AVISTA CORPORATION

2013

LONG LAKE HED

TEMPERATURE MONITORING REPORT

WASHINGTON 401 CERTIFICATION, SECTION 5.5

Spokane River Hydroelectric Project
FERC Project No. 2545

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List of Acronyms and Abbreviations

°C	degrees Celsius
7-DADM	7-day average daily maximum temperature
Avista	Avista Corporation
Certification	section 401 water quality certification
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
FERC	Federal Energy Regulatory Commission
Golder	Golder Associates Inc.
HED	hydroelectric development
LLFB	Long Lake Forebay monitoring station
LLTR	Long Lake HED tailwater monitoring station
m	meter(s)
Project	Avista's Spokane River Project
QAPP	Quality Assurance Project Plan
RM	River mile
Spokane Tribe	Spokane Tribe of Indians
TDG	total dissolved gas
Temperature WQAP	Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan
TP	Total Phosphorous
USFWS	United States Fish and Wildlife Service
WQM QAPP	Water Quality Monitoring and Quality Assurance Project Plan

1.0 INTRODUCTION

On June 18, 2009, the Federal Energy Regulatory Commission (FERC) issued a new license for the Spokane River Project (Project), FERC Project No. 2545 (FERC 2009a), which incorporated the Washington Department of Ecology (Ecology) Section 401 Water Quality Certification (Certification; Ecology 2009). In accordance with Section 5.10 and 5.5 of the Certification, Avista Corporation (Avista) developed the Water Quality Monitoring and Quality Assurance Project Plan (WQM QAPP; Avista 2009) and the Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan (Temperature WQAP; Avista 2011) in consultation with Ecology and the Spokane Tribe of Indians (Spokane Tribe). Avista filed the Ecology-approved WQM QAPP with FERC on August 13, 2009 and FERC approved it with modification on September 17, 2009 (FERC 2009b). Avista filed the Ecology-approved Temperature WQAP with FERC on January 26, 2011. On May 10, 2011, FERC (2011) issued an order approving and amending the 2009 WQM QAPP, pursuant to Article 401(A)(12) of the license.

As part of the Temperature WQAP, Avista is required to provide an annual summary report of the available temperature water quality monitoring results to Ecology by March 1 on an annual basis. This report summarizes temperature monitoring conducted for Long Lake Hydroelectric Development (HED) during the 2013 calendar year. The record of consultation with Ecology and the Spokane Tribe is provided in Appendix A. Previous reports summarized Long Lake HED temperature data collected in 2010 and 2011 (Golder 2012) and in 2012 (Golder 2013).

2.0 MONITORING ACTIVITIES

2.1 Objectives

The overall objectives of the Temperature WQAP Monitoring Report are to:

- Document monitoring periods
- Summarize temperature monitoring results
- Document compliance with the applicable water quality standards
- Describe any proposed changes to the Temperature WQAP and WQM QAPP

In addition to the above objectives we have included information pertaining to the Spokane Tribe's water quality standards in regards to waters downstream of the Project.

2.2 Monitoring Locations and Periods

Water temperature data that are included in annual summary reports are from a number of water quality monitoring programs as described in the Temperature WQAP (Avista 2011). This report presents temperatures obtained as a component of monitoring programs focused on Spokane River water quality (Ecology 2013a, 2013b), Lake Spokane water quality (Ecology 2013c), total dissolved gas (TDG)

(Golder 2014a), and Long Lake HED tailwater dissolved oxygen (Golder 2014b). Additional temperature data related to studies outside the scope of the Temperature WQAP are available upon request.

2.2.1 Lake Spokane

Temperature monitoring was conducted at two river stations upstream of Lake Spokane (inflow stations), six stations within Lake Spokane, and one station in the forebay just above Long Lake Dam (Table 2-1 and Figure 2-1). These monitoring efforts are described in more detail below.

2.2.1.1 Inflow Stations

Ecology has monitored temperature along with other water quality parameters in the Spokane River and Little Spokane River a short distance upstream of its confluence with Lake Spokane. This was done under Ecology's River and Stream Water Quality Ambient Monitoring Program, which included monthly monitoring October through September, the water year. Ecology's sampling efforts at these two stations was conducted in accordance with the Stream Ambient Monitoring QAPP (Ecology 2003). Preliminary data for the Spokane River at Nine Mile Bridge station (54A090) and Little Spokane River near Mouth station (55B070) located on the Little Spokane River at River Mile (RM) 1.1 were downloaded on December 18, 2013.

2.2.1.2 Within Lake Spokane

In 2013, Avista monitored temperature and other water quality through implementation of the Lake Spokane nutrient monitoring program, which it had collaboratively implemented with Ecology in 2010, 2011, and soley implemented in 2012. This program included one sampling event in May and October, and two sampling events per month, in June through September, in order to provide baseline data. All sampling was completed in accordance with the Ecology-approved QAPP for Lake Spokane Nutrient Monitoring.[1] Sampling was conducted at the six Lake Spokane monitoring stations described in Table 2-1 and from upstream to downstream are:

- LL5, at approximately RM 54.20
- LL4, at approximately RM 51.47
- LL3, at approximately RM 46.42
- LL2, at approximately RM 42.06
- LL1, at approximately RM 37.62
- LL0, at approximately RM 32.66

[1] The current QAPP (Ecology 2010) as supplemented by its addendum (Lunney and Plotnikoff 2012), which was approved by Ecology on July 16, 2012 (Ross 2012).

2.2.1.3 Long Lake HED Forebay

Avista monitored temperature at the Long Lake Forebay (LLFB) near elevation 1,499 feet, which is the centerline for the powerhouse intake that extends from an elevation of 1,491 to 1,507 feet. All monitoring was conducted in accordance with Avista's Detailed Dissolved Oxygen (DO) Phase II Feasibility and Implementation Plan (Avista 2010) and TDG Monitoring Plan (Golder 2010).[2] These two plans have separate seasonal monitoring timeframes; however both programs collect water temperature, TDG, and DO concentrations utilizing identical monitoring equipment. The quality control protocols for these two monitoring programs are described in each of the plans (Avista 2010; Golder 2010).

2.2.2 Long Lake Dam Tailrace

Both Avista and Ecology have monitored Spokane River temperatures below Long Lake HED in the past, although no temperature data were available from Ecology at its 54A070 station on December 18, 2013 (Ecology 2014). Avista's monitoring programs are described in more detail below.

2.2.2.1 Avista Monitoring

Specific to the Long Lake Dam tailrace waters, Avista monitored temperature at a station 0.6 miles downstream of the Long Lake Dam (LLTR). This was conducted in accordance with the same monitoring protocols followed for the LLFB monitoring efforts.

2.3 Temperature Numeric Criteria

The Washington state numeric temperature criterion that applies to Lake Spokane and the Long Lake HED tailrace (WAC 173-201A-602, WRIA 54 Notes 1, 2, and 3) limits 1-day maximum temperature to no more than 20.0 degrees Celsius (°C) due to human activities.[3]

The numeric temperature criteria for the Spokane Tribe, whose reservation is located downstream of the Project, are applicable from the upstream Spokane Indian Reservation boundary (approximately RM 32.7) to the mouth of the Spokane River (RM 0). For reference, the upstream boundary of the Spokane Indian Reservation is located approximately 1.2 miles downstream of Long Lake Dam and approximately 0.6 miles downstream of the Avista and Ecology monitoring stations located below the dam. The Spokane River temperature criteria are the Class A 7-day average daily maximum temperature (7-DADM) criteria. The 7-DADM is calculated as the arithmetic average of seven consecutive measures of daily maximum temperatures, with the 7-DADM for any individual day calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days before and the three days after that date. The maximum allowable limit (7-DADM) for the Spokane River varies throughout the year as described below (Spokane Tribe 2003).

[2] Avista obtained FERC approval of the Detailed Dissolved Oxygen Phase II Feasibility and Implementation Plan and TDG Monitoring Plan in December 2010 (FERC 2010a, 2010b).
[3] In addition, water temperature shall not be increased by greater than 0.3°C when natural conditions exceed 20.0°C.

- 18.5°C between June 1 and August 31
- 13.5°C between September 1 and September 30
- 11°C between October 1 and March 31
- 13.5°C between April 1 and May 31

3.0 RESULTS

Results of the temperature monitoring in 2013 are discussed below by monitoring location along with a comparison to the applicable Washington State water quality criteria.

In addition, the Discussion in Section 5.0, presents a comparison of the temperature results for the monitoring location below Long Lake Dam with the corresponding Spokane Tribe water quality criteria.

3.1.1 Lake Spokane

Lake Spokane water temperature was monitored at nine locations: Ecology's Spokane River at Nine Mile Bridge station (54A090), Ecology's Little Spokane River station (55B070), LL5, LL4, LL3, LL2, LL1, LL0, and LLFB.

3.1.1.1 Inflow Stations

Ecology's Spokane River at Nine Mile Bridge station (54A090) was monitored monthly from February through October. Water temperatures during this timeframe ranged from 5.3°C in February and March to 19.4°C in July (Table 3-1). All monitored water temperatures were less than the 20.0°C Washington State criterion.

Ecology's Little Spokane River station, 55B070, was monitored monthly from January through October, although temperature was not reported for July. Water temperatures during this timeframe ranged from 5.9°C in January to 16.5°C in August (Table 3-2). All monitored water temperatures were less than the 20.0°C Washington State criterion.

3.1.1.2 Within Lake Spokane

Vertical profiles of water temperatures were monitored at the six Lake Spokane sampling stations in 2013. The frequency of monitoring in 2013 was once in May; twice in the months of June, July, August, and September; and once in October. Results for each of the six lake stations are described below in order from upstream to downstream.

LL5

LL5 water temperature measurements were conducted near the surface, at 0.5 meter (m), and at 1-m intervals from 1 to 6 m below the water surface. The warming pattern observed from May through late July was interrupted by a very large storm event in early August that increased river inflows and resulted in August 6 temperatures varying by only 0.5°C throughout the water column. The surface temperature

was more than 3°C cooler than the previous and following monitoring periods. With the exception of three monitoring events (July 25, August 21, and September 12), thermal stratification did not occur at this station, as indicated by the vertical profiles in which temperature varied less than 1°C throughout the entire water column (Table 3-3). The results of the three dates showing thermal stratification indicate the thermocline was at 2.5 m on July 25 and August 21, and was at 1.5 m on September 12. (Table 3-3).[4] Seven LL5 temperature measurements were greater than the 20.0°C Washington State criterion; these values occurred down to 2 m on July 25 and August 21, and at a 0.5 m on September 12 (Table 3-3).

LL4

LL4 temperature measurements were taken at 0.5 m and at 1-m intervals from 1 m to 8 m below the water surface. The maximum temperature change rate was greater than 1°C/m for the vertical temperature profiles in July through September (Table 3-4), but had virtually no stratification in May, June, and October. These results indicate the thermocline was between 3.5 m and 5.5 m with the thermocline at its deepest in late August. Twenty-seven of the temperature measurements were greater than the 20.0°C Washington State criterion; all of these occurred down to 4 m on July 10, July 25, and September 10; and down to 5 m on August 6 and 21 (Table 3-4).

LL3

LL3 temperature measurements were taken at 0.5 m, at 1-m intervals from 1 m to 10 m, and at 12, 15, 18 and 19 m below the water surface. Vertical temperature profiles for May, early August, early September, and October had temperature change rates 1°C/m or less (Table 3-5). All remaining periods had temperature change rates greater than 1°C/m. In early June and late September, the maximum temperature change was deep (i.e., 18.5 m on June 12 and 11 m on September 25). These results are provided in Table 3-5. The thermocline had become established at a depth of 3.5 m by late June and extended to a depth of 5.5 m by late July when the intense storm disrupted the extent of thermal stratification. Following the August storm, the thermocline resided at a depth of 5.5 m to 6.5 m. Thirty-eight of the temperature measurements were greater than the 20.0°C Washington State criterion; these values occurred down to 6 m on July 10, 7 m on July 25 and August 21, 8 m on August 6, and 5 m on September 10 (Table 3-5).

LL2

LL2 temperature measurements were taken at 0.5 m, 1-m intervals from 1 m to 10 m, 3-m intervals from 12 m to 24 m, and at either 25 m or 26 m below the water surface. Vertical temperature profiles had maximum temperature change rates greater than 1°C/m in mid-May and between early July and early September (Table 3-6). The thermocline was at a depth of 3.5 m on July 9 and became deeper

[4] Thermocline depths are presented as the mid-point between depths of temperature measurements with the greatest change in temperature per meter.

throughout the summer reaching 6.5 m in late August and early September. Thirty-nine temperature measurements were greater than the 20.0°C Washington State criterion; these values occurred at a depth of 0.5 m on June 11; down to 6 m on July 9 and September 9; and down to 7 m on July 24, August 5, and August 20 (Table 3-6).

LL1

LL1 temperature measurements were taken at 0.5 m, 1-m intervals from 1 m to 10 m, 3-m intervals from 12 m to 33 m, and at 34 m below the water surface. Vertical temperature profiles had temperature change rates greater than 1°C/m for early July through early September (Table 3-7). The thermocline was at a depth of 3.5 m on July 9 and ranged from 5.5 m to 6.5 m into early September. Thirty-six temperature measurements were greater than the 20.0°C Washington State criterion; these occurred down to 6 m on July 9, August 5, and September 9; down to 8 m on July 24; and down to 5 m on August 20 (Table 3-7).

LL0

LL0 temperature measurements were taken at 0.5 m, 1-m intervals from 1 m to 10 m, and at 3-m intervals from 12 m to 45 m, and at 47, 48, and 49 m below the water surface. Only four of the LL0 vertical temperature profiles had maximum temperature change rates greater than 1°C/m. These values indicate that thermal stratification was not as strong at LL0 as at LL1 and LL2. Thirty-six temperature measurements were greater than the 20.0°C Washington State criterion; these values occurred down to 7 m on July 9, July 24, and August 5; down to 6 m on August 20; and down to 4 m on September 9 (Table 3-8).

Lake Station Temperature Profile Comparisons

Comparison of the 2013 temperature profiles for the six sampling stations during late June, July, August, and September are displayed in Figures 3-1 through 3-4, respectively. In late June, very similar thermal stratification occurred at the four downstream stations (LL3 through LL0) (Figure 3-1). By late July, thermal stratification was more intense and temperature exceeded 20.0°C near the surface at all lake stations (LL5 through LL0), and the station furthest upstream (LL5) had cooler temperatures than the other five stations (Figure 3-2). In late August, all stations recorded temperatures exceeding 20.0°C near the surface (Figure 3-3). The thermocline was similar at LL3, LL2, and LL1 at a depth of approximately 5.5 m to 6.5 m while the thermocline at the furthest downstream site (LL0) had begun to breakdown. By late September the surface temperature had cooled by more than 5°C and was less than 20.0°C (Figure 3-4). In addition, there was substantial cooling throughout the rest of the upper 20 m of the water column.

3.1.1.3 Long Lake HED Forebay

LLFB, Avista's Long Lake Dam Forebay station, is located between the HED's Unit 3 and 4 intakes. LLFB temperature data were collected in 15-minute intervals from June 18 through June 30 as part of the Washington Total Dissolved Gas Monitoring Plan and from July 1 to November 1 as part of the Detailed DO Phase II Feasibility and Implementation Plan (Figure 3-5). Daily maximum water temperatures for LLFB data ranged from 11.5°C[5] in late October to 25.0°C on July 23 (Table 3-9). Temperature measurements greater than the 20.0°C Washington State criterion occurred on 57 days, which occurred between June 28 and September 5 (Table 3-9). Water temperature variability at station LLFB is likely primarily due to the complex dynamics of hydraulics in the forebay intake area.

3.1.2 Long Lake Dam Tailrace

Long Lake Dam tailrace water temperature was monitored at Avista's Long Lake Dam Tailrace station, LLTR. LLTR temperature data were collected in 15-minute intervals from March 25 through June 30 as part of the Washington Total Dissolved Gas Monitoring Plan and from July 1 to November 1 as part of the Detailed DO Phase II Feasibility and Implementation Plan (Figure 3-6). Daily maximum water temperatures ranged from 5.8°C in late March to 20.4°C in mid-August (Table 3-10). A temperature of greater than the 20.0°C Washington State criterion occurred on 13 days, which were between July 16 and August 15.

Data for Ecology's Spokane River at Long Lake station (54A070) during 2013 was unavailable online as of February 15, 2014.

4.0 SCHEDULE

Avista has prepared, obtained approval, and implemented the Temperature WQAP and WQM QAPP along with other plans that have the potential to alter Lake Spokane temperatures, nutrients, and DO. Actions completed are summarized below.

- **WQM QAPP** - Prepared WQM QAPP (Avista 2009) in consultation with Ecology and the Spokane Tribe of Indians (Spokane Tribe). Approval of this plan was obtained from Ecology on August 13, 2009 and from FERC with modification on September 17, 2009 (FERC 2009b).
- **Temperature WQAP** - Prepared the Temperature WQAP (Avista 2011) in consultation with Ecology and the Spokane Tribe. Approval of this plan was obtained from Ecology on January 25, 2011 and from FERC (2011) on May 10, 2011 in an order approving and amending the 2009 WQM QAPP, pursuant to Article 401(A)(12).
- **Lake Spokane DO WQAP** – Avista prepared the Lake Spokane DO Water Quality Attainment Plan (DO WQAP; Avista and Golder 2012), which discussed nine feasible potential measures to improve DO conditions. Approval of the DO WQAP was obtained from Ecology on September 27, 2012 and from FERC on December 19, 2012

[5]The 11.4°C daily maximum value for November 1 is not representative of the true maximum for the day, since temperature monitoring was terminated for the season that morning.

(FERC 2012). Avista initiated the DO WQAP and summarized the actions conducted in 2013 in the DO WQAP 2013 Annual Summary Report (Avista 2014).

- **Cold Water Fish Habitat Evaluation** – Under contract to Avista, Tetra Tech evaluated the combined threat of warm temperatures and low DO within Lake Spokane to cold water species using monitoring results for baseline data with temperature and DO that are within the optimum ranges for growth of rainbow trout (Section 4.1.1 of TetraTech 2014).[6] The results of this analysis indicated that rainbow trout would probably avoid the warm epilimnion, which approaches 25°C, during most of the summer and prefer to seek cooler water deeper than 10 m. Applying the combination of temperature and DO preferences, suggests that rainbow trout are not severely limited by DO and are most likely inhabiting cooler water in metalimnion and upper portions of the hypolimnion. Additionally, the habitat volumes for temperature and DO together, as well as separately, were shown to indicate which factor was most limiting and indicated that temperature restricts habitat far more than DO for this species and at all sites.

- **Native Tree Plantings on Avista Shoreline Property -** Avista and the Stevens County Conservation District planted 300 trees consisting of native cottonwoods and willows along Lake Spokane's northern shoreline on Avista-owned property in April 2013. Once mature, the trees will help reduce water temperature and improve habitat along the lake shoreline. One of the areas planted consists of a very steep sandy slope. The trees in this location are also expected to reduce any natural sloughing of sediment, which may contain total phosphorous (TP), into the river.

- **Hangman Creek Basin Shoreline Stabilization and Agricultural Practices -** Avista continues to track plans and progress addressing erosion control in the Hangman Creek Basin by participating in meetings, including the Spokane Conservation District's Hangman Creek Bi-State Watershed Project and Ecology's Spokane River and Lake Spokane DO TMDL Advisory Committee meetings. During these meetings water quality and sediment loading concerns are discussed by a variety of stakeholders including lake associations, tribes, point-source entities, and local and state agencies.

  In addition, Avista and the Coeur d'Alene Tribe have acquired approximately 656 acres of farmland with straightened creek beds on upper Hangman Creek through implementation of one of Avista's Spokane River license Wetland Mitigation requirements. Site-specific wetland management plans are currently being developed for these properties and include establishing long-term, self-sustaining native emergent, scrub-shrub and/or forested wetlands, riparian habitat and associated uplands, through preservation, restoration and enhancement activities.

- **Wetland Restoration/Enhancement -** Avista has acquired a 109-acre parcel on the Little Spokane River, the Sacheen Springs property, to fulfill its 42.51 acre wetland mitigation requirement identified in Section 5.3.G of the Certification. This property contains over one-half mile of frontage along the West Branch of the Little Spokane River that contains a highly valuable wetland complex with approximately 59 acres of emergent, scrub-shrub and forested wetlands and approximately 50 acres of adjacent upland forested buffer. Several seeps, springs, perennial and annual creeks are also found on the property. The property was purchased "in fee" and Avista will pursue a conservation easement in order to protect the property in perpetuity. Avista is in the process of developing a detailed site-specific wetland management plan for the property.

- **Land Protection** - Avista has identified approximately 215 acres of land that is currently used for grazing under lease from the Washington State Department of Natural Resources (DNR). This land is located within the south half of Section 16 in Township 27 North, Rand 40 E.W. M. in Stevens County. In 2013 Avista began pursuing leasing the

[6] This habitat analysis was based on a maximum of the optimum temperature for growth of 18°C and minimum DO of 6.0 mg/L for rainbow trout (USFWS 1984).

215 acres of land from DNR with the intent of placing the land in conservation use, and thereby eliminating grazing activities for the term of its License.

In addition, Avista owns over 350 acres, located within 200 feet of the Lake Spokane shoreline at the downstream end of the reservoir. During 2013 Avista continued to protect these lands, which also serve as a buffer adjacent to other undeveloped Avista land.

- **Bulkhead Removal** - During 2012, Avista partnered with Ecology, the Spokane County Conservation District, and the Stevens County Conservation District through an Ecology grant to identify two to five homeowners and encourage them to convert their bulkheads to more naturalized shorelines. Progress to date includes the removal of an approximate 90 foot bulkhead located at the Staggs parcel in Spokane County and replacement of the bulkhead with a more naturalized shoreline.[7] In addition, a design for an additional bulkhead removal project on an Avista-owned shoreline parcel in Stevens County was initiated during 2013.
- **Carp Population Reduction Program –** In 2013, Avista contracted Golder to assist in conducting the Lake Spokane Carp Population Abundance and Distribution Study to investigate whether a carp population reduction program would improve water quality in Lake Spokane. The goals for this study are to better understand carp population abundance, distribution, and habitat use, as well as to help define a carp population reduction program that may benefit Lake Spokane water quality. The activities and results for study components conducted in 2013 are documented in the 2013 annual report for this study (Golder 2014c).

With the exception of the native tree plantings on Avista's shoreline property and the potential carp population reduction program, goals for these potential reasonable and feasible measures are primarily related to improving DO in the lake. Avista will continue to coordinate implementation of measures to improve water quality with the ultimate goal of enhancing cold water fish habitat. The list below summarizes Avista's planned actions for this goal.

- **Temperature WQAP** – Avista will provide annual reports summarizing water temperature data for the Long Lake HED in accordance to the approved Temperature WQAP and WQ QAPP and WQM QAPP.
- **Baseline Sampling** – In accordance with the FERC-approved schedule for implementation of the DO WQAP, Avista will continue to conduct baseline monitoring in 2014, 2015, and 2016. Then Avista will work with Ecology to define future monitoring goals for the lake.
- **Long Lake HED Turbine Aeration and Tailrace DO Monitoring** – Avista will refine implementation of turbine aeration, based on real-time water quality measurements that are monitored 0.6 miles downstream of Long Lake Dam from July 1 through October 30. Avista also will continue to coordinate results with the DO TMDL efforts, and evaluate the need for additional DO enhancement measures in accordance with the FERC-approved schedule (FERC 2010a).
- **Long Lake Dam TDG Abatement and Monitoring** – Avista will conduct Phase IV through VII TDG abatement measures. In 2014, this will include formulating the design, awarding construction, and obtaining permits for the preferred alternative for Long Lake HED TDG abatement. Construction of the structural modifications is expected to occur in 2015 through 2016. Following construction, the performance of the structural

[7] A time-lapse video produced by the Staggs features the bulkhead removal project is available for viewing at the following website: http://www.youtube.com/watch?v=luT0RZShJoY.

modifications will be tested and a spillgate protocol will be defined in 2017 through 2018. In 2017 through 2019, Avista will conduct monitoring to confirm effectiveness of the constructed structural modifications and spillgate operations and prepare annual monitoring reports.

- **Cold Water Fish Habitat Evaluation** - Avista will meet with Ecology and the Washington Department of Fish and Wildlife (WDFW) to discuss the cold water fish habitat available in Lake Spokane.
- **Lake Spokane DO WQAP and other Parallel Implementation Measures** – Avista will implement mitigation measures as proposed in the previous year's Annual Summary Report. In 2014, this will include continuing to conduct the Lake Spokane Carp Population Abundance and Distribution Study, which will result in a recommendation as to whether reducing Lake Spokane's carp population is a reasonable and feasible measure to increase Lake Spokane DO.

5.0 DISCUSSION

5.1 Lake Spokane

Temperature profile monitoring conducted during 2013 indicated that the 20.0°C Washington State criterion was exceeded in July, August, and September at all six within lake stations.[8] Exceedances of 20.0°C within the lake occurred to depths of 8 m in July and August, and depths of 6 m in September. At the Long Lake forebay station, the criterion was also exceeded during 3 days in June, 31 days in July, 18 days in August, and 5 days in September. Measurements at both the Spokane River at Nine Mile Bridge station and Little Spokane River station did not exceed the 20.0°C criterion.

The exceedances reported for Lake Spokane during 2013 are indicative of the natural stratification process typical of eastern Washington and northern Idaho lakes during the summer season. Avista however is continuing to pursue reasonable and feasible mitigation measures in accordance with its Ecology-approved Temperature WQAP and Lake Spokane DO WQAP that may have positive localized effects on temperature within the lake.

5.2 Long Lake Dam Tailrace

During 2013, temperature measurements at the Avista monitoring station, LLTR, located downstream of the Long Lake Dam exceeded the 20.0°C Washington State criterion on 13 days in July and August (Table 3-10).

Monitoring results indicate the Spokane Tribe's 7-DADM criteria established for tribal waters were exceeded May 14 through May 31 along with July 4 through October 29 (Table 4-1, Figure 4-1). It is important to note the monitoring station from which 2013 temperature data was collected is located approximately 0.6 miles upstream from the reservation boundary, where the Tribe's criteria is applicable.

[8]The only other exceedance of 20.0°C for the 2013 temperature profiles was the June 11, 2013 surface, 0.5 m depth, temperature for LL2, which was 20.1°C.

As part of a Memorandum of Agreement, Avista provides the Spokane Tribe with funds to complete water quality improvements to help address temperature exceedances along with other water quality improvement needs downstream of the Project. To date, the Spokane Tribe has planted trees and completed stream stabilization efforts in the Chamokane Creek watershed to reduce surface water temperatures. Avista and the Spokane Tribe will continue working together in the future to improve water quality within the reservation. These projects relate to DO, TDG, and temperature within the reservation.

6.0 PROPOSED CHANGES TO THE TEMPERATURE WQAP AND WQM QAPP

There are no proposed changes to the Temperature WQAP or amended WQM QAPP.

Avista will not be monitoring water quality at LLTR, LLGEN, or LLFB for the high-flow season (typically March/April through June) of 2014 through 2016, during the Long Lake Dam spillway modification project for TDG abatement. This past monitoring has indicated the only exceedances of the 20.0°C criterion occurred at LLFB on the last three days of June in 2013, and the maximum temperature for LLTR was 17.7°C (Golder 2012, 2013; Tables 3-9 and 3-10). Since Avista will deploy instruments at LLFB and LLTR in late June of 2014 for the Long Lake HED Tailrace DO monitoring season, the absence of temperature data from the high-flow season is not expected to impact collection of critical temperature data.

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TABLES

Table 2-1: Long Lake HED Temperature Monitoring Stations and Periods

Monitoring Station	Location	NAD83 Decimal Degrees		2013 Monitoring Year	
		Latitude	Longitude	Start	End
54A090	Spokane River at Nine mile Bridge approximately 0.2 miles downstream of Nine Mile Dam, at river mile (RM) 58	47.7767	117.5448	2/6/2013	10/15/2013
55B070	On the Little Spokane River approximately 1.5 miles upstream from its confluence with Lake Spokane, at RM 1.1	47.7829	117.5305	1/9/2013	10/15/2013
LL5	Long Lake sampling site 5, at RM 54.20	47.7985	117.5692	5/14/2013	10/15/2013
LL4	Long Lake sampling site 4, at RM 51.47	47.8137	117.6106	5/14/2013	10/15/2013
LL3	Long Lake sampling site 3, at RM 46.42	47.8641	117.6668	5/14/2013	10/15/2013
LL2	Long Lake sampling site 2, at RM 42.06	47.8636	117.7014	5/13/2013	10/14/2013
LL1	Long Lake sampling site 1, at RM 37.62	47.8305	117.7612	5/13/2013	10/14/2013
LL0	Long Lake sampling site 0, at RM 32.66	47.8339	117.8349	5/13/2013	10/14/2013
LLFB	Long Lake Forebay between Unit 3 and 4 intakes.	47.8367	117.8397	6/18/2013	11/1/2013
LLTR	On left downstream bank, at water pump house approximately 0.6 mile downstream from Long Lake Dam.	47.8375	117.8503	3/25/2013	11/1/2013
54A070	Approximately 0.6 mile downstream of Long Lake Dam, at the Highway 231 Bridge and RM 33.3.	47.8391	117.8525	Not Available	

Table 3-1: Spokane River at Nine Mile Bridge (54A090) Temperature Monitored in 2013

Date	Maximum Daily Water Temperature (°C)
2/6/2013	5.3
3/6/2013	5.3
4/3/2013	7.2
5/8/2013	12.3
6/5/2013	18.2
7/10/2013	19.4
8/8/2013	18.7
9/11/2013	16.9
10/15/2013	11.5

Notes:

On December 18, 2013, downloaded data from Ecology's website: http://www.ecy.wa.gov/apps/watersheds/riv/station.asp?theyear=&tab=final_data&scrolly=323&wria=54&sta=54A090

The 20.0°C criterion was not exceeded at this monitoring location in 2013.

Table 3-2: Little Spokane River Upstream of Lake Spokane (55B070) Temperature Monitored in 2013

Date	Maximum Daily Water Temperature (°C)
1/9/2013	5.9
2/6/2013	6.6
3/6/2013	6.1
4/3/2013	11.2
5/8/2013	15.8
6/5/2013	16.4
7/10/2013	no value reported
8/8/2013	16.5
9/11/2013	14.9
10/15/2013	10.5

Notes:

On December 18, 2013, downloaded data from Ecology's website: http://www.ecy.wa.gov/apps/watersheds/riv/station.asp?theyear=&tab=final_data&scrolly=0&wria=55&sta=55B070

The 20.0°C criterion was not exceeded at this monitoring location in 2013.

Table 3-3: LL5 Temperature Vertical Profiles in 2013

Depth (meters)	Water Temperature (°C)									
	5/14/2013	6/12/2013	6/26/2013	7/10/2013	7/25/2013	8/6/2013	8/21/2013	9/12/2013	9/25/2013	10/15/2013
0.5	14.1	15.9	16.2	18.8	**24.2**	19.5	**23.0**	**21.1**	13.1	10.2
1.0	14.1	15.9	16.2	18.3	**23.7**	19.3	**22.9**	19.4	13.1	10.2
2.0	14.1	15.9	16.1	18.1	**23.5**	19.3	**20.6**	15.8	13.0	10.2
3.0	14.1	15.9	16.1	18.2	18.4	19.3	17.4	15.8	13.0	10.2
4.0	14.1	15.9	16.1	18.0	18.1	19.2	16.5	15.7	13.0	10.2
5.0	14.1	15.9	16.1	18.0	18.1	19.2	16.5	15.7	13.0	10.2
6.0						19.0				
Max Change (°C/m)[1]	0.0	0.0	0.1	1.0	5.1	0.3	3.2	3.6	0.1	0.0
Depth of Max Change (m)[2,3]	N/A	N/A	3.50	0.75	2.50	0.75	2.50	1.50	0.75	N/A

Notes:

Data downloaded from Ecology's EIM database on December 17, 21013:
https://fortress.wa.gov/ecy/eimreporting/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&StudyUserId=LKSpokaneNutrient_WQ&StudyUserIdSearchType=Contains&StudyName=Lake+Spokane+Nutrients+Monitoring&StudyNameSearchType=Contains

Does not include results from field duplicates.

Shaded and bold values indicate an exceedance of the 20.0°C criterion.

1. The change in °C per meter of depth was calculated for each pair of adjacent measurement intervals in the table. This value represents the maximum value of the calculated change in °C per one meter of depth for each pair of adjacent measurement intervals.
2. Depth of Max Change (m) = the shallowest depth where the greatest temperature gradient occurs.
3. N/A = not applicable (dates with 0.0°C max change)

Table 3-4: LL4 Temperature Vertical Profiles in 2013

Depth (meters)	Water Temperature (°C)									
	5/14/2013	6/12/2013	6/26/2013	7/10/2013	7/25/2013	8/6/2013	8/21/2013	9/10/2013	9/25/2013	10/15/2013
0.5	14.2	17.3	16.7	**24.0**	**25.0**	**23.9**	**23.8**	**21.6**	17.2	10.6
1.0	14.2	17.1	16.5	**24.0**	**24.9**	**23.9**	**23.8**	**21.6**	17.1	10.6
2.0	14.2	16.9	16.4	**23.8**	**24.8**	**23.8**	**23.7**	**21.6**	17.1	10.6
3.0	14.2	16.9	16.4	**22.7**	**24.5**	**23.7**	**23.7**	**21.4**	17.1	10.6
4.0	14.2	16.8	16.4	**20.8**	**23.6**	**22.6**	**23.6**	**20.4**	16.0	10.6
5.0	14.2	16.9	16.4	19.3	20.0	**20.7**	**22.3**	17.3	13.5	10.6
6.0	14.2	16.8	16.4	19.1	18.2	19.5	17.6	15.6	13.4	10.6
7.0	14.2	16.8	16.4	19.0	18.1	19.1	17.2	15.6	13.4	10.6
8.0	14.2	16.8	16.4	18.9	18.1	19.1	17.2	15.6	13.4	10.6
Max Change (°C/m)[1]	0.0	0.5	0.4	1.9	3.6	1.9	4.8	3.1	2.5	0.0
Depth of Max Change (m)[2,3]	N/A	0.75	0.75	3.50	4.50	4.50	5.50	4.50	4.50	N/A

Notes:

Data downloaded from Ecology's EIM database on December 17, 21013:
https://fortress.wa.gov/ecy/eimreporting/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&StudyUserId=LKSpokaneNutrient_WQ&StudyUserIdSearchType=Contains&StudyName=Lake+Spokane+Nutrients+Monitoring&StudyNameSearchType=Contains

Does not include results from field duplicates.

Shaded and bold values indicate an exceedance of the 20.0°C criterion.

1. The change in °C per meter of depth was calculated for each pair of adjacent measurement intervals in the table. This value represents the maximum value of the calculated change in °C per one meter of depth for each pair of adjacent measurement intervals.

2. Depth of Max Change (m) = the shallowest depth where the greatest temperature gradient occurs.

3. N/A = not applicable (dates with 0.0C max change)

Table 3-5: LL3 Temperature Vertical Profiles in 2013

Depth (meters)	Water Temperature (°C)									
	5/14/2013	6/12/2013	6/26/2013	7/10/2013	7/25/2013	8/6/2013	8/21/2013	9/10/2013	9/25/2013	10/15/2013
0.5	15.0	19.4	19.7	**23.8**	**25.1**	**23.7**	**23.6**	**21.7**	18.3	13.1
1.0	14.9	19.4	19.7	**23.8**	**25.0**	**23.7**	**23.6**	**21.7**	18.4	13.2
2.0	14.9	19.4	19.6	**23.7**	**25.0**	**23.7**	**23.6**	**21.6**	18.4	13.2
3.0	14.9	19.1	19.4	**23.2**	**25.0**	**23.4**	**23.5**	**21.6**	18.4	13.2
4.0	14.9	18.5	18.3	**22.3**	**23.7**	**22.8**	**23.5**	**21.4**	18.4	13.3
5.0	14.9	18.0	18.1	**20.7**	**22.5**	**22.3**	**23.3**	**20.4**	18.4	13.3
6.0	14.9	17.9	17.5	**20.2**	**21.1**	**21.6**	**22.0**	19.4	18.4	13.0
7.0	14.8	17.8	17.4	19.9	**20.4**	**20.9**	**20.3**	18.8	18.4	12.8
8.0	14.8	17.8	17.0	19.7	19.5	**20.4**	19.4	18.6	18.4	12.8
9.0	14.8	17.8	16.7	19.6	19.2	19.7	19.0	18.0	18.1	12.6
10.0	14.8	17.7	16.7	19.5	18.8	19.4	18.4	17.8	17.8	12.2
12.0	14.8	17.6	16.6	18.9	18.5	18.6	18.0	16.5	15.0	11.9
15.0	14.8	17.2	16.5	17.4	18.4	17.5	17.9	15.7	14.6	11.6
18.0	14.8	16.8	16.5	16.5	18.2	16.5	17.8	15.6	14.1	11.3
19.0	14.8	15.5	16.5		17.5					
Max Change (°C/m)[1]	0.1	1.4	1.1	1.6	1.4	0.7	1.7	1.0	1.4	0.4
Depth of Max Change (m)[2]	0.75	18.50	3.50	4.50	5.50	6.50	6.50	5.50	11.00	9.50

Notes:

Data downloaded from Ecology's EIM database on December 17, 21013:
https://fortress.wa.gov/ecy/eimreporting/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&StudyUserId=LKSpokaneNutrient_WQ&StudyUserIdSearchType=Contains&StudyName=Lake+Spokane+Nutrients+Monitoring&StudyNameSearchType=Contains

Does not include results from field duplicates.

Shaded and bold values indicate an exceedance of the 20.0°C criterion.

1. The change in °C per meter of depth was calculated for each pair of adjacent measurement intervals in the table. This value represents the maximum value of the calculated change in °C per one meter of depth for each pair of adjacent measurement intervals.

2. Depth of Max Change (m) = the shallowest depth where the greatest temperature gradient occurs.

Table 3-6: LL2 Temperature Vertical Profiles in 2013

Depth (meters)	Water Temperature (°C)									
	5/13/2013	6/11/2013	6/25/2013	7/9/2013	7/24/2013	8/5/2013	8/20/2013	9/9/2013	9/24/2013	10/14/2013
0.5	15.3	**20.1**	19.4	**25.0**	**25.1**	**24.2**	**23.9**	**21.7**	18.4	14.1
1.0	15.3	20.0	19.1	**24.4**	**25.0**	**23.7**	**23.9**	**21.7**	18.4	14.0
2.0	15.3	20.0	18.9	**24.1**	**24.7**	**23.5**	**23.7**	**21.7**	18.3	13.9
3.0	15.2	19.9	18.9	**23.9**	**24.7**	**23.4**	**23.5**	**21.5**	18.3	13.8
4.0	15.1	19.3	18.8	**21.4**	**24.5**	**23.2**	**23.5**	**21.3**	18.3	13.8
5.0	15.1	18.5	18.3	**20.8**	**23.9**	**22.1**	**23.3**	**21.3**	18.3	13.7
6.0	15.0	18.1	18.0	**20.3**	**21.2**	**21.0**	**22.9**	**21.3**	18.3	13.7
7.0	14.9	17.3	17.6	19.9	**20.2**	**20.1**	**20.6**	19.5	18.3	13.7
8.0	14.9	17.1	17.5	19.6	19.8	19.5	19.6	18.7	18.3	13.7
9.0	14.9	17.1	17.2	19.3	19.3	19.3	19.1	18.2	18.3	13.7
10.0	14.8	16.9	16.8	19.0	19.1	18.9	18.8	17.9	18.3	13.7
12.0	14.4	16.2	16.3	18.5	18.8	18.6	18.4	17.4	18.1	13.7
15.0	13.7	14.6	16.1	17.4	18.5	17.8	18.1	17.0	16.6	13.0
18.0	13.0	14.1	16.0	16.8	17.8	16.7	17.9	16.5	15.2	11.6
21.0	12.3	13.9	15.8	16.3	17.1	16.0	17.6	16.4	14.9	11.5
24.0	8.8	13.7	15.7	15.8	16.5	15.9	16.7	16.2	14.9	11.4
25.0		13.6	15.4	15.6	16.2	15.9	16.2	16.2	14.9	11.4
26.0	8.7									
Max Change (°C/m)[1]	1.2	0.9	0.5	2.5	2.7	1.1	2.3	1.8	0.5	0.5
Depth of Max Change (m)[2]	22.50	6.50	4.50	3.50	5.50	5.50	6.50	6.50	13.50	16.5

Notes:

Data downloaded from Ecology's EIM database on December 17, 21013:
https://fortress.wa.gov/ecy/eimreporting/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&StudyUserId=LKSpokaneNutrient_WQ&StudyUserIdSearchType=Contains&StudyName=Lake+Spokane+Nutrients+Monitoring&StudyNameSearchType=Contains

Does not include results from field duplicates.

Shaded and bold values indicate an exceedance of the 20.0°C criterion.

1. The change in °C per meter of depth was calculated for each pair of adjacent measurement intervals in the table. This value represents the maximum value of the calculated change in °C per one meter of depth for each pair of adjacent measurement intervals.

2. Depth of Max Change (m) = the shallowest depth where the greatest temperature gradient occurs.

Table 3-7: LL1 Temperature Vertical Profiles in 2013

Depth (meters)	Water Temperature (°C)									
	5/13/2013	6/11/2013	6/25/2013	7/9/2013	7/24/2013	8/5/2013	8/20/2013	9/9/2013	9/24/2013	10/14/2013
0.5	15.7	19.8	19.1	**24.4**	**24.7**	**23.7**	**23.5**	**21.6**	18.2	13.8
1.0	15.7	19.7	19.0	**24.3**	**24.7**	**23.4**	**23.3**	**21.6**	18.2	13.8
2.0	15.6	19.3	18.9	**24.2**	**24.5**	**23.2**	**23.2**	**21.5**	18.2	13.8
3.0	15.1	19.1	18.8	**23.7**	**24.5**	**23.1**	**23.1**	**21.4**	18.2	13.8
4.0	15.0	19.0	18.7	**21.8**	**24.4**	**23.0**	**22.9**	**21.3**	18.2	13.8
5.0	14.9	18.8	18.5	**20.6**	**24.1**	**22.8**	**21.7**	**21.2**	18.2	13.8
6.0	14.9	18.0	17.6	**20.2**	**22.4**	**21.5**	19.9	**20.6**	18.1	13.8
7.0	14.6	17.9	17.2	19.7	**21.2**	19.9	19.4	19.2	18.1	13.8
8.0	14.5	17.8	17.0	19.5	**20.2**	19.3	19.1	18.5	18.1	13.7
9.0	14.3	17.6	17.0	19.3	19.6	19.0	19.0	18.3	17.7	13.7
10.0	14.0	16.9	16.9	19.1	19.3	18.9	18.8	18.1	17.0	13.7
12.0	13.8	16.6	16.6	18.4	18.8	18.6	18.5	17.8	16.8	13.7
15.0	12.9	15.5	16.2	17.6	18.5	18.1	18.1	17.2	16.6	13.3
18.0	12.7	14.9	15.8	16.9	17.9	17.6	17.9	17.0	16.2	12.5
21.0	11.6	14.3	15.7	16.5	16.9	17.2	17.5	16.6	16.0	11.9
24.0	11.3	14.2	15.4	16.2	16.3	16.4	16.6	16.3	15.9	11.8
27.0	10.1	13.9	15.2	15.8	15.9	16.0	15.8	16.1	15.6	11.7
30.0	9.2	13.6	14.6	15.5	15.4	15.7	15.5	16.0	15.5	11.6
33.0	8.8	13.4	14.0	15.0	14.9	14.9	15.3	15.4	15.4	11.6
34.0			13.9							
Max Change (°C/m)[1]	0.5	0.9	0.9	2.0	1.7	1.6	1.8	1.4	0.8	0.3
Depth of Max Change (m)[2]	2.50	5.50	5.50	3.50	5.50	6.50	5.50	6.50	9.50	16.50

Notes:

Data downloaded from Ecology's EIM database on December 17, 21013:
https://fortress.wa.gov/ecy/eimreporting/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&StudyUserId=LKSpokaneNutrient_WQ&StudyUserIdSearchType=Contains&StudyName=Lake+Spokane+Nutrients+Monitoring&StudyNameSearchType=Contains

Does not include results from field duplicates.

Shaded and bold values indicate an exceedance of the 20.0°C criterion.

1. The change in °C per meter of depth was calculated for each pair of adjacent measurement intervals in the table. This value represents the maximum value of the calculated change in °C per one meter of depth for each pair of adjacent measurement intervals.

2. Depth of Max Change (m) = the shallowest depth where the greatest temperature gradient occurs.

Table 3-8: LL0 Temperature Vertical Profiles in 2013

Depth (meters)	Water Temperature (°C)									
	5/13/2013	6/11/2013	6/25/2013	7/9/2013	7/24/2013	8/5/2013	8/20/2013	9/9/2013	9/24/2013	10/14/2013
0.5	16.5	18.5	19.5	**23.1**	**24.5**	**22.9**	**22.1**	**21.3**	17.7	13.5
1.0	16.5	18.4	19.3	**23.1**	**24.5**	**22.9**	**22.1**	**21.3**	17.7	13.6
2.0	16.3	18.4	19.1	**22.8**	**24.3**	**22.8**	**21.7**	**21.1**	17.7	13.6
3.0	14.8	18.4	18.8	**22.6**	**23.8**	**22.8**	**21.6**	**21.1**	17.7	13.6
4.0	14.3	18.2	18.7	**22.5**	**23.3**	**22.7**	**21.2**	**21.0**	17.7	13.6
5.0	13.5	18.0	18.1	**21.5**	**22.0**	**22.2**	**20.8**	19.7	17.7	13.6
6.0	13.4	17.9	17.7	**20.6**	**21.2**	**21.1**	**20.5**	19.2	17.3	13.6
7.0	13.4	17.7	17.4	**20.1**	**20.2**	**20.2**	19.8	18.8	17.1	13.6
8.0	13.3	17.7	17.0	19.9	19.6	19.4	19.1	18.6	17.1	13.6
9.0	13.3	17.4	16.8	19.7	19.3	18.9	19.0	18.2	16.9	13.6
10.0	13.1	16.7	16.7	18.9	18.9	18.6	18.8	18.0	16.9	13.6
12.0	12.9	16.2	16.5	18.3	18.7	18.4	18.6	17.6	16.7	13.6
15.0	12.9	15.5	16.2	17.4	18.0	17.9	18.2	17.1	16.6	13.4
18.0	12.5	14.5	16.0	16.7	17.6	17.7	17.6	16.7	16.5	12.7
21.0	12.5	14.3	15.8	16.4	16.9	17.5	17.0	16.6	16.5	12.3
24.0	12.2	14.1	15.5	16.1	16.4	16.5	16.3	16.4	16.3	12.2
27.0	11.7	14.0	15.2	15.7	16.0	15.8	15.7	16.1	16.0	12.1
30.0	11.0	13.8	14.7	15.3	15.4	15.4	15.5	15.3	15.8	12.0
33.0	10.9	13.7	14.2	14.7	14.8	14.9	15.1	14.8	15.4	12.0
36.0	10.3	13.6	13.8	14.1	14.0	14.2	14.3	14.0	14.5	12.0
39.0	9.8	13.6	13.6	13.6	13.5	13.5	13.5	13.4	13.8	12.0
42.0	9.6	13.4	13.4	13.4	13.4	13.4	13.4	13.3	13.4	12.0
45.0	9.5	13.3	13.4	13.3	13.3	13.2	13.2	13.2	13.2	12.0
47.0			13.3	13.2	13.2	13.2	13.1	13.1	13.1	11.9
48.0	9.3	13.3								
49.0	9.3									
Max Change (°C/m)[1]	1.5	0.7	0.6	1.0	1.3	1.1	0.7	1.3	0.4	0.2
Depth of Max Change (m)[2]	2.50	9.50	4.50	4.50	4.50	5.50	7.50	4.50	5.50	16.50

Notes:

Data downloaded from Ecology's EIM database on December 17, 21013:
https://fortress.wa.gov/ecy/eimreporting/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&StudyUserId=LKSpokaneNutrient_WQ&StudyUserIdSearchType=Contains&StudyName=Lake+Spokane+Nutrients+Monitoring&StudyNameSearchType=Contains

Does not include results from field duplicates.

Shaded and bold values indicate an exceedance of the 20.0°C criterion.

1. The change in °C per meter of depth was calculated for each pair of adjacent measurement intervals in the table. This value represents the maximum value of the calculated change in °C per one meter of depth for each pair of adjacent measurement intervals.

2. Depth of Max Change (m) = the shallowest depth where the greatest temperature gradient occurs.

Table 3-9: LLFB Daily Maximum Temperature in 2013

Day	Maximum Daily Water Temperature (°C)					
	June	July	August	September	October	November
1	Not Monitored	**24.89**	**22.11**	**20.74**	16.00	11.37
2		**24.54**	**23.02**	**20.56**	15.84	Not Monitored
3		**23.42**	**23.07**	**21.27**	15.61	
4		**23.44**	**23.10**	**20.80**	15.46	
5		**23.03**	**23.08**	**21.13**	15.44	
6		**23.69**	**22.94**	18.81	15.36	
7		**24.22**	19.52	18.89	15.28	
8		**22.33**	**20.68**	19.01	14.97	
9		**23.99**	20.00	19.33	14.79	
10		**24.39**	**21.13**	18.77	14.65	
11		**23.46**	19.39	19.34	14.51	
12		**21.34**	19.33	17.95	14.38	
13		**22.82**	**20.09**	18.60	14.14	
14		**23.30**	**20.12**	18.87	13.91	
15		**23.13**	**20.54**	18.67	13.76	
16		**23.12**	19.28	18.36	13.65	
17		**22.72**	19.47	19.24	13.50	
18	19.03	**21.30**	19.37	18.02	13.38	
19	18.89	**21.27**	19.67	18.98	13.18	
20	18.48	**21.37**	**20.20**	18.60	13.04	
21	18.17	**23.26**	**20.77**	18.71	13.04	
22	19.04	**21.73**	**20.47**	18.01	12.94	
23	19.88	**25.01**	**20.60**	17.41	12.81	
24	19.92	**21.54**	19.97	17.36	12.67	
25	19.67	**22.29**	**20.39**	17.50	12.50	
26	19.82	**21.11**	**20.07**	17.61	12.46	
27	19.37	**22.18**	**20.45**	17.43	12.21	
28	**21.37**	**23.56**	19.52	17.19	12.04	
29	**20.27**	**23.48**	19.49	17.00	11.84	
30	**22.27**	**22.69**	18.75	16.64	11.58	
31	--	**22.76**	19.24	--	11.46	

Notes:

-- = not applicable

Shaded and bold values indicate an exceedance of the 20.0°C criterion.

Data collected as part of Avista's Washington Total Dissolved Gas Monitoring Plan and Detailed DO Phase II Feasibility and Implementation Plan.

Table 3-10: LLTR Daily Maximum Temperature in 2013

Day	Maximum Daily Water Temperature (°C)								
	March	April	May	June	July	August	September	October	November
1	Not Monitored	6.47	9.69	14.33	18.33	19.75	19.63	15.59	11.31
2		6.89	9.68	14.30	18.22	19.57	19.62	15.51	Not Monitored
3		6.81	9.87	14.50	18.09	19.68	19.42	15.33	
4		7.41	10.34	14.96	18.52	19.64	19.16	15.10	
5		7.42	10.25	14.94	18.79	19.61	19.45	14.98	
6		7.79	10.36	14.87	19.00	19.48	19.34	14.95	
7		8.04	10.67	14.97	18.97	19.53	18.57	14.73	
8		8.06	10.93	15.64	18.79	19.89	18.50	14.35	
9		8.05	11.33	15.33	19.04	20.00	18.63	14.32	
10		7.83	12.14	16.22	19.63	**20.16**	18.54	14.27	
11		7.54	12.39	16.61	19.05	19.74	18.63	13.93	
12		7.25	12.79	16.60	18.97	19.71	18.58	13.67	
13		7.22	13.37	16.73	19.51	**20.17**	18.46	13.39	
14		7.15	13.81	16.78	19.63	**20.22**	18.60	13.21	
15		7.19	14.25	16.88	19.37	**20.36**	18.59	13.19	
16		7.15	14.42	17.20	**20.24**	19.75	18.31	13.10	
17		7.03	14.51	17.17	20.00	19.95	18.38	12.92	
18		6.90	14.68	16.87	19.56	19.73	18.12	12.83	
19		7.07	14.83	17.18	19.62	19.63	18.26	12.64	
20		7.08	14.81	17.18	19.68	19.52	18.19	12.59	
21		7.28	14.98	16.95	**20.02**	19.89	18.10	12.52	
22		8.12	14.81	17.00	19.99	19.77	17.58	12.47	
23		8.23	14.78	16.93	**20.15**	19.71	17.15	12.24	
24		8.21	14.67	16.88	**20.31**	19.58	16.96	12.16	
25	6.38	8.04	14.48	17.00	**20.21**	19.69	16.98	11.99	
26	6.15	8.29	14.50	17.02	**20.25**	19.58	16.97	11.91	
27	5.89	8.46	14.30	17.11	19.93	19.68	16.91	11.86	
28	5.79	9.04	13.97	17.39	**20.32**	19.57	16.72	11.74	
29	5.79	9.04	13.95	17.24	**20.14**	19.34	16.52	11.77	
30	5.86	9.58	13.97	17.74	**20.03**	18.96	16.24	11.44	
31	6.28	--	14.15	--	19.95	19.16	--	11.41	

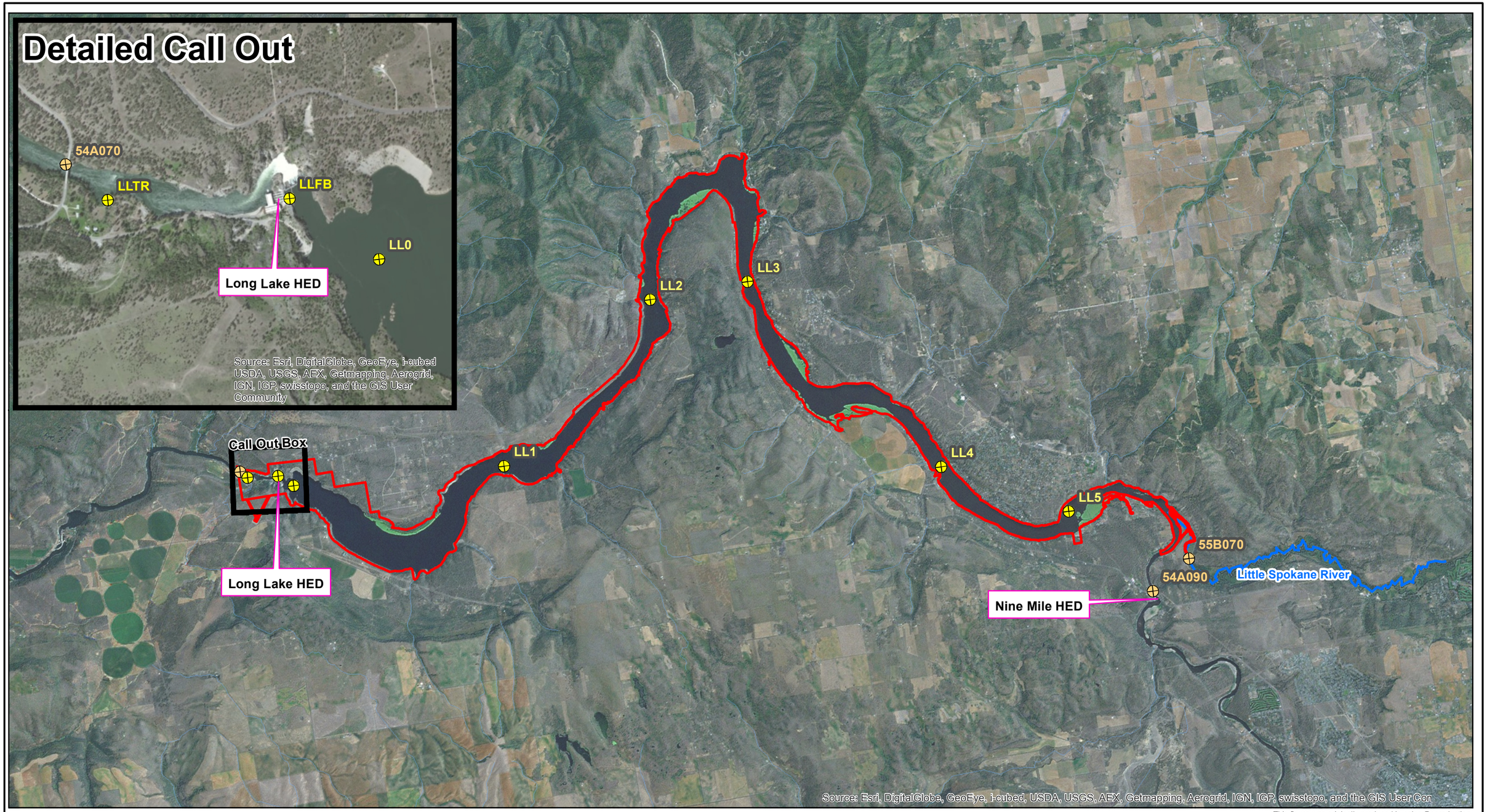
Notes:
-- = not applicable
Shaded and bold values indicate an exceedance of the 20.0°C criterion.
Data collected as part of Avista's Washington Total Dissolved Gas Monitoring Plan and Detailed DO Phase II Feasibility and Implementation Plan.

Table 4-1: Comparison of LLTR 2013 Values to Tribe WQ Standards

Day	7-DADM (°C)								
	March	April	May	June	July	August	September	October	November
1	Not Monitored	6.50	9.61	14.31	17.93	**19.82**	**19.33**	**15.86**	#N/A
2		6.73	9.78	14.45	18.13	**19.75**	**19.34**	**15.61**	Not Monitored
3		7.01	9.97	14.58	18.38	**19.67**	**19.40**	**15.39**	
4		7.26	10.12	14.70	**18.56**	**19.61**	**19.31**	**15.17**	
5		7.49	10.30	14.88	**18.63**	**19.63**	**19.15**	**14.99**	
6		7.65	10.54	15.03	**18.74**	**19.69**	**19.01**	**14.82**	
7		7.80	10.86	15.28	**18.96**	**19.76**	**18.88**	**14.67**	
8		7.82	11.15	15.51	**19.04**	**19.77**	**18.81**	**14.50**	
9		7.79	11.52	15.75	**19.06**	**19.79**	**18.68**	**14.32**	
10		7.71	11.95	16.01	**19.14**	**19.89**	**18.56**	**14.09**	
11		7.59	12.39	16.27	**19.23**	**19.98**	**18.56**	**13.88**	
12		7.46	12.87	16.45	**19.31**	**20.05**	**18.58**	**13.71**	
13		7.33	13.31	16.72	**19.49**	**20.02**	**18.53**	**13.54**	
14		7.22	**13.65**	16.85	**19.54**	**19.99**	**18.51**	**13.34**	
15		7.13	**13.98**	16.89	**19.61**	**19.98**	**18.43**	**13.19**	
16		7.10	**14.27**	16.97	**19.70**	**19.97**	**18.39**	**13.04**	
17		7.08	**14.47**	17.04	**19.73**	**19.88**	**18.35**	**12.93**	
18		7.10	**14.64**	17.06	**19.78**	**19.83**	**18.28**	**12.83**	
19		7.23	**14.72**	17.08	**19.87**	**19.75**	**18.13**	**12.72**	
20		7.39	**14.77**	17.04	**19.86**	**19.74**	**17.97**	**12.60**	
21		7.56	**14.79**	17.00	**19.90**	**19.69**	**17.77**	**12.49**	
22		7.72	**14.77**	17.02	**20.00**	**19.68**	**17.60**	**12.37**	
23		7.89	**14.72**	16.99	**20.09**	**19.68**	**17.42**	**12.27**	
24		8.09	**14.65**	16.98	**20.12**	**19.70**	**17.24**	**12.16**	
25	#N/A	8.34	**14.50**	17.05	**20.17**	**19.65**	**17.04**	**12.05**	
26	#N/A	8.47	**14.38**	17.08	**20.19**	**19.59**	**16.89**	**11.95**	
27	#N/A	8.67	**14.26**	17.20	**20.17**	**19.49**	**16.76**	**11.84**	
28	6.02	8.88	**14.19**	17.40	**20.12**	**19.43**	**16.56**	**11.73**	
29	6.03	9.11	**14.17**	17.58	**20.05**	**19.42**	**16.35**	**11.63**	
30	6.14	9.34	**14.14**	17.73	**19.96**	**19.42**	**16.12**	#N/A	
31	6.27	--	**14.17**	--	**19.92**	**19.39**	--	#N/A	

Notes:
-- = not applicable; #N/A = not enough days to calculate the 7-DADM
Shaded and bold values indicate an exceedance of the Tribe's 7-DADM Criteria.
Data collected as part of Avista's Washington Total Dissolved Gas Monitoring Plan and Detailed DO Phase II Feasibility and Implementation Plan.

FIGURES



LEGEND

- Long Lake HED Boundary
- Little Spokane River

Temperature Monitoring Stations

Sampling Entity

- Avista
- Ecology

0 0.95 1.9
Miles

Map Projection:
NAD 1983 StatePlane Washington
North FIPS 4601 Feet

Source:
ESRI (Aerial Imagery, Little Spokane River),
Avista (Avista HED), Golder Associates (Long Lake Boundary,
Tempurature Monitoring Locations)

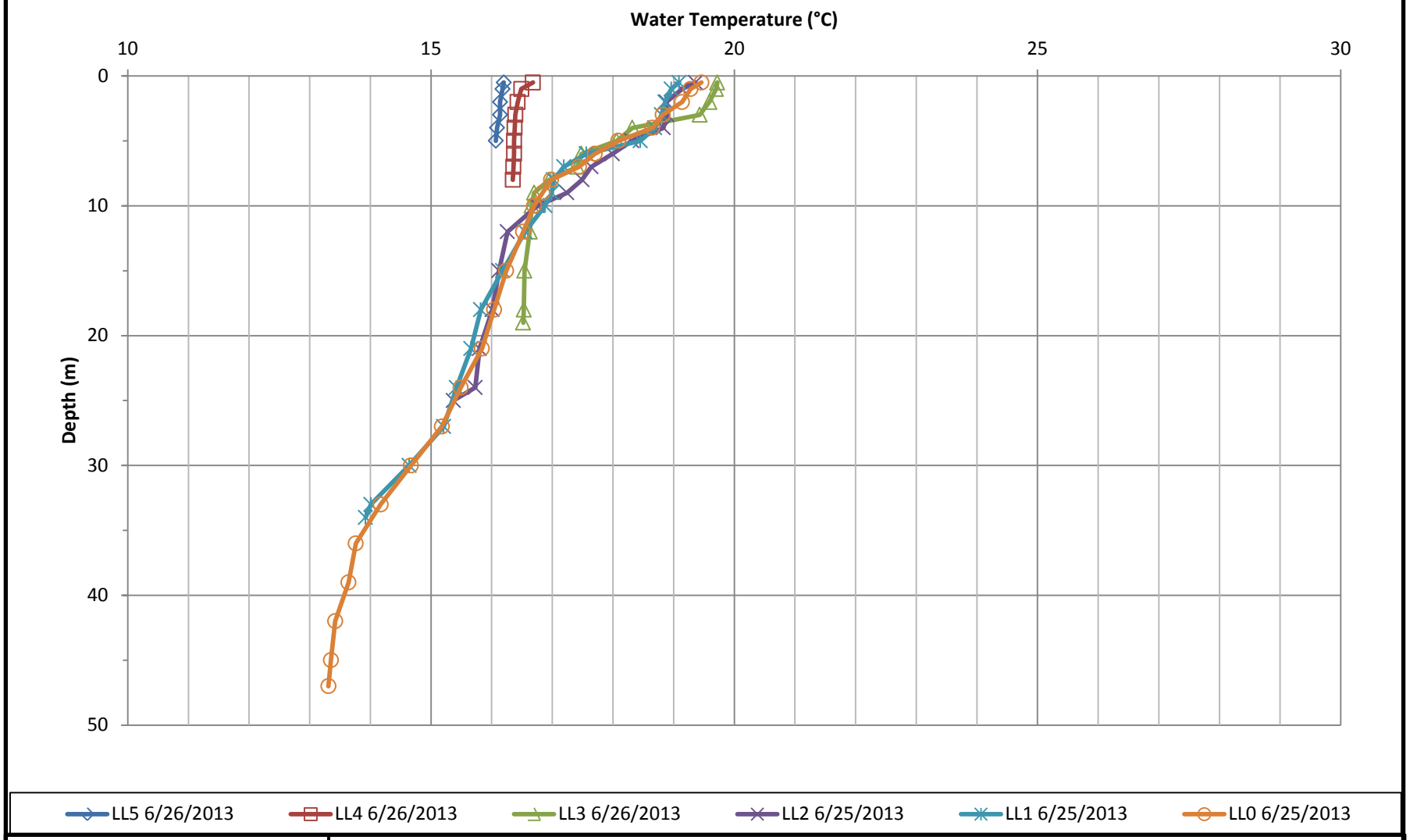
N

This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

FIGURE **2-1**
Long Lake HED 2013
Temperature Monitoring Stations

Golder Associates

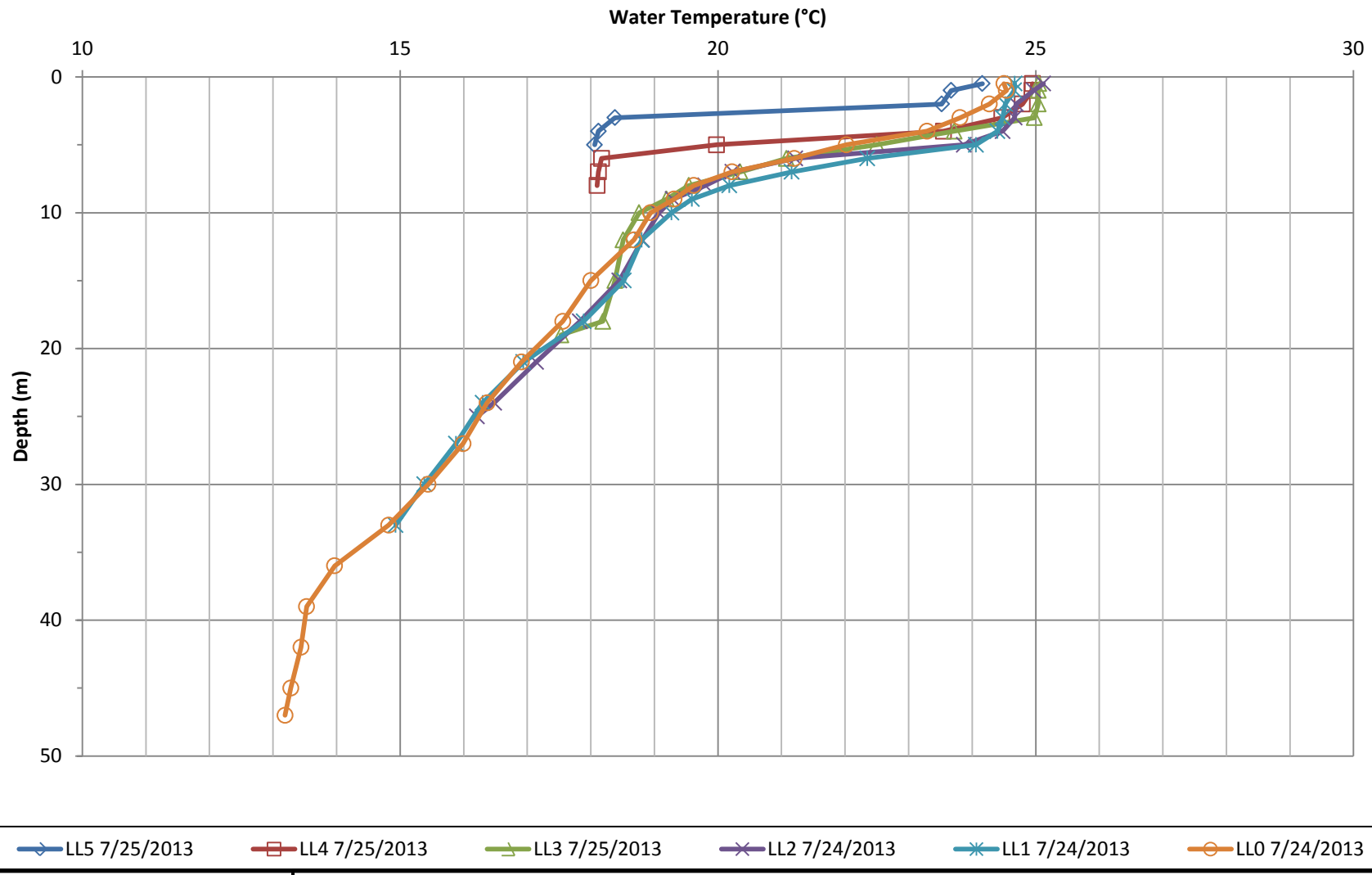
Path: M:\Projects\2010\10393119_AvistaAquaticWeeds\10393119_AvistaAquaticWeeds\MXD\R01\LakeSpokane_Temp_Monitoring_Sites Fig_2_1_20130208R01.mxdGLEHMAN



Golder Associates

Title	Lake Spokane Temperature Vertical Profiles, Late June 2013		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-10-100
Client Name	Avista	Date	February 18, 2014

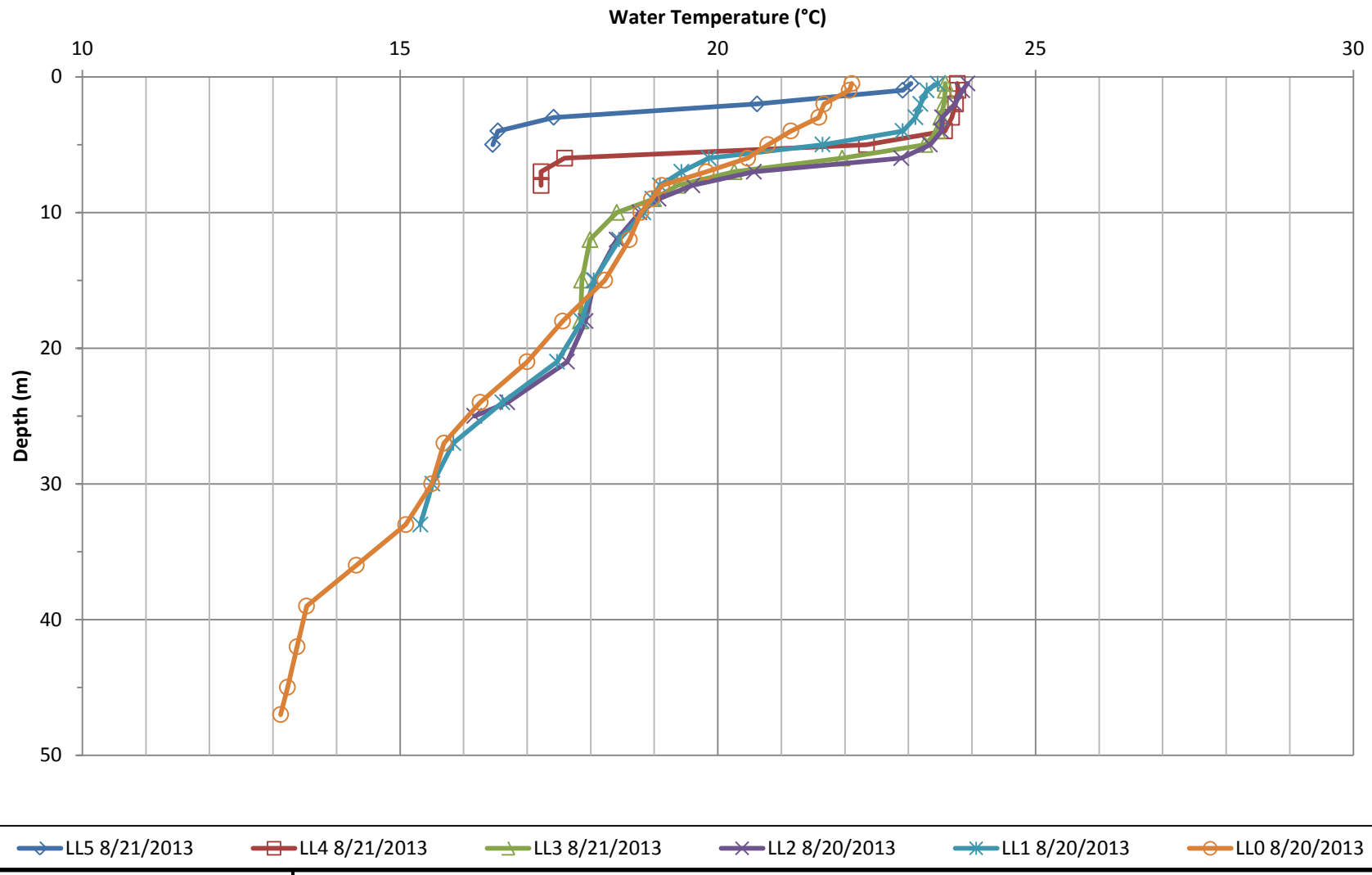
FIGURE 3-1



Golder Associates

Title	Lake Spokane Temperature Vertical Profiles, Late July 2013		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-10-100
Client Name	Avista	Date	February 18, 2014

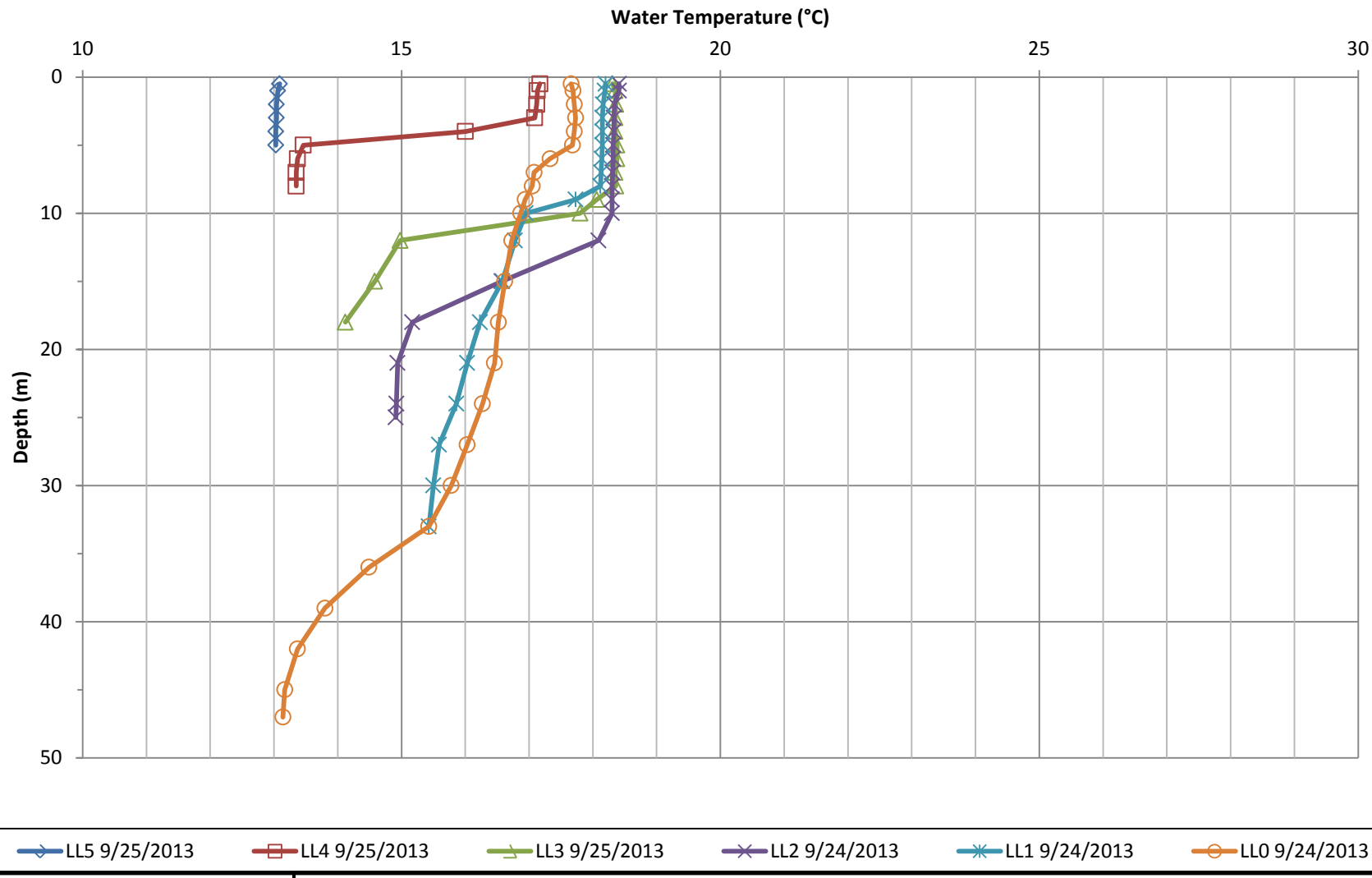
FIGURE 3-2



Golder Associates

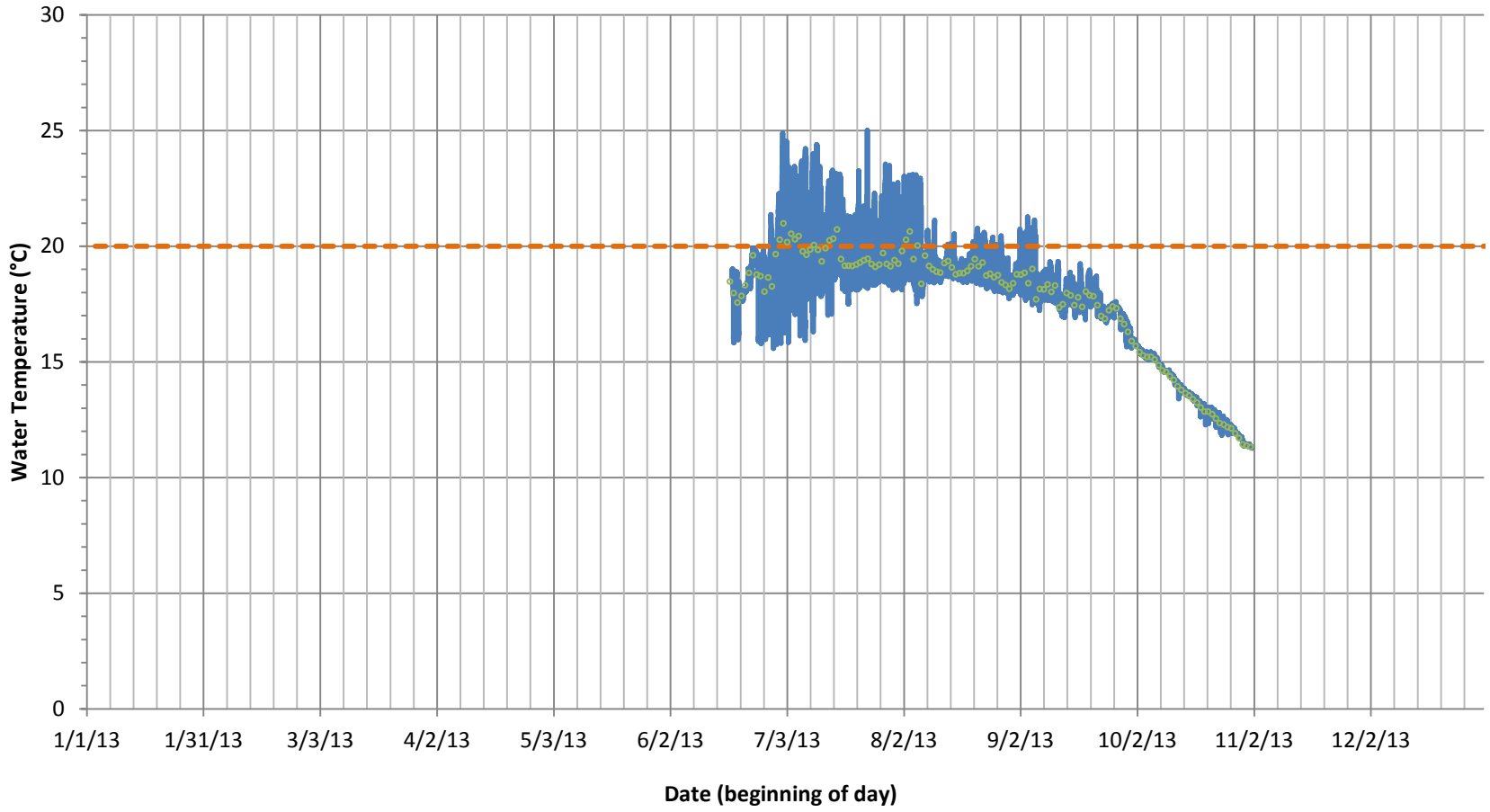
Title	Lake Spokane Temperature Vertical Profiles, Late August 2013		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-10-100
Client Name	Avista	Date	February 18, 2014

FIGURE 3-3



Golder Associates

Title	Lake Spokane Temperature Vertical Profiles, Late September 2013		
Project Name	LL HED Temp Monitoring Report	Project No. 073-93081-10-100	FIGURE 3-4
Client Name	Avista	Date February 18, 2014	

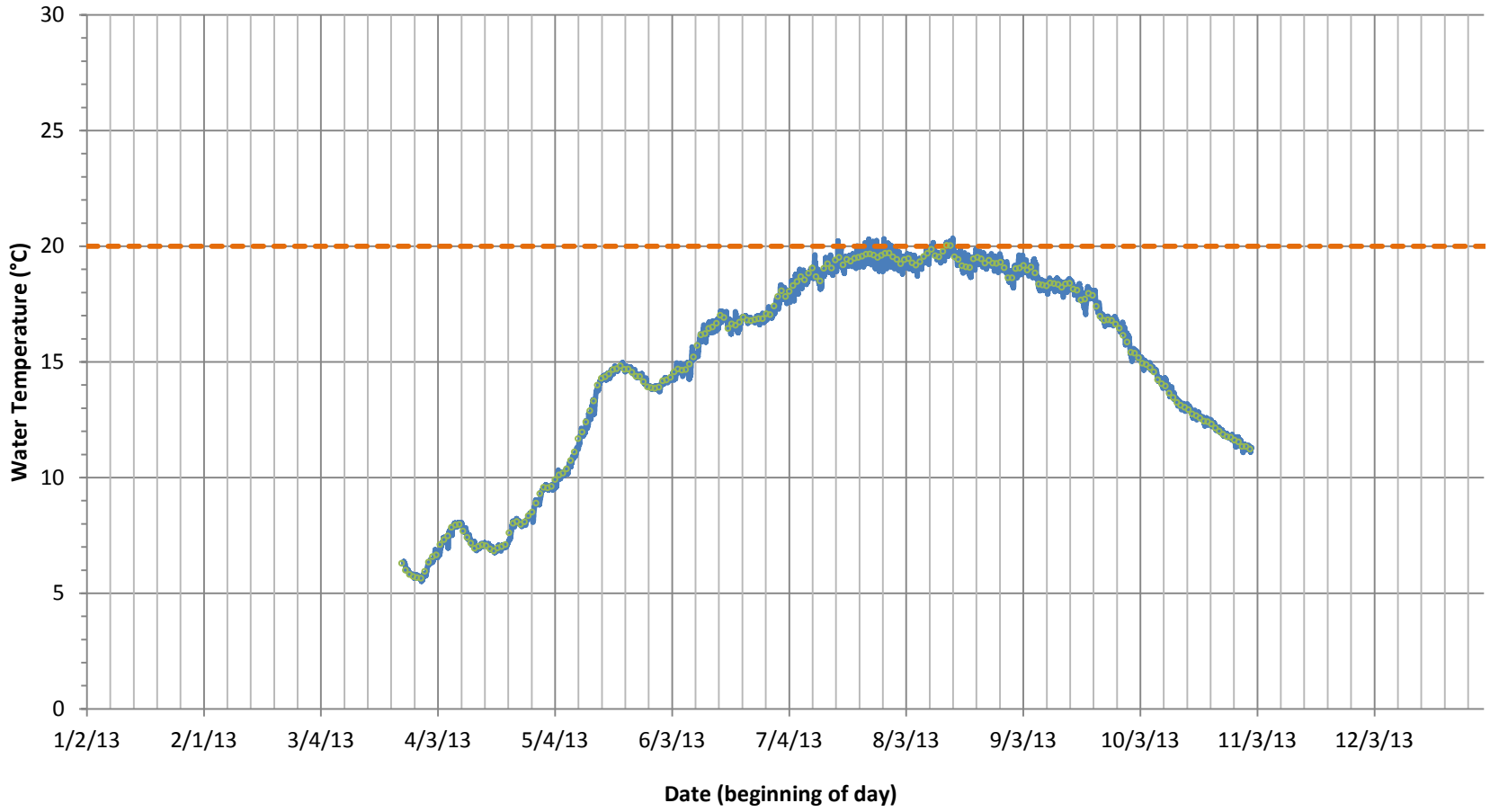


Golder Associates

Title: LLFB Temperature Time Series, 2013

Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-10-100
Client Name	Avista	Date	February 18, 2014

FIGURE 3-5

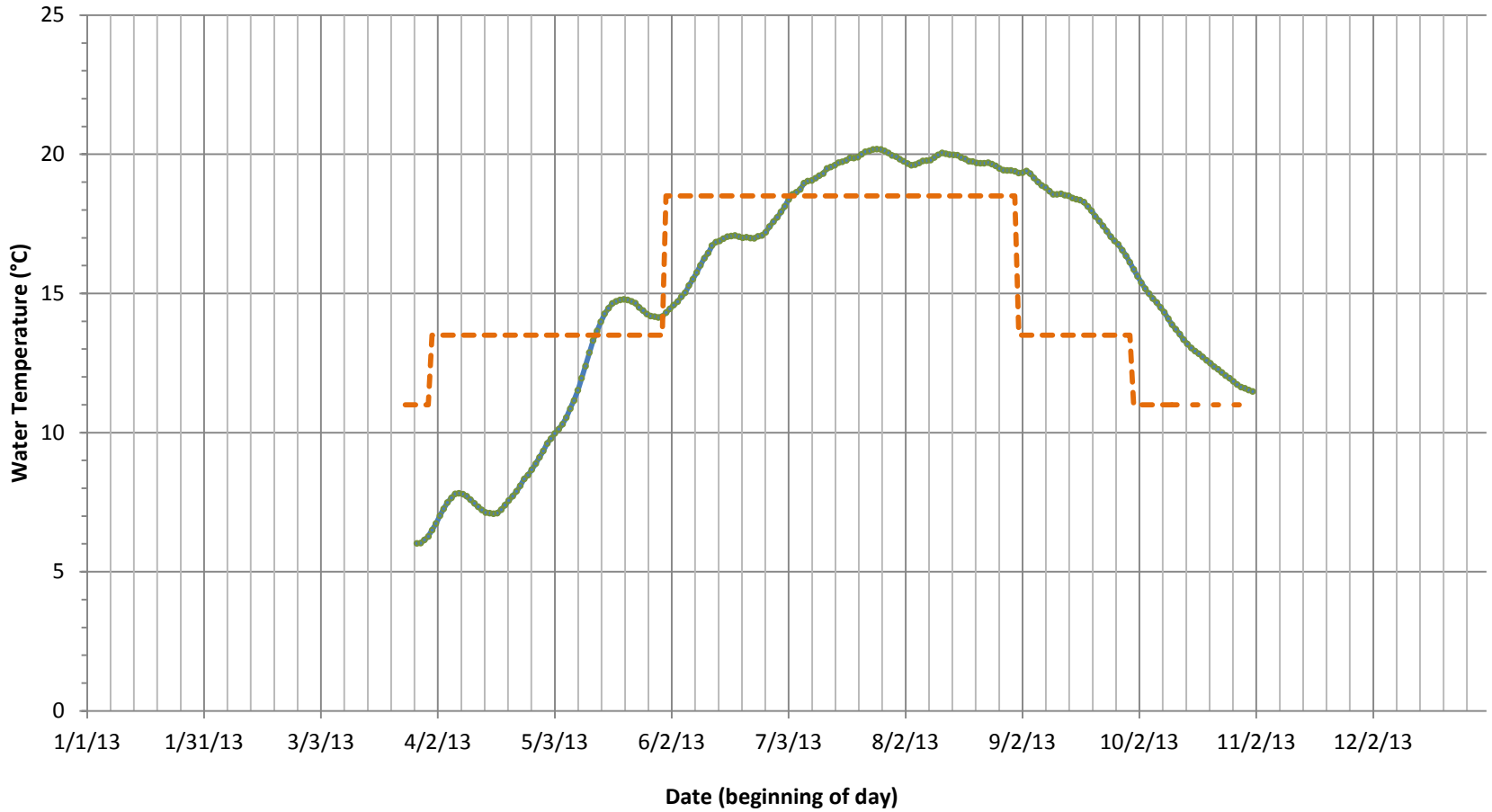


Golder Associates

Title: LLTR Temperature Time Series, 2013

Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-10-100
Client Name	Avista	Date	February 18, 2014

FIGURE 3-6



Golder Associates

Title	LLTR 7-DADM Time Series, 2013		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-10-100
Client Name	Avista	Date	February 18, 2014

FIGURE 4-1

APPENDIX A
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

Subject: Spokane River Hydroelectric Project, FERC Project No. 2545
2013 Long Lake Hydroelectric Development Temperature Monitoring Report

Dear Mr. McGuire:

I have enclosed the 2013 Long Lake Hydroelectric Development Temperature Monitoring Report (Temperature Monitoring Report) for your review and approval. The Temperature Monitoring Report was completed in accordance with the Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan, which was required by the Federal Energy Regulatory Commission (FERC) Spokane River Hydroelectric Project License Appendix B, Section 5.5.B.

We request your review and approval by **March 28, 2014**. This will allow us time to incorporate your comments and recommendations as appropriate, and submit the Temperature Monitoring Report to FERC by **April 15, 2014**.

Please feel free to call me at (509) 495-4643 if you have any questions about the Temperature Monitoring Report.

Sincerely,

Meghan Lunney
Aquatic Resource Specialist

Enclosure (1)

cc: Chad Brown, Ecology
Brian Crossley, Spokane Tribe of Indians

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

800.727.9170
Facsimile 509.777.9516
www.avistautilities.com

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

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 Temperature Monitoring Report.* Spokane River Hydroelectric Project, No. P-2545

Dear Ms. Lunney:

The Department of Ecology (Ecology) has reviewed the *2013 Long Lake Temperature Monitoring Report* sent to Ecology on February 28, 2014. The report is a requirement in Section 5.5.B of the 401Water Quality Certification. We have no comments for this report.

Ecology APPROVES the *2013 Long Lake Temperature Monitoring Report* as submitted. The report meets the 401 Water Quality Certification conditions and requirements for Section 5.5.B.

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

Ecology's April 1, 2014 letter, approving the 2013 Long Lake HED Temperature Monitoring Report, did not require responses, as Ecology provided no comments for this report.

February 28, 2014

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

Subject: Spokane River Hydroelectric Project, FERC Project No. 2545
2013 Long Lake Hydroelectric Development Temperature Monitoring Report

Dear Mr. Crossley:

I have enclosed the 2013 Long Lake Hydroelectric Development Temperature Monitoring Report (Temperature Monitoring Report) for your review and comment. The Temperature Monitoring Report was completed in accordance with the Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan, which was required by the Federal Energy Regulatory Commission (FERC) Spokane River Hydroelectric Project License Appendix B, Section 5.5.B.

Per the October 2008 Settlement Agreement between Avista and the Spokane Tribe, we would like to receive any comments that you may have on the Temperature Monitoring Report by **March 28, 2014**. This will allow us time to incorporate them as appropriate, and submit the Temperature Monitoring Report to FERC by **April 15, 2014**.

Please feel free to call me at (509) 495-4643 if you have any questions about the Temperature Monitoring Report.

Sincerely,

Meghan Lunney
Aquatic Resource Specialist

Enclosure (1)

cc: Patrick McGuire, Ecology

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

800.727.9170
Facsimile 509.777.9516
www.avistautilities.com

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,

Brian Crossley
Water & Fish Program Manager
crossley@spokanetribe.com

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 had only one comment applicable to the 2013 Long Lake HED Temperature Monitoring Report.

Spokane Tribe Comment
Analysis of the air temperature being used by the dissolved oxygen (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.

Avista Response
During a meeting on April 3, 2014, Avista and the Spokane Tribe (Tribe) discussed the 2010 HDR analysis of the air temperature being used by the DO aeration and the potential for variable-depth withdrawals.

HDR determined, that based upon the field data, when air is allowed to flow into the draft tube, there is no discernible difference in water temperature in the tailrace. This is because only a very small amount of air is introduced into the flow path (~80 to 100 standard cubic feet per second) compared to the total flow of water (~800 to 1,500 cubic feet per second) passing through the draft tube.

During the aforementioned April 3rd meeting, we also discussed that the configuration of Long Lake Dam's intakes does not accommodate variable depth withdrawals, and that withdrawing deeper water that is cooler and oxygen-depleted could negatively impact the positive benefits of aerating the tailrace and downstream river that we have already achieved. However, we will continue to work with the Tribe through adaptive management to look at other ways to improve temperature in the river.