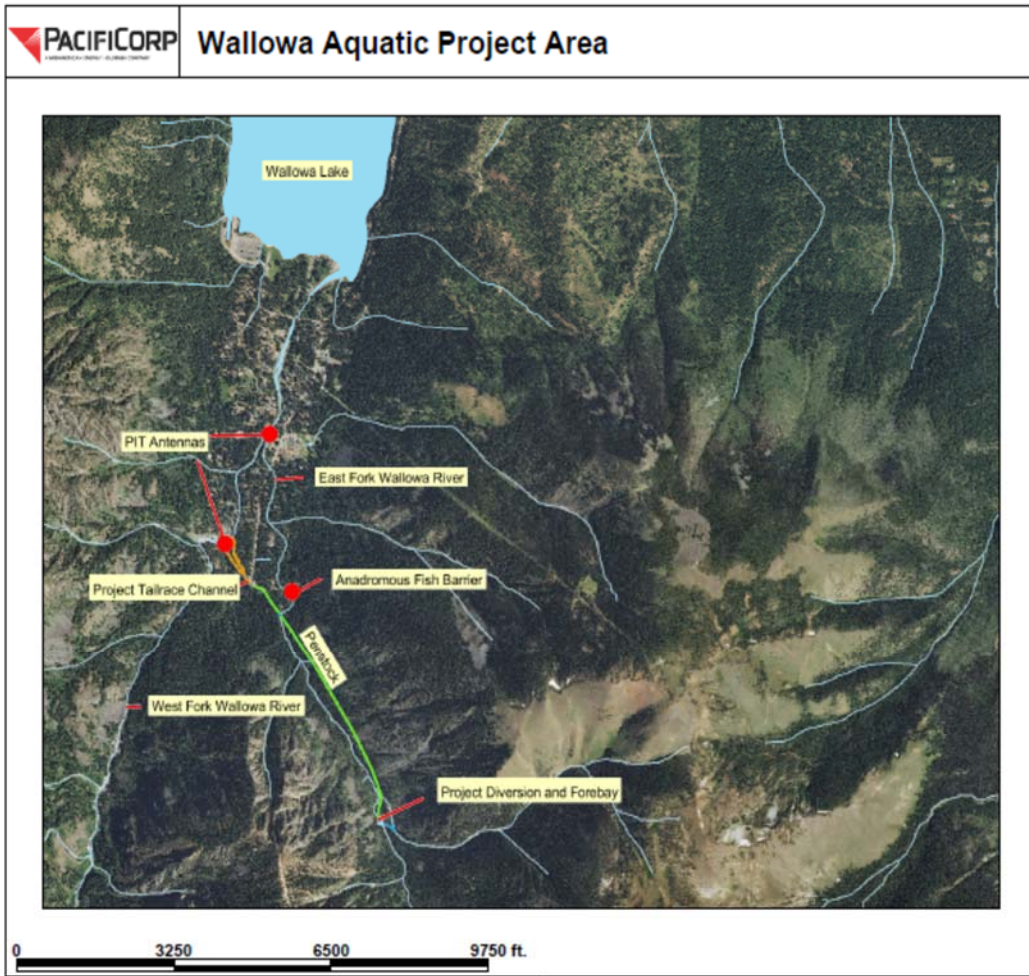


Figure 1. Wallowa Falls Hydroelectric Project.

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 to be 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 are included in this 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

The DEQ Evaluation and Findings Report (dated 3/31/2016) of the §401 Water Quality Certification for the Project describes several water quality standards of potential concern that, upon DEQ findings, DEQ is ‘reasonably assured’ that Project operations will comply with the respective water quality standard; these water quality standards that are subsequently not included in this WQMMP are shown in **Table 2**.

Table 2: Water quality standards of concern that upon investigation DEQ is reasonably assured will not be violated from Project operations.

Criterion	Rule	DEQ Findings Reference
Biocriteria	OAR 340-041-0011	Section 6.36 of the Evaluation and Findings Report
Discoloration, oily sheen, oily coating	OAR 340-041-0007(13)	Section 6.4.6 of the Evaluation and Findings Report.
Antidegradation	OAR 340-041-0004	Section 6.5.5 of the Evaluation and Findings Report.
Temperature	OAR 340-041-028	Section 6.6.4 of the Evaluation and Findings Report. To be included in WQMMP only to support dissolved oxygen monitoring.

Monitoring activities will occur during two separate monitoring periods, a high-flow monitoring period and a low-flow monitoring period, that will commence immediately after commissioning of the realigned tailrace. The high-flow monitoring period entails 72 hours of TDG monitoring during tailrace barrier initial high-flow operation in June-July. The low-flow monitoring period entails another 72 hour period of TDG monitoring during tailrace barrier initial low-flow operation in August-September and DO monitoring for 90 days starting August 1.

Temperature:

For redundancy, two (2) HOBO® Water Temp Pro v2 temperature data loggers will be placed in the water column in the Project tailrace at a location within 25 feet of the discharge to the West Fork Wallowa River. Temperature monitoring activities will coincide with all TDG and DO monitoring events. The temperature data loggers will be set to continuously record data in one-hour intervals.

Hourly temperature data will be converted to and reported as seven day averages of maximum daily temperatures. Temperature data will be included in the high-flow and low-flow monitoring reports.

Flow:

For redundancy, two (2) HOBO ® U20L-01 water depth loggers will be used to establish a temporary flow measurement gage in the tailrace immediately above the barrier. The depth loggers will be placed on the upstream side of the fish barrier and will be vertically fixed. The vertical distance between the logger and the crest of the barrier will be measured and subtracted out of the depth data. This will allow PacifiCorp to gather data representing the depth of flow over the barrier. The depth of flow over the barrier will then be used in a standardized weir-flow equation with the assigned discharge coefficient of the barrier to compute flow. Flow monitoring activities will coincide with all TDG and DO monitoring events. The water depth data loggers will be set to continuously record data in fifteen-minute intervals.

Flow data will be included in the high-flow and low-flow monitoring reports.

Generation:

Plant generation is remotely controlled, monitored and recorded using a SAP software “Pi” module. Continuous real-time monitoring of generation via Pi is conducted at the Hydro Control Center located in Ariel, Washington. Generation data will be reported for all TDG and DO monitoring events at the same interval times as flow.

Generation data will be included in the high-flow and low-flow monitoring reports.

Dissolved Oxygen:

For redundancy and comparison purposes, two Hach® Hydrolab® DS5 Multiprobe water quality meters will be used for measuring DO levels in the Project tailrace. The DO monitoring event will begin on the next ensuing August 1st following operational commencement of the realigned tailrace. Hourly DO measurements will be taken within the water column at the outlet of the new Project for a one-time 90 day

(low-flow monitoring) period. DO data will be downloaded and evaluated on a weekly basis for the entire monitoring period. The DS5 Multiprobe is capable of collecting water temperatures in addition to DO levels and will be programmed to do so during the monitoring period. Barometric pressure data will also be recorded on the same time interval and period as DO measurements in close vicinity to the DO meter. Barometric pressure will be measured using a Hach® Hydrolab® MS5 Multiprobe. 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.

DO data will be reported to DEQ within 90 days of the conclusion of the low-flow monitoring period. These data will be reported in hourly measurements in both tabular and graphical format. All flow, water temperature, and power generation data for the low-flow monitoring period will also be submitted.

Total Dissolved Gas:

For redundancy and comparison purposes, two Hach® Hydrolab® DS5 Multiprobe water quality meters will be used for measuring TDG levels in the Project tailrace. Hourly TDG measurements will be recorded in the Project tailrace at a location within 25 feet of the discharge to the West Fork Wallowa River. Barometric pressure data will be recorded using a Hach® Hydrolab® MS5 Multiprobe on the same time interval and period that TDG measurements are taken and within close vicinity to the TDG meter. TDG saturation levels will then be computed as the ratio of aqueous TDG pressure to barometric pressure. There will be two (2) separate monitoring periods for a given year; one monitoring period during June-July under higher flow conditions and another monitoring period during August-September under lower flow conditions. Both monitoring periods will record hourly TDG levels in the Project Tailrace outlet continuously until, at a minimum, each monitoring periods data-makeup contains seventy-two (72) hours of TDG data that occurred during Project generating conditions. Monitoring will begin during the first June-July and August-September time frames following operational commencement of the realigned tailrace.

TDG data will be reported to DEQ within 90 days of the conclusion the high-flow and low-flow monitoring periods. These data will be reported in hourly measurements in both tabular and graphical format. All flow, water temperature, and power generation data collected during TDG monitoring events will be included in the low-flow and high-flow monitoring period reports.

3.2 Addressing requirements under §401 Certification Conditions Section 3(b):

Within section 3(b) of the §401 Certification Conditions is the requirement for the WQMMP to contain procedures to correct the problem if monitoring results determine that Project operations are contributing to downstream violations of the applicable DO, TDG, or Antidegradation standards.

An additional monitoring period for identified parameters will be triggered if the above initial monitoring results find the Project may be contributing to violations of applicable State water quality standards. If the additional monitoring period results conclude that the Project is contributing to violations of applicable State water quality standards, consultation will ensue with the DEQ to discuss potential corrective action including possible modifications to Project structures or Project operations. Shut down of the Project due

to violations of the applicable DO or TDG standards is not recommended as it would result in an increase in flow (i.e. ramping) in the East Fork bypassed reach. Ramping in the East Fork bypassed reach during the bull trout spawning period would result in a violation of § 401 Certification Condition 1(c).

3.3 Addressing requirements under §401 Certification Conditions Section 3(c):

Within section 3(c) of the §401 Certification Conditions are a list of procedures that must be included in this WQMMP that address water quality monitoring equipment malfunctions. The required procedures are provided by monitoring parameter below. Item v. under Section 3(c) of the Certification Conditions document suggests developing '*Procedures and timelines for Project shutdown as may be necessitated by monitoring equipment malfunctions*'. PacifiCorp does not propose to execute Project shutdown due solely to monitoring equipment malfunctions.

Temperature:

Before the deployment for each monitoring event, the HOBO® data loggers will be checked for battery life and assessed for correct temperature readings. To calibrate, the loggers will be set to record temperature measurements on 30 second intervals and will be immersed in an ice bath for 15 minutes. During the 15 minute immersion PacifiCorp staff will take temperature measurements of the ice bath on one (1) minute intervals with a handheld National Institute of Standards and Technology (NIST) temperature probe. At the end of the 15 minute trial the data loggers will be downloaded, the data graphed and made sure the recordings converge to +/- 0.5° Celsius the data recorded by the handheld NIST temperature probe. Any data logger found to not meet this criterion will be taken out of service and replaced.

Upon any site visit to the project area by a qualified employee, the temperature data loggers will be downloaded, checked for battery life, and evaluated for proper function. Additional temperature loggers will be stored on site in the storage building in the case of equipment malfunction. Two (2) data loggers will be deployed in the tailrace during the monitoring periods in the case of equipment malfunction. In the event of equipment malfunction, DEQ will be notified of the date, duration and nature of the equipment malfunction and the corrective action taken.

Flow:

Prior to deployment both HOBO® depth loggers will be checked for battery life and assessed for correct depth readings. To calibrate, the loggers will be set to record depth measurements on 30 second intervals and will be placed at the bottom of a cooler filled with water. The cooler plug will then be slightly opened and the cooler will be allowed to slowly drain. PacifiCorp staff will measure the depth of the water with a ruler every 30 seconds until the cooler is fully drained. Pressure readings will then be downloaded, converted to water depth, and compared to the hand-measured depths. Any data logger found to not match the hand-measured data will be taken out of service and replaced.

Upon any site visit to the project area by a qualified employee, the water depth data loggers will be downloaded, checked for battery life, and evaluated for proper function. Two (2) data loggers will be deployed in the tailrace during the monitoring periods in the case of equipment malfunction. In the event

of equipment malfunction, DEQ will be notified of the date, duration and nature of the equipment malfunction and the corrective action taken.

Generation:

Plant generation is remotely controlled, monitored and recorded using a SAP software Pi module. Real-time monitoring of generation via Pi is conducted at the Hydro Control Center located in Ariel, Washington. Generation records for any time period can be retrieved from the SAP database. If communication to the plant is lost for any period of time, the generator automatically holds the last generation set-point indicated in Pi before communication was lost. A review of the tailrace flow data during the period communication is lost will be conducted to confirm generation did not fluctuate during the period when generation data was not recorded.

Dissolved Oxygen:

Prior to deployment, the DS5 DO meter will be cleaned, given new batteries, and calibrated. Calibration will be done by following the Hydrolab® instruction sheet for the Hach LDO™ Sensor (Cat. No. 00745589). Steps 1-8 under Method 1 of the instruction sheet will be followed for calibrating the DO meter. The Hydrolab® instruction sheet for the Hach LDO™ Sensor is provided in **Appendix A**.

During the DO monitoring event the meter will be downloaded weekly, installed with new batteries, and checked for proper function. During the download staff will view real time readings from the DO meter in the Project tailrace and simultaneously verify the readings with a handheld OxyGuard® Handy Polaris DO meter. In the event of equipment malfunction, DEQ will be notified of the date, duration and nature of the equipment malfunction and the corrective action taken.

Total Dissolved Gas:

Before deployment the MS5 TDG meter will be cleaned, installed with a new TDG membrane, given new batteries, and calibrated. A Hach Surveyor® 4a will be used to gather real time barometric pressure readings. The TDG meter will be connected to a PC and controlled through the Hyrdas 3 LT program/interface. With the TDG meter in air and reading the same ambient conditions as the Surveyor®, barometric pressure readings from the Surveyor® will be entered into Hyrdas 3 LT as the calibration standard and the TDG meter will be calibrated.

PacifiCorp staff will be onsite during the entirety of both seventy-two (72) hour TDG monitoring events. The TDG meter will be set to record measurements on the top of each hour, in this way (at the bottom of a given hour) PacifiCorp staff can momentarily connect a PC to the TDG meter during monitoring and check for proper function. In the event of equipment malfunction, DEQ will be notified of the date, duration and nature of the equipment malfunction and the corrective action taken.

4.0 Reporting

Within 90 days of completion of the high-flow and low-flow monitoring periods, a Water Quality Monitoring Report detailing all raw data collected and associated analysis of said parameters as well as water temperature, tailrace flow, and Project generation will be submitted to DEQ and the Federal Energy Regulatory Commission for review and comment.

5.0 Record of Consultation with ODEQ

A draft of the WQMMP was sent to the Oregon DEQ for review and comment on February 17, 2017. Comments on the draft WQMMP were received from DEQ on March 13, 2017. PacifiCorp revised the draft document to incorporate DEQ comments. A matrix summarizing the comments and PacifiCorp's response is provided below.

Agency	Comment	PacifiCorp Response
ODEQ	Page 7, paragraph 1 top of page. Please specify flow monitoring periods include 72 hours of TDG monitoring.	Incorporated into document.
ODEQ	Page 7, paragraph 2 on Temperature Monitoring. "Not necessary to convert to avg daily max. better to report as raw data as that is what is needed to calculate DO saturation."	Oregon State OAR temperature water quality standards are set as 7 day averages of daily maximum water temperature (7dadMAX). In order to assess compliance to set water quality standards, all captured temperature data will be converted to 7dadMAX and reported in this format. All raw hourly data will be utilized to calculate DO saturation.
ODEQ	Page 8, paragraph 6. "This suggestion is acceptable to DEQ. I did not envision a shutdown of the project due to the results of the first round of monitoring. If no violations are detected in the first round of monitoring described in the cert. conditions PacifiCorp can request to terminate monitoring."	Comment noted
ODEQ	Page 9, paragraph 5 on Flow Monitoring. "What is the level of accuracy expected, 0.1 foot?"	Expected level of accuracy per the manufacturer is below: Typical error: $\pm 0.05\%$ FS, 0.5 cm (0.015 ft) water Maximum error: $\pm 0.1\%$ FS, 1.0 cm (0.03 ft) water

6.0 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.

APPENDIX A