WATER QUALITY PROGRAMS DIVISION

Standard Operating Procedure for the Recording of Physical/Chemical Parameters using a Remotely Deployed Continuously Recording Multiparameter Instrument in Streams

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OKLAHOMA WATER RESOURCES BOARD
WATER QUALITY PROGRAMS DIVISION
3800 NORTH CLASSEN
OKLAHOMA CITY, OK 73118

STANDARD OPERATING PROCEDURE FOR THE RECORDING OF PHYSICAL/CHEMICAL PARAMETERS USING A REMOTELY DEPLOYED CONTINOUSLY RECORDING MULTIPARAMETER INSTRUMENT IN STREAMS

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1.0 General Information

A multiparameter instrument may be remotely deployed to collect and store information for some of the physical/chemical parameters of the stream being studied. Parameters measured by these instruments include water temperature, dissolved oxygen (D.O.), dissolved oxygen % saturation, pH, specific conductivity, salinity, depth, oxidation-reduction potential (redox), total dissolved solids, and turbidity. There are many similarities in operating both types of instruments. Some instructions on operating the Hydrolab® are provided in this document but specific training on the operation of each instrument will be provided by the supervising F.T.E. The important thing to remember is to always use the same type of multiparameter instrument (even the same serial number instrument, when possible) throughout a particular study so that data collected is comparable.

2.0 Definitions/Terms

- Team Leader—crew member of team who provides support, expertise, and opinions; gives instruction and has final say on how work will be done
- Team Member—crew member of team who provides support, expertise, and opinions; follows the instructions of the team leader
- Calibrating Multiparameter Instrument—instrument not deployed in the field but maintained in the office and used to check the remotely deployed instruments
- Remotely Deployed Multiparameter Instrument—instrument remotely deployed in the field for collection of continuously measured data *in-situ*
- Continuously Measured Data—data collected *in-situ* by a remotely deployed instrument with measurements made on set time interval (e.g., every 15 minutes)

3.0 Safety

Upon reaching the sampling location, site safety determinations should be made before proceeding. These will be different for wadeable and bridge sites. Please refer to the OWRB safety manual for instructions on how to sample both kinds of sites. When regulating the flow of traffic is necessary, please refer to the portion of the safety manual outlining “Traffic Safety Protocols”.

4.0 Quality of the Measurement

Principle investigators for the OWRB are required to have degrees and/or experience with biological or other applicable sciences. Principle investigators are defined as Team Leaders, and this designation may be made upon the leader of a multi- or a one-person crew. Training is required for all SOPs dealing with water quality and quantity collections and measurements as well as habitat assessments and biological

collections. In-house training will be conducted for the use of all meters and digital titrators used for water quality or quantity measurements. Investigators must be familiar with OWRB SOP document and all training will follow the methods outlined in that document. Extra training will be provided when new SOPs are developed. Training of field crews will be done through dry run exercises in the laboratory to familiarize field crews with sample collection, sample preservation, instrument operation, calibration, and maintenance. In addition, when new personnel are hired or new methods developed, qualified staff will train on sample collection, measurement, and field analysis methods through side-by-side field trips. These trips will familiarize staff with SOP requirements. When training is considered adequate, a qualified staff member will check field staff for adherence to SOPs.

When sampling for all programs, Quality Assurance/Quality Control (QA/QC) samples will be routinely collected to assure that environmental samples meet the Data Quality Objectives (DQO's) that are outlined in the controlling Quality Assurance Project Plan (QAPP). QA/QC sampling is designed to control each step of the sampling process. Known standards for each parameter should be routinely measured. Protocols for these calibrations are listed in Section 5.12 of this document

5.0 Personnel and Equipment

In most instances, the collection of water quality samples requires only one field person. However, depending on the safety requirements of a particular station, additional crewmembers may be necessary to ensure a safe work zone. Equipment used to collect the turbidity sample are described in the document "Standard Operating Procedure for the Collection of Water Quality Samples".

5.1 Calibrating Multiparameter Instrument

The calibrating instrument is maintained in the office and is used to check the calibration of remotely deployed instruments. Check calibration and maintenance logs before leaving office to ensure that the pre-trip calibration has occurred. If calibration has not occurred, perform the pre-trip calibrations (a supervising F.T.E. will demonstrate calibration techniques and the unit's operations manual can be consulted for calibration techniques). **ALL CALIBRATIONS AND MAINTENANCE MUST BE RECORDED IN THE UNIT'S LOGBOOK.**

5.11 Maintenance

When not in use, the minimonitor should be in kept in its carrying case. The instrument should be kept dry and clean both inside and out. After each measurement, the probes should be rinsed twice with tap water and stored in the storage cap in tap water. The instrument should never be stored in temperatures below freezing in extremely hot temperatures. Surveyor stored data should be recorded and deleted on a weekly schedule. Failure to do so may result in shortening the life of the internal lithium battery and/or the loss of valuable field data.

Specific pre-trip and in field maintenance should occur for the multiparameter instrument as follows

- **Multiparameter instrument casing**—Check the instrument casing periodically for cracks or looseness of connections. Connections may need to be tightened or re-siliconed periodically (only after the approval of a supervisor or senior staff member).
- **Bulkhead**—Periodically check the bulkhead connection for bent pins or looseness.
- **Dissolved Oxygen Probe**—Check the probe membrane for any cracks, bubbles, or other abnormalities, and change membrane if necessary.
- **pH Probe**—Check the probe bulb for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only after the approval of a supervisor or senior staff member). Clean with warm soapy water and Q-tip.
- **Specific Conductance (SpC) Probe**—Check the probe bulb for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only after the approval of a supervisor or senior staff member). Clean with warm soapy water and Q-tip.
- **Turbidity Probe**—Check the probe for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only after the approval of a supervisor or senior staff member). Clean with warm soapy water and Q-tip.
- **Stirrer**—Periodically take the stirrer end off and clean out embedded sediment.
- **Central Cleaning System**—Periodically check the wiping brush and clean out embedded sediment.

5.12 Pre-trip Calibration

Specific weekly pre-trip calibrations should occur for instrument as follows:

- **Dissolved Oxygen Percent Saturation**—Perform an "air" calibration with tap water using the barometric pressure (BP) of the laboratory. The lab and field barometers give BP in units of "inHg", and the unit can only accept BP in units of "mmHg". A conversion chart is provided in the laboratory and in each field notebook (the conversion is 'inHg x 25.4 = mmHg').
- **pH Probe**—Determine the expected range of pH by consulting the station data, and perform a two-point calibration based on the pH values. For example, if the ranges on the trip are from 7.5 to 8.1, perform a 7-10 pH calibration, or if the ranges are from 6.6 to 7.1, perform a 7-4 pH calibration. If values vary from station to station, always calibrate to the first station on the trip.
- **Specific Conductance (SpC) Probe**—Determine the expected range of SpC by consulting the station data, and perform a two-point calibration based on the SpC values. For example, if the ranges on the trip are low range (< 700), perform a 0-500 SpC calibration, or if the ranges are high range (> 700), perform a 0-1413 SpC calibration. If values vary from station to station, always calibrate to the first station on the trip.
- **Oxidation/Reduction Potential (ORP) —**Should be performed once per month. Consult unit logbook to determine if needed.
- **Turbidity—**Perform a calibration at all ranges of measurement including 0-10 NTU's, 10-100 NTU's, 100-1000 NTU's according to manufacturer specifications

and using manufacturer approved turbidity standards. If values vary from station to station, always calibrate to the first station on the trip.

5.13 Site Specific Calibrations or Checks

The following in-field calibrations and checks should occur as follows:

- **Depth—**Depth (meters) should be calibrated to 0.1 at each station.
- **Dissolved Oxygen Percent Saturation (D.O.)—**At each station, check the probe membrane for any cracks, bubbles, or other abnormalities, and change membrane if necessary. Dissolved oxygen percent saturation should also be calibrated when BP change is greater than 0.5 inHg in comparison to the previous calibration, when the reading is below the screening, or when the reading is outside the norm for a particular station (refer to the description of lab calibration). Local BP can be obtained from the SHERPA® weather watch or a comparable instrument (an FTE will demonstrate appropriate use and calibration of the watch). Also, the tap water used for calibrating should be changed each time calibration is done. Fresh tap water should be collected in the morning and at least once during the day and should always be kept in the cab of the truck to avoid freezing or over-heating.
- **pH—**At each station, check the probe bulb for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only change probe after consulting with supervisor). Clean with warm soapy water and Q-tip. Determine the expected range of pH by consulting the station data. Refer to the description of lab calibration. If the initial reading at a site is outside the range of current calibration, the instrument needs to be calibrated to the correct two-point calibration. If the reading is outside the OWQS standard of 6.5 to 9.0 s.u.'s, then the instrument needs to be calibrated at the appropriate range to ensure that the reading is accurate.
- **Specific Conductance (SpC)—**Check the probe bulb for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only change probe after consulting with supervisor). Clean with warm soapy water and Q-tip. Determine the expected range of SpC by consulting the station data. Refer to the description of lab calibration. If the initial reading at a site is outside the range of current calibration, the instrument needs to be calibrated to the correct two-point calibration.
- **Oxidation/Reduction Potential (ORP)—**Do not perform in field.
- **Turbidity—**Check the probe for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only change probe after consulting with supervisor). Clean with warm soapy water and Q-tip. Determine the expected range of turbidity by consulting the station data. Refer to the description of lab calibration. If the initial reading at a site is outside the range of current calibration, the instrument needs to be calibrated to the correct calibration range (0-10 NTU's, 10-100 NTU's, 100-1000 NTU's).

5.14 Post-Trip Checks

All units should undergo a post-trip check. After each trip (normally before pre-trip calibration for the following week), the unit should be checked against known standards

to ensure that probes are reading correctly. If a probe is not reading correctly, the information should be recorded in the logbook and on the field sheet of comments of the previous trip.

5.2 Remotely Deployed Multiparameter Instrument

The remotely deployed instrument is deployed in the field and is used to measure various *in-situ* parameters. Check calibration and maintenance logs at the site to determine if any special conditions or situations exist for the instrument. If previous calibrations are incomplete or have occurred to far in the past, please note on the "notes" sheet for the site visit (refer to section 7). **ALL CALIBRATIONS AND MAINTENANCE MUST BE RECORDED IN THE UNIT'S LOGBOOK.**

5.21 Maintenance

Specific in field maintenance should occur for the multiparameter instrument as follows

- **Multiparameter instrument casing**—Check the instrument casing periodically for cracks or looseness of connections. Connections may need to be tightened or re-siliconed periodically (only after the approval of a supervisor or senior staff member).
- **Bulkhead**—Check the bulkhead connection for bent pins or looseness.
- **Dissolved Oxygen Probe**—Check the probe for any cracks, bubbles, or other abnormalities. Change membrane at each visit.
- **pH Probe**—Check the probe bulb for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only after the approval of a supervisor or senior staff member). Clean with warm soapy water and Q-tip.
- **Specific Conductance (SpC) Probe**—Check the probe bulb for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only after the approval of a supervisor or senior staff member). Clean with warm soapy water and Q-tip.
- **Turbidity Probe**—Check the probe for cracks, dirt, scum, or other abnormalities, and change or clean probe if necessary (only after the approval of a supervisor or senior staff member). Clean with warm soapy water and Q-tip.
- **Stirrer**—Remove the stirrer end off and clean out embedded sediment.
- **Central Cleaning System**—Check the wiping brush for proper operation and clean out embedded sediment.

5.22 Calibration

During each visit, specific calibrations and checks should occur for instrument as follows:

- **Depth—**Depth (meters) should be calibrated to 0.1.
- **Dissolved Oxygen Percent Saturation**—Perform an "air" calibration with tap water using the barometric pressure (BP) of the laboratory. The lab and field barometers give BP in units of "inHg", and the unit can only accept BP in units of "mmHg". A conversion chart is provided in the laboratory and in each field notebook (the conversion is 'inHg x 25.4 = mmHg').
- **pH Probe**—Determine the expected range of pH by consulting the station data, and perform a two-point calibration based on the pH values. For example, if the

ranges on the trip are from 7.5 to 8.1, perform a 7-10 pH calibration, or if the ranges are from 6.6 to 7.1, perform a 7-4 pH calibration. Pre and post calibration, compare the instrument reading to known standards.

- **Specific Conductance (SpC) Probe**—Determine the expected range of SpC by consulting the station data, and perform a two-point calibration based on the SpC values. For example, if the ranges on the trip are low range (< 700), perform a 0-500 SpC calibration, or if the ranges are high range (> 700), perform a 0-1413 SpC calibration. Pre and post calibration, compare the instrument reading to known standards.
- **Oxidation/Reduction Potential (ORP) —**Should be performed once per month. Consult unit logbook to determine if needed.
- **Turbidity—**Perform a calibration at all ranges of measurement including 0-10 NTU's, 10-100 NTU's, 100-1000 NTU's according to manufacturer specifications and using manufacturer approved turbidity standards. Pre and post calibration, compare the instrument reading to known standards.

5.23 Outside Method Calibration

The probes of the remotely deployed instrument should be compared to outside water quality measurement equipment so that drift from the actual can be adequately quantified. Record these measurements on the "note" sheet for each station visit (refer to section 7).

- **Depth—**Measure depth of instrument at time of calibration using a weighted, calibrated steel tape.
- **Dissolved Oxygen Percent Saturation**—Perform a Winkler Titration on a grab sample collected near where the probe is installed.
- **Turbidity—**Measure turbidity using a calibrated, spectrophotometric turbidometer. Measure grab sample collected near where the instrument is deployed and measure a sample composited across the width of the channel.

6 Measurement of *in-situ* Parameters Using Multiparameter Instruments

6.1 Calibrating Grab Sample

Take measurement according to the referenced document "Standard Operating Procedure for the Recording of Physical/Chemical Parameters Using a Multiparameter Instrument in Streams".

6.2 Remotely Deployed Instrument

6.21 Installation

Installation of remotely deployed instruments can be done in one of several ways including a stainless steel standpipe, a polypropylene drag tube, or a stainless steel bank pipe. No matter the method to be used, the portion of the pipe where the instrument will be located should be perforated. The method used will be outlined in the station installation plan. The following general factors should be considered when selecting an installation method:

- **Safety of the Instrument—**This is perhaps the most significant factor to consider. These instruments are costly to replace, and although they are ruggedized, they cannot take a significant beating. Instrument should be deployed so that it does not hang so loosely in the pipe that it takes significant beatings during high flows. Instrument and instrument pipe should also be securely fastened to prevent removal by man or nature. This includes attaching the instrument by bail to tethered steel cable and locking the lower portion of the instrument.
- **Quality of the Measurement—**The instrument should be deployed in a location within the stream channel that will take the most representative measurement.
- **Accessibility—**Deployment should be in a place that is accessible for both maintenance and calibration of the instrument.

6.12 Measuring and Recording Readings

- Measurements will be made on a set schedule (e.g., every 15 minutes).
- Unit should be set so that probes are wiped before each reading.
- Before data is recorded probes should be given adequate time to equilibrate.
- Data may be stored internally within the instrument and downloaded at each site visit. If this is done, batteries should be changed on a regular basis.
- Data may be recorded using a data recorder by attaching the instrument via an SDI cable. When this is done, a calibration tail should be attached at the junction of the wet and dry cables. When data are recorded in this fashion, it is often telemetered and is the desired form of data acquisition.

7 Forms

For each visit to a station, a "Remotely Deployed Water Quality Notes" sheet is completed. This sheet will include the pre and post calibration results, maintenance performed, and results of other instrument checks. The sheet should also included notes about the condition of the installation and the instrument. Whether data are downloaded is also recorded on the sheet. Remember, the notes recorded are data and should be treated as such. Therefore, they should be written, legible, and complete. To avoid confusion and loss of data, a new sheet should be used at each project site. Field notes should be initialed and dated by the collecting personnel and data entry personnel. Both multiparameter instrument and recorded serial numbers should be recorded on the field notes. For guidance on proper procedure to complete the field notes, refer to your supervisor and or FTE. Field notes can be found at S:\Monitoring\STREAMS\forms\Field Notes.doc.

8 Data Storage

All completed paper copies of "notes" sheets should be maintained with the appropriate station notebook. The data from the field notes and laboratory data sheets should be either entered into or uploaded to the Water Quality Database. Each sample should be maintained electronically in the database under a unique sample number. Data will also be stored on the telemetry website. However, these data are not fully checked and censored and should not be considered final.

9 References