COASTAL RESOURCES MANAGEMENT COUNCIL

Oliver Stedman Government Center
4808 Tower Hill Road; Suite 116
Wakefield, RI 02879
401-783-3370

PUBLIC NOTICE

File Number: 2013-09-022 Date: October 1, 2013

This office has under consideration the application of:

The Nature Conservancy, Rhode Island Chapter
159 Waterman Street, Providence RI 02906
Email: dsbrown@tnc.org; Phone: 860-271-3535

for a State of Rhode Island Assent to construct and maintain:

Low-impact, biodegradable sediment erosion control materials along the John H. Chafee National Wildlife Refuge. The applicant proposes to utilize coir log, coir matting and bagged shell substrate to assess the extent to which these materials may reduce erosion and subsequent mass wasting along the marsh edge.

Project Location:	National Wildlife Refuge, Narrow River
City/Town:	Narragansett
Plat/Lot:	N/A (work to be conducted below MHW)
Waterway:	Narrow River

Plans of the proposed work may be seen at the CRMC office in Wakefield.

In accordance with the Administrative Procedures Act (Chapter 42-35 of the Rhode Island General Laws) you may request a hearing on this matter.

You are advised that if you have good reason to enter protests against the proposed work it is your privilege to do so. It is expected that objectors will review the application and plans thoroughly, visit site of proposed work if necessary, to familiarize themselves with the conditions and cite what law or laws, if any, would in their opinion be violated by the work proposed.

If you desire to protest, you must attend the scheduled hearing and give sworn testimony. A notice of the time and place of such hearing will be furnished you as soon as possible after receipt of your request for hearing. If you desire to request a hearing, to receive consideration, it should be in writing (**with your correct mailing address, e-mail address and valid contact number**) and be received at this office on or before November 1, 2013.

PERMIT APPLICATION
REQUEST 2013

Project Title: Evaluation of bank stabilization materials and ecological impacts on saltmarsh habitat in Narrow River, Rhode Island

Project Type: Research, Marsh Protection, Living Shoreline

Water Body Name: Narrow River

Location: John H. Chafee National Wildlife Refuge

Site 1 41.459598°
-71.449778°
Site 2 41.456074°
-71.450356°
Site 3 41.45032°
-71.44935°

City/State: Narragansett, Rhode Island 02882

Applicant: The Nature Conservancy, Rhode Island Chapter
159 Waterman Street, Providence Rhode Island
Email: dsbrown@tnc.org; Phone: 860-271-3535

Date Submitted: August 20, 2013

Submitted to the Rhode Island Coastal Resources Management Council (CRMC) for review by the Programmatic General Permitting (PGP) Council.

State and Federal Permits Request

We are requesting an Army Corps of Engineers (ACOE) Category I permit, Rhode Island Department of Environmental Management (DEM) Water Resources Permit, and a Rhode Island Coastal Resource Management Council (CRMC) Conservation Assent to evaluate the use of non-structural marsh bank protection materials in Narrow River, Rhode Island.

Background

Marsh habitat is vulnerable to shoreline development, alterations in sediment transport and hydrology, and vessel generated waves (VGW). Erosion of marsh edge coupled with the inability for marshes to retreat due to development is a growing cause of concern (Rogers 2001). Aquatic resource impacts associated with VGW include the disturbance and re-suspension of bottom sediment and mechanical weakening of vegetative root mats (Osborne 1999). Pitting and undercutting of banks leading to incremental loss of erodible sediments are common features in areas of high wave disturbance (Swann 2008; Richard 1997). Sediment disturbance in navigational waterways caused by boat wakes may diminish channel depth over time as well as impair ecological productivity of fish, shellfish, and benthic macro-invertebrate communities (Milken and Lee 1990; Richard 1997).

Since 2008, USFWS Refuge Staff have completed annual surveys documenting the impact of VGW on marsh bank habitat and loss of bank integrity (USFW 2009, USWF 2012) in Narrow River, Rhode Island. Permanent 30-m transects have been established to document rates of physical loss, bank undercutting, and more recently, loss of ribbed mussel habitat. In addition, USFWS Staff have collected wave velocity and height, and turbidity measures associated with boat passage in navigational channels. These studies have found that waves generated by boats operated in close proximity to shorelines above headway speed cause sediment resuspension and erosion along marsh edge. In 2012, TNC and URI Staff measured differences in sediment erosion and deposition along an erosional gradient in Narrow River. Sediment traps and erosional clod cards were deployed at distances along sections of marsh banks and within channels. Preliminary results show greater erosion in medium energy areas exposed to greater VGW compared to lower energy sites. In addition to the net loss in marsh habitat, the loss of salt marsh edge may have disproportionate impacts on nekton and benthic infauna, both of which have been shown to prefer salt marsh edges to interior salt marsh surface (Minello et al. 2003). The response of these organisms to loss of marsh edge due to VGW has not been evaluated. Furthermore, any modifications to the salt marsh edge for the purpose of erosion prevention will also need to be evaluated for impacts to marsh fauna.

Project Goals and Objectives

The need to reduce erosion and protect marsh habitat has been identified by state (CRMC 1986) and federal (USFW 2001) resource agencies in Rhode Island. Given continued marsh loss and uncertainty in shoreline protection practices, we intend on evaluating the use of low-impact, biodegradable sediment erosion control materials in Narrow River. We hypothesize that the combination of coir log, coir matting and bagged shell substrate will reduce erosion and subsequent mass wasting along marsh edge. Furthermore, we hypothesize the use of bagged shell

substrate will provide additional habitat for colonizing epifauna, and coir logs will retain fine sediments along marsh edge. Background characteristics of fauna and marsh vegetation that presumably reflect ongoing erosion from VGW in control areas will be compared to changes resulting from erosion control treatments. Long-term monitoring will allow for detection of change in faunal composition on reinforced banks compared with control sites.

Construction Methods and Design

We will test the following erosion control treatments to evaluate the impact on marsh bank habitat: (1) coir log with bagged shell, (2) coir log only, and (3) control (no log or shell). We will use a combination coconut fiber coir logs, coir wattle and coir matting. Coir wattle will be placed loosely into the undercut of marsh banks. Coir logs (16-in diameter, 20-ft sections) will be placed directly in-front of the marsh bank to stabilize sediments and wattle. Logs will be secured using twine and wooden stakes placed on either side of the log. Coir matting (4 x 20-ft sections) will be secured under the logs using bamboo staples. Matting will have large mesh openings (2-in diameter) allowing colonization and bioturbation by benthic infauna while improving sediment stability. Cured oyster and clam shell will be placed in coir rock bags (BioD-Rockbag™; 24 x 10-in; 0.12-in diameter mesh). Shell bags will be placed 2-ft from marsh edge and will not exceed 1-ft from the sediment surface. Materials needed per 100-ft (30-m) of shoreline treatment includes:

- x5 20-ft, 20-in diameter coir fiber logs
- x5 20-ft, 16-in diameter coir wattle logs
- x1 coir fiber mat (6.6 by 164-ft)
- x48 wooden stakes (12 per logs)
- x40 shell bags
- Coconut fiber twine (150-ft)

Each treatment will span 100-ft of shoreline with equal distances (100-ft) between treatments to minimize neighbor effects. Each project location will have a control (i.e., no log or shell). Treatments and control sites will be randomly selected for each project location using a random number generator and numerical assignment. Project locations will span 500-ft of shoreline. Three replicate locations with similar wave energy, geophysical, and biological conditions have been identified (Figure 1). All three project locations are adjacent to United States Fish and Wildlife Service (USFWS) refuge property (Figure 2). This study is being completed in collaboration with USFWS refuge staff. Project locations are sited in boat wake zones, approximately 350-ft from navigational channels. Marsh bank characteristics and channel information is provided in Table 1.

Communication

Notification of work and work dates will be provided to the Harbor Master, RI DEM, RI CRMC, and ACOE. Annual progress reports will be provided to RI CRMC and RI DEM in January of each year. TNC staff will monitor project sites over a 3-5 year period. Furthermore, the Narrow River Kayak Center, Narrow River Preservation Association, and United States Fish and Wildlife Staff have agreed to monitor the site for changes or loss in protection materials. Project signs including information on the type of project (marsh protection), permit numbers, and contact information will be placed in subtidal waters adjacent to or directly in-front of each project location. Approval of materials used and sign content will be provided by USFWS and CRMC prior to installation. Funding for this project is from RI CRMC's Coastal Estuary Habitat Trust Fund and private foundations.

Monitoring Methods

We will monitor for changes in both structural and functional variables to capture changes in marsh bank habitat following the installation of protection materials. Annual monitoring of response variables will occur in the late summer or early fall (August-September) from 2014 – 2016. Presence of slumping, cracking or pitting, and general structure of marsh edge will be noted at this time. Data for all response variables will be collected at permanent markers. Baseline evaluation of response variables will be collected in August 2013 prior to the installation of bank protection materials. Below is a description of response variables and methods that will be employed.

Marking Permanent Stakes (i.e. Fixed Stations): Fixed sample transects covering each treatment or control (100-ft) will be set with permanent markers every 30-ft (n=3 per treatment). We will use stakes (2-in wide, 3-ft long) made of locust wood. Markers will be set at a 2-m distance from marsh edge. The location of each stake will be recorded by d-GPS. This will permit a statically-correct Before-After-Control-Impact (BACI) design with replication by treatments and location. Further, we will not use destructive sampling techniques, and are therefore, not concerned with plot disturbance and sampling artifacts. Markers will be removed following the completion of our study.

Marsh Loss and Bank Geomorphology: we will monitor the rate of marsh loss by measuring the distance from sampling station stakes and to marsh edge to the nearest 0.01 cm. We will monitor for changes in marsh bank height, and depth and height of eroded undercut to the nearest 0.01 cm (Figure 2). The incremental loss of course sediments underneath the vegetative peat layer of marsh banks will provide an indicator of marsh loss and erosion (DeLaune 1994). We expect to find greater slumping and undercutting of peat along marsh edge in control plots compared to treatment plots resulting in a net loss of marsh habitat.

Vegetation: A 1/8 m^2 quadrat will be placed 15-cm in from the marsh edge at each fixed sampling station (Figure 2). Vegetation within each quadrat will be quantified using both the visual percent cover method (Pete et al. 1998) as well as the point intercept method (Romen et al. 2001). Within each quadrat, we will record the number and height of stems (dead and alive combined) for *Spartina alterniflora.* Clippings of *S. alterniflora* will be collected from ten random quadrats (1/8 m^2) from each study location during our baseline survey to calculate a biomass estimate. Currin (2011) found a positive relationship between *S. alterniflora* stem

heights and dry weight. Based on this finding and data collected in our baseline survey, we will estimate marsh biomass in dry weight without destructive harvesting methods by multiplying average stem height by the stem count for each quadrat sample. Further, this study will be limited to monitoring changes in above-ground production – a frequently used measure in vegetation status (e.g., Bertness 1991; Nixon and Oviatt 1973).

For each sample quadrat we will record the number of ribbed mussels (*Geukensia demissa*), and the number of crab burrows. Digital pictures of sampling quadrats will also be taken at this time. We expect an improvement in marsh vegetation in protected treatments compared to control. Eroding marsh habitat exhibit declines in marsh vegetation biomass and cover, dense concentrations of ribbed mussels attached to bases of decaying *S. alterniflora* stems, and increased burrowing into exposed sediments (DeLaune et al. 1994).

Nekton: Fish use of marsh bank and protection materials will be monitored using standard minnow and shrimp traps (0.125-inch mesh). Traps will be deployed 0.5-ft from marsh bank (or protection materials). Traps will not be baited, secured to the sediment surface using a wooden stake, and marked with a small surface float labeled with TNC's animal collection permit number. One set of traps will be deployed per treatment (or control) in each location for a 24-hr period. Upon collection fish, shrimp, and crabs will be identified and enumerated. The total length of fish and carapace length of crabs will be measured. We expect an increase in fish diversity and abundance in protected treatments. The vertical complexity provided by the erosion control materials will likely enhance the fish community structure.

Benthic Invertebrates: Changes in infaunal community structure and abundance will be monitored by collecting sediment cores (3-cm diameter, 7-cm long) 0.5-ft from marsh banks. Replicate cores per treatment per location will be collected. Upon collection, cores will be placed in pre-labeled plastic 2-L containers with 70% ethanol and Rose Bengal. In the lab, core samples will be gently washed over a 500-µm sieve. Whole or intact organism will be removed from sediments under stereomicroscope. Organism will be identified to the lowest practical taxonomic resolution and enumerated. We expect an increase in invertebrate diversity and abundance in protected treatments. Erosion control materials will likely enhance sedimentation and organic deposition thereby increasing food availability and productivity of benthos.

Sediment Grain Size: replicate sediment cores (1.5-cm, 5-cm) will be collected from each treatment and location. Core samples will be placed in labeled plastic bags and frozen prior to processing. After thawing, sediment samples will be dried at room temperature for a 24-hr period. Samples will be run through a series of nested sieves, including 5-mm, 1-mm, 0.75, 0.50, 0.25, and 0.075 to separate sediment grain fractions. Contents collected from each sieve will be weighed using a digital bench scale. We expect to find differences in sediment grain following the installation of erosion control materials. The vertical complexity of these materials will enhance the deposition of fine grain sediments.

Statistical Design and Analysis: Fish and invertebrate community structure will be evaluated using species richness (*S*), Shannon biodiversity (*H*), and Pielou's evenness (J) index. Our experimental design will detect environmental and biological changes following the installation of protection materials. We will have multiple impact sites and multiple control sites and will monitor changes annually. We will use a Before-After-Control-Impact (BACI) design and a two-factor mixed-effect ANOVA to evaluate differences in response variables. Site main effects and variance between quadrats within sites will be evaluated.

Potential Impacts

We don't anticipate any negative social or ecological impacts associated with the installation of marsh protection materials. Our communication outreach and collaboration with local groups will improve public awareness and understanding of this project. This project will not impact boat navigation or recreational use in Narrow River. Project materials will not exceed more than 10-ft from the saltmarsh edge and will be maintained at least 20-ft away from navigational areas and channels. Project signs will be placed at the start and end of each project location.

There is potential for impacting benthic infauna during the construction period; however, benthic infauna can rapidly recolonize and reach a pre-disturbance condition in short timeframes (days to months). Project activities will be completed outside of potential finfish nursery periods, especially winter flounder *(Pseudopleuronectes americanus*).

This project will not negatively impact habitat used by the saltmarsh sparrow (*Ammodramus caudacutus*) or the seaside sparrow (*Ammodramus maritimus*). We have consulted with experts from USFWS (Rhonda Smith) and University of Connecticut (Chris Elphick) regarding potential impacts on sparrow nesting habitat. *A. caudacutus* occupies and nests in the high marsh zone. Our project is located in the low marsh zone seaward of marsh edge. Furthermore, Conservancy staff will access project sites by water, thereby reducing any foot impact on high marsh habitat. The application of marsh protection materials may reduce erosion and enhance sedimentation in the low marsh, and therefore, reduce the loss of high marsh habitat.

Limitations on Success

Densely packed coir logs can last over 5 years in coastal marsh systems allowing vegetation and mussel aggregations to become fully established and self-sustaining (Erdle et al. 2006). However, coir logs can be dislodged or freed in high energy environments or during storm events. Short-term maintenance requirements may include periodic inspection (monthly, Year 1-2), and repositioning and replacement of protection materials.

Our experimental design and our adaptive management work plan will allow TNC and USFWS to detect and address negative ecological impacts associated with the installation of these materials. We anticipate moderate to significant changes in sediment grain size land-ward of the protection materials, and colonization and increased biomass of epifauna (e.g., ribbed mussels, tunicates, bryozoans) on coir logs and bagged shell materials.

Figures and Images

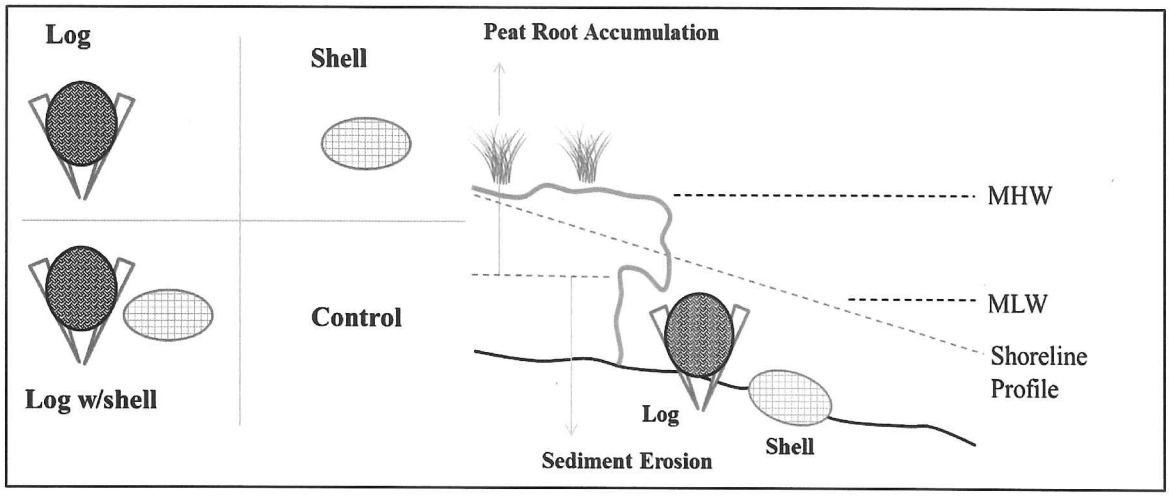

Figure 1. Conceptual experimental design and placement of erosion control materials along marsh bank edge.

Figure 2. Project locations in Narrow River. Yellow lines represent experimental bank protection treatments, spanning 100-ft of shoreline. Each station spans 500-ft of shoreline.

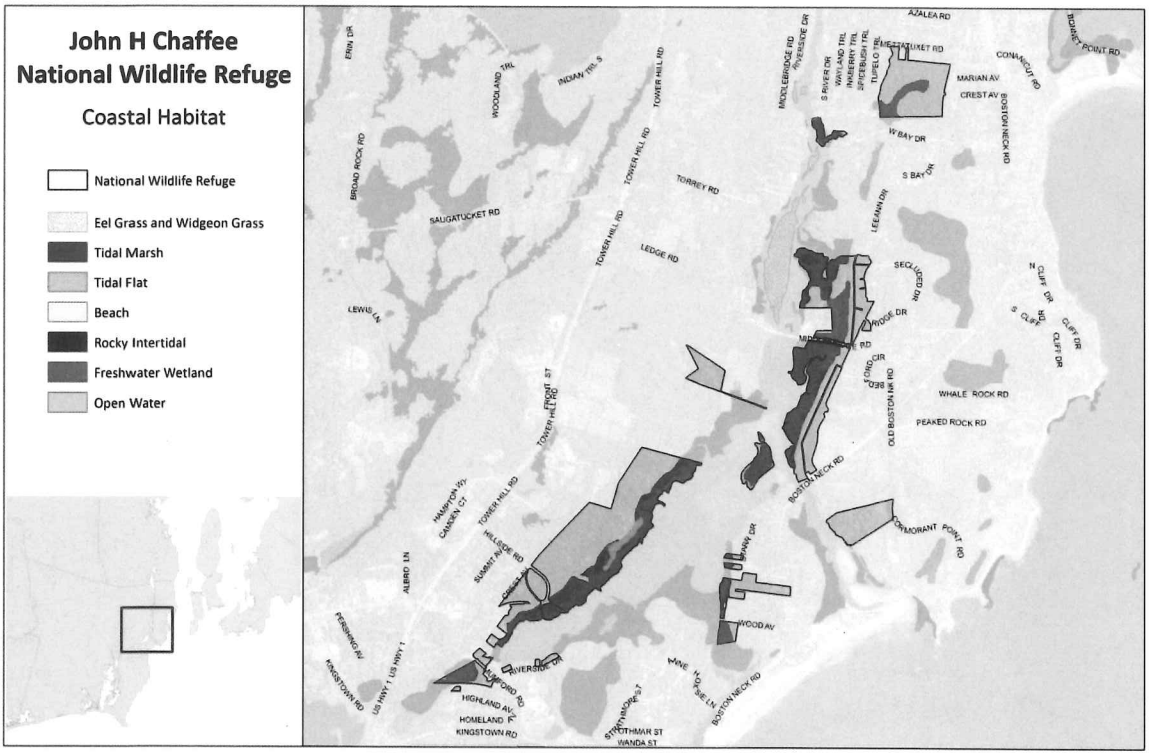

Figure 2. Location of USFWS John H. Chafee Refuge and estuarine habitats in Narrow River, Rhode Island.

Table 1. Physical and biological characteristics of project locations in Narrow River. Data is reported as mean value. Sediment grain size samples are being processed. Results will be available in August 2013.

	Station 1	Station 2	Station 3
Dist. from Channel (ft)	448	342	384
Channel Width (ft)	670	679	621
Bank Height (in)	28.8	25.7	20.8
Undercut Height (in)	14.6	11.9	10.8
Sed ϕ Value	NA	NA	NA
Erosion (g/day)	1.2	1.4	1.6
Mussel Density (ft)	22.8	15.3	8.1
Spartina Cover (%)	53.3	69.6	70.0

*NA – not available, sediment grain size is currently being processed by EPA AED.