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|--------------------------------|-------------------------------|-------------|
| Title: Sonde Deployment | No: SOP6.2 | Page 1 of 7 |
| | Revision 2 | |
| Effective Date: 3/15/2013 | Next Revision Date: 3/15/2015 | |

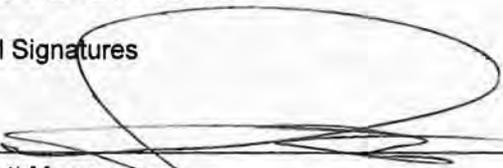
New Mexico Environment Department (NMED)
Surface Water Quality Bureau (SWQB)

Standard Operating Procedure (SOP)

for

SONDE DEPLOYMENT

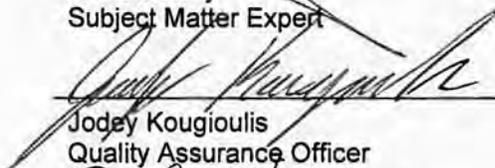
Approval Signatures



Scott Murray
Subject Matter Expert

4/3/13

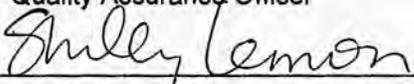
Date



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4-3-2013

Date

1.0 Purpose and Scope

The purpose of this document is to describe the SWQB procedure for deploying water quality sondes in rivers and streams for instantaneous or unattended measurements. This procedure covers use of the YSI 6-Series and Hydrolab MS5 Sondes and Onset HOBO DO Loggers described in SOP-6.1.

2.0 Personnel Responsibilities

All personnel who deploy sondes are responsible for implementing this procedure. The sonde manager and/or the Project Coordinator are responsible for downloading and managing the data after unattended deployment.

3.0 Background and Precautions

Streambed Dangers and Obstacles

Some channels have quicksand-like areas, deep holes, sharp rocks, fallen logs, etc., that can cause foot entrapment, injury, or falls. The wading rod (without the current meter attached) can be gently used for stabilization and to probe the streambed when conditions are uncertain. Use professional judgment to assess risks involved with working in the streambed.

Rule of 10

Wading across a streambed can be dangerous depending on flow and substrate conditions. Do not attempt to wade into a stream if the depth (in ft) multiplied by the velocity (in ft/s) equals or exceeds 10. For example, a stream 2 ft deep and with a velocity of 5 ft/s or more should be considered too dangerous to wade. If you start to take measurements and discover part of the way across a stream that you are violating or will violate the rule of ten, return to the nearest bank and note "too fast/deep to measure" on the field form.

| | | |
|--------------------------------|-------------------------------|-------------|
| Title: Sonde Deployment | No: SOP6.2 | Page 2 of 7 |
| | Revision 2 | |
| Effective Date: 3/15/2013 | Next Revision Date: 3/15/2015 | |

4.0 Definitions

DO Logger – a water quality monitoring device that measures and records dissolved oxygen and temperature that is deployed for unattended monitoring.

Sonde – a water quality monitoring device that can be deployed for unattended monitoring of multiple physical parameters. **Note:** the term “sonde” is used in this document to describe YSI and Hydrolab Sondes and Onset HOBO DO Loggers.

5.0 Equipment and Tools

The following equipment is used for unattended deployment or instantaneous measurements:

- YSI 6-Series and Hydrolab MS5 Sondes
- Onset HOBO DO Loggers, HOBO Optical Shuttle
- Interface Cable
- Handheld Data Logger or PC
- Nylon Straps
- Hose Clamps
- Bucket
- Field Calibration Standards
- Spare Batteries
- Steel T-posts (6 and 8 foot) and driver
- Tie wire
- Chain/cable and weather-resistant padlock
- Diagonal pliers and lineman’s pliers
- Sonde cover sleeve - perforated PVC tube of sufficient length to fully contain sonde
- Digital camera
- GPS unit
- 30 m measuring tape
- Surveyor’s flagging tape

6.0 Step-by-step Process Description

6.1 Prior to Field Measurements or Unattended Deployment

Each sensor requires calibration in the lab before field use, and an accuracy check upon retrieval (SOP 6.4, Data Logger QA and Upload). Calibrate the sensors according to SOP 6.1: Sonde Calibration and Maintenance. Sensors should be calibrated and checked more frequently if there is reason to suspect a problem. Calibrate the DO sensor in the field to the appropriate elevation, and re-calibrate whenever the elevation from one measurement location to the next changes 300 meters (1000 feet) or more. When calibrating the DO sensor as a result of an elevation change, record the calibration data in the correct location on the **Stream Field Data Form**. Record all calibration data and post-deployment check data on the **Sonde Deployment/Retrieval Form** and the **Sonde Calibration Form**.

6.2 Instantaneous Field Measurements

Measure field parameters during each sampling event as specified in the project Field Sampling Plan, and record the values on the **Stream Field Data Form**. Use a separate form for each station. Record all of the digits that are displayed on the data logger. Enter additional comments as appropriate.

In streams and rivers, if the flow appears to be well mixed from bank to bank, take measurements at the centroid of flow. The centroid is defined as the midpoint of the portion of the stream width that contains 50

| | | |
|--------------------------------|-------------------------------|-------------|
| Title: Sonde Deployment | No: SOP6.2 | Page 3 of 7 |
| | Revision 2 | |
| Effective Date: 3/15/2013 | Next Revision Date: 3/15/2015 | |

percent of the total flow. If the stream is not well mixed, it may be necessary to take measurements at more than one location along the cross section of flow. For lake and reservoir sampling, follow the procedures specified under SOP 12.0 Lake Sampling.

When field parameters cannot be measured *in situ* due to low flow, they may be measured in a container or a bucket used for sample collection. Use a bucket only when all efforts to obtain *in situ* measurements have been exhausted. Consider building small dams or depressions to create water deep enough to submerge the sensors. If a bucket is used, make clear notes on the **Stream Field Data Form** indicating exactly what was done. Use a bucket that is large enough to allow full immersion of the sensors and bring the bucket to the same temperature as the water before it is filled.

At all locations, replace the calibration cup with the sensor guard and carefully place the sonde in the water. Allow the sensors to equilibrate for at least one minute in "Run" mode, which can be done while water samples are being collected.

Minimize entrapment of air in the probe chambers, which can be indicated by unstable conductance values fluctuating up to ± 100 $\mu\text{S}/\text{cm}$. Do this by slowly and carefully placing the probe into the stream and quickly moving it through the water while the probe is completely submerged, releasing any air bubbles. Record temperature, conductance, pH, turbidity and finally DO on the **Stream Field Data Form**. After each sampling trip, transfer the information to the SWQB water quality database and store **Stream Field Data Form** in the project binder.

6.3 Unattended Deployment Monitoring

Deploy sondes as specified in the project Field Sampling Plan and calibrate the sonde sensors according to SOP 6.1 Sonde Calibration and Maintenance. Refer to the section 6.2 Instantaneous Field Measurements for guidance on taking sonde measurements in rivers and streams. Sondes deployed for unattended sampling are to be checked and calibrated every two weeks (if practicable) and at the end of deployment, or as otherwise indicated in the Field Sampling Plan. Sensors should be checked and calibrated more frequently if there is reason to suspect a problem with the sensors or the data. Calibrate the DO sensor in the field to the elevation of the station and perform the DO post-deployment check upon retrieval before leaving the station, or at a location with a similar elevation. Record all calibration and post-deployment check data on the appropriate forms.

Ensure that unattended sondes deployed for monitoring are securely anchored and protected. An unattended sonde may be mounted inside a sonde cover sleeve and chained to a tree in the most secure location available. Other methods include mounting to a T-post, suspending from fence posts or bridges, or attaching to USGS gauging station structures. Ideally the sonde should be deployed vertically in the centroid of flow where the sensors are most likely to remain submerged. However, the deployment location is subject to other factors such as the risk of vandalism or theft, and this may not always be feasible. If the sonde cannot be placed vertical it may be mounted horizontally 3-6 inches above the substrate with or without the cover sleeve and secured to a stable object such as rebar or a T-post. The sonde should not be laid horizontally directly on the substrate. If the sonde cannot be safely deployed due to a high risk of vandalism, theft, or imminent flooding, it should not be deployed for unattended monitoring.

Whenever possible, find an out-of-the-way place where the sonde is not easily detectable. If using, place the calibrated sonde with probe guard in the sonde cover sleeve (and note this in the comment field on the sonde deployment/retrieval form), which is perforated to allow the flow to contact the sensors while protecting the sonde from debris. Keep in mind that, while the cover sleeve may protect the sonde, it may also trap sediment in turbid waters and foul the sensors. Secure the sonde and cover sleeve to a T-post with nylon straps or hose clamps (Figure 1). Keep the sonde from touching the substrate and allow sufficient space for sediment and bedload transport. Secure the sonde with a chain or cable to a tree or other immovable object and lock with a weather resistant padlock.

| | | |
|--------------------------------|-------------------------------|-------------|
| Title: Sonde Deployment | No: SOP6.2 | Page 4 of 7 |
| | Revision 2 | |
| Effective Date: 3/15/2013 | Next Revision Date: 3/15/2015 | |



Figure 1: Typical sonde deployment with T-post and cover sleeve

6.4 Programming Sondes for Unattended Monitoring

YSI

Note: For a sonde with a Rapid Pulse DO probe, you must allow 15 minutes of “Run” time after changing the DO membrane to allow the membrane to “burn-in”. After “burn-in”, at least 6 hours is required for the membrane to stabilize prior to the pre-deployment calibration. If this is not practicable, use a sonde with an optical DO probe. The steps listed below outline the programming commands for the 650 YSI Data Logger:

650 Main Menu

System setup

Disable “Power sonde” (un-check circle)

Sonde menu

System

Date & Time

Check for accuracy and adjust as necessary

Sonde menu

Advanced

Setup

Enable “Auto sleep RS232” (check circle)

Sonde menu (same menu as above, just escape once to select *Sensor* menu)

Advanced

Sensor

Enable “wait for DO” (check circle)

Sonde menu (escape out of *Advanced* menu for this *Sensor* menu)

Sensor

Enable (check circles) the following sensors: Time, Temperature, Conductivity, Dissolved Oxy, ISE1 pH, Optic-T Turbidity, Battery

| | | |
|--------------------------------|-------------------------------|-------------|
| Title: Sonde Deployment | No: SOP6.2 | Page 5 of 7 |
| | Revision 2 | |
| Effective Date: 3/15/2013 | Next Revision Date: 3/15/2015 | |

Sonde menu

Main

Main

Run

Unattended sample → Unattended setup

- Set interval (15 minutes is preferred, but should not be greater than 1 hour), start date, start time, duration
- Create file name (mandatory), site (optional)
- **Scroll** to “Start logging” and press enter key → **Start Logging**
- “Are you sure?” Enter “yes”

Detach cable and install pressure cap.

Hydrolab

Creating Log Files using a PC

Note: A log file must be created and then enabled before data can be collected.

1. Connect the Data Cable to a computer and to the Sonde.
2. Start Hydras 3 LT. The software will automatically scan for Sondes. All detected sondes are displayed in the ‘Connected Sondes’ list in the Main window displayed below. If a sonde is not found, reattach the data cable and press **RE-SCAN FOR SONDES**. Retry until the sonde(s) are found.
3. Click on the Log Files tab.
4. Click the **CREATE** button.
5. Enter the name for the new log file. The empty log file is now created.
6. Enter the start and end time of the logging, the logging interval (15 minutes is preferred, but should not be greater than 1 hour), the sensor warm-up time before logging (20 seconds is sufficient), and how long before logging the circulator will be turned on (should be zero), and if audio signals will be used while logging.
7. Select the parameters in the ‘Parameter in Sonde’ list and click the **ADD** button to place them into the ‘Parameters in log file’ list. Change the order of the parameters using the **ARROW** buttons.
8. Click **UPDATE SETTING** to send the configuration to the Sonde.
9. Click **ENABLE** to start collecting data. Click **DISABLE** to stop collecting data during logging. A fully completed logging run will automatically disable at the end of the run.
10. Click **DOWNLOAD** to download and display the log file. Select printable or spreadsheet format, and save the file to your chosen location.

Note: To delete a log file, select the log file in the Log File drop-down menu and click the **DELETE** button.

Setting up the Hydrolab for remote data logging using the PDA

Adapted from Hydras 3 Pocket for Hydrolab Software Manual, September 2006, Edition 1.

Creating a new log file:

1. Select **LOG FILES** from the main screen. The Log Files screen will be displayed.
2. Select **NEW**.
3. Enter the name of the new log file and select **OK**. The Log File Setup screen will be displayed.
4. Select the **General** tab. Enter the setup information for the log file as follows:
 - **Start:** date and time when the log file will begin collecting data.
 - **End:** date and time when the log file will stop collecting data.
 - **Interval:** time interval (HH:MM:SS) between data points.
 - **Sensor Warm-up:** time for sensors to warm up and stabilize before each measurement.

| | | |
|--------------------------------|-------------------------------|-------------|
| Title: Sonde Deployment | No: SOP6.2 | Page 6 of 7 |
| | Revision 2 | |
| Effective Date: 3/15/2013 | Next Revision Date: 3/15/2015 | |

- **Circulator**: time for the circulator (if installed) to operate before each measurement.
 - **Audio**: sound made when measurements are taking place.
5. Select the **Parameters** tab. Add the parameters to include in the log file by selecting the check box next to each parameter. Change the order by highlighting the parameter and selecting **UP** or **DOWN** to move the parameter. Use the scroll bar to scroll up or down.
 6. Select **SAVE SETTINGS** to save the log file settings.
 7. Select **Templates** in the lower left corner to save the log file settings in the PDA for use in multiple sondes. Enter a name for the template and select **OK**. When setting up a new log file in a different sonde, select **Templates>Load** to populate the setup fields. **Note**: *The new log file will not log data until it is activated.*

Activating a log file

1. Select **LOG FILES** from the main screen. The Log Files screen will be displayed.
2. Highlight the log file to activate and select **TO ENABLE**.

The status will change from Disabled to Enabled. The sonde will begin recording data in the new log file at the specified start time. **Important Note**: *Log files that have completed running cannot be activated for re-use by changing the date. For log files occurring in the future, always set up a new log file!*

Onset HOBO DO Logger

Launching the Logger

1. With the logger connected to the computer via the HOBO shuttle, open HOBOWare. From the Device menu, select Launch.
2. Select both the DO and Temperature channels to log. Do not log battery life due to memory requirements. Bad battery events will still be recorded if they occur.
3. Select logging interval. Assessment protocols require at least 1 hour intervals
4. Choose when to start logging and click the Start button
5. Remove the logger from the coupler and screw the communications cap back on the logger.
Note: If a new sensor cap is being used, be sure to perform a lab calibration before deployment. The sensor cap is good for 6 months of deployment.
6. Remove the calibration boot before deployment.
7. Record the DO, Temperature and Conductivity/Salinity with a **YSI or Hydrolab sonde** at deployment and retrieval, and note these values on the **Sonde Deployment/Retrieval Form**.
Note: DO, Temperature, and Salinity values are required for DO% calculations and Field Calibration purposes

6.5 Sonde Retrieval

Upon retrieving a sonde, perform a post-deployment check of the DO calibration at the station or another location with a similar elevation. The post-deployment check for the other parameters can be done either at the station or at the lab. This check is not a recalibration, but an accuracy test to verify that the sensors are still functioning properly and to check for drift in the calibrations. Enter the data on the **Sonde Deployment/Retrieval Form**. Return the sondes to the sonde data manager or sonde manager to upload the data following procedures specified in the **Sonde Data Upload Instructions** attachment.

7.0 Related Forms

Sonde Deployment/Retrieval Form
 Setting Sondes for Unattended Sampling
 Sonde Securing Procedures
 Sonde Data Upload Instructions
 Sonde Calibration Form (see SOP 6.1)
 Stream Field Data Form (see SOP 8.0)

| | | |
|--------------------------------|-------------------------------|-------------|
| Title: Sonde Deployment | No: SOP6.2 | Page 7 of 7 |
| | Revision 2 | |
| Effective Date: 3/15/2013 | Next Revision Date: 3/15/2015 | |

8.0 Revision History

Revision 2 – February 2013 – updated to incorporate Onset HOB0 DO Loggers. Removed “Sonde Data Manager” role and directed those duties to the Project Coordinators. Clarified Unattended Monitoring procedures.

Revision 1 – February 2012 – updated to incorporate Hydrolab sondes
Original modified from SOP 2007.

9.0 References

Hach Environmental. 2006. Hydrolab DS5X, DS5, and MS5 Water Quality Multiprobes User Manual. February 2006, Edition 3.

Onset Computer Corporation. 2012. HOB0 Dissolved Oxygen Logger (U26-001) Manual.
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