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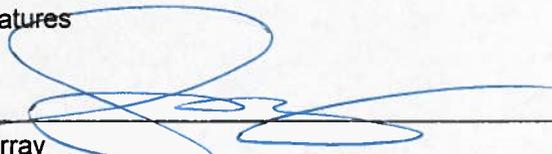
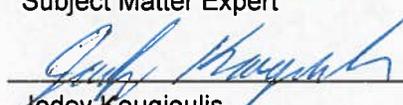
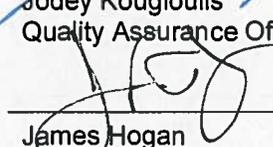
New Mexico Environment Department (NMED)  
Surface Water Quality Bureau (SWQB)

Standard Operating Procedure (SOP)

for

## SONDE DEPLOYMENT

Approval Signatures

 Scott Murray Subject Matter Expert	4-20-15 Date
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### 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 Long Term Deployment (LTD) Coordinator 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.

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#### 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 Cable Ties
- Hose Clamps
- Bucket
- Field Calibration Standards and Buffers
- 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 (e.g., biofouling). 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 on the **Sonde Calibration Form** and post-deployment check data on the **Sonde Deployment/Retrieval Form** or the **DO Logger Deployment/Retrieval Form**. Additionally for sonde/DO logger deployments, record the calibration data on the respective Deployment/Retrieval 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, attempt to take measurements at the centroid of flow. The centroid is defined as the midpoint of the portion of the stream width that contains 50 percent of the total flow. If the stream is not well mixed, it may be necessary to take

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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  $\pm 100$   $\mu\text{S}/\text{cm}$ . 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**, or log results using the internal storage of the sonde handset and transfer the data from the handset to the **Stream Field Data Form** daily. 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 secured to a tree or other stable structure in the most discrete 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 vertically 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 cable ties 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.

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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)

###### 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) –this command is available only for Rapid Pulse DO sensors

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

###### Sensor

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

## 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 (20 seconds), 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/Windows Mobile Device

*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.

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- **Sensor Warm-up:** Set to 20 seconds
  - **Circulator:** Set to 20 seconds
  - **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/Uploading/Retrieving the Logger

1. With the logger connected to the computer via the HOBO base station or 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, but 15 minutes is recommended.
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 check the expiration date and 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 and temperature with a **YSI or Hydrolab sonde** that has been calibrated at the deployment elevation at deployment and interim upload/retrieval, and note these values on the **DO Logger Deployment/Upload/Retrieval Form**. If, upon interim upload or retrieval, the sensor is either exposed to the air or buried in sediment, excavate or submerge the logger and place it in water along with a locally calibrated sonde. Leave the logger in water until at least one data point has been recorded. At the same time, record DO concentration, DO % saturation, and temperature from the sonde. If the stream has gone dry and no environmental water is available, use a bucket if possible. If neither environmental water nor a bucket of water is available, place the calibration boot with the dampened sponge over the sensor, wait at least 15 minutes, and allow the logger to record at least one data point of 100% saturated air. This is solely to be able to check the data for drift.  
**Note:** DO concentration and temperature values are required for DO% calculations and data management 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 readings. Enter the data on the **Sonde Deployment/Retrieval Form**. Return the sondes to the Project Coordinator or LTD Coordinator to upload the data following procedures specified in **SOP 6.4 Data Logger & Upload**

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## 7.0 Related Forms

DO Logger Deployment/Upload/Retrieval Form  
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)

## 8.0 Revision History

**Revision 3 – April 2015** – updated post deployment procedures, and assigned LTD data management to the LTD Coordinator.

**Revision 2 – February 2013** – updated to incorporate Onset HOBO 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. HOBO Dissolved Oxygen Logger (U26-001) Manual. <[http://www.onsetcomp.com/files/manual\\_pdfs/15603-B-MAN-U26x.pdf](http://www.onsetcomp.com/files/manual_pdfs/15603-B-MAN-U26x.pdf)>

YSI incorporated. 2011. 6-Series Multiparameter Water Quality Sonde User Manual. Revision H, November 2011. <<https://www.yei.com/media/pdfs/069300-YSI-6-Series-Manual-RevH.pdf>>