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UNH Eelgrass (*Zostera marina*) Monitoring Program Quality Assurance Project Plan

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**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
Office of Environmental Measurement and Evaluation
11 Technology Drive, North Chelmsford, MA 01863-2431**

MEMORANDUM

Date: July 28, 2003

QA Tracking #: RFA - 03384

Subject: QAPP approval
UNH Eelgrass Monitoring Program QAPP
Great Bay Estuary, NH
Prepared by UNH & NHEP (June 2003)

From: Alan Peterson, QA Chemist

To: Jean Brochi, EPA Project Officer

The Quality Assurance Unit has reviewed UNH's Eelgrass Monitoring QAPP (dated June 30, 2003). Based on the information provided, the QAPP meets EPA QA/R-5 requirements and is approved for site work.

Should you have any questions, please feel free to contact me at 617-918-8322.

**UNH Eelgrass (*Zostera marina*) Monitoring Program
Quality Assurance Project Plan**

June 30, 2003

FINAL

Prepared by:

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Durham, NH

Phil Trowbridge
NHEP Coastal Scientist
Department of Environmental Services
Concord, NH

Program Manager:

Signature / Date
Fred Short, Ph.D., UNH

Project QA Officer:

Signature / Date
Jeffrey Gaeckle, UNH

NHDES Quality Assurance Manager:

Signature / Date
Vincent Perelli, NHDES

NHEP/NHDES Project Officer:

Signature / Date
Phil Trowbridge, NHEP/NHDES

USEPA Project Officer:

Signature / Date
Jean Brochi, US EPA Region I

USEPA QA Manager:

Signature / Date
Arthur Clark, US EPA Region I

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A3 – Distribution List

Table 1 presents a list of people who will receive the approved QAPP, the QAPP revisions, and any amendments.

Table 1. QAPP Distribution List

QAPP Recipient Name	Project Role	Organization	Telephone number and Email address
Fred Short	Program Manager	UNH Jackson Estuarine Laboratory	603-862-2175 fred.short@unh.edu
Jeff Gaeckle	Project QA Officer	UNH / JEL	603-862-2175
Jamie Adams	GIS Staff	UNH / JEL	603-862-2175
David Rivers	Field Staff	UNH / JEL	603-862-2175
Phil Trowbridge	NHEP/NHDES Project Officer	NHDES Watershed Management Bureau	603-271-8872 ptrowbridge@des.state.nh.us
Vincent Perelli	NHDES Quality Assurance Manager	NHDES Office of the Commissioner	603-271-8989 vperelli@des.state.nh.us
Jean Brochi	USEPA Project Manager	USEPA New England	617-918-1536 brochi.jean@epa.gov
Arthur Clark	USEPA Quality Assurance Officer	USEPA New England	617-918-8374 Clark.Arthur@epamail.epa.gov
Jennifer Hunter	NHEP Director	NH Estuaries Project	603-433-7187 jennifer.hunter@rscs.net

Based on EPA-NE Worksheet #3

A4 – Project/Task Organization

The project will be completed by the UNH Jackson Estuarine Laboratory. Fred Short is the Program Manager for UNH and is the primary contact for UNH. Fred Short will be responsible for coordinating all program activities. This work is being done under contract for the NH Estuaries Project so the Program Manager will be accountable to the NHEP Coastal Scientist (Phil Trowbridge) and the NHEP Director (Jennifer Hunter). The U.S. Environmental Protection Agency provides funding to the NH Estuaries Project. Jean Brochi is the project manager for EPA.

Daily operations of the project will be managed by the Program Manager. The Program Manager will manage all field staff, be responsible for “stop/go” decisions in the field, and coordinate data analysis.

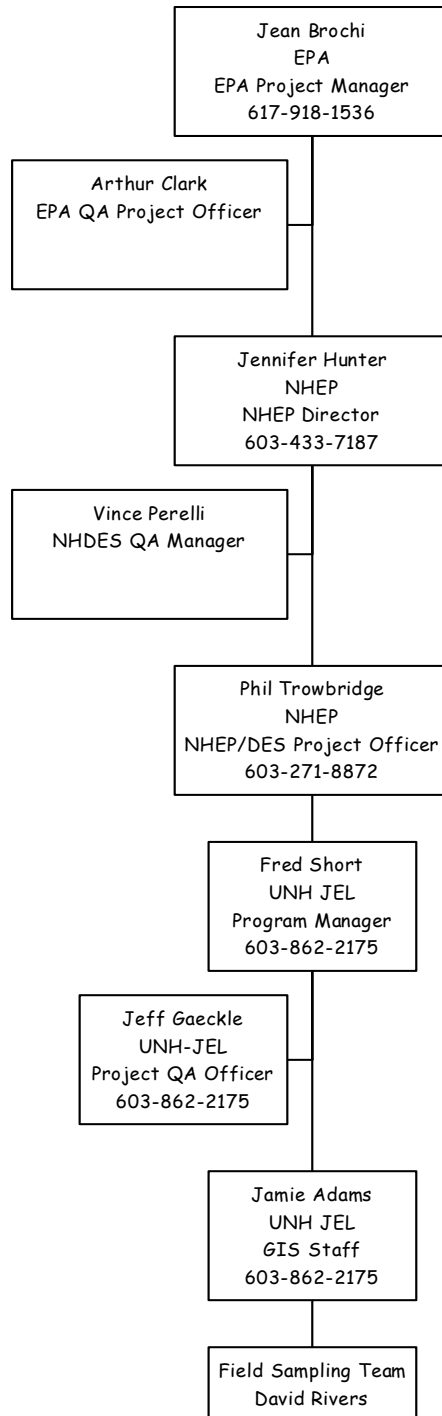
The Project QA Officer will be Jeffrey Gaeckle. The QA Officer will be responsible for a memorandum to the Program Manager summarizing any deviations from the procedures in the QA Project Plan, the results of the QA/QC tests, and whether the reported data meets the data quality objectives of the project. This memorandum should clearly state whether any data should be rejected because they did not pass QA tests.

GIS staff is Jamie Adams. Field staff will include David Rivers. Field staff will report any problems to the Program Manager. The Program Manager will be responsible for resolving any logistical problems and communicating the results to the field staff.

The principal users of the data from this project will be the NH Estuaries Project staff and NHDES. The Program Manager will submit a report to the NHEP/NHDES Coastal Scientist and the NHEP Director at the end of the project with all the data and the QA Officer’s summary report.

Figure 1 shows an organizational chart for this project.

Figure 1. Project organizational chart



A5 – Problem Definition/Background

Eelgrass (*Zostera marina*) is an essential habitat for the Great Bay Estuary because it provides food for wintering waterfowl and habitat for juvenile fish (Thayer et al. 1984, Short 1992).

The UNH Seagrass Ecology Group has mapped the distribution of eelgrass in Great Bay every year from 1986 to 2001 in the Great Bay. The entire Great Bay Estuary system (Great Bay, Little Bay, tidal tributaries, Piscataqua River, and Portsmouth Harbor) was mapped in 1996, 1999, 2000, and 2001. Figure 2 shows the trend in eelgrass cover in Great Bay over time.

Eelgrass cover in Great Bay has been relatively constant for the past 10 years at approximately 2,000 acres. In 1989, there was a dramatic crash of the eelgrass beds down to 300 acres (15% of normal levels). The cause of this crash was an infestation of a slime mold *Labryrinthula zosterae*, commonly called “wasting disease” (Muehlstein et al., 1991). The greatest extent of eelgrass was observed in 1996 following several years of good water quality (Fred Short, pers. comm.). The most recently mapped (2001) eelgrass coverage in the estuary is shown in Figure 3.

Figure 2: Eelgrass coverage in Great Bay

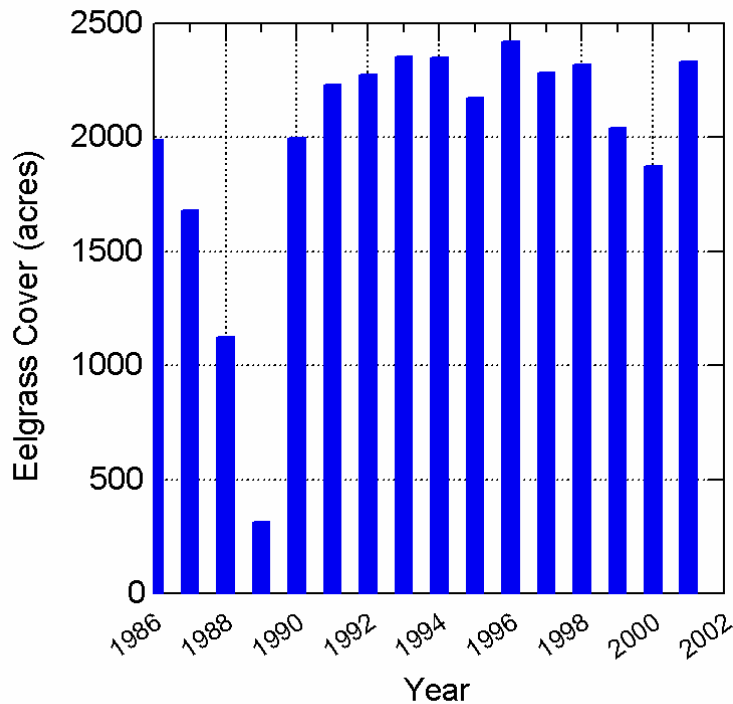
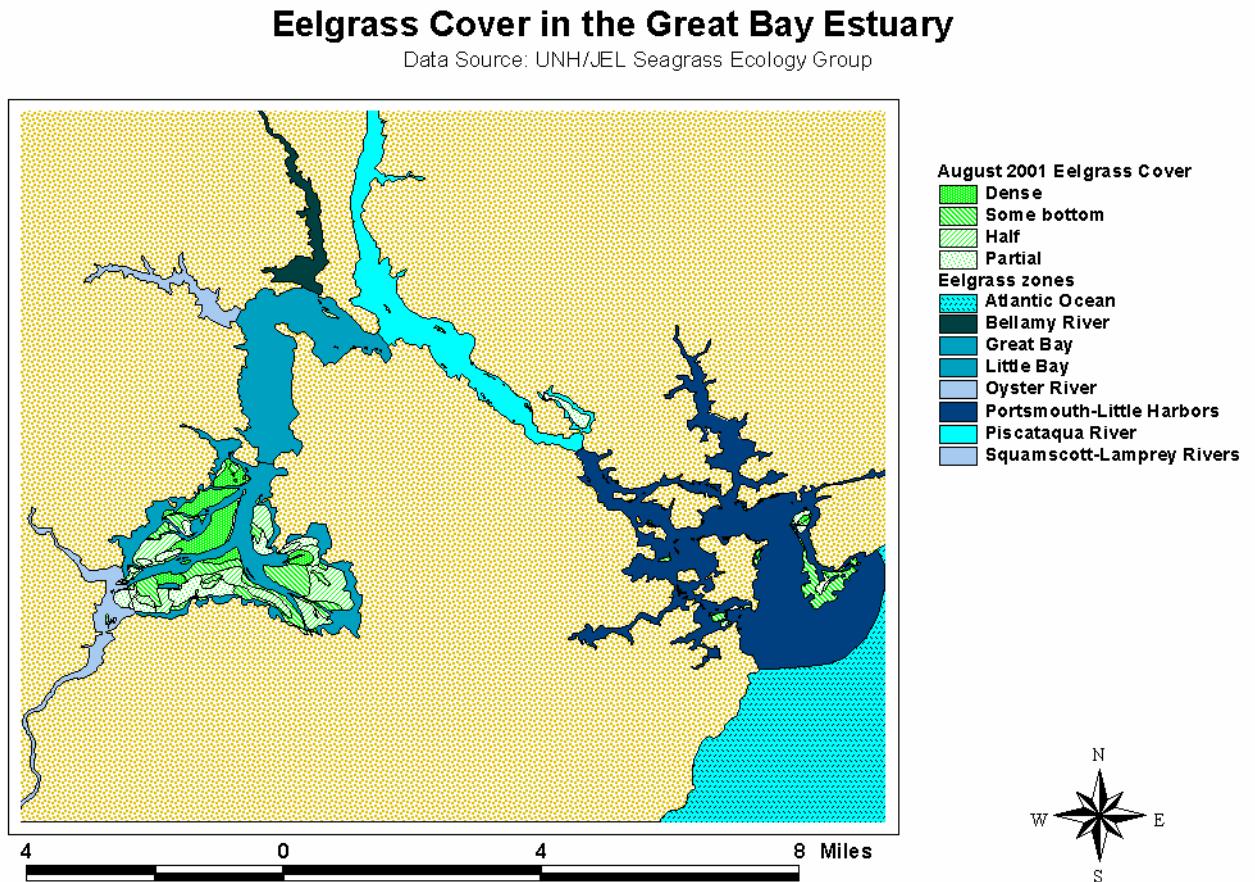


Figure 3: Eelgrass coverage in the Great Bay Estuary in 2001



The New Hampshire Estuaries Project (NHEP) coordinates environmental monitoring in NH's estuarine waters. Maps of eelgrass distribution in the Great Bay Estuary provide useful information on water quality and critical habitats within the estuary. The NHEP has developed a series of environmental indicators to track trends and to evaluate progress toward management goals. Eelgrass distribution is part of the NHEP Monitoring Plan to gather data on these indicators (NHEP, 2003). The NHEP contracted with UNH-JEL to continue this monitoring program in 2003 to ensure that the record of annual assessments would be unbroken.

Maps of eelgrass in the estuary will be used by the NH Estuaries Project, NH Department of Environmental Services, and other coastal resource managers to evaluate trends in eelgrass populations over time.

A6 – Project/Task Description

This project has six main tasks:

1. Prepare QA Project Plan

A QA Project Plan for eelgrass mapping will be produced by UNH. This plan must be approved by the NHEP Coastal Scientist and EPA Region I before field work on this project begins.

2. Train Project Staff

The Program Manager will organize and implement a training session for field and analysis staff. The training session will cover SOPs for field instruments, laboratory instruments, and field data sheets. The training will be based on the QA Project Plan document. Field and laboratory staff will sign an attendance sheet for the training. The training will be completed before sampling begins.

3. Acquire Aerial Imagery of the Estuary for 2003

The Program Manager will organize an aerial overflight in late August 2003 to collect aerial imagery of the eelgrass distribution in the estuary at low tide.

4. Ground-Truth Aerial Imagery

The Project Manager will organize field crews to ground-truth the aerial imagery from 2003.

5. Generate Maps of Eelgrass Distribution in 2002

Using aerial imagery and ground-truthing data from 2002, the Project Manager will coordinate the analysis and development of eelgrass distribution maps for 2002. The aerial imagery for 2002 was obtained during a previous project, but it has not been interpreted to generate eelgrass distribution maps for 2002. The methods for acquiring the imagery in 2002 were the same as will be used in 2003. The imagery from 2003 will be interpreted in 2004 under a different project.

6. Prepare Final Report

The final work product will be ArcInfo files of eelgrass distribution throughout the Great Bay Estuary for 2002, all necessary documentation/metadata for the ArcInfo files, and a final report describing the results and any deviations from the protocols established in the QA Project Plan.

Table 2. Project Schedule Timeline

Activity	Dates (MM/DD/YYYY)		Product	Due Date
	Anticipated Date(s) of Initiation	Anticipated Date(s) of Completion		
QAPP Preparation	6/1/03	7/15/03	QAPP Document	7/15/03
Field Team Training	7/15/03	7/30/03	Training Documentation	8/1/03
Acquire aerial imagery and ground truth imagery	8/1/03	10/30/03	Not applicable	NA
Final project report preparation	10/1/03	12/31/03	Final report	12/31/03

Based on EPA-NE Worksheet #10.

A7 – Quality Objectives and Criteria

This study is primarily an interpretation of aerial imagery with quality control ground-truthing checks. No laboratory measurements will be made. Therefore, not all of the standard data quality objective indices are relevant. Appendix D of EPA guidance on QAPP elements for geospatial studies (EPA, 2003) was consulted and used a guide for the correct location of relevant information within this and other sections of the QAPP.

Precision: Not applicable.

Accuracy: The method for mapping eelgrass in the Great Bay Estuary generally follows the standardized “C-CAP” protocol for mapping submerged aquatic vegetation (Coastal Change Analysis Program, NOAA). The aerial photographs are taken at 3,000 feet with roughly 60% overlap. Photographs are taken with a 35 mm camera at near vertical angles.

Representativeness: The entire estuarine system will be mapped so the results will be representative of the whole system.

Comparability: The method to be used for acquiring the imagery is a modification of the C-CAP protocol. The method is described in previously published papers (Short and Burdick, 1986).

Sensitivity: Not applicable.

Completeness: Not applicable.

A8 – Special Training/Certification

The Program Manager will organize and implement a training session for field and laboratory staff. The training will be based on the QA Project Plan document. Field and laboratory staff will sign an attendance sheet for the training, which will be retained by the Program Manager and included in the final report. The training will be completed before sampling begins.

Table 3. Special Personnel Training Requirements

Project function	Description of Training	Training Provided by	Training Provided to	Location of Training Records
Eelgrass ground truthing methods	Field method SOPs, and field data sheets. This training will be conducted once at the beginning of the field season.	Program Manager	All field team staff and analysis staff.	With Program Manager and included in final report to NHEP.

Based on EPA-NE Worksheet #7.

A9 – Documents and Records

QA Project Plan

The Program Manager will be responsible for maintaining the approved QA Project Plan and for distributing the latest version to all parties on the distribution list in section A3. A copy of the approved plan will be on file with the NHEP Coastal Scientist at the DES offices, 6 Hazen Drive, Concord NH.

Reports to Management

The Program Manager will provide a final report to the NHEP Coastal Scientist. The final report will contain ArcInfo files of eelgrass distribution throughout the Great Bay Estuary, all necessary documentation/metadata for the ArcInfo files, and a final report describing the results and any deviations from the protocols established in the QA Project Plan.

Archiving

The QA Project Plan and final report will be kept on file with the NHEP Coastal Scientist at DES in Concord for a minimum of 10 years after the publication date of the final report.

B1 – Sampling Process Design

Images will be acquired with a 60% overlap. Typically 300 images are needed to cover the entire Great Bay Estuary. Ground-truthing requirements are discussed in Section B5.

B2 – Sampling Methods

Aerial photographs are taken at 3000 feet at low spring tide with roughly 60% overlap on a calm day without preceding rain events and when the sun is at a low angle to minimize reflection (between 7 am and 10 am). Photographs are taken in late summer, usually late August or early September, depending on tides and weather, to reflect the maximum eelgrass annual biomass. 35 mm film (ASA 200) will be used to acquire the images. The orientation of the photographs is near-vertical. This is a slight deviation from the C-CAP protocol, but follows a published method (Short and Burdick, 1986).

B3 – Sample Handling and Custody

Photographs will be archived by the Project Manager at UNH. Methods for transferring analog images to digital files are discussed in Section B4.

B4 – Analytical Methods

The photographs, in the form of 35mm slides or digital computer images, are projected on a screen and the eelgrass images are transferred to a base map. These maps are then digitized and verified using the ground truthing data (discussed in Section B5) by placing the ground-truthing locations onto the digital image using ArcInfo software.

B5 – Quality Control

Ground-truthing will be done from a small boat during the same season as the photographs are taken. Observations are made at low tide. Samples are collected with an eelgrass sampling hook. Positions are determined using GPS. The ground-truth surveys assess 10-20% of the eelgrass beds mapped in the estuary.

B6 – Instrument/Equipment Testing, Inspection, Maintenance

Not applicable.

B7 – Instrument/Equipment Calibration and Frequency

Not applicable.

B8 – Inspection/Acceptance Requirements for Supplies and Consumables

Not applicable.

B9 – Non-direct Measurements

Not applicable.

B10 – Data Management

ArcInfo files of eelgrass in the estuary are maintained by the UNH Seagrass Ecology Group.

C1 – Assessments and Response Actions

Review and assessment of all aspects of this project is the responsibility of the Program Manager. The Program Manager will be involved with all aspects of this project. If problems occur, appropriate adjustments will be made. All such changes will be recorded and reported to the NHEP Project Manager immediately.

C2 – Reports to Management

The Program Manager will provide the following hardcopy reports to the NHEP:

- Interim Report #1 (due 6/30/03): An update on all activities between 4/1/03 and 6/30/03, including completion of a QA Project Plan.
- Interim Report #2 (due 9/30/03): A one page update on all activities between 7/1/03 and 9/30/03.

- Final Report (due 12/31/03): The final report will contain ArcInfo files of eelgrass distribution throughout the Great Bay Estuary, all necessary documentation/metadata for the ArcInfo files, and a final report describing the results and any deviations from the protocols established in the QA Project Plan.

D1 – Data Review, Verification and Validation

The Project QA Officer will review the methods used to acquire, process, and interpret data on eelgrass distributions in Great Bay to verify that the methods follow the procedures outlined in this QA Project Plan (Sections A7, B1, B2, B3, B4, and B5). The Project QA Officer will be responsible for a memorandum to the Program Manager summarizing any deviations from the procedures in the QA Project Plan, the results of the QA/QC tests.

D2 – Verification and Validation Procedures

The Program Manager reviews the memorandum from the QA Officer to see if there have been deviations from the QA Project Plan. Any decisions made regarding the usability of the data will be left to the Program Manager; however, the Program Manager may consult with project personnel, the NHEP Project Officer, or with personnel from EPA-NE, if necessary.

D3 – Reconciliation with User Requirements

The Program Manager will be responsible for reconciling the results from this study with the requirements of the study (the ultimate use of the data). Results that are qualified by the Project QA Officer may still be used if the limitations of the data are clearly reported to decision-makers. Data for this project are being collected as part of a long-term monitoring program. It is not possible to repeat sampling events without disrupting the time series. Therefore, the Program Manager will:

1. Review data with respect to sampling design.
2. Review the Data Verification and Validation reports from the Project QA Officer.
3. If the project objectives from Section A7 are met, the user requirements have been met. If the project objectives have not been met, corrective action as discussed in D2 will be established by the Program Manager prior to the next monitoring event.
4. Draw conclusions from the data.

References

- EPA (2003) Guidance for Geospatial Data Quality Assurance Project Plans. EPA QA/G-5G. EPA/240/R-03/003. U.S. Environmental Protection Agency, Office of Environmental Information, Washington DC. March 2003.
- Muehlstein LK, Porter D, Short FT (1991) *Labyrinthula zosterae* sp. Nov, the causative agent of wasting disease of eelgrass, *Zostera marina*. *Mycologia* **83**: 180-191.
- NHEP (2003) NHEP Monitoring Plan. NH Estuaries Project, Office of State Planning, Portsmouth, NH. March 2003.
- Short FT and Burdick DM (1996) Quantifying eelgrass habitat loss in relation to housing development and nitrogen loading in Waquoit Bay, Massachusetts. *Estuaries*, **19**:730-739.
- Short, F.T. 1992. (ed.) The Ecology of the Great Bay Estuary, New Hampshire and Maine: An Estuarine Profile and Bibliography. NOAA - Coastal Ocean Program Publ. 222 pp.
- Thayer GW, Kenworthy WJ, Fonseca MS (1984) The ecology of eelgrass meadows of the Atlantic coast: a community profile. US Fish and Wildlife Service, FWS/OBS-84/02, 147 pp.