Surface Water Ambient Monitoring Project in the Stanislaus National Forest

Quality Assurance Project Plan

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1.0 Plan Distribution and Approval

Table 1-1. Distribution List and Contact Information

Title	Name	Affiliation	Telephone	QAPP #
Project Manager	John Buckley	CSERC	(209) 586-7440	Revised
QA Officer	Dr. Tom Hofstra	Columbia College	(209) 588-5155	Revised
Technical Advisor	Erick Burres	State Water Board	(213) 576-6788	Revised
Group Rep.	Darca Morgan	Sierra Forest Legacy	(209) 532-0929	Revised
Group Rep.	Tom Harrington	Central Sierra Audubon	(209) 694-8564	Revised
Tech. Leader	Lindsey Myers	CSERC	(209) 586-7440	Revised

Approval Signatures

Title:	Name:	Signature:	Date:
Project Manager	John Buckley	_____	_____
QA Officer	Dr. Tom Hofstra	_____	_____

2.0 Introduction and Overview

The Central Sierra Environmental Resource Center (CSERC) is a non-profit organization that serves as a science-based environmental advocate for nearly 2,000,000 acres within the central region of the Sierra Nevada. For the past 19 years, CSERC has actively monitored grazing, logging, road construction, and other land disturbing activities, especially on federal lands of the region. In terms of water monitoring, CSERC staff has assisted the Tuolumne County Resource Conservation District in monitoring local waters to document water quality and to locate contaminate sources entering domestic waterways. CSERC has also served as a community watchdog, reporting a wide range of environmental problems affecting water quality on both public and private lands.

This monitoring plan describes the actions that will be undertaken by CSERC to sample streams during the summer/early fall high-use period to generate new information about water quality and to potentially identify contaminate sources entering waterways within the middle and upper elevations of the Stanislaus National Forest.

Beyond this Introduction the contents of the Plan are organized in the following sections:
Section 3 describes the roles and functions of the personnel involved in this project.

Section 4 provides the problem statement and the study question.
Section 5 describes the data that will generated, the geographic setting of this project, the project timeline and foreseeable constraints.
Section 6 reiterates measurement data and specifies the Measurement Quality Objectives (MQO).
Section 7 describes training and lab certification.
Section 8 describes the documentation and records that will be produced.
Section 9 reiterates the study question and discusses the project design.
Section 10 describes the methods used to collect water samples.
Section 11 describes how samples will be handled, transported, and how the chain of custody will be documented.
Section 12 describes the instrument used for field measurement and AquaLab's Analytical Methods.
Section 13 discusses Quality Control measures that will be used to ensure accurate data is produced during this project.
Section 14 describes necessary field and laboratory equipment inspection and maintenance, and calibration.
Section 15 describes the inspection of supplies used for sampling.
Section 16 discusses possible outside sources that may be used as supplemental information.
Section 17 describes pre and post sampling readiness and data reviews and laboratory data reviews.
Section 18 describes how data will be checked/reviewed to ensure quality data will be produced.
Section 19 describes steps that will be taken to verify the project's data for completeness.

3.0 Program Organization

3.1 Involved Parties and Roles

The Project Manager will be responsible for all contract management tasks including invoicing and reporting, management of the laboratory contract, and oversight of project progress. The Technical Leader of this Project is the author of the Monitoring Plan and this QAPP and will be responsible for the scientific integrity of the data collection effort throughout the life of the Project. The Technical Leader also is responsible for technical dialogs with advisors and experts, and for collaboration with other agencies and stakeholders active in the watershed. The Quality Assurance Officer works independently from the Project Manager and Technical Leader and is responsible for the data meeting all quality objectives.

Table 3. 1- Personnel Responsibilities

Name	Organizational Affiliation	Title	Contact Information (Phone/e-mail)
John Buckley	CSERC	Project Manager	(209) 586-7440/ johnb@cserc.org
Lindsey Myers	CSERC	Technical Leader	(209) 586-7440/ lindseym@cserc.org
Tom Hofstra	Columbia Community College	QA Officer	(209) 588-5155/ hofstra@yosemite.cc.ca.us

3.2 Project Manager Role

The Project Manager is responsible for all contract management tasks, including budgets, while the Technical Leader is responsible for the technical conduct of the proposed project, including the updating of this QAPP. The Quality Assurance Officer is responsible for ensuring that the data collected during the course of this project meets all documented quality objectives (i.e., Data Quality Objectives, Method Quality Objectives, etc.).

3.3 Quality Assurance Officer Role

The role of the Quality Assurance (QA) Officer is to provide independent oversight and review of the quality of the data being generated by the project with respect to the quality that is required. Thus, the QA Officer will be independent from those generating all project information and will not report to the proposed project director or to any of the proposed technical staff. In this role, the QA Officer has the responsibility to require data that is of insufficient quality to be flagged, or not used, or for work to be redone as necessary so that the data meets specified quality measurements. The QA officer is independent from this project and is not involved in generating data.

3.4 Responsible Person for QAPP Update and Maintenance

Lindsey Myers is responsible for maintaining and updating the official approved QAPP. Lindsey Myers also is the authorized person to make changes to the QAPP.

4.0 Problem Definition/Background

4.1 Problem Statement

The summer months (generally extending from June-September) are when the Stanislaus National Forest receives the highest number of Forest visitors. Many

thousands of backpackers, hikers, swimmers, campers, and other recreational users utilize water from Forest streams and lakes for drinking, swimming, bathing, etc. June through September is also when cattle are allowed to graze within allotments on the Forest.

Due to a lack of funding and personnel, local government agencies have not undertaken any consistent water sampling of streams to determine whether or not logging activities, recreational usage, or livestock grazing are negatively affecting water quality. Each of those potential threats to water quality could certainly be the focus of water sampling tied to specific locations that may be directly affected by each activity. Given CSERC's limited resources to undertake water quality sampling, this project will focus solely on streams affected entirely or primarily by livestock grazing. Currently there is no data available to show if the presence of cattle in the Forest is negatively impacting the beneficial uses of Forest water bodies used for recreation, wildlife habitat, or downstream domestic drinking water.

This project will be sampling tributary streams of the Clavey and Stanislaus Rivers, located in the Stanislaus National Forest, CA. The Clavey and Stanislaus River's are fed by melting snow pack from the Sierra Nevada Mountains, as well as springs and seeps that provide some additional water during the rest of the summer season.

4.2 Study Question and Data Overview

This monitoring effort will provide information about the physical state of several tributary streams of the Clavey and Stanislaus Rivers through field monitoring for pH, specific conductivity, water temperature, turbidity, and bacteriological samples tested for E. coli, total coliform, and fecal coliform.

The key study question that this project will attempt to answer is:

Does the summertime presence of cattle in the Stanislaus National Forest negatively affect the beneficial uses of water bodies for recreation, drinking water, or wildlife habitat?

Monitoring work will be performed during any weather conditions and will be collected starting at the end of May and on through September in order to document the water quality throughout the summer months.

4.3 Water Quality or Regulatory Criteria

This project will yield bacterial counts data and other water quality measurements, which will be collected in a special study to identify if the water bodies in the Stanislaus National Forest meet the Basin Plan water quality objectives for inland surface waters.

Table 4.3 Water Quality Concentration Standards used for this project

Constituent	Inland Surface Waters Quality Objectives *
fecal coliform	In areas designated as contact-recreation zones, the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not to exceed a geometric-mean of 200 per 100 ml, nor shall more than 10 percent of the samples in any 30-day period exceed 400 per 100 ml.
Turbidity	Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.

* From *Quality Control Plan for the Sacramento and San Joaquin River Basins* (Basin Plan). (Regional Board, 1994). Water quality concentration standards for California inland surface waters are promulgated by the U.S. Environmental Protection Agency in Title 40, Section 131.38 of the *Code of Federal Regulations*.

5.0 Program/Task Description

5.1 Work Statement and Produced Products

The project will only provide a final report due to the shortness of the project. No preliminary, interim, or additional reports are planned.

The project will include field water quality measurements and water samples for laboratory analysis. Sampling and measurements will be made during either wet or dry weather.

Station types sampled will include streams and/or flowing water moving through a meadow that joins with a creek or river. Such waters will be sampled at intervals from late May into September. The sampling area will include at a minimum: one tributary stream of the Tuolumne River via the Clavey River, and three tributary streams of the Stanislaus River.

Sampling techniques for bacteriological examination will include direct filling of sterile containers, and direct filling of amber containers for turbidity measurement; water temperature, pH, and specific conductivity are measured in the field using a YSI model 63. Observations about the weather, water, stream flow, etc, will also be noted on the field data sheet. Photos of each sample site will be taken during every sampling event to visually document the sites throughout the project.

5.2 Constituents to be monitored and measurement techniques

Field parameters that will be measured during the project include: specific conductivity, pH, water temperature, turbidity, and relative flow (by visual assessment).

The following conventional analyte pathogens will be measured in water using the Most Probable Number technique: E. coli, fecal coliform, and total coliform.

The results for fecal coliform are the primary purpose for conducting this project. The field parameters (specific conductance, pH, water temperature, and turbidity) along with the bacteriological results for total coliform and E. coli are of secondary importance.

5.3 Project Schedule

Each project location will be sampled/monitored a minimum of five times in one month of the first sample taken (initial sampling at the first site started May 27, 2009). After the first round of sampling is completed, one sample a week will be taken until the second round of sampling begins in July, when livestock may be actively grazing, trampling, browsing, and otherwise affecting riparian areas adjacent to sample sites. Once conditions are appropriate for the second round of samples to begin, at least five samples will be taken in one month at each site.

The final laboratory analyses/results should be collected no later than 14 days after the last sample is taken. The statistical analyses and final report for the project will be completed by November 2009.

Figure 5-1 Project timeline for major tasks

Task	May	June	July	August	Septem	Oct-Nov
Prepare QAPP						
Select sites, prepare for field work						
Conduct Sampling & analysis for water quality study						
Conduct data analysis						
Prepare Final Report						

5.4 Geographical Setting

"Located on the western slope of the Central Sierra Nevada, the Stanislaus National Forest contains about 1.1 million acres within its boundary, of which 898,000 acres is National Forest System (NFS) lands. The Forest's topography is characterized by a series of broad sloping benches separated by river canyons and numerous tributary

drainages. The dominant aspect is west towards the Central Valley and Pacific Ocean. Elevation varies from 1,100 feet in the Tuolumne River canyon to 11,575 feet a Leavitt Peak along the Sierra crest. Four major rivers (Merced, Mokelumne, Stanislaus an Tuolumne) occupy deep canyons that drain west into the Central Valley. A fifth river, the Clavey, flows southward into the Tuolumne. Elevation differences in these canyons can range from 1,000 to 2,000 feet within a half-mile of less. Slopes along the river canyons are steep with gradients of 60-100 percent.

The Forest contains a number of small to medium-sized lakes, mostly man-made. Cherry Lake (1,800 acres) is the largest while Pinecrest Lake (300 acres) and Lake Alpine (180 acres) are the most popular for recreation use. The only naturally occurring lakes are at the higher elevations. Granite, the most common rock type on the Forest, is especially evident at the higher elevations. Volcanic rocks once covered much of the Forest, but eroded away in many areas. The Dardanelles and nearby Table Mountain are remnants of these volcanic rocks.

Forest climate is directly related to elevation. Below 4,000 feet, mild rainy winters and hot dry summers prevail, with an average 30-35 inches annual precipitation. Above 4,000 feet summers are cooler, winter are cold and snowy, and annual precipitation is 40 to 65 inches. Snow accumulates on protected exposures, and surface runoff from snowmelt, which feed the rivers and higher elevation creeks, normally occurs from March through July.

The Stanislaus National Forest contains a mosaic of vegetation distributed and controlled primarily by climate and soil. The dominant vegetation types occur as broad bands oriented northwest-southeast across the Forest occupying general elevation zones. The annual grass-oak woodland-digger pine vegetation type is found up to about 3,000 feet along the steep sides of the major river canyons where it is confined primarily to the south-facing slopes. The chaparral vegetation type occurs higher, from about 1,500 to 3,500 feet elevation. Most of the forested land occurs between 3,500 to 7,500, with some as high as 8,500 feet. Evergreen and deciduous hardwoods are scattered throughout all elevation zones. The sub-alpine zone with a mixture of conifers and low growing shrubs exists above 7,500-8,500 feet (USDA 2009, 37-38)."

Project sample sites:

The four primary sample sites being monitored are all tributaries of two of the four major rivers within the Stanislaus National Forest. The four primary sample sites are each located within or directly below a specific meadow (1. Lower Round Meadow, 2. Upper Fiddlers Green Meadow, 3. Bull Run Meadow, and 4. Barn Meadow). CSERC is using Bourland Meadow as the control sample site.

1. The sample site that flows through Lower Round Meadow (which is within the Bell Meadow/Bear Lake Rangeland Allotment) is a tributary stream of Bell Creek and is entirely within the Tuolumne River watershed (the stream runs into the Tuolumne River via the Clavey River via Bell Creek).

The following four sample sites are located in the Stanislaus River watershed:

2. The sample site that flows through Upper Fiddlers Green Meadow (which is within the Herring Creek Rangeland Allotment) is a tributary stream of Herring Creek. Herring Creek flows into the South Fork of the Stanislaus River.

3. The sample site that flows through Bull Run Meadow (which is within the Herring Creek Rangeland Allotment) is a tributary stream of Cow Creek. Cow Creek flows into the Lower Middle Fork of the Stanislaus River.

4. The sample site that flows through Barn Meadow (which is within the Long Valley/Eagle Meadow Rangeland Allotment) is a tributary stream of Niagara Creek. Niagara Creek flows into Donnell Lake via the Middle Fork of the Stanislaus River.

Supplemental Sample Site:

5. Samples were collected from Rose Creek in an area accessed by Forest Service Road 3N59Y (which spurs off road 4N16). Rose Creek is entirely within the Stanislaus River watershed and flows into the Lower Middle Fork of the Stanislaus River.

Control Sample Site:

The control sample site is Bourland Creek. It will be sampled at the low end of Bourland Meadow (which is not included in a rangeland allotment and thus should not have any livestock grazing). Bourland Creek is entirely within the Tuolumne River watershed (the creek flows into the Tuolumne River via the Clavey River).

Additional sample sites may be added as the CSERC field crew locates new sample sites or if sites are added at the Project Manager's discretion. The new sample sites may include: sampling a single spot, and/or "above and below" samples (sampling the water above a potential contaminated area and sampling the water below the potential contaminated area for comparison). The sampling protocol will be the same for any added sampling sites, and maps will be created and added as necessary.

Appendix A: (Figures 5-2 through 5-5) contains maps of the four main sample sites, with the major roads, meadows and sample site identified, and the legal description of the location.

5.5 Constraints

Extreme dry weather would limit or prevent representative sampling at any specific sample site due to low flow and/or harsh conditions that would adversely affect the parameters being monitored.

The six-hour time limit from the field to the lab for the bacteriological samples collected for this project is not a problematic constraint. The field days are planned with this time

constraint in mind so that the field crew has ample time to deliver the bacteriological samples to AquaLab. However, if any bacteriological samples arrive past the six-hour time limit to the lab due to an unexpected delay (examples: flat tire, engine trouble, personnel injury), the data will either not be used or it will be flagged as not meeting the time limit if the data is included in the final report.

6.0 Data Quality Objectives and Acceptability Criteria for Measurement Data

The Data Quality Objectives for this project provide quality specifications for the study in question and are listed below.

The key study question to be answered is:

Does the summertime presence of cattle in the Stanislaus National Forest negatively affect the beneficial uses of water bodies for recreation, drinking water, or wildlife habitat?

Data Quality Objectives (DQOs) for the proposed project will be based on Measurement Quality Objectives (MQOs) for the analytes and organisms listed in Tables 6-1 and 6-2.

Data acquisition activities will include both field measurements and laboratory analyses; the MQOs for field measurements are listed in Table 6-1. Table 6-2 lists the MQOs for laboratory analyses.

Table 6-1 Measurement Quality Objectives for Field Measurements

Matrix	Parameter	Unit	Precision (RSD)*	Accuracy **	Measurement Range	Completeness
Water	Specific Conductivity	µS/cm	10%	+/-10.0	0 to 4999	Min 5 valid samples in a month
Water	Temperature	ºC	10%	+/-1.0	-5 to +75 ºC	Min 5 valid samples in a month
Water	pH	pH	10%	+/-0.1	0 to 14	Min valid 5 samples in a month

******The Relative Standard Deviation will be used to calculate the Precision as a percentage, the smaller the RSD% the more precise the measurements.*
***(Accuracy = average value – true value)*
true value = buffer solution standardized number, average value = YSI 63 pH reading of buffer solution.

Table 6-2 Measurement Quality Objectives for laboratory analyses results

Matrix	Analyte	Unit	Precision*	Completeness
Water	E. coli	MPN/100 ml	<25% difference	Minimum 5 valid samples over a month
Water	Total Coliform	MPN/100 ml	<25% difference	Minimum 5 valid samples over a month
Water	Fecal Coliform	MPN/100 ml	<25% difference	Minimum 5 valid samples over a month
Water	Turbidity	NTU	<25% difference	Minimum 5 valid samples over a month

**Precision will be calculated using the relative percent difference (RPD) of duplicate samples. If the RPD is >25%, the data will be flagged in the QAPP Report, but that data will still be used.*

Precision

The field parameters (specific conductance, temperature, and pH) are recorded three times at each sample site within five minutes. The precision for the field parameters will be calculated using the three entries by calculating the relative standard deviation (RSD), which will express how much the field measurements deviate as a percentage within that five-minute period of time. The RSD will be calculated for 10% of the total number of site visits (ex. If 80 samples are taken total, the RSD will be calculated for the pH, specific conductivity, and water temperature for 8 of those samples). An example calculation will be included in the final report.

The relative percent difference (RPD) will be calculated for the duplicate bacteriological analysis results (for total coliform, fecal coliform, and E. coli) and turbidity duplicates. As discussed in Section 13 Quality Control, 10% of samples taken will be duplicate samples. An example calculation will be included in the final report.

The standard deviation (SD) will also be calculated for all field blank samples taken for bacteriological analysis, which will be 5% of total samples taken as discussed in Section 13 Quality Control.

Accuracy

The accuracy for the field parameters specific conductance and pH will be measured by taking repeated measurements using buffers with known concentrations. For example, the accuracy of the pH probe will be measured by recording the probes reading using buffer solutions pH 4.00, 7.00, and 10.00, (rinsing the probe with deionized water before switching solutions) at least five times on separate days. The five recordings for each of the pH buffer solutions at 4.00, 7.00, and 10.00 will have the accuracy calculated (Accuracy = average value – true value), the difference between the average pH value and the true value will be evaluated whether or not the accuracy is satisfactory for the data quality objectives of the project. The standard deviation will be calculated from the five accuracy calculations.

The accuracy of the specific conductance sensor will be measure by recording the probes reading using, conductivity calibration solution 447.1µS or 1,000 µS at least five times on separate days. The specific conductivity reading will be recorded and the accuracy calculated (Accuracy = average value - true value). The accuracy will further be tested by diluting the conductivity calibration solution 447.1 µS with deionized water (100 ml conductivity calibration solution 447.1 µS + 100 ml deionized water = 223.55 µS, this solution will again be diluted with 200 ml of deionized water), the specific conductivity of the deionized water will also be tested and recorded.

Representativeness

All regular sample sites were selected at the end of spring (late May through early June); they are all located at a stream either within or below a meadow. All sites have flowing water (sites are fed either directly from snow-melt, or by a spring or seep coming out of the mountain). Once the sites are selected, the same site will be sampled thereafter, unless the site dries-up. Then the site will be moved as close as possible down-stream until flowing water is found again and another sample site is chosen. The new sample site will be as representative of the dry sample site as possible (within or below a meadow) and will be sampled for the remainder of the project. There is only one set of field equipment and only one field crew will be sampling for this project at a time. Lindsey Myers will oversee and be present for all sampling events to ensure consistency of field crew sampling methods.

Completeness

The minimum number of samples taken for bacteriological analysis for valid results is: at least five samples taken in a month-long period for each sample site (the associated meadows being: Lower Round Meadow, Upper Fiddlers Green Meadow, Bull Run Meadow, and Barn Meadow). There will be two separate sets of five samples taken in a month-long period; one minimum set of five samples before the cows are present in the local area of the Forest and a second minimum set of five samples after the cows are present in the local area of the Forest. More than five samples are planned to be collected at each site for both the "before" and "after" cattle scenario to ensure that there are at least five valid samples collected. Valid samples are those that have been collected using the methods described in the SOP (Appendix D) for this project and that have been delivered to the lab within the six hour time limit.

The same minimum number or samples will be needed for the parameters that are of secondary importance to this project, which are the turbidity samples and the field parameters (specific conductivity, pH, and water temperature). It will be noted in the final report if the minimum number of samples is met for: turbidity, specific conductivity, pH, and/or water temperature (a potential example reason for any incomplete data would be equipment failure). However, being that this is information of secondary importance, it will not reduce the value of the final report if it does not meet the completeness minimum.

Comparability
This is the first year that this project will be conducted in Stanislaus National Forest by CSERC, and no other projects have been conducted in the area by other agencies. However, if CSERC or another group chooses to conduct the same or similar project in the future, the data units and sampling methods should be comparable.

The results for pH and fecal coliform are comparable to the Basin Plan standards.

7.0 Special Training Requirements/Safety

The laboratory, AquaLab Water Analysis, has ELAP certification from California (State Certification #1359), and no other training or requirements are necessary for the purposes of this project. Lindsey Myers received basic water quality training from the Tuolumne County Natural Resource Conservation District in September 2008, and has been a monthly "Stream Team" member, sampling creeks in Tuolumne County once a month since January through June 2009. All other involved staff members have received the basic training needed from Lindsey Myers, and no additional specialized training is needed for this proposed project.

7.1 Training and Certification Documents

AquaLab Water Analysis maintains its own training documents and certification records. Additional training and certification documentations in not needed for the purposes of the proposed project.

7.2 Training Personnel

All proposed project members already have the required basic training and no additional training is needed for this proposed project (a description of sampling protocol will be provided).

8.0 Documentation/Records and Final Report

8.1 Documentation/Records

Lindsey Myers will be responsible for developing, maintaining, and updating the Quality Assurance Project Plan (QAPP). All field data gathered by this project will be recorded on field datasheets and entered/kept in a digital database. Documentation for analytical data will be kept on file at the laboratory for review during any external audits by outside quality assurance agencies. The laboratory records will include the analyst's comments on the condition of the sample and progress of the analysis, raw data, instrument

printouts, and results of calibration and QC checks. All original documentation as well as the QAPP will be held at the Central Sierra Environmental Resource Center office. The QAPP and its revision will be distributed to all parties involved with the project, including Sierra Forest Legacy and Central Sierra Audubon Society. Upon revision, the replaced QAPPs will be discarded.

John Buckley the project manager, will oversee the maintenance of all records and will arbitrate any issues related to records retention. All records generated by this project will be stored at the CSERC office. AquaLab Water Analysis's director will be responsible for maintaining and retaining all analytical records, including sample receipt records, chain-of-custody forms, and printed and electronic data from laboratory analyses. Laboratory records generated by this project will be maintained at the CSERC office and AquaLab Water Analysis for five years following project completion. Data files will be maintained without discarding. AquaLab Water Analysis will archive all analytical records generated for this project. John Buckley of the CSERC will be responsible for archiving all other records.

All field operation records will be entered into electronic formats and maintained in a dedicated directory at the CSERC office. Each file will also have at least one back-up copy on compact disc.

Table 8.1 - Document and Record Retention, Archival, and Disposition

Record Type	Identification Type Needed	Retention	Archival	Disposition
Field Records	Includes: field observations and measurements, site ID, and sample ID.	5 Years	CSERC Office	Recycling
Analytical Records	Includes: receipts, chain of custody forms, quality control records	5 Years	CSERC Office	Recycling
Data Records and Assessment records	Includes: field measurements and laboratory results	5 Years	CSERC Office	Recycling

Field Records will be kept in a folder at the CSERC office for 5 years, after which time they will be recycled if they are no longer needed or valid.

All analytical records including receipts, chain of custody forms, quality and control records will be kept at the CSERC office for 5 years, after which time they will be recycled if they are no longer needed or valuable.

8.2 Final Report

Lindsey Myers will be responsible for the final report that will be provided by the end of 2009 to Erick Burres, Darca Morgan, Tom Harrington, John Buckley, and Dr. Tom Hofstra.

9.0 Sampling Process Design (Experimental Design)

The study question to be answered is:

Does the summer time presence of cattle in the Stanislaus National Forest negatively impact the beneficial uses of Forest water bodies for recreation, drinking water, or wildlife habitat?

Stations will be located in streams - flowing water. The stations will be selected with the intent of contaminant source identification. The timing of monitoring will start in spring when the water is expected be pristine/high quality in order to document the quality of the water as the season progresses.

The sampling design principles used for this project can be defined as follows: Directed - A deterministic approach in which sample points are selected deliberately based on knowledge of their attributes of interest as related to the environmental site being monitored. The timing when monitoring will occur is during the day when the lab is open (during normal office hours), the season is determined by when the cattle are present in the Forest (which is the summer season).

The CSERC Field Crew will measure at each site visit: water temperature, specific conductivity, and pH at the same spot and the same time where/when they collect water samples for lab analyses for the turbidity and the presence of bacteria (E.coli, total coliform, and fecal coliform), and take notes on the weather, relative flow of water, and take pictures of the sample site.

The total number of site visits will be +/-15. Stations will be visited at a frequency daily to every other day to weekly until five samples have been collected in a month starting in late spring (May-June). A sample a week will be taken until the second round of sampling begins, another five samples in a month in summer (July-August). The planned interval between visits will vary from daily to weekly.

If a sampling site becomes dry or inaccessible, the field crew will select a new sampling site downstream within the watershed as close to the old sample site as possible. They will select the new site by walking down the stream along which their sample site has dried. The field crew will follow the dried portion of the stream until the stream starts flowing again (with water either from a meadow lower in elevation or a seep or spring) where they will pick a new sample site. The new sample site should be as

representative of the dried site as possible. The field crew will continue sampling at this new site until the project is complete.

This study question will not require continuous monitoring.

To avoid non-natural variability and ensure sample accuracy, samples will be taken at the same spot every time (unless the sample site has dried up, then a new sample site will be chosen down-stream and will be sampled thereafter); the field equipment will be calibrated regularly (see Table 14-2 Maintenance Schedule) and checked for field drift by checking the calibration of the pH and specific conductance before and after a sampling day. Laboratory samples will be checked for accuracy by taking field duplicate samples and field blanks using bottled water.

Possible sources of variability and sample inaccuracy and efforts to ensure quality data:

1. Measurement error (both lab and field measurements) - Quality Control samples (duplicate and field blanks) will be taken to ensure laboratory accuracy and that field methods are not contaminating the sample. Field equipment will be maintained with regularly scheduled calibrations, and by calculating the field drift (by checking the calibration with buffer solutions before and after several sample days).
2. Natural (inherent) variability - Three measurements for temperature, specific conductance and pH will be taken at each site to compensate for natural variability; the average will be the final number. To compensate for any natural degradation in water quality (for instance, that may not be associated with the arrival of cattle), a control meadow (no grazing allowed) will be sampled to document any natural water quality variability.
3. Sample misrepresentation - All samples will be collected from the same site (unless the site had to be moved due to lack of flow), from flowing water, 0.1 m under the surface (if stream depth allows), using properly cleaned/sterilized and calibrated equipment.

Each sample event will occur during normal business hours, all samples will be kept on ice and delivered to AquaLab within six hours of the time they were taken.

Table 9.1 Sampling day schedule/timeline

Time/hours	Task*
08:00-09:00	Arrive at office, prep for field day by going through checklist.
09:01-10:00	Depart office, drive to furthest sample site from office.
10:01-11:00	Arrive at sample location, collect first sample at Barn Meadow (tributary stream to Niagara Creek).
11:01-12:00	Drive to next sample location, collect sample below Bull Run Meadow (tributary stream to Cow Creek).
12:01-13:00	Drive to next sample location, collect sample below Upper Fiddlers Green Meadow (tributary stream to Herring Creek).
13:01-14:00	Drive to next sample location, collect sample in Lower Round Meadow (tributary stream of Bell Creek).
14:01-15:00	Drive to AquaLab, fill out Change of Custody form and drop-off samples. Pick-up more sample bottles for next sampling day.
15:01-16:00	Return to CSERC office, unpack equipment for next sampling day. Calibrate equipment if scheduled or necessary.

*This is an approximate timeline and the timing of tasks may vary +/- one hour. The field crew aims to have samples to the lab before/around 16:00. The lab stays open until 17:00-18:00 (the field crew will call the lab on a rare occasions when they cannot get a sample to the lab by 17:00).

All information gathered for this project is for informational/assessment purposes only.

Station location maps are provided in the Appendices to this QAPP.

10.0 Sampling Methods Requirements

Water samples that are collected for bacteriological testing are collected while wearing sterile gloves and collected in sample bottles sterilized and provided by AquaLab Water Analysis. The bacteriological samples are collected before any other work is done at the site. The sample bottle is filled approximately 3/4 to 4/5 of capacity, directly from flowing water approximately 0.1 m below the surface.

The sterilized Nalgene bottles provided by AquaLab for the bacteriological testing hold 125mL of liquid; they are filled to approximately 100mL with sample water.

The sterilized containers are provided by AquaLab Water Analysis, which has ELAP certification.

The sample container are marked with an unique 3 digit identifying number with an indelible marker so that the markings will not run or become illegible when collecting the sample. The collection date, time and sampler's names are recorded on the field

datasheet (Appendix B) that are kept at the CSERC office, they are also recorded on the Chain-of-Custody (Appendix C) form that is given to AquaLab along with the samples.

If monitoring equipment fails or sampling bottles are contaminated, CSERC Field Crew members will report the problem in the comment section of their field datasheet and will not record data values for the questionable measurement. Actions will be taken to replace or repair broken equipment or sampling bottles prior to the next field visit, no data will be recorded with faulty or contaminated equipment or sampling bottles.

All water samples taken for bacteriological samples will be delivered to AquaLab within 6 hours from the time they were taken. The sampler will wear sterile gloves while taking and handling the sample. The sample will be kept in a ziploc bag (to avoid contamination from the ice water), on ice in a cooler until delivered to AquaLab.

Protocols for measuring pH, water temperature, specific conductivity, turbidity, and fecal bacteria are measured using protocols outlined in the EPA document, *Volunteer Stream Monitoring: A Methods Manual*. The appropriate sections are: 2.3 Safety Considerations, Chapter 5 Water Quality Conditions-Quality Assurance, Quality Control, and Quality Assessment, 5.3 Temperature, 5.4 pH, 5.5 Turbidity, 5.9 Conductivity, 5.11 Fecal Bacteria, and Chapter 6 Managing and Presenting Monitoring Data, 6.1 Managing Volunteer Data, 6.2 Presenting the Data, 6.3 Producing Reports.
CSERC will provide the appropriate sections of, *Volunteer Stream Monitoring: A Methods Manual* upon request, or they can be viewed by going to: www.epa.gov Appendix D contains more information about accessing this document.

Lindsey Myers will be present for all sampling events to ensure that the field sampling methods will be consistent throughout the project. If the field crew is getting unusual readings for: water temp, specific conductivity, or pH, the YSI 63 calibration will be re-checked. If the field readings are found to be inaccurate due to equipment failure, they will not be included in the Final Report and the YSI 63 will be recalibrated before the next field day.

Table 10-1 Specifications for Sample Handling

Matrix	Parameter	Sample Equip. & Containers*	Minimum Container Amount	Preserv-ative	Holding Time (at 4 C)
Water	E. coli	125 mL (4 oz.) Nalgene bottle	80-100 mL (3 oz.)	None	Less than 6 hours
Water	Total Coliform	125 mL (4 oz.) Nalgene bottle	80-100 mL (3 oz.)	None	Less than 6 hours
Water	Fecal Coliform	125 mL (4 oz.) Nalgene bottle	80-100 mL (3 oz.)	None	Less than 6 hours
Water	Turbidity	125 mL amber bottle	100 mL	None	Less than 24 hours
Water	pH	YSI 63	None	None	Reading taken in stream
Water	Specific Conduct.	YSI 63	None	None	Reading taken in stream
Water	Temp	YSI 63	None	None	Reading taken in stream

*Sample containers are the property of AquaLab

11.0 Sample Handling and Custody

Lindsey Myers, Julia Stephens, John Buckley, Tracy Knopf, and Rebecca Cremeen will be responsible for custody of the samples from the time they are taken until they are delivered to Aqualab. (Lindsey, Julia, and John are CSERC staff. Tracy, and Rebecca are volunteers. Lindsey will personally oversee custody responsibility for nearly all, if not all, samples taken.)

Field crews will fill out a field data sheet (Appendix B) for each sampling event. In the field data sheet the following items will be recorded: time of sample collection, sample identification number, results of field measurement (water temp, specific conductivity and pH), arrival and departure time from sample site, qualitative description of relevant water flow and weather conditions at the time of sample collection, and a description of any unusual occurrences associated with the sampling event (especially those that could affect sample or data quality).

The field crews will have custody of samples during field sampling and chain-of-custody (see Appendix C) forms will accompany all samples to the analyzing laboratory. Chain-of-custody procedures require that possession of samples be traceable from the time the samples are collected until completion and submittal of analytical results. The analytical laboratory will maintain custody logs sufficient to track each sample submitted and to analyze or preserve each sample within specified holding times.
In the field, all samples will be packed in wet ice, so that they will be kept at

approximately 4 deg. C. Transport of the samples to the analytical laboratory will be by staff and/or personal vehicles. As soon as the samples are properly packaged and cooled with ice they will promptly be transported to the analytical laboratory for analysis along with the appropriate chain-of-custody forms.

12.0 Analytical Methods Requirements

Neither in situ nor continuous monitoring methods will be used with this project.

Protocols for measuring pH, water temperature, specific conductivity, turbidity, and fecal bacteria are measured using protocols outlined in the EPA document, *Volunteer Stream Monitoring: A Methods Manual*.

Table 12-1 – Instruments used for Field Measurements

Matrix	Parameter	Instru-ment	Features	Calibration Mode	Available Range and Units	Resolution for para-meter
Water	Specific conductivity	YSI 63	Conductivity cell w/ 4 pure nickel electrodes	Manual	0 to 4999 µS/cm	1 µS/cm
Water	Temp	YSI 63	Stainless steel thermometer	Non-adjustable	-5 to +75 ºC	0.1 ºC
Water	pH	YSI 63	Glass Combination electrode w/ gel reference	Manual	0 to 14	+/- 0.02

Table 12-2 - Laboratory Analytical Methods and their Performance Criteria

Matrix	Analyte	Method Type/ Principle	Detection Limit	Medium Check	Precision*
Water	E. coli	Multiple Tube Fermentation MPN/100 ml	Two organisms	Known Pos/ Neg Cultures	<25% difference
Water	Total coliform	Multiple Tube Fermentation MPN/100 ml	Two organisms	Known Pos/ Neg Cultures	<25% difference
Water	Fecal coliform	Multiple Tube Fermentation MPN 100 ml	Two organisms	Known Pos/ Neg Cultures	<25% difference

*Precision will be calculated using the Relative Percent Difference (RPD) of duplicate samples. If RPD for the duplicate samples is >25%, the data will be flagged in the QAPP report but will still be included in the final report.

A copy of AquaLab's SOP for Multiple Tube Fermentation is on file at the CSERC office, the analytical standards utilized by this laboratory are derived from "Standard Methods

For the Examination of Water and Wastewater", the 19th Edition. Upon request, CSERC or AquaLab will distribute this document to interested parties.

AquaLab Water Analysis will provide the analyses for samples that are submitted for laboratory analysis. All of the methods that will be used are listed in Table 12-2 with specific method performance criteria.

AquaLab staff will be responsible for any corrective actions that may be needed in the event of methods failure to produce. If a method fails to provide reliable data for any reason, including analyte or matrix interferences, instrument failures, etc., then the involved samples will be analyzed again if possible. The laboratory's SOP for handling these types of problems will be followed. When a method fails to provide reliable data, then the laboratory's SOP for documenting method failures will be used to document the problem and what was done to rectify it.

After analysis of the project's samples have been completed by the laboratory they will be disposed of in compliance with all federal, state, and local regulations. The laboratory has standard procedures for disposing of its waste, including left over sample materials.

Turn around times for sample analyses will be as fast as possible based on the laboratory's work load. However, the turn around times will not exceed the holding times limit necessary for reliable results. The laboratory understands and has agreed to meet the turn around times needed for our proposed sample analyses.

13.0 Quality Control

To ensure Measurement Quality Objectives are met for laboratory analyses results, the field crew will be collected field blanks and field duplicates.

Field blanks - Field blanks provide bias information for field handling, transport, and storage operations. They will be collected to evaluate whether contaminants have been introduced into the samples during sample collection due to exposure from ambient conditions or from the sampling containers. These blanks will be obtained by pouring deionized water into a sampling container at the sampling location. Field blanks will be preserved, packaged, and sealed exactly like the surface water samples and will be submitted blind to the lab.

Field duplicated - Field duplicate samples provide precision information on all steps after sample acquisition. These samples will be collected as duplicates at designated sample locations by alternately filling two distinct sample containers for each analysis. The field duplicate samples will be preserved, packaged, and sealed in the same manner described for the surface water samples. A separate sample number and station number will be assigned to each duplicate and the samples will be submitted

blind to the lab. The replicate values must have a RPD of less than 25% to be acceptable.

Table 13-1 Frequency of Checks for Sample Integrity, Laboratory Accuracy, Laboratory Precision, and Process Reproducibility

Matrix	Parameter	Trip/Field Blank Frequency	Field Duplicates Frequency	Percent QC of Total Samples
Water	Fecal bacteria	1 for every 20 samples taken	1 for every 10 samples taken	15%

Background samples will also be taken, they provide a comparison between the concentrations or levels of the target parameters in the project's environmental samples with samples from an earlier time that is known or believed to be uncontaminated (i.e., to contain the target parameters at "natural" concentrations or levels. This is necessary in order to differentiate between the project on-site contribution and the off-site natural contribution to the parameter's concentrations or levels. Background samples will be the first round of sampling (5 samples in two weeks) taken before cattle are allowed into the Forest. They will be taken as close to the expected entry date of the cattle as possible to ensure that the second round of samples (another 5 samples in two weeks) are documenting the variations in data caused by the cattle (when present) and not the natural stream fluctuations. The analyses to be conducted on the background samples will be the same as that for the other project samples. A control sample from a pristine location (no cattle grazing allowed) will also be taken using the same sampling protocol for comparison/background purposes.

If the MQOs (Table 6-2 below, see Section 6 for further discussion) are not met for the samples taken for lab analysis the results will still be included in the final report and will be flagged as not meeting the desired precision level. For the purposes of this project, the main interest is when/if the fecal coliform levels exceed the water quality standards set in the Basin Plan. Therefore, even if the desired precision level is not achieved, the information will still be valuable for looking at trends in quality of the water.

Table 6-2 Measurement Quality Objectives for laboratory analyses results

Matrix	Analyte	Unit	Precision*	Completeness
Water	E. coli	MPN/100 ml	<25% difference	Minimum 5 valid samples over a month
Water	Total Coliform	MPN/100 ml	<25% difference	Minimum 5 valid samples over a month
Water	Fecal Coliform	MPN/100 ml	<25% difference	Minimum 5 valid samples over a month
Water	Turbidity	NTU	<25% difference	Minimum 5 valid samples over a month

**Precision will be calculated using the relative percent difference (RPD) of duplicate samples.*

If the MQOs (Table 6-1 below, see Section 6 for further discussion) are not met for the field measurements the results will be flagged as not meeting the desired precision or accuracy level, but will still be included in the final report. However, data with erroneous readings where equipment failure is suspected will be thrown out and not included in the final report.

Table 6-1 Measurement Quality Objectives for Field Measurements

Matrix	Parameter	Unit	Precision (RSD)*	Accuracy **	Measurement Range	Completeness
Water	Specific Conductivity	µS/cm	10%	+/-10.0	0 to 4999	Min 5 valid samples in a month
Water	Temperature	ºC	10%	+/-1.0	-5 to +75 ºC	Min 5 valid samples in a month
Water	pH	pH	10%	+/-0.1	0 to 14	Min valid 5 samples in a month

***The Relative Standard Deviation will be used to calculate the Precision as a percentage, the smaller the RSD% the more precise the measurements.*
***(Accuracy = average value – true value)*
true value = buffer solution standardized number, average value = YSI 63 pH reading of buffer solution.

14.0 Instrument/Equipment Testing, Inspection, Maintenance and Calibration Frequency

14.1 Instrument/Equipment Testing, Inspection, Maintenance

Field measurement equipment will be checked for operation in accordance with manufacturer's specifications. This includes battery checks and routine replacement and/or cleaning of parts as specified by the manufacturer. All equipment will be inspected for damage when first employed and again when returned from use. Maintenance logs will be kept and each piece of equipment will have its own log that documents the dates and description of any problems, the action(s) taken to correct problem(s), maintenance procedures, system checks, follow-up maintenance dates, and the person responsible for maintaining the equipment.

Laboratory measurement equipment will be maintained in accordance with the lab's Standard Operating Procedures (SOPs). This includes procedures specified by the manufacturer and also any that are specified by the methods used. Maintenance logs will be kept and each piece of equipment will have its own log that documents the dates and description of any problems, the action(s) taken to correct problem(s), maintenance procedures, system checks, follow-up maintenance dates, and the person responsible for maintaining the equipment.

14.2 Instrument/Equipment Calibration and Frequency

AquaLab Water Analysis management or designated staff will be responsible for Section 14 instrument/equipment calibration and frequency for the appropriate laboratory equipment. This will include documenting and checking that the specified calibration procedures were performed for each of the selected parameters being measured.

Lindsey Myers will be responsible for calibrating/maintenance of the field instrument/equipment, and inspection of bottles received from AquaLab. This will include maintaining the logs that document what was done, who did the work, and when the work was done as described in the narrative and in Table 14-1 below.

Table 14-1 Field Instrument Calibration and Quality Checks Frequency

Matrix	Analyte	Instrument Kind	Instrument Name or Type	Frequency of Calibration & Accuracy Checks	Freq of Repeated field Measurements
Water	Specific Conductivity	Multi-meter	YSI model 63	1 per month	3 measurements for each sample event
Water	pH	Multi-meter	YSI model 63	1 per month	3 measurements for each sample event
Water	Temperature	Multi-meter	YSI model 63	1 per month	3 measurements for each sample event

Table 14-2 Calibration Schedule

May	YSI 63 pH and conductivity calibrated by QA officer
June	YSI 63 pH and conductivity calibrated by Lindsey Myers at AquaLab
July	YSI 63 pH and conductivity calibrated by Lindsey Myers using buffer solutions* at the CSERC office
August	YSI 63 pH and conductivity calibrated by Lindsey Myers using buffer solutions* at the CSERC office
July-August	Check calibration for pH and conductivity before and after sampling event to calculate the field drift (the field drift will be recorded in the final report).

*YSI 63 pH probe calibrated using pH buffer solution 4.0, 7.0, and 10.0, the conductivity sensor is calibrated using conductivity calibration solution 447.1 µS and 1,000 µS.

15.0 Inspection/Acceptance for Supplies

Lindsey Myers will be responsible for the visual inspection of field equipment (the YSI 63). It will be visually inspected before and after a sample event to verify that it is not damaged, is working properly, and has adequate battery life remaining. Lindsey Myers will also be responsible for the visual inspection and acceptance of supplies obtained for AquaLab. They will be examined for damage, and replaced when they are found damaged. Selected critical supplies are: sterile bottles for bacteria samples, and amber bottle for turbidity samples.

All supplies will be examined for damage as they are received and then again as they are obtained for use with the proposed project. Containers will be inspected for breakage and proper sealing of caps. Reusable supplies (e.g., coolers and safety equipment) will be examined for acceptable cleaning and reuse. Any supplies deemed to be in unacceptable condition would be replaced. The laboratory's requirements for supplies and consumables are described in their QA Manual.

16.0 Non-direct Measurements (External Data)

It is not expected that external sources of data will be used to supplement the information produced by this project. No specific external data sources have been identified yet. If needed, literature searches will be conducted

Background data will be used in comparison purposes, or to supplement the monitoring data that will be measured and documented for this project.

Data Quality Indicators (DQIs) will be used to judge whether the external data meets acceptance criteria. These include, for example, precision, accuracy, representativeness, comparability, completeness, bias, and sensitivity.

Any external data that fails to meet acceptance criteria will not be used in the proposed project. If and when external data does not meet acceptance criteria it will, at the very least, be flagged as such. Flagged data may possibly be used under some conditions but its use will be limited and clearly designated.

As noted above, there are no expectations that external sources of data will be used to supplement the information produced by this project.

17.0 Assessments and Response Actions

17.1 Readiness Reviews

Lindsey Myers will review all field equipment, instruments, containers, and paperwork to ensure that everything is ready prior to each sampling event. Before every sampling event a readiness review will be conducted by checking a list of everything that is needed to sample. It is important that all field equipment be clean and ready to use when it is needed. Therefore, prior to using all sampling and/or field measurement equipment, each piece of equipment will be checked to make sure that it is in proper working order. Adequate supplies of all bottles, labels, waterproof pens, etc. will be checked before each field event to make sure that there are sufficient supplies to successfully support each sampling event. It is important to make sure that all field activities and measurements are properly recorded in the field. Therefore, prior to starting each field event, necessary paperwork such as the field datasheet, chain of custody record forms, etc. will be checked to ensure that sufficient amounts are available during the field event. In the event that a problem is discovered during a readiness review it will be noted in the field notes and corrected before the field crew is deployed. If actions are taken to correct the problem will also be documented with the problem in the field notes.

17.2 Post Sampling Event Reviews

Lindsey Myers will be responsible for post sampling event reviews. Any problems that are noted will be documented along with recommendations for correcting the problem. Post sampling event reviews will be conducted following each sampling event when the field data is entered into a database in order to ensure that all information is complete and any deviations from planned methodologies are documented. Post sampling event reviews will include field sampling activities and field measurement documentation in order to help ensure that all information is complete. Post sampling reviews are important to ensure that data collected is consistent from the first sampling event to the last and to ensure that all data collected is useable.

17.3 Laboratory Data Reviews

Lindsey Myers will be responsible for reviewing the laboratory's data for completeness and accuracy. The data will also be checked to make sure that the specified methods were used and that all related QC data were provided with the sample analytical results. Laboratory data reviews will be conducted following receipt of each data package from a laboratory in order to ensure that all information is complete and any deviations from planned methodologies are either corrected or the reasons for change are documented. Any laboratory data that is discovered to be incorrect or missing will immediately be reported to the laboratory's QA officer. The laboratory's QA manual details the procedures that will be followed by laboratory personnel to correct any invalid or missing data. The project director has the authority to request re-testing if a review of any of the laboratory data is found to be invalid or if it would compromise the quality of the data and resulting conclusions from the proposed project.

18.0 Data Review, Verification, and Validation Requirements

Defining data review, verification, and validation procedures helps to ensure that project data will be reviewed in an objective and consistent manner. Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly. Lindsey Myers will be responsible for data review. This includes checking that all technical criteria have been met, documenting any problems that are observed and, if possible, ensuring that deficiencies noted in the data are corrected.

In-house examination of the data produced from the proposed project will be conducted to check for typical types of errors. This includes checking to make sure that the data have been recorded, transmitted, and processed correctly. The kinds of checks that will be made will include checking for data entry errors, transcription errors, transformation errors, calculation errors, and errors of data omission.

Data generated by project activities will be reviewed against method quality objectives

(MQOs) that were developed and documented in Section 6. This will ensure that the data will be of acceptable quality.

QA/QC requirements were developed and documented in Sections 12-14 and the data will be checked against this information. Checks will include evaluation of field and laboratory duplicate results and the field blank results. This will ensure that the data produced by this project will be as accurate and complete as possible.

Field data consists of all information obtained during sample collection and field measurements, including that documented in field log books and/or recording equipment, photographs, and chain of custody forms. Checks of field data will be made to ensure that it is complete, consistent. Lindsey Myers will enter all information recorded on the field datasheets into a Microsoft Excel workbook; any missing or unclear information will be resolved at this time. The Excel workbook for each sample site will be saved in a file along with the pictures of that sample site for that day. Once CSERC receives the bacteriological analysis from AquaLab, the results will be recorded in the appropriate Excel workbook, the lab report is also checked for completeness at this time.

Lab data consists of all information obtained during sample analysis. The laboratory QA/QC Officer in accordance with the lab's internal data review procedures will perform initial review of laboratory data. However, once we receive the lab data then we will perform independent checks to ensure that it is complete and consistent.

Data verification is the process of evaluating the completeness, correctness, and conformance / compliance of a specific data set against the method or procedural specifications. We will conduct data verification, as described in Section 6 and 13, Lindsey Myers will be responsible for data verification.

Data validation is an analyte- and sample-specific process that evaluates the information after the verification process (i.e., determination of method, procedural, or contractual compliance) to determine analytical quality and any limitations. Lindsey Myers will be responsible for data validation.

Data will be separated into three categories for use with making decisions based upon it. These categories are: (1) data that meets all acceptance requirements, (2) data that has been determined to be unacceptable for use, and (3) data that may be conditionally used and is noted and flagged as so.

19.0 Validation / Verification Methods and Reconciliation with Data Quality Objectives

19.1 Validation / Verification Methods

Defining the methods for data verification and validation helps to ensure that project data are evaluated objectively and consistently. For the proposed project many of these methods have been described in 19.2 of this section. Additional information is provided below.

All field datasheets for the proposed project will be checked visually against the Excel workbook datasheet copy, Lindsey Myers will conduct all of these reviews and record the date of the review. Julia Stephens will perform an independent re-check of at least 10% of these records as the validation methodology. The review and re-check will be conducted before any MQOs are calculated (as discussed in section 6).

All of the laboratory's data will be checked as part of the verification methodology process. Lindsey Myers will conduct reviews of all laboratory data for verification of their accuracy. Julia Stephens will perform independent re-checks of at least 10% of them as the validation methodology. Any errors in data entry will be corrected; outliers and inconsistencies will be flagged for further review, or discarded, and all calculations will be double-checked. Problems with data quality will be discussed in the QAPP report.

Any data that is discovered to be incorrect or missing during the verification or validation process will immediately be reported to the Project Director. If errors involve laboratory data then this information will also be reported to the laboratory's QA officer. The laboratory's QA manual details the procedures that will be followed by laboratory personnel to correct any invalid or missing data. Lindsey Myers will be responsible for reporting and correcting any errors that are found in the data during the verification and validation process.

If there are any data quality problems we will try to identify whether the problem is a result of project design issues, sampling issues, analytical methodology issues, or QA/QC issues (from laboratory or non-laboratory sources). If the source of the problems can be traced to one or more of these basic activities then efforts will be made to immediately resolve the problem.

19.2 Reconciliation with Data Quality Objectives

Information from field data reports (including field activities, post sampling events, and corrective actions), laboratory data reviews (including errors involving data entry, transcriptions, omissions, and calculations and laboratory audit reports), will be used to determine whether or not the project's objectives have been met.

Both field and laboratory data will be statistically analyzed for precision, accuracy, and

completeness to ensure that the project's goals are met (as discussed in Section 6). The field and laboratory statistical data will be compared against the measurement quality objectives (MQOs) documented in Section 6. If the MQOs are not met, data may be flagged or discarded.

Data from all monitoring measurements will be summarized in tables. In addition, data that shows significant changes over time during the monitoring period will be plotted in graphs and charts.

Limitations will be clearer as the project progresses.

The above evaluations will provide a comprehensive assessment of how well the project meets its objectives. No other evaluations will be used.

Lindsey Myers will be responsible for reporting project reconciliation at the end of the project. This will include measurements of how well the project objectives were met. All information will be checked by the Project Manager and the QA Officer.

References

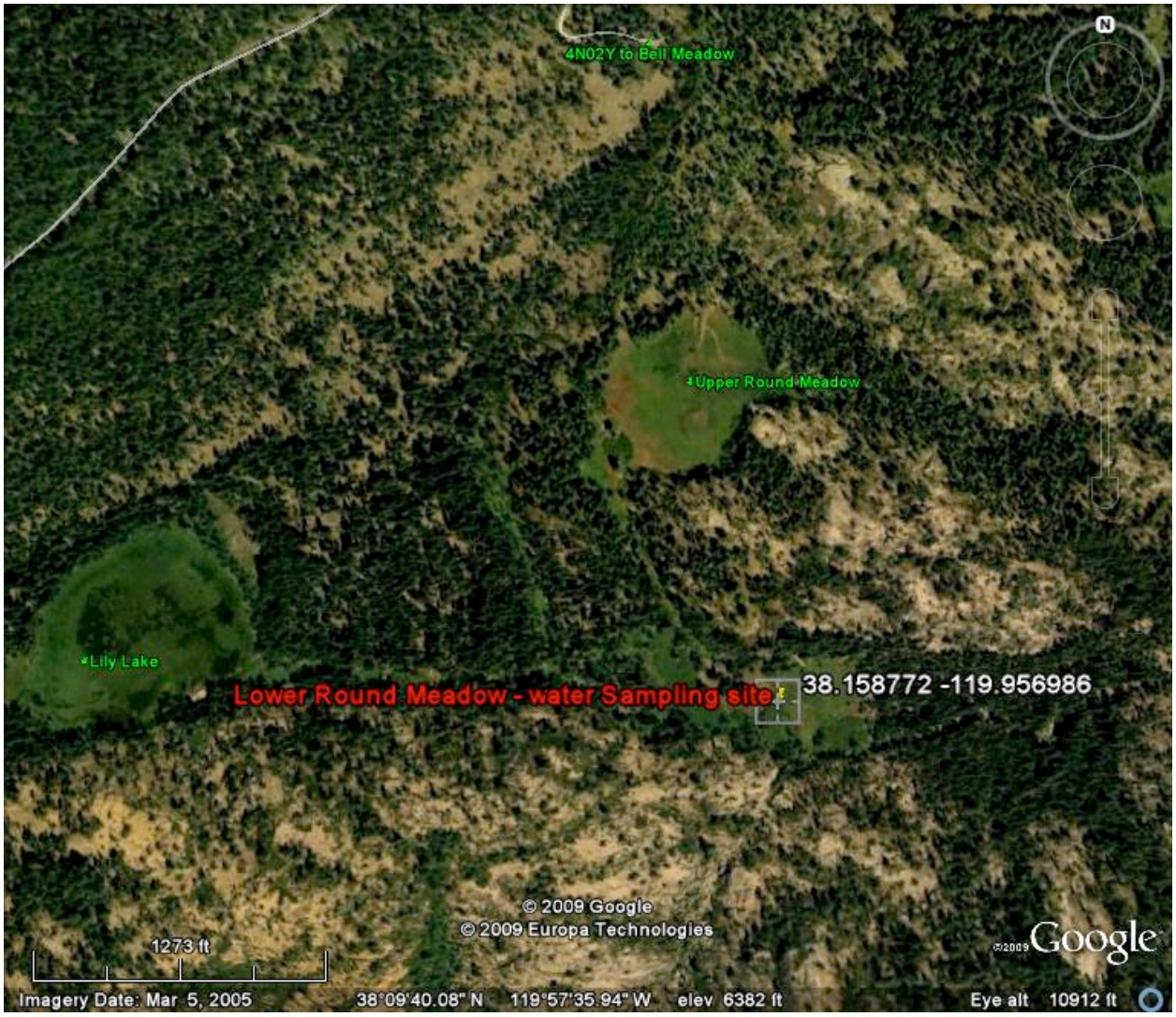
USDA 2009. Draft Environmental Impact Statement; Stanislaus National Forest Motorized Travel Management R5-MB-183; Affected Environment Overview. Forest Service, Stanislaus National Forest, Sonora, CA. 37-38 p.

USEPA 1997. Volunteer Stream Monitoring*: A Methods Manual*. EPA 841-B-97-003. Office of Water, U.S. Environmental Protection Agency, Washington, DC.

Water Quality Control Plan for the Sacramento and San Joaquin River Basins (Basin Plan), Central Valley Regional Water Quality Control Board (1994) http://www.swrcb.ca.gov/rwqcb5/water_issues/basin_plans/

Appendix A

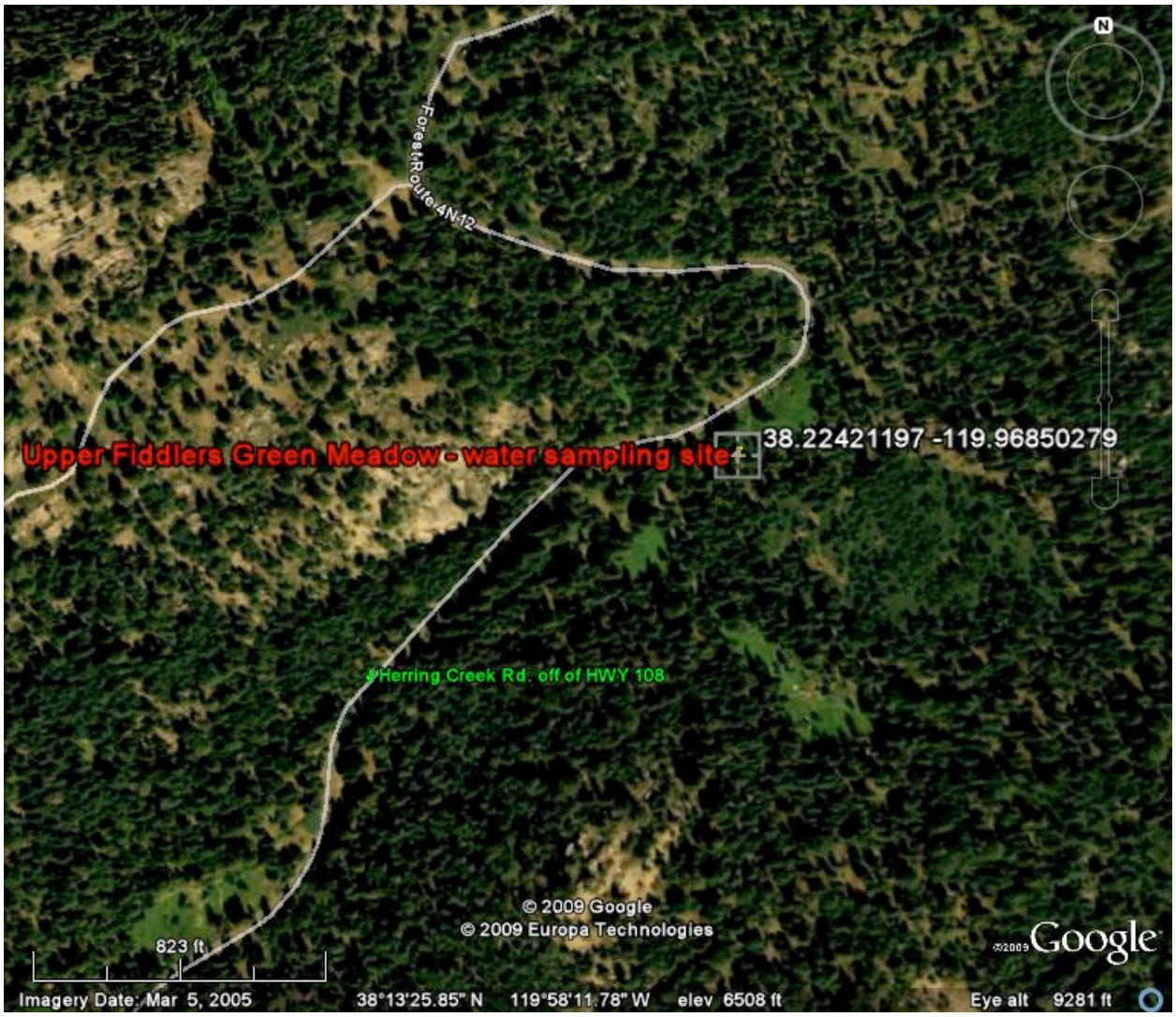
Figure 5-2 Map of Sample Site associated with Lower Round Meadow



Legal Description for the Lower Round Meadow Water Sample Site:

NW ¼ of the SW ¼ Sec 36 T3N R17E

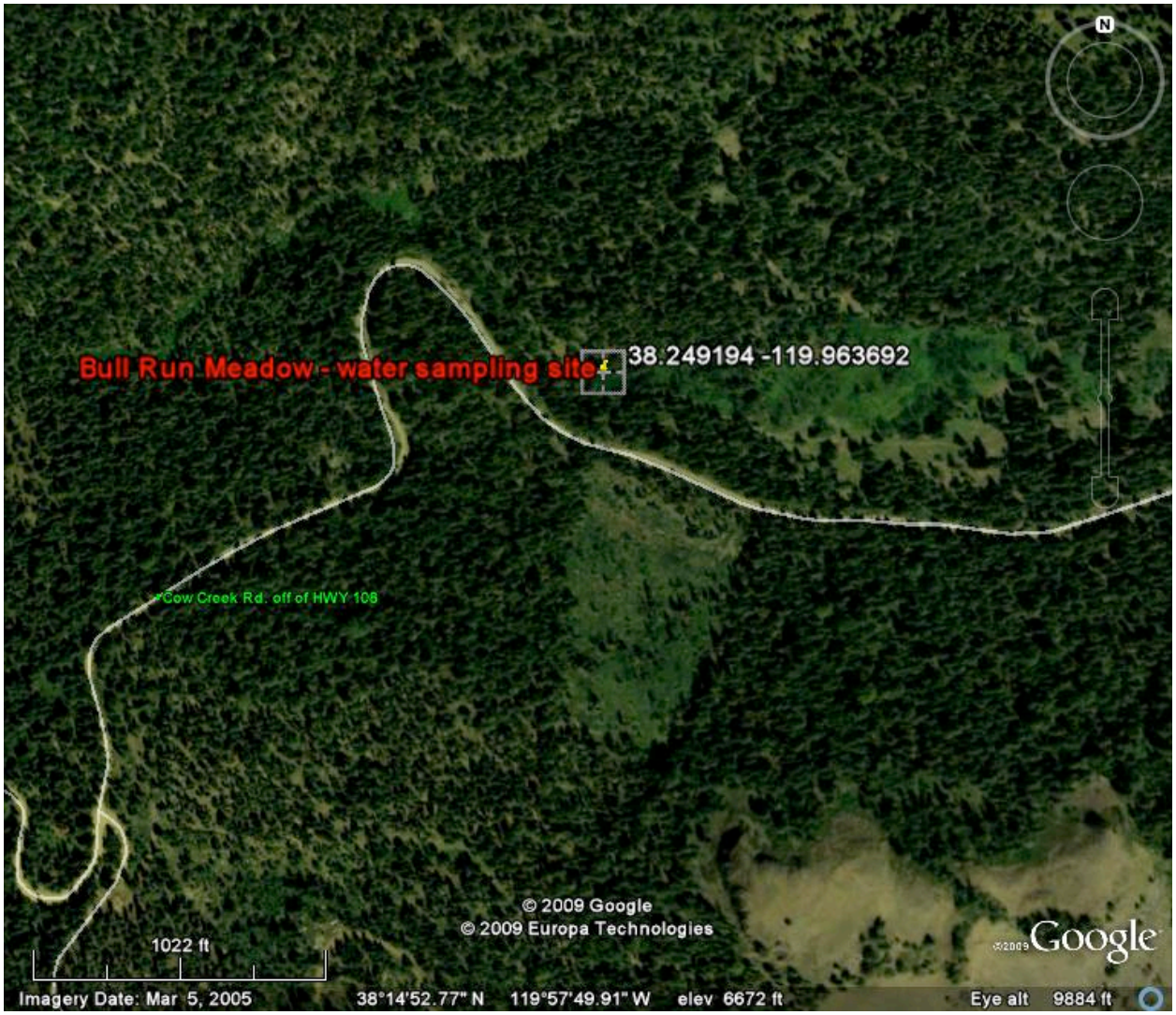
Figure 5-3 Map of Sample Site associated with Upper Fiddlers Green Meadow



Legal Description for the Upper Fiddlers Green Meadow Water Sample Site:

NE ¼ of the NW ¼ Sec 11 T4N R18E

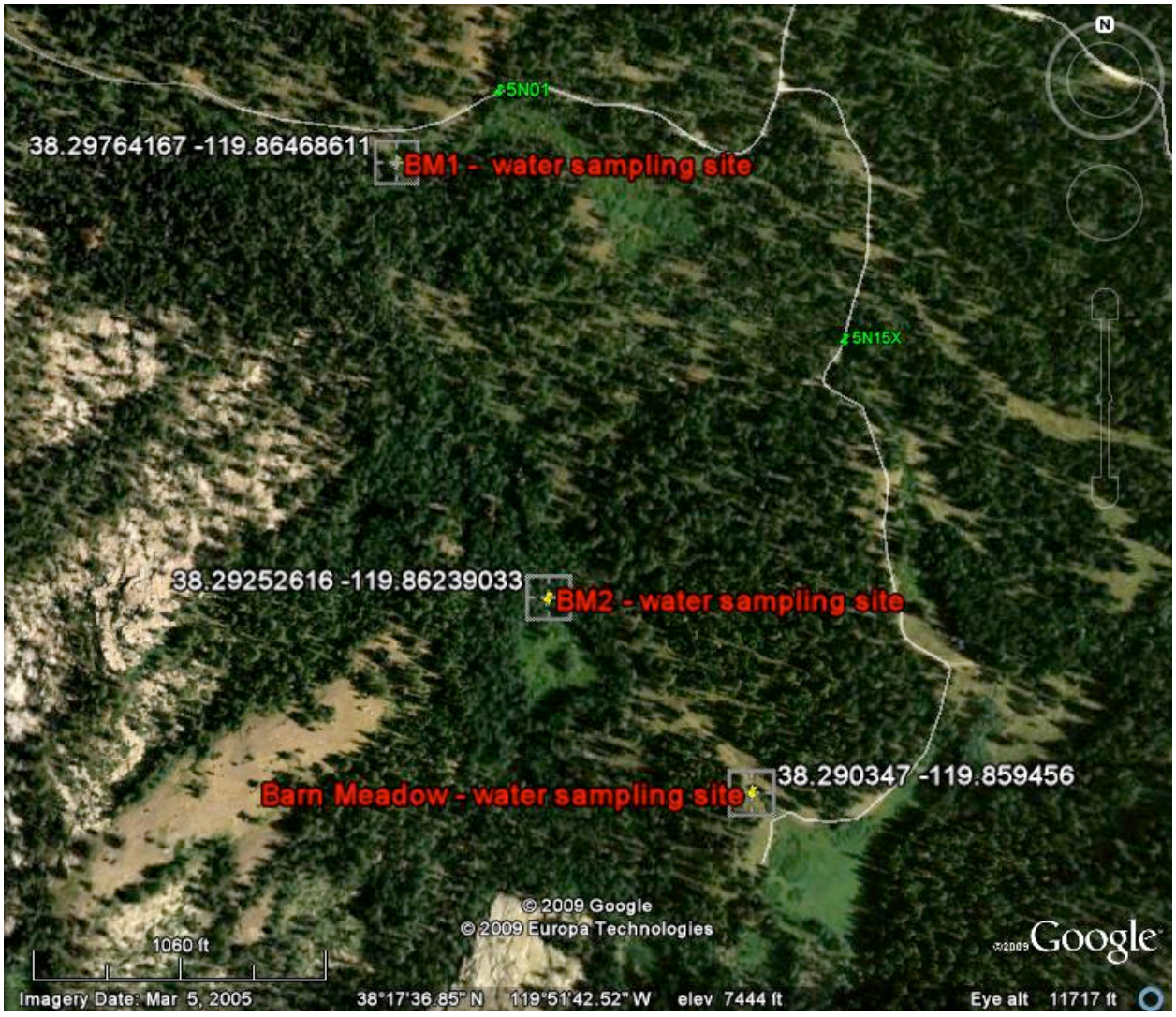
Figure 5-4 Map of Sample Site associated with Bull Run Meadow



Legal Description for the Bull Run Meadow Water Sample Site:

NW ¼ of the NE ¼ Sec 35 T5N R18E

Figure 5-5 Map of Sample Site associated with Barn Meadow



Legal Description for the Barn Meadow Water Sample Site:

SW ¼ of the NW ¼ Sec 14 T5N R18E

Figure 5-6 Map of Sample Site associated with Bourland Meadow (control site)

Legal Description for the Bourland Meadow Water Sample Site:

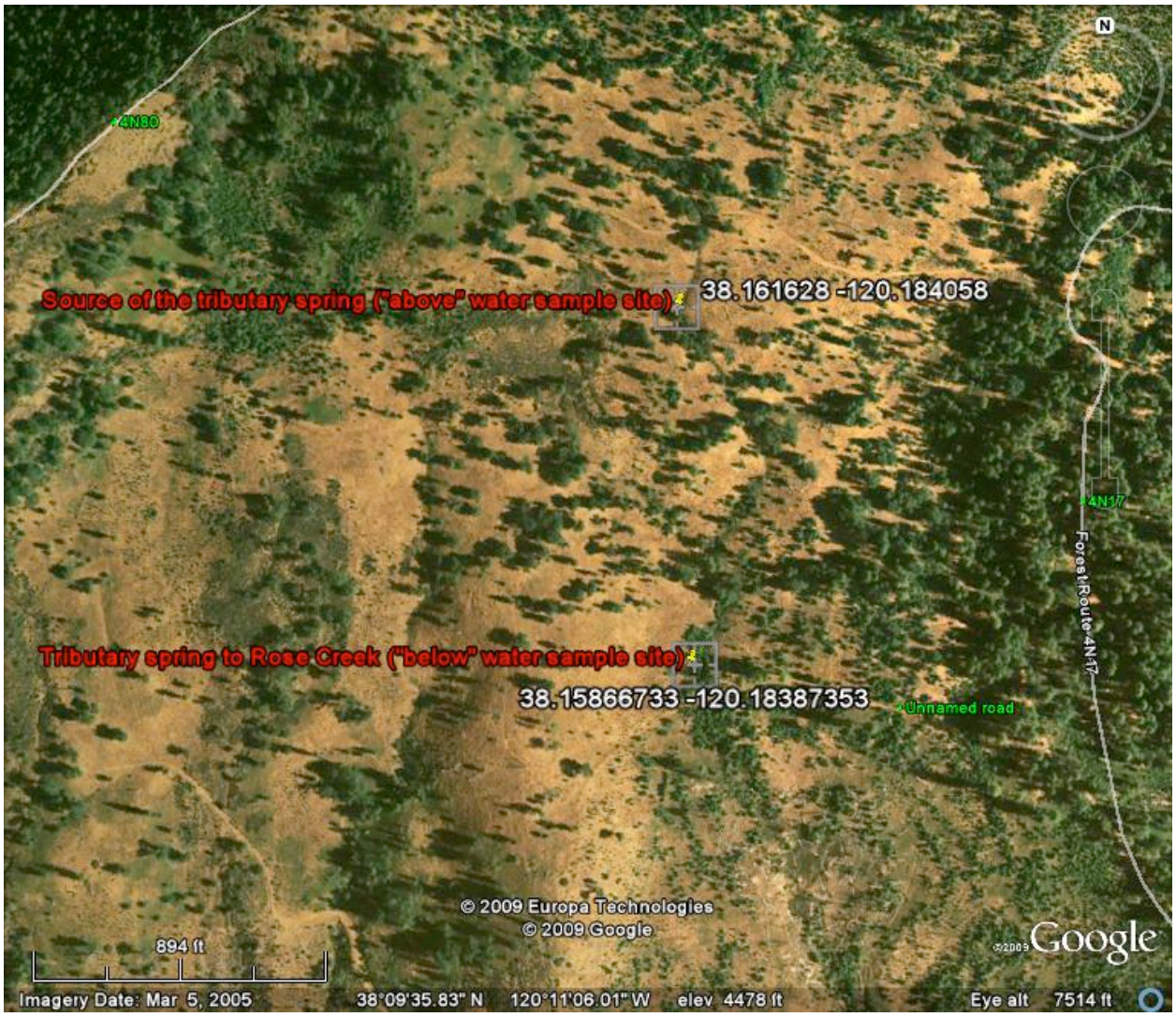
SE ¼ of the SW ¼ T3N R19E Sec 17

Figure 5-7 Map of Sample Site associated with Rose Creek

Legal Description for the Rose Creek Water Sample Site:

NE ¼ of the SE1/4 T3N R16E Sec 3

Figure 5-8 Map of Sample Sites for the tributary seep to Rose Creek "above" and "below" Water Sampling Sites



Legal Description for the tributary seep to Rose Creek "above" and "below" Water Sampling Sites:

"Above" site: NE ¼ of the NW ¼ T4N R16E Sec 35
"Below" site: SE ¼ of the NW ¼ T4N R16E Sec 35

Appendix B: Field Datasheet

Field Data Sheet for Water Quality Monitoring Sample # for site_____
Surface Water Ambient Monitoring Project in the Stanislaus National Forest

Waterbody or Stream Name_____ Arrival time_____

Location ID_____ Departure time_____

Samplers_____ Date_____

Site Observations:

Cloud Cover	No Clouds; Partly Cloudy; Cloudy Sky (overcast)
Precipitation	None; Misty; Foggy; Drizzle; Rain; Snow
Wind	Calm; Breezy; Windy
Water Murkiness	Clear Water; Cloudy Water; (>4" visibility) Murky; (<4"visibility)
Estimated Flow (relative)	Very Low; Low; Medium; High; Very High; Same
Sample color	None; Amber; Yellow; Green; Brown; Gray; Other
Sample odor	None; Algae smell; Chlorine; Sulfide; Sewage; Other
Presence	Algae or water plants; leaf litter; trash; Other
Habitat	Describe;
Bank Disturbance	Describe;

Comments:

Water Quality Measurements

Instrument ID	Parameter	Unit	Reading 1	Reading 2	Reading 3
YSI meter	Conductivity	µS/cm			
YSI meter	pH	pH			
YSI meter	Water Temp	°C			

Comments:

Bacteria Sample Container ID_____ Collection time_____
Bacteria Sample Container ID_____ Collection time_____

Sample arrival time at Aqualab_____

Comments:

Entered into dBase by_____ Date_____

Appendix C: Change of Custody form

AquaLab Water Analysis P.O. Box 356 Twain Harte CA 95383	State Certification # 1359 (209) 586-3400 Fax: (209) 586-1492

BACTERIOLOGICAL EXAMINATION OF WATER

CENTRAL SIERRA ENVIRONMENTAL RESOURCE COUNCIL P O BOX 396 TWAIN HARTE CA 95383	LAB TURBIDITY **NTU=**

Phone:586 7440 JOHN BUCKLEY	Date:	Sampler:

Source		Reason	Type
1) Surface/ Spring 2) Well Head 3) Well Distribution	4) Reservoir 5) Distribution 6) Treatment Plant	A) Routine B) Repeat C) Special	C) Total Coliform F) Fecal Coliform H) Heterotrophic Plate Count E) *E. coli*

Collection Data								Five Portions							Presence/Absence			
Lab ID / Bottle ID	Time	Location	CL2	Source	Reason	Type	Vol mL	# Positive Tubes							Coliform			CFU mL 35 C @ 48HR
								Prsmp		Confirmed					P/A or MPN			
								24	48	24	24	48	48	#	Total	Fecal	E.coli	

Notification/Comments:	Set-Up: Date/Time/By:
	Completed: Date/By:

Appendix D: SOP

Protocols for measuring pH, water temperature, specific conductivity, turbidity, and fecal bacteria are measured using protocols outlined in the EPA document, *Volunteer Stream Monitoring: A Methods Manual*.

The appropriate sections are:
2.3 Safety Considerations,
Chapter 5 Water Quality Conditions-Quality Assurance, Quality Control, and Quality Assessment,
5.3 Temperature,
5.4 pH, 5.5 Turbidity,
5.9 Conductivity,
5.11 Fecal Bacteria, and
Chapter 6 Managing and Presenting Monitoring Data,
6.1 Managing Volunteer Data,
6.2 Presenting the Data,
6.3 Producing Reports.

CSERC will provide the appropriate sections of, *Volunteer Stream Monitoring: A Methods Manual* upon request, or they can be viewed by going to: www.epa.gov and searching for:

USEPA 1997. Volunteer Stream Monitoring*: A Methods Manual*. EPA 841-B-97-003. Office of Water, U.S. Environmental Protection Agency, Washington, DC.

http://nepis.epa.gov/Exe/ZyNET.exe/20004NN2.txt?ZyActionD=ZyDocument&Client=EPA&Index=2006%20Thru%202010%7C2000%20Thru%202005%7C1995%20Thru%201999%7C1991%20Thru%201994%7C1986%20Thru%201990%7C1981%20Thru%201985%7C1976%20Thru%201980%7CPrior%20to%201976%7CHardcopy%20Publications&Docs=&Query=841B97003&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5CZYFILES%5CINDEX%20DATA%5C95THRU99%5CTXT%5C00000009%5C20004NN2.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C&MaximumDocuments=15&FuzzyDegree=0&ImageQuality=r65g4/r65g4/x150y150g16/i360&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x