

Quality Assurance Project Plan

Solar Pathfinder™ Monitoring for Coeur d'Alene Region PNV Temperature TMDLs



**State of Idaho
Department of Environmental Quality**

Coeur d'Alene Regional Office

Version 3.0

May 15, 2017

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1 Title and Approval Page

Quality Assurance Project Plan

Title: Solar Pathfinder™ Monitoring for Coeur d'Alene Region PNV Temperature TMDLs

Region/Division: Coeur d'Alene Regional Office

Version Number: 3.0

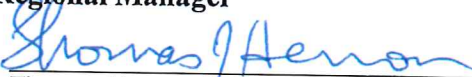
Date: May 15, 2017

Approval Signatures

Note: This QAPP becomes effective on the date of the last approval signature.

Program/ Regional Manager

Signature:



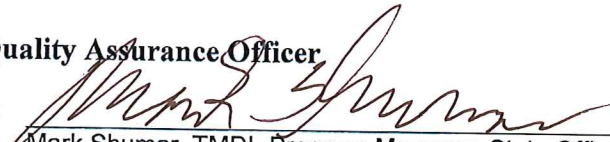
Name: Thomas Herron, Surface Water Program Manager, Coeur d'Alene Regional Office

5/22/2017

Date

Project Quality Assurance Officer

Signature:



Name: Mark Shumar, TMDL Program Manager, State Office

5/22/17

Date

*Note: At the time of QAPP signature, the project QAO is required to update the DEQ QAO project document tracker, found at TRIM Record #2012AEB8.

Project Manager

Signature:



Name: Kajsa Van de Riet, Coeur d'Alene Basin Restoration Plan Coordinator, Coeur d'Alene Regional Office

5/22/2017

Date

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Appendices

Appendix A. Project Checklists

Appendix B. Solar Pathfinder™ Field Form

3 Distribution List

At a minimum, the following personnel and analytical laboratory contacts will receive either an electronic or hard copy of the final signed quality assurance project plan (QAPP) (Table 1).

Table 1. Project QAPP distribution list.

Name	Project Affiliation	Organization and Address/Location	Contact Number
Don Zaroban	DEQ Quality Manager	DEQ— State Office Technical Services	(208) 373-0405
Thomas Herron	Program/Regional Manager	DEQ—Coeur d'Alene Regional Office	(208) 666-4631
Mark Shumar	Project Quality Assurance Officer	DEQ—State Office	(208) 373-0132
Kajsa Van de Riet	Project Manager	DEQ— Coeur d'Alene Regional Office	(208) 666-4633
Cory Sandow	Project Staff	DEQ—State Office Technical Services	(208) 373-0193
To be determined, as necessary	Temporary Technicians	DEQ—Coeur d'Alene Regional Office or State Office	To be determined, as necessary

4 Project/Task Organization

Key project personnel and their responsibilities are defined in Table 2. An organizational chart is provided in Figure 1.

The project staff duties and responsibilities described in Table 2 are not intended to be all inclusive; see sections 1.2.5 through 1.2.7 of the DEQ *Quality Management Plan* (QMP) (DEQ 2016) for a more detailed description.

Table 2. Key project personnel and associated responsibilities.

Name	Project Title/Responsibility
Thomas Herron	<p>Program/Regional Manager: Note: The following description is <i>not all inclusive</i>; see section 1.2.7 of the DEQ QMP for a more detailed description. This person is the regional manager or State Office program manager for the project. Duties and responsibilities include:</p> <ul style="list-style-type: none"> • Assists in the review of the QAPP and signs the final QAPP as an approver. • Confirms the project QAPP meets the needs of the program/region. • Ensures the QAPP is approved prior to the start of project work. • Ensures the program/regional procedures and policies referenced in the QAPP are current and approved for use. • Performs all duties and responsibilities as assigned in the project QAPP. • Selects and assigns a project quality assurance officer (QAO), who meets the criteria for independence defined in the DEQ QMP (see QAO duties below), and obtains approval for this selection from the DEQ quality manager.
Mark Shumar	<p>Project Quality Assurance Officer: Note: The following description is <i>not all inclusive</i>; see section 1.2.5 of the DEQ QMP and the project QAPP for a more detailed description. Each project has an assigned QAO, whose duties and responsibilities include:</p> <ul style="list-style-type: none"> • Assists in the review of the QAPP, verifies the QAPP meets the requirements of the DEQ QMP, and signs the QAPP as an approver. • All assigned QAOs are required to contact the DEQ quality manager to discuss the project prior to signing any project QAPP for approval. When the project QAO signs the QAPP for approval, the QAO is required to update the DEQ QAO project document tracker found at TRIM record #2012AEB8. • Performs an annual audit, using the QAO audit checklist, on all assigned projects to evaluate project compliance with the approved project QAPP. Files the completed audit checklist in TRIM to document the audit. • Provides data validation per the project QAPP, using the appropriate checklist, and may also participate in final project report review. • Documents all audit and data validation activities in the DEQ TRIM system, per the DEQ QMP and the approved QAPP. • In matters of project quality, this individual has a direct line of communication to the DEQ quality manager. • Must meet the following independence criteria: The QAO shall not be the project manager, program manager, or be otherwise assigned to the project data generation efforts. Neither the project manager nor the QAO may directly report to the other within the DEQ organizational structure, and both of these individuals may not be directly supervised by the same person. • Performs all other duties and responsibilities as assigned in the project QAPP. The duties and responsibilities of the project QAO also apply to any field sampling plan (FSP) generated under the project QAPP, unless an FSP-specific QAO is assigned and approved.
Kajsa Van de Riet	<p>Project Manager: Note: The following description is <i>not all inclusive</i>; see section 1.2.6 of the DEQ QMP for a more detailed description. Each project has an assigned project manager, whose duties and responsibilities include:</p> <ul style="list-style-type: none"> • Serves as the primary author of the project QAPP, and signs the final QAPP as an approver. • Performs overall project planning, document development and approval, sample planning and coordination, laboratory coordination, reporting functions, project report/summary development, and project file maintenance in TRIM. • Enters the approved and current project QAPP in the TRIM system, including a

	<p>copy of the signed approval page.</p> <ul style="list-style-type: none"> • Ensures all project work is conducted in accordance with the DEQ QMP, the approved QAPP, and the applicable project operating procedures. • Ensures that personnel assigned to this project are appropriately trained and qualified, with the corresponding training records on file in human resources. • Performs data review and verification per the project QAPP, using the appropriate checklists located in 0. • Reviews the project QAPP/FSP and standard operating procedures (SOPs) annually to determine if revision is necessary. If the project QAPP, FSP, or associated SOPs do require revision, the project manager initiates such action. All such documents will be revised, reviewed, and approved in accordance with the DEQ QMP. • Documents all audit and data review/verification activities in the DEQ TRIM system, per the DEQ QMP and approved QAPP. • Performs all other duties and responsibilities as assigned in the project QAPP. The duties and responsibilities of the project manager also apply to any FSP generated under the project QAPP, unless an FSP-specific project manager is assigned.
To be determined, as necessary	<p>Temporary Technicians: One or more individuals may be necessary to collect field data. They will work under direction of the Project Manager according to this QAPP and associated field sampling plans (FSPs), if applicable. They will be responsible for being familiar with these plans and collecting field data as described herein under supervision by Project Manager or Project Technical Lead.</p>

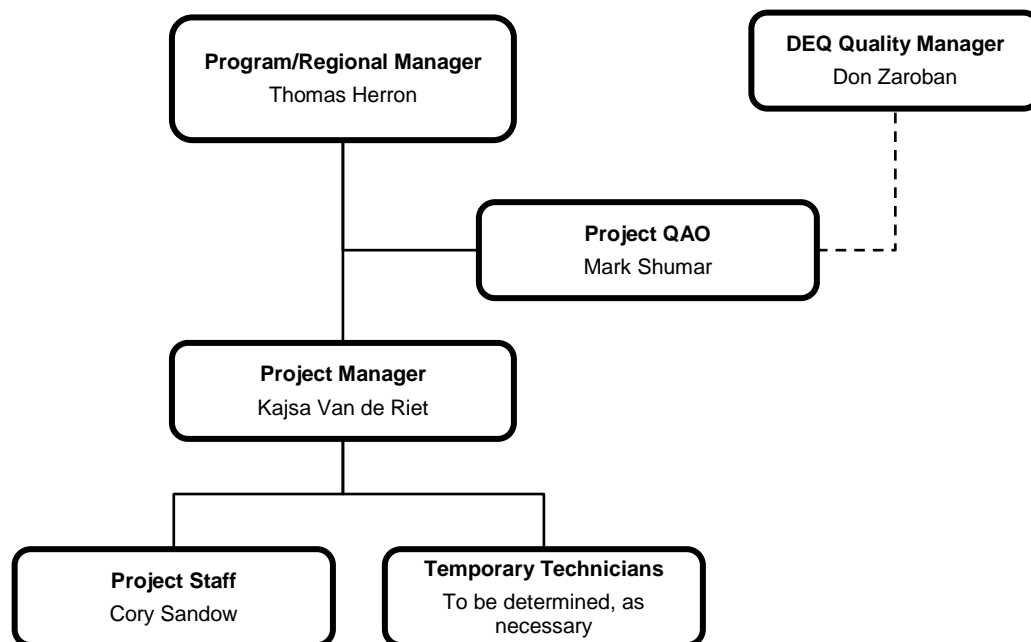


Figure 1. Project organizational chart.

5 Problem Definition/Background

5.1 Problem Statement

Temperature total maximum daily loads (TMDLs) using potential natural vegetation (PNV) techniques involve aerial photo interpretation of existing shade on streams. Stream shade is observed in aerial photographs on geographic information system (GIS) or similar technology and stream shade is visually estimated from the amount of riparian vegetation seen, the size of the channel and professional opinion about topographic shade. To field-verify these estimates, accessible reaches of stream are typically visited and measurements of actual shade collected with a Solar Pathfinder™. The Solar Pathfinder™ measurements of shade are then compared to the aerial estimates of shade for the same stream reaches and corrections are made to the aerial interpretation. Not only are the specific reaches visited verified, but the information is used to calibrate the TMDL writer's eyes for enhancing the quality of the remainder of the aerial interpretation. Shade monitoring may also be needed to evaluate and document progress toward attaining TMDL goals and to help justify delisting proposals.

5.2 Intended Usage of Data

Data will be evaluated and compared to the aerial photo interpretation to verify estimated existing shade in accordance with procedures described in *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual* (Shumar and De Varona, 2009). Data will be used for either verifying specifically visited reaches or to calibrate the eyes of the aerial photo interpreter for other, non-visited reaches. Data may also be used to evaluate and document progress toward attaining TMDL goals and to help justify delisting proposals.

6 Project/Task Description

6.1 General Overview of Project

This project proposes to collect Solar Pathfinder™ shade data related to any PNV-style temperature TMDL on any water body in the state of Idaho. There is no time limit for future TMDLs; however, there are seasonal restrictions for when Solar Pathfinder™ data can be collected. Estimates of shade by a Solar Pathfinder™ should only be attempted during the growing season when deciduous leaves are on the riparian vegetation. This in general limits data collection to the months of April through early October; however, each location will vary depending on local growing season.

A Solar Pathfinder™ is a device developed for the solar panel industry for measuring the amount of openness to solar radiation when siting panel locations. The device suits ecological purposes well as it can be used to measure shade (the opposite of openness) in any location including streams. The Solar Pathfinder™ will be deployed following DEQ's *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual* (Shumar and De Varona, 2009). This method will be referred to as 'PNV Manual' throughout

this document. Data are collected as photographs that will be downloaded from the camera, and processed using Solar Pathfinder Assistant™ (v.1.1.6 or later) software, supplied by the Solar Pathfinder™ manufacturer.

A given set of Solar Pathfinder™ data for an individual site is usually 10 Solar Pathfinder™ readings (photographs) set at 50 paces apart along the stream reach. Other pace sizes (e.g., 25 paces) can be used when streams are small or there are known obstacles that would prevent the accumulation of 10 50-pace readings; however, the number of paces should not exceed 50. If the reach in question is very long and data are needed to characterize the entire length, it is best to perform multiple site samples (i.e., additional sets of 10 readings at 50 paces apart). Each photograph is processed through the Solar Pathfinder Assistant™ software and shade values are determined for each month of the year for that photograph. The shade values for the six months between April and September are averaged together to provide a single shade value for the spring/summer period. Since there are 10 photographs for a given site, the six-month average from each of the 10 is then averaged for a single shade value for that Solar Pathfinder™ site. This shade value can be anywhere between 0% and 100%.

The Solar Pathfinder™ monitoring can be applied to any stream or river that is accessible by either wading or by boat with a Solar Pathfinder™ attached. Therefore, any water body in the state that meets that description is potentially included as locations for Solar Pathfinder™ monitoring. Specific locations for any given TMDL analysis will be described in a project specific monitoring plan or FSP.

6.2 Project Timetable

Table 3. Timetable of project milestones

Activity	Projected Start Date	Anticipated Date of Completion
Solar Pathfinder™ measurements	April or later	Early October
Analyze data	Anytime after measurement	Anytime
Report results	Anytime following analysis of data. Report separately or include in applicable TMDL, 5yr review or special study.	Anytime. Complete when individual report, TMDL, 5yr review, or special study is complete.

7 Quality Objectives and Criteria

The objective of quality assurance and quality control (QA/QC) is to assure that data gathered for this project are representative of actual field conditions.

At 10% of the monitored sites, two sets of data will be taken at a given site. In other words, the ten photographs of Solar Pathfinder™ traces at 50 paces apart will be repeated in the same reach of stream as they were first taken. Processing of this second pass of a given reach will provide information on the error associated with the shade estimate generated for a given site.

Data collected under this QAPP are data quality Level II: field screening or analyses using portable instruments, generating data that are quantitative and acceptable for compliance purposes.

7.1 Data Accuracy, Precision, and Measurement Range

Precision is a measure of agreement between two measurements of the same property under prescribed conditions. The difference between the Solar Pathfinder™ readings of two similarly-placed Solar Pathfinder™ sites (i.e. the same stream reach sampled twice) will be used to assess data precision. Two sets of Solar Pathfinder™ data will be taken at the same stream reach, and the difference between each average of 10 measurements will be calculated. The difference between the two Solar Pathfinder™ averages will be determined and used as the level of confidence in measuring shade on streams in the field. The level of precision of measuring shade on a stream reach (i.e., Solar Pathfinder™ site) is not known and may vary from site to site, plant community to plant community, region to region. If the duplicate site shade values differ by more than 20%, then all the datasets must be flagged/qualified to reflect the potential error and what restrictions have been placed on the use of the data as a result.

The accuracy of the Solar Pathfinder™ photograph is assessed by the Solar Pathfinder Assistant™ software. Photographs that are taken incorrectly (e.g., usually by tilting the camera instead of holding it completely vertical) are identified by the software with a percent error estimation. It is common for most users to have tilting errors around 1-2% since it is nearly impossible to hold a camera completely steady in the field. Photographs with error estimates provided by the software greater than 5% will be discarded and not used in the analysis of shade for that site. Sites with less than 10 viable photographs still contain important information and will have use, albeit limited (see Section 7.4 Data Completeness).

7.2 Data Representativeness

Representativeness is defined as the degree to which the sample data accurately and precisely represent site conditions. The representativeness criterion is best satisfied by confirming that measuring locations are properly selected and that the Solar Pathfinder™ is correctly deployed. All sampling procedures will follow the PNV Manual.

Solar Pathfinder™ readings should be taken in a reach of stream that has been determined to be relatively homogenous with respect to shade on an aerial photo interpretation. Boundary crossings between two different levels of shade as interpreted on the aerial photograph should be avoided as much as possible. The purpose of the Solar Pathfinder™ measurement is to verify a given interpretation of an aerial photograph. The aerial photo interpretation procedure described in the PNV Manual requires placing reaches of stream into one of ten possible 10%-shade class intervals. It is this shade class interval that is being field-verified with the Solar Pathfinder™ readings from a stream reach.

If the Solar Pathfinder™ readings for a given site cross a shade class boundary that was not previously identified in the aerial photo interpretation, that boundary may be identified in the Solar Pathfinder™ analysis. If such boundary crossing is identified in a Solar Pathfinder™ site

that is being used for QA/QC objectives (i.e. sampled twice), that site will be removed from the QA/QC process and another site will be selected for duplication.

7.3 Data Comparability

Comparability is defined as the confidence with which one data set can be compared with another data set. The use of the PNV Manual as a standard monitoring method maximizes comparability. All Solar Pathfinders™ and associated Solar Pathfinder Assistant™ software deployed by DEQ are manufactured by one company and are expected to be identical in their precision. However, the Solar Pathfinder Assistant™ software requires the user to digitize the shade boundary on a given photograph. Different users may perform this task slightly different from each other, resulting in small differences in shade calculations between users. Typically, DEQ relies upon a single user to process all photographs for a given sampling event; therefore, there should be no loss of comparability within that sampling event. It should be stipulated that only one user of the software will be used for a given sampling event.

7.4 Data Completeness

Completeness is defined as the percentage of valid data relative to the total possible data points. For data to be considered valid, it must meet all of the acceptance criteria, including accuracy and precision, as well as any other criteria specified by the analytical method used.

Solar Pathfinder™ sites on streams are often limited by time and access. In general, a given sampling event to field-verify an aerial photo interpretation of shade for a TMDL involves about 10 to 20 sites. However, TMDLs vary in size from one to many streams, and as a result, the number of Solar Pathfinder™ sites possible will vary widely. In order to provide as much data as possible to verify an interpretation, DEQ strives to visit every stream in the analysis with at least one Solar Pathfinder™ site and to attempt to visit all the shade class intervals that are represented in the interpretation. In cases of very limited access, watershed size, and available time, these site number objectives may not be met. Still, a small number of sites are better than no data at all.

A single Solar Pathfinder™ site typically involves 10 Solar Pathfinder™ readings (photographs) at 50 paces apart along a stream reach. In some cases, barriers or other situations that may prove dangerous, prevent the sampler from completing the 10 readings for a given site. Despite this truncation of data, DEQ strives to make use of the information as much as possible. If there are at least three readings, but less than 10, we will process the data and use it to provide information about the aerial interpretation. Since it is limited data we will not use it for QA/QC procedures or in the analysis of interpretation variance.

8 Special Training/Certification

The Project Manager and/or Program Manager is responsible for ensuring that personnel assigned to this project are appropriately trained and qualified, with the appropriate training records on file in DEQ Human Resources.

All work performed by DEQ personnel will be conducted in accordance with the DEQ's Safety Manual (DEQ 2015).

No special training is required; staff will have previous surface water sampling experience and, if necessary, on-the-job training.

9 Documentation and Records

The Project Manager is responsible for ensuring that the most current approved revision of the project QAPP, with any related FSPs and SOPs, is available in the DEQ TRIM electronic records management system.

The Project Manager or Project Technical Lead will ensure that all applicable personnel are using Solar Pathfinder™ equipment and software appropriately.

Field personnel will document the deployment of Solar Pathfinder™ sampling using a field form or field book. At minimum, the following fields must be completed:

- Stream name
- Site description (including shade-producing vegetation and structures)
- Latitude
- Longitude
- Channel width
- Sampling date

Project data must be recorded directly, promptly, and legibly. Any flags qualifying data usability will also be recorded.

At the end of the sampling effort, the Project Manager or Project Technical Lead will scan and file the field forms on either a local computer or TRIM, following applicable program filing procedures. Spreadsheets will be similarly filed.

The Project Manager will ensure that the sampling event is adequately described in the applicable reports.

10 Sampling Process Design

10.1 Rationale for Selection of Sampling Sites

The sites under analysis are being investigated for verification of aerial photo interpretation of existing shade on streams. In order to verify a specific aerial interpretation of existing shade, the sampling site should be within one specific 10% shade class as described from an aerial photo. Additional rationale and detail may be provided in applicable FSPs.

The exact location of the Solar Pathfinder™ sampling site is measured using a GPS unit, and recorded on the waypoint function of the GPS, in the form of latitude and longitude. You can also record the latitude and longitude in your notebook by hand.

10.2 Sample Design Logistics

The sampling logistics will be identified by the field team responsible for the Solar Pathfinder™ sampling. The PNV Manual contains a recommended list of equipment. At a minimum, the following equipment must be taken into the field:

- Solar Pathfinder™
- GPS unit
- Digital camera
- Field notebook

11 Sampling Methods

The PNV Manual will guide the sampling procedure (see Section 7). Sites will be selected in the field with the aid of aerial photo interpretation maps and other appropriate transportation maps. Additional detail may be provided in applicable FSPs.

Site selection is dependent upon access to the water bodies being sampled. Usually public lands are sampled unless access to private lands has been granted. Access is also affected by distance from nearest navigable road, terrain, and hazards.

Solar Pathfinders™, digital camera and GPS units should be in good working order and extra batteries should be carried.

12 Sample Handling and Custody

Sample data are digital photographs contained within the camera after Solar Pathfinder™ photographs are taken, latitude/longitude waypoints contained within the GPS unit, and associated field forms

Following field sampling, data will be downloaded as soon as possible by the DEQ individual who collected the field data. Until the data are downloaded, the digital camera and GPS units will be maintained in the physical custody of the DEQ individual who collected the field data. If the camera/GPS units are not to be retained in the physical custody of the individual who collected the data from the sampling locations until data download is complete, then appropriate chain-of-custody methods and documentation will be employed for the temporary storage of the units. The Project Manager or Project Technical Lead is responsible for coordinating sample handling and custody.

13 Analytical Methods

Digital photographs of Solar Pathfinder™ readings require processing with the Solar Pathfinder Assistant™ software available at DEQ. GPS waypoints can be downloaded to a PC as either a spreadsheet of latitudes and longitudes or as an ArcGIS shapefile (preferred). There are no other analytical methods required for these types of data.

14 Quality Control

14.1 Field QC Checks

At 10% of the monitored sites, two samples (of ten photos each) of the same reach will be taken. See section 7A.

14.2 Laboratory Quality Control Checks

None: project data do not require laboratory analysis.

14.3 Data Analysis Quality Control Checks

The QC check data may be checked or reviewed for quality by the Project Technical Lead, the Project Manager, or the Project QA Officer at any time during the project, and must be checked once all of the data is collected. Corrective actions, as needed, will be documented in the event that control limits are exceeded. Data qualifiers will be assigned following appropriate data verification/validation procedures. Any qualifiers added will be defined in the project summary/technical report and will be consistent with appropriate EPA guidance (EPA 2002).

Data quality objectives are outlined in section 7. Datasets that do not meet the requirements of the data quality objectives will be identified and explained when they are described in an individual PNV-style temperature TMDL. These datasets may still have limited use. For example, an inaccurate Solar Pathfinder™ reading might still give clues as to the type of riparian plant community at the sampling location and possibly an approximation of existing shade.

15 Instrument/Equipment Testing, Inspection, and Maintenance

Project field instrument/equipment testing, inspection, and maintenance will be performed in accordance with the individual instrument/equipment manual.

The Solar Pathfinder™ used will be manufactured and sold by the Solar Pathfinder Company (see www.solarpathfinder.com).

The Solar Pathfinder™, digital camera, and GPS unit will be visually inspected prior to use. Damaged Solar Pathfinders™, digital cameras, or GPS units will not be deployed.

The above equipment are self-contained, and the manufacturer does not recommend any additional maintenance.

16 Instrument/Equipment Calibration and Frequency

The sampling equipment requires no calibration.

17 Inspection/Acceptance of Supplies and Consumables

With the exception of batteries for the camera and GPS unit, the sampling requires no supplies and consumables.

18 Nondirect Measurements and Data Acquisition

This section addresses data obtained from existing data sources, not directly measured or generated in the scope of this project.

Solar Pathfinder™ data from outside sources must meet data quality objectives outlined above in order to be acceptable for use associated with a PNV-style temperature TMDL produced by DEQ.

19 Data Management

Hard copies of field notes and data analysis reports will be kept at least until data review and reporting is complete.

Electronic copies of all digital photographs, GPS waypoints and processed shade reports will be kept on the sampler's office computer.

After data are verified, validated, assessed and reconciled in accordance with this QAPP, they will be uploaded to the appropriate TMDL folder in TRIM or in the appropriate surface water database as determined by the Surface Water Program.

The Project Manager or Project Technical Lead is responsible for coordinating data management.

20 Assessment and Response Actions

Assessment of the project quality control plan will be performed by reviewing field notes, photo libraries, Solar Pathfinder™ reports, and by conducting field audits where possible. This assessment will be completed or directed by the Project QA Officer. Any errors or inconsistencies identified in the assessment will be investigated and corrected to ensure the integrity of the data and conformation to the QAPP and associated sampling protocol documents.

The Project QAO shall review the QAPP annually, to determine if revision is necessary. The Project Manager should also review the project QAPP on an annual basis to ensure that the project QAPP continues to meet the needs of the data users. If the project QAPP does require revision, the revised QAPP must be submitted for approval, prior to implementation, per the DEQ QMP.

21 Reports to Management

Project and sample results for the Solar Pathfinder™ Monitoring for Coeur d'Alene Region PNV Temperature TMDLs will be included in the appropriate and updated TMDL.

22 Data Review, Verification, and Validation

Data collected under this QAPP will be reviewed by the Project Manager, Project Technical Lead, and the Project QAO to ensure the data has been recorded, transmitted, and processed correctly. This QC effort shall include an evaluation of the completeness of the data set.

Review by the Project QA Officer shall include a minimum of 10 percent of all project data with a goal of at least 20 percent.

The duplicate sample sites (Section 7.1 Data Precision, Accuracy, Measurement Range) will be compared. The results will be used to quantify shade estimate precision and will be included in applicable PNV-style TMDLs.

Data verification and validation efforts will be recorded in project documentation.

23 Review, Verification, and Validation Methods

DEQ personnel performing data verification and validation are encouraged to review the EPA guidance on methods for this task, found in EPA Guidance on Environmental Data Verification and Data Validation (EPA 2002).

Data verification will be performed by the Project Manager, who will ensure that all procedures are followed correctly. This verification will include the entry and calculations for accuracy, precision, and data completeness.

Data validation will be performed by the Project QAO, extending the data evaluation beyond method and procedural compliance, to determine the analytical quality of the data set. Assignment of data validation qualifiers will be completed by the Project Manager and/or Project Technical Lead consistent with appropriate EPA guidance.

Validation by the Project QAO will include review of data qualifiers. The intent of data validation is to determine if the data are adequate to support the objectives of the project. Items to be considered include:

- Do the data meet the needs of the project?

- Do the data meet the quality objectives of the project?

The Project QAO will review the duplicate Solar Pathfinder™ data. The two datasets will be directly compared, and the average discrepancy will be calculated. An assessment of data completeness will be made by the Project Manager and reviewed by the Project QAO. These measures will then be compared with project goals.

Data validation will also include a determination, where possible, of the reasons for any failure to meet method or procedural requirements, and an evaluation of the effect of such failure on the overall data set.

Any discrepancies from requirements of the QAPP, with respect to the data, will be noted during the verification and validation process. As determined by the Project Manager, the Project Technical Lead, or the Project QAO, if the data do not meet the needs of the project, or the quality objectives of the QAPP, and/or if the conclusions drawn from the data do not appear to be reasonable, the Project Manager and the Project QAO shall immediately report such findings to the appropriate Regional Manager and State Office Program Manager for determination of the necessary corrective actions.

The data will be considered valid if the QA checks indicate that they are accurate and precise, as defined in this plan.

24 Reconciliation with User Requirements

Data Quality Assessment (DQA) will be performed in accordance with the DEQ QMP (DEQ 2016). Additional guidance can also be found in EPA Data Quality Assessment: A Reviewer's Guide (EPA 2006a), or in Data Quality Assessment: Statistical Methods for Practitioners (EPA 2006b).

The DQA, performed by the Project Manager and the Project QAO, addresses the determination whether a data set is of the right type, quality, and quantity to achieve the objectives of the project and can confidently be used to make an informed decision.

As previously stated in Section 23, if the Project Manager, the Project Technical Lead, or the Project QAO, reach the conclusion that the project data do not meet the needs of the project, or the quality objectives of the QAPP, and/or if the conclusions drawn from the data do not appear to be reasonable, the Project Manager and the Project QAO shall immediately report such findings to the appropriate Regional Manager and State Office Program Manager for determination of the necessary corrective actions

If sampling activities require revision, the project QAPP and/or FSP will be revised as necessary. Following revision and prior to implementation, the revised project QAPP and/or FSP must be re-approved in accordance with the Idaho DEQ QMP (DEQ 2016).

Accuracy: Solar Pathfinder™ photographs with error estimations greater than 5% will be properly disposed of and data not used.

Precision: The level of precision of measuring shade on a stream reach (Solar Pathfinder™ site) is not known, and may vary from site to site, plant community to plant community, region to region. If the duplicate site shade values were to differ by more than 20%, then all the datasets must be flagged/qualified to reflect the potential error and what restrictions have been placed on the use of the data as a result.

Comparability: If the Solar Pathfinders™ have been deployed according to the monitoring plan, then they are expected to be comparable.

Completeness: All valid data may be used. A single faulty or unusable Solar Pathfinder™ photograph will not affect the results from the others. Even imprecise data may be useful in determining other information about the site.

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25 References

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Appendix A. Project Checklists

Prior to using an activity checklist, project staff should review the applicable requirements listed in the project QAPP and the QMP.

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DEQ QAPP/FSP Checklist—Data Review

The individual assigned in the project QAPP/FSP to perform project **data review** *shall complete and file this checklist in the appropriate project TRIM system files*. Project personnel are encouraged to expand this standard list, as project conditions warrant.

Printed Name of Staff Performing Data Review

Date Completed

Project QAPP/FSP Title

QAPP/FSP TRIM Record #

Check the following review boxes following completion of each listed task.

Check *yes* if the task was completed without any noted discrepancies. Otherwise, check *no* and include a description of the discrepancy in the space provided. Use additional sheets as necessary.

Yes No

- Verify that the approved current project QAPP, including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the QAPP is not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

- If the project utilizes an FSP, verify that the approved project FSP, including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the FSP is not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

- Examination and review the project QAPP (and FSP, if used) to determine if additional project-specific data *review* requirements apply. Update this checklist to include all such items.

- Examine project data, identifying errors in data entry, storage, calculation, reduction, transformation, or transcription.

Yes No

Ensure all required sample information is documented and available, in preparation for the verification, validation, and assessment process. This includes pertinent project information concerning blanks, matrixes, temperature requirements, duplicates, preservatives, shipping dates, holding times, chain-of-custody records, etc.

Identify if all required nondirect measurement data (existing data) information *and supporting documentation*, as required by the project QAPP (and FSP, if used), have been received and are available for the verification and validation process.

Determine if any data deficiencies exist, such as missing data or compromised data integrity, due to issues such as loss in acquisition, storage, or processing.

Ensure all necessary analytical laboratory support documentation, as set forth and stipulated in the project QAPP (and FSP, if used), have been received from the applicable laboratories.

Identify programming and/or software related errors, if applicable to the project.

Ensure that all deficiencies and/or conditions adverse to quality determined during the project data *review* process have been communicated to project management and are listed on this checklist or attached for inclusion in the TRIM record system.

Verify that a copy of this data review checklist has been provided to the project manager for deficiency resolution and placed in the project TRIM file system. Note that additional data review actions may be required based on the checklist findings, such as a corrective action plan/reports, etc. The project manager shall consult the DEQ QMP and proceed accordingly.

Please list any additional comments below. Attach additional sheets as necessary.

DEQ QAPP/FSP Checklist—Data Verification

The individual assigned in the project QAPP/FSP to perform project **data verification** *shall complete and file this checklist in the appropriate project TRIM system files*. Project personnel are encouraged to expand this standard list, as project conditions warrant.

Printed Name of Staff Performing Data Verification

Date Completed

Project QAPP/FSP Title

QAPP/FSP TRIM Record #

Check the following review boxes following completion of each listed task.

Check *yes* if the task was completed without any noted discrepancies. Otherwise, check *no* and include a description of the discrepancy in the space provided. Use additional sheets as necessary.

Yes No

- Examine and review the project QAPP (and FSP, if used) to determine if additional project specific data *verification* requirements apply. Update this checklist to include all such items.

- Verify that all data completeness criteria, as stated in the project QAPP (and FSP, if used), have been satisfied. This shall include items such as the number of samples, number of QC samples such as spikes and duplicates, and chain-of-custody record continuity.

- Verify that the values of individual data points, and/or comparison calculations such as RPD, meet the criteria specified in the QAPP (and FSP, if used).

- Verify that the required analytical methods, as listed in the project QAPP (and FSP, if used) correspond to the analytical methods employed by the laboratory, as recorded in laboratory reports.

- Verify that QAPP (and FSP, if used) requirements relative to laboratory analytical support documentation have been satisfied by the reporting laboratory, including the correct application of data qualifiers.

- Verify that all supporting information and documentation for nondirect measurement data (existing data) meet the requirements of the QAPP (and FSP, if used). If not, identify any limitations or restriction on the use of such data.

Yes No

Verify that data and sample collection practices adhered to procedural requirements, to include a review of project logs and field notes, as applicable.

Verify that sample handling activities conform to QAPP (and FSP, if used) requirements. Examples include sample shipment timelines, sample holding times, preservatives, number of samples obtained, duplicate or split sample frequency, and chain-of-custody documentation.

Verify that data calculation and handling activities conform to QAPP (and FSP, if used) requirements. Examples include correct use of mathematical formulas and numerical methods, correct use of programs and programing, and correct application of database information transfers.

Verify that any remaining or unique project QAPP (and FSP, if used) or procedural requirements have been met, and if not, determine the extent to which these requirements failed to be achieved.

Determine and document any limitations on the use of the project data.

Ensure that all deficiencies and/or conditions adverse to quality determined during the project data *verification* process have been communicated to project management and are listed on this checklist or attached for inclusion in the TRIM record system.

Verify that a copy of this data verification checklist has been provided to the project manager for deficiency resolution and placed in the project TRIM file system. Note that additional data verification actions may be required based on the checklist findings, such as a corrective action plan/reports, etc. The project QAO shall consult the DEQ QMP and proceed accordingly.

Please list any additional comments below. Attach additional sheets as necessary.

DEQ QAPP/FSP Checklist—Data Validation

The individual assigned in the project QAPP/FSP to perform project **data validation** shall complete and file this checklist in the appropriate project TRIM system files. Project personnel are encouraged to expand this standard list as project conditions warrant.

Printed Name of Staff Performing Data Validation

Date Completed

Project QAPP/FSP Title

QAPP/FSP TRIM Record #

Check the following review boxes following completion of each listed task.

Check *yes* if the task was completed without any noted discrepancies. Otherwise, check *no* and include a description of the discrepancy in the space provided. Use additional sheets as necessary.

Yes No

- Verify that the approved current project QAPP, including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the QAPP is not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

- If the project utilizes a FSP, verify that the approved project FSP, including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the FSP is not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

- Examine and review the project QAPP (and FSP, if used) to determine if additional project-specific data *validation* requirements apply. Update this checklist to include all such items.

- Evaluate and examine all (100%) of obtained field QC sample results, such as duplicates and trip blanks, etc., followed by assignment (if necessary) of appropriate data qualifiers to these data based on project criteria.

- Review project analytical laboratory reports and data, including the assigned data qualifiers, to evaluate the data quality with respect to the project DQOs. Assign data qualifiers to individual data values as necessary and appropriate.

Yes No

- Review the outcome of the data verification effort to evaluate the impact on data quality with respect to the DQOs.

- Determine, when necessary and where possible, the reasons for any failure to meet methodological, procedural, or contractual requirements and evaluate the impact of such failure on the overall data.

- Compare the project DQOs, as defined in the project QAPP (and FSP, if used), to the data obtained by the project to assess the adequacy of the data (new or existing) in relation to their intended use.

- Determine the extent to which any nondirect measurement data (existing data), and the accompanying supporting information and documentation, meet the requirements of the data user. Specifically, does the quality of the existing data adequately support the needs of the project and support the intended use of the data for the project?

- Determine and document any limitations on the use of the project data.

- Determine the adequacy of the data to proceed on to the data assessment and reconciliation with user requirements phase.

- Ensure that all deficiencies and/or conditions adverse to quality determined during the project data *validation* process have been communicated to project management and are listed on this checklist or attached for inclusion in the TRIM record system.

- Verify that a copy of this data validation checklist has been provided to the project manager for deficiency resolution and placed in the project TRIM file system. Note that additional data validation actions may be required based on the checklist findings, such as a corrective action plan/reports, etc. The project QAO shall consult the DEQ QMP and proceed accordingly.

Please list any additional comments below. Attach additional sheets as necessary.

DEQ QAPP/FSP Checklist—Annual QAO Project Audit

The individual assigned in the project QAPP/FSP as the project quality assurance officer (QAO) shall audit the project on at least an annual basis. The QAO shall complete this checklist as part of the audit process and file the completed form in the appropriate project TRIM system files. Project QAOs are encouraged to expand this standard list as project conditions warrant.

Printed Name of Staff Performing the QAO Audit _____ Date Completed _____

Project QAPP/FSP Title _____ QAPP/FSP TRIM Record # _____

Check the following review boxes following completion of each listed task.

Check *yes* if the task was completed without any noted discrepancies. Otherwise, check *no* and include a description of the discrepancy in the space provided. Use additional sheets as necessary.

Yes No

- Verify that the approved current project QAPP (and FSP, if used), including a copy of the signed approval signature page, is currently filed in the TRIM system. Also, verify the project information for the QAPP (and FSP, if used) has been entered into the QAO project tracker found at TRIM record #2012AEB8. If the QAPP (and FSP, if used) are not filed in TRIM, or the QAO tracker is not current, immediately inform the DEQ QA manager.

- Verify that the approved and current project documents, such as the project QAPP (and FSP, if used), SOPs, etc., are available to project staff and are in use per project requirements.

- Determine through review and observation if the project has performed and documented project activities as described and required by the project QAPP (and FSP, if used) such that the needs of the data user are satisfied.

- Determine if the project QAPP (and FSP, if used) adequately document and describe the actual project requirements such that the needs of the data user are satisfied. If necessary, in coordination with the project manager, initiate project document revision, review, and approval efforts in accordance with the DEQ QMP.

Yes No

Determine if the project analytical requirements are adequately met by the selected laboratory, including use of proper analytical methods and sufficient analytical data support documentation.

Determine if project sample handling activities are in compliance with the requirements of the project QAPP (and FSP, if used).

Determine if project field activities are in compliance with the requirements of the project QAPP (and FSP, if used).

Determine if all nondirect data acquisition associated with the project has been addressed and properly documented in the project QAPP (and FSP, if used).

Compare actual project documents available in the DEQ TRIM record system against the document filing requirements contained in the project QAPP (and FSP, if used). Identify existing deficiencies in the project TRIM system files, such as missing field note pages and missing chain-of-custody forms, and provide this information to the project manager for immediate resolution.

Ensure that all deficiencies and/or conditions adverse to quality determined during the project QAO audit process are listed on this checklist or attached for inclusion in the TRIM record system.

Verify that a copy of this annual QAO audit report has been provided to the project manager for deficiency resolution and placed in the project TRIM file system. Note that additional audit administrative actions may be required based on audit findings, such as a corrective action plan/reports, etc. The project QAO shall consult the DEQ QMP and proceed accordingly.

Please list any additional comments below. Attach additional sheets as necessary.

Appendix B. Solar Pathfinder™ Field Form

Date: _____ Observer(s): _____

Stream: _____ Assessment Unit #: _____

Shade Class Interval: _____ Duplicate Site: __Yes __No

Location Description:

Weather/Other Observations:

Stream Temperature: _____ pH: _____ Conductivity: _____

Additional Photopoints:

Photo #: _____

Description: _____

Photo #: _____

Description: _____

Photo #: _____

Description: _____

Photo #: _____

Description: _____

Photo #: _____

Description: _____

Photo #: _____

Description: _____

TRACES

Trace 1: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 2: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 3: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 4: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 5: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 5-Dup: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 6: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 7: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 8: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 9: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____

Trace 10: BF Width (m): _____ Photo #: _____

Lat: _____ Long: _____