AVISTA CORPORATION

2013
LONG LAKE
TOTAL DISSOLVED GAS
MONITORING REPORT

WASHINGTON 401 CERTIFICATION, SECTION 5.4(D)

Spokane River Hydroelectric Project
FERC Project No. 2545

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Table of Contents

List of Tables

List of Figures

List of Appendices

List of Acronyms and Abbreviations

% saturation	percent of saturation
°C	degrees Celsius
7Q10	7-day average flow with a 10-year return period
ft amsl	feet above mean sea level
Avista	Avista Corporation
BAR	barometric pressure
cfs	cubic feet per second
DO	dissolved oxygen
DQO	data quality objective(s)
Ecology	Washington State Department of Ecology
FERC	Federal Energy Regulatory Commission
Golder	Golder Associates Inc.
HED	hydroelectric development
LLFB	monitoring station at Long Lake forebay
LLGEN	monitoring station at Long Lake HED Unit 4 generation plume
LLGEN_Spot	monitoring station between Long Lake powerhouse and LLTR
LLTR	monitoring station at Long Lake tailrace
LLTRSP1	monitoring station across the river from LLTR
m	meter(s)
mg/L	milligrams per liter
mm Hg	millimeters mercury (pressure)
MQO	measurement quality objective
MS5	Hydrolab® MS5 Multiprobe®
NHC	northwest hydraulic consultants
PDT	Pacific Daylight Time
RMSE	root mean squared error
Spokane Tribe	Spokane Tribe of Indians
TDG	total dissolved gas, as pressure
TDG%	total dissolved gas, as percent of saturation
WQAP	Water Quality Attainment Plan

1.0 INTRODUCTION

On June 18, 2009, the Federal Energy Regulatory Commission (FERC) issued Avista Corporation (Avista) a License for the Spokane River Project which includes Long Lake Dam (FERC 2009). Article 401(a) of the License required Avista to develop a Total Dissolved Gas (TDG) monitoring plan and a TDG Water Quality Attainment Plan (WQAP) for Long Lake Dam.

Avista consulted with Washington State Department of Ecology (Ecology) and the Spokane Tribe of Indians (Spokane Tribe) as it developed the TDG monitoring plan, which addresses TDG associated with spills from the Long Lake and Nine Mile hydroelectric development (HEDs) (Golder 2010a). Ecology approved this plan on March 17, 2010, and Avista filed the Ecology-approved plan with FERC on March 26, 2010. Avista filed the WQAP, with FERC on July 16, 2010, and FERC approved it on December 14, 2010.

Avista implemented the WQAP in 2010 and continued through 2013 for seasonal TDG monitoring at Long Lake Dam. Annual reports document the TDG monitoring for 2010 (Golder 2011), 2011 (Golder 2012), and 2012 (Golder 2013). This report discusses TDG monitoring conducted for Long Lake Dam during the 2013 high-flow season. A summary of the 2013 data quality is provided in Appendix A and a record of consultation with Ecology and the Spokane Tribe is provided in Appendix B.

Based on the approved Long Lake HED TDG compliance schedule (Figure 1-1)[1], 2013 will be the last season of monitoring TDG before structural changes are completed at the dam.

[1] Ecology and FERC approved the Revised Long Lake HED TDG Compliance Schedule on March 19, 2013 and August 13, 2013, respectively.

2.0 LONG LAKE HED

2.1 Objectives

The overall objectives of the Long Lake HED TDG Monitoring Plan, developed as part of the Washington TDG Monitoring 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

2.2 Monitoring Period

The 2013 monitoring period was from March 25 through June 30. Use of the Long Lake Dam spillways began on March 22, three days prior to the initiation of the 2013 TDG monitoring season and occurred as late as June 22.

2.3 Methods

Water quality parameters that were recorded include TDG (millimeters mercury [mm Hg]), dissolved oxygen (DO) concentration (milligrams per Liter [mg/L]), and water temperature (°C). Water depth (meters [m]) was also recorded and used in conjunction with water temperature to evaluate the timing for any water quality monitoring instruments being out of water and above the minimum TDG compensation depth. In addition, barometric pressure (BAR; mm Hg) was recorded.

2.3.1 Equipment and Calibration

Hydrolab® MS5 Multiprobe® (MS5) instruments with TDG, optical DO, temperature, and depth sensors were used. Each MS5 that was deployed for extended periods[2] was connected to an external alternating current power source throughout the entire monitoring period with the goal of reducing potential issues associated with low or no power supply.

Solinst® barologgers were used to determine local barometric pressure, BAR. A primary barologger was deployed at the Long Lake Tailrace (LLTR) for the entire monitoring season. A back-up barologger was also deployed at the LLTR to provide BAR data if the primary barologger failed. As an additional quality assurance measure, site-specific barometric pressures were compared to corresponding values for the Spokane International Airport. Spokane International Airport station sea-level daily ranges for barometric

[2] AC power was not connected to MS5s used during spot measurements.

pressure were downloaded from the Weather Underground[3] and adjusted by subtracting 37.05 mm Hg to account for the altitude of the Long Lake HED tailrace (1,365 feet above mean sea level [ft amsl]).

Monitoring equipment was calibrated according to the manufacturer's instructions and following the data quality objectives for the project prior to deployment and on periodic site visits. All instruments used were maintained and calibrated by the factory's service department prior to the 2013 monitoring season. Pre-deployment field verification included synchronizing the clocks, comparing the MS5s' TDG pressure value with the silastic membrane removed to the ambient barometric pressure, confirming the MS5s' patency of the TDG silastic membrane, and testing the barologgers to confirm that the recorded values were similar and comparable to the Spokane International Airport.

During service periods, each MS5 was retrieved and the pull time recorded. Each service session included verification of logging status and downloading the data to a portable field computer. The Solinst® barologgers also were downloaded during these service periods. Patency of the original TDG membrane was confirmed by observing a rapid increase in TDG pressure while pressurizing the sensor with carbonated soda water. Depth, temperature, and DO sensors were calibrated according to the manufacturer's instructions.

In addition, a MS5 equipped with a short power/data cable and a laptop computer was used as a portable TDG meter to obtain spot measurements at long-term and short-term TDG monitoring stations.

2.3.2 Station Facilities

To facilitate TDG and DO monitoring, permanent water quality monitoring facilities were constructed at three locations: 1) 0.6 mile downstream of the Long Lake Dam referred to as LLTR, 2) in the Long Lake HED Unit 4 generation plume referred to as LLGEN, and 3) in the Long Lake HED forebay referred to as LLFB (Table 2-1; Figure 2-1). The long-term monitoring strategy described in the TDG monitoring plan (Golder 2010a) consists of TDG monitoring at two of the permanent monitoring stations, the downstream station, LLTR, and LLGEN. If spill does not occur late in the season, the LLGEN sampling gear is relocated to the LLFB station in order to prepare for annual DO monitoring conducted at the dam. In 2013, the incoming TDG was monitored at LLGEN until June 18 and then at LLFB for the remainder of the TDG monitoring period.

Each permanent station consists of a 4-inch-diameter pipe stilling-well (standpipe), which is sealed at the pipes' submerged end to prevent the MS5 from falling out of the pipe. Each standpipe has 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.

[3] On each site visit day, Spokane, Washington KGEG barometric pressure data were downloaded from the History & Almanac section of http://www.wunderground.com/cgi-bin/findweather/getForecast?query=99219&sp=MKGEG.

Each standpipe's top end is protected by an enclosed box containing AC power and data communication equipment.

2.3.3 Spot Measurements

Spot measurements of TDG, water temperature, and DO were made, when practical[4], at each of the TDG monitoring stations. Site visits were done at approximately one-to-three week intervals. Spot measurements also were taken across the river from LLTR, at LLTRSP1 (Table 2-1).

2.3.4 Data Collection and Processing

Parameters monitored at 15-minute log intervals with the instruments described above included:

- Barometric pressure (mm Hg)
- Air Temperature (°C)
- Depth (m)
- TDG (mm Hg)
- Dissolved Oxygen (mg/L)
- Water Temperature (°C)

In addition, TDG percent of saturation (TDG%) was computed based on measurements, as:

- TDG% = TDG in mm Hg / Barometric pressure in mm Hg x 100

Data downloaded to the laptop computer were transferred to an office server and were checked for errors using Microsoft Excel®. Erroneous data were identified, assigned data quality codes, and removed from the final data set.

Long Lake HED operational logs were provided by Avista for the entire TDG monitoring period of March 25 through June 30, 2013. These logs provide the HED's hourly discharges as generation and spill, along with total discharge.

2.3.5 Monitoring Difficulties

Two monitoring difficulties occurred during the 2013 TDG monitoring season.

Prior to the TDG monitoring season, Avista's six MS5s were serviced and calibrated at Hach Hydromet Technical Support & Service, and each unit successfully passed the mass verification test conducted the morning of March 25, indicating they were operating correctly and providing reliable values. MS5 #48763 was deployed at LLGEN on March 25 at 12:00 Pacific Daylight Time (PDT) and recorded data without issue until March 26 at 1:45 PDT. The internal battery power rapidly decreased from 11.8 volts to 6.8

[4] On five of the seven site visits, extreme turbulence at LLGEN was deemed likely to damage the MS5 if it were deployed in the powerhouse tailrace near the long-term monitoring standpipe. Therefore, spot measurements were only done at LLGEN on the other two site visits (i.e., April 23 and May 6).

volts after 20.25 hours of the deployment at LLGEN and the MS5 stopped recording values, which resulted in a data gap from March 26 at 9:00 PDT through April 12 at 14:30 PDT. At this time, which was the typical interval for servicing the units, the station was serviced, which included replacing MS5 #48763 with MS5 #48762. MS5 #48762 provided quality data for the period it was deployed at LLGEN. The problematic MS5 #48763 was not used again for monitoring in 2013, and was returned to Hach for maintenance to resolve the issue. Hach reported that MS5 #48763 had an internal sensor failure that caused the rapid power loss, and replaced the faulty sensor.

On July 18, data downloaded from MS5 #48762 at LLFB indicated the MS5 was not recording DO values. This resulted in a gap in DO values from June 28 11:45 PDT through July 18 at 12:00 PDT. Upon inspecting the MS5 it was determined that this may have been due to an inadvertent programming error.

To minimize the likelihood of similar events in the future, we adopted new procedures in which the field crew will verify the MS5's are programmed and operating correctly approximately every two weeks.

2.4 Results

The TDG monitoring season consisted of the period from March 25 at 11:00 PDT through June 30, 2013, which included 9,364 15-minute periods (Table 2-2). Since the MS5 at LLGEN needed to be moved to LLFB for the DO monitoring season, which started July 1, data were collected at LLGEN from March 25 to June 18 (87 percent of the TDG monitoring season's 15-minute periods), and at LLFB from June 18 through June 30 (13 percent of the TDG monitoring season's 15-minute periods).

The primary barologger deployed at LLTR provided local barometric pressure for 100 percent of the continuous monitoring period (Appendix A, Table A-4). TDG data were successfully obtained for 100 percent of the continuous monitoring period at LLTR and 99 percent of the continuous monitoring period for LLFB. The monitoring difficulties described above limited the LLGEN station TDG data collection to 78 percent of the March 25 to June 18 continuous monitoring period. The gap in LLFB DO recordings described above in "Monitoring Difficulties" occurred during non-spill operations. Spot measurements were collected at LLTRSP1 on March 25, April 12, April 23, May 6, and May 20, when long-term deployment or download of instruments was conducted (Table 2-3). Results of continuous and spot measurements are displayed in Figures 2-2 through 2-5.

2.4.1 Discharge

Combined Long Lake HED generation and spill discharge for the March 25 11:00 PDT through June 30 monitoring period ranged from approximately 210 cubic feet per second (cfs) to approximately 20,480 cfs. Spills at Long Lake Dam reached a maximum of approximately 15,650 cfs, which was 82 percent of the total river discharge (generation plus spill discharge) of approximately 19,080 cfs on May 16, 2013. Spill from the Long Lake HED occurred as late as June 22. With the exception of 77 hours[5], Long Lake HED generation was near full capacity for periods when spill occurred at Long Lake Dam.

2.4.2 Water Temperature

Water temperature in the tailrace (LLTR) increased from approximately 5.5°C in late March to approximately 18°C near the end of June (Figure 2-2). Maximum temperature was 17.7°C at LLTR on June 30. Maximum temperature at LLGEN was 17.8°C on June 17. Water temperature measured at LLFB during June 18 through June 30 reached a maximum of 22.3°C and was more variable than LLTR. The higher level of variability of water temperature at station LLFB than observed at station LLTR also occurred in previous years and is likely due to the complex dynamics of hydraulics and temperature in the forebay intake area. Corresponding temperature measurements at the two long-term TDG monitoring stations (LLTR and LLGEN) were within 1°C of one another (Figure 2-2).

2.4.3 Barometric Pressure

Site-specific barometric pressures ranged from 711 to 737 mm Hg based on the Solonist® barologger deployed at LLTR (Figure 2-3).

2.4.4 Total Dissolved Gas

TDG pressure for LLTR was greater than corresponding values for LLGEN during most of the periods with spill (Figure 2-3). Comparisons of continuous data indicate TDG pressure varied substantially longitudinally below the dam (Figure 2-3). Spot values for all five days monitored for LLTRSP1 closely coincided with the continuous monitoring data for LLTR, which is across the river from LLTRSP1, even when the maximum total hourly discharge was 19,830 cfs, with a spill of 13,130 cfs on April 12, 2013.

TDG% values for LLGEN, which is virtually unaffected by spill at Long Lake Dam, exceeded 110 percent of saturation from the beginning of the second deployment on April 12 into May 27 except for a 38-hour period starting on May 1. TDG% at LLTR, which is affected by spill at Long Lake Dam, exceeded 110 percent of saturation from the beginning of monitoring on March 25 into May 26, when spill was reduced to approximately 700 cfs.

The range of TDG% computed for the 2013 TDG monitoring season was 105 to 116 percent of saturation for LLGEN, 102 to 112 percent of saturation for LLFB, and 102 to 130 percent of saturation for LLTR (Figure 2-4).[6] Periods with spillgate usage at Long Lake Dam had TDG% at LLTR greater than corresponding values at LLGEN 93 percent of the time and greater than LLFB 52 percent of the time.

[5] Long Lake HED generation discharge was less than 5,900 cfs for 7 hours on April 30, 36 hours on May 15 through May 16, and 34 hours on May 21 through May 22. These periods can be seen along with water quality in Figures 2-2 through 2-5.

[6] The depths for all LLTR and LLFB continuous TDG measurements were below the compensation depth, although depths for LLGEN TDG measurements were less than the compensation depth approximately 0.7 percent of the time.

The 110 percent of saturation TDG criterion is not applicable when stream discharge exceeds the 7-day average flow with a 10-year return period (7Q10), which Ecology (2009) specified as 32,000 cfs for the Spokane River at Long Lake Dam and Nine Mile Dam. During the 2013 TDG monitoring study, maximum total discharge (spill plus turbine discharge) was 20,480 cfs, hence the Ecology-designated 7Q10 was not exceeded (Figure 2-4). Table 2-4 provides the specific periods with TDG% of greater than the 110 percent of saturation criterion when total discharge was less than the Ecology-specified 7Q10.

2.4.5 Dissolved Oxygen

Measured DO concentrations were 9.7 to 13.2 mg/L for LLGEN, 8.1 to 11.6 mg/L for LLFB, and 8.5 to 14.6 mg/L for LLTR (Figure 2-5). The greatest DO concentrations occurred in March and April when the temperature was at 5.5 to 8.0°C causing solubility for oxygen to be greatest.

2.5 Schedule

Avista has made substantial progress toward addressing TDG loadings caused by the use of Long Lake Dam spillways in accordance with the approved schedule (Figure 1-1). Interim operational measures that can be implemented with the current structures have been identified and implemented to address TDG loadings in the short-term, while extensive studies have been conducted to identify reasonable and feasible long-term measures (i.e. structural changes) to address TDG loadings at Long Lake Dam. Specific tasks have included:

- Prepared TDG Water Quality Attainment Plan (TDG WQAP), which included development of reasonable and feasible interim spillgate protocols for the HED's existing structures, in 2010 (Golder 2010b). Approval of the TDG WQAP was obtained from Ecology on July 9, 2010 and from FERC on December 14, 2010 (FERC 2010).
- Implemented the approved interim spillgate propotcols starting in 2011.
- Prepared and submitted TDG Monitoring Plan (Golder 2010a), and obtained approval from Ecology on March 17, 2010 and from FERC on December 14, 2010 (FERC 2010).
- Designed and constructed permanent water quality monitoring stations.
- Monitored TDG and other relevant conditions during the high-flow seasons of 2010,[7] 2011, 2012, and 2013. No additional TDG monitoring will be conducted until after the structural modifications are constructed.
- Prepared and distributed annual TDG monitoring reports (Golder 2011, 2012, 2013, and this report).
- Completed 3 phases of the approved 7-phased feasibility studies for decreasing TDG loadings at the Long Lake HED. These are:
  - Phase I Initial Feasibility Study. Which was conducted before issuance of the 2009 FERC license for the project (EES 2006). This study included identification and screening of a wide range of structural alternatives for TDG abatement that might be possible at Long Lake HED.

[7] Avista initiated early implementation of TDG monitoring on April 18, 2010, which was after Ecology had approved the TDG monitoring Plan but prior to FERC approving the plan.

- Phase II Feasibility Study. Evaluation of six alternatives, five of which were selected in the Phase I study along with a stepped spillway structure (NHC 2010)
- Phase III Feasibility Study. Conducted physical modeling to further evaluate three alternatives with respect to their estimated TDG performance and developed construction cost estimates. A preliminary geotechnical analysis was also conducted for these alternatives (NHC 2013). Based upon Phase III results, the Avista team selected a preferred alternative consisting of a set of deflectors in spill bays 7 and 8, rock removal from the outcropping below these two spill bays, and additional deflectors on spill bays 3 through 6. Concurrence with the selected preferred alternative was obtained from Ecology on March 19, 2013 and from FERC on July 25, 2013 (Aedo 2013).

- Modified the anticipated schedule for the TDG WQAP to account for unanticipated delays in development of a preferred alternative. Approval of the modified schedule was obtained from Ecology on March 19, 2013 and from FERC on August 13, 2013 (FERC 2013).

Avista plans to implement the following schedule to complete the remaining Long Lake Dam TDG abatement tasks:

- 2014: Phase IV Formulate design, plans, and specifications for the preferred alternative for Long Lake HED TDG abatement
- 2014: Phase V Award construction bid and permit these structural changes
- 2015 - 2016: Phase VI Construct the structural modifications
- 2017 – 2018: Phase VII Test performance, and define spillgate protocol
- 2017 – 2019: Conduct monitoring to confirm effectiveness of the constructed structural modifications and spillgate operations and prepare annual monitoring reports

2.6 Discussion

Consistent with historic measurements (Golder 2003, 2004, 2011, 2012, 2013) and expectations, TDG was typically greater at LLTR than at LLGEN and LLFB, and followed the pattern of spill flows. Comparison of the TDG% at LLTR and spill discharges for 2013 indicate TDG% was greater than the 110 percent criterion when spill was at least 5,000 cfs, but it was only greater than the 110 percent criterion 54 percent of the time for spills of less than 5,000 cfs (Table 2-5). Comparison of LLTR TDG% and LLGEN TDG% for the same time (referred to as data pairs[8]) shows that TDG% values at LLTR were greater than at LLGEN and exceeded the 110 percent criterion for 36 percent of the 997 15-minute data pairs with spill of less than 5,000 cfs. These are similar to 2011 results, in which TDG% for LLTR were greater than at LLFB and exceeded the 110 percent criterion for 46 percent of the 709 15-minute data pairs with spill of 5,000 cfs or less. In contrast to 2011 and 2013 results, which had lower exceedance, all 229 TDG% data pairs for spills of less than 5,000 cfs in 2012 had TDG% at LLTR greater than at LLGEN and exceeded the 110 percent criterion, although the spill regime was considerably different. The lowest spill for 2012 TDG% data pairs was 1,525 cfs, which exceeded 74 percent of the 2013 spills with TDG% data pairs of less than 5,000 cfs.

[8] A data pair is a set of LLTR and LLGEN TDG% values for the same time.

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TABLES

Table 2-1: Long Lake Dam TDG Monitoring Stations

Station Code	Description	Latitude / Longitude (NAD83)	Monitoring Type
LLFB	Long Lake Forebay between Unit 3 and 4 intakes near centerline of intake (elevation 1499 feet)	47°37'48" / 117°31'47"	Long-term for DO monitoring season starting June 18
LLGEN	Long Lake HED Unit 4 generation plume	47°37'48" / 117°31'47"	Long-term until June 18
LLTR	On left downstream bank, at a water pump house approximately 0.6 mile downstream from Long Lake dam	47°37'48"/ 117°31'47"	Long-term
LLTRSP1	On right downstream bank, across river from LLTR station	47° 50'19" / 117° 51'02"	Spot during spillway use

Table 2-2: Summary of Continuous Monitoring Results

Parameter	LLGEN			LLFB			LLTR		
	Minimum	Maximum	Count	Minimum	Maximum	Count	Minimum	Maximum	Count
Date/Time (m/dd/yyyy PDT)	3/25/13 12:00	6/18/13 10:45	8,156	6/18/13 12:30	6/30/13 23:45	1,198	3/25/13 11:00	6/30/13 23:45	9,364
Water Temperature (°C)	5.94	17.80	6,391	15.59	22.27	1,195	5.51	17.74	9,339
Dissolved Oxygen (mg/L)	9.73	13.15	6,389	8.06	11.55	957	8.54	14.61	9,339
BAR (mm Hg)	Used LLTR BAR			Used LLTR BAR			711	737	9,362
TDG (mm Hg)	761	833	6,371	734	803	1,189	739	936	9,318
TDG (% saturation)[1]	105.0	116.4	6,370	101.7	112.4	1,188	102.2	129.7	9,316

Notes:

1. TDG (% saturation) calculated using site-specific barometric pressure (BAR) data collected at LLTR and corrected for altitude.

Golder Associates

Table 2-3: LLTRSP1 Spot Measurement Results

Date Time (PDT)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	TDG (mm Hg)	LLTR BAR (mm Hg)	TDG (% of saturation)[1]
3/25/2013 13:45	6.4	13.4	823	725	113.5
4/12/2013 15:30	7.2	13.7	896	718	124.8
4/23/2013 13:00	8.0	14.2	863	729	118.3
5/6/2013 12:15	10.2	13.1	866	720	120.3
5/20/2013 11:30	14.8	10.9	861	728	118.3

Notes:

1. TDG (% saturation) calculated using site-specific barometric pressure (BAR) data collected at LLTR.

Table 2-4: Summary of Exceedances of TDG Criterion when Total Discharge was Less Than or Equal to Ecology-Specified 7Q10 of 32,000 cfs in 2013

	LLTR			LLGEN			LLFB		
# of records that exceeded 110% saturation	5,979			4,137			79		
Total # of records	9,316			6,370			1,188		
Periods when TDG exceeded 110% saturation (PDT)[1,2,3]	3/25/2013 11:45	to	4/12/2013 11:45	4/12/2013 15:15	to	4/23/2013 8:00	6/18/2013 13:15	to	6/18/2013 23:00
	4/12/2013 13:30	to	4/23/2013 8:00	4/23/2013 8:30	to	4/23/2013 11:30	6/19/2013 7:15	to	6/19/2013 16:45
	4/23/2013 8:30	to	4/23/2013 10:15	4/23/2013 13:30	to	5/1/2013 3:00			
	4/23/2013 11:30	to	5/6/2013 11:15	5/1/2013 4:00					
	5/6/2013 13:00	to	5/20/2013 10:00	5/2/2013 16:45					
	5/20/2013 11:30	to	5/26/2013 21:30	5/2/2013 17:30	to	5/20/2013 11:00			
	5/30/2013 7:30	to	5/30/2013 9:00	5/3/2013 7:45	to	5/27/2013 3:30			
	6/18/2013 9:15	to	6/18/2013 9:30	5/6/2013 11:45	to	5/27/2013 18:15			
				5/20/2013 12:45	to	5/27/2013 19:00			
				5/27/2013 12:00	to	5/27/2013 20:00			
				5/27/2013 18:45	to	5/29/2013 11:00			
				5/27/2013 19:30	to	6/7/2013 5:15			
				5/29/2013 10:45	to	6/14/2013 5:15			
				6/7/2013 5:15					
				6/14/2013 5:15					
				6/18/2013 10:45					

Notes:

1. Flow never exceeded the 7Q10 during the 2013 TDG Monitoring season.
2. Refer to Figure 2-4 and Appendix A for data gaps.
3. LLGEN had a data gap between 3/26/2013 8:45 PDT, which had a TDG% of 106.1%, and 4/12/2013 15:15 PDT, which had a TDG% of 113.5%.

Table 2-5: Summary of LLTR TDG% by Spill Category and Comparison with LLGEN TDG%

Spill Category	All LLTR TDG% Values			LLTR TDG% Paired with LLGEN TDG% [1]		
	Total Count	Count >110%	% >110%	Total Count	Count >110% and >LLGEN	% >110% and >LLGEN
>11 kcfs spill	1,134	1,134	100%	727	727	100%
5-11 kcfs spill	3,909	3,909	100%	3,168	3,168	100%
<5 kcfs spill	1,719	932	54%	997	359	36%
No spill	2,554	4	0%	1,459	2	0%
All spill and non-spill	9,316	5,979	64%	6,351	4,256	67%

Notes:

1. TDG (% saturation) calculated using site-specific barometric pressure (BAR) data collected at LLTR and corrected for altitude.

FIGURES

Revised February 2013

Revised Long Lake HED TDG Compliance Schedule

Schedule for Operational Adjustments and Structural Modifications to Address TDG Production at Long Lake Dam

Action	Task	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
General Monitoring	Select/design permanent monitoring stations and develop monitoring plan	M	M										
	Monitor TDG and other relevant water quality conditions at the Unit 4 generation plume (LLGEN) and the tailrace (LLTR) [1]		M	M	M	M				M	M	M	
	Annual Monitoring Report[2]			M	M	M	M				M	M	M
Operational Changes - Spill Protocols	Continue historical preferential use of spill gates	O	O										
	Develop reasonable and feasible interim spill gate protocol based on the 2003/2004 spill testing		O										
	Implement selected reasonable and feasible interim spill gate protocol based on 2003/2004 spill testing			O	O	O	O						
	Suspend interim spill operations in 2015 and 2016 during construction							O	O				
	Implement revised spill gate protocol, which takes advantage of constructed structural modifications									O	O	O	O
Structural Modifications	Phase II Feasibility Study- Evaluation of Alternatives		S										
	Phase III Feasibility Study - Select Alternatives, Physical Model			S	S								
	Submit and request agency review of Phase III Recommendation					S							
	Upon FERC approval, prepare RFP for design engineering services and secure contract					S							
	Phase IV - Formulate design, plans, and specs						S						
	Phase V – Award construction bid and permit project						S						
	Phase VI - Construction							S	S				
	Phase VII – Testing, performance evaluation, and define spillgate protocol									S	S		
Effectiveness Monitoring	Confirm effectiveness of structural modifications and spillgate operations at reducing TDG									M	M	M	

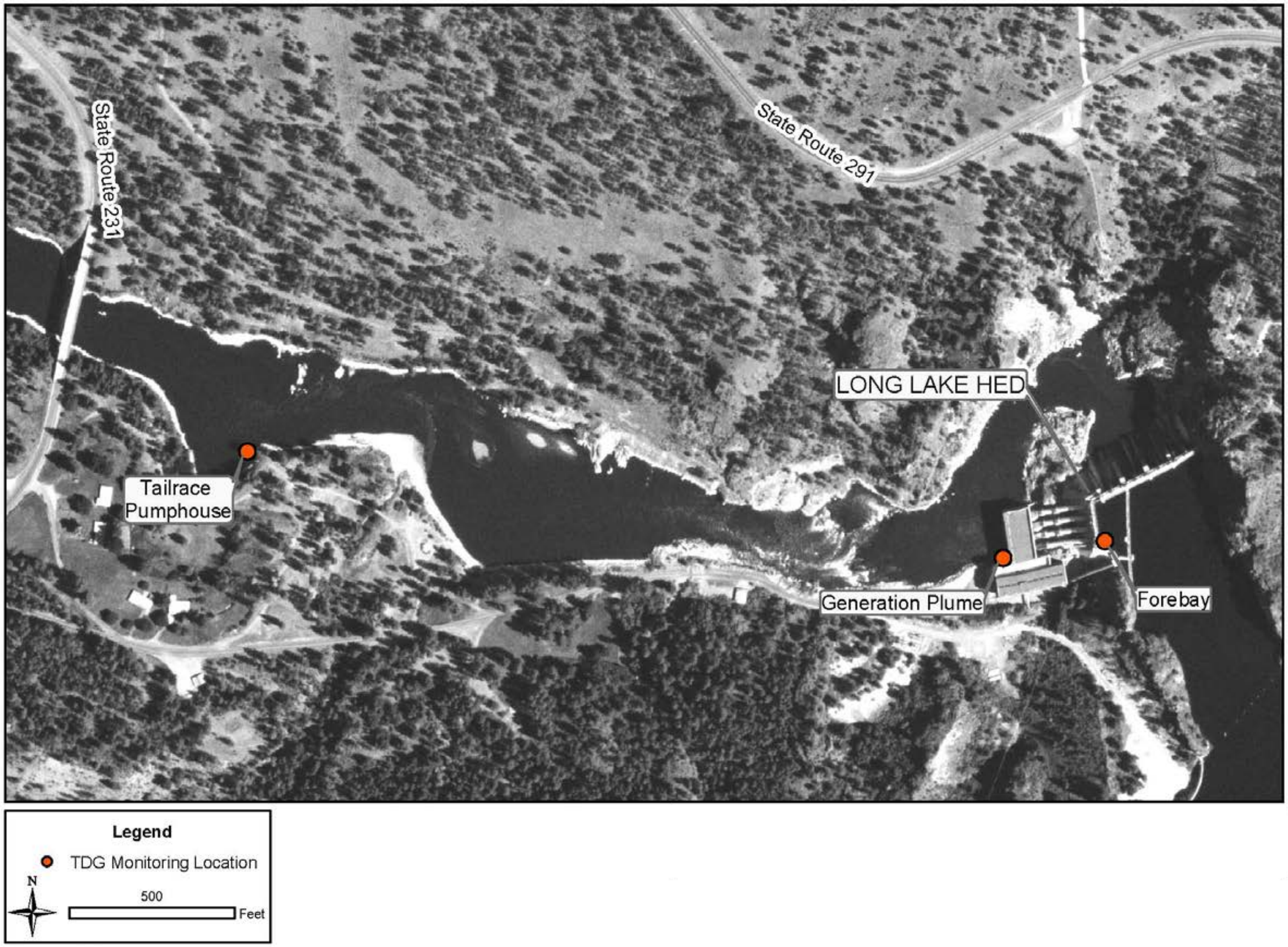
Notes

S	Structural
O	Operations
M	Monitoring

(1) Monitoring will be suspended following FERC approval of the Phase III recommendation and will resume once construction has been completed.
(2) Annual Monitoring Reports are only required following a monitoring season.

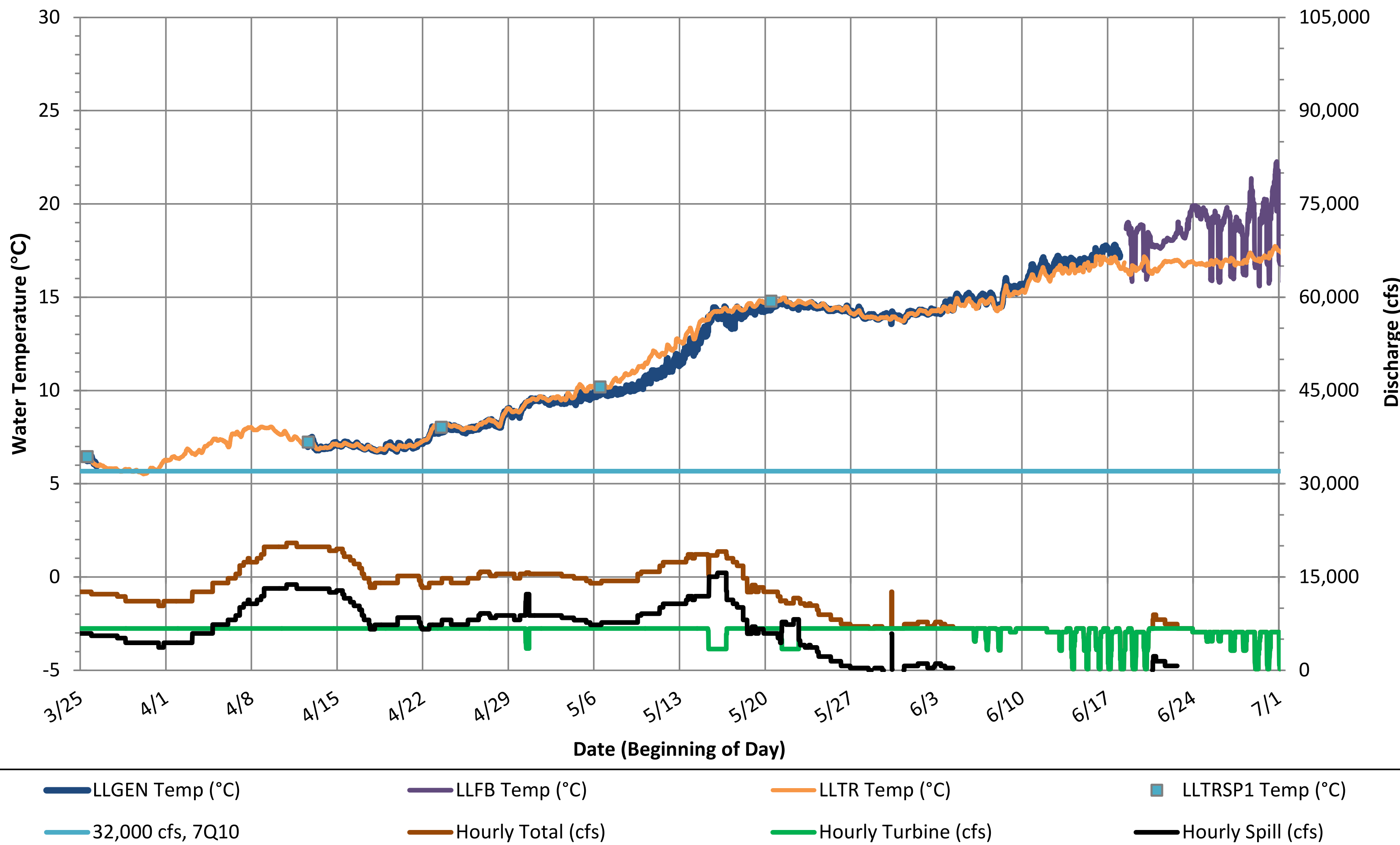
Figure 1-1: Long Lake HED TDG Compliance Schedule

Note: Approved by Ecology on March 19, 2013 and approved by FERC in an Order Amending Total Dissolved Gas Attainment and Monitoring Plan issued August 13, 2013 (FERC 2013).



Source: Avista

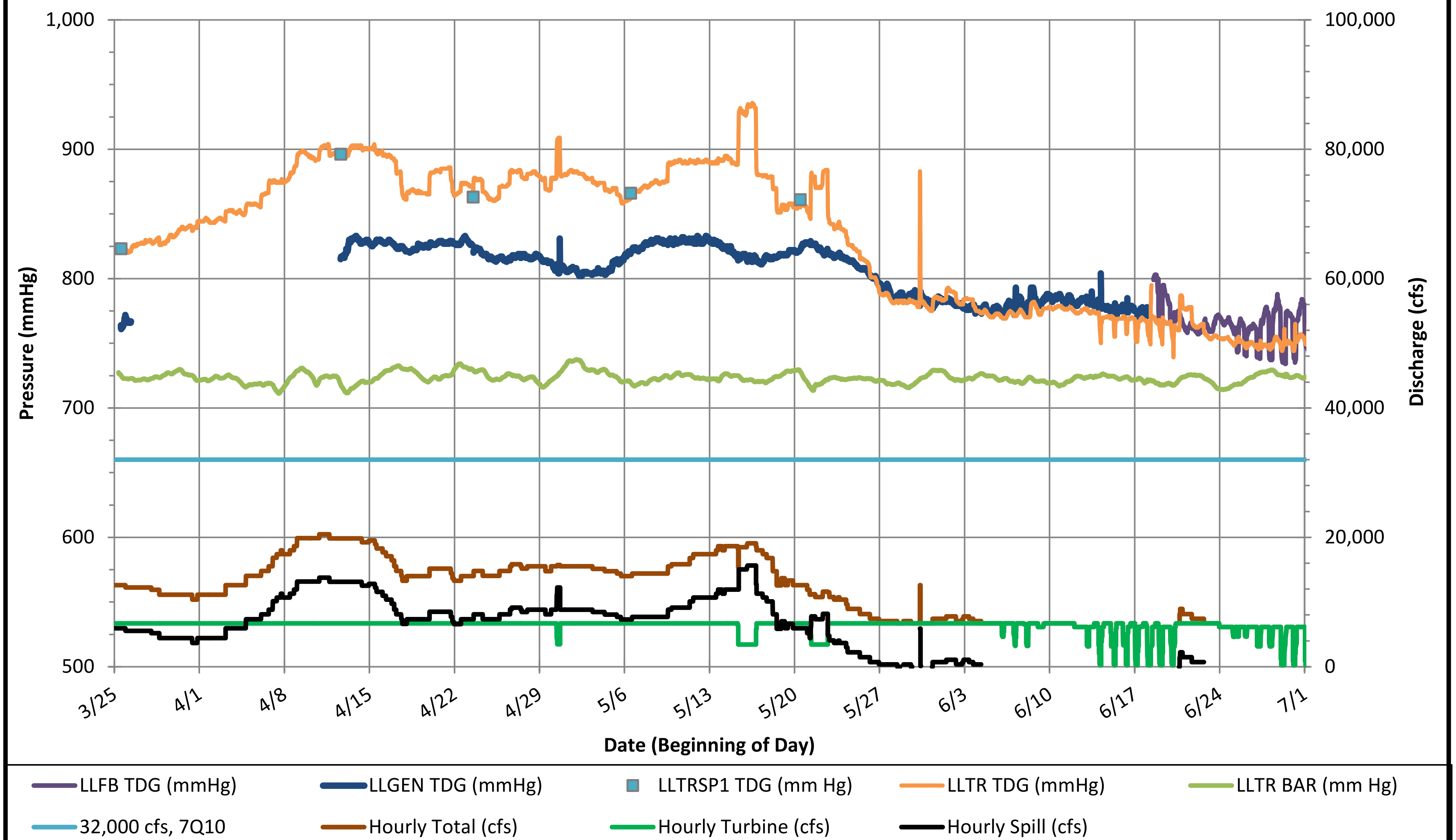
Figure 2-1: Long Lake Dam Long-Term Water Quality Monitoring Locations



Golder Associates

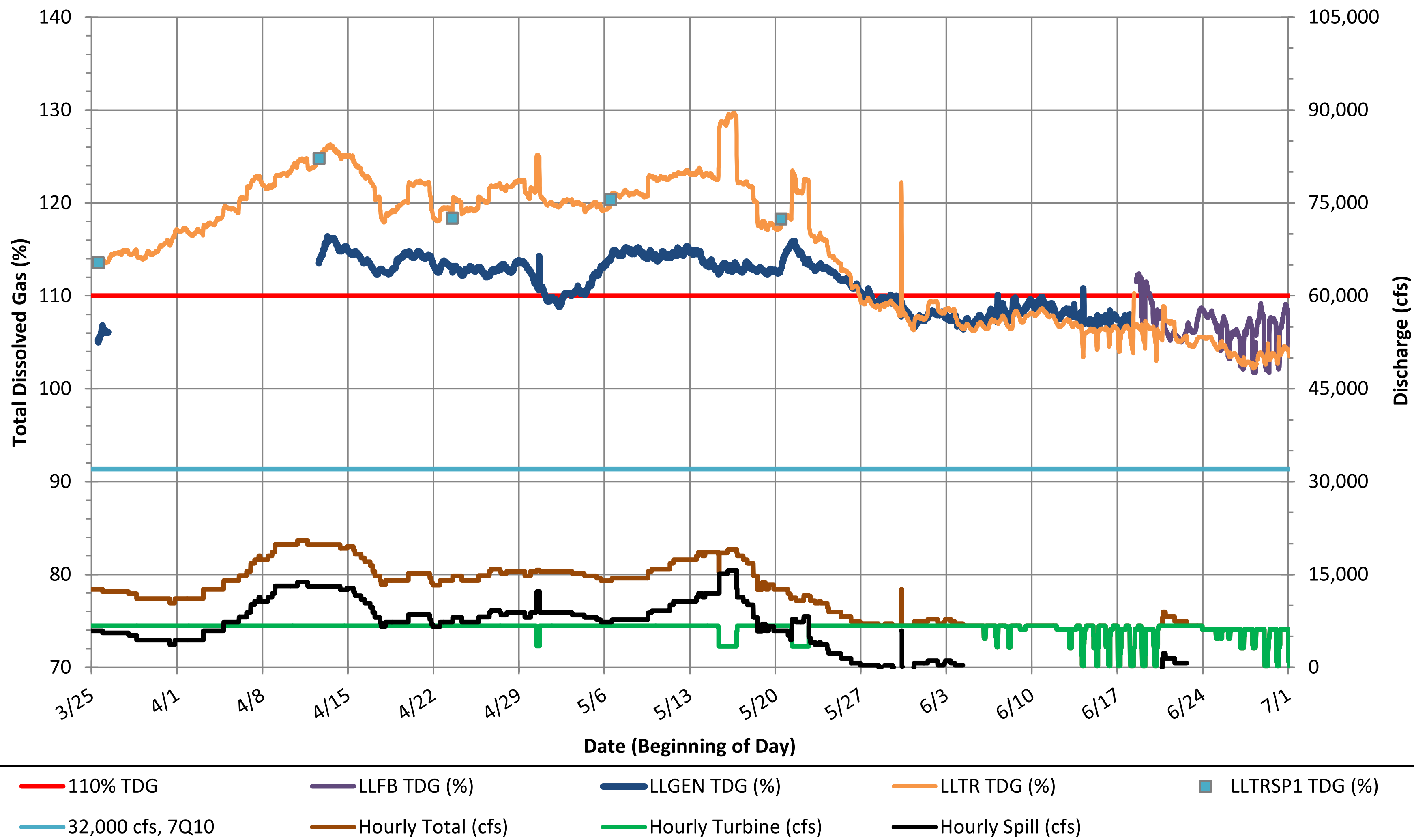
Title	Water Temperature and HED Operations		
Project Name: LL TDG Monitoring	Project No.: 073-93081-08.411	FIGURE 2-2	
Client Name: Avista	Date: February 27, 2014		

J:\Doc-Dev\2007\073-93081 Avista_Mattax\x08\Ph 411\022714blm1_LL_TDG_Processed_Data_2013-Restricted.xlsx



Golder Associates	Title: Total Dissolved Gas Pressure, Barometric Pressure, and HED Operations		
	Project Name: LL TDG Monitoring	Project No.: 073-93081-08.411	FIGURE 2-3
	Client Name: Avista	Date: February 27, 2014	

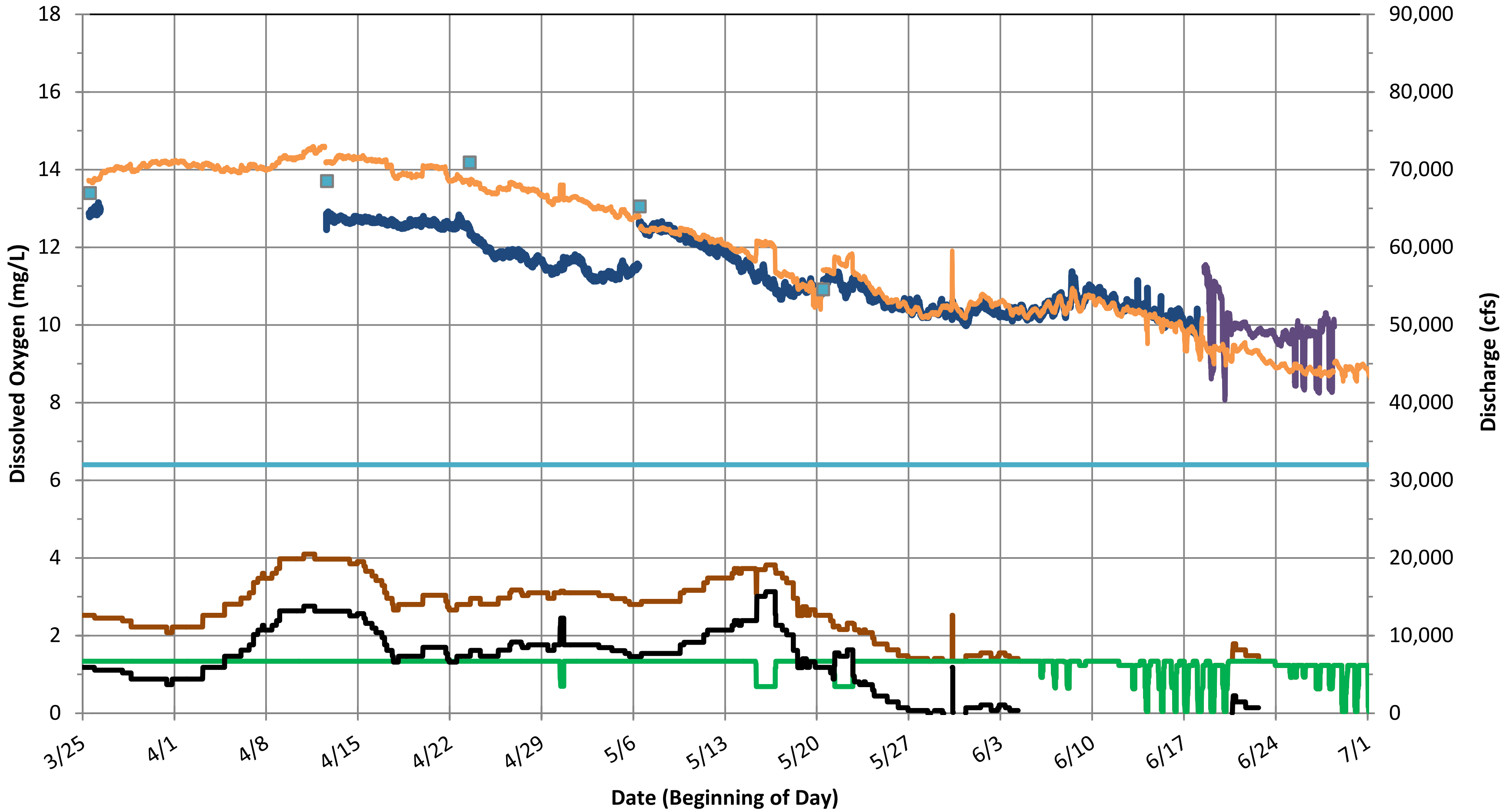
J:\Doc-Dev\2007\073-93081 Avista_Mattax\x08\Ph 411\022714blm1_LL_TDG_Processed_Data_2013-Restricted.xlsx



Golder Associates

Title	Total Dissolved Gas Percent of Saturation and HED Operations
Project Name	LL TDG Monitoring
Project No.	073-93081-08.411
Client Name	Avista
Date	February 27, 2014
FIGURE	2-4

J:\Doc-Dev\2007\073-93081 Avista_Mattax\x08\Ph 411\022714blm1_LL_TDG_Processed_Data_2013-Restricted.xlsx



Golder Associates

Title	Dissolved Oxygen Concentration and HED Operations		
Project Name	LL TDG Monitoring	Project No.	073-93081-08.411
Client Name	Avista	Date	February 27, 2014

FIGURE 2-5

APPENDIX A

DATA QUALITY ANALYSIS

DATA QUALITY SUMMARY

Data quality objectives (DQOs) and Measurement Quality Objectives (MQOs) 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 measurement range, accuracy, precision, representativeness, completeness, and comparability. The range, accuracy, and resolution for each measured parameter are provided in Table A-1.

Table A-1: Range, Accuracy and Resolution of Parameters Recorded

Instrument and Parameter	Range	Accuracy	Resolution
MS5 Total Dissolved Gas	400 to 1300 mm Hg	±0.1 % of span	1.0 mm Hg
MS5 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
MS5 Temperature	-5 to 50°C	±0.10°C	0.01°C
MS5 Depth (0-25 meters)	0 to 25 meters	±0.05 meter	0.01 meter
Barologger Relative Barometric Pressure	1.5 meter of water	± 0.1 cm of water	0.002% of full scale
Barologger Temperature	-10 to 40°C	± 0.05°C	0.003°C

Notes: Sources: Hach MS5 User Manual and Solinist Levelogger User Guide [9]

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. Table A-2 presents MQOs selected during preparation of the Washington TDG Monitoring Plan along with the same MQO for DO as used for the Long Lake HED tailrace DO monitoring plan. The meter-specific root mean squared error (RMSE) of the calibration corrections applied after each calibration, and an overall RMSE for all meters compared to MQOs are shown in Table A-3.

Table A-2: Measurement Quality Objectives (MQOs)

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

[9] Hach Corporation. 2006. Hydrolab DS5X, DS5, and MS5 Water Quality Multiprobes User Manual. February 2006, Edition 3. Catalog Number 003078HY and Solinist. 2010. Levelogger Series (Levelogger Gold, Barologger Gold, Levelogger Junior, LTC Levelogger Junior and Rainlogger) User Guide - Software Version 3.4.0. August 17, 2010.

Table A-3: Difference Between RMSE and MQOs by MS5

Part 1: Barometric Pressure (BAR), Total Pressure, and Total Dissolved Gas (TDG)

Meter IDs and Locations	RMSE [1]				MQO			RMSE - MQO			
	BAR[2] (mm Hg)	Total Pressure[3] (mm Hg)	TDG-cal[4] (%)	TDG-spot[5] (%)	BAR (mm Hg)	Total Pressure (%)	TDG (%)	BAR (mm Hg)	Total Pressure (%)	TDG-cal (%)	TDG-spot (%)
48762 (GAICdA 3/24; LLGEN 4/12-6/18; LLFB 6/28-7/18)	2.11	0.29	0.29	1.00	2	1	1	0.11	-0.71	-0.71	0.00
48763 (GAICdA 3/24; LLGEN 4/12)	1.00	0.14	0.14	1.01	2	1	1	-1.00	-0.86	-0.86	0.01
48764 (GAICdA 3/24; LLTR 4/12-7/18)	2.21	0.31	0.31	1.00	2	1	1	0.21	-0.69	-0.69	0.00
60375 (GAICdA 3/28)	4.00	0.56	0.56	0.99	2	1	1	2.00	-0.44	-0.44	-0.01
60376 (GAICdA 3/28; LLTR 4/12, 5/20, 6/18-7/18; LLGEN 4/23-5/6, 5/29)	1.56	0.22	0.22	1.00	2	1	1	-0.44	-0.78	-0.78	0.00
Overall RMSE	2.03	0.28	0.28	1.00	2	1	1	0.03	-0.72	-0.72	0.00

Notes:
Shaded values indicate exceedance of MQO.
[1] RMSE calculated for each meter during calibration checks and spot measurements from multiple meters.
[2] RMSE calculated from BAR measured during calibration compared to the TDG in air uncorrected reading.
[3] RMSE calculated as the difference in TDG in air uncorrected measured during calibration minus the BAR, then divided by the TDG and multiplied by 100%.
[4] RMSE calculated as TDG in air uncorrected measured during calibrations divided by the BAR and multiplied by 100%.
[5] RMSE calculated as the measured TDG in air uncorrected divided by the group average measured TDG.
N/A - Not available, measurement not taken.

Root mean squared error (RMSE) = $\sqrt{\frac{\sum_{i=1}^{n}(x_{1,i} - x_{2,i})^2}{n}}$.

Table A-3 (Continued): Difference Between RMSE and MQOs by MS5,

Part 2: Temperature and Dissolved Oxygen (DO)

Meter IDs and Locations	RMSE				MQO		RMSE - MQO			
	Temperature[1]		DO[2]				Temperature[1]		DO[2]	
	Calibration (°C)	Spot (°C)	Calibration (mg/L)	Spot (mg/L)	Temp (°C)	DO (mg/L)	Calibration (°C)	Spot (°C)	Calibration (mg/L)	Spot (mg/L)
48762 (GAICdA 3/24; LLGEN 4/12-6/18; LLFB 6/28-7/18)	0.21	0.49	0.22	0.49	0.5	0.5	-0.29	-0.01	-0.28	-0.01
48763 (GAICdA 3/24; LLGEN 4/12)	0.25	0.02	0.41	0.25	0.5	0.5	-0.25	-0.48	-0.09	-0.25
48764 (GAICdA 3/24; LLTR 4/12-7/18)	0.26	0.01	0.14	0.25	0.5	0.5	-0.24	-0.49	-0.36	-0.25
60375 (GAICdA 3/28)	0.22	0.04	0.34	0.13	0.5	0.5	-0.28	-0.46	-0.16	-0.37
60376 (GAICdA 3/28; LLTR 4/12, 5/20, 6/18-7/18; LLGEN 4/23-5/6, 5/29)	0.23	0.31	0.27	0.33	0.5	0.5	-0.27	-0.19	-0.23	-0.17
Overall RMSE	0.23	0.29	0.24	0.32	0.5	0.5	-0.27	-0.21	-0.26	-0.18

Notes:

[1] For Calibration, RMSE calculated from the difference between the meter and calibration thermometer at all calibration checks. Spot differences are differences between measured values from group average.

[2] Calibration RMSE as difference of the pre-calibration measurement and calculated 100% saturation. Spot RMSE calculated as difference between measured values from group average.

N/A - Not available, measurement not taken

Root mean squared error (RMSE) = $\sqrt{\frac{\sum_{i=1}^{n}(x_{1,i}-x_{2,i})^2}{n}}$.

Measurement Range

The measurement range, range of reliable readings of an instrument or measuring device, specified by the manufacturer is displayed in Table A-1 for each measured parameter. Maintenance of field sampling equipment was conducted in a manner consistent with the corresponding manufacturer's recommendations to provide reliable readings within each instrument's reported measurement range.

Bias

TDG meters, like other field monitoring instruments, are subject to bias due to systematic errors introduced by calibration, equipment hardware or software functioning, or field methods. Bias was minimized by following standard protocols for calibration and maintenance, and by following field protocols for stabilization of meter readings.

Precision

Precision refers to the degree of variability in replicate measurements and is typically defined by the instrument's manufacturer. Manufacturer values for the MS5 and barologger (Table A-1) were within MQOs.

Accuracy

Accuracy is a measure of confidence that describes how close the average of a series of replicate measurements is to the "true" value (low bias). Throughout this seasonal TDG monitoring study, the MS5s underwent calibration and verification procedures.

Instrument accuracy was evaluated through the calibration and maintenance activities. MQOs for total pressure and pre-calibration TDG% were met for all meters. Four of the five MS5s met the MQO for TDG paired spot measurements with the only one not meeting this MQO being an exceedances of 0.01 for MS5 #48763, which was replaced at LLGEN on April 12, 2013 (Table A-3). However, three of the five MS5s did not meet MQO for barometric pressure (Table A-3). The largest exceedance of the MQO for barometric pressure was experienced by MS5 #60375 for which there was only one set of values, which was a comparison between the MS5 in Golder's Coeur d'Alene office to the National Weather Service's Felts Field station approximately 25 miles away. Local differences could account for this exeedance.

All five MS5s met the 0.5°C water temperature MQO and 0.5 mg/L DO MQO both for pre-calibration and paired spot measurements.

Discharge data were obtained from Avista, which uses a well-established monitoring program. Golder reviewed the variability of discharge data to determine whether it was appropriate based on expected values. All discharge data were deemed acceptable.

Representativeness

Representativeness qualitatively reflects the extent to which sample data represent a characteristic of actual environmental conditions. For this project, representativeness was addressed through proper design of the sampling program to ensure that the monitoring locations were properly located and sufficient data were collected to characterize TDG at that location.

Comparability

Comparability is the degree to which data can be compared directly to previously collected data. Comparability was achieved by consistently monitoring the same downstream long-term monitoring station (LLTR) monitored in the past, monitoring in the LLGEN stilling well that also was a TDG monitoring station in 2009, 2010, and 2012; and conducting spot measurements at the same location across the river from LLTR as in past years.

Completeness

Completeness is the comparison between the quantity of data planned to be collected and how much usable data was actually collected, expressed as a percentage (Table A-4). The TDG data collection period consisted of 9,364 15-minute periods at LLTR, with shorter periods for both LLGEN and LLFB. Data completeness was at least 99 percent for all parameters at LLTR. LLFB had data completeness of 80 percent for DO and 100 percent for all other parameters. Completeness of all parameters for LLGEN was 78 percent. The primarily reason for data gaps at LLGEN was MS5 #48763 power issues at this monitoring site. Replacement of this MS5 resolved this issue.

Table A-5 summarizes the number of specific DQCodes applied to LLTR, LLGEN, and LLFB data.

Table A-4: Project Completeness

	LLGEN		LLFB		LLTR	
Parameter	**Count**	**Completeness (%)**	**Count**	**Completeness (%)**	**Count**	**Completeness (%)**
Monitoring Period	8,156	--	1,198	--	9,364	--
Water Temperature (°C)	6,391	78%	1,195	100%	9,339	100%
Dissolved Oxygen (mg/L)	6,389	78%	957	80%	9,339	100%
BAR (mm Hg)	Used LLTR BAR		Used LLTR BAR		9,362	100%
TDG (mm Hg)	6,371	78%	1,189	99%	9,318	100%
TDG (% saturation)	6,370	78%	1,188	99%	9,316	99%

Table A-5: Number of Specific DQCodes During the Monitoring Period

DQ Code	DQ Code Description	LLGEN					LLFB					LLTR						
		Temp (°C)	TDG (mmHg)	Depth (meters)	DO (mg/L)	Batt (volts)	Temp (°C)	TDG (mmHg)	Depth (meters)	DO (mg/L)	Batt (volts)	Temp (°C)	TDG (mmHg)	Depth (meters)	DO (mg/L)	Batt (volts)	Level (m H2O)	ATemp (°C)
997	Equilibrating after deployment	0	17	0	0	0	0	6	0	0	0	0	21	0	0	0	0	0
996	No data reported by instrument even though progammed correctly	1,638	1,638	1,638	1,638	1,638	0	0	0	0	0	0	0	0	0	0	0	0
994	Parameter not monitored during the monitoring period	0	0	0	0	0	0	0	0	238	0	0	0	0	0	0	0	0
993	Out of water for calibration/servicing	19	19	19	19	19	3	3	3	3	3	25	25	25	25	25	2	2
990	Depth <0.25 meter	77	77	0	77	0	0	0	0	0	0	0	0	0	0	0	0	0
889	Power loss/ late probe turn on	11	11	11	12	12	0	0	0	0	0	0	0	0	0	0	0	0
211	Depth < TDG compensation depth	20	23	1	21	0	0	0	0	0	0	0	0	0	0	0	0	0
-101	Less than "minimum operating voltage" (<7 volts), but other data appear reliable	24	24	24	24	33	0	0	0	0	0	0	0	0	0	0	0	0
-102	Between "minimum operating voltage" (<9 volts) and 7 volts, but other data appear reliable	59	59	59	59	60	0	0	0	0	0	0	0	0	0	0	0	0
-211	Depth < TDG compensation depth, but data appear reliable	40	37	59	39	0	0	0	0	0	0	0	0	0	0	0	0	0
-300	DO recorded in % of saturation instead of mg/L, corrected for difference in units	0	0	0	1,238	0	0	0	0	0	0	0	0	0	0	0	0	0
-889	Power loss/ late probe turn on, but data appear reliable	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-990	Depth <0.25 meter, but data appear reliable	0	0	77	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-1002	Corresponds with spot measurement	2	1	2	1	0	1	1	1	1	1	7	7	7	7	2	0	0
-1003	Corresponds with spot measurement at nearby station	0	0	0	0	0	0	0	0	0	0	5	4	5	5	0	0	0
0	No data qualifiers	6,265	6,249	6,265	5,028	6,394	1,194	1,188	1,194	956	1,194	9,327	9,307	9,327	9,327	9,337	9,362	9,362
	Monitoring Period[1]	8,156	8,156	8,156	8,156	8,156	1,198	1,198	1,198	1,198	1,198	9,364	9,364	9,364	9,364	9,364	9,364	9,364

Notes:

1. Monitoring periods consisted of 3/25/2013 11:00 PDT to 6/30/2013 23:45 PDT for LLTR, 3/25/2013 12:00 PDT to 6/18/2013 10:45 PDT for LLGEN, and 6/18 12:30 PDT to 6/30/2013 23:45 PDT for LLFB.

APPENDIX B

CONSULTATION RECORD

February 28, 2014

Mr. Patrick McGuire, Water Quality Program
Washington Department of Ecology
Eastern Region Office
4601 N Monroe Street
Spokane, WA 99205-1295

RE: Federal Energy Regulatory Commission's Spokane River Hydroelectric Project License, Appendix B, Sections 5.4 and 5.6, TDG and DO Reporting Requirements

Dear Mr. McGuire:

Ordering Paragraph E of the Federal Energy Regulatory Commission (FERC) Spokane River Hydroelectric Project License incorporated the Washington Department of Ecology (Ecology) Certification Conditions under Section 401 of the Federal Clean Water Act Water Quality Certification (Certification) as Appendix B of the License. In accordance with Section 5.4 and Section 5.6 of the Certification, Avista is submitting the following reports for your review and approval.

Section 5.4: Total Dissolved Gas

There are two components related to Total Dissolved Gas (TDG), which include the following:

1. *2013 Long Lake Total Dissolved Gas Monitoring Report, Golder Associates, February 2014.* The enclosed 2013 Long Lake TDG Monitoring Report provides the results of monitoring TDG at Avista's Long Lake Hydroelectric Development (HED) during 2013. In accordance with the approved Revised Long Lake HED TDG Compliance Schedule, Avista will not be monitoring TDG during 2014 through 2016, during the Long Lake Dam spillway modification project for TDG abatement.

2. *Nine Mile TDG Monitoring.*
   In accordance with the Ecology letter dated February 17, 2012, Avista did not conduct TDG monitoring at its Nine Mile Hydroelectric Development (HED) during 2013. As indicated in the Ecology Letter, Avista will resume monitoring TDG the first season following the removal of sediment in front of the sediment bypass intake and the replacement of turbine units 1 and 2. This will ensure Nine Mile HED is operating under normal Project operations prior to resuming TDG monitoring. Also, as requested by Ecology in the February 17, 2012 letter, Avista will provide an update on the progress of the turbine removal and replacement by September 1, 2014.

Section 5.6: Dissolved Oxygen

The enclosed 2013 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report illustrates the seasonal changes in DO immediately downstream of Long Lake Dam during the low flow period of the year and summarizes the use of draft tube aeration to boost DO levels in the river below the dam's tailrace. Besides providing a full season of DO data below the dam, the report details the success of the aeration system, which is installed on all four units. Avista plans to continue with the aeration program in 2014.

With this, Avista is submitting the 2013 Long Lake Total Dissolved Gas Monitoring Report and the 2013 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report for Ecology's review and approval. We would like to receive any comments or recommendations that you may have by March 28, 2014, which will allow us time to file the reports with FERC by April 15, 2014.

Please feel free to contact me at (509) 495-4643 if you have any questions or wish to discuss the reports.

Sincerely,

Meghan Lunney

Meghan Lunney
Aquatic Resource Specialist

Enclosures (2)

cc: Chad Brown, Ecology
Brian Crossley, Spokane Tribe

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
4601 N Monroe Street • Spokane, Washington 99205-1295 • (509)329-3400

APR - 2 2014

April 1, 2014

Ms. Meghan Lunney
Aquatic Resource Specialist
Avista Corporation
1411 East Mission Avenue, MSC-1
Spokane, WA 99220-3727

RE: Request for Ecology Review and Approval – *2013 Long Lake Total Dissolved Gas Monitoring Report*. Spokane River Hydroelectric Project, No. P-2545

Dear Ms. Lunney:

The Department of Ecology (Ecology) has reviewed the *2013 Long Lake Total Dissolved Gas Monitoring Report* (TDG) sent to Ecology on February 28, 2014.

Ecology APPROVES the *2013 Long Lake Total Dissolved Gas Monitoring Report* as submitted. The report meets the 401 Water Quality Certification conditions and requirements for Section 5.4.D.

In addition, we would like to provide the following comments for the TDG report:

- Ecology recognizes that monitoring difficulties can occur during the year. The 2013 report mentions that there were two data collection problems in 2013. We approve of the new field crew procedures to verify the operational status of the MS5s every two weeks, which is more frequent than previous years.
- The TDG data in Table 2-4 shows the TDG exceeded 110% of water quality standards in 10,116 of 15,686 data records. Ecology acknowledges that since Avista is actively working toward addressing the high TDG loadings according to the TDG Abatement Plan and compliance schedule, Avista is in compliance with the 401 certification.

Please contact me at (509) 329-3567 or pmcg461@ecy.wa.gov if you have any questions.

Sincerely,

Pat McGuire

Patrick McGuire
Eastern Region FERC License Coordinator
Water Quality Program

PDM:jb

cc: Elvin "Speed" Fitzhugh, Avista
Brian Crossley, Spokane Tribal Natural Resources

ECOLOGY COMMENTS AND AVISTA RESPONSES

The comments included in Ecology's April 1, 2014 letter, approving the 2013 Long Lake Total Dissolved Gas Monitoring Report, did not require responses.

February 28, 2014

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

RE: Federal Energy Regulatory Commission's Spokane River Hydroelectric Project License, Appendix B, Sections 5.4 and 5.6, TDG and DO Reporting Requirements

Dear Mr. Crossley:

Ordering Paragraph E of the Federal Energy Regulatory Commission Project (FERC) Spokane River Hydroelectric Project License incorporated the Washington Department of Ecology (Ecology) Certification Conditions under Section 401 of the Federal Clean Water Act Water Quality Certification (Certification) as Appendix B of the License. In accordance with Section 5.4 and Section 5.6 of the Certification, and per the October 2008 Settlement Agreement between Avista and the Tribe, Avista is submitting the following reports for your review and comment.

Section 5.4: Total Dissolved Gas
There are two components related to Total Dissolved Gas (TDG), which include the following:

1. *2013 Long Lake Total Dissolved Gas Monitoring Report, Golder Associates, February 2014.* The enclosed 2013 Long Lake TDG Monitoring Report provides the results of monitoring TDG at Avista's Long Lake Hydroelectric Development (HED) during 2013. In accordance with the approved Revised Long Lake HED TDG Compliance Schedule, Avista will not be monitoring TDG during 2014 through 2016, during the Long Lake Dam spillway modification project for TDG abatement.

2. *Nine Mile TDG Monitoring.*
   In accordance with the Ecology letter dated February 17, 2012, Avista did not conduct TDG monitoring at its Nine Mile Hydroelectric Development (HED) during 2013. As indicated in the Ecology Letter, Avista will resume monitoring TDG the first season following the removal of sediment in front of the sediment bypass intake and the replacement of turbine units 1 and 2. This will ensure Nine Mile HED is operating under normal Project operations prior to resuming TDG monitoring. Also, as requested by Ecology in the February 17, 2012 letter, Avista will provide an update on the progress of the turbine removal and replacement by September 1, 2014.

Section 5.6: Dissolved Oxygen
The enclosed 2013 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report illustrates the seasonal changes in DO immediately downstream of Long Lake Dam during the low flow period of the year and summarizes the use of draft tube aeration to boost DO levels in the river below the dam's tailrace. Besides providing a full season of DO data below the dam, the report details the success of the aeration system which is installed on all four units. Avista plans to continue with the aeration program in 2014.

1411 East Mission Avenue
PO Box 3727 MSC-25
Spokane, Washington 99220-3727

800.727.9170
Facsimile 509.777.9516
www.avistautilities.com

With this, Avista is submitting the 2013 Long Lake Total Dissolved Gas Monitoring Report and the 2013 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report for your review and comment. We would like to receive any comments that you may have by March 28, 2014, which will allow us time to file the reports with FERC by April 15, 2014.

Please feel free to contact me at (509) 495-4643 if you have any questions or wish to discuss the reports.

Sincerely,

Meghan Lunney
Aquatic Resource Specialist

Enclosures (2)

cc: Patrick McGuire, Ecology

Spokane Tribal Natural Resources
P.O. Box 480 • Wellpinit, WA 99040 • (509) 626 - 4400 • fax 258 - 9600

3/28/2014

Megan Lunney
1411 East Mission Avenue
PO Box 3727 MSC-25
Spokane WA 99220

Dear Megan:

I have reviewed the 2013 dissolved oxygen, total dissolved gas and temperature monitoring reports with the assistance of DNR staff and would like to present various concerns. These reports focus on Long Lake Dam and its effect on dissolved oxygen, total dissolved gas and temperature. The standard at LLTR for dissolved oxygen is 8.0 mg/L and is not predicated upon whether power generation is occurring at Long Lake. This fact is obviously excluded from the discussion and the calculations. Figure 2-3 of the DO Report shows clearly that the DO was not at or above 8 mg/L 91 percent of the time. Table 2-5 of the same report fails to show where the 91% attainment is calculated from except the combined row at the bottom which includes dates when aeration was not occurring. The sum of the frequencies below 8 mg/L is 70% which appears to represent the concentrations in Figure 2-3. The minimum DO concentration "during generation is identified however the minimum during non-generation is not. Similar exclusions were in previous reports. The statements in section 3.2 are incorrect as to pertaining to "meeting the standard". I am requesting the appropriate reports be modified to address these exclusions.

Figure 2-5 suggests that regardless of aeration; turbine generation improves oxygen (Aug 1-6). An analysis and presentation of a daily cycle would be helpful to determine average daily increases from aeration and the extent of DO loss during non-generation and non-aeration.

Additional questions and evaluations should be made to understand the potential for cooling the water through the DO tubes and the alternatives to "normal" operations that might improve the DO sags when the turbines are off. For example, could one turbine remain on during the night at a lower level to keep oxygen from declining?

It was my understanding from talking to Avista staff that generation is not necessary at Long Lake to meet the 200-500 cfs minimum flow requirement at Little Falls during Lake Roosevelt drawdown. On page 5 it suggests that the flow dropped to approximately 90 cfs. How is the minimum flow met downstream during this period?

I have no significant comments on the Temperature or TDG Reports. Analysis of the air temperature being used by the DO aeration as well as the concept of variable depth withdrawals should be addressed. The Temperature Attainment Plan is broad in its scope but should be willing to approach such topics.

Sincerely,

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cc: Patrick McGuire, Dept. of Ecology
BJ Kieffer, Director Dept. of Natural Resources
Matt Wynne, Tribal Council

SPOKANE TRIBE COMMENTS AND AVISTA RESPONSES

The Spokane Tribe's March 28, 2014 letter did not provide comments on the 2013 Long Lake Total Dissolved Gas Monitoring Report. Therefore no responses were required.