AVISTA CORPORATION

SPOKANE RIVER
WATER TEMPERATURE AND DISCHARGE FLOW
QUALITY ASSURANCE CONTROL PROJECT PLAN

IDAHO 401 CERTIFICATION, SECTION I (B) (1)

Spokane River Hydroelectric Project
FERC Project No. 2545

Prepared by:
Golder Associates, Inc.
And
Avista Corporation

In consultation with
Idaho Department of Environmental Quality and
Washington Department of Fish and Wildlife

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1.0 Purpose

On June 18, 2009, the Federal Energy Regulatory Commission (FERC) issued a new license (license) for the Spokane River Project, FERC Project No. 2545-091. Ordering Paragraph D of the FERC license incorporated the conditions set by the Idaho Department of Environmental Quality (IDEQ) under its Federal Clean Water Act Section 401 water quality certification (Idaho WQC) for Avista Corporation's Post Falls Hydroelectric Development, which was issued on June 5, 2008. These conditions can be found in Appendix A of the license. The conditions imposed in the Idaho WQC address water quality effects that the Post Falls HED has within waters subject to the State of Idaho's jurisdiction.

This quality assurance control project plan (QAPP) describes measures that will be enacted to ensure the quality and validity of all data collected under the Spokane River Water Temperature and Discharge Flow Monitoring Plan (Monitoring Plan; Golder 2009). The Monitoring Plan was designed to comply with conditions I.B and I.C of the State of Idaho section 401 Water Quality Certification (Idaho WQC, Idaho 2008) for Avista Utilities' Post Falls Hydroelectric Development. This QAPP establishes procedures for the collection, evaluation and reporting of discharge flow and water temperature data to help assess the relationship on which the Post Falls HED lake level and discharge flows in the Idaho WQC (with the exception of the alternative discharge flows which are set for this monitoring program, condition I.B.2) were developed. This QAPP outlines a consistent and acceptable approach to data collection and management for the Monitoring Plan.

This QAPP is consistent with applicable Idaho water quality law and includes:

1) Appropriate protocols for flow and temperature measurements;
2) The flow monitoring schedule for the Spokane River; and
3) A description of the manner in which Avista shall incrementally increase and monitor discharges from the HED during low flow conditions.

Upon approval, Avista will implement the Monitoring Plan in accordance with the QAPP for a period of five years, unless IDEQ determines that five full years of monitoring are not necessary.

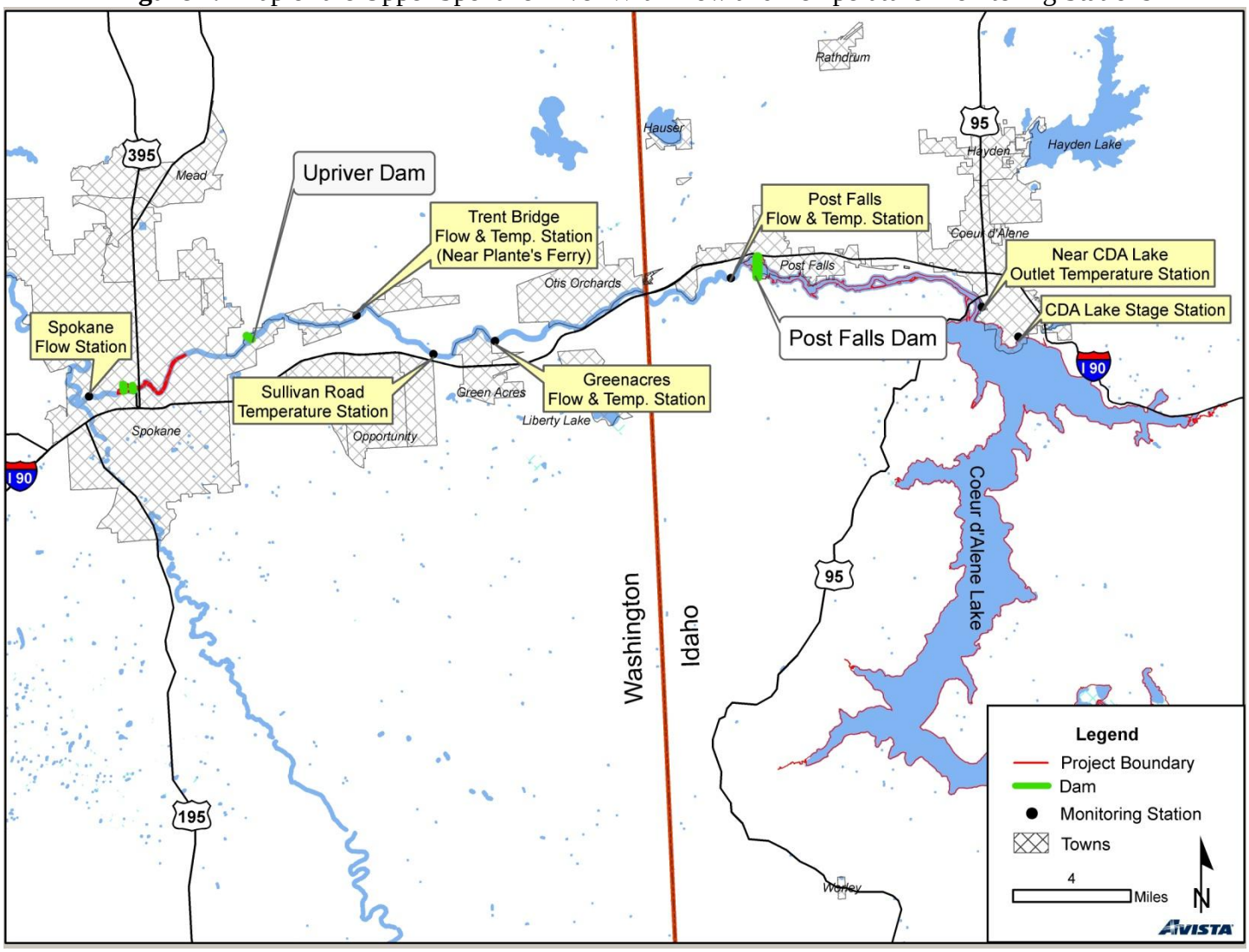
This QAPP describes the quality assurance program associated with the Monitoring Plan as required by condition I.B.1 of the Idaho WQC. This QAPP describes a consistent and acceptable approach to data collection and management that will facilitate achievement of plan objectives for the monitoring period. This QAPP satisfies the Idaho Department of Environmental Quality (IDEQ) quality assurance requirements.

2.0 Project Background

The Post Falls HED is located 9 miles downstream of the outlet of Coeur d'Alene Lake, which is the headwaters of the Spokane River. The study area for the Monitoring Plan (Golder 2009) and this associated QAPP includes the north portion of Coeur d'Alene Lake and the Spokane River, from near the Coeur d'Alene Lake outlet in Idaho downstream to the USGS gage in Spokane,

Washington. Monitoring locations for water temperature and flow were selected according to the Idaho Water Quality Certification (Figure 1).

Figure 1. Map of the Upper Spokane River With Flow and Temperature Monitoring Stations



During about half of any year, a natural channel restriction controls Coeur d'Alene Lake's water elevation and Spokane River flows. In contrast, the Post Falls HED controls water elevations in Coeur d'Alene Lake and flow in the Spokane River after spring run-off, and through the summer and fall.

During summer, warm surface water, from Coeur d'Alene Lake flows into the Spokane River. Warm water temperatures of 20°C and greater, which are common in the summer Coeur d'Alene Lake outflows, are unsuitable for cold-water aquatic species like rainbow trout (Horner 2004). Downstream, near Sullivan Road in Washington, cold-water inflow from the aquifer begins to recharge and cool the Spokane River. This cooling provides cold-water refuge for wild rainbow

trout in the Spokane River, and trout are known to migrate to this area during the summer months (Parametrix 2004; NHC and HDI 2004; Koreny 2004; Horner 2004).

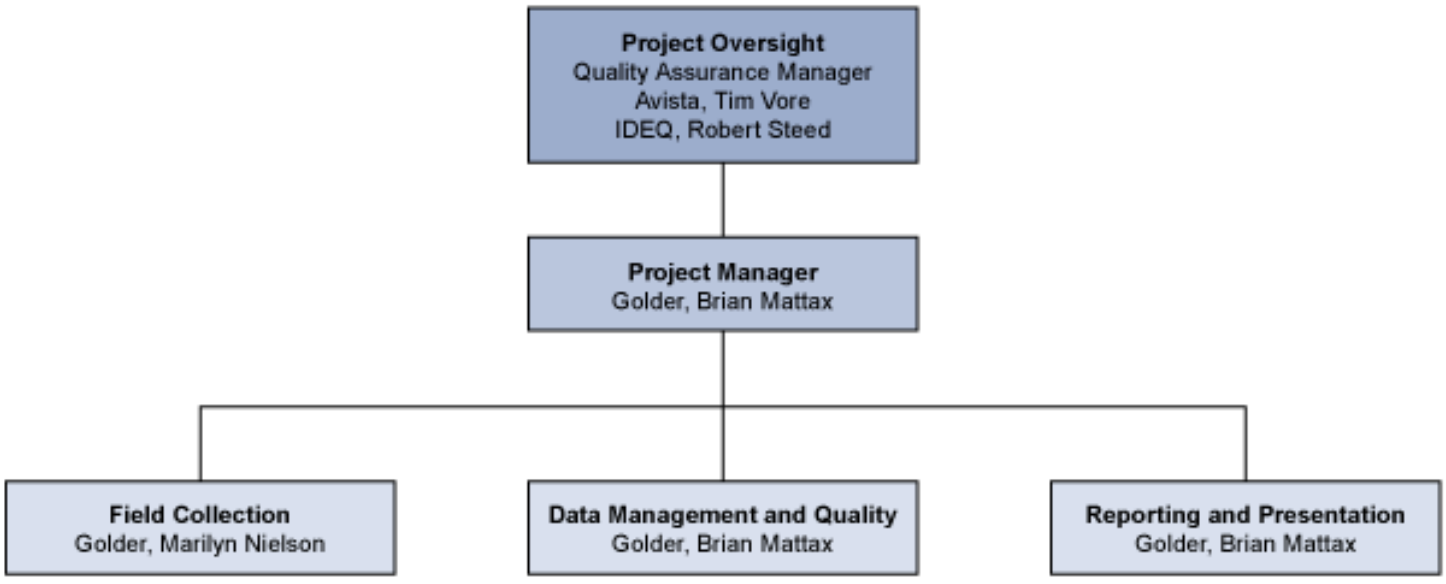
The possible effects of increased discharge from the HED and associated changes in water temperature in the Spokane River were modeled and assessed during project relicensing using a calibrated CE-QUAL-W2 model (Koreny 2004). Modeling results for varied flow regimes show that upstream from Sullivan Road summer river temperatures are warm and little affected by discharge from the HED. In contrast, model results show that increasing summer discharges from the HED, thereby drafting more warm water out of Coeur d'Alene Lake, increases Spokane River temperatures downstream of Sullivan Road (Horner 2004; Koreny 2004).

Implementation of this QAPP along with its companion document, the Monitoring Plan (Golder 2009), will satisfy the water temperature and discharge monitoring component of the Idaho WQC requirement. Implementation will begin following IDEQ approval of the Monitoring Plan and QAPP. Both of these documents have been developed in consultation with IDEQ. The Monitoring Plan employs analyses of discharge flow and water temperature data collected by Avista and its contractors. As part of this plan, Avista will consult with IDEQ to oversee all aspects of water quality monitoring to ensure a rigorous, cost-effective program that provides consistent, high quality data. Water quality monitoring will be conducted in accordance with this QAPP.

3.0 Project Management

Golder Associates will direct all project activities and will be responsible for scheduling and coordinating the sampling performed by the personnel conducting the field effort, data management, and analysis/reporting. Project organization is shown in Figure 2.

Figure 2. Project Personnel Organization



4.0 Monitoring Plan Goals

Implementing the Monitoring Plan will result in collection of data on the relationship between the Post Falls HED discharges and temperature in the Spokane River. The primary goal for this monitoring study is to help validate the basis on which the Post Falls HED lake level and discharge flow requirements were set in the Idaho WQC. More specific monitoring objectives include:

1) Define appropriate protocols for flow and temperature measurements for five consecutive years.
2) Collect Coeur d'Alene Lake level data at 15-minute intervals from July 1st through September 30th for the Coeur d'Alene Lake at Coeur d'Alene, ID (USGS 12422500).
3) Collect flow data at 15-minute intervals from July 1st through September 30th for the following operating locations:

   Spokane River near Post Falls, ID (USGS 12419000)
   Spokane River at Greenacres, WA (USGS 12420500)
   Spokane River below Trent Street Bridge (USGS 12421500)
   Spokane River at Spokane, WA (USGS 12422500)

4) Collect river temperature at 15-minute intervals, starting on the hour, from July 1st through September 30th from the following locations:

   Spokane River near Coeur d'Alene Lake Outlet (USGS12417610)
   Spokane River near Post Falls, ID (USGS 12419000)
   Spokane River at Greenacres near Barker Road (near USGS 12420500)
   Spokane River downstream of Sullivan Park (near USGS 12420800)
   Spokane River below Trent Street Bridge

5) Describe how Avista will, in accordance with the requirements set forth in the Idaho WQC's condition I.B.2, incrementally increase and monitor flows up to 700 cfs during low flow conditions.

4.1 Data Quality Objectives

Data quality objectives (DQOs) are the quantitative and qualitative terms used to specify the quality of data needed to meet the Monitoring Plan's specific goals. DQOs for data measurement are also referred to as data quality indicators, and include: precision, accuracy, measurement range, representativeness, completeness, and comparability. The USGS maintains standard procedures to ensure its DQOs for flow and lake level data are met. Below, we describe the DQOs for the water temperature measurements for this study.

4.1.1 Precision

Precision refers to the degree of variability in replicate measurements. Two thermographs will be deployed next to one another at one randomly selected temperature monitoring station and their high-quality temperature data will be compared to determine the precision of measurements. After excluding data that are deemed not representative of water temperatures, data from the paired thermographs will be compared to one another. If this comparison shows a systematic

bias in the recorded temperatures, corrections may be made to remove this bias. Precision of each pair of temperature measurements will be evaluated by computing Relative Percent Deviation (RPD) as indicated in the following equation.

$$\text{RPD} = \left[\frac{|\text{Temp}_1 - \text{Temp}_2|}{(\text{Temp}_1 + \text{Temp}_2)/2} \right] \text{x } 100$$

The precision for temperatures of 15°C and greater will be categorized as:

- Good for RPD of <3 percent
- Moderate for RPD of 3 to 5 percent
- Poor for RPD of >5 percent

Temperature data categorized as having moderate or poor precision will be flagged as such. The frequency of each precision category will be determined for temperatures of 15°C and greater.

4.1.2 Accuracy and Bias

Accuracy is a measure of confidence that describes how close an analytical measurement is to its "true" value, or the combination of high precision and low bias. The thermographs selected for this study (i.e., Onset Hobo Water Temp Pro v2) have a reported accuracy of 0.2°C (Onset 2009). Verification of the accuracy of the thermographs will be done before the first deployment for the monitoring season and following their recovery at the end of the monitoring season using an approach similar to outlined by Ward (2003). For each of these verifications, all of the thermographs will be placed in two coolers filled with water at near 25°C and near 10°C while logging the temperatures. Then the recorded temperatures for each thermograph will be compared to temperatures recorded with a certified thermometer.

Differences between temperatures of the certified thermometer and thermographs will be compared to a Data Quality Objective (DQO) equivalent to the reported accuracy of the instruments (i.e., 0.2°C). All thermographs with a Pre-deployment difference of >0.2°C will be retested. Thermographs that fail the second pre-deployment check will not be deployed.

The same testing process will occur following retrieval and download of the thermographs at the end of the monitoring season. All thermographs that fail the difference test will be retested. If the second post-deployment test also has a difference of >0.2°C, the thermograph's data will be adjusted to account for bias and qualified as having "Moderate" or "Poor" quality.

Data adjustments and qualification will be done as follows:

- If the post-deployment test has a difference of ≤0.2°C, no adjustments will be made and the data will be categorized as "Good" quality.
- If the post-deployment test has a difference >0.2°C and the difference between the pre- and post-deployment test results are ≤0.2°C, the thermograph's raw temperature data will be adjusted by the difference between the mean of the pre- and post-deployment tests and the certified reference thermometer, and categorized as "Moderate" quality.

- If the post-deployment test has a difference >0.2°C and the difference between the pre- and post-deployment test results are >0.2°C and ≤0.4°C, the thermograph's raw temperature data will be adjusted by the difference between the mean of the pre- and post-deployment tests and the certified reference thermometer, and categorized as "Poor" quality.
- If the post-deployment test has a difference of >0.2°C and the difference between the pre- and post-deployment test results are >0.4°C, the thermograph's raw temperature data will be rejected.

4.1.3 Measurement Range

Measurement Range is the range of reliable readings of an instrument or measuring device, as specified by the manufacturer. Onset reports the measurement range for its Hobo Water Temp Pro v2 as -20°C to a maximum sustained temperature of 50°C in water. Annual maintenance of field sampling equipment will be conducted in a manner consistent with the manufacturer's recommendations and records of all maintenance activities will be recorded and included with the field notes.

4.1.4 Representativeness

Representativeness is the extent to which the measurements actually represent the true environmental conditions. For this monitoring effort, the sampling locations will be chosen to best represent the main Spokane River temperature and flow conditions and to minimize specific bias. Stations have been chosen in consultation with IDEQ. Potential bias in the program procedures will be minimized through selecting specific temperature monitoring stations with minimal direct influence from groundwater inflows and solar radiation.

As another measure to ensure that the temperature data collected represent the main river flow, temperature measurements will be made at river cross-sections in the vicinity of each of the four temperature monitoring stations and compared to temperatures at the thermograph locations. The cross-sections will be measured during the anticipated low flow period of the first monitoring season so as to maximize the potential to capture thermal gradients in the river. A percent exceedance analysis will be conducted for temperature measurements, and temperatures within the 25 to 75 percent occurrence will be considered representative of the main river flow. Temperatures recorded at the thermograph locations will be compared to these values and categorized as follows:

- Good for temperatures within 25 to 75 percent exceedance of the corresponding cross-section's temperatures
- Poor for outside 25 to 75 percent exceedance of the corresponding cross-section's temperatures.

Thermographs at locations categorized as having poor representativeness will be relocated to a location which is representative of the main river flow, and IDEQ and Avista will be notified of this relocation.

4.1.5 Completeness

Completeness is the amount of usable data that is actually collected in comparison to the amount of data which should be collected (i.e., 8,832 15-minute values for July 1-September 30 at each

monitoring station), expressed as a percentage. Data may be determined to be unusable in the validation process. Vandalism also may limit the amount of temperature data obtained, although we are limiting downloads during the monitoring season to just the secondary thermographs to minimize the risk of vandalism to thermographs at the primary sites. A completeness of greater than 90 percent is expected for this study, assuming minimal vandalization.

Completeness of data deemed useable will be calculated for each thermograph location. Temperature data completeness will be categorized as:

- Excellent for >97 percent
- Good for 90 to 97 percent
- Moderate for 75 to 89 percent
- Poor for <75 percent

Relationships between discharge and water temperature will be based on a single set of temperature data for each monitoring station. For each station, the primary thermograph will provide this data unless it has less than acceptable completeness and the secondary thermograph has better ratings for the other DQOs. If completeness is not categorized as fair or better for at least one thermograph at the Sullivan Road or Trent Street Bridge stations, then monitoring may be extended by one year to compensate for this lack of data. IDEQ will make this determination, in consultation with Avista, based on whether the data collected at these stations contribute to understanding the effects of discharge on river temperatures.

4.1.6 Comparability

Comparability is the degree to which data can be compared directly to previously collected data of the same parameter. Comparability will be achieved through the selection of sampling locations that are in proximity to previously monitoried stations along with procedures and analyses that are consistent with previous work.

4.2 Training Needs and Certifications

All personnel will be qualified scientists with relevant experience; however, no special training or certifications are required for samplers or data managers involved with the Monitoring Plan. Strict adherence to sampling methods defined in the QAPP is required to ensure compliance with data quality objectives.

4.3 Records Management

The following documents will be produced during this monitoring program:

1) *Field Notebooks, Data Sheets, and Related Forms*. These will be produced during the course of the field component of the monitoring program and copies and/or originals will be available to IDEQ;
2) *Data Files*. Raw temperature and flow data will be compiled as soon as practicable after each site visit and consolidated after the post-September 30 recovery each year. Raw data will be compiled and provided to IDEQ.

3) *Project Reports*. These include one technical memorandum addressing cross-sectional temperatures and representativeness of thermograph locations, the annual data summaries and a more detailed evaluation at the end of the five-year monitoring period.

Additional project documents may be produced during the course of the monitoring program, and will be maintained by the project manager including communication records such as emails, telephone, fax, and written correspondence. In addition to hardcopy or paper documents, computer files will be generated during the course of implementing the Monitoring Plan. Original files will be maintained by the consultant during the course of the program and copies will be provided to Avista and IDEQ as the data is compiled.

5.0 Data Acquisition

This section presents additional details pertaining to data collection and acquisition for the Spokane River Water Temperature and Discharge Study.

5.1 Monitoring Design and Methods

Water temperature and flow monitoring are designed to satisfy the requirements of conditions I.B and section I.C.1 of the Idaho WQC. The WQC requires five seasons of temperature monitoring, including monitoring during flow discharge test periods. The Spokane River Water Temperature and Discharge Flow Validation Monitoring Plan (Golder 2010) describes the monitoring framework; additional details pertaining to data quality are presented below.

Daily weather conditions and air temperature will be obtained for the Felts Field weather station, which is in the Spokane Valley, for the seasonal sampling period. These data will include daily maximum and daily minimum air temperatures, cloud cover, and precipitation. Air temperature also will be obtained at 15-minute intervals for the Post Falls HED through deployment of a thermograph.

5.2 Test HED Discharge Flow Protocol

The Post Falls HED will be operated in a manner consistent with the lake level and discharge restrictions set in conditions I.A and I.B.2 of the Idaho WQC. In order to assess the effects of Post Falls HED on Spokane River temperatures, river temperatures and discharge flows will be compared for a variety of conditions including tests specifically developed for that purpose, as required under condition I.B.2. The following test procedures will be conducted:

Test 1) The Coeur d'Alene Lake USGS gage (12415500) will be monitored to determine when the Lake elevation is near 2,127.75 feet (2,127 feet 9 inches) as a result of the 600 cfs discharge flow requirements. The first year these operational conditions occur, IDEQ will be notified and Avista will increase discharge to 700 cfs for seven consecutive days (i.e., 168 hours). After at least 168 hours of near 700-cfs discharges, Avista will reduce discharge to the required 500 cfs to end the test. Reducing discharge will be required to adhere to the downramping rate requirement of the FERC license, Appendix A. VI.

Test 2) In addition to the test described above, two additional flow manipulation test(s) will occur during the five-year period. The commitment to perform the test(s) will be contingent on appropriate flow and weather conditions. The additional test(s) will begin seven days after the initial reduction to near 500 cfs (as required by condition I.A. of the Idaho WQC). During this test, discharge will be increased from 500 cfs to near 700 cfs for three to seven days (i.e., 72 to 168 hours) followed by a reduction in discharge to the required 500 cfs.

Resulting flow and water temperature data for the Spokane River downstream of the Post Falls HED will be assessed for each of the stations. All flow changes will be correlated with subsequent effects on water temperature downstream. Information on discharge flow and water temperature will be downloaded into a spreadsheet and assessed for 15-minute values throughout the test period. Graphs of flow changes and resulting water temperatures will be produced for each test.

5.3 Quality Control

5.3.1 Field Quality Control

The precision of thermograph measures will be evaluated by deploying a thermograph alongside of a randomly selected thermograph as described in section 4.1.1.

All thermographs will be appropriately shielded from sunlight and suspended in the water column of the free-flowing river to minimize any localized effects of groundwater and backwater effects so that temperature data collected are representative of the main flow of the Spokane River at each monitoring station. In order to provide a redundant monitoring system, two thermographs will be launched and installed at each temperature monitoring station. The paired thermographs will be placed in the same reach of the free-flowing river yet far enough from one another to minimize the risk of vandalism to both instruments. To ensure consistency between years, the thermographs will be deployed at the same locations each year.

The following actions will be taken for each monitoring station:

1) Record the deployment position with a Global Positioning System (GPS) receiver;
2) Record the location on a map. Include the site's location relative to local identifiable landmarks and the nearby river temperature monitoring site;
3) Photograph the deployment location;
4) Record the estimated depth, distance above the streambed, and distance from the river's bank; and
5) Provide IDEQ and Avista with a record of the deployment location, which will include the above information.

Temperature and depth will be recorded for one cross-section at each of the four monitoring stations during the anticipated low-flow period of the first monitoring season. The data collected will be used evaluate whether the thermographs have been deployed at locations with temperature representative of the main flow of the river. Any thermograph not located in a location with temperatures representative of the main flow of the river will be relocated to a site

that is representative of the main flow of the river, based on temperature measurements made at the same time as the cross-section. A technical memorandum will be prepared and provided to IDEQ and Avista to document these field measurements and any resulting thermograph relocations.

5.3.2 Data Quality Control

Each temperature station will be visited at approximately two–week intervals to ensure that the thermographs are secure and collecting data, download data from the secondary thermographs, and to enable any corrective action to address inoperable or missing thermographs. During each station visit, the date, time, field staff, and station condition will be recorded. The quality of water temperature data will be managed and evaluated following Data Quality Objectives as discussed in section 4.0 of this QAPP.

5.3.3 Inspection of Field Supplies and Materials

Prior to mobilization, all field monitoring supplies and materials will be inspected to ensure they are in proper condition and working order. Additional monitoring supplies will be brought into the field in the event that damage occurs.

5.4 Data Management

The project manager will ensure that the field forms are completed and data are downloaded, backed up, reviewed for outliers and data entry errors, and appropriately qualified and adjusted, if necessary. The project manager will ensure that the following information is made available to Avista and IDEQ:

- Pre- and Post-deployment calibrations checks
- Field forms and associated notes
- Quality assurance and quality control summaries
- Raw data including the water quality database and any related information or programs developed specifically for this purpose[1]

6.0 Quality Assurance Oversight Process

6.1 Quality Assurance Review Process

Prevention is the primary mechanism through which data quality objectives (DQOs) will be met. Thoughtful planning and design, including documented instructions and procedures, and use of qualified and experienced personnel will all be implemented to prevent data quality and quantity problems. The effectiveness of this monitoring program's ability to prevent data quantity and quality problems will be evaluated by the project manager throughout each year and further evaluated by IDEQ and Avista during the annual review of the data. The project manager will annually provide IDEQ and Avista notification of whether the DQOs were met and, if appropriate, any planned corrective actions to address not meeting them.

[1] Since the secondary thermographs serve as only a backup in case of vandalism or equipment failure, the database will include only one set of temperature data for each temperature monitoring station.

6.2 Quality Assurance Response Actions

In the event that a quality assurance review identifies problems with this study's data, response actions will be implemented, as appropriate. The nature of any actions taken will depend upon the severity and type of problem, and will begin with a review of project procedures related to the identified problem(s). For any field-related issues such as a missing or inoperable thermograph, the field crew will notify the project manager as soon as practical. The project manager will notify the Avista quality assurance manager (currently, Tim Vore) of both field and office related issues that are identified and recommend a response to the issue. Avista's quality control manager will then decide whether to implement the recommended action and/or another response to the issue. Avista will inform IDEQ of any quality assurance issues identified and the responses to these issues that were taken no later than the following annual meeting. Should Avista determine that it is important to discuss an issue and/or response before the next annual meeting, a conference call or meeting will be scheduled with Avista, IDEQ and potentially the consultant's project manager to discuss the matter.

Additional response actions may include the following preventative and corrective actions:

Preventive Response Actions - These measures are directed at preventing the identified problem from being repeated:

- A high-level of monitoring of project activities associated with the problem;
- Implementing a new system of audits to determine consistency with procedures outlined in the QAPP, and identifying appropriate corrective measures.

Corrective Response Actions - These measures will result in a correction of the problem and replacement of the data affected by the problem:

- Implement appropriate corrective measures identified to address problems identified (see above);
- Re-analyze data associated with the problems that are or may be related to procedures;
- Exclude data which are inconsistent with DQOs from the final product.

7.0 Data Validation

7.1 Data Verification

Data verification refers to the routine checks the sampling oversight officer conducts in ensuring that the QAPP is followed, as well as to the quality control procedures. At a minimum, data verification will include evaluation of sampling documentation, compliance with sample methods, method quality control sample results and evaluation of the comparison of data from paired thermographs.

7.2 Data Validation Feedback Mechanism

Data validation refers to the confirmation by examination and provision of objective evidence that the particular requirements for the intended use of data have been met. Data will be

reviewed to check for calculation and transformation errors, verify measurements are within calibration range, verify that the thermographs were not out of water, and identify data entry errors. Various computer software programs, including Microsoft Excel may be used to assist in the data review process to identify data which may be erroneous.

The verified data will be evaluated according to the project DQOs. At a minimum, the validation process will include an evaluation of the overall quality of the data based on a review for potential transcription errors, data omissions, and suspect or anomalous values. Anomalous and suspect values will be noted and an explanation provided.

8.0 Quality Assurance Project Plan Implementation

8.1 Review and Approval Process

This QAPP is to be distributed to IDEQ, Avista and the consultant. By signing the approval section at the front of this document, the signatory agrees that he/she has read and understands his or her role in the monitoring program, and will adhere to all sections of this QAPP. Additionally, all personnel involved in the project should retain or have access to the current version of this QAPP.

8.2 Annual Review and Revision Process

This QAPP will be reviewed by IDEQ, Avista and the contractor annually, or as needed upon adoption of any changes to the Monitoring Plan. Any modifications or changes to this QAPP will require formal approval by both Avista and IDEQ. WDFW input on matters affecting modifications to this QAPP will be sought.

9.0 Literature Cited

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