Addendum to Rapid Assessment Monitoring Program for Tidal Wetlands of Delaware, New Jersey & Pennsylvania (MACWA RAM Umbrella QAPP 1.0)

for the project

Development and Implementation of an Integrated Tidal Wetlands Monitoring and Assessment Program in the Barnegat Bay and Delaware Estuaries (New Jersey – Coastal Plan Region.) EPA # CD972259-09

Quality Assurance Project Plan
MACWA RAM Project QAPP v1.2

Barnegat Bay Partnership & Partnership for the Delaware Estuary

Note: The Mid-Atlantic Coastal Wetland Assessment (MACWA) consists of two components: rapid assessment methods (RAM) and site-specific intensive monitoring (SSIM). A general QAPP is available that describes methods and data quality objectives for each of the two components, referred to as the MACWA RAM Umbrella QAPP and the MACWA SSIM Umbrella QAPP. Project-specific statements of work with details such as location information, sampling density and timelines are omitted from the two umbrella QAPPs. These details are included in supplemental, project-specific QAPP's that are considered as addenda to the umbrella QAPPs. This document is Project QAPP 1.2, which is one of the addenda to the MACWA RAM Umbrella QAPP v1.0. Any future revision of the umbrella QAPP will be denoted as a new version number (whole number to the left of the decimal; e.g. from 1.0 to 2.0) and be applied to all addenda (e.g., from 1.2 to 2.2 for this QAPP.)

Date: July 22, 2010

Prepared by: Danielle Kreeger, PhD, Science Director and Angela Padeletti Science Specialist, Partnership for the Delaware Estuary; and Martha Maxwell-Doyle, Barnegat Bay Partnership

Prepared for: United States Environmental Protection Agency, Region 2

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Organization name:	Partnership for the Delaware Estuary & Barnegat Bay Partnership
Effective date:	September 1, 2010[1]
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1.3 Project/Task Organization

The relationships of the main partners are summarized in Figure 1 and identified below. The principal investigator responsible for scientific guidance and analysis is D. Kreeger.

Project Managers

Martha Maxwell-Doyle, Project Coordinator of the Barnegat Bay Partnership (BBP) will be responsible for overall organization and implementation of projects that are funded by this grant received by the BBP. This organization will coordinate various subawards from BBP as well as maintain the official approved QA Project Plan for this project and associated QA documents deemed necessary, such as the Umbrella QAPP linked to this plan.

Danielle Kreeger, PhD, Science Director of the Partnership for the Delaware Estuary (PDE) will be responsible for the overall organization, scientific design, and implementation of the Rapid Assessment. Dr. Kreeger will also serve as the QA Officer for this project on behalf of both NEPs. If subawards from PDE are needed, Dr. Kreeger will coordinate those as well as maintain the officially approved QA Project Plan for PDE and BBP.

Collaborators – Subawardee and Associates

Technical and logistical assistance is expected from MACWA collaborators such as David Velinsky, PhD, Vice President and Director of the Patrick Center for Environmental Research, Academy of Natural Sciences of Philadelphia. Subawardees may provide supplemental staff for collecting of rapid assessment data as well as boat support to access some sites.

State Partners

Thomas Belton, New Jersey Department of Environmental Protection (NJDEP), and Dorina Frizzera, New Jersey Coastal Zone Program (NJCZP) will work with PDE to facilitate coordination and data sharing with other monitoring in New Jersey and help with any state-specific needs of the project.

Federal Partners

US EPA Quality Assurance Officer: Donna Ringel, EPA Region 2, will perform the responsibilities as Quality Assurance Officers for the US Environmental Protection Agency.

US EPA Project Officer: Kathleen Drake Wetland Protection Team, USEPA Region 2 will perform responsibilities as Project Officers for this wetland assessment grant

administered to BBP through US EPA Region 2.

US Fish and Wildlife Service: Edwin B. Forsythe National Wildlife Refuge; ~~Kevin Holcomb~~, will help to coordinate monitoring within the refuge.

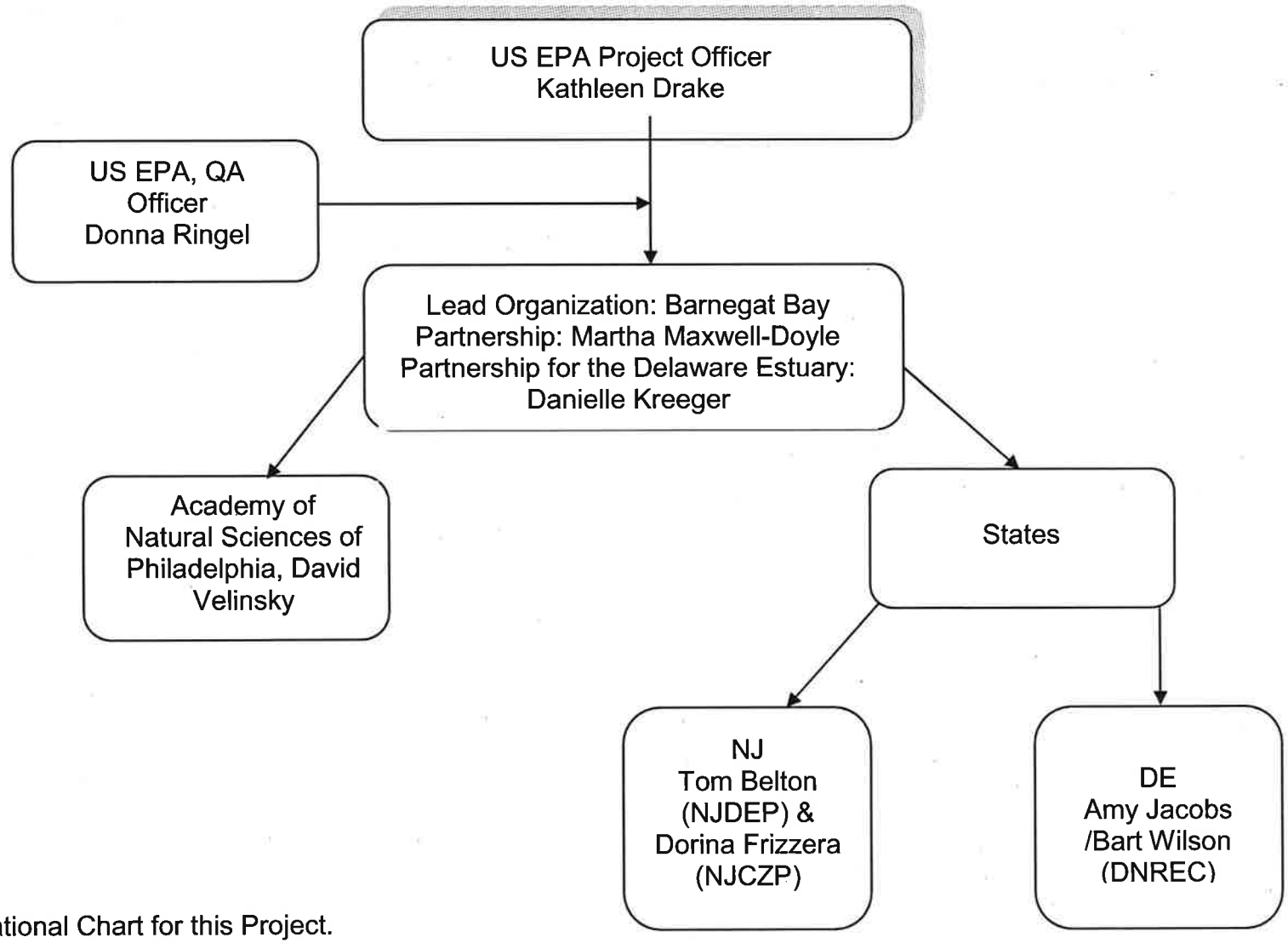

Figure 1: Organizational Chart for this Project.

1.4 Problem Definition/Background

1.4.1 Problem Definition

See page 14, Rapid Assessment Monitoring Program for Tidal Wetlands of Delaware, New Jersey & Pennsylvania, Version 1.0

1.4.2 Background

See page 14, Rapid Assessment Monitoring (RAM) Program for Tidal Wetlands of Delaware, New Jersey & Pennsylvania, Version 1.0. This specific project is an EPA Region 2 State and Tribal Grant awarded to the Barnegat Bay Partnership to permit the first series of rapid assessments for tidal wetlands within Barnegat Bay and to augment rapid assessment in the Ney Jersey portion of the Delaware Estuary.

In Year 1, we will jointly field test the RAM in each of the watersheds, performing at least 2 sites per watershed. These sites will be chosen based off of best scientific judgment and accessibility. Due to the fact that this will be the first time the Mid-Atlantic RAM will be performed in coastal New Jersey, the data and results from Year 1 testing will be analyzed by the Mid-Atlantic Coastal Wetland Assessment Work Group (MACWAG). Each metric will be analyzed to confirm if they are adequate and sensitive enough. The MACWAG will use this information to decide whether the RAM needs any further modification to accommodate differences in tidal marsh types or estuaries.

In Year 2, the (potentially refined) RAM approach will be will be used at 30 random sites; 15 in each of the estuaries. Resulting data will help the state of New Jersey establish baseline data for the health of their coastal marshes, for which there are currently no comparable data.

By comparing the health of assessed tidal wetlands between the two estuaries and with other RAM data from MACWA, we also expect to discern how stressor gradients interact with climate change (specifically sea level rise) to impair marsh status across southern New Jersey.

1.5 Project/Task Description

Sites. A full probabilistic survey of all tidal wetlands in Barnegat Bay and the New Jersey portion of the Delaware Estuary would entail sampling at hundreds of sites to cover the sample frame and subpopulations. Therefore, the initial approach of the Mid-Atlantic Coastal Wetland Assessment (MACWA) will be to focus on distinct watersheds that represent this sample frame and which, together, contain representative subpopulations and varying stressor conditions.

The two representative watersheds selected to be surveyed here will augment efforts by other MACWA grants, which do not have ample funding to assess tidal wetland health in the State of New Jersey (except PDE has one grant to examine condition in the Maurice River watershed.)

We will assess 30 sampling points, 15 in Barnegat Bay and 15 in the Dennis Creek watershed of the Delaware Estuary (Table 1). Figure 2 shows spatially the locations of the two tributary watersheds that will be sampled in this project. Completion of additional sample points (or watersheds) will be contingent on additional grants and addressed with separate project-specific QA plans (addenda to MACWA RAM Umbrella QAPP 1.0) if funded by EPA.

Fifteen points per watershed is suboptimal. Typically 30-50 points per watershed are suggested by the MidTRAM protocol (Mid-Atlantic Tidal Wetlands Rapid Assessment Method; see Appendix C of the MACWA RAM Umbrella QAPP 1.0). Our intent will be to find additional funding to augment the RAM in this project and strengthen the assessment by increasing point density.

Barnegat Bay is reported to contain 24,551 hectares of tidal wetland the Delaware Estuary contains 11,709 hectares, based off of the latest data. To maintain a similar level of point density per studied watershed, HUC12 units will be used to denote a RAM study watershed, with the goal of 30 or more sample points (more if wetlands are diverse in type along a salinity gradient for example.)

The hydrologic unit code (HUC)12 watershed to be studied for this project in the Delaware Estuary will be Dennis Creek in southwestern New Jersey (Table 1.) This watershed was chosen because there are some existing data available from past coring studies, and some marshes in the watershed have been used as reference monitoring stations for wetland restoration projects elsewhere. Generally, Dennis Creek is not as impaired as other adjacent watersheds such as the Maurice River watershed which receives comparatively high nutrient loadings (Fig. 2.) Furthermore, PDE will perform RAM on the Maurice River with other funding, and so a comparison of RAM data between similar type salt marshes in the Maurice (nutrient impaired, largely impounded) and Dennis (reference) will be particularly informative for establishing break points for the RAM scoring.

This project will be the first use of the Mid-Atlantic Tidal Wetlands Rapid Assessment Method (Mid-TRAM) in coastal New Jersey. Due to this fact the 15 sites measured in the Barnegat Bay estuary are not to be determined by HUC 12 delineations. Fifteen points will be randomly determined over the entire watershed. It is hoped from this initial study of 15 points that the estuary programs can better focus on specific watersheds (with future grants) within the Barnegat once this data is analyzed.

Table 1: Survey design for rapid assessment of 30 tidal wetland sample points within two representative watersheds in New Jersey.

State	Watershed	Estuary Region	Dominant Marsh Type	Points	Year
NJ	Barnegat Bay	Polyhaline	Salt marsh	15	2 (2011)
NJ	Dennis	Polyhaline	Salt marsh	15	2 (2011)

Per watershed, the 15 sample points will be randomly selected with the environmental statisticians at US EPA's Western Ecology Division. We will provide EPA with the USFW National Wetlands Inventory GIS layer for the watersheds of interest (Barnegat Bay and Dennis Creek) and which delineate tidal (estuarine) from non-tidal (palustrine) wetlands. We will request a 2x – 3x overdraft of random points within each watershed. The additional points will be sequentially selected if additional funding is acquired to boost sample point density as well as to allow for the rejection of sample points from the initial set of thirty in the instance that a site is inaccessible or for any other reasons that are stated in the Mid-Atlantic Tidal Wetlands Rapid Assessment Method (Appendix C of the MACWA RAM Umbrella QAPP 1.0) in the section "Establishing the Assessment Area".

Tidal wetlands are impacted by diverse stressors. Salt marshes appear impacted by seaward erosion, drowning due to sea level rise, and interior decay from various anthropogenic and natural disturbances; whereas, brackish marshes are disturbed by invasive *Phragmites*, hydroplogic alterations, development, etc. Freshwater tidal marshes appear most degraded by contaminants, nutrients, hydrologic alteration, and development. All appear constrained in their landward migration by development in their buffers. By surveying 15 points in each watershed, we will begin to characterize the condition of the principal diversity of stressors and marsh types across the estuary.

All equipment needed to perform this study can be found in Appendix C of the MACWA RAM Umbrella QAPP 1.0. There are no special personnel required for this project, only training that is described in section 1.7.

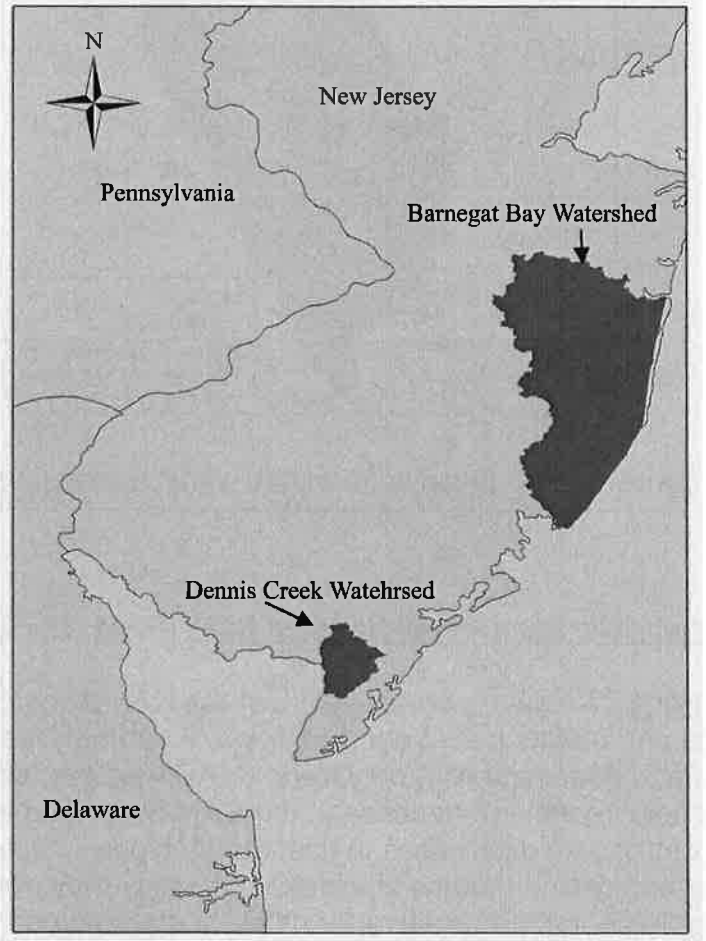

Figure 2: Map of two watersheds in New Jersey, within which 15 rapid assessment sites per watershed will be sampled.

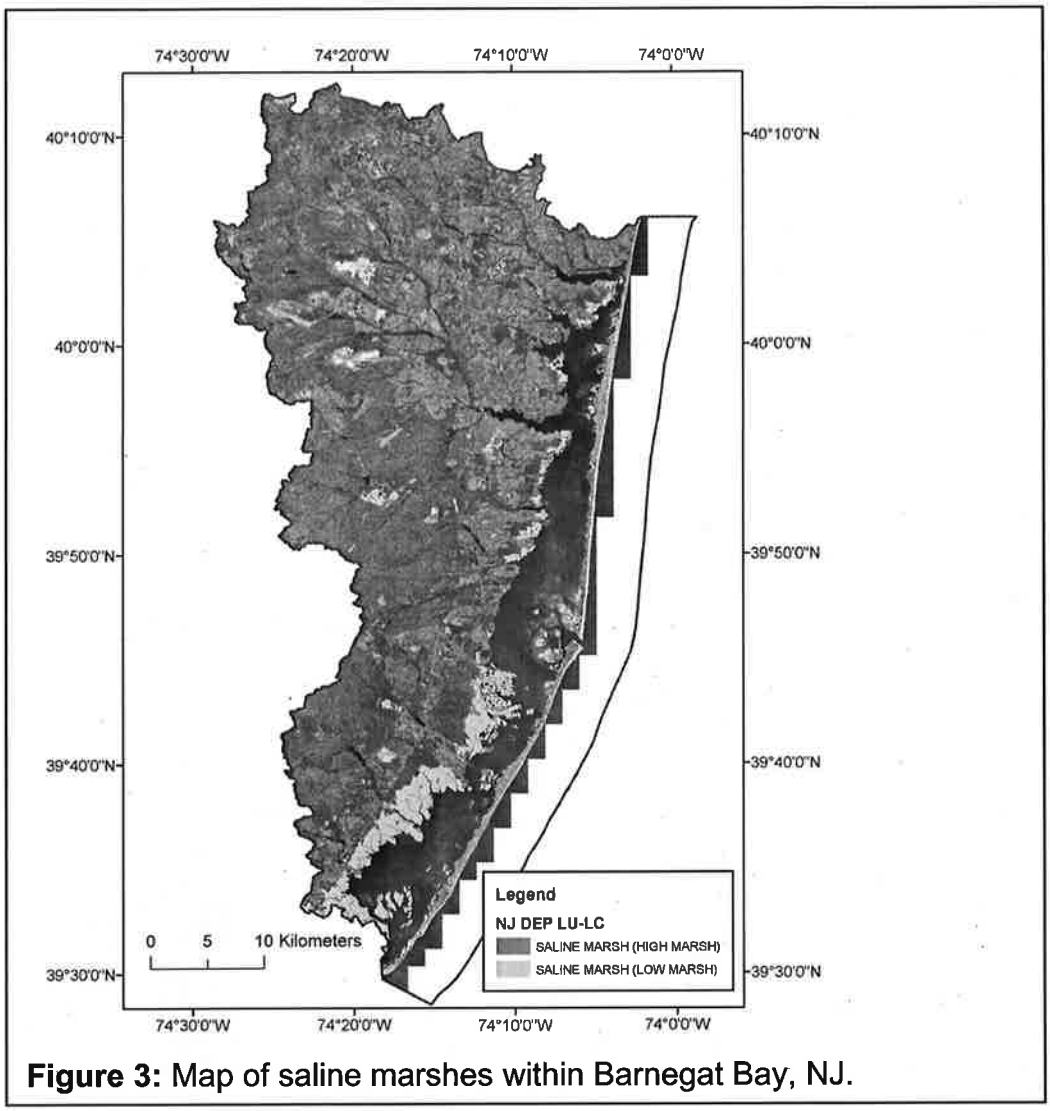

Figure 3: Map of saline marshes within Barnegat Bay, NJ.

Probabilistic Sampling at Random Sites (RAM, Tier 2):

Timeline: In Year 1, we will field test the RAM at each of the two watersheds. Data and results from Year 1 testing will be analyzed by the Mid-Atlantic Coastal Wetland Assessment Work Group (MACWAG) during the winter following the first field season. If necessary, the RAM may need to be modified to accommodate differences in tidal marsh types or estuaries. For example, "core" parameters and metrics of widespread utility may need to be augmented with "supplemental" parameters for different marsh types or issues that exist in different states and conditions. The MACWAG will make these decision in the winter of Year 1. In Year 2, the (potentially refined) RAM approach will be used at 15 random points in each of the estuaries, as described above.

Roles of Partners: PDE will coordinate all rapid assessment tasks associated with this grant. PDE will be responsible for communicating among various collaborators and the MACWAG including staff from BBP, NJDEP and EPA Region 2. If needed, PDE and BBP will establish subawards, oversee the work, and manage budgets for any assisting entities.

PDE staff who has been QAed by Delaware's Department of Natural Resources and Environmental Control will consistently lead all RAM activities in the field, and they will also manage RAM data according to the QA program. BBP staff and potentially others will assist PDE in field work, help to interpret results for diverse audiences, and prepare interim and final reports.

The MACWAG will provide technical guidance and in-kind support. Member organizations with local knowledge of targeted watersheds will be engaged as subawardees. Examples include the Academy of Natural Sciences (ANSP), NJ Department of Environmental Protection (NJDEP), Rutgers University, and possibly also Villanova University.

Staff from NJDEP plan to materially participate in both technical advising and field assessments. Example individuals are Dorina Frizzera and Dr. Thomas Belton.

Primary data collected in this project will be synthesized with secondary data obtained from our partners to begin to develop a network of wetland condition information across the Delaware Estuary and the adjacent coastal habitats. Associated datasets and reports will be interpreted in the context of stressor gradients (nutrients, contaminants, development) and climate change (sea level rise, species range shifts). Condition data will also be contrasted with information being collected in intensive studies at fixed stations to begin to deduce relationships between tidal wetland condition and function, with management implications regarding ecosystem services, restoration planning, and climate adaptation.

1.6 Quality Objectives and Criteria for Measurement Data

See Rapid Assessment Monitoring Program for Tidal Wetlands of Delaware, New Jersey & Pennsylvania, Version 1.0 (page 14).

1.7 Special Training Needs/Certification

See Rapid Assessment Monitoring Program for Tidal Wetlands of Delaware, New Jersey & Pennsylvania, Version 1.0 (page 14)

1.8 Reporting, Documents, Records & Reports to Managment

BBP and PDE will work with the Mid-Atlantic Coastal Wetland Assessment Group (MACWAG) to review data and reports and make any adjustments deemed necessary. BBP and PDE will also share reports with their respective Science and Technical Advisory Committees (STACs) for peer review.

All final data products will be kept at the Wilmington, DE offices of the PDE and a copy retained at the Toms River offices of BBP. Electronic versions of all data will be backed up electronically on the PDE server as well as copied onto a CD monthly.

All data (hard copy and electronic) will be stored at PDE for a period of 10 years after the conclusion of the project. Electronic formats of data will include excel files, word documents, MS access files, csv files, jpgs. Paper field notes will be copied and stored at the PDE offices as well as provided to the project partners.

A final report for this project will be prepared 90 days after the project period ends (12/31/2013) in a legible font style and size. This report will summarize all methods, field data, lab data (if appropriate), and provide a report about the field audit. All field logs and data sheets will be archived at PDE for a minimum of 10 years. Data obtained from this project might be used to produce a manuscript for submission to a peer reviewed journal.

Intern reports will be submitted 30 days after each yearly anniversary of the award. If an subawards are issued, subawardees will be required to provide interim reports to PDE and BBP as to their specific contracts as well as a final report to the Project Managers. Any such reports will also be archived at PDE as noted above.

Monitoring and Assessment data will be in the following documentation:

- Field data sheets
- Field log books
- Field validation sheets
- Site maps
- Sample preparation notes
- Laboratory analysis reports
- QC checks of laboratory results
- Calibration of instrument results
- Instrument printouts
- QAPP reports
- Computer database of field data
- Computer files of background papers and reports
- Yearly Reports
- Final Report

2.1 Sampling Process Design/Monitoring Process Design (Experimental Design)

This probabilistic study aims to elaborate and expand wetlands work that is currently being done in the Delaware Estuary by partners as the State of Delaware as well as the Center for the Inland Bays. The area of immediate interest includes Barnegat Bay, a shallow lagoonal estuarine system, as well as the Delaware Estuary, with more classical estuary geography. It is hoped that MACWA will be expanded in coverage to include the entire sample frame, consisting of tidal wetlands between coastal New Jersey and coastal Delaware. It is also hoped that rapid assessments will be sustained and become a periodic, regular form of monitoring in the states of Delaware, Pennsylvania and New Jersey, perhaps with rotating assessments in different sub-watersheds every 5-10 years.

This program is working with the national guidance from USEPA (http://www.epa.gov/owow/wetlands/monitor/) and associated documents such as; Application of Elements of a State Water Monitoring and Assessment Program For Wetlands. April 2006. Wetlands Division Office of Wetlands, Oceans and Watersheds, U.S. Environmental Protection Agency. Many of the metrics included in these protocols are standard, but some are also more experimental in nature. Standardized metrics are preferred to ensure that as much useful and comparable data are collected as possible. Standardized metrics are usually more readily compared to the historical record. New experimental metrics are being tested as well, however, because they might result in more insightful information products than traditional measures.

The subpopulations of this study will be wetland type (oligohaline, mesohaline, polyhaline), state (DE, NJ, PA), and major estuary system (e.g., Delaware, Barnegat.) By including these subpopulations it is hoped that resulting data can be extrapolated to give a baseline of the overall condition of tidal wetlands in the MACWA sib-region. With corresponding data from Tier 4 intensive studies at representative fixed stations within the same sub-watersheds, resulting comparisons and scientific findings will be strengthened and yield more useful outcomes for managers in land use planning and climate adaptation planning.

Besides variability among wetland types, watersheds, and states, we expect there to be some seasonal and inter-annual variation among major RAM efforts funded by different projects. This variability will be limited by performing the rapid assessments at the peak of the growing season (summer to early fall) consistently across the MACWA sub-region and projects. We expect to also see soil profile changes throughout both estuaries. Any weather variations that occur during sampling or among sampling years will be documented in the field notes (Appendix E) and analyzed through repeated assessment at the same points (up to 10%) over appropriate time scales.

The number of sampling points and specific metrics to be performed within each watershed will vary depending on the funding available to that project. A more detailed description of this will be found in each project addendum. Ideally, at least 30-50 sample points will be assessed per HUC8 or HUC12 watershed.

The array of points will be determined for each watershed with the help of US EPA's Western Ecology Division and their environmental statisticians. For each watershed to be examined, PDE will provide EPA with the most recent available USFW National Wetlands Inventory GIS layer that has vegetated tidal wetlands identified (we will not assess non-vegetated habitat attributes.) We will ask EPA to provide at least 2x as many points (and preferably 3X) as are needed to allow for sequential random replacement of points in instances where a site is inaccessible or in the case that additional funds are obtained to increase the sample point density (or for any other reasons that are stated in the Mid-Atlantic Tidal Wetlands Rapid Assessment Method (see Appendix B, section "Establishing the Assessment Area".)

One limitation of rapid assessments is that the results are typically only a "snap shot" of the wetland condition of that particular watershed at one point in time; however, as noted above, our long-term objective is to repeat assessments in each watershed on a rotating basin, hopefully by building state capacity to assume management and continued operation of MACWA. In the short-term, the MidTRAM will only be performed once within a particular sub-watershed and then any additional resources will be dedicated to performing assessments in unassessed sub-watersheds until complete coverage is achieved for each major estuary or basin.

Types of metrics and associated data collection protocols for the MidTRAM 2.0 are fully described the Mid-Atlantic Tidal Wetland Rapid Assessment Method (See Table 1 and Appendix B). No grab-type samples are taken in the MIDTRAM and so there are no subsequent lab analyses required. Therefore, all data are collected in the field at each sample point on the day of the assessment. Some office analysis of aerial imagery is required for buffer and land use metrics to ensure that a sufficient number of sample points are chosen to capture the full diversity of major tidal wetland types and stressor conditions within each sub-watershed. However, we will not stratify the points by marsh type and the relative proportion of different marsh types assessed will reflect their relative acreage within each point array (i.e. watershed.)

If a chosen sample point is not accessible or suitable, decisions to move or otherwise adjust the location will be made as per the Mid-Atlantic Tidal Wetland Rapid Assessment Method (Appendix B.)

We expect to see considerable variability among different fields of sampling points in different watersheds due to their unique stressor gradients, arrays of marsh types, and subpopulation characteristics. Reference points for highest and lowest condition, might also differ somewhat among point fields and marsh

types, but this is intentional and should reflect true differences. If RAM scores are found to consistently be lower across numerous watersheds for a specific type of tidal wetland, then we might need to further adapt the MidTRAM to ensure broad applicability and consistency for all subpopulations, thereby refining our knowledge about the overall health of tidal wetlands across the whole estuary

2.2 Sampling Methods/ Monitoring Methods

Step I. MidTRAM Sampling

MidTRAM sampling will follow the protocols set forth in the Mid-Atlantic Tidal Wetland Rapid Assessment Method V2.0 (Appendix B), and all QA procedures that are in the Quality Assurance Project Plan for State of Delaware's Wetland Monitoring and Assessment Program (Appendix C) that pertain to the MidTRAM sampling. A list of equipment can be found in the MidTRAM (Appendix B).

Potential problems are most likely to arise when determining the assessment areas (AA) and subplots within the AA. These concerns are addressed within Appendix B in the section titled "Establishing the Assessment Area". If other problems arise, these will be addressed by the team leader at the time. If cell phone reception is accessible the team leader will call the project manager and discuss problems. If the project manager cannot be accessed, the field team will use their best judgment and record any and all deviations from the methodologies. When the field team returns the situation will be fully discussed with the project manager, and any changes in protocol or sample points will be discussed. If any material changes in methods are needed, they will be fully disseminated to all field teams, team leaders, and the QAPP will be adjusted accordingly.

PDE and BBP staff, and all project partners, will routinely clean field gear prior to leaving field sites to avoid unintentional dispersal of invasive species, particularly seeds from plants. Cleaning includes washing gear, boots, and other apparel with brushes and a jug of tap water taken to the field for this purpose, and ensuring that no ambient water or mud is trapped in gear or boots and carried among locations. All field equipment will be cleaned before entering a new site, to prevent cross contamination or dispersal of seeds.

2.6 Sample Handling and Custody Requirements

Data collected on data sheets and log books will be kept in project specific bags that will be taken on each field day so that all data will be kept in one place. Every two weeks, the Project Manager or PDE science staff will collect all data sheets and log books to be copied twice to ensure backup of all data, and these copies will be kept at the PDE office.

MIDTRAM sample points will be named by year and state then an abbreviation of the estuary (PDE or BBP), followed by a watershed location abbreviation (e.g., Broadkill= Brk, Maurice= Mar), followed by a point number (i.e. 09DE-PDE-Brk-008). If partner entities such as DNREC collect MidTRAM data to be used by MACWA but which are named differently, then PDE or BBP staff will rename the points and associated data files as per this MACWA convention, retaining a file that explains the matched pairs of names (source name, MACWA name).

Data collected from each sample point will be clearly labeled with this information. There will be no grab samples collected for the MidTRAM. If any samples are collected for supplemental studies, they will follow the same sample point naming convention, but with an additional component in the name that explains the metric or sample.

For sections 2.0 through 3.5, please refer to:

PDE and BBP 2010. Rapid Assessment Monitoring Program for Tidal Wetlands of Delaware, New Jersey & Pennsylvania: Quality Assurance Project Plan Version 1.0 (MACWA RAM Umbrella QAPP 1.0). Prepared by the Partnership for the Delaware Estuary and Barnegat Bay Partnership for EPA, June 2010. 40p.

Project Management and Objectives Elements

1.1 Quality Assurance Project Plan Approval Sheet

Program Title: Rapid Assessment Monitoring Program for Tidal Wetlands of Delaware, New Jersey and Pennsylvania (MACWA RAM Umbrella QAPP 1.0)

Project Title: Development and Implementation of an Integrated Tidal Wetlands Monitoring and Assessment Program in the Barnegat Bay and Delaware Estuaries (New Jersey – Coastal Plan Region.) (MACWA RAM Project QAPP 1.2)

Organization name:	Partnership for the Delaware Estuary & Barnegat Bay Partnership
Effective date:	July 1, 2010[1]
Approval:	
Project Start Date:	July 1, 2010
Project End Date:	December 31, 2013

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Barnegat Bay Partnership

QA Officer: _____ Date: _____
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EPA Project Officer : _____ Date: _____
Kathleen Drake
EPA Wetland Protection Team, USEPA Region 2

EPA QA Officer: _____ Date: _____
Donna Ringel
EPA Region 2

NJ DEP _____ Date: _____
Mark Ferko
NJDEP Office of Quality Assurance

[1] Effective date may be changed to reflect the date of signature of agreement between EPA Region 2, and the Partnerships