Hurricane Sandy Coastal Resiliency Competitive Grants Program
#42279 DOI/NFWF
Building Ecological Solutions to Coastal Community Hazards

Atlantic City Living Shoreline Project Monitoring Plan
Partnership for the Delaware Estuary and Barnegat Bay Partnership

Site: NJDEP-NFWF Atlantic City Living Shoreline Project
North Rhode Island Ave and Parkside Ave)

Dates Active: March 1, 2015 - March 2018

Project Lead: Elizabeth Terenik, Planning Director, Atlantic City

Partners: NJDEP, NWF, Barnegat Bay Partnership (BBP), Partnership for the Delaware Estuary (PDE), Arthur W. Ponzio and Associates, Rutala Associates, Atlantic City Dept. of Planning and Development, Stevens Institute of Technology

Project Design Team: Arthur W. Ponzio and Associates, Rutala Associates, Atlantic City Dept. of Planning and Development

Monitoring Plan Design Team: Barnegat Bay Partnership (BBP), Partnership for the Delaware Estuary (PDE)
Point of Contact: LeeAnn Haaf (PDE), Erin Reilly (BBP), Joshua Moody (PDE), Martha Maxwell Doyle (BBP), Danielle Kreeger (PDE)

Monitoring Implementation Team: Erin Reilly lead, Josh Moody co- lead

Project Type

Description of the overall project including the type of living shoreline being installed (bio-based, hybrid, etc...) or restoration technique being employed that requires a structured monitoring program.

Hybrid Living Shoreline

Project Goal and Objectives

List project goal and provide reasoning for this goal being selected (e.g.: erosion control as goal due to value of infrastructure behind shoreline or value of habitat, etc...). State project objectives as monitoring actions that will be taken to assess the ability of the project to meet its defined goal. See PDE monitoring framework for a listing and description of restoration types and goals.

To stabilize shoreline and provide flood protection to local infrastructure located behind the Area of Interest (AOI). The project specific goals are in line with the goal of erosion control as defined in the monitoring framework developed by the NJ living shorelines monitoring framework work group. Therefore, the goal of erosion control was used to identify relevant metrics to monitor for this project.
Objectives:

1. Monitor position of established shoreline
2. Monitor extent of biological (shellfish and vegetative) communities
3. Monitor topography within project area
4. Monitor ability of materials to persist over time

Project Location

Provide GPS coordinates of project centroid and short description of the project area/location. Provide map as Figure 1.

The site, Lot 6 Block 103, is located in the northern section of Atlantic City in the sub-area known as Gardner's Basin near the intersection of North Rhode Island Ave and Parkside Ave. Gilchrest Restaurant is located to the north of the project site and a work boat dock is located to the south (Fig. 1).

Northern Extent: 39.375202, -74.421227
Southern Extent: 39.374961, -74.421141

Treatment Description

Description of treatment and control (if applicable) designs including: relationships to existing structures on site; replications; and components. Detail should be reflective of the current stage of project and should be updated throughout the course of the project to reflect any, and all, changes or adaptive management activities. Previous entries should not be altered, but a new section should be added by date. This section will serve as a journal of the conception and evolution of treatments/installations.

The treatment will consist of two stone sills configured in an overlapping manner to allow for passage of fauna into and out of the treatment area. The water-ward sill will be installed at an elevation so that the top of the sill is located at 1.8' relative to NAVD88 (as are all elevations in this plan) and will have a front slope of 1.5:1 and a rear slope of 1:1. The landward stone sill will be positioned approximately 5.0' landward and will close a gap at the southern end of the treatment area that allows for fauna passage. Heights and physical specs are the same as the water-ward sill. Fill between the sills and existing land will consist of loam sand to an elevation of 1.0'-3.0' at the landward extent. Area of salt meadow created between the sill and upland will be approximately 300 square feet and will planted with *Spartina alterniflora* planted 18" on center. At the landward extent of the treatment a berm will be constructed from 3.0-6.0' with a slope of 2:1 and will be planted with a combination of native landscape plants and mowed grasses. See engineering designs for more detail.

Endpoints

Description of the parametric value or temporal scale that will dictate the completion of the project according to permit(s).

This project does not have specific end point goals, but aims to track changes to the physical and biological conditions of interest as a result of the installation until 3/2018.

Monitoring Tasks

Metrics of interest required by monitoring plan and associated methods used for data collection. Provide monitoring table from Monitoring Frame work, including reasoning for methodologies chosen. Methods in red indicate techniques that require specialized equipment, knowledge, permitting, or training. Methods in green indicate techniques that do not require and specialized, equipment, knowledge, permitting, or training besides on-site instruction for from trained staff. **Photo documentation is a mandatory monitoring task at ALL visits to a project site as well as a monitoring task on all monitoring dates.**

Table 1 Monitoring metric and method table

Restoration Type and Goal	Class of Metrics	Metric	Method	Reasoning	Sampling Type (See Sampling Design Type)
Hybrid Living Shoreline for Erosion	Photo	Appearance	Fixed Photo Points	Provides visual documentation of project and site over the course of the monitoring timeline	Photo

Control	Physical	Position of Erosion Control Structure and Associated Materials	RTK GPS Survey Fixed Photo Points	Assessment of ability of materials to withstand local physical forces	Targeted Point RTK Sampling
		Structural Integrity of Materials	Observation Logging on Data Sheets	Assessment of ability of materials to withstand local physical forces	Site Level Sampling
		Position of Contiguous Vegetated Shoreline (Horizontal Change)	RTK GPS Survey Fixed Photo Points	Measure changes in the horizontal extent of the vegetative community over time as a result of the treatment	Targeted Point RTK Sampling
		Elevation (Vertical Change and Retention of Fill Material)	RTK GPS Survey	Measure changes in the vertical extent and trajectory of the vegetative community over time within the local tidal prism as a result of the treatment and its likelihood of resilience	Targeted Point RTK Sampling
	Biological	Vegetation: Survivorship of Planted Plugs	Observation & Counts Logged on Data Sheets	Measure persistence of planted vegetation within the treatment and its likelihood of future survivorship	Stratified Biological Plot Sampling
		Vegetation: Growth	Measurement of Blade Height with Meter Stick	Measure above ground growth of vegetation to determine health of vegetation within the treatment	Stratified Biological Plot Sampling
		Target Species: Shellfish Presence	Observation & Counts Logged on Data Sheets	Measure changes in extent of local shellfish communities as a proxy for increased water quality ecosystem service benefits as a result of the treatment	Stratified Biological Plot Sampling & Site Level Sampling
		By-catch	Observation & Counts Logged on Data Sheets	Account for impingement or entrapment of local fauna by treatment	Site Level Sampling

	Chemical	Water Salinity	YSI or other Acceptable Equipment	Measure local conditions within which to frame the results of other data collected	Site Level Sampling

Sampling Frame

Description of the area within which data will be collected, referenced to existing structures, relative position within the local tidal spectrum, and three-dimensional features of interest (e.g.: tops of structural components). GPS coordinates (4 minimum) demarcating the bounds of the sampling frame are to be listed. These coordinates are to be collected during the first survey (see Table 2 below). A map of the sampling frame is included as Figure 2.

Sampling frame will extend from mean low water to the landward extent of the regarded area, and from the wooden deck at the northern extent to the concrete wall at the southernmost extent. Sampling frame will include existing outfall pipe in the southern area of the treatment (Fig. 2).

Sampling Frame Coordinates

39.375212, -74.421062

A. 39.375198, -74.421240
B. 39.374959, -74.421127
C. 39.375104, -74.420941

Sampling Design Type

Description of the sampling methodologies/techniques employed (e.g. systematic non-random grid sampling, targeted point sampling, stratified random sampling, etc...) and their associated metrics from Table 1. **All metrics from Table 1 need to be accounted for under one of the Sampling Design Types listed below**.

1. Photo Documentation from Fixed Photo Points: a photo documentation technique in which photographs are taken of a site/project from pre-determined and demarcated photo points.

A. Appearance

2. Targeted Point RTK Sampling: a survey design in which point measurements are taken at specific locations. At this site, metrics that include features of interest are:

A. Position of Erosion Control Structure and Associated Materials
B. Position of Contiguous Vegetated Shoreline
C. Elevation (Vertical Change and Retention of Fill Material)

3. Stratified Biological Plot Sampling: a sampling scheme in which the treatment area is divided into strata among which sampling is targeted. Within each strata replicate plots are placed in fixed locations along transects which are re-sampled periodically. At this site, metrics within strata are:

A. Vegetation: Survivorship of Planted Plugs
B. Vegetation: Growth
C. Target Species: Shellfish Presence

4. Site Level Sampling (Measured or Observational): a sampling scheme in which either: data will likely not vary across the AOI (e.g. water temperature, wave climate, etc..) and sub-sampling is not required; or it is not advisable to limit the scope of monitoring within treatment area (e.g. stratified sampling locals), as the data of interest may be aggregated and thus not captured by targeted sampling (e.g. shellfish aggregates). At this site, metrics that will be evaluated across the site are:

A. Structural Integrity of Materials
B. Target Species: Shellfish Presence
C. By-catch

Sampling Spatial Resolution

For each Sampling Design Type, describe the spatial resolution at which the methodologies will be employed, including targeted or delineated (strata) physical or zonated locals. Provide a map (Figure 3) of the spatial resolution of the data collection (e.g. quadrat location, sample well locations, grid system resolution, structural locations, etc...).

1. Photo Documentation from Fixed Photo Points: Fixed photo points will be located, at a minimum, at each end of a project site. Any other angles of interest can be added to the photo documentation series. Exact locations of fixed photo points will be provided after the first visit to the site (see Table 2)

2. Targeted Point RTK Sampling: An RTK point will capture the latitude, longitude and elevation will be taken 1-meter intervals along the base of each side and the top of all structures, along the continuous vegetation line, and each transect and within each of the stratified biological sampling plots within the sampling frame.

A. Rock Sills
B. Contiguous Vegetation Line
C. Stratified Biological Sampling Plots
D. Berm

3. Stratified Biological Plot Sampling: Four transects will be placed along the AOI, numbering 1-4 moving North to South. Within each transect there will be one transect plot waterward of built structures and one sampling plot on the graded slope (Figure 3). Between built structures and graded slopes, the transects will have the following number of sampling plots along them: Transect 1: 1; Transect 2: 2; Transect 3: 2 (one between stone sills, one between landward sill and graded slope); Transect 4: 2 (one between stone sills; one between landward sill and graded slope).

A. Waterward of built structures
B. Between built structure and graded slope
C. Graded slope

4. Site Level Sampling (Measured or Observational): Observations/measurements across entire sampling frame.

A. Structural integrity will be observed along all pre-existing and installed structures
B. Salinity measurements will be collected at various stages of the tide
C. Bycatch will be observed within the entire site

Sampling Temporal Resolution

Description and table of planned sampling events including large scale factor level events such as site characterization, baseline data collection, as-built surveying and annual monitoring, as well as seasonally focused monitoring such as vegetation monitoring occurring during maximum growth seasons and aerial survey during leaf-off seasons.

Sample data is characterized as being collected "Before Installation", "As Built" and "After Installation" for use in statistical analysis. As of now there is no additional annual monitoring planned for this site.

Table 2 Example Data collection schedule

Date	Temporal Factor Level	Data	Collected by	Collected On
May 2, 2016	Before Installation	Targeted Point Sampling; Photo; Sampling Frame Coordinates	BBP/PDE	5/2/2016
May 2, 2016	Before Installation	Site Level Sampling; Photo	BBP/PDE	5/2/2016
TBD	As Built	Targeted Point Sampling; Photo	BBP/PDE	
TBD	As Built	Stratified Biological Plot Sampling; Photo	BBP/PDE	
TBD	As Built	Site Level Sampling; Photo	BBP/PDE	
TBD	After Installation	Targeted Point Sampling; Photo	BBP/PDE	
TBD	After Installation	Stratified Biological Plot Sampling; Photo	BBP/PDE	
TBD	After Installation	Site Level Sampling; Photo	BBP/PDE	

Recommended Minimum Long-Term Monitoring

Description of the recommended monitoring past the duration of the stated monitoring timeline

It is recommended that all metrics with associated methods that do not require and specialized, equipment, knowledge, permitting, or training besides on-site instruction for from trained staff (indicated in green in the Monitoring Tasks Table (1) above) continue to be collected annually subsequent to the end date of the project with the following exception:

- Photo Documentation from Fixed Photo Points: This metric should be collected twice annually
    A. Early Spring: before the plants emerge from senescence
    B. Late Summer: When maximum vegetative growth is visible

Statistical Methodology

Description of the statistical methods that will be used to evaluate data (e.g. BACI design, 2-way ANOVA, multiple-regression, etc...)

A before-after statistical analysis will be conducted as a one way ANOVA to detect changes in metrics as a result of the installation. Factor levels will be: Before Installation; As-Built; and After Installation. Additionally, changes in metrics of interest will be evaluated for coincidences with changes in other metrics and correlative relationships.

Sampling Methodologies

See Metrics and Methods

Figure 1. Location of Atlantic City Hybrid Living Shoreline

Figure 2. Sampling frame for Atlantic City Hybrid Living Shoreline

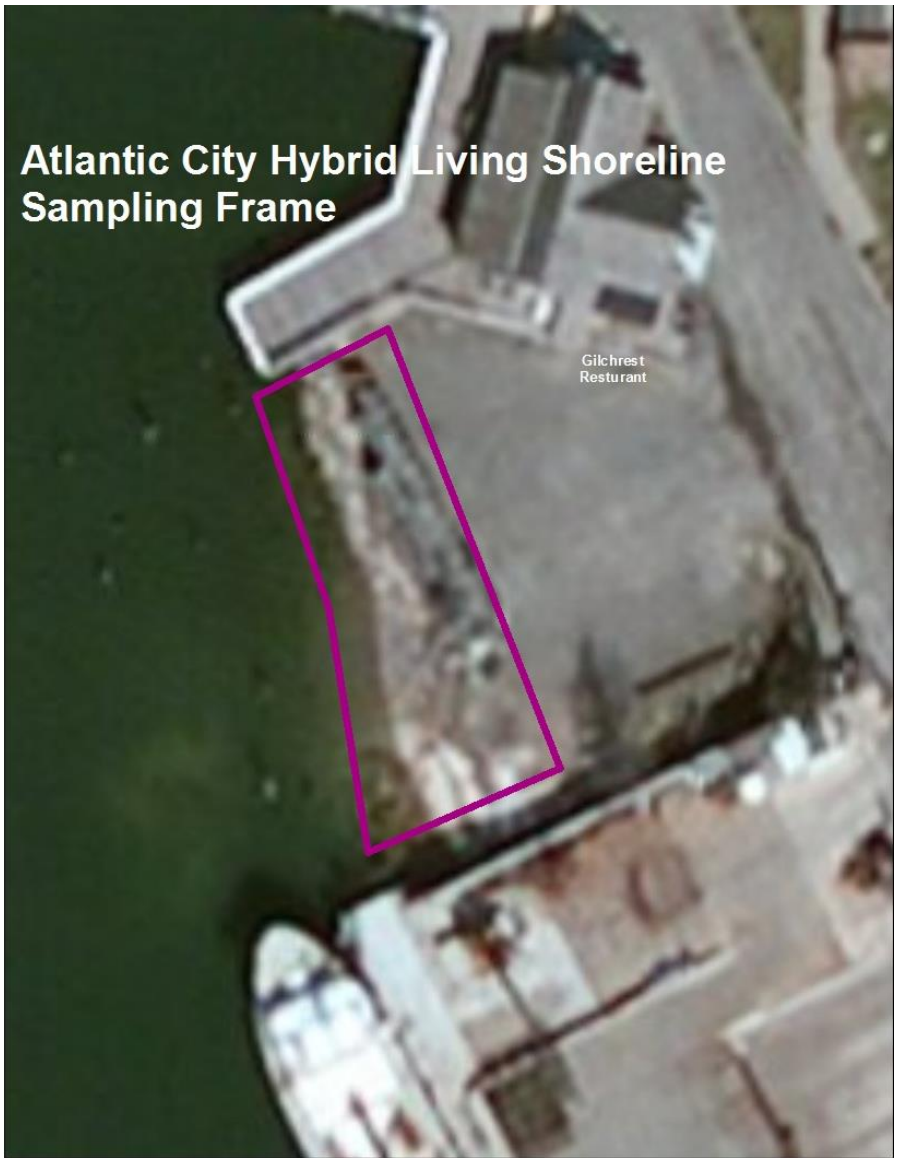
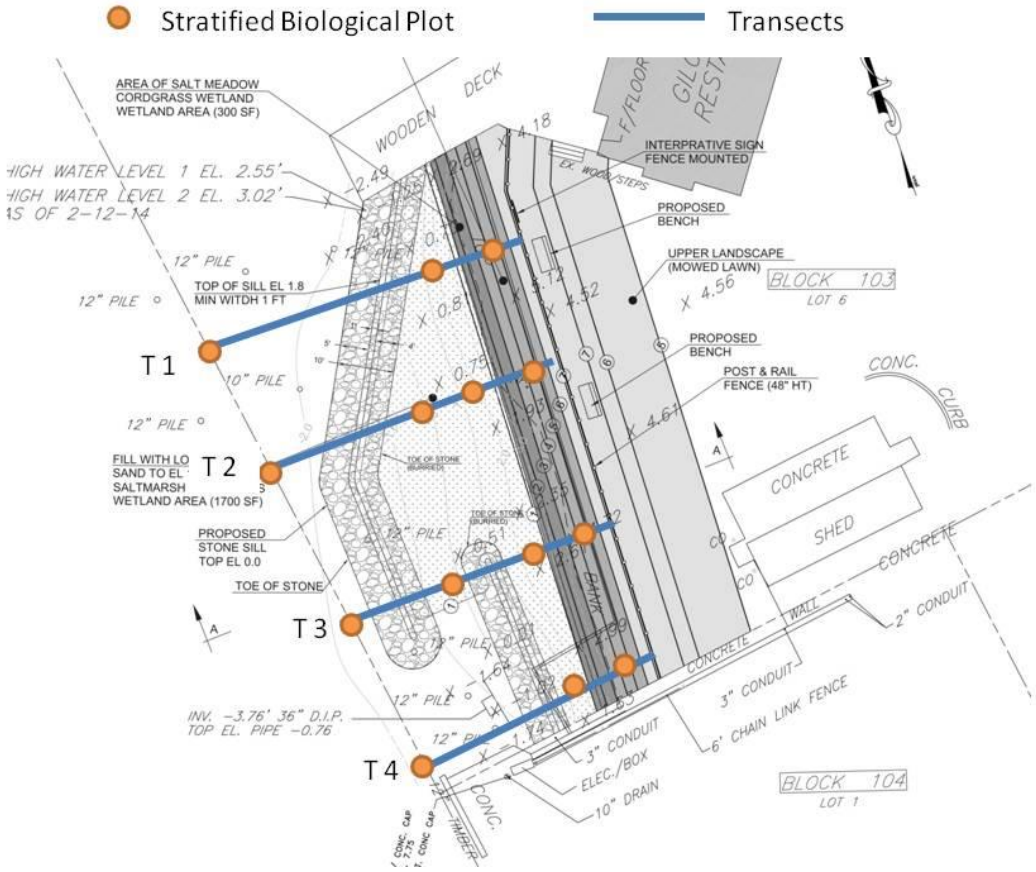


Figure 3. Stratified Biosocial Sampling Plot locations



Metrics and Methods for Atlantic City

Fixed Photo Points

Standard Operating Procedure No. SOP-XX
Date Prepared: 8/23/16 (v2)
Prepared By: _____

Fixed Photo Points

Description

This Standard Operating Procedure (SOP) describes the collection of fixed photo points at restoration projects. Photo documentation of a site will be taken from predetermined and demarcated photo points to assess the changes over time of the area. Because locational positioning of restoration structures and relevant areas of interest (e.g. current vegetation line, location of outfalls etc.) is being measured in other ways, it is not critical that photo-point photographs are an exact replicate of previous photos, but rather capture the entire area of interest.

Summary of Approach

Changes over time are critical to document, whether it be for a permit or educational use. By taking pictures at fixed locations, more exact changes can be documented over time. Importantly, when taking fixed photo points, it is crucial to find the location of the fixed position and to identify the features that you are supposed to capture in the photograph. To ensure that this occurs, detailed descriptions of location, direction, and features should be documented so that all photos capture the same area. In addition to fixed photo points, supplementary photographs should be taken at the discretion of the photographers to document other interesting conditions at the site.

Equipment and Materials

- Camera
- Photo Journal/Station Location Guide
- Topographic and/or site map with photo point locations
- Extra batteries for camera (if applicable)
- GPS unit (if applicable)

Optional:

- Aerial photos and previous photos if available
- GoPro with Telescoping Pole for overhead images
- Ruler (for scale on close up views of streams and vegetation)
- Posts for dedicating fixed photo points if the site plan allows for installation

Procedures

1. In the photo journal, record information about the site including site ID, date, photographer name, camera being used and start time. An example can be seen below:

Atlantic City Project
July 6, 2016
D. Stout
PDE Camera 1
Start 10:30 AM

2. Ensure that the date and time in the camera are set correctly. If they are not correct and you cannot figure out how to reset them; make a note of the incorrect time on the datasheet.

3. Confirm photographer location with either existing marker (steel fence post), GPS, or by referencing the description contained within the station location guide. When creating descriptions for the station location guide, descriptions should be detailed enough that someone unfamiliar with the project could capture the same image.

4. Locate the definitive features for the given photo-point and correctly align the features of interest described within the station location guide/photo journal.

5. Take a photograph.

6. With digital cameras, confirm photograph is as close to a complete duplication as possible to the original photograph.

    - Pay particular attention to the corners of the old photo. Does your photo have the same features in each corner?
    - Does your photo look like it is too close or too far away? If so, move accordingly.
    - Is the horizon the same?

7. Record all of the photo numbers in the photo journal along with a detailed description of the features that the photo contains.

8. If possible, attach GoPro to the telescoping pole. Use the station location guide/photo journal to set the height of the telescoping pole. GoPro has a smartphone application that allows you to see what your GoPro will capture. Line up the camera to capture the features described in the station location guide/photo journal. Take the photo. Record the photo number(s) in the photo journal/datasheet.

9. Once all required photos have been taken, survey the site to see if there are any additional features of interest that should be captured (e.g. extensive bycatch, presence of significant wrack, unexpected plants). Record descriptions of any additional photos taken in the photo journal with photo numbers.

10. If applicable, fill out data sheet. For long term monitoring, it is critical to document factors about the photograph that are not contained within the picture. The following information should be recorded with all photo-points and supplementary photographs:

    - Photo file name

- Date the photograph was taken
- Name of photographer
- Location (site and stream)
- Description of photograph

11. Photos are to be transferred off of the camera shortly after they are collected.

12. It is important to have file and data management of pictures. Follow appropriate project specific protocols for archiving photos (i.e., PDE-Best Practice #2 Procedure for Archiving Photo Data)

Best Practice #14 Set-Up and Use of the Trimble RTK GPS

Created By: Kurt Cheng, Priscilla Cole, Jessie Buckner 9/18/14

Materials

- Data Logger (Controller)
- Antenna (Receiver)
- Pole (2 sections inside case)
- Mifi
- Battery Pack (2) – for Antenna
- Controller handle (clip) – attaches data logger to the pole
- Case for mifi (waterproof)
- Tape measure/Measuring stick
- Charging device (1), Charging cords (2)
- Pelican Hard Case

Protocols

Day Before

1. Charge three parts:
    a. Battery pack(s) for Antenna - removable packs fit into charger which has cord to plug into electrical outlet
    b. Mifi – cord connects device to electrical outlet (USB)
    c. Data Logger – cord connects device to electrical outlet

Survey Day

Assembly & Setup

1. Turn on mifi and place into waterproof case
2. Assemble the pole by screwing 2 parts together
3. Place charged battery pack into Antenna
4. Turn on Antenna
5. Screw Antenna onto top of pole
6. Measure distance from the base of antenna to the bottom of the pole (typical 1.94m)
7. Turn on Data Controller

Data Controller Settings

1. Main Menu → Setup Internet→wifi
2. Main Menu→Measure→Create New Job→Give the job a name
3. Main Menu→Measure→Measure Points→VRS Rover→VRS-CMRX

Logging Points

Point density of sampling will be determined on a site by site basis. At some sites constructed structures may be GPSed, at others transects may run though the project area, and at others shoreline or creek morphology might be captured. See each projects Monitoring Plan.

1. You should now be on the data capture screen
2. Insert "height to antenna" measurement in height field (#6 under assembly)
3. Naming Scheme – All points need to have a name, but the code-field is optional
    a. Point names will auto-advance in sequential order (numbers or alphabetical), unless otherwise modified.
    b. Code field is just another attribute field to capture additional data. PDE staff often use the code to capture vegetation or sediment types.
4. Press "Enter" (bottom right)
5. Press "Capture Observation" (bottom right)

Error Handling

1. Errors will occur if Mifi is moved too far away from the device.
2. Mifi can get too hot if left in its case for too long on sunny days. Keep the case cool and remove the device from its case if needed.
3. High RMS – Points will not log if movement is too high. In this case, abandon the point and recapture.
4. Cannot connect with satellites – reconnect

Day After

Uploading Files

1. Plug RTK handset into computer using USB cord
2. Power handset ON (green button on bottom left-hand corner)
3. On your computer, when the window pops up click→ Connect without setting up your device
    a. Click→File Management
        i. →Browse the Contents of your Device
            1. →Trimble data
                a. →Living Shorelines
                    i. →Export
                        1. Select Site Files
                        2. Copy (Ctrl-c)
                        3. Open T:\Science Stuff\GIS\Living Shorelines\SITE Name\RTK_Data
                        4. Paste Site Files (Ctrl-v)
                        5. DO NOT DELETE FROM HANDSET
4. On the handset screen, click "X" in the top-right corner to exit

5. Hold power button down for 5 seconds and follow prompts to Shutdown
6. Return handset to library and make sure that the RTK is signed in.
7. Email Data Specialist to alert about new data creation

Best Practice # 18 Field Protocol for Vegetation: Survivorship

3/17/16

Description: Collect data at 1 m^2 vegetation plots to assess vegetation survivorship of planted plugs at restoration sites.

Materials

Required for sampling

- 1.0 m^2 PVC quadrat
- 2 meter stick
- GPS unit-with sites
- Camera
- Writing utensil
- Clip board
- Maps of sites in plastic sheet covers
- Datasheets
- Plant field guide

Protocols

A stratified random sampling technique to determine the location of permanent survey plots will be used. The number of sampling plots depends on the vegetation community, final number of plantings, number and size of planting areas and spacing of plantings. Data should be collected at 3 or more sampling plots to allow for statistical analysis, when possible. Since some of the habitat types that are being re-vegetated could be very narrow bands, it is possible that the plots will not fall within each habitat type.

1. Plots should be marked with at least one PVC stake
2. Maps of the site may be useful if vegetation is thick or cloud cover limits GPS accuracy
3. Lay 1.0 m^2 quadrat over permanent PVC markers or with middle of quadrant at GPS point
4. Record presence or absence of each live plug including each species
5. Record observations regarding plant health (e.g., vigor, evidence of herbivory, evidence of dieback shoots, severe insect infestation, etc.) on data sheet

Best Practice # 19 Field Protocol for Vegetation: Growth

3/17/16

Description: Collect data at 1 m^2 vegetation plots to assess vegetation growth, by linking the blade height to the growth of the plant layer.

Materials

Required for sampling

- 1.0 m^2 PVC quadrat
- 2 meter stick
- GPS unit-with sites
- Camera
- Writing utensil
- Clip board
- Maps of sites in plastic sheet covers
- Datasheets
- Plant field guide

Protocols

Locating Plots

1. Coordinates of plots should be loaded into GPS before work begins
2. Plots should be marked with at least one PVC stake
3. Maps of the site may be useful if vegetation is thick or cloud cover limits GPS accuracy
4. Proceed with data collection as described below

Data Collection

1. Lay 1.0 m^2 quadrat over permanent PVC markers or with middle of quadrant at GPS point
    a. Avoid disturbing canopy structure by reassembling quadrat in place
2. Record: Location and its respective plot number; initials of crew on datasheet
3. Use plant guide to correctly identify plants in the plot
        i. If plant is unknown, take sample & photo (note photo # on data sheet), identified *within 48 hr* of sampling
4. Measure blade heights – on blade height datasheet
    a. Measure the height, in centimeters, of the first 25 stems of individual plants
        i. Do not use multiple leaves from the same plant
        ii. Start with a corner closest to the water's edge, working diagonally towards opposite corner
        iii. Stems and species are recorded in the order they occur
    b. Make any notes if measurements capture average height of all plants in the plot

SOP #42 Field Protocol for Vegetation Assessment at Marsh Futures Bio-Assessment Plots

Joshua Moody 4/30/2015
Adapted from L. Haaf Best Practice #5

Estimate Plant Coverage

c. Use plant guide to correctly identify plants in the plot

i. If plant is unknown, take sample & photo (note photo # on data sheet), identified *within 48 hr* of sampling

d. Estimate cover visually and agree on approximate covers amongst field crew
    i. Percent cover should reflect one species at a time; overlap may occur, so percentages may not add to 100%

PARTNERSHIP FOR THE DELAWARE ESTUARY Science Group

Operation of YSI Professional Plus Instrument

Procedure No. PDE-SOP-#44
3/25/16
Prepared By: Kurt M. Cheng
Spencer A. Roberts

Operation of YSI Professional Plus Instrument

Description

This SOP describes the YSI Professional Plus (Pro Plus) water quality instrument and the proper materials and methods for its calibration, field operation, long-term storage and data extraction.

Terminology and Orientation

The YSI Pro Plus consists of a data logger (handheld computer) that provides real-time measurements and storage of water quality data. A cable connects the data logger to the sonde which contains water quality probes and is designed to be equipped with a sampling guard for use in the field. The YSI Pro Plus is currently equipped to measure and record water quality parameters including water temperature (°C), specific conductivity/conductivity (mS/cm), salinity (ppt), pH, and dissolved oxygen (% and mg/L) where C = Celsius, mS = millisiemens, cm = centimeters, ppt = parts per thousand, mg = milligrams, and L = liters.

Equipment

- YSI Pro Plus handheld data logger
- YSI quatro cable and sonde
- Probe guard
- Guard cover
- O-rings
- O-ring grease
- Size “C” batteries (2)
- USB connector
- USB cable
- YSI data manager software
- Conductivity/temperature sensor
- pH sensor
- DO sensor
- pH 4 buffer standard
- pH 7 buffer standard
- pH 10 buffer standard
- Conductivity 1 mS calibration standard
- Conductivity 10 mS calibration standard
- De-ionized (DI) water
- Spring water
- pH sensor storage container
- Sampling cup
- Small sponge
- Cleaning brush
- Circle wrench
- DO membrane caps
- DO electrolyte solution

Procedure

1. Calibration
   - 1.1 Temperature
     - 1.1.1 There is no calibration required for temperature
   - 1.2 Conductivity
     - 1.2.1 Power on data logger and connect to sonde with cable
     - 1.2.2 Rinse the calibration cup and sonde with DI water and fill calibration cup with desired conductivity standard. For freshwater applications, a 1 mS/cm standard should be used. For brackish water applications, a 10 mS/cm standard should be used
     - 1.2.3 Place sonde into calibration cup and ensure probes are completely submerged adjusting probe to remove any air bubbles
     - 1.2.4 Press CAL and select **Conductivity**, then select **Specific Conductivity**
     - 1.2.5 Enter the calibration value of the standard (e.g. 1 mS/cm or 10 mS/cm)
     - 1.2.6 Let specific conductivity value stabilize and then select Enter
     - 1.2.7 Select Enter again to continue
     - 1.2.8 Calibrate conductivity sensor monthly
   - 1.3 pH
     - 1.3.1 Power on data logger and connect to sonde with cable
     - 1.3.2 Rinse the calibration cup and sonde with DI water prior to calibration
     - 1.3.3 Rinse calibration cup and sonde with desired pH buffer standard
     - 1.3.4 Fill calibration cup with desired pH buffer standard and place sonde into calibration cup so probe is completely submerged adjusting to remove any air bubbles
     - 1.3.5 Note the temperature (put the sonde in read mode) for pH calibration
     - 1.3.6 Press CAL then select **ISE1 (pH)**
     - 1.3.7 Then select **ISE1 (pH)**
     - 1.3.8 Enter the solution value in accordance with ambient temperature (temperature specific pH values are listed on buffer solution bottle)
     - 1.3.9 Wait for pH reading to stabilize and then select Enter to finish calibration
     - 1.3.10 Repeat steps 1.3.3 through 1.3.9 to calibrate for each pH value (i.e. 4, 7, 10) desired for the expected environment
     - 1.3.11 Calibrate the pH sensor before each day in the field
   - 1.4 Dissolved Oxygen
     - 1.4.1 Power on data logger and connect to sonde with cable
     - 1.4.2 Allow 10 minutes for warm up
     - 1.4.3 Rinse calibration cup and sonde with DI water
     - 1.4.4 Partially fill calibration cup with spring water (one half inch above cup base)
     - 1.4.5 Place the sonde in the calibration cup and screw cup on 1 or 2 turns, leaving room for air flow.
     - 1.4.6 Wait 5-15 minutes for sensor to stabilize.
     - 1.4.7 If DO measurements do not stabilize (e.g. continual decline), service DO probe according to 4.3.
     - 1.4.8 Press CAL and select **DO** then select **DO%**
     - 1.4.9 Press Enter to continue
     - 1.4.10 Calibrate DO sensor before each day in the field
     - 1.4.11

2. Field Use and Short-term storage
    2.1 Field Sampling
        2.1.1 Power on data logger and connect to sonde with cable
        2.1.2 Remove calibration cup and screw on probe guard
        2.1.3 Submerge sonde into water and continually swirl sonde to maintain adequate water flow over probes. If sampling in swift water, orient sonde perpendicular to flow to avoid damaging probes.
        2.1.4 Record data onto datasheet or notebook, or follow 2.2 for storing data
        2.1.5 If multiple sites are visited during one day, cover the probe guard with the guard cover to prevent drying out probes throughout the day
    2.2 Storing data
        2.2.1 To store water quality data press ENTER
        2.2.2 Either log data into existing Folder and Site or create a new Folder for that sampling effort
        2.2.3 To create a new folder select **FOLDER**
        2.2.4 Scroll to the end of the list to **ADD NEW**
        2.2.5 For adding a new Site select **SITE** and select **ADD NEW**
        2.2.6 Once satisfied with the storage location select **LOG NOW**
        2.2.7 To view logged data press FILE and select **VIEW DATA**
    2.3 Short-term Storage
        2.3.1 After field use rinse sonde with DI water
        2.3.2 Keep small amount of DI water in calibration cup with clean sponge
        2.3.3 The sensors should not be submerged but kept in a humid environment
3. Long-Term Storage (for storage 30 days or longer)
    3.1 pH sensor
        3.1.1 Unscrew pH sensor from sonde
        3.1.2 Seal sensor port with plug
        3.1.3 Fill pH storage container with pH 4 buffer solution
        3.1.4 Make sure the sensor is submerged and sealed in container so it does not dry out during storage
    3.2 DO sensor
        3.2.1 Remove DO sensor from sonde
        3.2.2 Seal sensor port with plug
        3.2.3 Remove membrane cap and rinse DO probe to clean
        3.2.4 Allow to air dry and store dry
    3.3 Temperature/Conductivity sensor
        3.3.1 Unscrew from sonde and replace with port plug
        3.3.2 Clean with conductivity cleaning brush
4. Probe installation
    4.1 O-rings
        4.1.1 When setting up the YSI Pro Plus after short or long-term storage, check the conditions of o-rings for proper sealing.
        4.1.2 If an o-ring appears worn-out or cracked, replace and apply a small amount of o-ring grease

4.2 pH sensor
    4.2.1 Remove pH sensor from stage container and solution
    4.2.2 Rinse sensor with distilled water
    4.2.3 Remove port plug and insert pH sensor into sonde
4.3 DO sensor
    4.3.1 Clean sensor with cleaning brush and rinse sensor tip with DI water
    4.3.2 Fill a new membrane cap with sensor electrolyte solution
    4.3.3 Thread and screw on new membrane cap while removing air bubbles
    4.3.4 Remove port plug and insert DO sensor into sonde
4.4 Conductivity sensor
    4.4.1 Remove port plug and insert conductivity sensor into sonde using circle wrench
    4.4.2 Use cleaning brush if necessary to clean sensor

5. Digital Data Management
5.1 Extracting stored data from data logger
    5.1.1 Attach USB connector to the back of the data logger and plug USB cable from connector into a personal computer
    5.1.2 Launch YSI Pro Series Data Manager Software and select instrument
    5.1.3 Explore and transfer desired data files from the data logger

	Sensor Type	**Range**	**Accuracy**	**Resolution**	**Units**
Dissolved Oxygen (%) (temp range -5 to 45 °C)	Polarographic	0 to 500%	0 to 200% (±2% of reading or 2% air saturation, whichever is greater) 200% - 500% (± 6% of reading)	1% or 0.1% air saturation (user selectable)	%
Dissolved Oxygen (mg/L) (temp range -5 to 45 °C)	Polarographic	0 to 50 mg/L	0 to 20 mg/L(±2% of the reading or 0.2mg/L, whichever is greater) 20 to 50 mg/L (±6% of the reading)	0.1 or 0.01 mg/L; 0.1% air saturation	mg/L, ppm

Temperature	-	-5 to 70°C	±0.2°C	0.1°C	°C
Conductivity (derived parameters include resistivity, salinity, specific conductance, and total dissolved solids)	Four electrode cell	0 to 200 mS/cm	±1% of reading or 0.001 mS/cm (whichever is greater)	0.001 mS (0 to 500 mS); 0.01 mS (0.501 to 50.00 mS); 0.1mS (50.01 to 200 mS)	µS,mS
Salinity	Calculated from conductivity and temperature	0 to 70 ppt	±1.0% of reading or 0.1 ppt, whichever is greater	0.01 ppt	ppt, PSU
pH	Glass Combination Electrode	0 to 14 units	±0.2 units	0.01 units	mV, pH units
Barometer	Piezoresistive	375 to 825 mmHg	±1.5 mmHg from 0 to 50°C	0.1 mmHg	mmHg, inHg, mbar, psi, kPa, ATM

Datasheets for Atlantic City

NFWF Monitoring

Location: Atlantic City Transect # _____ Date _____

Site Name_____ Completed by:_____

Time of Start& Finish____:____ ____:____

		Vegetation Robustness and Survivorship			Light Attenuation		Shellfish
PLOT 1	LAT	Plant Species	% Total Cover	# Live Plugs	Top	Bottom	Lip Counts
	LONG						
	Camera ID						
	Photo #						

		Vegetation Robustness and Survivorship			Light Attenuation		Shellfish
PLOT 2	LAT	Plant Species	% Total Cover	# Live Plugs	Top	Bottom	Lip Counts
	LONG						
	Camera ID						
	Photo #						

		Vegetation Robustness and Survivorship			Light Attenuation		Shellfish
PLOT 3	LAT	Plant Species	% Total Cover	# Live Plugs	Top	Bottom	Lip Counts
	LONG						
	Camera ID						
	Photo #						

		Vegetation Robustness and Survivorship			Light Attenuation		Shellfish
PLOT 4	LAT	Plant Species	% Total Cover	# Live Plugs	Top	Bottom	Lip Counts
	LONG						
	Camera ID						
	Photo #						

Water

Land

Site Level Observations:

Site-level Fixed Photo Point Identification Numbers and Description:

	Photo ID #	Description	Comments
1			
2			
3			
4			
5			
6			
7			
8			

Salinity _____ppt **Method Used**: YSI_____ Refractometer_____

Are invasive plant species present? Yes_____ No_____

If Yes, which ones? _____

Is debris present? Wrack_____ Trash_____ Other_____ None_____

If Yes, what is the abundance of the debris? High_____ Moderate_____ Low_____

What structures are present? Riprap_____ Coir Log_____ Berm_____ Other_____

Has the structure/site been impacted by ice? Yes_____ No_____

What is the condition of the structure? Excellent_____ Fair_____ Poor_____

Are shellfish present? Yes_____ No_____

If yes, what type of shellfish? Oysters_____ Mussels_____

Other comments or observations:

NFWF Monitoring Vegetation Growth

Date:___________

Location:________

Site #:__________

Completed by:______________

Stem Heights (cm)

T#	Plot	SPP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Mumichog Data Sheet

Date: _____ **Personel:** _____

Plot ID: _____ **Tide:** _____

Latitude: _____ **Longitude:** _____

Time Start: _____ **Time End:** _____

Temperature: _____ **DO %:** _____

Salinity: _____ **DO mg/L:** _____

Plant Species/Features:	% Cover	Plant Species/Features:	% Cover

Species:			Measure Standard Length (mm)					Total:	

Species:			Measure Standard Length (mm)					Total:	