AVISTA

March 26, 2010

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington D.C. 20426

Re: Federal Energy Regulatory Commission's Spokane River Hydroelectric Project (FERC Project No. 2545-091) License, Appendix B, Section 5.4.A, Washington Department of Ecology's Total Dissolved Gas Requirements

Dear Ms. Bose:

On June 18, 2009, the Federal Energy Regulatory Commission (FERC) issued a new license (License) for the Spokane River Hydroelectric Project (FERC Project No. 2545). Ordering Paragraph E of the FERC License incorporated the *Washington Department of Ecology (Ecology) Certification Conditions Under Section 401 of the Federal Clean water Act (Issued on May 8, 2009 and amended on May 11, 2009).* The Conditions can be found in Appendix B of the license.

In accordance with License Article 401, Avista is required to provide a Total Dissolved Gas Monitoring Plan (Plan) for the Long Lake and Nine Mile Hydroelectric Developments within one year of License issuance. The Spokane Tribe of Indians and the Washington Department of Ecology have reviewed and approved the Plan and provided comments, which are included in Appendix B, followed by our responses.

We would greatly appreciate it if you could expedite your review and approval of this Plan in order to be able to implement monitoring activities during the 2010 spill season. If you have any questions regarding the Plan or our response to agency comments, please feel free to contact me at (509) 495-4998.

Sincerely,

Speed Fitzhugh

Elvin "Speed" Fitzhugh
Spokane River License Manager

Enclosure

cc: Brian Crossley, Spokane Tribe of Indians
Hank Nelson, Avista
Marcie Mangold, WA Department of Ecology

AVISTA CORPORATION

WASHINGTON TOTAL DISSOLVED GAS MONITORING PLAN

WASHINGTON 401 CERTIFICATION, SECTION 5.4(A)

Spokane River Hydroelectric Project
FERC Project No. 2545

Prepared By:
Golder Associates, Inc.

March 26, 2010

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1.0 INTRODUCTION

This Total Dissolved Gas Monitoring Plan (Plan) has been prepared to fulfill requirements of:

- Washington Department of Ecology (Ecology) for a total dissolved gas monitoring plan as specified in section 5.4 of the amended section 401 water quality certification (WQC) issued on May 8, 2009 for the Spokane River Hydroelectric Project (FERC No. 2545) (Ecology 2009)
- Federal Energy Regulatory Commission (FERC) for a Total Dissolved Gas monitoring plan as specified in Article 401 of the license issued for the Spokane River Project on June 18, 2009 (FERC 2009a)
- FERC for "information regarding the frequency of monitoring, sampling procedures, and equipment to be used" for monitoring total dissolved gas to be filed with the FERC as required by FERC's order approving and modifying the Water Quality Monitoring and Quality Assurance Project Plan, which was issued on September 17, 2009 (FERC 2009b)

Avista recognizes the need to address the potential negative effects of total dissolved gas (TDG) production caused by water spilling through the Long Lake spillway, and as a result proposed a protection, mitigation, and enhancement measure (PME) as part of its license application to the FERC (Avista 2005). This PME, referred to as SRP-WQ-1 "Total Dissolved Gas Control and Mitigation Program", has the overall goal of reducing the project's production of elevated TDG levels to the extent necessary for Project compliance with applicable water quality standards.

Ecology issued and amended a 401 water quality certification (WQC) for the four Spokane River Project hydroelectric developments that are located in Washington (i.e., Upper Falls, Monroe Street, Nine Mile and Long Lake HEDs). Section 5.4 of this WQC provides Avista's requirements to address the HEDs' effects on TDG. The general requirements of each of its subsections are:

- Section 5.4(A) mandates Avista to provide a TDG monitoring plan within one year of license issuance
- Section 5.4(B) states that the seven-day, ten-year frequency flood (7Q10) for the Long Lake Dam and Nine Mile Dam is 32,000 cfs
- Section 5.4(C) describes Nine Mile Dam monitoring requirements and conditions which would require a TDG Water Quality Attainment Plan (TDG WQAP) for Nine Mile Dam
- Section 5.4(D) describes Long Lake Dam monitoring requirements, and the required contents and schedule for a TDG Water Quality Attainment Plan (TDG WQAP) for Long Lake Dam

On June 18, 2009, FERC issued a license for the Spokane River Project (FERC 2009a). Article 401(a) of this license requires Avista to file the TDG monitoring plan required by WQC section 5.4(A) and the TDG WQAP for Long Lake Dam required by WQC section 5.4(D) for approval prior to implementation.

Since the TDG monitoring requirements and goals for the Long Lake and Nine Mile HEDs are distinctly different, this plan addresses the HEDs separately in sections 2.0 and 3.0, respectively. Appendix A provides a record of consultation for the Long Lake Hydroelectric Development (HED) and Nine Mile HED

TDG monitoring plans and Appendix B provides comments and responses to the comments on earlier drafts of these TDG monitoring plans.

1.1 TDG Causes and Effects

When water plunges into a pool, air becomes entrained regardless of whether the plunge is caused by a natural waterfall or a dam spillway (Weitkamp and Katz 1980). As stated by Ecology (2005), “Fish in water with high TDG levels may not display signs of difficulty if higher water pressures at depth offset high TDG pressure passing through the gills into the blood stream. However, if the fish inhabit supersaturated water for extended periods, or rise in the water column to a lower water pressure at shallower depths, TDG may come out of solution within the fish, forming bubbles in their body tissues.” This gives rise to a condition called gas bubble disease (GBD) or gas bubble trauma (GBT) that can harm fish (Weitkamp 2000; Backman and Evans 2002; Backman et al. 2002; Ryan et al. 2000).

1.2 Water Quality Standards

Washington State’s TDG standard is designed to protect fish. Under this standard, TDG is not to exceed 110 percent of saturation [WAC 173-201A-200(1)(f)] when stream flows are at or less than the seven-day, ten-year frequency flood [7Q10; WAC 173-201A-200(1)(f)(i)]. This numeric criterion is not applicable when stream flows exceed the 7Q10, which Ecology (2009) specified as 32,000 cfs for the Spokane River at Long Lake Dam and Nine Mile Dam. Starting approximately 1.5 mile downstream of Long Lake Dam, the Spokane Tribe of Indians water quality standards, which also is set at 110 percent of saturation but does not include a 7Q10 exception (Spokane Tribe 2003, § 9(2)(c)(iii)), applies to the Spokane River.

2.0 LONG LAKE HED TDG MONITORING PLAN

Long Lake Hydroelectric Development (HED) is the lowermost of the five hydroelectric developments of the Spokane River Hydroelectric Project (FERC No. 2545). It is located on the Spokane River at approximately river mile 34, a distance of 25-30 miles northwest of Spokane, Washington. The drainage area upstream of Long Lake Dam is approximately 5,840 square miles, and includes the Hangman Creek[1] and Little Spokane River watersheds, along with the watersheds that feed Coeur d'Alene Lake in Idaho. Plate LL1 shows the primary Long Lake HED facilities.

Plate LL1. Long Lake Dam and Powerhouse as Viewed From Overlook, May 22, 2008 at 09:45 PDT

2.1 Hydroelectric Development Description

Long Lake HED includes an L-shaped, concrete gravity dam ("main dam") and adjacent intake structure; a concrete arch cutoff dam ("crescent dam") located along the western shoreline approximately 700 to 800 feet upstream of the main dam; a gated spillway along the top of the main dam; and a powerhouse.

[1] Hangman Creek is also known as Latah Creek. This document uses Hangman Creek, which is the USGS convention.

The powerhouse contains four turbine-generator units with a total generating capacity of 71.7 megawatts and a combined hydraulic capacity of 6,300 cfs. The HED's reservoir (commonly known as Lake Spokane) extends approximately 23.5 miles upstream of the main dam. It has a 5,060-acre surface area at normal full pool elevation of 1,536 feet and it has a usable storage of 66,720 acre-feet at a drawdown of 14 feet. The main dam is a 593-foot-long, 213-foot-high concrete gravity dam (plate LL1). The top of the dam is at elevation 1,537 feet. The main dam includes a 353-foot-long, gated ogee spillway with a crest elevation of 1,508 feet. The spillway has eight 25-foot-wide 29-foot-high vertical lift gates and a capacity of 115,000 cfs at a water surface elevation of 1,536 feet.

Long Lake HED is operated as a storage facility for power generation purposes with a normal full-pool elevation of 1,536 feet. Although Avista was allowed to draw down Lake Spokane by as much as 24 feet under the previous FERC license, it voluntarily limited drawdown to approximately 14 feet (elevation 1,522 feet) beginning in the late 1980s. Article 402 of the new Federal Energy Regulatory Commission (FERC) license, which was issued on June 18, 2009, officially establishes the 14-foot drawdown limit.[2] Winter drawdown does not occur each year, due to variations in weather and river flows. When a drawdown occurs, its magnitude is dependent on weather conditions and other factors. The lake is normally held within 1 foot of the full-pool elevation throughout the summer recreation season.

2.2 Historical Conditions

During 2003 and 2004, continuous TDG measurements for the Long Lake HED forebay ranged from 101 to 123 percent of saturation, and typically had daily fluctuations of less than 5 percent of saturation (Golder 2003, 2004). TDG behind Long Lake Dam is not the same throughout the water column, but varies with depth and location (Golder 2004, 2006). Evaluation of the data collected suggests that mixing of the stratified layers of water (e.g., due to wind events, dam operations, etc) likely causes significant fluctuations of TDG in the forebay.

TDG measurements obtained 0.6 mile downstream of Long Lake HED reached as high as 129 and 125 percent of saturation in 2003 and 2004, respectively (Golder 2003, 2004). In 2003, TDG in the Long Lake tailrace exceeded 110 percent of saturation from March 20 to May 15, and generally exceeded 120 percent of saturation from March 24 to April 14 and from April 21 to April 29 (figure LL1). The Long Lake tailrace also had extended periods when TDG exceeded 110 and 120 percent of saturation in 2004. TDG exceeded the 110-percent of saturation criterion during these periods when water was being spilled through the Long Lake Dam spillways.

[2] License Article 402 states that "The drawdown requirement may be temporarily modified if required by operating emergencies beyond the control of the licensee."

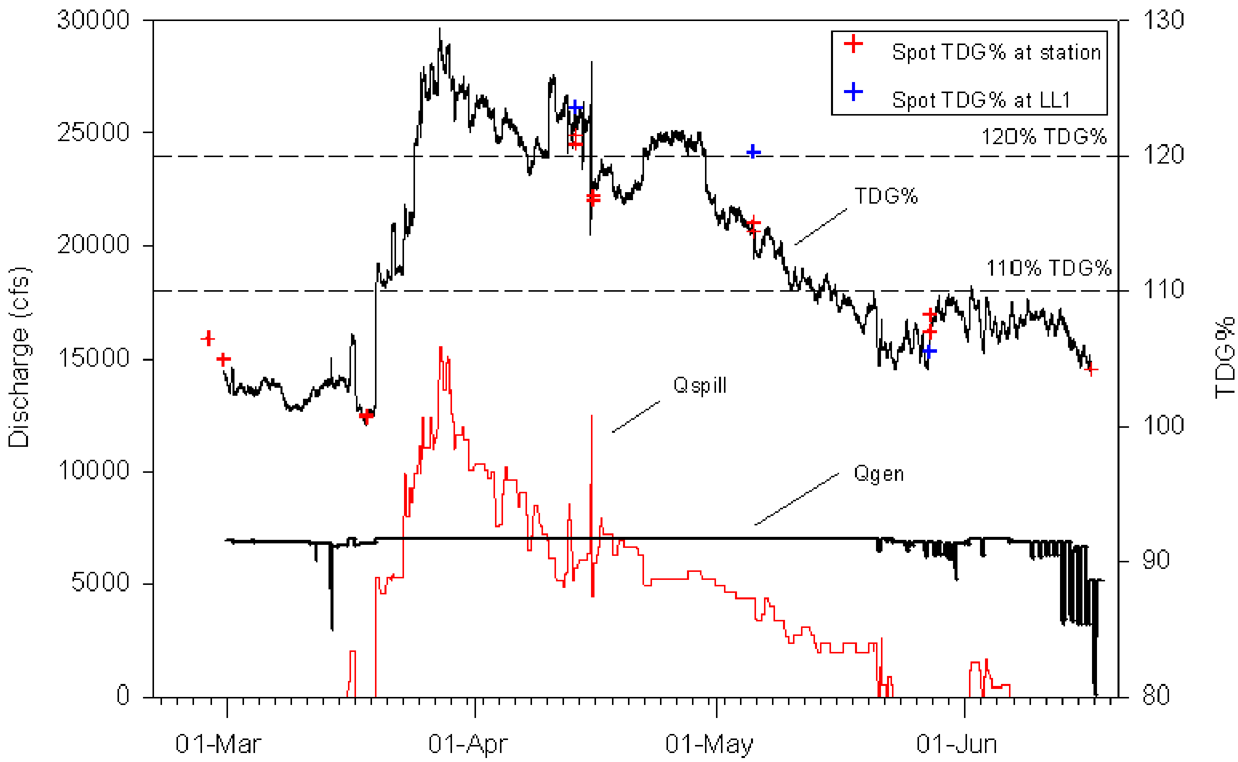

Figure LL1. Long Lake HED Tailrace TDG in Relation to Spill and Generation Discharge, February 24-June 17 of 2003

Spot measurements were taken adjacent to the continuous tailrace monitoring station ("at station") and in the spill channel ("at LL1"). (Source: Golder 2003)

During previous studies at lower flows following the freshet, Long Lake forebay meters recorded increasing erratic TDG levels that appeared to fluctuate randomly (figure LL2), (Golder 2003, 2004; Mattax 2009). When periodic large reductions in TDG were recorded at these stations, concurrent reductions in water temperature and DO were also recorded. Vertical profiles conducted at forebay monitoring locations document that forebay water was strongly stratified and that deeper water layers were cooler and had low DO concentrations. The apparent random fluctuations in TDG were assumed to be related to disturbance of the stratified water layers due to operation of the Long Lake HED powerplant, combined with wind and wave action on the reservoir (Golder 2004). Spot and continuous TDG measurements for the generation plume varied from concurrent measurements taken near the forebay powerplant intakes. High water velocities at the intake and generation monitoring locations posed significant challenges in deploying and maintaining continuous monitors. The monitoring data collected, however, suggests that the entrainment of different stratified water layers is not predictable or consistent and that a TDG sensor, even when deployed directly in front of the powerplant intake, does not always equal TDG in the generation plume. Consequently, we recommend installation of a station at a location that will enable direct monitoring of TDG within the generation plume.

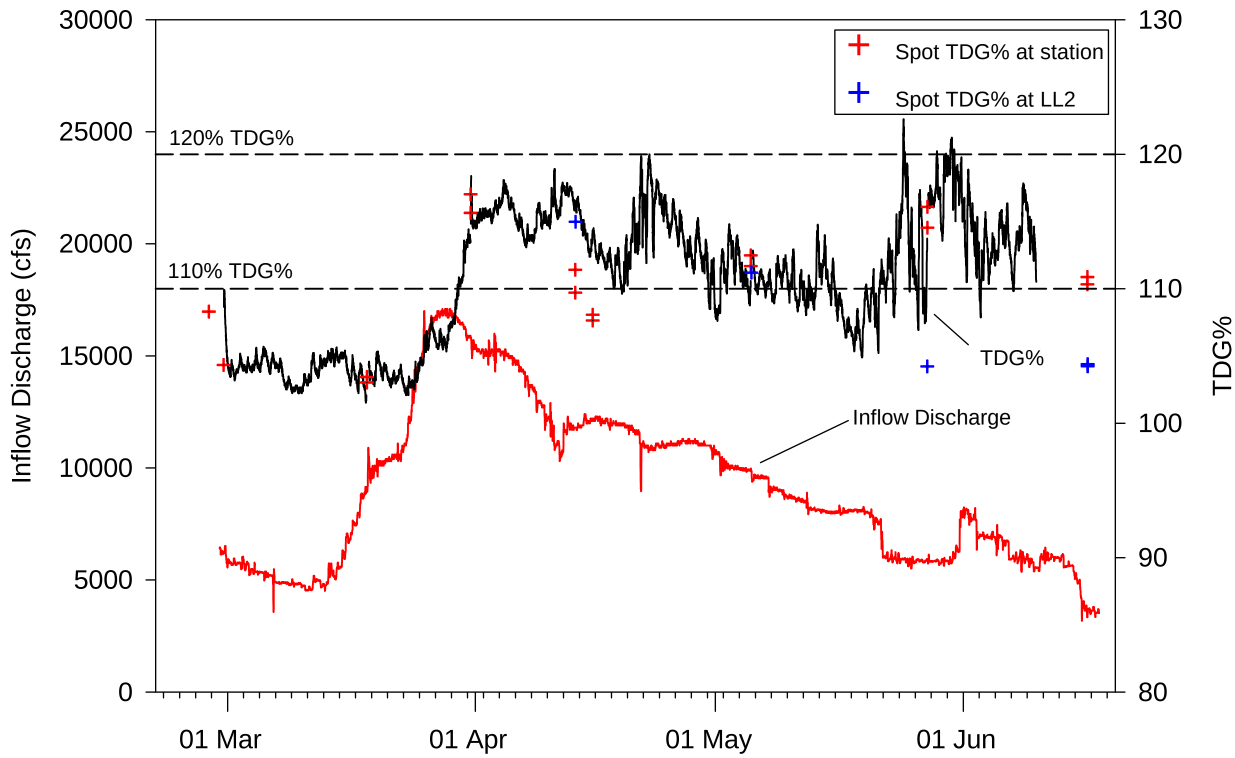

Figure LL2. Long Lake HED Forebay TDG in Relation to Inflows, February 24-June 17 of 2003

Spot measurements were taken adjacent to the continuous forebay monitoring station ("at station") and in the generation plume immediately downstream of the Long lake powerhouse ("at LL2"). Inflow discharge is the rate of Spokane River inflow to the Long Lake reservoir. (Source: Golder 2003)

2.3 TDG Monitoring

2.3.1 Objectives

Section 5.4(D) of the WQC requires that within one year of license issuance Avista develop a compliance schedule and TDG WQAP for Long Lake Dam for Ecology review and approval, and that the plan include:

1. Detailed Phase II Feasibility and Implementation Plan based on Long Lake Dam TDG Abatement Initial Feasibility Study Report (EES 2006)
2. Description of standard project operations with regard to minimizing TDG associated with spills
3. Description of how the project will minimize all spills that produce TDG exceedances at the Project

4. An evaluation of all potential and preferred structural and operational improvements to minimize TDG production

5. A timeline showing when operational adjustments will occur

6. A schedule for construction

7. Monitoring plans to further evaluate TDG production and to test effectiveness of gas abatement controls

The purpose of this study plan, hereafter referred to as the Long Lake HED TDG Monitoring Plan, is to address the seventh component of section 5.4(D) requirements as it pertains to conducting a TDG monitoring concurrent with the implementation of a TDG abatement strategy for Long Lake Dam. The objectives of this plan are to:

- Collect data to test the efficacy of using selected operational measures to reduce gas production by Long Lake dam spillway(s)
- Collect data for modeling the effectiveness of using selected structural measures to reduce gas production by Long Lake dam spillway(s)
- Test the effectiveness of selected operational and structural TDG abatement measures for Long Lake HED
- Confirm that Long Lake dam does not cause exceedances of the TDG standard after implementation of selected operational and/or structural measures

2.3.2 Monitoring Stations

For Long Lake Dam, the WQC requires Avista to "monitor TDG in the forebay **or** generation plume and near the end of the aerated zone (the area of bubble entrainment and dissipation) of Long Lake Dam upon issuance of the FERC license."[3] Golder has worked with Avista to determine whether the forebay or generation plume should be monitored and has designed permanent monitoring station facilities to be used for this monitoring along with other water quality monitoring.

TDG monitoring for Long Lake Dam will need to be done for several purposes (see Objectives, above), which will require a somewhat flexible approach for selecting monitoring locations to facilitate meeting multiple objectives.

The overall long-term monitoring strategy will consist of TDG monitoring at a station in the Unit 4 generation plume and at a location 0.6 mile downstream of the Long lake Dam (table LL1). Permanent facilities will be constructed at both of these stations by Avista personnel with technical assistance from Golder. The permanent stations will consist of a length of 4-inch-diameter aluminum pipe stilling-well (standpipe), which is sealed at the pipe's submerged end to prevent the TDG probe from falling out of the pipe. Each standpipe will have ½-inch-diameter perforations along its sides and a hole at the bottom to provide water exchange between the interior and exterior of the pipe and limit accumulation of sediment and debris in the bottom of the pipe. The standpipe will be anchored to the dam face at LLGEN and

[3] Emphasis added

anchored to the concrete base of the pumphouse and a rock outcrop at LLTR. Depending on the perceived need for security, the top end of each standpipe will be protected by either a locked metal access door and break-out box attached to the end of the pipe, or simply by a threaded metal cap. Armored flex conduit will be used to protect data power cables should the need to have external power be required at the station. A more detailed description of the potential configuration of each long-term monitoring station is provided in Golder (2009).

TABLE LL1
Long Lake HED TDG Monitoring Stations

Station Code	Description	UTM Coordinates	Monitoring Type
LLGEN	Long Lake HED Unit 4 generation plume	11T 437069E 5298473N	Long-term
LLTR	On left downstream bank, at a water pumphouse approximately 0.6 mile downstream from Long Lake dam	11T 436381E 5298603N	Long-term
LLTRSP1	On right downstream bank, across river from LLTR station	11T 436315E 5298725N	Spot during spillway use

During site visits done at approximately 2-week intervals, a spot measurement of TDG will be done at each of the TDG monitoring stations being operated at the time. Spot measurements also will be taken at LLTRSP1 if any of the Long Lake dam spillways are being used.

2.3.3 Monitoring Equipment

Since 1998, Avista has purchased a moderate amount of TDG monitoring equipment from two main manufacturers, Common Sensing Inc. and Electronic Data Solutions (EDS). Golder conducted a review of Avista's existing inventory of TDG monitoring equipment in August 2009 to assess the total number of reliable TDG monitors that could be used to conduct evaluation and compliance monitoring for the Spokane River Project (Golder 2009). The review determined that the majority of the Common Sensing equipment has significant reliability issues due to obsolescence and component failure. The newer EDS equipment was determined to be more reliable and the three units available likely could be used effectively to conduct long-term monitoring at one location, but additional units would have to be purchased to meet all monitoring objectives. The EDS equipment, however, was found to have several design limitations, such as a fixed probe cable length, a less robust design, and a relatively complex user interface that would limit deployment location options and use of the equipment as a portable monitor.[4]

In anticipation of the need to obtain additional new equipment, Golder conducted a review of the Hydrolab® MS5 Multiprobe® (MS5) platform, which identified several strengths suggesting Hydrolab equipment to likely be the most appropriate for long-term TDG monitoring at Long Lake HED (see Golder 2009). The MS5s are self-contained data loggers powered by an internal battery pack consisting of eight

[4] Note that Avista must also conduct TDG monitoring at the Post Falls HED, as required by section (H) of the FERC license (FERC 2009).

AA batteries. They are as 29.5-inches long, have an outer diameter of 1.75 inches, and a total weight with battery pack of 2.9 pounds. The MS5 internal memory allows recording up to 120,000 measurements. The primary strength identified was that the sensor array on MS5 can be configured to monitor a variety of water quality parameters in addition to TDG. For example, the same equipment could be configured to monitor TDG, dissolved oxygen (DO) concentrations, and temperature. This will enable use of the MS5s for multiple purposes associated with Long lake development, including monitoring TDG during high flows in spring and summer, DO and TDG during low flow in late summer and fall. The availability of a low maintenance optical DO sensor is a significant strength, which would enable accurate DO monitoring over longer deployment periods than other instrumentation.

Hydrolab® MS5 Multiprobe® (referred to as MS5) instruments with TDG, optical DO, temperature, and depth sensors will be purchased from Hach Company Inc. Each MS5 deployed at a location with an alternating current power source available will be connected to a surface data hub by a power/data download cable. With an external power source, the battery pack in the MS5 will serve as a backup source of power for periods as long as two weeks in case of power failure.

A shortcoming of the MS5s being self-contained and entirely submerged when deployed is the need for an independent barometric pressure readings when the unit is used to monitor TDG. Solinst® produces a cost-effective, small, weatherproof, and reliable barologger that is powered by a 10-year battery (Solinist 2009). One of these barologgers or equivalent instrumentation will be used to monitor barometric pressure at the Long Lake HED pumphouse or powerhouse. Data recorded by this instrument will be corrected when used to calculate supersaturation at other stations. The correction will account for differences in elevations between the monitoring station where the barologger is located and the TDG monitoring stations that are located at different elevations.

In order to provide a backup source of barometric pressure readings, two barologgers will be used to record barometric pressure at the Nine Mile HED and/or Long Lake HED. In seasons that TDG monitoring occurs at both Long Lake HED and Nine Mile HED, data from the barologger at the Nine Mile HED forebay will be used if the barologger at Long Lake HED fails. In seasons that TDG monitoring only occurs at the Long Lake HED, the backup barologger will be deployed at a second location associated with the Long Lake HED (i.e. a baralogger will be deployed at the Long Lake powerhouse and pumphouse).

A MS5 equipped with a short power/data cable and a Hydrolab Surveyor 4a® will be used as a portable TDG meter to obtain spot measurements at long-term and short-term TDG monitoring stations. These spot readings will be used to verify the quality of data from the MS5s deployed at the stations. The Surveyor 4a will have an internal barometer and barometric pressure data from this instrument will be used to evaluate the quality of both recorded and elevation-adjusted barometric pressure values for each operational station.

2.3.4 TDG Monitoring Procedures

Water quality parameters that will be recorded consist of TDG (mm Hg), dissolved oxygen concentration (mg/L) and water temperature (°C). Water depth (meters) will also be recorded and used in conjunction with water temperature to identify if and when MS5s emerge from the water and when MS5s are above the minimum TDG compensation depth. The range, accuracy, and resolution for each measured parameter are provided in Table LL2. Even though external alternating current power will be used for most of the monitoring, internal battery voltage will be recorded to monitor power consumption and determine any need for battery replacement. To produce a consistent set of measurements that are taken at the same times, MS5s that are deployed will be programmed to sample and record values on the hour and at 15, 30, and 45 minutes after the hour. This will be accomplished by delaying sampling and logging until the beginning of the next 15-minute period and logging at 15-minute intervals.

TABLE LL2

Range, Accuracy and Resolution of Parameters That Will be Recorded Under the Long Lake HED TDG Monitoring Plan

Parameter	Range	Accuracy	Resolution
Total Dissolved Gas	400 to 1300 mm Hg	±0.1 % of span	1.0 mm Hg
Temperature	-5 to 50°C	±0.10°C	0.01°C
Depth (0-25 m)	0 to 25 m	±0.05 m	0.01 m
Dissolved Oxygen	0 to 30 mg/L	± 0.01 mg/L for 0 to 8 mg/L ± 0.02 mg/L for >8mg/L	0.01 mg/L
Barometric Pressure	500 to 800 mm Hg	±3.5 mm Hg within 6 months of zero calibration at 25°C	0.1 mm Hg
Relative Barometric Pressure	1.5 m, typically 30-100 cm	0.1 cm	0.002% of full scale

2.3.4.1 Calibration and Maintenance

2.3.4.1.1 External Barometer Calibration

Barometric pressure will be measured with a Hydrolab Surveyor 4a, Solinst® barologger, or equivalent instrumentation. These instruments will be maintained following the corresponding manufacturer's instructions. Before using one of these instruments for pre-deployment or post-recovery field verification sessions, the values recorded will be compared to a known National Institute of Standards and Technology (NIST) pressure source at either a nearby USGS gage station or airport.

2.3.4.1.2 Annual Factory Calibration and Servicing

Each year before deployment of the TDG monitoring equipment, all MS5s will be sent to Hach for factory calibration and adjustment. Annual factory calibration is a critical component that will help ensure reliable recording of quality data. Factory calibration also will provide an auditable track to verify equipment has been maintained in proper working order.

2.3.4.1.3 Pre-Deployment Field Verification

Each year, field personnel will conduct pre-deployment field testing no more than two weeks before the planned initial deployment of MS5s. This will include the following steps for each instrument to be used for TDG monitoring:

- The clock of each MS5 and Solinst® barologger will be synchronized to the correct date and time, and then a test will be done to confirm that each instrument will log and download data.
- The TDG silastic membrane will be removed from each MS5 and the recorded TDG value will be compared to ambient barometric pressure of a recently calibrated external barometer (either a Surveyor 4a or the Solinst® barologger).
- The patency of each TDG silastic membrane will be confirmed by pressurizing the membrane using carbonated soda water and confirming that a substantial pressure change is registered.
- A mass verification of the MS5s will be conducted, likely at the LLTR monitoring station under elevated TDG levels. Each unit will be delay started to the same time and set to log data at one-minute intervals. All units will then be tied together and deployed so that the TDG sensor of each unit is at a depth of about 10 feet below the water's surface. After a total deployment period of approximately one hour, the units will be downloaded and concurrent TDG, water temperature, depth, at the 20 and 50 minute mark will be compared for all units and any differences noted.
- The barologgers also will be tested to confirm that they record values are similar to one another.

2.3.4.1.4 Deployment Maintenance and Servicing

During each service period, each MS5 will be retrieved and the pull time recorded. Each service session will include verification of logging status and downloading of the data to a portable field computer. The Solinst® barologgers also will be downloaded. For each data file downloaded, the data file name and location will be recorded and the logged data start and end date and times will be recorded. If the MS5 has lost power, an attempt will be made to determine the cause of the power loss and the backup batteries will be checked and replaced, if appropriate. If the MS5 was operational upon retrieval, the internal and external voltage reading as reported by the unit will be recorded.

Patency of the original TDG membrane will be confirmed by pressurizing the sensor with soda water and all damaged, unresponsive TDG membranes will be marked. Each MS5's TDG membrane will be removed, cleaned and allowed to dry. With the TDG sensor exposed to air, the barometric pressure will be recorded and compared to a barometric pressure reading from either a Surveyor 4a or a Solinst® barologger. A one-point calibration will be conducted if the TDG pressure reading in air differs from the secondary source by more than 2 mm Hg. Once calibrated, a new membrane will be installed and patency confirmed by again pressurizing the sensor with soda water. Air temperature, depth and internal battery voltage will also be recorded. Depth, temperature and DO sensors will then be calibrated according to the manufacturer's instruction and the difference between the pre- and post- calibrated value recorded.

Once all MS5 sensors are calibrated, the field crew will initiate and verify data logging. Initiating data logging will include synchronizing the logger clock, ensuring the correct parameters are selected for logging, confirming that the logging interval is set to 15 minutes, and setting the delay log start time to the nearest quarter hour interval (ie.15, 30, 45 or 60 minute mark each hour). The logging end date will be set to one year after start up. This step is crucial to avoid premature shutdown of the unit. To confirm log initiation, the field crew will select the audible tone feature so that each unit emits a series of beeps prior to logging and a single beep while in standby mode. Upon confirmation of logging, the MS5 will be reinstalled in the standpipe, and the deployment time recorded. At stations where a Solinst® barologger is to be deployed, the barologger's clock will be synchronized with the laptop, the local altitude entered, linear logging at 15-minute intervals, setting the logging start time to the nearest quarter hour interval (ie.15, 30, 45 or 60 minute mark each hour), and the barologger deployed. Before leaving the area, all doors and locks will be checked and noted in the written log to verify the station is secure.

2.3.4.1.5 Post-Recovery Field Verification

At the end of each annual TDG monitoring study, all MS5s and Solinst® barologgers used during the monitoring season will undergo post-verification following procedures nearly identical to pre-deployment field calibration, with the exception that mass *in situ* verification will not be conducted. All differences in TDG pressure, dissolved oxygen, temperature, depth, and barometric pressure will be recorded. These differences, if substantial, will be used to qualify and correct the data for periods when the unit was out of calibration.

2.3.4.2 Data Quality Control and Quality Assurance

Golder will document records of factory calibration in its project files. This will include records of when the equipment is sent to and received from the manufacturer along with a record of servicing done by the manufacturer. All calibration done by Golder, as outlined above, will be recorded on datasheets. The hardcopies for all field forms will be scanned and saved as PDF files on a Golder file server. As a redundant protective measure, field notes and calibration forms will also be photocopied and the original stored in a fire-proof area.

In the absence of an automated download system, data download would be conducted at approximately 2-week intervals in conjunction with TDG instrument maintenance and calibration. Both the MS5 and Solinst® barologger data downloaded will be documented in the field on each datasheet. Excel® spreadsheets will be used to inspect all downloaded data and verify the start and end dates. A backup copy of the electronic file will be saved to a USB drive as well as on the computer. Once a station's data download has been successful and verified, the MS5 will be initialized under delay start mode with the integrated audible tone feature to verify the unit is logging data. If a remote data download system is incorporated into the design of any Long Lake HED stations, data will be downloaded from the station(s) more frequently. A status check of each TDG station would be conducted for early identification of any problems.

Golder will use Excel® spreadsheets to identify and remove outliers from downloaded data and operations data, provided by Avista. A second reviewer will verify the "cleaned" data and then all TDG data along with qualifiers will be imported into an Access® database. The cleaned data will be plotted using either Excel or Access during the initial review process, and, if required, to produce figures for interim memorandums. A more sophisticated charting package, such as Sigmaplot®, will be required for final report figures of TDG and discharge data, especially during spillway and other TDG mitigation testing.

Data quality objectives (DQOs) are the quantitative and qualitative terms used to specify how good the data need to be to meet the project's specific monitoring objectives. DQOs for measurement data, also referred to as data quality indicators, include precision, accuracy, measurement range, representativeness, completeness, and comparability. Measurement Quality Objectives (MQOs) specify how good the data must be in order to meet the objectives of the project. MQOs are the performance or acceptance thresholds or goals for the project's data, based primarily on the data quality indicators precision, bias and sensitivity. The measurement quality objectives (MQOs) that will be used for this monitoring plan are displayed in table LL3. Golder will calculate and report the station-specific root mean squared error (RMSE) of the calibration corrections applied after each calibration, and an overall RMSE for each station based on the average time for calibration corrections.

TABLE LL3

Measurement Quality Objectives (MQOs) for Long Lake HED TDG Monitoring Plan

Parameter	MQOs
Barometric Pressure	2 mm Hg
Temperature	0.5ºC
Total Pressure	1% (5 to 8 mm Hg)
TDG%	1%
Dissolved Oxygen	0.5 mg/L

TDG meters, like other field monitoring equipment, are subject to bias due to systematic errors introduced by calibration, equipment hardware or software functioning, or field methods. Bias will be minimized by following standard protocols for calibration and maintenance, and by following field protocols for stabilization of meter readings. Bias is difficult to assess for TDG field measurements, because a more accurate verification method, such as a laboratory standard, is not available. No DQOs are being set for bias.

Precision refers to the degree of variability in replicate measurements; however, the precision of the results from continuous monitoring instruments cannot be estimated from replicate measurements. Therefore, the potential variability of TDG results may be indicated by agreement among the simultaneous results from two or more instruments, either during calibration or in the field. Instrument precision will be evaluated through the calibration and maintenance activities described in Section 2.3.4.1. Most TDG measurements are expected to be within the range of 100 to 140 percent of saturation. The Washington State criterion is currently set at 110 percent of saturation. MQOs are equal to DQOs and equal to 1 percent of saturation. MQOs will be met if TDG meter readings are within 1 percent saturation or 5 mm Hg of spot measurements taken using portable Hydrolabs. If MQOs are not met, the differences will be evaluated but the data will not be qualified or discarded unless other information indicates a problem with the data.

TDG percent of saturation values are dependent on barometric pressure readings so MQOs are also necessary for the barometric pressure measurements taken using portable Hydrolabs and Solinst® baraloggers. The target for this project will be an MQO of 2 mm Hg for the field barometer readings. The barometric pressure MQO will be evaluated by paired readings with a field barometer, Hydrolab pressure sensor with the TDG membrane removed, or a known National Institute of Standards and Technology (NIST) pressure source at either a nearby USGS gage station or airport.

Water temperature data also will be collected because it can influence TDG. Since this is a parameter of secondary importance to the study, DQOs have not been established, but an MQO has been set at 0.5°C. Data will be reported if post-calibration shows that the temperature is within the MQO. Data that do not fall within the MQO will not be reported.

The quality of existing data will be evaluated where available. Sources within well-established programs will be acceptable based on the credibility of the source (such as the National Weather Service or U.S. Geological Survey data). The variability of data will be reviewed to evaluate for whether it is appropriate based on expected values and comparison between data sets. Data with too much or too little variability will not be used.

Accuracy is a measure of confidence that describes how close a measurement is to its "true" value, or the combination of high precision and low bias. Refer to table LL2 for the accuracy of each measured parameter. At the end of each seasonal TDG monitoring study, all MS5s and Solinst® baraloggers used for the monitoring season will undergo post-verification procedures as described in Section 2.3.4.1.5. All differences between TDG pressure, dissolved oxygen, temperature, depth, and barometric pressure will be recorded and these differences, if substantial, used to qualify and correct the data for periods when the unit was out of calibration.

Measurement Range is the range of reliable readings of an instrument or measuring device, as specified by the manufacturer. Refer to table LL2 for the range for each measured parameter. Annual maintenance of field sampling equipment will be conducted in a manner consistent with the manufacturer's recommendations and records of all maintenance activities will be recorded and included with the field notes.

Representativeness qualitatively reflects the extent to which sample data represent a characteristic of actual environmental conditions. For this project, representativeness will be addressed through proper design of the sampling program which will ensure that the monitoring locations are properly located and sufficient data are collected to characterize TDG at that location. This includes comparing spot measurements at both the long-term monitoring stations and at other stations to confirm complete mixing.

Completeness is the comparison between the amounts of data that has been planned to be collected and how much usable data is actually collected, expressed as a percentage. Data may be determined to be unusable in the validation process if the data set does not meet the completeness designated for the project. A project completeness of greater than 90 percent is expected under normal operating conditions. If project completeness falls below 90 percent, then corrective measures including resampling or reanalysis will be employed. Completeness will be evaluated and documented throughout all monitoring activities and corrective actions taken as warranted on a case-by-case basis.

Comparability is the degree to which data can be compared directly to previously collected data. Comparability will be achieved for this project through External Barometer Calibration activities (refer to Section 2.3.4.1.1).

2.3.5 Study Coordination and Schedule

Effective coordination and communication is critical to successfully meeting the objectives identified in section 2.3.1. This is particularly challenging due to the various levels of communication which are needed (i.e., agency, management, and field) and multiple parties (Avista, Ecology, Spokane Tribe, FERC, Golder and the Feasibility Study Consultant) being involved in different aspects of this effort. Figure LL3 and table LL4 show the organization and communication channels associated with this monitoring effort. Avista will directly communicate with Ecology, the Spokane Tribe, and the FERC.

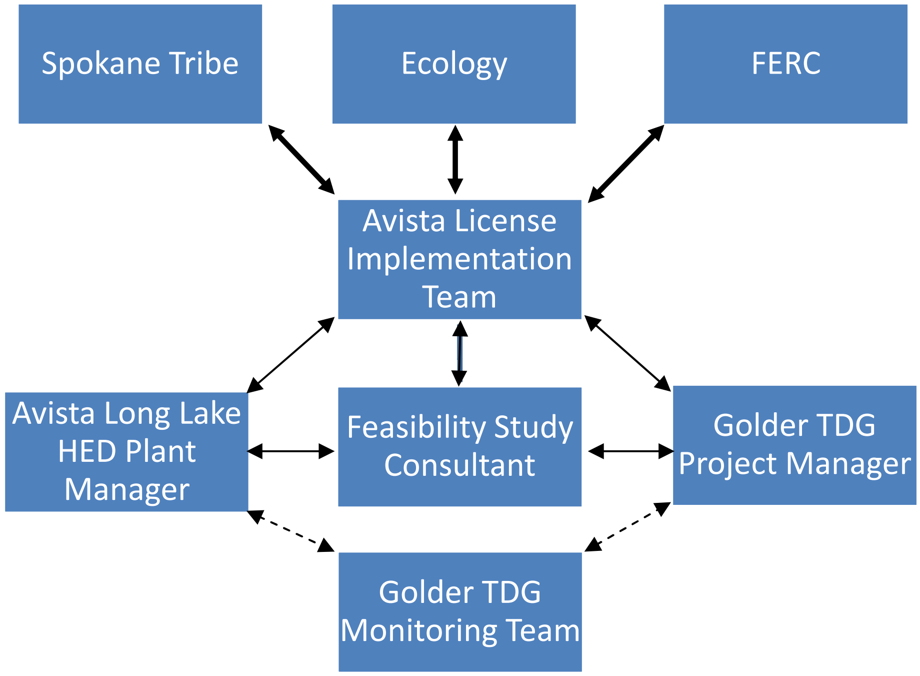

Figure LL3. Project Organization and Communication Channels for Long Lake HED TDG Monitoring Plan

Thick solid arrows indicate agency and public communication, thin solid arrows indicate management level communication, dashed arrows indicate field level communication.

TABLE LL4

Long Lake HED TDG Monitoring Plan Project Contacts

Position	Name
Ecology	Marcie Mangold
FERC	George Taylor
Spokane Tribe	Brian Crossley
Avista License Implementation Team	Speed Fitzhugh, Hank Nelson
Avista Long Lake Plant Manager	Bill Maltby
Golder TDG Project Manager	Brian Mattax
Golder TDG Monitoring Team	Paul Grutter, Max Birdsell
Feasibility Consultant	Lisa Larson

For the feasibility study, Avista, Golder, and the consultant selected to conduct the feasibility study, will communicate as a team keeping each other informed of technical needs, Long Lake HED operational schedules, and any challenges that occur in meeting the needed products. Avista has selected northwest hydraulic consultants inc. (nhc) as to be the Phase II Feasibility Study Consultant. The Golder TDG Project Manager will ensure that the TDG Monitoring Plan is implemented concurrently with planned TDG abatement operational tests conducted during for the feasibility study. Golder and the Feasibility Study

Consultant also will coordinate all monitoring and operational testing efforts with Avista's Long Lake HED Plant Manager and ensure information regarding timing and implementation are relayed to field personnel responsible for conducting the TDG abatement tests and concurrent TDG monitoring. Golder will collect, compile and conduct a quality review of the TDG data and Long Lake operations data, which are provided by Avista. Then the results of TDG monitoring will be communicated to the Feasibility Study Consultant Project Manager and the Avista License Implementation Team. The Avista License Implementation Team will be responsible for communicating study progress and results to Ecology, the Spokane Tribe, and the FERC. Any requests for additional information will be submitted to the Avista Management Team, who will communicate these requests to the Feasibility Study Consultant Project Manager and/or Golder TDG Project Manager, as appropriate. In the field, it is assumed that the engineering and TDG field personnel will likely operate independently of each other.

Following the selection and implementation of TDG abatement measures, Golder will collect, compile and conduct a quality review of the TDG data and Long Lake HED operations data, which are provided by Avista. Golder will use the "cleaned data" to evaluate the effectiveness of measures implemented and identify any need for additional feasibility studies to reduce the dam's TDG production, and communicate this information to the Avista License Implementation Team. The Avista License Implementation Team will determine an approach to meet identified needs. As for the feasibility study period, the Avista License Implementation Team will be responsible for communicating study progress and results to Ecology, the Spokane Tribe, and the FERC.

Work associated with further evaluating the feasibility of potential TDG abatement measures at Long Lake Dam will begin in 2010, and is expected to continue for 2-4 years. This will include monitoring TDG and associated parameters (water temperature and barometric pressure) while operating Long Lake HED according to a spillway gate test matrix schedule, which identifies the spillway and gate height, to be tested should flow conditions permit. The time period to test spillway operations near 7Q10 flows may be limited to brief periods in a high flow year during the ascending and descending limbs of the hydrographs. Depending on the availability of high flow, the results of the spillway gate tests, and other factors affecting the feasibility of operation and/or structural TDG abatement measures, the initial test matrix schedule may be revised and tested in the following year. Annually, seasonal monitoring will continue at the long-term TDG stations until compliance with the applicable TDG standard is documented or the end of the 10-year compliance period, whichever occurs first.

2.3.6 Adaptive Revisions to Monitoring Plan

The signatories to this monitoring plan recognize that there may be advantages to monitoring TDG at specific locations and times, which have not been identified in this plan, to better determine the feasibility of specific potential TDG abatement measures. The Avista License Implementation Team and Feasibility Study Consultant will jointly identify desired changes in the:

- Timing and duration of TDG monitoring
- Installation of new temporary monitoring stations
- Increased frequency of data reporting
- Additional spot TDG measurements

The Avista License Implementation Team will communicate these desires with the Golder TDG Project Manager, who will provide Avista feedback on the perceived need for requested changes. Should Avista decide to request a change in the monitoring plan, the Avista License Implementation Team will notify Ecology, the Spokane Tribe, and FERC of the desired change and provide the rationale for the requested change. All changes will be dependent upon approval by Ecology and the FERC prior to implementation.

2.3.7 Reporting

Data reporting for the feasibility study will consist of interim technical memorandums that summarize data recorded for particular phases of operational spillway gate tests that require TDG data to be available to the Feasibility Study Consultant within 2 to 4 weeks of test completion. We assume that interim reports will only be required in situations that demand that TDG from the previous test be reviewed and interpreted before subsequent tests can be conducted. The format and content of interim reports will be defined through a discussion between the Avista License Implementation Team, Golder TDG Project Manager and the Feasibility Study Consultant. Golder will conduct QA/QC on all data before inclusion in any interim report. Before beginning the planned spillway gate tests, the Feasibility Study Consultant, Avista License Implementation Team, and Golder TDG Project Manager will establish a reporting schedule so that personnel and appropriate resources can be assigned. A reporting schedule for any data collection activities after the Phase II feasibility study is completed will be established, as needed.

Following the end of each annual TDG monitoring season, Golder will compile all data collected during the previous TDG monitoring season and prepare an annual TDG report. Annual TDG reports will include time series charts of TDG with the 110-percent of saturation criterion along with spill and generation flows, charts of TDG in the tailrace compared with TDG in the generation plume, and a description of the frequency and periods of TDG standard exceedances. Avista will submit the annual report to Ecology, the Spokane Tribe, and the FERC.

3.0 NINE MILE HED TDG MONITORING PLAN

Nine Mile Hydroelectric Development (HED) is located on the Spokane River at approximately river mile 58 and is approximately 24 river miles upstream of the Long Lake HED. The drainage area upstream of Nine Mile HED is approximately 4,998 square miles, and includes the Hangman Creek watershed along with watersheds that feed Coeur d'Alene Lake in Idaho. Hangman Creek, which has a drainage area of about 690 square miles and peak flows of more than 20,000 cfs during extreme runoff conditions (Kimbrough et al. 2006 at 489), contributes its flow to the Spokane River approximately 14.4 river miles upstream of Nine Mile HED. Plate NM1 shows the Nine Mile Dam and powerhouse during spill conditions.

Plate NM1. Nine Mile Dam and Powerhouse Viewed From West Charles Road Bridge, May 22, 2008 at 11:15 PDT

3.1 Hydroelectric Development Description

Nine Mile HED is generally operated as a run-of-river facility, with relatively minor pool level fluctuations and only 3,130 acre-feet of potential storage. Two rows of 5-foot-high flashboards are installed on the spillway to maintain the full-pool elevation of 1,606.6 feet. During high flow periods, sections of the flashboards are removed to allow the water to pass, resulting in the HED's impoundment's water level being reduced as much as ten feet. Flashboard removal occurs in increments, anytime between late winter and spring, as runoff patterns vary each year. Sections of the top set of 5-foot flashboards are removed first, followed removal of sections of the lower set of 5-foot flashboards, if required by high flows. The flashboards are replaced once river flows have dropped to a level that allows safe access to the crest of the dam. Nine Mile HED does not have a bypass reach, since the powerhouse is integral to the dam. Therefore, all flow, whether from the powerhouse discharge or spill, stays in the river channel downstream of the dam.

Avista plans to begin construction to replace the two tiers of flashboards with a pneumatically controlled metal gate (Plate NM2) in October 2010. The gate, pneumatic bladders, and control system will be designed and manufactured by Obermeyer Hydro Inc. The new spillway control structure will consist of three individual metal hinged gates supported with rubber bladders that will be inflated or deflated to raise and lower the gate sections either in unison or independently. Each gate section will be approximately 75 feet long and 10 feet high in the fully raised position. During high flows, one or more gate(s) will be lowered to allow flow to overtop it/them. When fully lowered, the metal leaf will closely conform to the existing spillway crest profile and the crest of the spillway will not be significantly altered in terms of shape or height. In the fully lowered position, the hydraulics of water spilling down the face of the spillway are not expected to be altered. However, when water is spilled with the gates not in the fully lowered position, the presence of an air filled space below the gate may result in an increase in air entrainment at the air-water interface as water contacts the dam face.

Plate NM2. Example of Pneumatic Controlled Spillway Control Structure Manufactured by Obermeyer Hydro Inc.

(Source: photograph courtesy of Obermeyer Hydro Inc.)

3.2 Historical Conditions

Spokane Falls naturally increase TDG in the Spokane River upstream of the Nine Mile HED. Review of historical photographs taken before and during construction of Upper Falls and Monroe Street HEDs indicates that these facilities did not significantly alter the hydraulics of the original falls, although they resulted in powerhouse flows of as much as 2,500 and 2,850 cfs being routed around the upper and lower falls, respectively (Golder 2004). Routing high flows through powerhouses instead of over natural falls typically results in less TDG production. Nonetheless, TDG levels measured in the Nine Mile HED forebay range from 98 to 121 percent of saturation (Golder 2003, 2004). Throughout the majority of the monitoring periods, daily fluctuations in TDG levels were substantial (e.g., from 3 to 7 percent of saturation). Daily minimum TDG levels in the forebay exceeded 110 percent of saturation from late March to early May in 2003 and 2004 and from late May to early June in 2004. TDG levels obtained at a tailrace station located 0.4 mile downstream of the Nine Mile dam ranged from 96 to 123 percent of saturation, and were typically less than in the forebay (figure NM1). During the peak spill periods of 2004, Nine Mile tailrace TDG levels were typically 2 to 4 percent of saturation less than in the HED's forebay (Golder 2004).

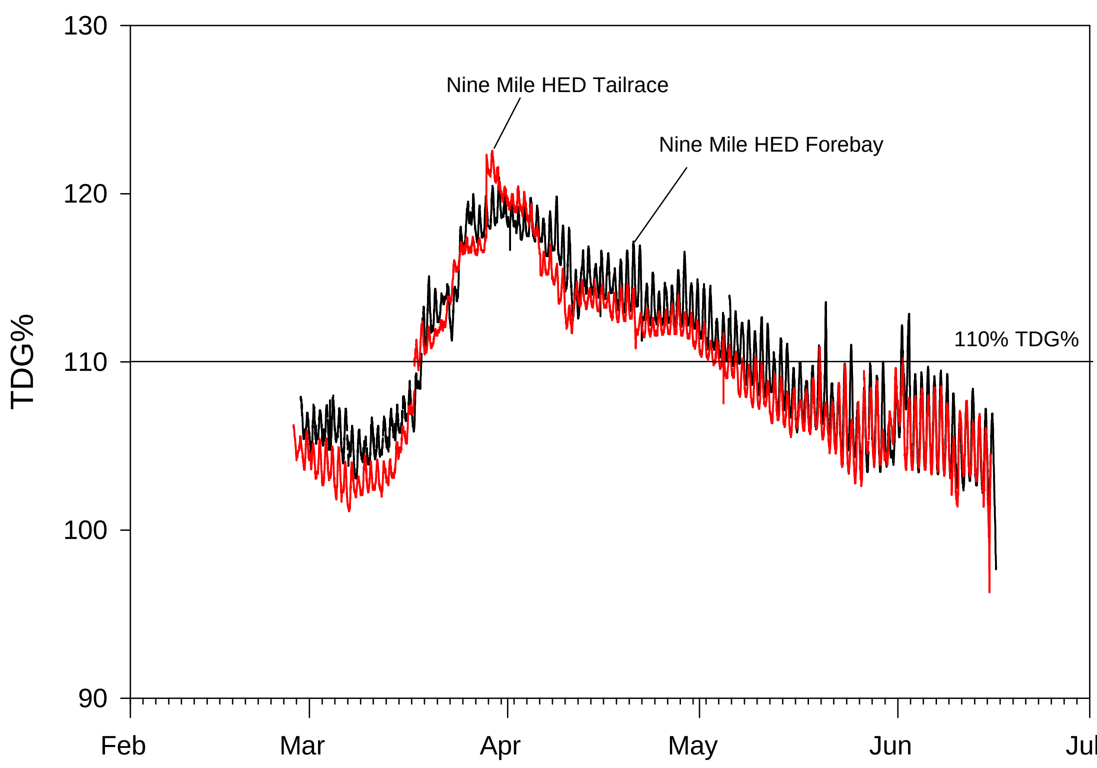

Figure NM1. Nine Mile HED Forebay and Tailrace TDG, February 24 - June 17 of 2003 (Source: Golder and Weitkamp 2008)

3.3 TDG Monitoring

3.3.1 Objectives

The draft Water Quality Assessment Report for the Spokane River Project (Golder and Weitkamp 2008) states that:

"Available data demonstrates that the Nine Mile HED does not significantly elevate TDG levels, but usually reduces TDG levels, at total river flows of up to 17,000 cfs. In the absence of TDG measurements at higher flows, it is not evident whether the Nine Mile HED sometimes contributes to TDG exceedances of the 110-percent of saturation criterion, which applies when flows are less than the seven-day, ten-year frequency flood (7Q10). Therefore, Avista should develop and implement a monitoring plan to document any contribution that the Nine Mile HED has on exceedances of the TDG standard".

Section 4.3(E)(2) of the WQC also acknowledges this trend in TDG data and the need for more studies and information to identify what is occurring at Nine Mile Dam.

Section 5.4(A) of the WQC requires that Avista provide a TDG monitoring plan for Ecology review and approval within one year of license issuance and that it submit a plan each year thereafter with the annual monitoring report. Section 5.4(C) of the WQC specifically mandates:

"*The Licensee shall monitor TDG in the forebay and near the end of the aerated zone (the area of bubble entrainment and dissipation) of Nine Mile Dam. The Licensee shall collect TDG data for two years when flows occur during the 7Q10 median flow of 25,400 cfs or higher at the Spokane gage (USGS 12422500). The flows may or may not be consecutive years. If within these two years, the data show that Nine Mile Dam is not exceeding the 110 percent TDG criterion then Ecology will consider the dam in compliance with the 110 percent water quality standards criterion for TDG of 110 percent saturation and may allow the Licensee to cease or reduce this monitoring.*

If any modifications to the dam such as construction (i.e. installation of a rubber dam), the Licensee shall collect TDG data for two years when flows occur during the 7Q10 median flow of 25,400 cfs or higher at the Spokane gage (USGS 12422500) after such installation or construction has occurred. The flows may or may not be consecutive years.

*The Licensee shall develop a compliance schedule if Nine Mile Dam is **creating** TDG greater than 110 percent."*[5]

As discussed above (see section 3.1), Avista plans to modify the Nine Mile Dam spillway before the second high-flow season following license issuance. Since the new spillway may alter the dam's TDG production, monitoring TDG in the single high-flow season that will occur before the spillway modifications

[5] Emphasis added.

are done would not provide meaningful data to identify post-modification TDG conditions. The Spokane Tribe's comments on the earlier draft of this plan support this conclusion (personal communication (e-mail) between Brian Crossley, Water & Fish Program Manager, Spokane Tribe, and Hank Nelson, Environmental Coordinator, Avista, regarding: draft TDG monitoring plan comments, January 22, 2010). Based on the construction schedule provided by Avista and barring any substantial delays, TDG monitoring will begin in the late winter of 2011, at the earliest following construction of the rubber dam. Avista will decide whether to monitor TDG in a given year based in part on snowpack and runoff forecasts. Should these forecasts indicate a high flow year during which the 7Q10 median flow of 25,400 cfs will be met or exceeded, preparation equipment will commence in the spring of that year prior to the start of freshet. The objective for this TDG monitoring associated with Nine Mile Dam is:

- Collect two years of data during high-flow seasons with at least 25,400 cfs at the Spokane gage (USGS 12422500) to evaluate whether the Nine Mile Dam with the modified spillway causes exceedances of the TDG standard

3.3.2 Monitoring Stations

The monitoring strategy will consist of TDG monitoring at two stations throughout the spill season complemented by spot measurements taken at additional locations downstream of Nine Mile Dam (table NM1). The NMFB and NMTR stations were previously used for seasonal TDG monitoring.

TABLE NM1

Nine Mile HED TDG Monitoring Stations

Station Code	Description	UTM Coordinates	Monitoring Type
NMFB	In the middle of a walkway used to access the Nine Mile HED powerhouse, immediately downstream from trash boom	UTM 11T 459184E 5291406N	Two-year
NMTR	On left downstream bank, approximately 0.2 mile downstream from the face of the Nine Mile HED powerhouse	UTM 11T 459127E 5291694N	Two-year
NM2-2011	On right downstream bank, approximately 0.6 mile downstream of the Nine Mile HED powerhouse	11T 459278E 5292358N	Potential spot
NM3-2011	On right downstream bank, at a dock on Shoemaker Lane, approximately 1.2 miles downstream of the Nine Mile HED powerhouse	11T 460128E 5292952N	Potential spot

Notes:

"Two-year" indicates that an instrument would be deployed to monitor TDG at regular intervals.

"Potential spot" indicates that the station will be further evaluated to determine if accurate TDG spot measurements likely can be made in a safe manner.

Station NMFB is located within the Nine Mile HED compound and is secure from vandalism. At this station, TDG monitoring equipment will be protected by an ABS housing that is deployed on a bottom-weighted steel cable at a minimum depth of 12 feet below full pool elevation of 1606.6 feet (i.e., 1,594.6 feet or lower) to ensure the TDG probe remains no higher than the compensation depth.

In the NMTR tailrace station is located in a publically accessible area; hence it will be deployed in secure housing. In 2008, the ABS standpipe of the station was damaged during high flows. In November 2009, Avista personnel repaired, reinforced, and extended the standpipe to allow the station to be accessed during high flow conditions yet maintain the TDG instrument below compensation depth during the spill season.

Observations made during the high-flows in June 2008 indicate that NMTR may be well within the aerated zone during flows of greater than 25,000 cfs (plate NM3). Therefore, Avista also will evaluate the potential to conduct TDG spot measurements at two monitoring stations located between Nine Mile Dam and the confluence of the Spokane and Little Spokane rivers (table NM1). During previous field efforts, conducting TDG spot measurements at a station along the right downstream bank approximately 0.3 mile downstream of the Nine Mile powerhouse (station NM1) was problematic due to flooded vegetation and a shallow bank slope gradient which made it difficult to deploy a TDG probe to the compensation depth and then retrieve it without the probe getting tangled in vegetation. Golder identified stations NM2-2011 and NM3-2011 as candidate spot measurement stations based on a review of Google Earth®. Both stations are far enough downstream to ensure complete cross-bank mixing during high flows. It appears that station NM2-2011 likely also has abundant vegetation and a shallow bank slope gradient, which would make obtaining accurate TDG measurements difficult. However, station NM3-2011 appears to be located at a boat launch with a dock. Assuming freshets in the Little Spokane River do not result in substantial backwater conditions at this location, station NM3-2011 may be most representative location at which to conduct TDG measurements.

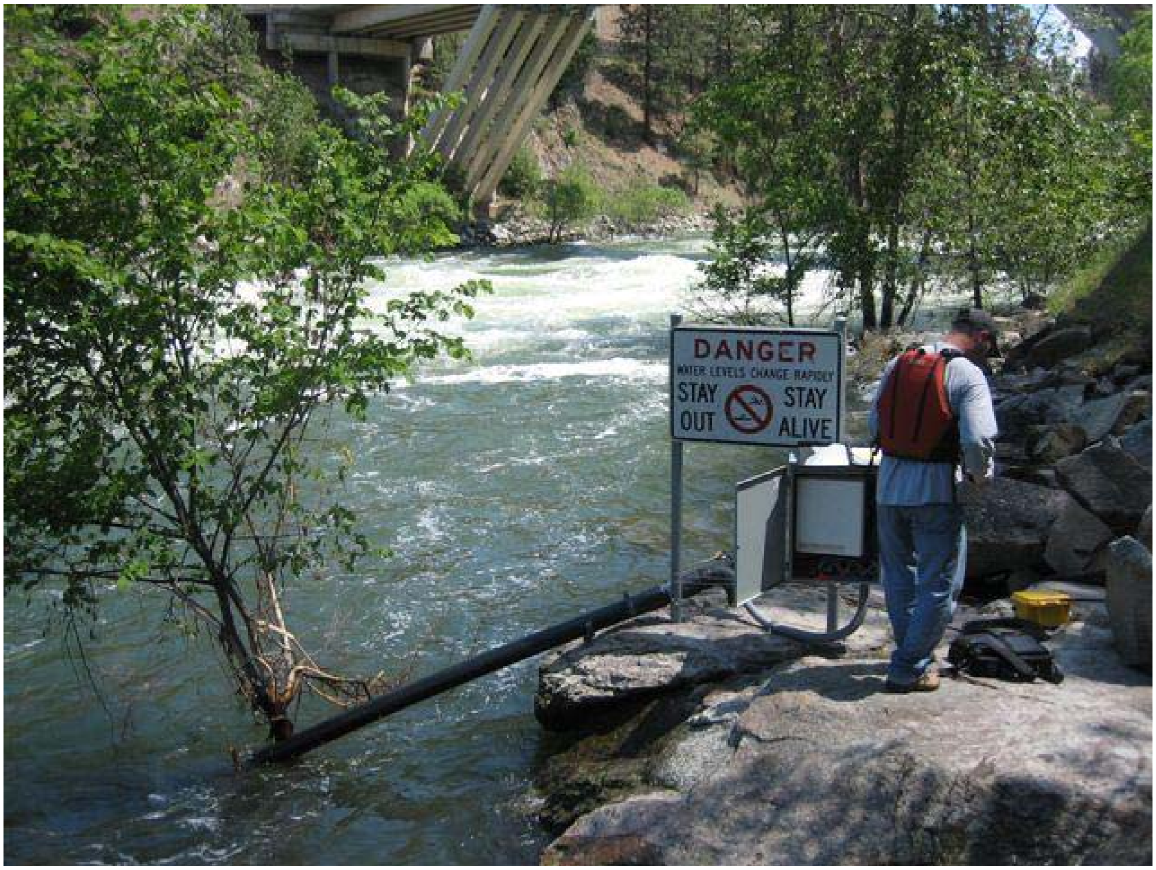

Plate NM3. Aerated Zone Extending Downstream of Nine Mile Tailrace Station, June 12, 2008 at 12:45 PDT

(Source: Mattax 2009)

3.3.3 Monitoring Equipment

Hydrolab® MS5 instruments with TDG, optical DO, temperature, and depth sensors will be purchased from Hach Company Inc. These units will be configured identical to the MS5s purchased for Long Lake HED TDG monitoring. The MS5s will rely on their internal battery pack to power the unit during deployments and spot measurements. The deployed MS5s will be serviced at approximately 2-week intervals to calibrate the TDG sensor, download recorded data, and to replenish the batteries, as needed. A MS5 linked to a Hydrolab® Surveyor 4a will be used as the portable TDG meter for the Nine Mile HED.

Local barometric pressure will be monitored at the Nine Mile HED forebay (NMFB) station with a barologger manufactured by Solinst®. Data recorded by this instrument will be corrected, as appropriate to account for differences in elevations between its elevation and the elevation of other Nine Mile HED TDG monitoring stations. The data from the barologger installed at the Long Lake HED pumphouse or powerhouse will serve as a backup source of barometric pressure data in case the barologger at the Nine Mile HED fails. The barologgers will be deployed at both monitoring stations throughout the Nine Mile HED and Long Lake HED TDG monitoring season.

3.3.4 TDG Monitoring Procedures

Water quality parameters that will be recorded consist of TDG (mm Hg), dissolved oxygen concentration (mg/L) and water temperature (°C). Water depth (meters) will also be recorded and used in conjunction with water temperature to identify if and when MS5s emerge from the water and when MS5s are above the minimum TDG compensation depth. The range, accuracy, and resolution for each measured parameter are provided in table NM2. Even though external alternating current power will be used for most of the monitoring, internal battery voltage will be recorded to monitor power consumption and determine any need for battery replacement. To produce a consistent set of measurements thatare taken at the same times, MS5s that are deployed will be programmed to sample and record values on the hour and at 15, 30, and 45 minutes after the hour. This will be accomplished by delaying sampling and logging until the beginning of the next 15-minute period and logging at 15-minute intervals.

TABLE NM2

Range, Accuracy and Resolution of Parameters That Will be Recorded Under the Nine Mile HED TDG Monitoring Plan

Parameter	Range	Accuracy	Resolution
Total Dissolved Gas	400 to 1300 mm Hg	±0.1 % of span	1.0 mm Hg
Temperature	-5 to 50°C	±0.10°C	0.01°C
Depth (0-25 m)	0 to 25 m	±0.05 m	0.01 m
Dissolved Oxygen	0 to 30 mg/L	± 0.01 mg/L for 0 to 8 mg/L ± 0.02 mg/L for >8mg/L	0.01 mg/L
Barometric Pressure	500 to 800 mm Hg	±3.5 mm Hg within 6 months of zero calibration at 25°C	0.1 mm Hg
Relative Barometric Pressure	1.5 m, typically 30-100 cm	0.1 cm	0.002% of full scale

3.3.4.1 Calibration and Maintenance

3.3.4.1.1 External Barometer Calibration

Barometric pressure will be measured with a Hydrolab Surveyor 4a, Solinst® barologger or equivalent instrumentation. These instruments will be maintained following the corresponding manufacturer's instructions. Before using one of these instruments for pre-deployment or post-recovery field verification sessions, the values recorded will be compared to a known National Institute of Standards and Technology (NIST) pressure source at either a nearby USGS gage station or airport.

3.3.4.1.2 Annual Factory Calibration and Servicing

Each year before deployment of the TDG monitoring equipment, all MS5s will be sent to Hach for factory calibration and adjustment. Annual factory calibration is a critical component that will help ensure reliable recording of quality data. Factory calibration also will provide an auditable track to verify equipment has been maintained in proper working order.

3.3.4.1.3 Pre-Deployment Field Verification

Each year, field personnel will conduct pre-deployment field testing no more than two weeks before the planned initial deployment of MS5s. This will include the following steps for each instrument to be used for TDG monitoring:

- The clock of each MS5 and Solinst® barologger will be synchronized to the correct date and time, and then a test will be done to confirm that each instrument will log and download data.
- The TDG silastic membrane will be removed from each MS5 and the recorded TDG value will be compared to ambient barometric pressure of a recently calibrated external barometer (either a Surveyor 4a or the Solinst® barologger).
- The patency of each TDG silastic membrane will be confirmed by pressurizing the membrane using carbonated soda water and confirming that a substantial pressure change is registered.
- A mass verification of the MS5s will be conducted, likely at the LLTR monitoring station under elevated TDG levels. Each unit will be delay started to the same time and set to log data at one-minute intervals. All units will then be tied together and deployed so that the TDG sensor of each unit is at a depth of about 10 feet below the water's surface. After a total deployment period of approximately one hour, the units will be downloaded and concurrent TDG, water temperature, depth, at the 20 and 50 minute mark will be compared for all units and any differences noted.
- A mass verification of the barologgers will be conducted to ensure that they record similar values.

3.3.4.1.4 Deployment Maintenance and Servicing

During each service period, each MS5 will be retrieved and the pull time recorded. Each service session will include verification of logging status and downloading of the data to a portable field computer. The Solinst® barologgers also will be downloaded. For each data file downloaded, the data file name and location will be recorded and the logged data start and end date and times will be recorded. If the MS5 has lost power, an attempt will be made to determine the cause of the power loss and the backup batteries will be checked and replaced, if appropriate. If the MS5 was operational upon retrieval, the internal and external voltage reading as reported by the unit will be recorded.

Patency of the original TDG membrane will be confirmed by pressurizing the sensor with soda water and all damaged, unresponsive TDG membranes will be marked. Each MS5's TDG membrane will be removed, cleaned and allowed to dry. With the TDG sensor exposed to air, the barometric pressure will be recorded and compared to a barometric pressure reading from either a Surveyor 4a or a Solinst® barologger. A one-point calibration will be conducted if the TDG pressure reading in air differs from the secondary source by more than 2 mm Hg. Once calibrated, a new membrane will be installed and patency confirmed by again pressurizing the sensor with soda water. Air temperature, depth and internal battery voltage will also be recorded. Depth, temperature and DO sensors will then be calibrated according to the manufacturer's instruction and the difference between the pre- and post- calibrated value recorded.

Once all MS5s are calibrated, the field crew will initiate and verify data logging. Initiating data logging will include synchronizing the logger clock, ensuring the correct parameters are selected for logging, confirming that the logging interval is set to 15 minutes, and setting the delay log start time to the nearest quarter hour interval (ie.15, 30, 45 or 60 minute mark each hour). The logging end date will be set to one year after start up. This step is crucial to avoid premature shutdown of the unit. To confirm log initiation, the field crew will select the audible tone feature so that each unit emits a series of beeps prior to logging and a single beep while in standby mode. Upon confirmation of logging, the MS5 will be reinstalled in the standpipe, and the deployment time recorded. At stations where a Solinst® barologger is to be deployed, the barologger's clock will be synchronized with the laptop, the local altitude entered, linear logging at 15-minute intervals, setting the logging start time to the nearest quarter hour interval (ie.15, 30, 45 or 60 minute mark each hour), and the barologger deployed. Before leaving the area, all doors and locks will be checked and noted in the written log to verify the station is secure.

3.3.4.1.5 Post-Recovery Field Verification

At the end of each annual TDG monitoring study, all MS5s and Solinst® barologgers used during the monitoring season will undergo post-verification following procedures nearly identical to pre-deployment field calibration, with the exception that mass *in situ* verification will not be conducted. All differences in TDG pressure, dissolved oxygen, temperature, depth, and barometric pressure will be recorded. These differences, if substantial, will be used to qualify and correct the data for periods when the unit was out of calibration.

3.3.4.2 Data Quality Control and Quality Assurance

Golder will document records of factory calibration in its project files. This will include records of when the equipment is sent to and received from the manufacturer along with a record of servicing done by the manufacturer. All calibration done by Golder, as outlined above, will be recorded on datasheets. The hardcopies for all field forms will be scanned and saved as PDF files on a Golder file server. As a redundant protective measure field notes and calibration forms will also be photocopied and the original stored in a fire-proof area.

In the absence of an automated download system, data download would be conducted at approximately 2-week intervals in conjunction with TDG instrument maintenance and calibration. Both the MS5 and Solinst® barologger data downloaded will be documented in the field on each datasheet. Excel® spreadsheets will be used to inspect all downloaded data and verify the start and end dates. A backup copy of the electronic file will be saved to a USB drive as well as on the computer. Once a station's data download has been successful and verified, the MS5 will be initialized under delay start mode with the integrated audible tone feature to verify the unit is logging data.

Golder will use Excel® spreadsheets to identify and remove outliers from downloaded data and operations data, provided by Avista. A second reviewer will verify the "cleaned" data and then all TDG data along with qualifiers will be imported into an Access® database. The cleaned data will be plotted using either Excel or Access during the initial review process, and, if required, to produce figures for interim memorandums. A more sophisticated charting package, such as Sigmaplot®, will be required for final report figures of TDG and discharge data, especially during spillway and other TDG mitigation testing.

Data quality objectives (DQOs) are the quantitative and qualitative terms used to specify how good the data need to be to meet the project's specific monitoring objectives. DQOs for measurement data, also referred to as data quality indicators, include precision, accuracy, measurement range, representativeness, completeness, and comparability. Measurement Quality Objectives (MQOs) specify how good the data must be in order to meet the objectives of the project. MQOs are the performance or acceptance thresholds or goals for the project's data, based primarily on the data quality indicators precision, bias and sensitivity. The measurement quality objectives (MQOs) that will be used for this monitoring plan are displayed in table NM3. Golder will calculate and report the station-specific root mean squared error (RMSE) of the calibration corrections applied after each calibration, and an overall RMSE for each station based on the average time for calibration corrections.

TABLE NM3

Measurement Quality Objectives (MQOs) for Nine Mile HED TDG Monitoring Plan

Parameter	MQOs
Barometric Pressure	2 mm Hg
Temperature	0.5ºC
Total Pressure	1% (5 to 8 mm Hg)
TDG%	1%
Dissolved Oxygen	0.5 mg/L

TDG meters, like other field monitoring equipment, are subject to bias due to systematic errors introduced by calibration, equipment hardware or software functioning, or field methods. Bias will be minimized by following standard protocols for calibration and maintenance, and by following field protocols for stabilization of meter readings. Bias is difficult to assess for TDG field measurements, because a more accurate verification method, such as laboratory standard, is not available. No DQOs are being set for bias.

Precision refers to the degree of variability in replicate measurements; however, the precision of the results from continuous monitoring instruments cannot be estimated from replicate measurements. Therefore, the potential variability of TDG results may be indicated by agreement among the simultaneous results from two or more instruments, either during calibration or in the field. Instrument precision will be evaluated through the calibration and maintenance activities described in Section 3.3.4.1. Most TDG measurements are expected to be within the range of 100 to 140 percent of saturation. State criteria are currently set at 110percent of saturation. MQOs are equal to DQOs and equal to 1percent of saturation. MQOs will be met if TDG meter readings are within 1 percent saturation or 5 mm Hg of spot measurements taken using portable Hydrolabs. If MQOs are not met, the differences will be evaluated but the data will not be qualified or discarded unless other information indicates a problem with the data.

TDG percent of saturation values are dependent upon barometric pressure readings so MQOs are also necessary for the barometric pressure measurements taken using portable Hydrolabs and Solinst® barologgers. The target for this project will be an MQO of 2 mm Hg for the field barometer readings. The barometric pressure MQO will be evaluated by paired readings with a field barometer, Hydrolab pressure sensor with the TDG membrane removed, or a known National Institute of Standards and Technology (NIST) pressure source at either a nearby USGS gage station or airport.

Water temperature data also will be collected because it can influence TDG. Since this is a parameter of secondary importance to the study, DQOs have not been established, but an MQO has been set at 0.5°C. Data will be reported if post-calibration shows that the temperature is within the MQO. Data that do not fall within the MQO will not be reported.

The quality of existing data will be evaluated where available. Sources within well-established programs will be acceptable based on the credibility of the source (such as the National Weather Service or U.S. Geological Survey data). The variability of data will be reviewed to evaluate for whether it is appropriate based on expected values and comparison between data sets. Data with too much or too little variability will not be used.

Accuracy is a measure of confidence that describes how close a measurement is to its "true" value, or the combination of high precision and low bias. Refer to table NM2 for the accuracy of each measured parameter. At the end of each seasonal TDG monitoring study, all MS5s and Solinst® barologgers used for the monitoring season will undergo post-verification procedures as described in Section 3.3.4.1.5. All differences between TDG pressure, dissolved oxygen, temperature, depth, and barometric pressure will be recorded and these differences, if substantial, used to qualify and correct the data for periods when the unit was out of calibration.

Measurement Range is the range of reliable readings of an instrument or measuring device, as specified by the manufacturer. Refer to table NM2 for the range for each measured parameter. Annual maintenance of field sampling equipment will be conducted in a manner consistent with the manufacturer’s recommendations and records of all maintenance activities will be recorded and included with the field notes.

Representativeness qualitatively reflects the extent to which sample data represent a characteristic of actual environmental conditions. For this project, representativeness will be addressed through proper design of the sampling program which will ensure that the monitoring locations are properly located and sufficient data are collected to characterize TDG at that location. This includes comparing spot measurements at both the long-term monitoring stations and at other stations to confirm complete mixing.

Completeness is the comparison between the amount of data that has been planned to be collected versus how much usable data is actually collected, expressed as a percentage. Data may be determined to be unusable in the validation process if the data set does not meet the completeness designated for the project. A project completeness of greater than 90 percent is expected under normal operating conditions. If project completeness falls below 90 percent, then corrective measures including resampling or reanalysis will be employed. Completeness will be evaluated and documented throughout all monitoring activities and corrective actions taken as warranted on a case-by-case basis.

Comparability is the degree to which data can be compared directly to previously collected data. Comparability will be achieved for this project through External Barometer Calibration activities (refer to Section 3.3.4.1.1).

3.3.5 Study Coordination and Schedule

Each year, the Avista License Implementation Team and Golder TDG Project Manager will have one or more teleconferences or meetings to determine if the expected flows will meet the monitoring objective and whether TDG monitoring will occur. The Avista License Implementation Team will provide written notification of this decision to Ecology and the Golder TDG Project Manager by February 16, although subsequent weather and flow conditions may cause Avista to change this decision. Should this occur, Avista will provide written notification of any changes in its plan for Nine Mile HED TDG monitoring in the upcoming high-flow season and the rationale for this change, as soon as practical.

For years when the decision is made to proceed with Nine Mile HED TDG monitoring, at least one meeting will be conducted between the Avista License Implementation Team, the Nine Mile HED Plant Manager, and Golder to review the study plan, station installation requirements and logistics, site access, and communication protocols. At this meeting, any special requirement(s) associated with station installation and/or servicing will be identified and addressed. Specific work instructions based on the study plan and decisions made during management meetings will be jointly developed by the Avista License Implementation Team and Golder Project Manager and communicated to the Golder TDG monitoring team field staff. The field staff will in turn coordinate with the Nine Mile HED Plant Manager during station installation and during servicing of the stations. Should a problem or issue arise during field installation, the field staff will communicate the appropriate details to the Golder TDG Project Manager and Nine Mile HED Plant Manager, if warranted, as soon as practical. If the issue pertains specifically to Avista operations, equipment, and personnel and/or it cannot be easily addressed by the Golder TDG Project Manager, the Golder TDG Project Manager will inform the Avista License Implementation Team of the issue and either propose a solution or work with Avista personnel to identify a solution. The Avista License Implementation Team will directly communicate study results and progress to Ecology and the

FERC. An overview of the study hierarchy and channels of communication is provided in figure NM2, and the person(s) fulfilling each role is provided in table NM4.

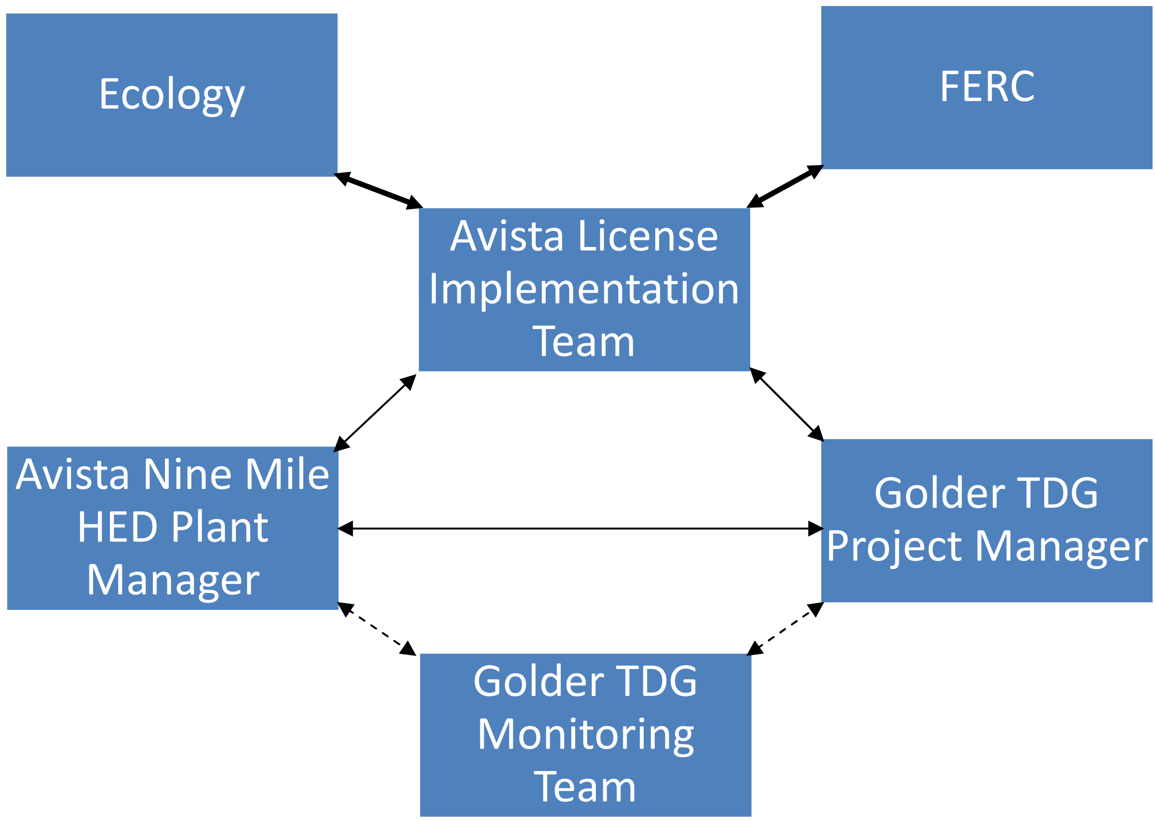

Figure NM2. Project Organization and Communication Channels for Nine Mile HED TDG Monitoring Plan

Thick solid arrows indicate agency and public communication, thin solid arrows indicate management level communication, and dashed arrows indicate field level communication.

TABLE NM4

Nine Mile HED TDG Monitoring Plan Project Contacts

Position	Name
Ecology	Marcie Mangold
FERC	George Taylor
Avista License Implementation Team	Speed Fitzhugh, Hank Nelson
Avista Nine Mile HED Plant Manager	Jeff Turner
Golder TDG Project Manager	Brian Mattax
Golder TDG Monitoring Team	Paul Grutter, Max Birdsell

With installation of the pneumatic spillway gates scheduled for October 2010, the earliest that TDG monitoring would start is early 2011. Avista plans to obtain the TDG monitoring equipment by March 1, 2011. The equipment will be maintained following the manufacturer's recommendations. Each year that the Avista License Implementation Team determines it is appropriate to send the equipment in for factory calibration, it will do so in a timely manner so that the serviced equipment will be available for use by March 1st. As indicated above, whether monitoring proceeds in a given year will depend on flow estimates that are based on snow pack.

This TDG monitoring plan should be implemented until two years of Nine Mile HED TDG monitoring has occurred concurrent with flow at the Spokane River gage at Spokane (USGS 12422500) reaching a daily average flow of at least 25,400 cfs. Following the season that meets this requirement, the data collected will be analyzed to determine if there is evidence that use of the Nine Mile Dam spillway significantly increases TDG to a level which exceeds the TDG water quality standard. If this is not the case, Ecology shall determine that TDG monitoring for the Nine Mile HED has been fulfilled. If use of the spillway is determined to significantly increase TDG to a level that exceeds the TDG water quality standard, Avista will initiate a feasibility study to evaluate potential TDG abatement measures, and develop a compliance schedule for the Nine Mile Dam, as required by section 5.4(C) of the WQC.

3.3.6 Adaptive Revisions to Monitoring Plan

Currently, it appears that there will be no need for adaptive revisions to this plan as long as use of the Nine Mile Dam spillway is not found to significantly increase TDG to a level that exceeds the TDG water quality standard. However, it is possible that revisions will be appropriate to address replacement of TDG monitoring equipment, arranging or conducting station repairs, relocating and installing replacement temporary monitoring station(s).

If use of the Nine Mile Dam spillway is found to significantly increase TDG to a level that exceeds the TDG water quality standard, this plan likely will need to be revised to collect appropriate data to facilitate feasibility studies for potential TDG abatement measures, and evaluations of the effectiveness of TDG abatement measures that are implemented.

The Golder TDG Project Manager will identify the need(s) for revising this plan and suggest appropriate revisions to the Avista License Implementation Team. The Avista License Implementation Team will inform Ecology and FERC of proposed revisions to this plan, and following approval by Ecology and FERC will implement the approved revisions.

3.3.7 Reporting

Following the end of each annual Nine Mile HED TDG monitoring season, Golder will prepare an annual TDG report for the Nine Mile HED. Annual TDG reports will include time series charts of TDG with the 110-percent of saturation criterion along with spill and generation flows, charts of TDG in the Nine Mile HED tailrace compared with TDG in the Nine Mile HED forebay, and a description of the frequency and periods of TDG standard exceedances. Avista will submit the annual report to Ecology and the FERC.

4.0 LITERATURE CITED

Avista. 2005. Spokane River Hydroelectric Project, FERC Project No. 2545, Application for New License, Major Project – Existing Dam, Volume II: Applicant-Prepared Preliminary Draft Environmental Assessment. Avista Corporation, Spokane, Washington. July 2005.

Backman, T.W.H., A.F. Evans, M.S. Robertson and M.A. Hawbecker. 2002. Gas bubble trauma incidence in juvenile salmonids in the lower Columbia and Snake rivers. Columbia River Inter-Tribal Fish Commission, Portland, Oregon and Real-Time Research, Portland, Oregon. North American Journal of Fisheries Management 22: 965-972.

Backman, T.W.H., and A.F. Evans. 2002. Gas bubble trauma incidence in adult salmonids in the Columbia River Basin. Columbia River Inter-Tribal Fish Commission, Portland, Oregon. North American Journal of Fisheries Management 22: 579-584.

Ecology (Washington Department of Ecology). 2005. Assessment of Total Dissolved Gas in the Spokane River at Upriver and Little Falls Dams. Authored by P.J. Pickett. Prepared by the Washington State Department of Ecology. July 2005. Ecology Publication No. 05-03-010. 58 pp.

Ecology. 2009. 401 Certification-Order Spokane River Hydroelectric Project, Certification-Order No. 5492, FERC License No. 2545, As amended May 8, 2009 by Order 6702. Prepared by Eastern Regional Office Water Quality Program staff, Spokane, WA. May 8, 2009.

EES (EES Consulting, Inc.). 2006. Long Lake Hydroelectric Development total dissolved gas abatement initial feasibility study report. Submitted to Avista Utilities. September 2006. 102 pp.

FERC. 2009a. Project Nos. 2545-091, 12606-000, Order issuing new license and approving annual charges for use of reservation lands. Issued June 18, 2009. 167 pp.

FERC. 2009b. Avista Corporation Project No. 2545-113 Order modifying and approving Water Quality Monitoring and Quality Assurance Project Plan pursuant to Article 401(A)(12). Issued September 17, 2009. 5 pp.

Golder (Golder Associates Inc.) and D. Weitkamp. 2008. Draft Water Quality Assessment Report Spokane River Hydroelectric Project (FERC NO. 2545). Prepared for Avista Utilities, Spokane, Washington. Prepared by Golder Associates Inc., Redmond, Washington with assistance of Don Weitkamp, Parametrix, Bellevue, Washington. May 14, 2008.

Golder (Golder Associates Ltd.). 2003. Total dissolved gas pressure (TDG) monitoring on the Spokane River 2003 data report. Prepared for Avista Corporation, Spokane, WA. Prepared by Golder Associates Ltd., Castlegar, B.C. October 2003. Golder Report No. 033-1363CD: 40 p. + 1 CD Appendix.

Golder. 2004. Total dissolved gas pressure (TDG) monitoring on the Spokane River 2004 final data report. Data on CD. Prepared for Avista Corporation, Spokane, WA. Prepared by Golder Associates Ltd., Castlegar, B.C. September 2004. Golder Report No. 033-1363C2004F: 55 p. + 1 Appendix + plates.

Golder. 2006. Total dissolved gas monitoring of generation discharge and forebay water at Long Lake HED. Submitted to Avista Corporation, Spokane, WA. Prepared by Golder Associates Ltd., Castlegar, B.C. August 4, 2006. Golder Report No. 06-1480-005F: 15 p. + 1 CD Appendix + plates.

Golder. 2009. Draft Technical Memorandum Re: Technical Basis for Long Lake and Nine Mile HED TDG Monitoring Stations. To: Hank Nelson (Avista Corporation). From: Paul Grutter, Brian Mattax, and Dana Schmidt (Golder). August 7, 2009.

Kimbrough, R.A., G.P. Ruppert, W.D. Wiggins, R.R. Smith, and D.L. Kresch. 2006. Water Resources Data, Washington, Water Year 2005, WA-05-1: U.S. Geological Survey Annual Data Report 2005, 825 p.

Mattax, Brian, Sr. Aquatic Scientist, Golder Associates, Inc., Redmond, WA draft technical memorandum RE: 2008 Total Dissolved Gas Study to Hank Nelson, Water Resources Lead, Avista Corporation, Spokane, WA, dated April 6, 2009.

Ryan, B.A., E.M. Dawley, and R.A. Nelson. 2000. Modeling the effects of supersaturated dissolved gas on resident aquatic biota in the main-stem Snake and Columbia rivers. National Marine Fisheries Service, Seattle, Washington. North American Journal of Fish Management 20:192–204.

Solinist. 2008. Levelogger Series (Levelogger Gold, Barologger Gold, Levelogger Junior, and Rainlogger) User Guide – Software Version 3.2.3. June 5, 2008. 62 pp.

Solinist. 2009. Levelogger Series, Model 3001 Data Sheet, September 2, 2009, Accessed at http://www.solinst.com/Prod/Data/3001Gold.pdf

Spokane Tribe of Indians (Spokane Tribe). 2003. Spokane Tribe of Indians Surface Water Quality Standards. March 7, 2003. Resolution 2003-259.

Weitkamp, D.E. 2000. Total dissolved gas supersaturation in the natural river environment. Prepared for Chelan County PUD No. 1, Wenatchee, WA. Prepared by Parametrix, Inc., Kirkland, WA. March 2000. 19 pp.

Weitkamp, D.E. and M. Katz. 1980. A review of dissolved gas supersaturation literature. Transactions of American Fisheries Society 109:659–702.

APPENDIX A

CONSULTATION RECORD

Consultation associated with development and approval of the Washington Total Dissolved Gas Plan included:

- August 7, 2009 – Avista submitted to Ecology for review and approval its draft Water Quality Monitoring and Quality Assurance Project Plan and draft Technical Memorandum for Long Lake and Nine Mile HED Monitoring Stations, and provided these documents to the Spokane Tribe
- August 13, 2009 – Ecology provided comments and approved the draft Water Quality Monitoring and Quality Assurance Project Plan and draft Technical Memorandum for Long Lake and Nine Mile HED Monitoring Stations
- August 13, 2009 – Avista filed with FERC its Water Quality Monitoring and Quality Assurance Project Plan pursuant to Article 401(A)(12)
- September 17, 2009 – FERC issued order modifying and approving Water Quality Monitoring and Quality Assurance Project Plan pursuant to Article 401(A)(12)
- January 5, 2010 – Avista (Hank Nelson) submitted Draft Washington TDG Monitoring Plan to Spokane Tribe (Brian Crossley)
- January 22, 2010 – Spokane Tribe (Brian Crossley) provided comments on Draft Washington TDG Monitoring Plan to Avista (Hank Nelson)
- February 11, 2010 - Avista (Hank Nelson) letter regarding responses to Tribe's comments on Draft Washington TDG Monitoring Plan to Spokane Tribe (Brian Crossley)
- February 12, 2010 – Avista (Speed Fitzhugh) submitted Revised Washington TDG Monitoring Plan to Ecology (Marcie Mangold) for review
- February 18, 2010 – Spokane Tribe (Brian Crossley) email Re: revised WA TDG monitoring plan … to Avista (Hank Nelson)
- March 17, 2010 – Ecology (Marcie Mangold) email approving plan and offering comments to Avista (Speed Fitzhugh)

APPENDIX B

COMMENTS AND RESPONSES

1/5/10

Brian Crossley
Spokane Tribe of Indians
P.O. Box 480
Wellpinit, WA 99040

Brian,

Attached is a draft of the Washington Total Dissolved Gas (TDG) Monitoring Plan as required by Section 5.4 of the 401 Water Quality Certification issued by the Washington Department of Ecology and Article 401 of the FERC license for the Spokane River Projects. Please send me your comments within 30 days.

Section 2.3.5 of this plan references feasibility studies which will occur for Long Lake HED. Avista has issued an RFP to conduct a Phase II TDG Abatement Study. The resulting proposals are still being evaluated.

Feel free to call me with any questions as you review this draft. I'd also be happy to meet with you if you prefer. I can be reached at 509-495-4613. I look forward to your comments by 2/3/10.

Sincerely,

Hank Nelson
Environmental Coordinator

Nelson, Hank

From: Brian Crossley [crossley@spokanetribe.com]
Sent: Friday, January 22, 2010 9:51 AM
To: Nelson, Hank
Cc: 'Brian Crossley'; 'Chris Butler'; bjk@spokanetribe.com; 'theodore knight'
Subject: RE: draft TDG monitoring plan comments

Hank, Chris Butler and I have had a chance to review the Draft TDG Monitoring Plan;

The comments are listed in chronological order as we reviewed the plan.

1 P3, Water Quality Standards; our standard is the same as the State's therefore I had to think about this. The Tribes Standard doesn't have the 7Q10 flow exclusion; when two standards are placed up against each other the more stringent applies. Maybe just a mention of the downstream standard as it applies to flow over 32 kcfs.

2 P11, Table LL2 Barometric pressure should be listed and recorded in this table and subsequent QA procedures; especially if you are using a separate piece of equipment (Solinst); and the Hydrolab Surveyor is +/- 10 mmHg.

3 P13, 2.3.4.2 2nd paragraph "conducted" spelling

4 P18, Study Coordination and Schedule, Clarification? Monitoring will occur during the evaluation and feasibility phase; which is projected out 2-4 years starting in 2010; is there a schedule for anything post?

5 P22, 3.2 Historical Conditions "Because of the high TDG levels produced by the Spokane Falls and (add Monroe St HED) , TDG levels measured in the Nine Mile HED forebay ....
There have been many changes to the Spokane Falls therefore the HED should be identified as well as any other things that have changed the flow dynamics upstream.

6 P22, 3.3 TDG Monitoring (at Nine Mile) we support the proposed idea that based on the expected construction of the pneumatic gates beginning in 2010 monitoring at the HED would not generate usable data in determining effects of the HED on total dissolved gas. We would hope that construction would be expeditious and not delay potential high flow TDG monitoring for more than two seasons.

If you have any questions about these comments please feel free to call or email me.

Brian Crossley
Water & Fish Program Manager
Spokane Tribe
crossley@spokanetribe.com
509-626-4409

Nelson, Hank

From: Brian Crossley [crossley@spokanetribe.com]
Sent: Thursday, February 18, 2010 1:56 PM
To: Nelson, Hank
Subject: RE: revised WA TDG monitoring plan...

Hank, everything looks good except one thing. I would like to look at the historical photos of the Spokane Falls and
have a discussion about the changes that have been made in support of your (Golder) determination that the Monroe St.
HED doesn't significantly alter the hydrodynamics of the river. This is an honest request; I've only seen a couple of
historical photos and would like more insight on this topic because I'm still not comfortable with the conclusion until I see
7 additional evidence.

I think this "determination" was made during the ALP studies and I don't remember if the supporting photos were included in that report. There may have been changes pre-HED that altered the flow; I would just like to understand the whole thing. I'm willing to come in and take a look at photos or reports to help me understand this better.

Thanks, Let me know

Brian

From: Nelson, Hank [mailto:hank.nelson@avistacorp.com]
Sent: Thursday, February 11, 2010 2:03 PM
To: crossley@spokanetribe.com
Subject: revised WA TDG monitoring plan...

Hi Brian,

Attached is a cover letter and the revised TDG monitoring plan. I'll also mail you a hard copy. Speed is sending the plan to Ecology for review.

Hank <<comment.docx>> <<021110bm1_WA TDG Monitoring Plan.pdf>>

February 11, 2010

Ms. Marcie Mangold
Washington Department of Ecology
Eastern Region Office
4601 N. Monroe St.
Spokane, WA 99205

Re: Federal Energy Regulatory Commission's Spokane River Hydroelectric Project (FERC Project No. 2545-091) License, Appendix B, Section 5.4.A, Washington Department of Ecology's Total Dissolved Gas Requirements

Dear Ms. Mangold:

On June 18, 2009, the Federal Energy Regulatory Commission (FERC) issued a new license for the Spokane River Hydroelectric Project (FERC Project No. 2545). Ordering Paragraph E of the FERC license incorporated the *Washington Department of Ecology (Ecology) Certification Conditions Under Section 401 of the Federal Clean water Act (Issued on May 8, 2009 and amended on May 11, 2009)*. The Conditions can be found in Appendix B of the license.

In accordance with the License, Avista is required to provide a Total Dissolved Gas Monitoring Plan (Plan) for the Long Lake and Nine Mile Hydroelectric Developments for Ecology's review and approval within one year of license issuance. The Spokane Tribe of Indians has reviewed the Plan and provided comments, which are included in Appendix B, followed by our responses.

With this, and in order for us to meet our consultation requirements, we request your review of the enclosed Plan by March 15, 2010. After we receive your comments we are required to submit the Plan to FERC for their review and approval by June 18, 2010. If you have any questions or wish to discuss anything, I can be reached at (509) 495-4998. In my absence please feel free to contact Hank Nelson at (509) 495-4613.

Sincerely,

Speed Fitzhugh

Elvin "Speed" Fitzhugh
Spokane River License Manager

Enclosure

cc: Brian Crossley, Spokane Tribe of Indians
Hank Nelson, Avista

Fitzhugh, Speed (Elvin)

From: Mangold, Marcie (ECY) [DMAN461@ECY.WA.GOV]
Sent: Wednesday, March 17, 2010 3:04 PM
To: Fitzhugh, Speed (Elvin)
Cc: Baldwin, Karin K. (ECY); Bellatty, James (ECY); Nelson, Hank
Subject: TDG monitoring report

Speed,

8 The Department of Ecology approves the TDG monitoring report for Nine Mile and Long Lake Dams as stated in sections 5.4.C.6 and 5.4.D.7 respectively of the 401 Certification.

We have the following comments to offer;

9 1. The Corps had been working with the MiniSonde probes that you are planning on switching to and experienced some problems with data drift. I believe Pend Oreille PUD has had similar problems. The Corps was working the QA problems out with Hach Environmental. TJ Sisson, the Hach rep. that is likely working with you can probably assist or share knowledge on these issues.

10 2. In sections 2.3.7 and 3.3.7 could use the inclusion of the comparison to the standards and frequency of exceedances. In the Historical Conditions sections, you describe critical periods and times of exceedance of the criteria. A similar summary of the annual data graphically and/or narratively is important to include. This will likely be part of the annual reports but would be nice to be spelled out in the reporting sections.

Thank you,

D. Marcie Mangold
Department of Ecology
Water Quality Program
phone (509) 329 3450
fax (509) 329 3570

Table B-1

Responses to Comments

Comment #	Response
Comments on Draft Plan	
1	A discussion of the Spokane Tribe's TDG standards was incorporated into section 1.2 Water Quality Standards.
2	Table LL2 was revised to include the specifications for barometric pressure measurements with a Hydrolab Surveyor 4a® and Solinst® barologger. In addition, QA procedures for the Hydrolab Surveyor 4a® and Solinst® barologgers were incorporated into section 2.3.4 TDG Monitoring Procedures and section 3.3.4 TDG Monitoring Procedures.
3	Revised, as requested.
4	The schedule was clarified in section 2.3.5 Study Coordination and Schedule.
5	The discussion of upstream effects on TDG in the Nine Mile HED forebay, which is in section 3.2 Historical Conditions, was expanded.
6	We appreciate your support on this issue, and have indicated this support in section 3.3.1 Objectives.
Comments on Revised Plan	
7	Avista will work with Brian Crossley of the Spokane Tribe to arrange a mutually agreeable time to view historic photographs of the Spokane Falls.
8	We appreciate your approval of the plan.
9	We will consult T.J. Sisson of Hach Environmental to gain an understanding of relevant MiniSonde potential data drift and corresponding solutions.
10	We have revised sections 2.3.7 and 3.3.7 to include additional detail on reporting related to TDG standard exceedances.