Snohomish County Surface Water Management
Resource Monitoring Group
Standard Operating Procedures for Hydrolab® DataSonde®, MiniSonde®, and HL4 Multiprobes
Version 1.0

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Please note that Snohomish County Surface Water Management's (SWM) Standard Operating Procedures (SOPs) are adapted from Washington State Department of Ecology Standard Operating Procedure EAP 033, other published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Snohomish County use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by Snohomish County.

Although SWM follows the SOP in most cases, there may be instances in which the County uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)

Resource Monitoring Group

Standard Operating Procedure for Hydrolab® DataSonde®, MiniSonde®, and HL4 Multiprobes

Introduction

DataSondes®, MiniSondes®, and HL4s are multi-parameter water quality probes used by Snohomish County Public Works, Surface Water Managements (SWM) Resource Monitoring (RM) Group to measure pH, dissolved oxygen, conductivity, temperature, depth, and barometric pressure. They can be used for discrete measurements as the user moves from site to site throughout the course of a day, depth profiling, or short and long-term unattended monitoring at specified time intervals. Currently, the RM group does not use Hydrolabs® to gather chlorophyll *a*, blue-green algae, ambient light and photosynthetically active radiation (PAR), turbidity, ammonium, chloride, or nitrate/nitrite data, but these non-standard sensors are available through Hach/Hydrolab® if needed.

1.0 Purpose and Scope

This Standard Operating Procedure (SOP) details methods used by the RM group for using Hydrolab® DataSondes®, MiniSondes®, and HL4®,s. It may also contain methods that other users would find helpful for their monitoring work.

The scope of this SOP applies to cleaning, calibration, general set up and use, storage, and equipment protection (theft) of Hydrolab® multi-parameter water quality probes.

Each new Hydrolab® user must be trained by a custodian or other designated, trained user. Hydrolab® user's manuals should be consulted for detailed instructions on maintenance, deployment, and troubleshooting of Hydrolabs®. Failure to do so may result in injury to the operator or equipment. Additionally, online training videos are available at http://www.ott.com/en-us/

If the Hydrolab® User's manual does not provide adequate information, consult a Hydrolab® custodian or call technical support. For information on using rhodamine, TDG, ORP, and other non-standard sensors, please consult the appropriate Hydrolab® manual or Hach's website at http://www.ott.com/en-us/ and contact technical support.

Non-program reservations for RM group Hydrolab® equipment must be made through Outlook® as the primary reservation resource. Non-program staff must be properly trained to use any Hydrolab® equipment. A Hydrolab® custodian or company representative can help fulfill the training requirement. See your supervisor for further details.

2.0 Applicability

2.1 This SOP is intended for any SWM monitoring program that makes water quality measurements. The Hydrolab® instrument has a great range of uses from routine water quality monitoring to collecting *in situ* water quality data that is companion to biological monitoring. This instrument is a primary tool for conducting limnological studies in lakes and reservoirs.

3.0 Glossary of Terms

3.1 Calibration – To standardize or correct sensors after determining, by measurement or comparison with a standard, the correct value.

3.2 Conductivity – A measure of the ability of water to pass an electrical current. This parameter indicates the amount of dissolved substances (salts) present in the water.

3.3 DO – Dissolved oxygen in water, measured in mg/L.

3.4 DO % – The percent saturation of dissolved oxygen in water.

3.5 LDO – Luminescent dissolved oxygen. The Hach LDO sensor cap is coated with a luminescent material. Blue Light from an LED strikes the luminescent chemical on the sensor. The luminescent chemical instantly becomes excited. As the excited chemical relaxes, it releases red light. The higher the oxygen concentration, the less red light given off by the sensor cap. The red light is detected by a photo diode. The time it takes for the chemical to return to a relaxed state is measured. The oxygen concentration is inversely proportional to the time it takes for the luminescent material on the sensor cap to return to a relaxed state. Between flashes from the blue LED, a red LED of known intensity is flashed. The red LED (light emitting diode) acts as an internal standard for reference comparison to the red light given off by the luminescent sensor cap. This comparison allows the sensor readings to remain stable for long periods of time.

3.6 m – meter

3.7 Multi-parameter – The combination of several sensors or sensor assemblies into a complete, stand-alone piece of equipment, which simultaneously measures multiple parameters for profiling, spot-checking, or logging readings and data.

3.8 NIST – National Institute of Standards and Technology

3.9 ORP - Oxidation/Reduction Potential

3.10 pH – A measure of the hydronium ion concentration of a solution. Solutions with a pH less than 7 are considered acidic, while those with a pH greater than 7 are considered basic. The pH is the negative logarithm of the hydronium ion concentration in solution.

For example, if the hydronium ion concentration is 10^{-7}, the pH is 7.

3.11 Post-check – Assessing the performance of a sensor - after use - by noting the variation from a standard, to ascertain necessary correction factors.

3.12 Profiling – Lowering a multi-parameter water quality probe through a water column to measure water chemical and physical changes with depth.

3.13 PPE – Personal Protective Equipment

3.14 RM - Resource Monitoring (Group)

3.15 SOP - Standard Operating Procedure

3.16 SWM - Surface Water Management

3.17 TDG - Total Dissolved Gas

4.0 Personnel Qualifications/Responsibilities

4.1 Field operations require training for all staff conducting monitoring and identified by job title as listed in the SWM Safety Training database.

4.2 This SOP pertains to all Natural Resource Scientists, Environmental Specialists, Interns and Environmental Technicians in the RM group or other staff using this SOP.

4.3 All field staff must have read the instrument manual, this SOP, completed field training and be familiar with procedures for data collection.

4.4 All field staff must be familiar with the electronic data recording tablet and entries required for a monitoring program.

4.5 The field lead directing sample collection must be knowledgeable of all aspects of the project's Quality Assurance Monitoring Plan (QAMP) to ensure that credible and useable data are collected. All field staff should be briefed by the field lead or project manager about the sampling goals and objectives prior to arriving at the site

5.0 Equipment, Reagents, and Supplies

5.1 pH buffer solution (2 - 3 low or normal ionic strength buffers) that bracket the typical range of water quality observations expected for a set of sampling sites
5.2 Conductivity standard, typical to the range of water to be measured
5.3 DO water bath equipped with an aquarium pump and air stone
5.4 1 liter poly bottle.
5.5 Tap and deionized water
5.6 DataSonde®, MiniSonde®, or HL4 instrument
5.7 Surveyor (deck unit) or Surveyor HL with charger
5.8 5 m cable (calibration or discrete measurements)
5.9 25 m cable (profiling)
5.10 Calibration/Storage cup
5.11 Calibration stand
5.12 Weighted sensor guard
5.13 Barometer
5.14 DataSonde® or MiniSonde® bail kit or HL4 mooring cap (profiling)
5.15 Laptop or tablet (communication with instrument)

5.16 Hydras 3LT communication software or Hydrolab® Operating Software (HL4)

5.17 Hydras 3LT manual, Surveyor manual, Hydrolab® manual (model specific)

5.18 Toolbox containing:

- Spare parts: o-rings, screws, calibration cups, etc.)
- Soft wipes
- Cotton swabs
- Silicone grease
- pH reference electrolyte solution
- pH potassium chloride pellets
- Ethyl alcohol
- Phillips and flathead screwdrivers
- Toothbrush
- Pliers
- Crescent wrench
- Tweezers
- Electrical tape
- ‘AA’, ‘C’, and/or ‘D’ cell batteries
- Allen wrenches

6.0 General Instrument Set Up and Sensor Configuration

6.1 Hydrolab® DataSondes®, MiniSondes®, and HL4 instrument sensors must be configured prior to initial use or considered when monitoring locations change from fresh to salt waters. Sensor configuration for specific conductance allows for the computation of conductivity using 5 different methods, including for measurements from fresh and salt water. The Hydrolab® user’s manual and the custodian should be consulted for sensor configuration. For general measurements of specific conductance in freshwater streams and rivers, it is recommended that users apply the instruments freshwater computational function which corrects measurements to 25°C, allowing for comparison across sites. Sensor configuration for salt waters are established based upon project needs. See each instruments user’s manual for more detailed instruction.

Summary of Procedure

6.2 Calibration

Note: ORP, TDG, and rhodamine sensors are non-standard and not covered in this SOP

6.3 Temperature is factory-calibrated (it can be checked against a NIST standard during the DO calibration if using a water bath)

6.4 LDO can be moved after pH if preferred.

6.5 Conductivity

6.6 pH

6.7 Depth (if needed)

6.8 <u>Preparation of Hydrolab®(s) for Calibration</u>

6.9 Remove the battery cover for the Surveyor data collection device and install freshly charged 9V battery. Place the discharged battery in an appropriate container for recycling.

6.10 If planning for short or long term deployment of Hydrolab®(s), remove the battery cover sleeve and install new batteries (properly dispose of old batteries).

6.11 Put a thin layer of silicone grease on the O-rings to seal battery compartments.

6.12 Re-install the battery cover making sure to tighten snugly to the O-rings. <u>**IMPORTANT**</u>: Over tightening the battery covers can cause leaking at the O-rings, crack covers and strip screws. O-ring damage can cause catastrophic failure of the instrument resulting in data loss and broken equipment. Inspect the Surveyor data collection device and Hydrolab®(s), housing and all installed probes for any obvious damage or deficiencies and cleanliness. If there is damage to the Surveyor, Datasonde housing or probes that would make the instruments unusable, do not use it and notify the custodian as soon as possible. If the Hydrolab® is dirty, proceed to 6.13. If the Hydrolab® is visually clean, proceed to 7.0

6.13 Clean the Surveyor and Hydrolab® housing and probes with a mild detergent and a soft toothbrush. Make sure to clean in between all of the probes. Take care not to scrub the ends of the probes with the toothbrush

6.14 Gently clean the tip of the LDO probe with a dampened cotton swab or soft wipe. If too much pressure or vigor is used during cleaning sensors will be damaged. LDO probes require little maintenance and should only be done under the guidance of a custodian or experienced user referencing manuals for specific maintenance steps.

6.15 Gently clean the glass bulb of the pH sensor and the pH reference electrode with a dampened cotton swab. If the glass bulb and sensor area are visibly dirty, a soft bristled toothbrush can be used. The glass bulb is fragile, so take care not break the bulb while cleaning. **Do not use alcohol for cleaning**. If the Hydrolab® has not been used for a long period of time or has had issues with calibration in the past, replace the reference electrolyte and KCL tablets in the reference electrode following the instructions in the Hydrolab® manual (model specific).

6.16 Firmly wipe the conductivity electrodes with a dampened cotton swab. Alcohol may be used with the conductivity probe, if necessary.

6.17 If the Hydrolab® is equipped with a stirrer, remove all iron shavings from in and around the stirrer.

6.18 Inspect the depth port (pressure sensor) to ensure that there are no blockages. Rinse out if necessary. Do not put anything down the port as the membrane damages easily.

7.0 LDO Calibration

7.1 There are three different methods for calibrating the LDO sensor. Each method requires a single point calibration for measurement of concentrations in mg/L. To calibrate the sensor for percent saturations, the barometric pressure where the calibration is being performed must be determined. It can be read from the Surveyor.

7.2 To limit confusion, two calibration options will be presented. The first is the preferred method and the other is a secondary method that can be used if the preferred method is not able to be performed. The preferred method is saturating water with air by shaking in a 1 liter bottle and the secondary method is air saturated water using a water bath.

7.3 Large changes in elevation do not require re-calibration because instruments have integrated barometric pressure sensors and automatically compensate dissolved oxygen measurements for changes in pressure.

7.4 Preferred LDO Method

7.4.1 Connect the Hydrolab® to the Surveyor or PC, using the 5 meter calibration cable and turn the units on.

7.4.2 Pour existing tap water out of calibration cup.

7.4.3 Complete top portion of calibration form to record instrument use for the day. This includes recording the User, Date, Time, Instrument Used, Purpose for Use, Barometric pressure (measured outside using either the Surveyor or a credible source of nearby barometric pressure.), Air temperature and Surveyor Battery Voltage.

7.4.4 Set out a 1 liter bottle half full of tap water with the cap slightly threaded on. Make sure the bottle is out long enough for temperature to equilibrate with the calibration environment.

7.4.5 Tighten the cap on the 1 liter bottle of tap water and shake the bottle for 40 seconds. Pour the water from the bottle into the calibration cup up to the bottom of the threads.

7.4.6 Remove any water droplets from the sensor cap with a tissue or clean cotton cloth. Set the calibration cup cap on top of the calibration cup upside down.

7.4.7 Navigate to the appropriate software's calibration menu and choose the appropriate unit for calibration, either mg/l or % saturation.

Note: It is important to maintain temperature stability during calibration. Care should be taken to minimize exposure to sunlight if calibrating in the field. If the temperature in the calibration cup changes by more than 0.5°C during calibration, it is recommended to recalibrate the sensor.

7.4.8 Wait for equilibration, which may take several minutes.

7.4.9 Enter the barometric pressure as measured outside using either the Surveyor or a credible source of nearby barometric pressure.

7.4.10 Click Done. A "Calibrate Successful" message should appear. If not, repeat calibration. If a valid calibration cannot be achieved, maintenance of the DO probe is required.

7.4.11 Record post calibration value, temperature, brand, lot# and expiration dates of standards on the calibration form.

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7.5 Secondary LDO Method

7.5.1 Connect the Hydrolab® to the Surveyor or PC, using the 5 meter calibration cable and turn the units on.

7.5.2 Once connected to the Hydrolab®, navigate to calibration, and choose the percent saturation option.

7.5.3 To calibrate using the secondary air saturated water method, assemble a water bath with an air stone and aquarium pump at least 30 minutes prior to calibration. To achieve an accurate calibration, it is important that the temperature of the water bath not change more than 0.5 °C during calibration. To achieve a stable temperature in the water bath, let the water sit out overnight so that it can equilibrate to the temperature of the room. A battery operated portable aquarium pump is recommended for field calibrations.

7.5.4 Pour existing tap water out of calibration cup.

7.5.5 Place the Hydrolab® in the water bath and let it sit for a minimum of 5 minutes to allow the temperature to equilibrate. To ensure the probes are not damaged during this calibration make sure that a clean sensor guard is on the Hydrolab®.

7.5.6 Complete top portion of calibration form to record instrument use for the day. This includes recording the: User, Date, Time, Instrument Used, Purpose for Use, Barometric pressure, Air temperature and Surveyor Battery Voltage.

7.5.7 Record and then enter the current local barometric pressure in millimeters of mercury (mm Hg). If the available barometric pressure is in inches Hg, multiply it by 25.4 to get mm Hg. For detailed steps on calibration of DO using a Surveyor or Hydras 3 LT, consult the corresponding user's manual.

7.5.8 Before leaving the DO calibration screen make sure to record the post calibration reading.

7.5.9 Use temperature and barometric pressure and the USGS oxygen solubility tables to verify that the calibration was accurate. .\USGS_DO_Temp_BP_Tables.pdf. Record the value from the USGS table. If the calibration was not successful repeat the calibration process. If a valid calibration cannot be achieved, maintenance on the DO probe is required.

8.0 Conductivity Calibration

8.1 If not already connected, connect the Hydrolab® to a Surveyor or Hydras 3 LT and navigate to the calibration screen. Choose specific conductance. For detailed instructions on how to connect to a Hydrolab® using a Surveyor or Hydras 3 LT and getting to the calibration section of the software consult the corresponding user's manual.

8.2 Sensor configuration for specific conductance allows for the computation of conductivity using 5 different methods, including for measurements from fresh and salt water. The Hydrolab® user's manual and the custodian should be consulted for sensor configuration. For general measurements of specific conductance in freshwater streams and rivers, it is recommended that users apply the instruments freshwater computational function which corrects measurements to 25°C, allowing for comparison across sites. Sensor configuration for salt waters are established based upon project needs. See each instruments user's manual for more detailed instruction.

8.3 Rinse thoroughly with deionized water. It is recommended to remove the calibration cup and pour copious amounts of deionized water from a clean container over the sensors to avoid contamination from the pH reference sensor. The pH reference sensor contains a high conductivity solution used in measuring pH. When rinsing the sensors with the calibration cup attached to the Hydrolab® this solution can be drawn out and contaminate the sensors and cup.

8.4 After rinsing, reinstall the calibration cup. Note: For most applications, a two point calibration is recommended. This includes a zero check in air and a reference solution above your highest expected values.

8.5 Zero check in air. Pour any remaining deionized water out of the calibration cup. With no liquid in the calibration cup and the sensor free of water droplets, record the specific conductance and temperature reading from the calibration screen. The Hydrolab® should be reading 0 µS/cm. If it is higher, repeat steps until the specific conductance is 0 µS/cm.

8.6 With the calibration cup in place, rinse the probes 3 times with standard to be used for the calibration.

8.7 After rinsing, fill the calibration cup with the appropriate standard and carefully place the Hydrolab® in the calibration stand. The correct concentration of conductivity standard will be determined by the expected range of conductivity of the water being studied.

8.8 Wait 1-2 minutes for a stable reading. If the reading is within 5% of the standard, record the temperature and pre-calibration specific conductance reading from the calibration screen. If the reading is greater than 5% of the standard repeat 7.6.6 – 7.6.8 until within 5% of the standard.

8.8 Once the Hydrolab® is reading within 5% of the standard, enter the value of the conductivity standard + temperature and calibrate the sensor. Record the post calibration reading from the calibration screen. If the calibration fails, the conductivity sensor is in need of maintenance.

9.0 pH Calibration

9.1 The pH sensor can be calibrated with a 2 or 3 point calibration. It is most common for users to use a 2 point calibration. Calibrate the sensor to bracket the expected field readings. A pH 7 buffer must always be the first point in the calibration sequence followed by the 4 or 10 buffer. If doing a 3 point calibration, start with the 7, follow it with the 10 buffer, and then finish with 4 buffer.

9.2 If not already connected, connect the Hydrolab® to a Surveyor or Hydras 3 LT and navigate to the calibration screen. Choose a 2 or 3 point calibration. For detailed instructions on how to connect to a Hydrolab® using a Surveyor or Hydras 3 LT and getting to the calibration section of the software consult the corresponding user's manual.

9.3 With the calibration cup installed rinse the sensors 3 times with deionized water. To do this partially fill the calibration cup with deionized water, cap and shake vigorously for 6 seconds. Empty and repeat.

9.4 After the deionized water rinse, triple rinse the sensors with each pH buffer prior to the individual calibration.

9.5 Triple rinse the sensors with the pH 7 buffer and then place the Hydrolab® in the calibration stand. Fill the calibration cup with the pH 7 buffer so that it covers the pH sensor by at least one centimeter.

9.6 Record the temperature from the calibration screen and corresponding pH buffer value from the standards bottle. Enter the temperature corrected value for the pH 7 buffer in the calibration window. Let the sensors sit until a stable reading is achieved, usually within 3-5 minutes.

9.7 After a stable reading has been achieved calibrate the pH sensor and record the post-calibration reading. If the calibration fails repeat calibration with a fresh bottle of pH buffer. If repeating the calibration with a fresh bottle of pH buffer does not work, then the pH sensor needs maintenance.

9.8 For a 2 point or 3 point calibration, repeat calibration with the selected pH buffer (4 or 10).

10.0 Depth Calibration (If needed)

10.1 It is recommended that for the most accurate depth data that the calibration be done in the field.

10.2 If not already connected, connect the Hydrolab® to a Surveyor or Hydras 3 LT and navigate to the calibration screen. Choose depth. For detailed instructions on how to connect to a Hydrolab® using a Surveyor or Hydras 3 LT and getting to the calibration section of the software consult the corresponding user's manual.

10.3 Remove the calibration cup and install the weighted sensor guard. Turn the Hydrolab® so that the sensors are pointing down.

10.4 Navigate to the depth calibration screen and record the pre-calibration reading.

10.5 Enter 0 for the calibration standard and calibrate the pressure sensor. Record the post calibration reading. If the calibration fails, the pressure sensor needs maintenance.

11.0 General Field Use

11.1 Using a Hydrolab® for discrete measurements or profiling requires a field tablet with the operating software for the selected Hydrolab® or the handheld Surveyor or Surveyor HL (HL4). The user will also need the appropriate length of cable to connect the Hydrolab® to the field tablet or handheld. If the Hydrolab® is to be lowered in any way, a bail kit or mooring cap (HL4) is required for instrument safety. Detailed information on using Hydrolabs® for discrete measurements or profiling is covered in the training and SOP SWM_RM_003. Basic information is also covered in the user's manual.

11.2 Using a Hydrolab® for unattended deployments is complex and highly variable and will be covered in training. Basic information is covered in the user's manual. Note: If a Hydrolab® being used for an unattended deployment is equipped with a Clark Cell for measuring DO, it is best to place it in an area around 1 cubic foot per second of water flow.

11.3 After using any Hydrolab® make sure to clean it following the procedures in 6.1.2 and note and communicate any deficiencies to the custodian.

11.4 Short-term Storage (1 day to 3 months)

11.5 If not already completed, clean the Hydrolab® following procedures in 6.1.2. Keep a minimal amount of tap water or pH 4 buffer (about ½ inch) in the calibration cup. A clear pH 4 buffer without red dye is recommended for Hydrolabs® equipped with a rhodamine sensor. Do not use any other type of water unless it's the only water available.

11.6 Long-term storage (over 3 months)

11.7 Follow section 6.3 procedures. In addition, remove external batteries, but do not remove the lithium battery which powers the Hydrolabs® internal time clock.

11.8 Equipment Protection (Theft)

11.9 Hydrolabs® deployed in small creeks and clear rivers are easily seen. To avoid problems with theft and vandalism, hide them carefully. If possible, deploy Hydrolabs® upstream or downstream of public access areas, private property, or places where boaters and swimmers can see them. Under overhanging vegetation or behind instream rocks and fallen trees are often good places to hide them, as long as water circulation is not limited.

11.10 Do not use large floats or anchors in smaller streams; they attract attention. Instead, note where the Hydrolab® is and cover it as much as possible while maintaining good water flow past the sensors. Small cement blocks work well as anchors. If the

11.11 Hydrolab® is deployed in a large river, floats, line, and larger anchors may be necessary. See an experienced Hydrolab® user for further details.

11.12 If you cannot find a Hydrolab® and suspect theft is the cause, notify your project manager and/or supervisor. It may be necessary to contact purchasing or risk management to obtain a replacement.

11.13 Equipment and/or calibration problems will be discussed with team members and documented in an electronic log.

11.14 Calibration forms and any field forms will be stored electronically or in hardcopy form by the project manager in a designated location.

11.15 If the Hydrolab®(s) are used for a deployment, the log files created will be downloaded from the Hydrolab® and stored in electronic format in a location designated by the project manager.

12.0 Records Management

12.1 Calibration records and field observations and measurements are either stored on the Surveyor, on hard copy field forms or more routinely in project specific electronic field forms.

12.2 Calibration records are kept in instrument-specific binders in the lab space.

12.3 Field observations and measurement data are transferred to the network for verification and WISKI database import. Detailed instruction for database import is found in guidance outside this SOP.

12.4 Guidance for archival of records can be found at https://team/depts/spw/AO/Records/default.aspx

13.0 Quality Control and Quality Assurance

13.1 Hydrolabs® should be calibrated before each use and then checked against standards after each use. Post checking against standards should be completed following the procedures in the calibrations section. The difference being that the Hydrolab® should only be used to measure the standards not calibrate to them. All calibration and post use data should be recorded in a field form (paper or electronic) and stored in a location designated by the project manager.

13.2 In addition to calibration prior to use and post checks after use, intermediate checks can be conducted. These checks will differ if the Hydrolab® is being used for discrete measurements or has been deployed.

13.3 Intermediate checks for a deployed Hydrolab® should include:

13.4 Checks with another Hydrolab® or equivalent hand-held meter over the expected range of the parameter being measured. At a minimum, one intermediate check should be completed for a short deployment (one week or less).

13.5 The number of intermediate check measurements will be dictated by the length of deployment and the requirements described in the associated Quality Assurance Project Plan.

13.6 Upon retrieval of the deployed Hydrolab®, field staff should check measurement with another Hydrolab® or equivalent hand-held meter.

13.7 This field check regime will provide a minimum of three checks per deployment and help identify if instrument drift occurs.

13.8 Additional quality checks for discrete or deployed use will be dealt with on a project by project basis in the Quality Assurance Project Plan.

13.9 Specific measurement quality objectives should also be developed in the QAPP. At a minimum the following objectives are recommended for post and intermediate checks:

Parameter	Units	Accept	Qualify	Reject
pH	Std. units	< or = ± 0.25	> ± 0.25 and < or = ± 0.5	> ± 0.5
Conductivity	µS/cm	< or = ± 5%	> ± 5% and < or = ± 15%	> ± 15%
Temperature	°C	< or = ± 0.2	> ± 0.2 and < or = ± 1.0	> ± 1.0
Dissolved Oxygen	mg/L	< or = ± 0.3	> ± 0.3 and < or = ± 1.0	> ± 1.0
Dissolved Oxygen	% saturation	< or = ± 5%	> ± 5% and < or = ± 10%	> ± 10%

13.10 When traveling from site to site, make sure the Hydrolab® sensors are kept moist so they don’t dry out and become inaccurate. It is recommended to only use tap water in the calibration cup to keep the sensors moist. If site water is all that is available, make sure to change it out with tap water as soon as possible.

13.11 If collecting data in an area of known concern for New Zealand Mudsnails, inspect and clean the equipment between stations. Remove any visible soil, vegetation, vertebrates, invertebrates, aquatic plants or algae. If necessary, use a brush to clean the equipment housing. Follow other applicable invasive decontamination procedures.

13.12 Although Hydrolab® equipment is robust and made for heavy field use, it should be handled with care at all times. This is especially true when removing and replacing the calibration cup and sensor guard.

14.0 Safety

14.1 Persons involved with collection of field measurements could be subjected to unsafe environments. Hazards include, but are not limited to roadside traffic, slips, trips, falls, drowning, heat and cold stress, exposure to chemicals and biological pathogens.

14.2 Staff are provided appropriate PPE to minimize hazards. Teams of two should be considered especially for sites where data are gathered on larger streams/rivers during moderate to high flow events.

14.3 Washington State Department of Labor and Industries requires that employers provide a safe work environment through communicating hazards and providing adequate training.

14.4 Required safety training, inclusive of General Field Safety, Chemical Hygiene, Hazwoper, Roadway Safety, and Swiftwater awareness have been identified by position.

15.0 References

15.1 Washington State Department of Ecology. Environmental Assessment Program, 2016. Standard Operating Procedures for Hydrolab DataSonde, MiniSonde, and HL4 Multiprobes Ver. 2.1.Washington State Department of Ecology. Olympia, WA.