Standard Operating Procedure for:

Eureka Amphibian and Manta Water Quality Multiprobe for Multiple Location Parameter Measurement (1200R02 Eureka Snapshot.doc)

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and

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Revision History

Revision number	Revision date	Revisions made (Indicate the section changed and what changes were made)
1	9/14/06	First version of this SOP.
2	4/30/07	Snapshot log designation vs timed log

1 Identification of the test method

Operation of the Eureka Amphibian with Manta water quality multiprobe

2 Applicable matrix or matrices

This instrument can be used for natural water samples.

3 Detection Limit

The operating ranges for this instrument are: temperature -5º to 50ºC, conductivity 0 to 112 mS/m, Dissolved Oxygen (DO) 0 to 50 mg/L, pH 2 to 12, and turbidity 0 to 3000 NTU. The range for depth measurements is 0 to 100m, however, the instrument currently has only a 3 m cable.

4 Scope of the test method

4.1 This procedure will be used as a field reference guide for the collection of water quality parameters. Water temperature, conductivity, pH, dissolved oxygen, and turbidity can be recorded using the Eureka Amphibian and Manta water quality multiprobe.

4.2 The Eureka meter can also measure depth.

4.3 The procedures described here list the set up, calibration and reporting procedures. The user should review the instrument manuals for further information about the units.

5 Summary of test method

5.1 The Eureka Water Quality Multiprobe uses a thermistor to measure temperature. Temperature influences the conductivity of water. As the temperature increases, conductivity increases, due to the increased movement of ions in the solution. Temperature changes in water can have extreme biological effects. In general, as the temperature of water increases, the amount of oxygen dissolved in the water decreases and there is a tendency for the amount of pollutants to increase. The unit of measurement for temperature is ºC (Celsius).

5.2 Conductivity is a measure of the ability of an aqueous solution to carry an electric current. The conductivity of water depends upon the presence of ions (their total concentration, mobility, valence, and relative concentrations) and on the temperature of the solution. Adding electrolytes such as salts, acids, or bases to pure water increases conductance. The conductivity of water is determined by measuring the resistance of ion flow in between charged plates because conductivity is inversely proportional to resistance. The Eureka reports conductivity as mS/cm (milli Siemen / centimeter). Multiply this value by 1000 to report the conductivity value as µS/cm.

5.3 The Eureka uses the membrane-electrode method for Dissolved Oxygen (DO). A reduction reaction in the cathode is caused by oxygen diffusing through the membrane of the sensor to create a current. This current is proportional to the concentration of oxygen dissolved in water. DO is reported as mgDO/L.

5.4 Potential of hydrogen (pH) is a unit used to show the degree of acidity on a scale of 0 to 14. The pH is a measure of the hydrogen ion (H^+) activity in a solution. Activity of the hydrogen ion (as moles/L) can be calculated as: $pH = -\log_{10}[H^+]$. Or, $[H^+] = 1/10^{pH}$. The pH scale is logarithmic, so that a decrease of 1 pH unit is equivalent to a ten fold increase in the hydrogen ion activity. For example, a solution that has a pH of 4.0 is ten times more acidic than a solution with a pH of 5.0. The neutral point for pH is temperature dependent; at 25ºC pH 7.0 is neutral, at 0ºC the neutral point is pH 7.5 and pH 6.5 is the neutral point at 60ºC (Standard Methods, 2005). The glass-electrode method is used by the Eureka. The known pH of a reference solution is determined by using two electrodes, a glass electrode and a reference electrode, and measuring the voltage (difference in potential) generated between the two electrodes. The difference in pH between solutions inside and outside the thin glass membrane creates electromotive force in proportion to this difference in pH. There is no reporting unit for pH.

5.5 Turbidity in water is caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms. Turbidity is measured in the Eureka using the light-transmission scattering method. The unit for turbidity is NTU (Nephelometric Turbidity Unit). The Eureka turbidity probe has a wiper function that allows for the surface of the probe to be cleaned. The wiper is a replaceable foam pad.

6 Definitions

6.1 Measurement Duplicate (MD): Two samples taken at the same time and place under identical circumstances and that are treated identically throughout field and laboratory procedures. Analysis of field duplicates indicates the precision associated with sample collection, preservation, and storage as well as laboratory procedures.

6.2 Laboratory Reagent Blank (LRB): An aliquot of deionized water treated as a sample in all aspects, except that it is not taken to the sampling site. The purpose is to determine if the if analytes or interferences are present in the laboratory environment, the reagents, or the apparatus.

6.3 Relative Percent Difference (RPD): calculated as the difference between a sample and duplicate results, divided by the average of the sample and duplicate results, multiplied by 100%.

7 Interferences

An improperly calibrated instrument can lead to erroneous results. See the manufacturer's instruction manual for proper calibration procedures and in sections 14 and 15. The Eureka probes should be clean prior to use to avoid contamination for any of the analytes.

8 Health and safety

8.1 When wading in streams where water depths may be 1 meter deep or more, wear a life preserver and/or remove hip boots or chest waders. Currents can force wading field workers into deep water and water-filled boots can make swimming difficult.

8.2 When walking through densely vegetated areas along streams, be sure to look for and avoid toxic plants like poison ivy. Be sure to wear appropriate insect repellent and protective clothing for protection from mosquitoes, chiggers, and ticks. In addition, probe areas in your path with a walking stick to warn and disperse poisonous snakes like the cottonmouth and copperhead, which may inhabit riparian areas.

8.3 Be sure to clean up with bacteria disinfectant soap and water after wading in streams. This is particularly important for streams that drain livestock areas, sewage treatment plant effluents, and other obvious pollution sources. Under no circumstances should you drink the water from any stream.

9 Personnel qualifications

Water parameters will be collected by Missouri State University (MSU) graduate assistants who have received appropriate training, prior coursework, and field experience regarding the collection of water parameter data, and who are familiar with all of MSU's sample handling and labeling procedures.

10 Equipment and supplies

10.1 Eureka Water Quality Multiprobe, Eureka Environmental Engineering, 2113 Wells Branch Parkway Suite 4400, Austin, Texas 78728, Telephone: 512-302-4333, Fax: 512-251-6842, www.eurekaenvironmental.com.

a. Amphibian: includes a PDA and a water proof case
b. Manta Multiprobe: includes calibration cup and probe guard
c. Connection cables
d. Spare parts kit

10.2 Water Quality Field Book, Pen

11 Reagents and standards

11.1 Deionized Water (DI)

11.2 pH 7.00 Reference Solution:

11.3 pH 4.00 Reference Solution:

11.4 147 µS/cm Conductivity Standard:

11.5 1412 µS/cm Conductivity Standard:

11.6 0 NTU Turbidity Standard:

11.7 77 NTU Turbidity Standard:

12 Sample collection, preservation, shipment and storage

Water samples are not collected using this procedure. The analyses are conducted *in situ* and only data are collected and stored in the instrument.

13 Quality control

13.1 Laboratory Reagent Blank (LRB): before leaving the laboratory, the analyst should perform one measurement of deionized water. This operation will show that the auto-calibration has been performed and that the unit is reading blanks correctly.

13.2 Measurement Duplicates (MD): Two measurement readings taken at the same sampling location. The results are compared after downloading the data. One MD will be collected with every ten samples collected in the field.

14 Calibration and standardization

14.1 The Eureka water quality probe will be calibrated every month before going into the field.

14.2 The sensors in the probe will be cleaned every time the probe is returned to the laboratory. Soft brushes will always be used to clean the sensors. At no time will abrasives or cleansers be used.

14.3 Clean and perform routine maintenance as outlined in the Manta operator's manual.

14.4 Calibration Procedures

Temperature

a. This sensor is factory calibrated and does not require calibration.
b. The sensor should be checked annually against a NIST traceable thermometer. Record the deviation from the NIST thermometer in the instrument maintenance log book.

Dissolved Oxygen

a. Select **Probe**
b. Select **Calibration**
c. Select **DO% Saturation** (this will also calibrate for DO concentration)
d. Fill the calibration cup to below the level of the DO membrane with tap water.
e. Wipe the membrane dry with a paper towel.
f. Place the black rubber cal cup cover upside down over the calibration cup.
g. Wait approximately two minutes for the air to become fully saturated and the temperature to equilibrate. Make sure that the circulator is turned off.
h. Select **Calibrate**
i. It takes 60 seconds for stabilization to occur.

pH

a. Rinse the sensors with the pH 7.00 buffer. Discard the rinsate.
b. Fill the calibration cup with enough pH 7.00 buffer to cover the pH glass bulb and reference sensors.
c. Follow the instructions on the Amphibian
d. Discard the buffer and rinse with the 4.00 pH buffer. Discard this rinsate.
e. Fill the calibration cup with enough pH 4.00 buffer to cover the pH glass bulb and reference sensors.
f. Calibrate with the second buffer following the instructions on the Amphibian.

Conductivity

a. Fill the calibration cup to cover the conductivity sensor. Tap gently on the cup to make sure there are no bubbles trapped in the sensor.
b. Follow the instructions on the Amphibian to calibrate the sensor.

Depth

a. Depth is a one point calibration, which should be done in air to set the zero point.
b. Make sure there is no water in contact with the depth sensor. Shake the probe a bit if necessary.
c. Follow the instructions on the Amphibian.

Turbidity

a. The turbidity sensor is an optical device. Care must be taken to minimize external effects.
    i. Calibration solutions should be kept in dark bottles.
    ii. Keep the sensor very clean. Dust or water that makes its way into the calibration solution will adversely affect the instrument calibration.
    iii. Start calibration with the lowest value (0 NTU) and work up in value to minimize the effects of cross contamination.
b. Fill the calibration cup with the 0 NTU standard.
c. Hold the probe a few degrees from the vertical and gently tap the calibration cup to dislodge any air bubbles from the optic face.
d. Follow the instructions on the Amphibian
e. Rinse the sensor with the 100 NTU standard. Discard rinsate.
f. Fill the calibration cup with the 100 NTU standard.
g. Follow the instructions on the Amphibian.

15 Procedure

15.1 Connect Amphibian to Manta (green light flashes on Manta).
15.2 The Manta must have the weighted, protective guard in place prior to sampling.
15.3 Turn Amphibian PDA on
15.4 Start Eureka program
    a. Lower right button on PDA or
    b. **Start – Eureka**

15.5 Un-select the parameters from "**View**" menu that are not needed (e.g., salinity, % DO sat, longitude, latitude, GPS, etc.).
15.6 Set up file for data collection
  a. Select "**Log**" from menu (not green icon), select **Locations**, select **New**
  b. Type in the project name and date; for example, Finley Creek 09072006.
15.7 Place the probe into the sampling location.
15.8 Press the "**Snapshot**" icon (SnapShot Log). The Manta can be used as a data logger to produce timed logs, see 1200R02 Eureka Timed.doc
15.9 "**Location Exists**" will appear on the screen. Select "**Append**".
15.10 Enter annotation: use the sample site code; for example, ALD (Above Lindenlure Dam).
15.11 Press **OK**. Data is collected and stored.
15.12 To review data; **File** – **Open** – select file name - **OK**

16 Data acquisition, calculations, and reporting

16.1 To down load data from the Amphibian to the computer:
16.2 Connect the cable from the Amphibian to the USB port.
16.3 When PC recognizes the PDA (may have to disconnect from USB more than once, wait 45 seconds between attempts).
16.4 The Microsoft ActiveSync page will display a green "sync" icon
16.5 Double click the Eureka icon
16.6 Select the Transfer icon
16.7 Select the file containing the data
16.8 Transfer All
16.9 Files are transferred to C:\Eureka Data
16.10 Open sample data file
16.11 File will open in Excel
16.12 Save file to an Excel folder for the project
16.13 Print out a copy for data review and reporting

17 Computer hardware and software

17.1 Eureka and Manta software are provided for the instrument by Eureka Environmental Engineering.
17.2 This document is created using Microsoft Word. The Word file name for this SOP is: 1200R01 Eureka.doc
17.3 Microsoft Excel is used for recording and reviewing the final data from the Amphibian.

18 Method performance

There are no published method performance data for this method.

19 Pollution prevention

All wastes from these procedures shall be collected and disposed of according to existing waste policies within the MSU College of Natural and Applied Sciences. Volumes of reagents made should mirror the number of samples being analyzed. These adjustments should be made to reduce waste.

20 Data assessment and acceptable criteria for quality control measures

20.1 The analyst should review all data for correctness.

20.2 Relative percent difference (RPD) should be calculated for pairs of duplicate analyses to determine precision.

20.3 The desired precision is ± 20%

20.4 The completed Excel spreadsheet is reviewed by the analyst's supervisor or the OEWRI QA officer.

21 Corrective actions for out-of-control or unacceptable data

21.1 The results for precision and blank data are compared to the acceptable values for this analysis; ± 20% and 0 for all analytes, respectively.

21.2 If data are unacceptable for any reason, the analyst should review their analytical technique prior to conducting this analysis again.

21.3 The instrument may require trouble shooting techniques if the data are unacceptable

a. Clean the probes
b. Perform maintenance procedures as outlined in manual
c. Replace defective sensors
d. Send the instrument to the manufacturer for repair.

22 Waste management

The wastes generated in this method are not hazardous. The quantities are very small and can be discarded in the laboratory sink.

23 References

23.1 Amphibian User's Guide. 2006. Eureka Environmental Engineering, Austin Texas.

23.2 Manta Startup Guide. 2004. Eureka Environmental Engineering, Austin Texas.

23.3 Manta Multiprobe Manager.2006. Eureka Environmental Engineering, Austin Texas.

24 Tables, diagrams, flowcharts and validation data

Common status icons are listed below. For additional information, consult Chapter4: Amphibian Software Screens in the Startup Guide.

Status Icons:


No probe attached

Probe warming up

Logger is running

Statistics is running

The Pocket PC batteries are critical