Standard Operating Procedure – Turbidity, Turbidimeter

1  POINT OF CONTACT

NAME: Peter Linderoth, Save the Sound / CFE, Water Quality Program Manager
ADDRESS: 545 Tompkins Ave, 3rd Floor, Mamaroneck, NY 10543
EMAIL: plinderoth@savethesound.org
PHONE: 914-263-6233

2  OBJECTIVE

Determine the turbidity (NTU) in the surface water, 0.5 m below the surface, following guidelines of the Unified Water Study (UWS). Frequency of sampling and daily order of events are specified in the “UWS Sampling Plan SOP.”

3  DEFINITIONS AND ABBREVIATIONS

Embayment: A recess in a coastline or an indentation off a shoreline which forms a bay. In Long Island Sound, the names of embayments often include the words Harbor (27%), River (23%), Cove (19%), Bay (10%), Creek (10%), and Pond (7%); with a few including the names Brook, Gut, Inlet, or Lake.
Field Team: Person or group of people working together to sample a station.

Monitoring Group: The group conducting the field work.

Section: The reporting regions for the embayment report card. Each section must include a minimum of three stations. Sections will be assigned a unique name by the UWS; examples are included below.

<table>
<thead>
<tr>
<th>Number of Sections</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Sections</td>
<td>whole</td>
<td>inner, outer</td>
<td>inner, middle, outer</td>
</tr>
<tr>
<td>Abbreviations for Sections</td>
<td>W</td>
<td>I, O</td>
<td>I, M, O</td>
</tr>
</tbody>
</table>

Site: The whole embayment, as defined by the UWS list. Each site has a unique three letter code assigned by the UWS; for example, Little neck Bay, NY is “LNE”.

SOP: Standard operating procedure; this document is a SOP.

Station: The location where samples are collected, identified by a GPS location.

UWS: Unified Water Study

UWS Coordinator: The person designated as the point of contact for the UWS.

UWS Scientific Advisor: Estuarine or water quality scientists designated as advisors to the UWS.

4 OVERVIEW

At each station, a water sample is collected from 0.5 m below the surface to determine the turbidity (NTU) using an optical meter. Ideally, the sample is analyzed within 8 hours of collection. However, the sample may be held in a refrigerator (4°C) up to 48 hours before analysis; do not freeze. Frequency of sampling and daily order of events are specified in the “UWS Sampling Plan SOP.”

The use of a turbidimeter can replace the sampling of Secchi depth. A turbidity sensor added to a multiparameter sonde can also replace sampling of Secchi depth.

Samples for turbidity can be collected in the morning and delivered to a central location for analysis. This means that for monitoring groups with many field teams, only one turbidimeter is required.

A second sample from 0.5 m below the surface at one station per embayment per field day will be analyzed, to assess precision of the method. Only one duplicate station is required per embayment, even if multiple field teams are working in the embayment. At 0.5 m below surface, collect two independently obtained samples (do not sample the same collection bottle twice). These duplicate samples will usually come from the last station sampled, for time management purposes.

5 SOURCES

These procedures are based on the EPA Volunteer Estuary Monitoring Manual (EPA, 2007) and follows methods used in the EPA National Coastal Assessment (EPA, 2001). The EPA Volunteer Estuary Monitoring Manual (EPA, 2007) provides a wealth of specific data for monitoring groups. All groups should refer to the EPA manual for specific guidance.
6 MATERIALS AND EQUIPMENT

→ Turbidimeter; examples of instruments include:

- 2100Q Portable Turbidimeter (HACH Product # 2100Q01) & Portable Turbidimeter Sample Cells (HACH Product # 2434706)
- 2020we Portable Turbidity Meter (LaMotte Order Code # 1970-EPA) & LaMotte 0290-6 Turbidity Sample Test Tubes/Vials; 6/Pk (LaMotte Mfr# 0290-6)

→ Turbidimeter Accessories

- Sampling pole with clearly marked 0.5 m measurement to ensure correct depth is sampled
- Kimwipes
- Powder-free nitrile gloves (for handling turbidity cell)
- Silicone oil, 15 mL SCDB (HACH Product # 126936)
- Microfiber cloth
- Pipette
- YSI turbidity standard (124 NTU) (YSI SKU: 607300), $340 / 1 gallon – Sharing of this standard among groups is recommended, it is reusable (does not need to be disposed after each calibration). Contact the UWS coordinator for more information.
- ASTM type I (ultrapure) water or equivalent for 0 NTU turbidity standard solution and 0 RFU (and 0 µg/L) for chlorophyll a calibration, $76 / 20L (FisherSci catalog #9150-5)
- ASTM type II water (distilled or reverse osmosis) or better for rinsing turbidimeter sample cell
- If saving samples for later analysis, one 60 mL (or larger) sample bottles per station, plus one extra. Bottle may be opaque or transparent. Bottle may be high density polyethylene plastic (HDPE), high density polycarbonate plastic (HDPC), or glass. This same sample can be used for both salinity and turbidity, BUT NOT CHLOROPHYLL.

7 METHODS

7.1 Preparation

- If field teams will be delivering samples to a central location for analysis, print out labels and check that you have enough sample bottles for three samples per station (surface, bottom, mid-depth).
- Check the battery power for the portable turbidimeter. Pack extra batteries in the field tool kit.
- Wear gloves anytime a turbidimeter cell (i.e. the vial you put in the instrument) is being touched.
- Examine turbidimeter cells and check for scratches and excessive markings. Do not use scratched sample cells as they lead to inaccurate results.
  - If the manufacturer’s guidelines suggest, apply a small volume (a few drops) of silicone gel from top to bottom of sample cell. Use provided oil cloth to wipe off excess gel so only thin layer remains.
- Calibrate the turbidimeter according to manufacturer’s instruction, specific to each instrument. Calibration should be conducted the afternoon before the field day.
  - Conduct a two-point calibration using the 0 NTU (ASTM type I water, ultrapure water) and 124 NTU standard solutions.
  - The instrument should be factory calibrated at the manufacturer’s recommended interval.
  - Record calibration information in a calibration log book. The following information should be entered into the UWS data entry template:
    - turbidity standard - manufacturer and value (NTU)
    - turbidity standard - lot number
    - turbidity standard - expiration date
    - turbidity - post calibration reading in standard (NTU)
  - The instrument should be factory calibrated at the manufacturer’s recommended interval.
- When finished, clean turbidimeter cells with warm water and then follow with several rinses with ASTM Type III water (distilled or reverse osmosis) or better. Dry the sample cell with microfiber and then thoroughly wipe with a Kimwipe.
- Read the turbidity standard and record, as verification reading. This should be done at the time of calibration and after a field day.

### 7.2 Field Collection and Processing

1. Collect water sample from 0.5 m below surface (see “Sampling Plan SOP” for details).
2. At least one station per field day per embayment, collect a second sample from 0.5 m below the surface, as a verification replicate. This should be a second sample, not two samples from the same collection bottle.
3. If you are delivering the sample to a central location for analysis, deliver at least 50 mL into the sample bottle and store in a cool, dark location (e.g. on ice in a cooler). This same water can be used for reading the salinity. Do not freeze this sample.
  - DO NOT combine the chlorophyll a water sample with the turbidity and salinity samples. While the sample water used for any of these analyses can be interchanged, storing the salinity and turbidity sample water in the same bottle as the chlorophyll a leads to the possibility of dumping the sample after filtering for chlorophyll a, but before analyzing salinity and turbidity. Storing the samples in separate bottles reduces the chance that you will accidentally dispose of a sample.
4. Gently invert the sampling bottle several times to mix water.
5. Rinse the turbidimeter pipette three times with sample water.
6. Fill the turbidimeter cell.
7. Wipe the outside of the turbidimeter cell with a Kimwipe – the cell must be free of smudges.
8. Place turbidimeter cell in turbidimeter.
9. Select averaging and read the turbidity value of the sample. Averaging will increase signal to noise ratio, thus better differentiating the signal from the background noise of the instrument.
   - The HACH Turbidimeter will average the signal after 12 repetitions.
   - Select 10 repetitions on LaMotte Turbidimeter to average signal.
10. Record turbidity in NTU on the field data sheet.

7.3 Sample Storage

- If you are delivering the sample to a central location for analysis, deliver at least 50 mL into the sample bottle and store in a cool and dark location. You MUST have some air in the bottle, to allow for adequate mixing before reading. This same water can be used for reading the salinity.

7.4 Laboratory Analysis

- Follow procedure provided in Section 7.2.

8 TROUBLESHOOTING / HINTS

- Inspect all sample cells for excessive scratches and marks. Replace as needed, scratches and marks will result in reduced accuracy of reading.
- Prepare sample cells, cleaning and applying silicone gel (if required), prior to reading a sample.
- Always select average signal when taking readings.
- Always carry a copy of this SOP and the relevant parameter-specific SOPs.
- Print out the “quick sheets” for relevant SOPs to use as a reminder in the field. Do not laminate these as you will want to add notes. A plastic page protector taped close can be used to keep these sheets dry.

9 DATA PROCESSING AND STORAGE

The UWS Coordinator will be the custodian of the finalized data files. The UWS Coordinator will maintain a database which includes the unique site codes, section codes, and station codes for the embayment. Each unique station code will be affiliated with the corresponding GPS for the station.

The monitoring group is responsible for obtaining data, entering data into the UWS data template, and delivering the data to the UWS Coordinator.

The monitoring group is responsible for assuring that the correct unique station ID assigned by the UWS
is properly matched with the local organizations station ID codes. Both codes (monitoring group’s station code and UWS unique station ID) will be entered into the data template, along with the GPS coordinates.

Field data entry, data entry into the Excel-based data entry template, and reporting of data are covered in the “Recording and Reporting SOP.”

10 REFERENCES


11 Quick Sheet – Turbidity

- Inspect all sample cells for excessive scratches and marks. Replace as needed, scratches and marks will result in reduced accuracy of reading.
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Preparation

SAMPLE ONLY 0.5 m BELOW SURFACE

- If field teams will be delivering samples to a central location for analysis, print out labels and check that you have enough sample bottles for three samples per station (surface, bottom, mid-depth).
- Check the battery power for the portable turbidimeter. Pack extra batteries in the field tool kit.
- Wear gloves anytime a turbidimeter cell (i.e. the vial you put in the instrument) is being touched.
- Examine turbidimeter cells and check for scratches and excessive markings. Do not use scratched sample cells as they lead to inaccurate results.
- When finished, clean turbidimeter cells with warm water and then follow with several rinses with ASTM Type II water (distilled or reverse osmosis) or better. Dry the sample cell with microfiber and then thoroughly wipe with a Kimwipe.
  - If the manufacturer’s guidelines suggest, apply a small volume (a few drops) of silicone gel from top to bottom of sample cell. Use provided oil cloth to wipe off excess gel so only thin layer remains.
- Calibrate the turbidimeter according to manufacturer’s instruction, specific to each instrument. Calibration should be conducted the afternoon before the field day.
  - Record calibration information in a calibration log book and enter into the UWS data entry template.

Field Collection and Processing

1. Collect water sample from 0.5 m below surface (see “Sampling Plan SOP” for details).
2. At least one station per field day per embayment (typically the last one), collect a second sample from as a verification replicate. This should be a second sample, not two samples from the same collection bottle.
3. If you are delivering the sample to a central location for analysis, deliver at least 50 mL into the sample bottle and store in a dark location. This same water can be used for reading the salinity. DO NOT COMBINE WITH CHLOROPHYLL SAMPLE. Do not freeze. Leave some air in the bottle.
4. Gently invert the sampling bottle several times to mix water.
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