SOP 2: Data Evaluation and Grading
Version 1.0

Revision History Log:

Prev. Version #	Revision Date	Updated By	Changes Made	New Version #
-	Oct. 2011	C. Sergeant, B. Moynahan	Initial version	1.0

1.0 Introduction
After raw freshwater water quality data is collected in the field, data are evaluated by the Park and Project Leads for accurate transfer of data from the sonde to the handheld data display to the computer (SOP 3). After this initial evaluation, erroneous values are flagged and remaining data are quality-graded (Poor/Fair/Good/Excellent).

This SOP describes which raw values will be flagged as outliers and prescribes a method for grading the quality of remaining data. Generally, USGS guidelines and standard procedures for water quality monitoring (Wagner et al. 2006) are followed, with some modifications required by logistical constraints. Refer to section 7 of the protocol narrative for discussion of implementing a data correction procedure by the start of the 2013 field season.

2.0 Flagging Erroneous Values
Before raw data are graded or processed, erroneous (invalid) values are flagged by the Project Leader based on minimum and maximum acceptable values (Table SOP 2.1). Data outside of these ranges are most likely due to sensor malfunction or readings taken during sonde servicing while the sonde was out of water. All flagged values are reviewed for accuracy and approved by the Project Leader. In addition, the Project Leader identifies other erroneous values that may fall within the acceptable value range, but based on expert opinion are not representative water quality values. For example, while the sonde was being serviced, a single temperature reading of 18°C may have been recorded by the sonde, but the preceding and subsequent values taken from the river were much lower. It was obvious that the higher reading was recording air temperature during a monthly maintenance trip and should be flagged as an outlier. In all cases, data will be examined carefully and properly documented to ensure that potentially important marginal values are not incorrectly flagged as erroneous.

Table SOP 2.1. Minimum and maximum acceptable values for each water quality parameter. Because long-term water quality data sets do not exist for rivers monitored by SEAN, these ranges may be updated over time based on future observations.

Measured Field Parameter	Minimum Acceptable Value	Maximum Acceptable Value
Water temperature	0.0°C	18.0°C
Specific conductance	0 mS/cm	2 mS/cm
Dissolved oxygen	1 mg/L	18 mg/L
pH	5 units	10 units
Turbidity[1]	0 NTU	1,000 NTU

[1] Range based on manufacturer's stated measurement capacity

3.0 Data Grading

Data grading assigns a quality rating to discrete periods of water quality data based on observed fouling error and calibration drift between monthly sonde maintenance visits. We use a data grading procedure slightly modified from strict USGS protocols (Wagner et al. 2006). Our approach avoids the necessity of a field meter during monthly maintenance visits, which would complicate field procedures, increase time requirements for site visits, and add to logistical considerations.

During each monthly maintenance visit (SOP 1), Park Leads will record measured values of each parameter against calibration standards with the exception of temperature, which will be compared to readings from an NIST-traceable thermometer. The observed deviation between the calibration standard value and the measured parameter value will be used to grade data based on the recommended USGS ranges (Table SOP 2.2). Three parameters will be measured against two standards: conductivity (0.100 and 1.413 mS/cm), pH (7 and 10), and turbidity (1.0 and 100 NTU). For parameters calibrated against two standards, deviation from the standard will be averaged.

Table SOP 2.2. Table of data grade ranges for each measured water quality parameter based on the recommendations of Wagner et al. (2006).

	Data Grade Range			
Measured Field Parameter	**Excellent**	**Good**	**Fair**	**Poor**
Water temperature	≤±0.2°C	>±0.2–0.5°C	>±0.5–0.8°C	>±0.8°C
Specific conductance	≤±3%	>±3–10%	>±10–15%	>±15%
Dissolved oxygen	≤±0.3 mg/L or ≤±5%, whichever is greater	>±0.3–0.5 mg/L or >±5–10%, whichever is greater	>±0.5–0.8 mg/L or >±10–15%, whichever is greater	>±0.8 mg/L or >±15%, whichever is greater
pH	≤±0.2 units	>±0.2–0.5 units	>±0.5–0.8 units	>±0.8 units
Turbidity	≤±5%	>±5–10%	>±10–15%r	>±15%

4.0 Literature Cited

Wagner, R.J., R. W. Boulger, Jr., C. J. Oblinger, and B. A. Smith. 2006. Guidelines and standard procedures for continuous water-quality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3. 51 pp. + 8 attachments. Available at http://pubs.water.usgs.gov/tm1d3 (accessed 16 September 2011).