



## Natural Resource Services, Inc.

Assessment of Salt Marsh Restoration  
Required Pursuant to  
CRMC Assent 2007-06-075

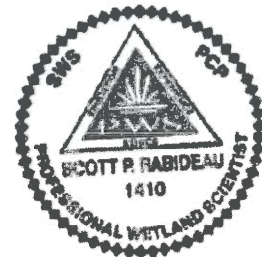
Maritime Way  
North Kingstown, Rhode Island



Prepared for:  
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95 Cripe Street  
North Kingstown, RI 02852

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August 16, 2022

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## **Introduction**

Natural Resource Services, Inc. (NRS) has been retained by the Quonset Development Corporation (QDC) to perform a final monitoring and assessment of a salt marsh restoration located at the terminus of Maritime Way. The RI Coastal Resources Management Council (CRMC) issued an assent to the QDC on October 24, 2007 for various roadway and drainage improvements. A salt marsh restoration effort was included in the project as a mitigation measure for impacts to freshwater wetlands and buffer zones. The impacted wetlands were considered tributary wetlands pursuant to the Coastal Resources Management Program (CRMP) which required the QDC to secure a Special Exception to a Program prohibition.

Once the salt marsh restoration was completed, Stipulation J of the CRMC assent required the QDC to submit monitoring reports on the conditions present within the salt marsh restoration area for five (5) consecutive years. The restoration effort took place during September and October, 2008. NRS performed the required monitoring in June, 2009 and July, 2010. However, the three years of subsequent monitoring did not take place.

The purpose of this report is to provide the CRMC with a current status of the conditions within the salt marsh restoration area and an assessment as to whether the effort is considered successful. NRS performed the inspections of the salt marsh during four (4) visits from July 19<sup>th</sup> through August 8, 2022.

## **Methodology and Results**

In order to remain consistent with the original monitoring that was performed, the four transect lines and photo plot locations from the previous NRS reports were re-established using the GPS coordinates. Each plot was either flagged using existing vegetation or by driving 2 foot wooden grade stakes into the marsh. A 1 meter square frame was placed over the established plot. All vegetation within the frame was inventoried to the species level with dominance estimated using a visual assessment of percent cover. A photograph of the plot and adjacent area was also taken.

Using the line function on a Trimble Geo7X, the limit of the salt marsh vegetation (i.e., *S. patens*, *S. alterniflora* and *J. gerardii*) was mapped. This effort separated the area of restored salt marsh from areas within the restoration limits which re-colonized with common reed (*P. australis*). Salt marsh vegetated areas containing 25 percent or less of common reed were included as restored salt marsh. Areas containing greater than 25 percent common reed were included in the non-restored area.

Figure 1 is a graphic created from the original site development plan submitted to the CRMC with the assent application (Garofalo & Associates, June 5, 2008). The Garofalo plan included the mapped limits of the remnant salt marsh contained within a larger wetland consisting exclusively of common reed. The restoration area limits represented on the graphic are within the NRS delineated contiguous freshwater wetland limits as of 2007. This graphic provides the baseline area of salt marsh present prior to the salt marsh restoration effort.

Figure 2 represents the conditions present within the salt marsh restoration area as of July 14, 2010 (approximately 18 months post-construction). The graphic clearly depicts the constructed breach, tidal channels and tidal pool. The non-vegetated mudflat and areas with early colonizing vegetation (*Salicornia europaea*) were mapped at that time and the area of each zone is listed on the graphic.

Figure 3 represents the current salt marsh conditions. As previously noted, the limit of salt marsh vegetation present was mapped using a hand-held GPS unit. The unit used is rated to sub-meter accuracy with proper satellite coverage. Due to the open nature of the salt marsh, the unit did not have optimal satellite coverage when in use. The open water tidal channels and tidal pool areas were calculated from aerial photography. The restoration limits are from the Garofalo plan utilized for Figure 1.

A total of 15 data plots were established along four (4) transect lines. The most dominant vegetation present within the restored salt marsh are smooth cordgrass (*Spartina alterniflora*) and salt marsh hay (*Spartina patens*). Several areas along the outer limit of the restoration contained concentrations of salt marsh rush (*Juncus gerardii*). The only other species identified was hightide bush (*Iva frutescens*) occurring primarily along the dune limits.

It is important to point out that data plots established within the dune back in 2009 now occur at or below the mean higher high tide limit along the beach. There is clear evidence that the barrier has migrated landward over the last 14 years. This dune migration has resulted in the loss of salt marsh in the eastern portion of the restoration area.

## Discussion and Summary

The salt marsh restoration effort authorized as a mitigation measure pursuant to the CRMC assent number 2007-06-075 required the regrading of a contiguous freshwater wetland dominated by common reed (*P. australis*). The project engineer determined the final grade of the restored salt marsh based on the elevation of anticipated high tide for this section of Narragansett Bay. The soils removed from the area contained the rhizomes and above grade biomass of the *P. australis*. The inundation of the excavated basin with tidal water was anticipated to stem the re-emergence of *P. australis*, thereby allowing native salt marsh vegetation to colonize the area.

The restoration design included a restored tidal breach, tidal flow channels and interior tidal pool. Two sills were incorporated into the main tidal channel to ensure that a sufficient volume of water was retained within the tidal pool during low-tide. As part of the NRS monitoring, salinity levels were recorded within the tidal channel and tidal pool at low-tide. The salinity levels were at 23-27 parts per thousand, consistent with normal bay water (see Figure 4).

Based on the NRS mapping of the restoration area in July, 2022, there is 63,022 square feet of salt marsh present. Subtracting the original 22,884 square feet, the net gain of salt marsh is 40,138 square feet, a 175 percent increase 14 years after the excavation and installation of the tidal channel and pool. It should be noted that dune migration over this same time period has

eliminated a significant amount of the original salt marsh area. An exact calculation of the lost marsh was not determined as part of this monitoring effort.

The outer limits of the restoration area consist of dense shrub wetland habitat dominated by Speckled alder (*Alnus rugosa*) and a ring of *P. australis*. The *P. australis* area present is 13,907 square feet. This represents a reduction of 90 percent from the pre-restoration condition.




Based on the mapping performed by NRS, the salt marsh restoration initiated by the QDC in 2008 has resulted in the creation of a viable tidal pool and high quality marsh habitat. The breach for the tidal channel has shifted position over the 14 year timeline, but it has continued to allow sufficient salt water into the tidal pool and salt marsh to control the spread of *P. australis*. The concentric ring of *P. australis* along the perimeter of the marsh may well be due to freshwater flows from the surrounding upland areas.

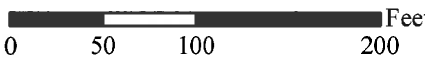
The barrier dune is actively migrating landward. The rate of migration may be accelerated over time due to rising sea levels. This is a dynamic process for any barrier which will result in the continued loss of salt marsh. However, this dune migration should not be factored into the assessment of the relative success or failure of the salt marsh restoration effort.

The QDC effort has resulted in a 175 percent increase in salt marsh habitat and a 90 percent reduction in the *P. australis* monoculture. Based on these percentages, the salt marsh restoration has achieved a significant level of long-term success.

## Appendix

**Legend**

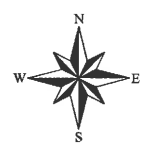
-  CRMC Approved Restoration Limit
-  Limit of Salt Marsh Vegetation = +/- 22,884 sq ft
-  Limit of Common Reed = +/- 166,571 sq ft

 Feet  
0 50 100 200










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NOT A SURVEY PLAN  
URI EDC, RIGIS

**Figure 1:**  
**Pre-Restoration Site Conditions**



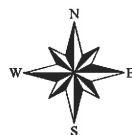
# Legend

-  CRMC Approved Restoration Limit
-  NRS Transect & Plot Location
-  Early Colonizing Vegetation  
= +/- 68,813 sq ft
-  Mud flat = +/- 17,814 sq ft
-  Open Water = +/- 9,827 sq ft
-  Limit of Salt Marsh Vegetation  
= +/- 22,884 sq ft

 Feet  
0 50 100 200



**Figure 2:**  
**Post-Restoration Site Conditions**  
**July 14, 2010**



**RIGIS**

Natural Resource Services, Inc.








PO Box 311  
180 Tinkham Lane  
Harrisville, RI 02830

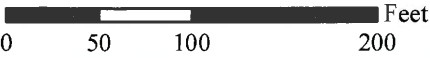
2011 Aerial  
RI DEM Maps

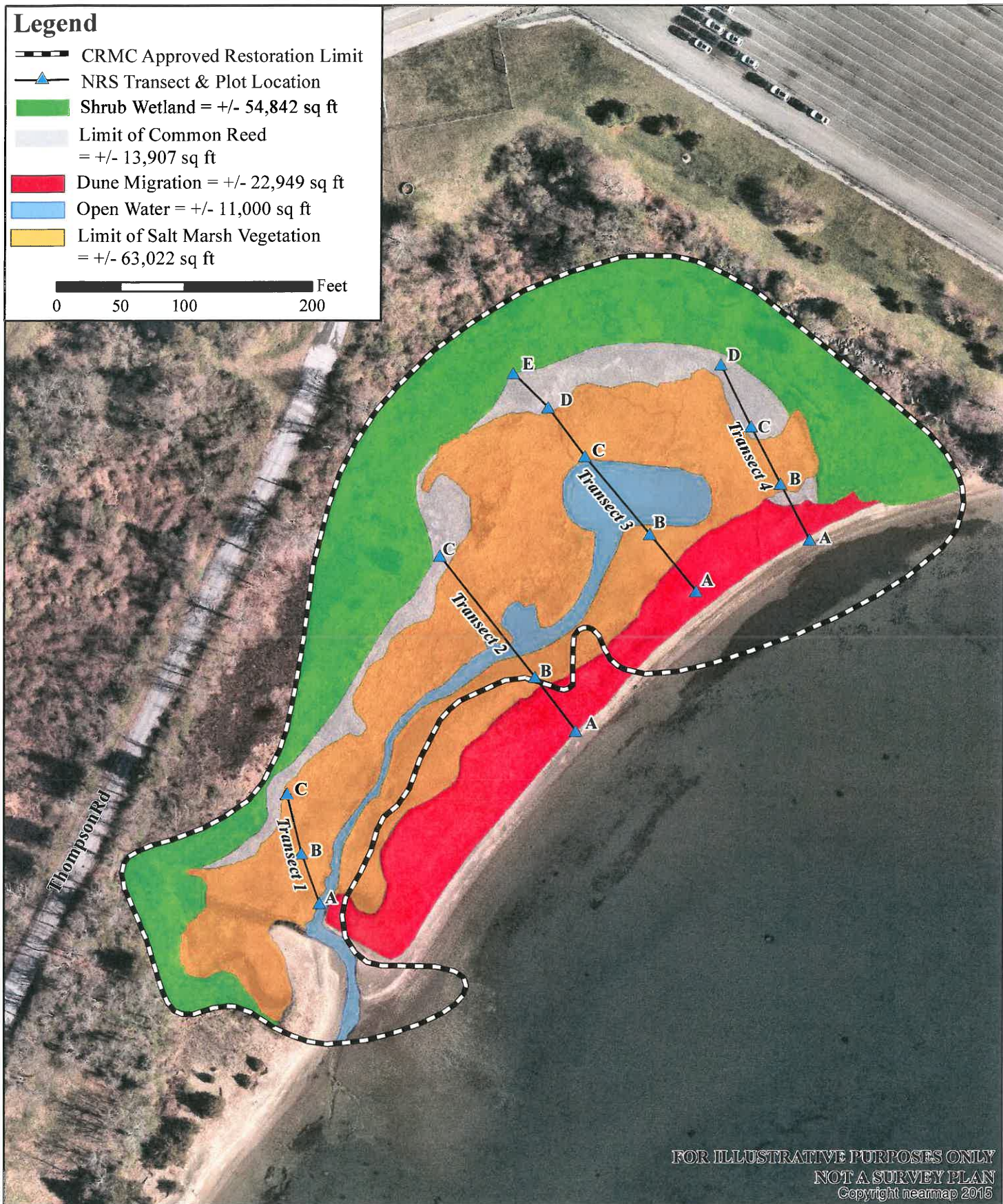
p: (401) 568-7390  
(c) RIGIS



**Legend**

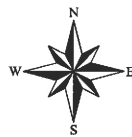
-  CRMC Approved Restoration Limit
-  NRS Transect & Plot Location
-  Shrub Wetland = +/- 54,842 sq ft
-  Limit of Common Reed = +/- 13,907 sq ft
-  Dune Migration = +/- 22,949 sq ft
-  Open Water = +/- 11,000 sq ft
-  Limit of Salt Marsh Vegetation = +/- 63,022 sq ft

 Feet  
0 50 100 200



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**Figure 3:**  
**Current Salt Marsh Conditions**





### Salinity Level

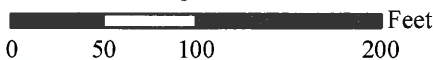
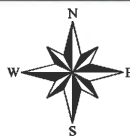
	Test #		
	1	2	3
Testing Location			
1	25	25	25
2	23	25	25
3	27	27	27

Testing performed from 9 - 9:45 AM on 8/8/2022  
 using a Vista Model A366ATC Salinity Refractometer  
 Readings are in parts per thousand  
 Low Tide on 8/8/2022 at 10:11 AM

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**Figure 4:**  
**Salinity Testing at Low Tide**

Performed by:  
 Staff biologist Hannah Chace 8/8/2022  
 Located using a hand-held Trimble GeoXH



## Data Plot Inventory and Photographs

Transect 1 – Plot A		
<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Iva frutescens	50	Areas of exposed sand present
Spartina patens	25	
Salicornia europaea	10	



*Looking north from Plot 1A*

Transect 1 – Plot B		
<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Iva frutescens	25	
Spartina patens	65	
Spartina alterniflora	10	



**Transect 1 – Plot C**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Spartina patens	75	
Palustris australis	25	



**Transect 2 – Plot A**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Unvegetated		Located adjacent to current high tide wrack line



*Looking north from Plot 2A*

**Transect 2 – Plot B**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Spartina patens	98	Some Iva frutescens at base of adjacent dune
Palustris australis	2	



*Dune accretion in marsh south of Plot 2B*

**Transect 2 – Plot C**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Iva frutescens	40	Located at upland interface
Palustris australis	20	
Spartina patens	20	

**Transect 3 – Plot A**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Palustris australis	20	Located below high tide wrack line



**Transect 3 – Plot B**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Spartina alterniflora	80	Some mudflat exposure



*Looking north from Plot 3B*

**Transect 3 – Plot C**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Spartina alterniflora	100	



*Looking south from Plot 3C*

<b>Transect 3 – Plot D</b>		
<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Juncus gerardii	50	
Palustris australis	50	



*Looking southeast from Plot 3D*

<b>Transect 3 – Plot E</b>		
<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Palustris australis	100	Located at upland interface

<b>Transect 4 – Plot A</b>		
<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Unvegetated		Located below the high tide wrack line



**Transect 4 – Plot B**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Spartina patens	95	
Palustris australis	5	

**Transect 4 – Plot C**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Spartina alterniflora	40	
Palustris australis	60	

**Transect 4 – Plot D**

<u>Species</u>	<u>Percent Cover</u>	<u>Remarks</u>
Juncus gerardii	10	
Palustris australis	90	