Quality Assurance Project Plan (QAPP) for the Assessment of Parcels for Marsh Migration Potential in Rhode Island

EPA WPDG CD00A01323

EPA QA Tracking # 25162

June 24, 2025

State of Rhode Island Department of Environmental Management
Office of Water Resources and Narragansett Bay National Estuarine Research Reserve

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A3. Table of Contents

A. PROJECT MANAGEMENT

A3. Distribution List (EPA QA/R-5 A3)

- Signatories (Title Page) (EPA QAPP Standard A1)
    - Michele McCaughey, michele.mccaughey@dem.ri.gov
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- Rhode Island Coastal Resources Management Council (CRMC), Leah Feldman, Policy Analyst, lfeldman@crmc.ri.gov
- Rhode Island Natural History Survey (RINHS), Wetlands Scientist, Thomas Kutcher, tkkutcher@rinhs,org

A4. Project Organization (EPA QA/R-5 A4) (EPA QAPP Standards A8 and A10)

The Department of Environmental Management (DEM) Office of Water Resources and the Narragansett Bay National Estuarine Research Reserve (NBNERR) will be the lead agencies to co-manage and implement this project. DEM has contracted with the RI Natural History Survey (RINHS) and the RINHS has recruited and hired staff. Qualified and experienced personnel are available to execute the work. The following people will administer and conduct this work as outlined below and depicted in Figure 1.

- Michele McCaughey, Environmental Scientist III, DEM Office of Customer and Technical Assistance (OCTA) - Quality Assurance Manager;
- Elise McNally, EPA Region 1 - Quality Assurance Reviewer;
- Donna Smith-Williams, EPA Region 1 - Wetland Program Development Grant Project Officer and primary point of contact;
- Susan Kiernan, Administrator, DEM Office of Water Resources – DEM Program Manager, Responsible for contract agreement and fiscal grant management, and general program oversight;
- Caitlin Chaffee, Reserve Manager, NBNERR – Responsible for project management and communication;
- Kenneth Raposa, PhD., Research Coordinator, NBNERR – Project Quality Assurance Officer. Experienced salt marsh research ecologist with over 30 peer-reviewed publications, salary-funded externally to this QAPP. Responsible for data review, quality assurance as described below, report writing, supervision of field staff, and other duties consistent with this QAPP;
- David Gregg, RINHS, Executive Director – Responsible for contract management and supervision of RINHS staff; and
- Thomas Kutcher, Wetland Scientist, RINHS – Responsible for field and office data collection, entry and analysis, QAPP and report writing, and supervision of field staff.

Project Quality Assurance Manager Independence

The DEM Quality Assurance Manager (QAM) is a salaried state employee working independently of the environmental information operations subject to this QAPP. The QAM will not be involved with the program or project management of the Project.

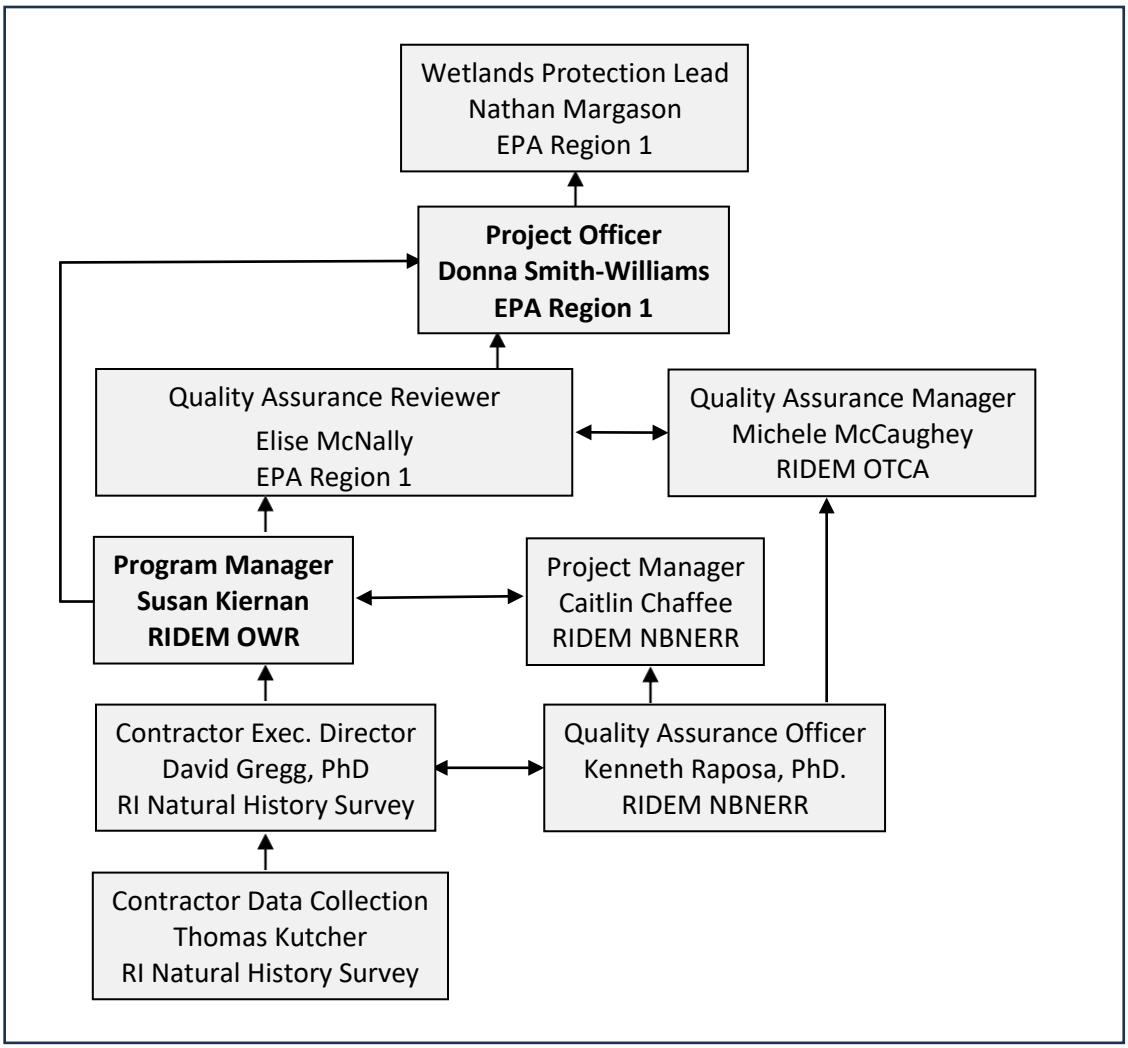

Figure 1. Organizational Chart for Project management and quality assurance.

A5. Problem Definition/Background (EPA QA/R-5 A5) (EPA QAPP Standard A4)

Background

Salt marshes have been migrating landward for centuries and the rate of migration has recently been increasing. Migration of salt marshes can alleviate environmental stress by allowing marshes to vegetate adjacent uplands as they may lose seaward area. Marsh migration can also be a concern for coastal property owners who risk losing properties to coastal inundation. Coastal property owners may choose to conserve some or all of their properties to mitigate losses and allow for marsh migration. State managers and planners have used Geographic Information Systems (GIS) to develop mapping tools to help municipalities plan for inevitable marsh migration onto coastal properties. A statewide coastal planning model was used to broadly predict marsh losses and migration gains across coastal Rhode Island (CRMC 2015), which has framed the general issue for state and municipal coastal planners. However, more precise information was needed to begin specific planning actions.

More recently, efforts were made to refine the coastal planning model to assess migration potential on the parcel scale, so coastal planners and managers can assess options for individual coastal property owners. The more recent model, the Salt Marsh Coastal Parcel Planning Tool (hereafter, SM Planning Tool) (URI EDC 2023) contains higher-resolution information on elevation, coastal inundation from tides and storms, and ownership at the parcel level. With ground verification and supplementary field data, this information can be used by planners and managers to target individual parcels for partial or total conservation, allowing for marsh migration while protecting valuable property and infrastructure from unexpected harm.

This QAPP details the quality assurance procedures for a project (hereafter, the Project) that involves the development of a Marsh Migration-Potential Field Assessment Method (hereafter, Field Method) to support the SM Planning Tool. This tool will validate the findings of the SM Planning Tool and provide reliable, field-based information to help coastal planners, managers, and property owners make important decisions about coastal properties facing the potential risks and benefits of ongoing and increasing marsh migration.

A6. Project/Task Description and Schedule (EPA QA/R-5 A6) (EPA QAPP Standard A5)

The Project will assess the utility of existing and new metrics to characterize the potential for marshes to migrate onto specific parcels that have been classified as *high priority* for marsh migration by the Planning Tool. Priority parcels will be visited during the growing season (June through October) to determine various physical, biological, and cultural attributes that together determine the potential for marsh migration, the relative risk for infrastructure and buildings, and the relative effort for management actions.

The Project use existing and new data collection methods to develop a single model to guide the Field Method (Table 1). Data based on existing parameters and methods will use EPA-approved quality assurance procedures detailed in an earlier approved QAPP titled *Quality Assurance Project Plan (QAPP) for Nine Salt Marsh Monitoring and Assessment Methods, applicable July 2024 through July 2029* (EPA QA Tracking # QA24157) (DEM 2024) (hereafter the "Methods QAPP"), available at: https://dem.ri.gov/sites/g/files/xkgbur861/files/2025-06/ninemethod-saltmarsh-qapp-24157.pdf, whereas procedures for data collected using new methods developed specifically for this Project are detailed below.

The Field Method will be developed and tested (i.e., piloted) across 10 coastal parcels in Rhode Island with existing state ownership or under conservation easement for marsh migration. Development of the Field Method will entail GIS and field assessment of the parcels using the MarshRAM Migration Potential metric (Appendix A), enhanced with additional information and precision needed to inform the risks and migration potential at the parcel level. Once the Field Methods are developed, piloted, and finalized, they will be applied to 10 parcels classified as *high priority* by the Planning Tool. The timeline for the Project is outlined in Table 2.

Table 1. Sampling parameters to be piloted for the Marsh Migration-Potential Field Assessment Method with references to the methods, procedures, and relevant quality assurance project plans.

#	Sampling Parameter	Method Source	QAPP Reference
1	MarshRAM Section F, Migration Potential	Kutcher 2022	Methods QAPP 2024
2	Characterization of the Marsh-Upland Ecotone	Raposa et al. 2002	Methods QAPP 2024
3	Characterization of Elevation and Slope	This QAPP	This QAPP
4	Distance from Marsh Edge to Infrastructure	This QAPP	This QAPP

Table 2. Timeline for Project activities.

Activity	Start Date	End Date
Method Development	Prior to this QAPP	December 2025
Piloting the Method (10 Parcels)	August 2025	October 2025
Applying the Method (10 Parcels)	July 2026	September 2026
Project Reporting	November 2025	December 2026

A7. Quality Objectives and Criteria for Measurement Data (EPA QA/R-5 A7)

Measurement data will be collected with the intent of characterizing landscape and cultural features for the purpose of informing management actions. The quality objective is that data accurately represent actual conditions adequately to clarify conditions or condition categories for comparison to other properties, which can then inform management (*representativeness*). The methods will be measured as described in sections below. Quality criteria are that the collection and handling of data ensure *precision* and minimize user *bias* to produce consistent and reliable results. Qualified field personnel will conduct these methods as designed and reported in this QAPP and the Methods QAPP (RIDEM 2024). Through communications with field personnel and review of the data, the Project Quality Assurance Officer will verify that data were collected properly.

A7.1 Precision, Bias, and Representativeness

Precision, *bias*, and *representativeness* are integrated in the sampling designs of each of the sampling methods of the Project. Precision, bias, and representativeness for sampling methods 1 and 2 (Table 1) are covered in the Methods QAPP (RIDEM 2024). Precision, bias, and representativeness for methods for characterization of elevation and slope (3), and distance from marsh edge of various types of infrastructure (4) are addressed below.

3. Characterization of Elevation and Slope

   Precision, *bias*, and *representativeness* for characterizing elevation and slope will be addressed by testing two reliable methods against each other. Elevation and slope will be characterized in one of two ways, whichever is found in testing to be more efficient and adequately precise. Slope and elevation measurements using existing high-resolution LiDAR data for Rhode Island (RIGIS 2022) will be tested for accuracy using survey-quality transit and staff surveying equipment and a Trimble® GPS unit to establish baseline elevations relative to the North American Vertical Datum (NAVD 1988). To ensure precision, the GPS coordinates will be corrected in real time (RTK) using correction data from a remote base station at the University of Rhode Island or from a portable base station. If LiDAR relative elevation errors are found to be on-average within 10cm of field-survey data, and LiDAR-generated slopes are within 0.5 degrees of Survey-generated methods, then LiDAR will be used to characterize slopes and elevations of the properties, as it is more efficient to

use. If LiDAR data are found to be less precise than the above quality assurance criteria, then the Field Methods will instead use only field survey data for characterizing slope and elevations.

4. Distance from Marsh Edge to Infrastructure
   Precision, bias, and *representativeness* for measuring distances to infrastructure will be addressed by standardizing the measurement procedures using high-quality measuring tools. Measurements will be made first remotely using GIS and recent aerial imagery supplied by Rhode Island Geographic Information Systems (RIGIS). RIGIS data are quality assured during acquisition and processing to be spatially accurate and precise. RIGIS imagery has been tested extensively by the Wetland Scientist (T. Kutcher) against other remote imagery and data sources and in the field using mapping software and has been found to be spatially accurate and precise (personal observations). Additional measurements will be taken in the field to verify remote measurements. Field measurements will be directly taken using a professional surveyor's tape measure. Measurements may include distances from the marsh edge (as delineated by the Wetland Scientist) to various relevant features such as roads, parking lots, and other impervious features; houses, outbuildings, and other structures; stone walls; and outcroppings, steep banks, ditches, and other landscape features that may affect migration.

A7.2 Completeness, Comparability, and Sensitivity

All data collection will pursue *complete* application of each method. Data that are deemed to be incomplete and thus unusable or unsuitable for analysis by the Project Quality Assurance Officer will be discarded. Data comparability will be assured through using the same methodologies for each metric and by each metric being conducted by a single team (the Wetland Scientist and his assistant). Additionally, once the metrics are developed and finalized, specific standardized directions for their applications will be detailed in the final report.

A8. Special Training Requirements/Certification (EPA QA/R-5 A8)

Only trained and experienced scientists will conduct the methods covered in this QAPP. NBNERR and RINHS monitoring and assessment partners have been instrumental in developing and testing most of the methods detailed in this QAPP, and trained, qualified personnel will conduct the work. Kutcher (Sub-awardee, data collection) has nearly two decades of experience conducting wetland assessment methods and will, as needed, provide training to any untrained technicians collecting data. Kenneth Raposa, PhD, has been the Research Coordinator for the Narragansett Bay National Estuarine Research Reserve for over 20 years and has published numerous studies assessing salt marsh health and migration. Kutcher and Raposa developed the MarshRAM methods, the Ecotone-edge methods, and the slope methods to be adapted in the Field Methods, and both have extensive scientific field and laboratory experience adequate for adapting these procedures to the Field Methods for this Project. Training of technicians for any Project method will be conducted by demonstration of the method in the field, and observation, by the trainers, of the trainee consistently performing the method to the standards detailed in this QAPP. An email will be submitted to the Quality Assurance Officer documenting the training and the performance of the trainee for each method the trainee will conduct.

A9. Documents and Records (EPA QA/R-5 A9)

The format for all data reporting packages will be consistent with the requirements and procedures used for data validation and data assessment described below. This QAPP will be reviewed regularly by the Project Manager and Quality Assurance Officer, to confirm that it remains current and accurate, and is effective at meeting the Project and data quality objectives.

A9.1 QA Project Plan Distribution

This QAPP will be distributed to all appropriate persons within DEM OCTA, Office of Water Resources, NBNERR, CRMC, EPA Region 1, and the RINHS as identified in section A3 of this QAPP. It will also be posted on the DEM web page for Environmental / Quality Assurance Project Plans @ https://dem.ri.gov/data-maps/data.php#quapps and may be posted on the NBNERR web page @ http://www.nbnerr.org.

A9.2 Field Documentation and Records

Field data will be hand-recorded by completely filling out paper field forms, which will be designed for the Field Method as it develops, including the date of the field observations and the identity or the person making the observations; waterproof paper will be used in rainy weather. All data will be housed at the RINHS office until analysis and reporting are complete. All field data forms will then be transferred to NBNERR to be held as detailed below. Daily activities (e.g., location, mileage, assessments) of field staff will be documented in diaries, timesheets, and logs as required by EPA grant conditions on relevant OMB circulars cited therein and held by the RINHS.

A9.3 Laboratory Documentation and Records

Field data will be entered into an electronic spreadsheet (Microsoft Excel) at RINHS where they will be housed on a hard drive and the "cloud" (Google Drive or similar) until analysis and reporting are complete (see timeline), at which time they will be transferred to NBNERR along with any secondary and derived data. The Project will implement proper document control procedures consistent with DEM's Quality Management Plan (revised Nov. 22, 2022). The NBNERR Project Quality Assurance Officer will have ultimate responsibility for any and all changes to records and documents after submittal to NBNERR and shall be responsible for their retention and storage. The RINHS will copy all final Excel spreadsheet files and GIS shapefiles collected under this QAPP to the DEM Office of Water Resources Program Manager or assigned representative for permanent retention under DEM Record Series 6.13.4.

The DEM Program Manager and the NBNERR Project Quality Assurance Officer shall retain the final approved QAPP and all updated versions and will be responsible for any distribution of the current version. The DEM Program Manager shall retain copies of all contract- and grant-management documents, and the NBNERR Project Quality Assurance Officer shall retain all draft and final reports, memoranda, and technical correspondence between NBNERR and all project personnel. The RINHS will copy all draft and final reports and memoranda produced under the QAPP to the DEM Office of Water Resources Program Manager or assigned representative for permanent retention under DEM Record Series 6.13.4

Records and documents that will be produced in conjunction with this QAPP may include:

- Completed field forms and site maps
- Excel spreadsheet files for data storage and analysis
- GIS shapefiles of assessment or study areas
- This QAPP
- Draft project reports and appendices
- Final project reports and appendices

Storage of project information

Files, paper and electronic records, and other media, such as incidental photographs, will be maintained by the NBNERR for a minimum of three (3) years after the completion of this work

and delivery of RINHS products to NBNERR. After three years, some records may be moved to the NBNERR Records Archives for storage in accordance with relevant NBNERR record retention policy. All field data forms will be retained by NBNERR permanently. The DEM Office of Water Resources shall also retain records of project deliverables and grant management associated with projects funded by EPA to the Office of Water, pursuant to its records retention schedules. As it is anticipated that wetland assessment will continue indefinitely, the time frames stated are the minimum and likely will be exceeded as the information will be needed for the ongoing program.

Backup of electronic files

Electronic files will be maintained on the NBNERR network server, as well as periodically backed up locally by the NBNERR Project Quality Assurance Officer on CD's, demountable hard drives, solid state digital storage devices, or the internet "cloud".

A9.4 Bi-annual and/or Final Reports

The draft and revised final reports will be provided to DEM and NBNERR by RINHS. Results of data collected will be documented and reported as follows:

- a detailed description of methods employed;
- data analyses and demonstrations as listed in section 1.6 and detailed below;
- a site map depicting assessment unit locations; and
- tables and figures as necessary to illustrate the work, analyses, and results.

The NBNERR and project participants and partners will provide written comments on a draft report for any given project. A final report, which will be completed by RINHS and/or other project participants, will incorporate responses to revisions based on the NBNERR or other comments.

B. DATA GENERATION AND ACQUISITION

B1-2-4 Sampling Design, Methods, and Analysis (EPA QA/R-5 B1, B2, and B4) (EPA QAPP Standards B1 and B2)

Sampling design, methods, and analysis for sampling methods 1 and 2 (Table 1) are covered in the existing Methods QAPP (DEM 2024), whereas methods 3 and 4 are detailed below. As methods for the Project are developed and piloted, a field datasheet that includes all relevant measurements and decision criteria will be developed as part of this Project. Table 3 outlines the intensity of field surveillance for each parcel.

Table 3. Field-survey intensity for each parameter that may be included in this Project.

#	Sampling Parameter	# Stations or Transects per Parcel
1	MarshRAM Section F, Migration Potential	1 Form
2	Characterization of the Marsh-Upland Ecotone	1 Transect
3	Characterization of Elevation and Slope	1 or 2 Transects (see Sec. B1-2-4, 3)
4	Distance from Marsh Edge to Infrastructure	1 or more measurements (see Sec. B1-2-4, 4)

3. Characterization of Elevation and Slope

Elevation and slope will be characterized in one of two ways, whichever is found in testing to be more efficient and adequately precise. Slope and elevation measurements using existing high-resolution LiDAR data for Rhode Island (RIGIS 2022) will be tested for accuracy using survey-quality transit and staff surveying equipment and an RTK GIS unit. If LiDAR relative elevation errors are found to

be within 10cm of field-survey data, and LiDAR-generated slopes are within 0.5 degrees of Survey-generated methods, then LiDAR will be used to characterize slopes and elevations of the properties, as it is more efficient to use. If LiDAR data are found to be less precise than the above quality assurance criteria, then the Field Methods will instead use only field survey data for characterizing slope and relative elevations. Slope will be calculated as H/D, where H=horizontal change, and D=distance from the starting point to the endpoint of the survey along a linear transect. Slope may also be depicted as a cross section (graph) with D on the *x* axis and H on the *y* axis to characterize slope variability across the transect. One representative transect will be surveyed per parcel, unless the marsh border of the parcel is >200' and the slope is variable across the border, as determined through pre-field GIS reconnaissance using GIS measuring tools and high-resolution elevation data (*RIGIS 2' Contour Lines* or similar, available at www.RIGIS.org); in such case, two transects may be used to best characterize slope of the parcel at the discretion of the surveyor. Elevation will be in relation to the marsh surface and in relation to NAVD 1988 using an RTK-corrected GPS unit.

4. Distance from Marsh Edge to Infrastructure

   Measurements will be made remotely and directly in the field. Remote measurements will use GIS and recent aerial imagery supplied by Rhode Island Geographic Information Systems (RIGIS). Additional measurements will be taken directly in the field to verify remote measurements. Field measurements will be taken using a professional surveyor's tape measure. Measurements may include distances from the marsh edge (as delineated by the Wetland Scientist) to various relevant features such as roads, parking lots, and other impervious features; houses, outbuildings, and other structures; stone walls; and outcroppings, steep banks, ditches, and other landscape features that may affect migration. At least one measurement will be taken per feature. The number of measurements taken per feature will depend upon the size and characteristic of the feature. For example, for a small building, one measurement of the closest point to the edge of the marsh will be taken, whereas for a linear feature, such as a roadway or stone wall, two or more measurements may be taken to characterize the range of distances from the marsh that the feature spans. If, during the pilot phase, remote (GIS) measurements are consistently (>90% of the time) within 10% of the field measurements, the field measurements may be omitted. The utility of using or omitting field measurements will be assessed for further application as part of this Project and discussed in the Project report. Specifics will be developed and finalized as part of the Project.

B3. Sample Handling and Custody (EPA QA/R-5 B3) (EPA QAPP Standard B3)

No samples will be collected by the Project.

B5. Quality Control Requirements (EPA QA/R-5 B5)

RINHS and NBNERR will work together to ensure that all assessment activities are conducted within the criteria set for the project, specifically as described in the above sections.

B6. Instrument/Equipment Testing, Inspection, and Maintenance (EPA QA/R-5 B6)

All equipment will be inspected for proper functionality prior to each use.

B7. Instrument/Equipment Calibration and Frequency (EPA QA/R-5 B7)

3. Characterization of Elevation and Slope

Field measurements of elevation and slope will be conducted using a Topcon (24X AT-B4) surveyor's transit and rod. The transit will be calibrated using the integral bubble level prior to each reading. Otherwise, the transit is calibrated at the factory and no further calibration can be conducted by the user. No other equipment requires calibration or adjustment. The GPS unit, if used, will be set within the manufacturer's thresholds for ideal accuracy and the data will be corrected (calibrated) in real time using RTK technology.

B8. Inspection/Acceptance Requirements for Supplies and Consumables (EPA QA/R-5 B8) (EPA QAPP Standard B6)

Not applicable. No critical consumables will be used.

B9. Data Acquisition Requirements (Non-Direct Measurements) (EPA QA/R-5 B9)

Geospatial data from the Rhode Island Geographic Information System (RIGIS, available: www.rigis.org) may be used for generating site maps and locating monitoring stations, as detailed in the above sections of this document. RIGIS data are thoroughly quality assured geospatial data, meet FGDC mapping standards, have standardized metadata, and are widely used by State, Federal, and local scientists conducting geospatial analysis in the State of RI.

B10. Data Management (EPA QA/R-5 B10)

Field data will be collected and stored in a metal file cabinet in a locked office in the RINHS or at the NBNERR. All data will be transposed to electronic format in the form of Excel spreadsheet files. The Excel files will be coded by date and corrections to the file will be coded by the revision or correction date followed by the suffix *correction*. Duplicate versions of the datasets will be coded specifically for analysis and kept in a separate folder. Analysis versions will also be coded by date with each use. Baseline and analysis data files will be stored in the RINHS laboratory at East Farm, URI, Kingston, RI on a hard drive and on the internet "cloud" (e.g., Google Drive). Any GIS data will be stored in file folders as shapefiles, which will be housed on two separate hard drives within the RINHS.

Field and electronic data will be quality checked for errors by qualified personnel following data collection and following data upload into Excel. Any corrections will be handled as noted above. The Wetland Scientist will be responsible for data management until the data are transferred to NBNERR at the end of the analysis and reporting period, at which time the Project Quality Assurance Officer will be responsible for the data.

C. ASSESSMENT AND OVERSIGHT

C1. Assessments/Oversight and Response Actions (EPA QA/R-5 C1) (EPA QAPP Standard C1)

Project oversight will be provided through regular correspondence between the NBNERR Project Quality Assurance Officer and RINHS no less than once per month. Correspondence will be in the forms of email and telephone correspondence, review meetings, memoranda, and the exchange of key data and documents. Assessment-oversight will involve review of all aspects of the Project and its progress. Technical advisors, who may include academic experts, state scientists, EPA scientists, and other expert stakeholders may also be consulted throughout the Project. NBNERR and RINHS will respond to input as necessary to ensure the efficient use of Project resources in evaluating the

effectiveness of salt marsh assessment tools to meet state reporting requirements.

The Project Quality Assurance Officer has the authority to issue a stop work order if something is not going right and to document corrective actions that need to be taken. For example, if, upon quality assurance investigations (always done prior to any analysis), the Project QA Officer or Wetland Scientist finds that the data from any instrument (specifically, the transit and any other devise used) does not follow prior trends, or otherwise appears erroneous, indicating malfunction or loss of calibration, The QA Officer will discard any erroneous data and immediately take the instrument out of service to be recalibrated by the manufacturer or replaced with a new instrument.

C2. Reports to Management (EPA QA/R-5 C2) (EPA QAPP Standard C2)
Brief bi-annual memoranda and final reports will be submitted by the RINHS to the Project Quality Assurance Officer, the Program Manager or assigned representative, and the Project Manager at the following project milestones: (1) the completion of field work and prior to the initiation of data analysis, (2) the completion of data analysis, (3) the draft Report, (4) the Final Report.
Memoranda may be appended to or incorporated into the draft and final reports. The EPA Project Officer will receive a copy of the final report.

D. DATA REVIEW AND USABILITY

D1. Data Review, Verification, and Validation Requirements (EPA QA/R-5 D1) (EPA QAPP Standard D1)
The validity and utility of data collected in the field is dependent upon (1) the qualifications of the field personnel, (2) the validity of the methodology, and (3) the appropriate analysis and interpretation of the data, which have been addressed in prior sections of this QAPP. Following the methods described in this QAPP and its appendices should assure the quality of the data. Only trained scientists will be able to assess the quality and validity of the data from these methods. The staff analyzing the data are trained to detect errors or inconsistencies in the data through identifying outliers and other unexpected or erroneous behaviors of the data. Data errors and inconsistencies will be highlighted in a copy of the data spreadsheet renamed with the suffix *ERROR* and sent to the Quality Assurance Officer via state email. Data quality will be further assured through the review of data reports submitted to technical peer reviewers from partner academic, state, or federal agencies. The Quality Assurance Officer will ensure that appropriate external peer reviewers review the data outcomes before data reports are finalized.

D2. Verification and Validation Methods (EPA QA/R-5 D2) (EPA QAPP Standard D1)
The data quality will be verified by the Wetlands Scientist and other field partners by reviewing field datasheets and electronic data as described above. The Quality Assurance Officer will be made aware of data inconsistencies and errors as described in Section D1, and will have the power to require data to be discarded or re-collected, as possible, if it does not meet the requirements detailed in Sec. A7.

3. Elevation and Slope
Elevation and slope data will be collected on field forms and entered into spreadsheet software by the Wetland Scientist or his qualified assistant. The Quality Assurance Officer will produce and review data trends for inconsistencies and outliers. Any data points flagged as inconsistent against expected or typical outcomes will be reviewed and, as necessary, corrected in the electronic dataset. Any inconsistencies that cannot be corrected through this review process will be discarded prior to analysis, and this action will be documented in data reports.

4. Distance from Marsh Edge

Measurement data collected will be recorded by qualified personnel. The data will be aggregated and inspected on field and laboratory datasheets and following upload to electronic spreadsheet software, where the data will be analyzed for validity using statistical and spreadsheet software to review the data for inconsistencies and outliers. Any inconsistencies or discrepancies in outcomes among users or platforms will be investigated and rectified. Data that cannot be rectified as error-free will be discarded and re-analyzed or re-collected, as relevant and possible, and this action will be documented in data reports.

D3. Reconciliation with User Requirements (EPA QA/R-5 D3)

The goals of the Project include testing the applicability of existing and new marsh-migration metrics across a range of conditions, and demonstrating the utility of the methods and resulting data in characterizing marsh migration potential on a given parcel in relation to other parcels. Because of the complex nature of the data, it is expected that the interpretation and application of the data will be primarily limited to the planning and management professionals who requested the work (the users). As such, the data will be collected specifically for the direct use of the intended users. However, it is anticipated and intended that the data will also be used and interpreted for generating reports, graphics, and other outreach materials aimed at secondary and tertiary consumers of the information, such as for municipalities, property owners, and conservation groups.

E. REFERENCES

CRMC (Coastal Resources Management Council), 2015. The Rhode Island SLAMM Project, Rhode Island Coastal Resources Management Council, Wakefield, RI. 25pp.

URI EDC (University of Rhode Island Environmental Data Center), 2023. Salt Marsh Coastal Parcel Planning Tool. Interactive mapping dataset, available online at: https://www.arcgis.com/apps/dashboards/d8e34046c32246b0ba4026bdce1d160b

Kutcher, T.E., 2022. MarshRAM user's guide: detailed instructions on how to conduct and interpret the Salt Marsh Rapid Assessment Method, MarshRAM. Rhode Island Department of Environmental Management Office of Water Resources, Providence, RI, 40pp.

RIDEM (Rhode Island Department of Environmental Management), 2024. Quality Assurance Project Plan for Nine Salt Marsh Monitoring and Assessment Methods. RI Department of Environmental Management, Providence, RI. 174pp.

Appendix A

MarshRAM Marsh Migration Metric (Kutcher 2022)

Investigator_____ Site _____ Date_____

F. Migration Potential

Estimate the proportion, to the nearest tenth, of surrounding land within 60m falling into each class, and multiply. Total sum of proportions must = 1.0 and sum of weighted values must = 0.0 to 10.0.

Landward* Surface Waters

No Potential:

____Ocean
____Estuary
_____Lake/pond
____Other

Sum =_____x 0 = 0

*separated from marsh by upland

Elevated Land >1.5m above MHW

No Potential:

____Bedrock
____Hardened shoreline
____Developed land
____Landfill
____Other_____

Sum =_____x 0 = 0

Low Potential:

____Elevated erodible Land

Sum =_____x 2 = _____

Low-lying Land <1.5m above MHW

No Potential:

_____Ocean Beach / Dune
_____Estuarine Beach

Sum =_____x 0 = 0

Low Potential:

____Paved street or lot
_____Residential development (structures present)
____ Industrial / commercial development (structures present)
____Other_____

Sum Low =_____x 2 = _____

Moderate Potential:

_____Active farmland
____Golf course
____Sand and gravel operation
____Undeveloped land behind a raised shoreline feature
____Freshwater deep wetland
____Other_____

Sum Moderate =_____x 5 = _____

Moderately High Potential:

____Forested or shrub wetland
____Phragmites marsh
____Forested or shrub upland
____Mowed land, no structures
____Pasture
____Other_____

Sum Mod High =_____x 8 = _____

High Potential:

____Emergent FW wetland
____Upland field / meadow
____Abandoned farmland
____Other_____

Sum High =_____x 10 = _____

Sum weighted values for **Migration Potential score:** [ ]

a. Area of Marsh = _____
b. Area of surrounding land to 60m = _____
c. Proportion of Moderately High +High class = _____

d. Migration Area = (b x c) = [ ]

e. Replacement Ratio = (d ÷ a) = [ ]