AVISTA CORPORATION

2012

LONG LAKE HED

TEMPERATURE MONITORING REPORT

WASHINGTON 401 CERTIFICATION, SECTION 5.5

Spokane River Hydroelectric Project
FERC Project No. 2545

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April 10, 2013

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List of Acronyms and Abbreviations

°C	degrees Celsius
7-DADM	7-day average daily maximum temperature
Avista	Avista Corporation
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
Washington 401	Amended section 401 water quality certification
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 (Washington 401; Ecology 2009). Section 5.5 of the Washington 401 required Avista Corporation (Avista) to prepare a temperature water quality attainment plan, and Section 5.10 required Avista to prepare a water quality monitoring and quality assurance project plan. Avista prepared 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).

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 1st on an annual basis. This report summarizes temperature monitoring conducted for Long Lake Hydroelectric Development (HED) during the 2012 calendar year.

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 regard to waters downstream of the Project.

2.2 Monitoring Locations and Periods

Water temperature data that are included in the annual summary report 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 2012a, 2013a, 2013b), Lake Spokane water quality (Ecology 2012b), total dissolved gas (TDG)

(Golder 2013), and Long Lake HED tailwater dissolved oxygen (Golder 2012b). 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 one inflow station to Lake Spokane, 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 Lake Inflows

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). Temperature data was not available for the Spokane River at Nine Mile Bridge (station 54A090) for the 2012 season. Preliminary data for the Ecology Little Spokane River near Mouth station (55B070), which is located on the Little Spokane River at RM 1.1, was downloaded on January 5, 2013.

2.2.1.2 Within Lake

In 2012, Avista implemented the Lake Spokane nutrient monitoring program, which it had collaboratively implemented with Ecology in 2010 and 2011, that included temperature monitoring. This program included one sampling event in May and October, and two sampling events per month, from 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 include:

- 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

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, which 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

[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).

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 January 5, 2013 (2013b). Avista's monitoring programs are described in more detail below.

2.2.2.1 Avista

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, Notes 1, 2, and 3 to WRIA 54) limits 1-day maximum temperature to no more than 20.0 degrees Celsius (°C) due to human activities.[3]

The numeric temperature criterion for the Spokane Tribe, whose reservation is located downstream of the Project, is applicable from the upstream Spokane Indian Reservation boundary (approximately RM 32.7) to the mouth of the Spokane River (RM 0) and is based on the 7-day average daily maximum temperature (7-DADM). 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)[4].

- 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

[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.
[4] The United States Environmental Protection Agency is currently reviewing the Spokane Tribe's 2010 water quality standards (Buffo 2012).

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.

3.0 RESULTS

Results of the temperature monitoring in 2012 are discussed below by monitoring location along with a comparison to the applicable Washington State water quality criteria.

In addition, the Discussion, Section 4.0, presents a comparison of the temperature results for the monitoring location below Long Lake Dam with the corresponding Spokane Tribe water quality criterion.

3.1.1 Lake Spokane

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

3.1.1.1 Lake Inflows

As noted in Section 2.2.1.1, temperature data for Ecology's Spokane River at Nine Mile Bridge station, 54A090, was not available.

Ecology's Little Spokane River station, 55B070, was monitored monthly from January through September. Water temperatures during this timeframe ranged from 6.2°C in March to 17.1°C in late July (Table 3-1). All monitored water temperatures were less than the 20.0°C Washington State criterion.

3.1.1.2 Within Lake

Vertical profiles or water temperatures were monitored at the six Lake Spokane sampling stations in 2012. The frequency of monitoring in 2012 was once in May; twice in 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 5 m below the water surface. Vertical profiles for May, June, July, September, and October had temperature change rates of less than 1 degree Celsius per meter (°C/m) of depth (Table 3-2). The August 21 profile had a maximum temperature change rate greater than 1°C/m, indicating the thermocline was at 2.5 m (Table 3-2).[5] Three of the 2012 LL5 temperature measurements were greater than the 20.0°C Washington State criterion; these values occurred at 0.5 m 1.0 m, and 2.0 m on August 21 (Table 3-2).

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. Vertical temperature profiles for May, June, and October had temperature change rates of less than 1°C/m (Table 3-3). The maximum temperature change rate was greater than 1°C/m for the other temperature profiles. These results indicate the thermocline was between 1.5 m and 3.5 m in July, 4.5 m and 5.5 m in August, and 4.5 m in September. Eighteen of the temperature measurements were greater than the 20.0°C Washington State criterion; all of these occurred at depths of 0.5 m to 2 m on July 11, 0.5 m to 3 m on July 25, 0.5 m to 4 m on August 7, and 0.5 m to 5 m on August 21 (Table 3-3).

LL3

LL3 temperature measurements were taken at 0.5 m, at 1-m intervals from 1 m to 17 m, and at either 18 m or 19 m below the water surface. Vertical temperature profiles for early July and early August had temperature change rates greater than 1°C/m; all other periods had maximum temperature change rates of less than 1°C/m (Table 3-4). These results indicate the thermocline was at 2.5 m on July 11, and 3.5 m on August 7. Thirty-two of the temperature measurements were greater than the 20.0°C Washington State criterion; these values occurred at depths of 0.5 m to 3 m on July 11, 0.5 m to 8 m on July 25, 0.5 m to 9 m on August 7, and 0.5 m to 8 m on August 21 (Table 3-4).

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 25.5 m below the water surface. Vertical temperature profiles for early July, and both early and late August had temperature change rates greater than 1°C/m; all other periods had maximum temperature change rates of less than 1°C/m (Table 3-5). These results indicate the thermocline was at 1.5 m on July 10, 3.5 m on August 6 and 6.5 m on August 20. Thirty-two temperature measurements were greater than the 20.0°C Washington State criterion; these values

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

occurred from depths of 0.5 m to 3 m on July 10; 0.5 m to 10 m on July 24; and from 0.5 m to 8 m on August 6, and from 0.5 m to 7 m on August 20 (Table 3-5).

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 for early July, both early and late August, and late September had temperature change rates greater than 1°C/m; all other periods had maximum temperature change rates of less than 1°C/m (Table 3-6). These results indicate the thermocline was at 3.5 m on July 10, 5.5 m on August 6, 6.5 m on August 20, and 9.5 m on September 25. Thirty-three temperature measurements were greater than the 20.0°C Washington State criterion; these occurred from depths of 0.5 m to 4 m on July 10, 0.5 m to 10 m on July 24, 0.5 m to 8 m on August 6, and from 0.5 m to 7 m on August 20 (Table 3-6).

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 near the bottom. Vertical temperature profiles for early July, late August, and late September had temperature change rates greater than 1°C/m; all other periods had maximum temperature change rates of less than 1°C/m (Table 3-7). These results indicate the thermocline was at 3.5 m on July 10, 6.5 m on August 20, and 4.5 m on September 10. Thirty-four temperature measurements were greater than the 20.0°C Washington State criterion; these values occurred from depths of 0.5 m to 3.0 m on July 10, 0.5 m to 12 m on July 24, 0.5 m to 9 m on August 6, and 0.5 m to 7 m on August 20 (Table 3-7).

Lake Station Temperature Profile Comparisons

Comparison of the 2012 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 the five downstream stations (LL4 through LL0), and the station closest to Long Lake Dam (LL0) had cooler temperature in the upper 7 m than LL1, LL2, and LL3 (Figure 3-2). In late August, the thermocline was stronger and at a depth of approximately 7 m for the four downstream stations (LL0 through LL3) (Figure 3-3). By late September there is substantial cooling throughout the water column (Figure 3-4). By late September, the lake near-surface waters had cooled to less than 20.0°C (Figure 3-4).

LLFB

LLFB, Avista's Long Lake Forebay station, is located between the HED's Unit 3 and 4 intakes. LLFB temperature data were collected in 15-minute intervals from June 28 through June 30 as part of the

Washington Total Dissolved Gas Monitoring Plan and from July 1 through October 31 as part of the Detailed DO Phase II Feasibility and Implementation Plan (Figure 3-5). Daily maximum water temperatures for the 2012 LLFB data ranged from 11.7 to 25.6°C (Table 3-8). Temperature measurements greater than the 20.0°C Washington State criterion occurred on 46 days during the monitoring period. These exceedances occurred between July 2 and September 7 (Table 3-8).

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 April 20 to 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 6.8 to 21.3°C (Table 3-9), with 38 days greater than the 20.0°C Washington State criterion occurring during the monitoring period. These exceedances occurred from July 15 to August 23 with exceptions on July 18 and August 14.

Data for Ecology's Spokane River at Long lake station (54A070) during 2012 was unavailable online as of January 5, 2013.

4.0 DISCUSSION

4.1 Lake Spokane

Temperature profile monitoring conducted during 2012 indicated that the 20.0°C Washington State criterion was exceeded in July at five of the six lake stations and in August at all six lake stations. Temperature measurements for the uppermost station, LL5, only exceeded 20.0°C within the top 2 m in August; whereas, the other five lake stations exceeded 20.0°C in both July and August. Exceedances of 20.0°C at these stations occurred at depths ranging down to 12 m in July and down to 9 m in August . At the Long Lake forebay station, the criterion was also exceeded during 27 days in July, 17 days in August, and 2 days in September. Little Spokane River station spot measurements did not exceed the 20.0°C criterion.

The exceedances reported for Lake Spokane during 2012 are indicative of the natural stratification process typical of eastern Washington and north 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 Water Quality Attainment Plan (DO WQAP) that may have positive localized effects on temperature within the lake. These include:

- **Wetland restoration/enhancement -** Avista is currently working with Ecology to evaluate two potential wetland mitigation opportunities, one in the Little Spokane River drainage (Sacheen Lake) and the other within the Hangman Creek drainage (Dunn Property), through its Lake Spokane Wetland Plan and Nine Mile Wetland Monitoring Program. In 2010 and 2011, Avista also pursued two separate wetland projects on land adjacent to Lake Spokane, but after multiple discussions with owners of the properties it was clear these two projects were not feasible.
- **Reduction of size and conversion of lakeshore lawns to native vegetation -** Avista worked with Ecology, Stevens County Conservation District, Spokane County Conservation District, and the Lake Spokane Association to identify properties to begin implementing shoreline naturalization projects in the upper portion of Lake Spokane. Two of the three projects identified include removing a bulkhead from the Staggs Property and the Tumtum Property. The remaining project includes adding native vegetation to the shoreline of the Crites Property. Although the target was to complete all three of these projects by March 2013, complications associated with permitting and/or landowner input will delay completion.
- **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 where water quality and sediment loading concerns are discussed by a variety of stakeholders including lake associations, tribes, and local and state agencies.

  In addition, Avista and the Coeur d'Alene Tribe have purchased over 600-acres of farmland in the Upper Hangman Creek Basin through implementation of one of Avista's Spokane River license Wetland Mitigation requirements. Site-specific wetland management plans for these properties are currently being developed.
- **Native tree plantings on Avista Shoreline Property -** Avista plans to plant approximately 300 trees along the northern shoreline of Lake Spokane on Avista-owned property upstream of the Washington Department of Natural Resources (DNR) Campground this spring. Avista has been working with the Stevens County Conservation District to select appropriate tree planting location(s), species, and a watering/care schedule to provide the best survival and benefit to the resource. Avista anticipates that as the planted trees mature they may reduce temperatures and improve habitat along the shoreline.
- **Carp reduction in Lake Spokane -** Carp can degrade water quality, alter food webs, and negatively impact native or recreationally important fish populations (Zambrano et al. 2001; Jackson et al. 2010). Avista's DO WQAP[6], identified carp population reduction as a potential mitigation measure to reduce phosphorus loading and phosphorus availability in Lake Spokane.

  Through implementation of the DO WQAP, and in order to effectively evaluate whether reducing carp populations will result in reducing phosphorus loading to the lake, Avista will conduct a Phase I Analysis to better understand carp abundance, basic biological measures, seasonal behavior, whole-body phosphorus concentrations, and estimate loads from carp excretions and bioturbation. Avista anticipates the Phase I Analysis will be complete by the end of 2014, with the results summarized early in 2015.

With the exception of the native tree plantings on Avista's shoreline property, goals for these potential reasonable and feasible measures are primarily related to improving DO in the lake. Their

[6] FERC (2012) approved Avista's DO WQAP (Avista and Golder 2012) on December 19, 2012.

implementation will be coordinated with the FERC-approved DO WQAP, and will provide both water temperature and DO improvements to the resource.

4.2 Long Lake Dam Tailrace

During 2012, temperature measurements at the Avista monitoring station, LLTR, located downstream of the Long Lake Dam exceeded the 20.0°C Washington State criterion in July and August (Table 3-9).

Monitoring results indicate the Spokane Tribe's 7-DADM criteria established for tribal waters were exceeded July 12 through October 29 along with May 31 (Table 4-1, Figure 4-1). It is important to note the monitoring station from which 2012 temperature data was collected is located approximately 0.6 miles upstream from the reservation boundary, where the Tribe's criteria is applicable.

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 HED. 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 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.

5.0 PROPOSED CHANGES TO THE TEMPERATURE WQAP AND WQM QAPP

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

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TABLES

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

Monitoring Station	Location	NAD83 Decimal Degrees		2012 Monitoring Year	
		Latitude	Longitude	Start	End
54A090	Spokane River at Ninemile Bridge approximately 0.2 miles downstream of Nine Mile Dam, at river mile (RM) 58	47.7767	117.5448	Not Available	
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	1/9/2012	9/24/2012
LL5	Long Lake sampling site 5, at RM 54.20	47.7985	117.5692	5/24/2012	10/16/2012
LL4	Long Lake sampling site 4, at RM 51.47	47.8137	117.6106	5/24/2012	10/16/2012
LL3	Long Lake sampling site 3, at RM 46.42	47.8641	117.6668	5/24/2012	10/16/2012
LL2	Long Lake sampling site 2, at RM 42.06	47.8636	117.7014	5/23/2012	10/15/2012
LL1	Long Lake sampling site 1, at RM 37.62	47.8305	117.7612	5/23/2012	10/15/2012
LL0	Long Lake sampling site 0, at RM 32.66	47.8339	117.8349	5/23/2012	10/15/2012
LLFB	Long Lake Forebay between Unit 3 and 4 intakes.	47.8367	117.8397	6/28/2012	10/31/2012
LLTR	On left downstream bank, at water pumphouse approximately 0.6 mile downstream from Long Lake Dam.	47.8375	117.8503	4/20/2012	11/1/2012
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: Little Spokane River Upstream of Lake Spokane (55B070) Temperature Monitored in 2012

Date	Maximum Daily Water Temperature (°C)
1/9/2012	6.6
2/13/2012	6.3
3/19/2012	6.2
4/16/2012	9.4
5/14/2012	14.4
6/25/2012	16.3
7/23/2012	17.1
8/27/2012	14.5
9/24/2012	12.5

Notes:
The 20.0°C criterion was not exceeded at this monitoring location in 2012.
Data collected as part of Avista's Detailed DO Phase II Feasibility and Implementation Plan.

Table 3-2: LL5 Temperature Vertical Profiles in 2012

Depth (meters)	Water Temperature (°C)									
	5/24/2012	6/6/2012	6/26/2012	7/11/2012	7/25/2012	8/7/2012	8/21/2012	9/11/2012	9/26/2012	10/16/2012
0.5	11.5	12.1	14.7	18.9	19.2	**22.9**	**22.9**	14.5	14.1	12.4
1.0	11.5	12.1	14.8	18.9	19.1	**20.7**	**22.9**	14.4	14.1	12.4
2.0	11.5	12.1	14.8	18.8	19.0	17.4	**22.1**	14.4	14.1	12.4
3.0	11.5	12.1	14.8	18.8	19.0	17.4	18.0	14.3	14.0	12.4
4.0	11.5	12.1	14.8	18.7	19.0	17.4	17.0	14.3	14.0	12.4
5.0	11.5	12.1	14.8	18.7	19.0	17.3	16.9	14.3	14.0	12.4
Max Change (°C/m)[1]	0.0	0.0	0.1	0.1	0.2	0.1	4.0	0.3	0.1	0.0
Depth of Max Change (m)	N/A	N/A	4.50	1.50	0.75	4.50	2.50	0.75	0.75	N/A

Notes:

Data downloaded from Ecology's EIM database on 12/17/2012 (http://www.ecy.wa.gov/eim/) with exception of 8/7/2012 at depths of 3.0 m and less, which were from TetraTech (2012).
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. nr = not reported.
4. N/A = not applicable (dates with 0.0°C max change).

Table 3-3: LL4 Temperature Vertical Profiles in 2012

Depth (meters)	Water Temperature (°C)									
	5/24/2012	6/6/2012	6/26/2012	7/11/2012	7/25/2012	8/7/2012	8/21/2012	9/11/2012	9/26/2012	10/16/2012
0.5	11.6	12.4	15.3	**23.6**	**23.5**	**24.6**	**23.9**	19.1	18.0	12.9
1.0	11.6	12.4	15.3	**23.1**	**23.3**	**24.5**	**23.9**	19.1	18.0	12.9
2.0	11.5	12.4	15.3	**20.5**	**23.1**	**24.4**	**23.9**	19.0	18.0	12.6
3.0	11.5	12.4	15.2	19.5	**22.4**	**24.3**	**23.4**	18.8	17.8	12.3
4.0	11.5	12.4	15.3	19.1	20.0	**22.6**	**22.6**	18.7	16.8	12.3
5.0	11.5	12.4	15.2	19.1	18.9	18.2	**20.7**	16.7	14.2	12.3
6.0	11.5	12.4	15.2	19.0	18.9	18.0	17.0	15.3	14.1	12.3
7.0	11.5	12.4	15.2	19.0	18.9	18.0	17.1	15.2	14.1	12.3
8.0	11.5	12.4	15.2	18.9	18.9	18.0	17.1	15.1	14.1	12.3
Max Change (°C/m)[1]	0.0	0.0	0.1	2.6	2.4	4.4	3.7	2.0	2.6	0.3
Depth of Max Change (m)	N/A	N/A	0.75	1.50	3.50	4.50	5.50	4.50	4.50	2.50

Notes:

Data downloaded from Ecology's EIM database on 1/12/2012: http://www.ecy.wa.gov/eim/

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: LL3 Temperature Vertical Profiles in 2012

Depth (meters)	Water Temperature (°C)									
	5/24/2012	6/6/2012	6/26/2012	7/11/2012	7/25/2012	8/7/2012	8/21/2012	9/11/2012	9/26/2012	10/16/2012
0.5	12.5	13.1	16.1	**24.3**	**23.8**	**24.3**	**23.9**	19.7	18.1	14.9
1.0	12.4	13.1	16.1	**24.1**	**23.8**	**24.3**	**24.0**	19.6	18.1	14.9
2.0	12.4	13.1	16.1	**22.4**	**23.8**	**24.3**	**23.9**	19.7	18.2	14.8
3.0	12.4	13.1	16.1	**20.0**	**23.4**	**24.1**	**23.5**	19.7	18.2	14.8
4.0	12.4	13.1	16.0	19.7	**23.2**	**22.8**	**23.1**	19.7	18.2	14.8
5.0	12.3	13.1	15.8	19.2	**22.5**	**21.8**	**22.5**	19.7	18.1	14.8
6.0	12.3	13.1	15.6	18.9	**21.6**	**21.1**	**21.6**	19.7	17.5	14.8
7.0	12.3	13.1	15.5	18.5	**21.1**	**20.5**	**20.7**	19.7	17.2	14.8
8.0	12.3	13.1	15.4	18.5	**20.4**	**20.3**	**20.1**	19.7	16.8	14.8
9.0	12.3	13.0	15.5	18.4	20.0	**20.1**	19.5	19.6	16.6	14.8
10.0	12.3	13.0	15.5	18.3	19.8	19.6	18.9	19.6	16.1	14.2
12.0	12.3	13.0	15.4	18.1	19.5	18.9	18.1	18.9	15.5	13.8
15.0	12.3	13.0	15.1	17.3	19.3	18.1	17.8	16.5	14.9	12.3
17.0	12.3	13.0	15.1							
18.0				16.7	17.8	18.1	17.7	16.2	14.8	12.0
19.0							17.7			
Max Change (°C/m)[1]	0.1	0.1	0.2	2.4	0.9	1.3	0.9	0.8	0.5	0.7
Depth of Max Change (m)	0.75	8.50	4.50	2.50	5.50	3.50	6.50	13.50	5.50	9.50

Notes:

Data downloaded from Ecology's EIM database on 1/12/2012: http://www.ecy.wa.gov/eim/
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 3-5: LL2 Temperature Vertical Profiles in 2012

Depth (meters)	Water Temperature (°C)									
	5/23/2012	6/5/2012	6/25/2012	7/10/2012	7/24/2012	8/6/2012	8/20/2012	9/10/2012	9/25/2012	10/15/2012
0.5	13.2	14.2	16.6	**23.4**	**23.6**	**24.5**	**24.1**	19.7	18.6	14.9
1.0	13.2	14.2	16.5	**23.2**	**23.6**	**24.5**	**24.1**	19.7	18.6	14.9
2.0	13.1	14.2	16.3	**21.7**	**23.5**	**24.4**	**23.8**	19.7	18.6	14.9
3.0	12.9	14.2	16.3	**20.2**	**23.3**	**24.0**	**23.7**	19.6	18.4	14.9
4.0	12.9	14.2	16.2	19.3	**23.2**	**23.0**	**23.3**	19.6	18.4	14.9
5.0	12.9	14.2	16.1	18.9	**23.1**	**22.2**	**22.6**	19.6	18.4	14.9
6.0	12.9	14.2	16.0	18.6	**23.1**	**21.4**	**21.9**	19.6	18.0	14.9
7.0	12.9	14.2	15.9	18.5	**22.3**	**20.8**	**20.3**	19.6	17.6	14.8
8.0	12.9	14.2	15.7	18.3	**21.4**	**20.4**	19.8	19.6	17.1	14.8
9.0	12.9	14.1	15.6	18.2	**20.6**	19.9	19.4	19.6	16.8	14.8
10.0	12.9	13.9	15.5	17.9	**20.1**	19.6	18.9	19.6	16.6	14.8
12.0	12.9	14.0	15.3	17.6	20.0	19.3	18.4	19.5	16.2	14.8
15.0	12.9	13.8	15.0	17.1	19.2	18.6	18.3	17.8	15.8	14.4
18.0	12.9	13.7	14.9	16.8	18.3	18.1	18.1	16.6	14.8	12.9
21.0	12.8	13.7	14.7	16.4	17.0	17.9	18.1	15.7	14.7	12.1
24.0	12.8	13.7	13.4	15.5	16.5	17.8	17.9	15.7	14.7	12.0
25.0	12.8		13.4	15.3	16.3	17.8	17.7	15.7	14.7	
25.5										12.0
Max Change (°C/m)[1]	0.2	0.1	0.4	1.5	0.9	1.0	1.6	0.6	0.5	0.5
Depth of Max Change (m)	2.50	13.50	22.50	1.50	7.50	3.50	6.50	13.50	7.50	16.5

Notes:

Data downloaded from Ecology's EIM database on 1/12/2012: http://www.ecy.wa.gov/eim/

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: LL1 Temperature Vertical Profiles in 2012

Depth (meters)	Water Temperature (°C)									
	5/23/2012	6/5/2012	6/25/2012	7/10/2012	7/24/2012	8/6/2012	8/20/2012	9/10/2012	9/25/2012	10/15/2012
0.5	12.9	15.3	17.2	**23.6**	**22.9**	**24.1**	**23.9**	19.7	18.5	15.1
1.0	12.9	15.2	17.1	**23.5**	**22.7**	**24.1**	**23.9**	19.7	18.4	15.1
2.0	12.9	15.2	17.0	**23.1**	**22.5**	**24.0**	**23.9**	19.7	18.4	15.1
3.0	12.8	15.2	16.9	**22.0**	**22.5**	**24.0**	**23.9**	19.7	18.4	15.1
4.0	12.7	15.2	16.7	**20.2**	**22.4**	**23.9**	**23.9**	19.7	18.4	15.0
5.0	12.7	15.1	16.1	19.3	**22.4**	**23.9**	**23.7**	19.7	18.4	15.0
6.0	12.7	14.9	15.9	18.9	**22.3**	**22.1**	**22.2**	19.7	18.4	15.0
7.0	12.7	14.7	15.7	18.5	**22.3**	**20.9**	**20.6**	19.7	18.4	15.0
8.0	12.7	14.5	15.6	18.2	**21.7**	**20.2**	20.0	19.2	18.3	15.0
9.0	12.7	14.2	15.6	18.0	**20.8**	19.7	19.4	18.9	18.2	15.0
10.0	12.7	13.9	15.6	17.9	**20.3**	19.5	19.2	18.0	17.1	15.0
12.0	12.7	13.7	15.1	17.6	19.8	19.2	18.8	17.6	16.5	15.0
15.0	12.7	13.5	14.9	17.2	19.2	18.9	18.5	16.9	16.0	14.2
18.0	12.6	13.4	14.8	16.8	17.9	18.3	18.3	16.7	15.5	13.3
21.0	12.7	13.3	14.0	16.5	17.2	18.1	18.1	16.3	15.0	12.5
24.0	12.6	13.3	13.6	15.9	16.9	17.7	17.9	16.0	14.8	12.4
27.0	12.7	13.0	13.5	15.3	16.3	16.2	17.4		14.8	12.3
30.0	12.6	12.9	13.4	15.1	15.6	15.5	16.0	15.8	14.7	12.3
33.0	12.6	12.6	13.4	14.9	15.1	15.1	15.2	15.8	14.6	12.3
34.0	12.6		13.4	14.9						
Max Change (°C/m)[1]	0.1	0.4	0.6	1.8	0.9	1.8	1.6	0.9	1.1	0.3
Depth of Max Change (m)	0.75	8.50	4.50	3.50	8.50	5.50	6.50	9.50	9.50	16.50

Notes:

Data downloaded from Ecology's EIM database on 1/12/2012: http://www.ecy.wa.gov/eim/
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: LL0 Temperature Vertical Profiles in 2012

Depth (meters)	Water Temperature (°C)									
	5/23/2012	6/5/2012	6/25/2012	7/10/2012	7/24/2012	8/6/2012	8/20/2012	9/10/2012	9/25/2012	10/15/2012
0.5	13.3	15.1	16.2	**24.2**	**21.3**	**24.2**	**24.3**	19.9	18.5	15.1
1.0	13.3	15.1	16.2	**24.2**	**21.1**	**24.1**	**24.0**	19.8	18.4	15.1
2.0	13.3	15.0	16.1	**23.8**	**21.0**	**24.1**	**23.5**	19.8	18.4	15.1
3.0	13.2	14.9	15.9	**21.6**	**20.9**	**24.1**	**23.2**	19.8	18.4	15.1
4.0	13.1	14.9	15.7	19.2	**20.8**	**23.6**	**23.1**	19.8	18.4	15.1
5.0	13.1	14.9	15.6	18.6	**20.8**	**22.7**	**22.8**	18.5	18.4	15.1
6.0	13.1	14.9	15.6	18.2	**20.7**	**21.8**	**22.1**	18.0	18.4	15.1
7.0	13.1	14.8	15.5	17.9	**20.6**	**21.0**	**20.2**	17.9	17.9	14.9
8.0	13.1	14.2	15.4	17.8	**20.6**	**20.4**	19.5	17.8	17.5	14.7
9.0	13.0	14.1	15.2	17.7	**20.5**	**20.1**	19.2	17.6	17.1	14.6
10.0	12.9	14.0	15.2	17.6	**20.4**	19.6	19.0	17.5	16.9	14.6
12.0	12.8	13.4	15.0	17.5	**20.2**	19.1	18.8	17.4	16.4	14.4
15.0	12.7	13.3	14.9	17.2	19.8	18.5	18.5	17.2	15.9	13.8
18.0	12.5	13.3	14.5	17.1	18.6	18.3	18.3	17.0	15.4	13.2
21.0	12.4	13.2	14.5	16.6	17.6	18.1	18.0	16.6	15.0	12.8
24.0	12.4	13.1	14.1	15.9	17.0	17.4	17.8	16.1	14.8	12.5
27.0	12.4	13.0	13.9	15.3	16.3	16.4	17.1	16.0	14.7	12.4
30.0	12.3	13.0	13.7	15.1	15.6	15.7	16.0	15.9	14.7	12.4
33.0	12.2	13.0	13.6	15.0	15.1	15.2	15.2	15.7	14.6	12.3
36.0	12.1	12.9	13.6	14.8	14.8	14.8	14.7	14.9	14.6	12.3
39.0	11.9	12.8	13.5	14.6	14.5	14.3	14.2	14.3	14.6	12.3
42.0	11.8	12.7	13.5	14.2	14.1	14.1	14.0	14.0	14.6	12.3
45.0	11.3	12.6	13.5	14.0	13.9	13.9	13.8	13.8	14.5	12.3
47.0					13.8					
48.0	11.1	12.5	13.5	13.8		13.7	13.7	13.7	14.0	12.3
49.3						13.7				
49.5	11.0							13.7	13.9	
50.0					13.7					
Max Change (°C/m)[1]	0.2	0.6	0.3	2.4	0.5	0.9	2.0	1.2	0.5	0.2
Depth of Max Change (m)	43.50	7.50	2.50	3.50	0.75	5.50	6.50	4.50	7.50	7.50

Notes:
Data downloaded from Ecology's EIM database on 1/12/2012: http://www.ecy.wa.gov/eim/
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: LLFB Daily Maximum Temperature in 2012

Day	Maximum Daily Water Temperature (°C)					
	June	July	August	September	October	November
1	Not Monitored	19.20	**24.41**	19.07	16.71	Not Monitored
2		**20.11**	**22.75**	19.38	16.55	
3		19.92	**23.98**	19.72	16.82	
4		19.11	**24.52**	19.52	16.82	
5		19.77	19.95	19.52	16.60	
6		**20.77**	**24.64**	**20.47**	16.39	
7		**20.40**	19.56	**20.35**	16.11	
8		**21.95**	**25.25**	19.60	15.31	
9		**22.34**	**25.15**	19.68	15.27	
10		**21.53**	**24.79**	17.47	15.39	
11		**23.54**	**25.13**	18.24	15.27	
12		**22.84**	**24.74**	18.29	15.24	
13		**24.16**	19.51	18.28	15.18	
14		**24.64**	**20.55**	17.86	15.07	
15		**25.27**	**23.69**	17.39	15.01	
16		**25.56**	**21.27**	17.01	14.82	
17		**24.77**	19.06	17.06	14.10	
18		**23.95**	18.87	17.12	14.17	
19		**25.25**	19.16	16.80	14.16	
20		**25.17**	**21.57**	16.80	14.03	
21		**24.87**	19.23	16.69	13.43	
22		**25.33**	19.01	16.70	13.37	
23		**23.97**	19.12	16.74	13.19	
24		**23.01**	18.78	18.20	13.01	
25		**24.39**	18.76	18.22	12.84	
26		**25.31**	**20.78**	17.82	12.73	
27		**20.01**	**20.45**	17.41	12.50	
28	18.56	**24.95**	19.26	17.10	12.06	
29	19.54	**20.64**	18.83	17.19	11.97	
30	19.69	**25.18**	**20.74**	16.68	11.66	
31	--	**24.58**	18.55	--	11.76	

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 3-9: LLTR Daily Maximum Temperature in 2012

Day	Maximum Daily Water Temperature (°C)							
	April	May	June	July	August	September	October	November
1		9.50	13.82	16.10	**20.63**	18.63	16.24	11.52
2		9.64	13.71	16.68	**20.16**	18.46	16.18	
3		9.64	13.93	16.43	**20.21**	18.66	16.06	
4		9.53	13.92	16.85	**20.99**	18.43	16.05	
5		9.29	14.16	17.02	**21.03**	18.35	15.86	
6		9.32	14.05	17.21	**20.50**	19.30	15.63	
7		9.71	14.27	17.31	**20.54**	18.78	15.46	
8		9.93	14.23	17.86	**20.32**	18.30	15.21	
9		9.87	13.86	18.15	**20.45**	18.24	15.08	
10	Not monitored	9.99	13.27	18.22	**20.43**	17.56	14.96	
11		11.01	13.53	18.49	**20.29**	17.59	14.84	
12		11.14	13.41	18.40	**20.23**	17.60	14.61	
13		11.08	13.42	18.64	**20.30**	17.57	14.71	
14		11.15	13.46	19.11	19.90	17.43	14.50	
15		11.36	13.47	**20.06**	**21.27**	17.36	14.45	
16		11.55	14.13	**20.26**	**20.68**	17.35	14.26	
17		12.08	13.92	**20.24**	**20.12**	17.19	14.06	Not Monitored
18		12.69	14.16	19.57	**20.17**	17.13	14.09	
19		13.44	14.47	**20.16**	**20.11**	17.00	14.08	
20	6.83	13.22	14.87	**20.68**	**20.33**	16.88	13.94	
21	7.10	13.17	14.86	**20.23**	**20.26**	16.80	13.57	
22	7.76	13.11	14.86	**20.60**	**20.08**	16.73	13.48	
23	7.98	13.16	14.56	**20.21**	**20.16**	16.71	13.43	
24	8.53	13.41	15.14	**20.41**	19.32	16.85	13.23	
25	9.59	13.56	15.04	**20.70**	19.55	16.82	13.12	
26	9.74	13.52	15.13	**20.65**	19.69	16.69	12.81	
27	9.98	13.40	15.78	**20.57**	19.69	16.60	12.67	
28	9.99	13.25	15.85	**20.65**	19.23	16.54	12.46	
29	9.79	13.08	16.19	**20.93**	18.94	16.49	12.26	
30	9.68	13.30	16.23	**20.91**	19.32	16.31	12.01	
31	--	13.58	--	**20.82**	19.13	--	11.98	

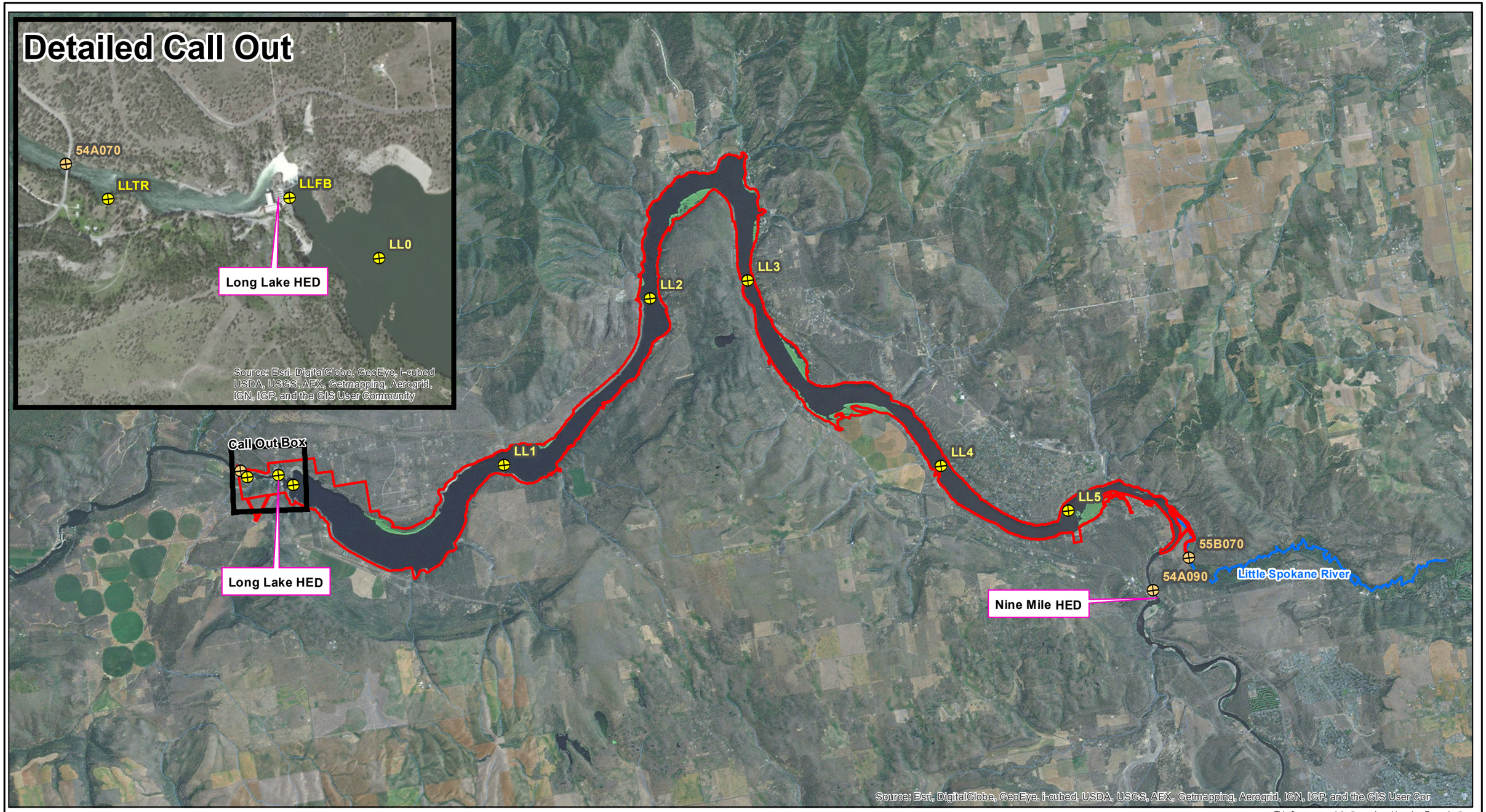
Notes:
-- = not applicable.
Shaded and bold values indicate an exceedance of the 20.0°C criterion.
Data collected as part of Avista's Washington Total Dissolved Gas Monitoring Plan and Detailed DO Phase II Feasibility and Implementation Plan.

Table 4-1: Comparison of LLTR 2012 Values to Tribe WQ Standards

Day	7-DADM (°C)						
	April	May	June	July	August	September	October
1	Not monitored	9.71	13.62	16.33	**20.66**	**18.80**	**16.27**
2		9.58	13.77	16.50	**20.68**	**18.71**	**16.17**
3		9.51	13.88	16.65	**20.62**	**18.71**	**16.05**
4		9.52	13.98	16.80	**20.58**	**18.66**	**15.93**
5		9.58	14.04	17.05	**20.54**	**18.61**	**15.78**
6		9.61	14.06	17.26	**20.58**	**18.58**	**15.62**
7		9.70	13.97	17.52	**20.61**	**18.42**	**15.46**
8		9.91	13.91	17.75	**20.51**	**18.30**	**15.29**
9		10.18	13.80	17.95	**20.39**	**18.20**	**15.11**
10		10.43	13.71	18.15	**20.37**	**17.95**	**14.98**
11		10.63	13.60	18.41	**20.27**	**17.76**	**14.84**
12		10.84	13.49	**18.72**	**20.41**	**17.62**	**14.74**
13		11.08	13.53	**19.03**	**20.44**	**17.49**	**14.62**
14		11.34	13.62	**19.31**	**20.40**	**17.44**	**14.49**
15		11.58	13.71	**19.47**	**20.38**	**17.38**	**14.38**
16		11.91	13.86	**19.72**	**20.36**	**17.29**	**14.31**
17		12.21	14.07	**20.01**	**20.37**	**17.19**	**14.20**
18		12.50	14.27	**20.17**	**20.42**	**17.10**	**14.06**
19		12.75	14.47	**20.25**	**20.25**	**17.01**	**13.93**
20	#N/A	12.98	14.53	**20.24**	**20.18**	**16.92**	**13.81**
21	#N/A	13.17	14.70	**20.27**	**20.06**	**16.87**	**13.69**
22	#N/A	13.30	14.83	**20.43**	**19.97**	**16.83**	**13.55**
23	8.22	13.31	14.92	**20.50**	**19.91**	**16.78**	**13.37**
24	8.71	13.33	15.05	**20.48**	**19.82**	**16.74**	**13.19**
25	9.15	13.34	15.19	**20.54**	**19.67**	**16.71**	**13.03**
26	9.44	13.34	15.38	**20.59**	**19.51**	**16.67**	**12.85**
27	9.68	13.36	15.62	**20.69**	**19.39**	**16.61**	**12.65**
28	9.82	13.38	15.76	**20.75**	**19.36**	**16.53**	**12.47**
29	9.83	13.42	15.99	**20.74**	**19.23**	**16.44**	**12.24**
30	9.81	13.45	16.18	**20.67**	**19.06**	**16.35**	#N/A
31	--	**13.52**	--	**20.62**	**18.91**	--	#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

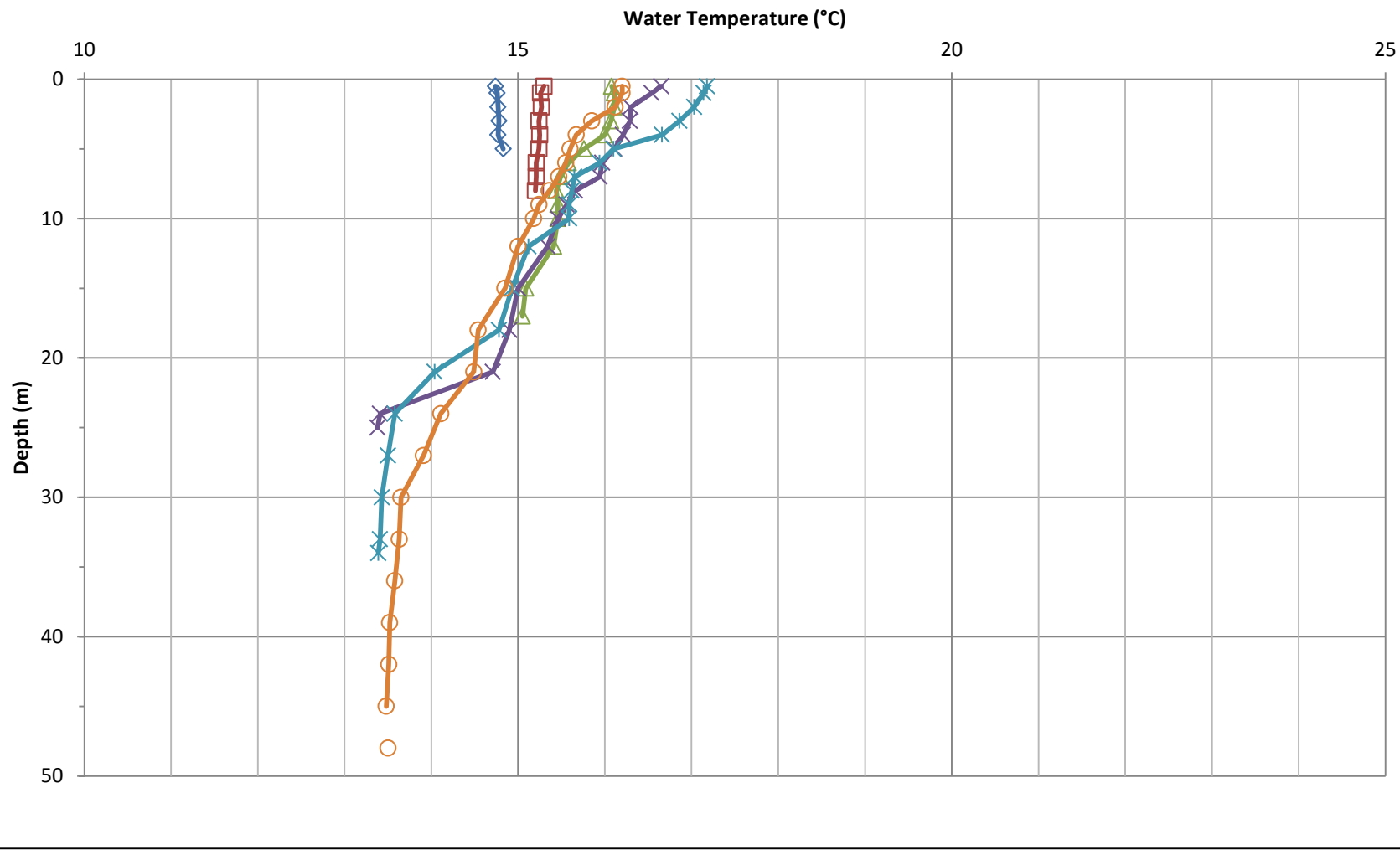
This figure was originally produced in color. Reproduction in black and white may result in a loss of information.

FIGURE **2-1**

Long Lake HED 2012
Temperature Monitoring Stations

Golder Associates

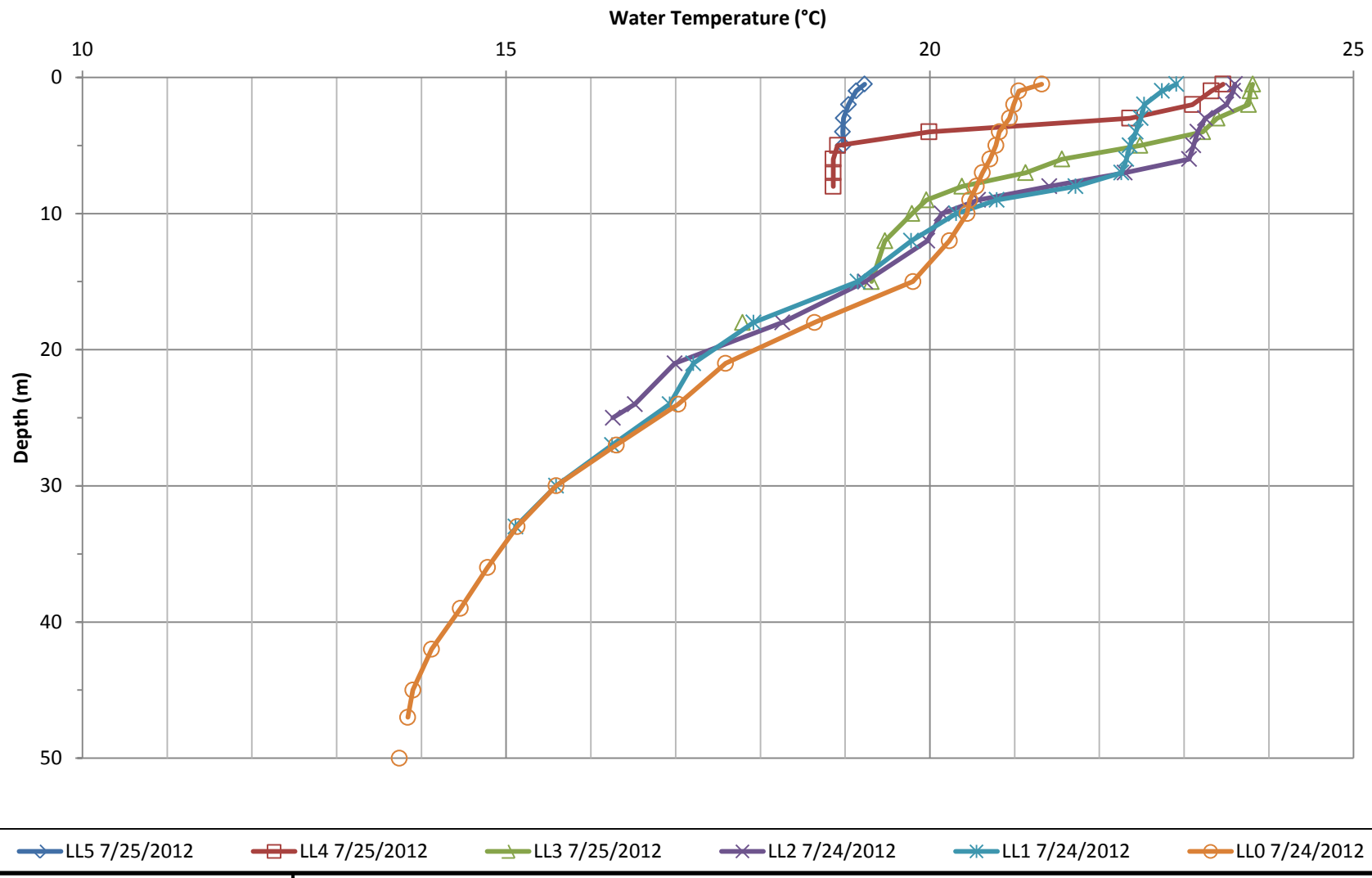
Path: M:\Projects\2010\10393119_AvistaAquaticWeeds\MXD\LakeSpokane_Temp_Monitoring_Sites Fig_2_1_20130208.mxdGLEHMAN



Golder Associates

Title	Lake Spokane Temperature Vertical Profiles, late June 2012		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-06.100
Client Name	Avista	Date	February 22, 2013

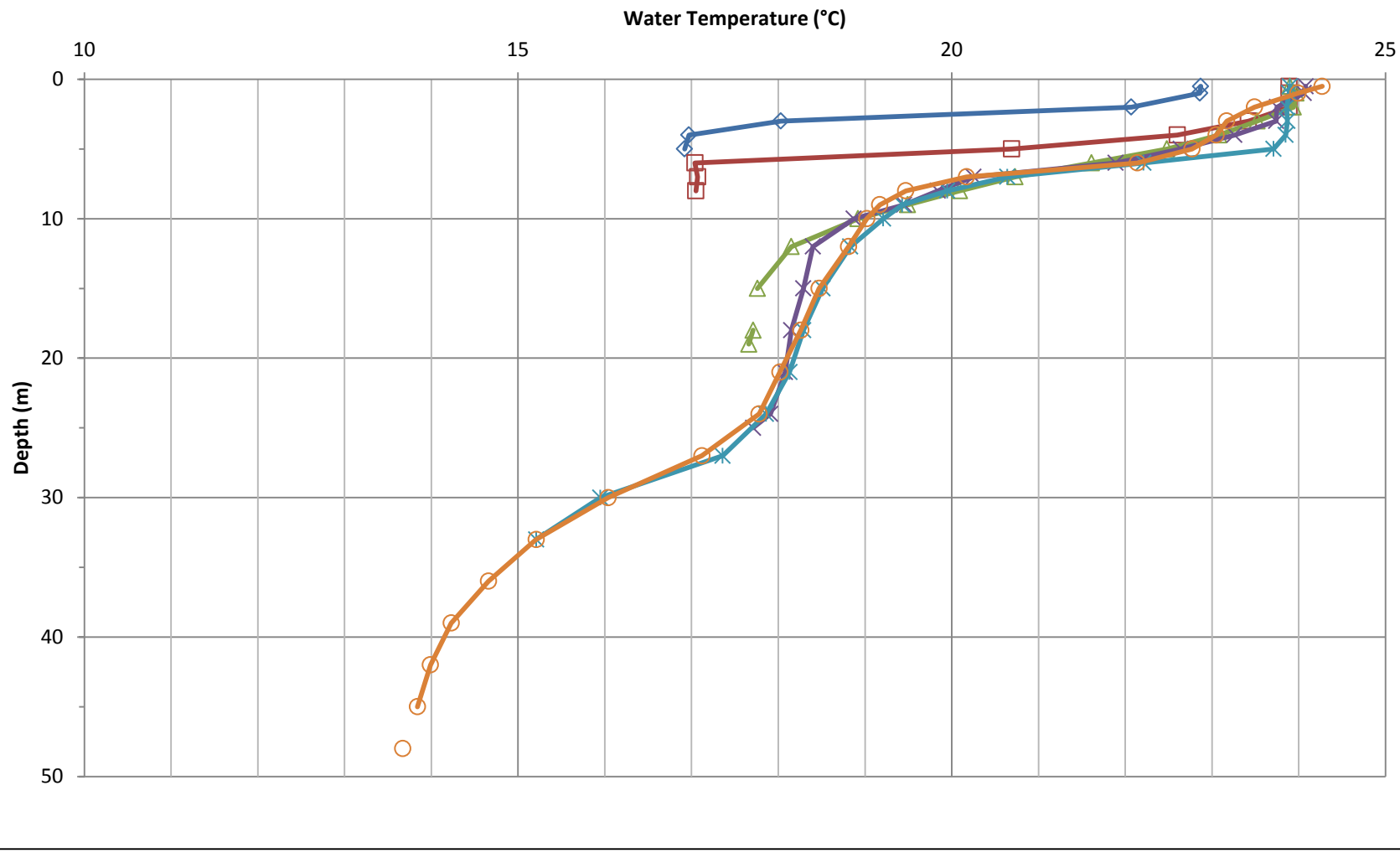
FIGURE 3-1



Golder Associates

Title	Lake Spokane Temperature Vertical Profiles, late July 2012		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-06.100
Client Name	Avista	Date	February 22, 2013

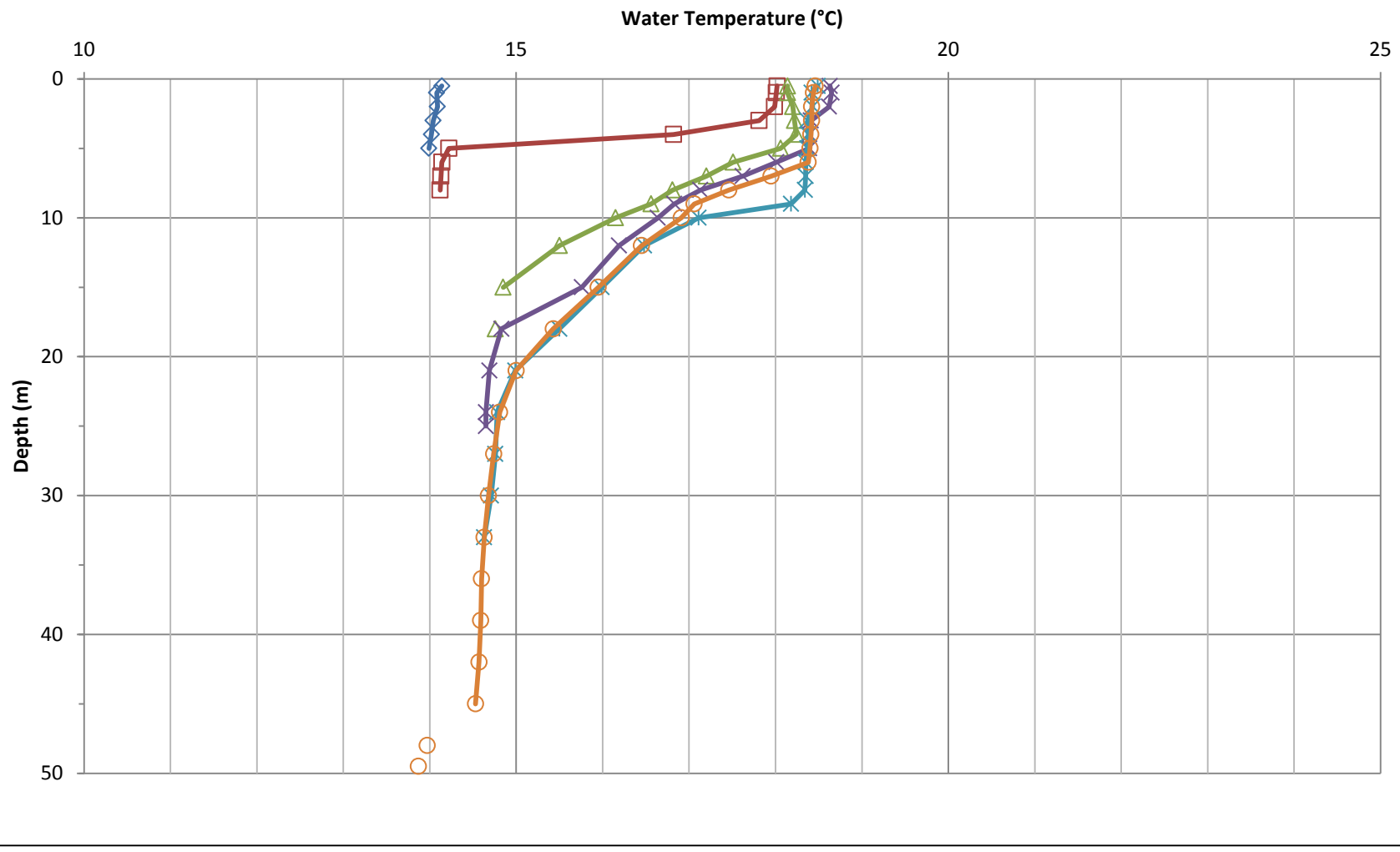
FIGURE 3-2



Golder Associates

Title	Lake Spokane Temperature Vertical Profiles, late August 2012		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-06.100
Client Name	Avista	Date	February 22, 2013

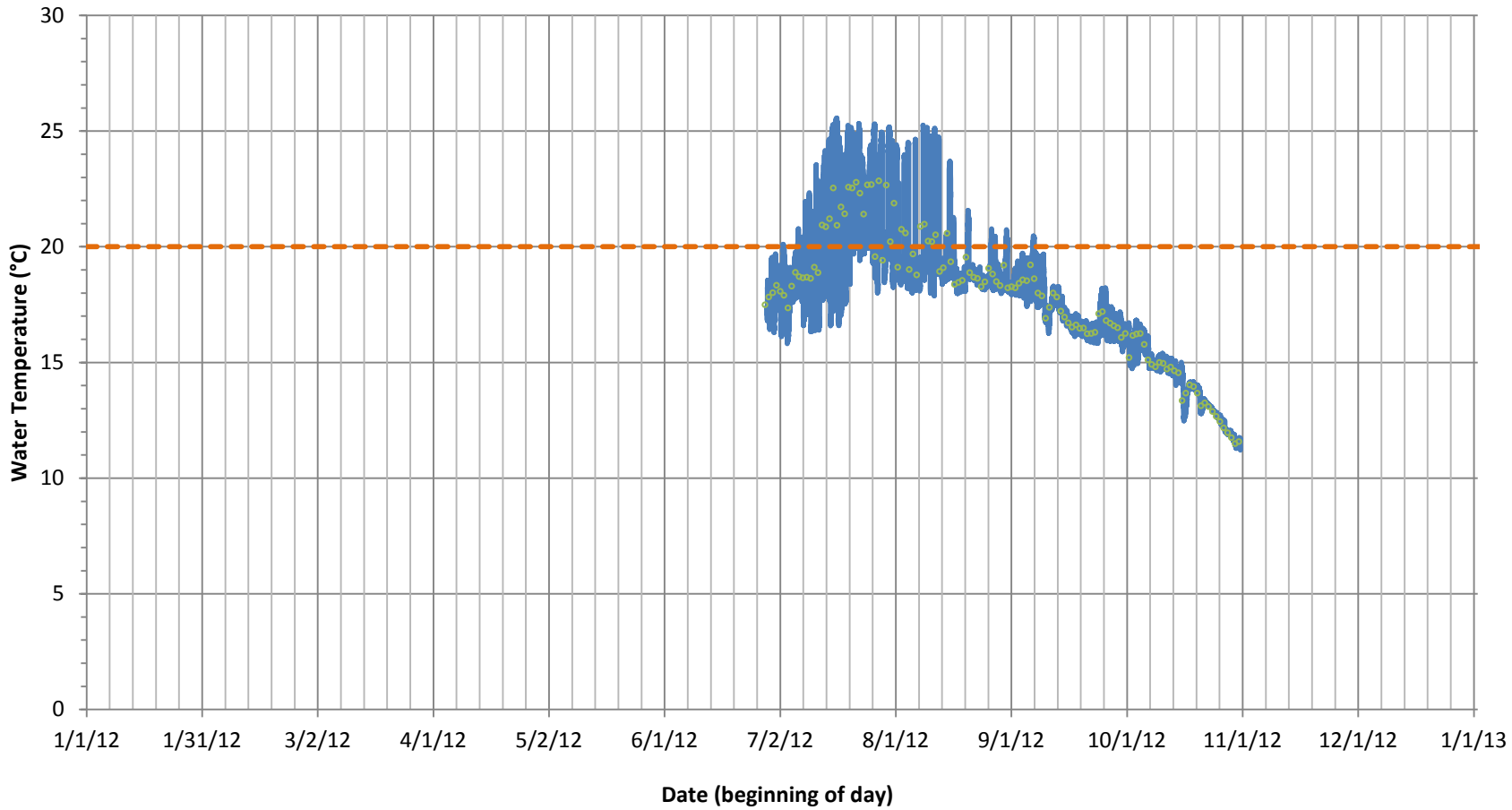
FIGURE 3-3



Golder Associates

Title	Lake Spokane Temperature Vertical Profiles, late September 2012		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-06.100
Client Name	Avista	Date	February 22, 2013

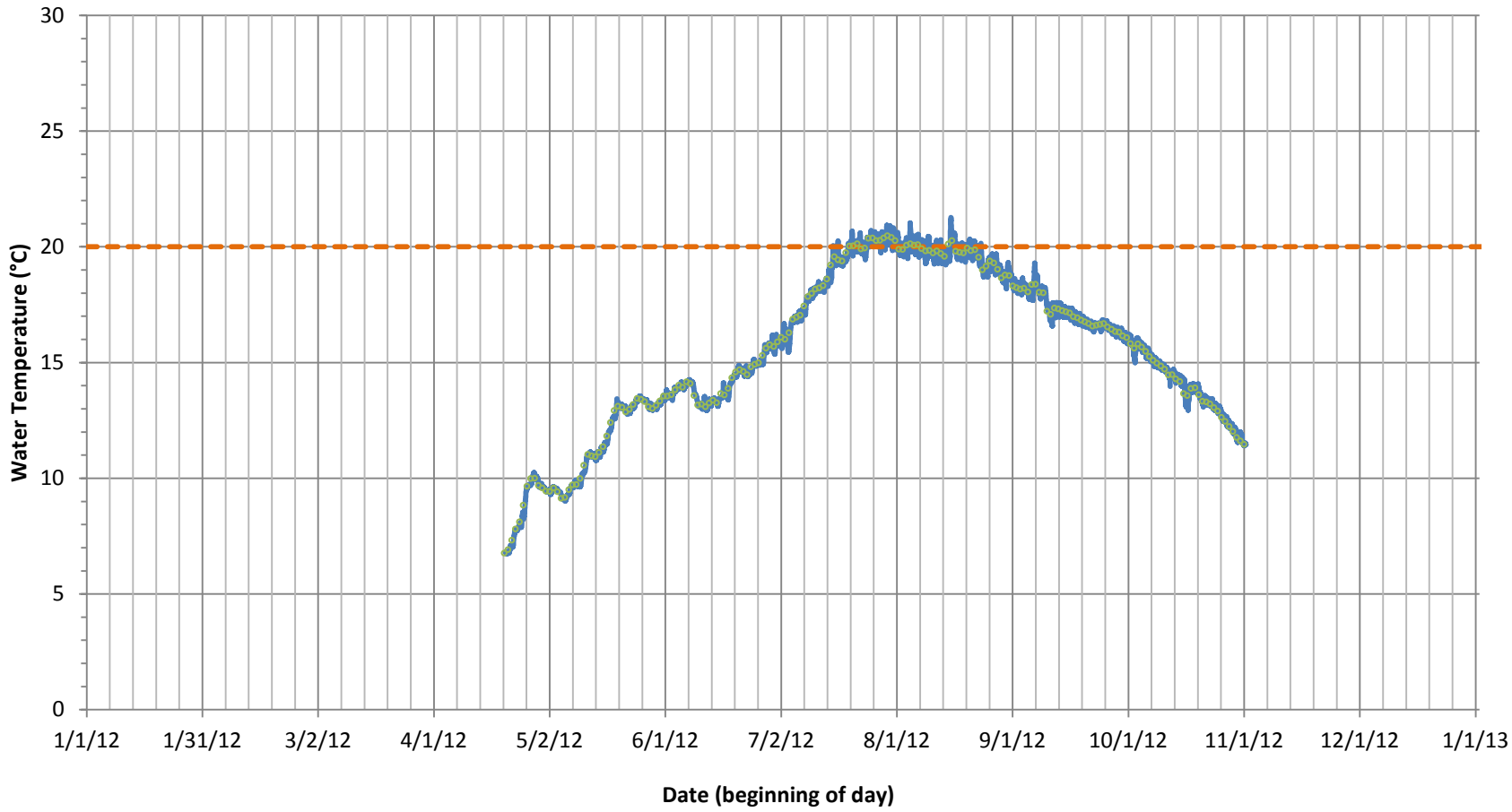
FIGURE 3-4



Golder Associates

Title	LLFB Temperature Time Series, 2012		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-06.100
Client Name	Avista	Date	February 22, 2013

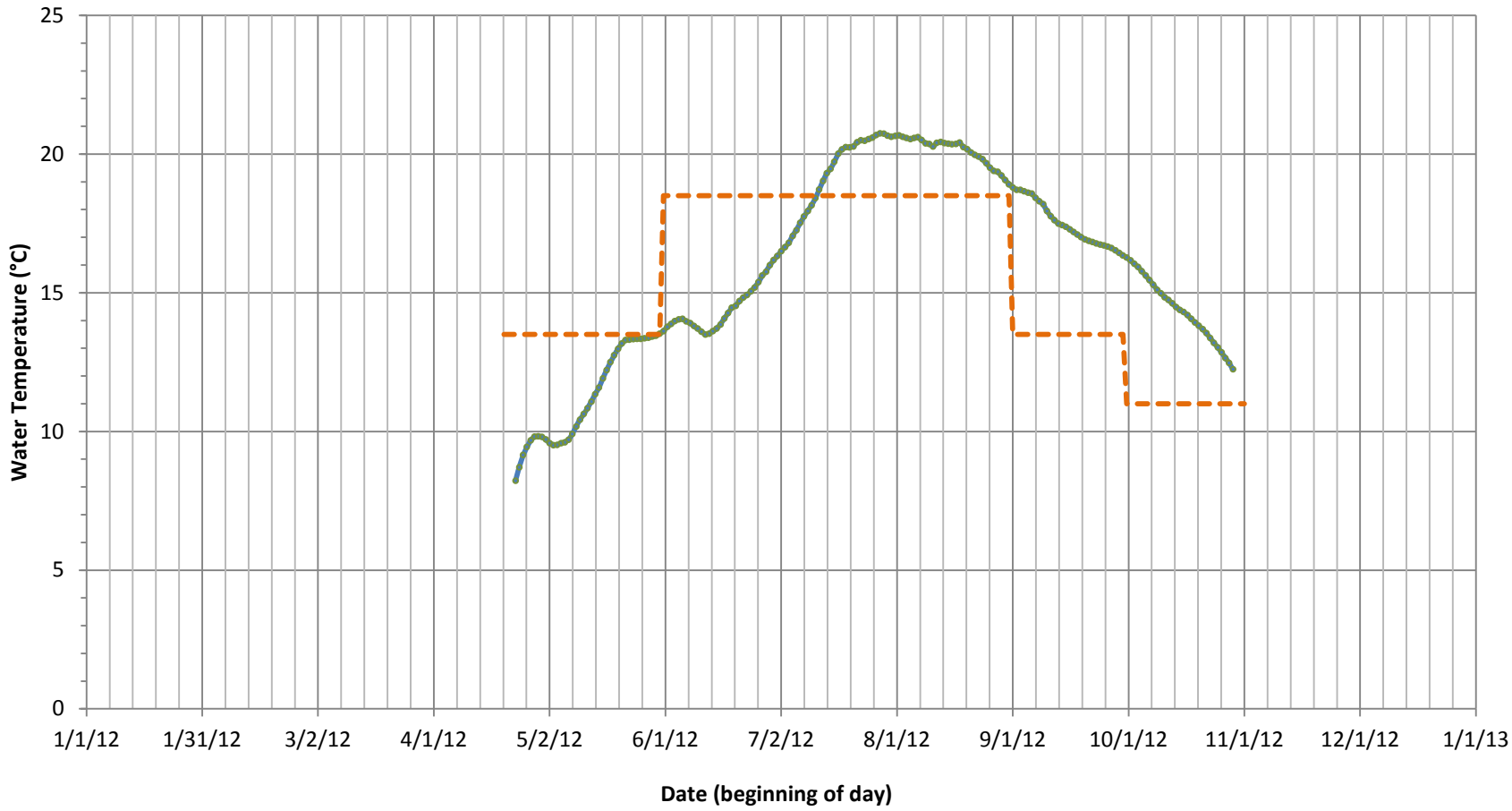
FIGURE 3-5



Golder Associates

Title	LLTR Temperature Time Series, 2012		
Project Name	LL HED Temp Monitoring Report	Project No.	073-93081-06.100
Client Name	Avista	Date	February 22, 2013

FIGURE 3-6



Golder Associates	Title: LLTR 7-DADM Time Series, 2012		
	Project Name: LL HED Temp Monitoring Report	Project No.: 073-93081-06.100	FIGURE 4-1
	Client Name: Avista	Date: February 22, 2013	

APPENDIX A
CONSULTATION RECORD

February 28, 2013

Marcie Mangold, 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
2012 Long Lake Hydroelectric Development Temperature Monitoring Report

Dear Ms. Mangold:

I have enclosed the 2012 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, required by the Spokane River Hydroelectric Project License (License) Appendix B, Section 5.5.B of the Washington Department of Ecology Section 401 Water Quality Certification.

We request your review by **March 28, 2013**. This will allow us time to incorporate your comments and recommendations as appropriate, and submit the Temperature Monitoring Report to the Federal Energy Regulatory Commission by **April 15, 2013**.

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
Spokane, Washington 99220-3727

800.227.9187
www.avistautilities.com

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

March 19, ~~2012~~ 2013 EOA

Mr. Elvin "Speed" Fitzhugh
Spokane River License Manager
Avista Corporation
1411 East Mission Ave., MSC-1
Spokane, WA 99220-3727

RE: Request for Review and Approval – Spokane River Hydroelectric Project No. 2545, 2012 Long Lake HED Temperature Monitoring Report – Washington 401 Certification, Section 5.5

Dear Mr. Fitzhugh:

We have reviewed the *2012 Long Lake HED Temperature Monitoring Report* that was emailed to the Department of Ecology (Ecology) on February 28, 2012.

Overall the report was well written and well organized. For future annual reports, it would be helpful if the compliance schedule from the temperature water quality attainment plan (WQAP) was included in a summary section toward the end of the document. This section would be used to look at progress being made regarding the temperature WQAP compliance schedule so that any adaptive management decisions regarding the schedule could be assessed.

Although the data showed that temperature exceeded the 20.0°C water quality standard in several monitoring locations, Ecology acknowledges that while you are actively working on your compliance schedule identified in your temperature WQAP, you are in compliance with your 401 water quality certification.

Please feel free to contact me at (509) 329-3450 or by email at dman461@ecy.wa.gov if you have any further questions regarding this matter.

Sincerely,

D. Marcie Mangold

D. Marcie Mangold
Water Quality Program

DMM:dw
cc: Brian Crossley, Spokane Tribe of Indians
Meghan Lunney, Avista
David Knight, Ecology/WQP

ECOLOGY COMMENTS AND AVISTA RESPONSES

These comments and responses pertain specifically to the 2012 Long Lake HED Temperature Monitoring Report.

Ecology Comment
Ecology requested that for future annual reports, Avista include the compliance schedule from the Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan (Temperature WQAP) in a summary section toward the end of the document. This new section could be used to evaluate progress made regarding the compliance schedule so that adaptive management decisions regarding the schedule could be assessed.

Avista Response
Avista will incorporate the compliance schedule from the Temperature WQAP in future annual monitoring reports and will provide a summary of progress made with respect to the compliance schedule so that adaptive management decisions regarding the schedule can be assessed.

February 28, 2013

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

Subject: Spokane River Hydroelectric Project, FERC Project No. 2545
2012 Long Lake Hydroelectric Development Temperature Monitoring Report

Dear Mr. Crossley:

I have enclosed the 2012 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, required by the Spokane River Hydroelectric Project License (License) Appendix B, Section 5.5.B of the Washington Department of Ecology Section 401 Water Quality Certification.

Per the October 2008 Settlement Agreement between Avista and the Spokane Tribe, we request your review and comment on the Temperature Monitoring Report by **March 28, 2013**. This will allow us time to incorporate your comments and recommendations as appropriate, and submit the Temperature Monitoring Report to the Federal Energy Regulatory Commission by **April 15, 2013**.

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: Marcie Mangold, Ecology

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

800.227.9187
www.avistautilities.com

Lunney, Meghan

From: Brian Crossley [crossley@SpokaneTribe.com]
Sent: Tuesday, April 09, 2013 12:44 PM
To: Lunney, Meghan
Cc: Casey Flanagan
Subject: RE: 2012 Long Lake HED Temperature Monitoring Report

Casey Flanagan and I have reviewed the annual monitoring reports for TDG, Temperature and TDG-sorry about the delay. A couple of comments: Casey did notice better dissolved oxygen in our water quality data collected down at the Bible Camp. There appears to be some attenuation of dissolved oxygen even when the turbines are not turning. The only other item concerning temperature is if you have given thought to whether there is an increase in temperature from aerating by the draft tube method and if so; could that be reduced by providing a cooler air source?

We did notice that for TDG; sampling started on April 20th when TDG was already above 110%; any reason for this? I also noticed on Figure 2-4 (TDG report) that there are several 3% drops in LLGEN TDG and did not see a reason for these drops other than they were right before the data didn't meet DQO's.

From: Lunney, Meghan [Meghan.Lunney@avistacorp.com]
Sent: Thursday, February 28, 2013 1:10 PM
To: Brian Crossley
Cc: Mangold, Marcie (ECY); Fitzhugh, Speed (Elvin); Goloborodko, Yelena
Subject: 2012 Long Lake HED Temperature Monitoring Report

Brian,
Attached is the 2012 Long Lake HED Temperature Monitoring Report (Temperature Monitoring Report) which was completed in accordance with the Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan, required by the Spokane River Hydroelectric Project License (License) Appendix B, Section 5.5.B of the Washington Department of Ecology Section 401 Water Quality Certification.

Per the October 2008 Settlement Agreement between Avista and the Spokane Tribe, we request your review and comment by **March 28, 2013**. This will allow us time to incorporate your comments and recommendations as appropriate, and submit the Temperature Monitoring Report to FERC by **April 15, 2013**. In addition to this e-mail, I am also mailing you a hard copy.

Please give me a call at 509-495-4643 if you have any questions.

Thanks!

Meghan Lunney
Aquatic Resource Specialist
Avista Utilities
(509) 495-4643

SPOKANE TRIBE COMMENTS AND AVISTA RESPONSES

These comments and responses pertain specifically to the 2012 Long Lake HED Temperature Monitoring Report.

Spokane Tribe Comment
Has Avista given thought to whether there is an increase in temperature from aerating by the draft tube method and if so; could that be reduced by providing a cooler air source?

Avista Response
Avista asked HDR in 2011, following the 2010 testing of the draft tube aeration system, to evaluate whether introducing air into the draft chest had an effect on downstream water temperature. HDR completed an evaluation based upon the temperature data that was collected in 5-minute intervals during field testing of the draft tube aeration system. 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. They further indicated that this is due to the small amount of air introduced into the flow path (~80 to 100 standard cubic feet per second), which is very small compared to the total flow of water (~800 to 1,500 cubic feet per second) passing through the draft tube. They also indicated another reason tailrace water temperature was unaffected, is that the air temperature (~25 degrees Celsius) is close to the water temperature (~17 to 18 degrees Celsius) and that mixing with air and water only occurs for about 10 to 15 seconds while the air is flowing out of the draft tube and into the tailrace.

HDR did note however, that an increase in water temperature did occur when hydropower generation was turned on and water was withdrawn from the reservoir forebay. The water pulled in through the intakes was about 1 to 2 degrees Celsius warmer than the tailrace water temperature, this most likely reflects the thermal stratification affecting water temperature in the forebay.