GENERAL INVESTIGATION

RHODE ISLAND SOUTH COAST HABITAT RESTORATION

FINAL FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

June 2002

US Army Corps of Engineers

New England District

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	June 2002	General Investigation

4. TITLE AND SUBTITLE
Rhode Island South Coast Habitat Restoration
Final Feasibility Report &
Environmental Assessment

5. FUNDING NUMBERS

6. AUTHOR(S)
U.S. Army Corps of Engineers
New England District

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release,
distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
The Rhode Island South Coast Feasibility Study determined that aquatic habitat restoration in Ninigret, Winnapaug, and Quonochontaug ponds along the southern coast of Rhode Island is both feasible and cost effective. The selected plans will improve the aquatic habit of up to 57 acres of the shoaled-in salt ponds through selective dredging, planting of eelgrass, and establishing sedimentation basins to prevent future shoaling and subsequent loss of restored and existing eelgrass beds. The dredged material consists of medium to fine sands and is suitable for placement along nearby beaches. Restoring the migratory pathway of herring and other anadromous species to Cross Mills Pond in Charlestown will further improve the ecosystem through the restoration of about 20 acres of spawning habitat. The District Engineer recommends that the selected plans be implemented in accordance with the Feasibility Report recommendations at an estimated first cost of $7.6 million. The Federal share of this cost is $4.9 million and the non-Federal share is $2.7 million. This is in accordance with Federal statute, which requires that environmental restoration projects be constructed at 65 percent Federal cost and 35 percent non-Federal cost. This recommendation is subject to the non-Federal sponsor securing the necessary lands, easements, and rights of way for construction and assuming future operation, repair, rehabilitation, and replacement of the project.

14. SUBJECT TERMS
Rhode Island, coastal lagoons, eelgrass, aquatic vegetation, anadromous fish, ecosystem restoration

15. NUMBER OF PAGES
350

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

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Rhode Island South Coast
Habitat Restoration
Feasibility Report

Syllabus

There are nine coastal ponds (brackish waterbodies separated from the ocean by barrier beaches) located along the south coast of Rhode Island. Five of the nine ponds were given permanent breachways during the last century. The most prevalent problem that has arisen with the permanent breachways is an increased rate of sedimentation in the ponds, mainly in the form of flood tidal shoals that continually expand and change shape. These flood tidal shoals have resulted in the loss of valuable eelgrass beds and shellfish habitat. Also, upland development over the last century has resulted in the loss of valuable spawning habitat in some of the freshwater ponds that are connected to the coast.

In response to these problems, Congress, through a resolution adopted by the Committee on Environment and Public Works of the United States Senate, dated August 2, 1995, authorized the Corps of Engineers to conduct a General Investigation of the area from Watch Hill (Westerly) to Narragansett. The resolution authorizes the Secretary of the Army to review a previous report "… with a view to determine whether modification of the recommendations contained therein are advisable in the interest of improved flood control, frontal erosion, coastal storm damage reduction, watershed, stream and ecosystem habitat viability, and other purposes…" A reconnaissance level investigation, completed in November 1997, determined that there were several opportunities for aquatic habitat restoration within the designated study area.

The Rhode Island Coastal Resources Management Council (RICRMC) entered into a Feasibility Cost Sharing Agreement with the Corps in May 1998. The Rhode Island Department of Environmental Management (RIDEM) and the towns of Charlestown, Westerly, and South Kingstown also contributed financially to this partnership. The results of the Feasibility Study are presented in this report.

The purpose of the Feasibility Study was to determine the most technically and economically feasible; and socially, environmentally, and culturally acceptable project, if any, to restore valuable aquatic habitat in the form of eelgrass beds, and fish and shellfish habitat in Ninigret, Winnapaug, and Quonochontaug ponds. The feasibility study also evaluated opportunities to improve anadromous fish passage at Cross Mills Pond in Charlestown. An anadromous fish passage site at Factory Pond and a salt marsh restoration site were also part of the original study scope of work, but both were later dropped at the request of the study sponsor.

Eelgrass, from a national perspective, is very important because it contributes to a healthy estuary in several ways. Eelgrass beds are nursery areas for many commercial and recreational fisheries species, including bay scallops, cod, winter flounder, blue mussels, blue crabs and lobsters. Eelgrass acts as a filter of coastal waters, taking up nutrients and contaminants from the water and causing suspended sediment to settle. Eelgrass is part of the food chain: as the plants age and break down, they become part of the detritus that is eaten by small crustaceans, which in turn are preyed upon by fish. Eelgrass is submerged aquatic vegetation as defined by the Clean Water Act and therefore is a Special Aquatic Site under Section 404 Guidelines of the Act - and by extension a federally significant resource. In the context of the Rhode Island Ecosystem, over 90% of the historical eelgrass resources have been lost to dredging and poor water quality impacts in the last century.

The most feasible solutions were examined collectively to develop a comprehensive restoration plan that will minimize environmental impacts and project costs, and maximize environmental benefits. Technical oversight of the study was provided by a team comprised of the Corps, RICRMC, RIDEM, the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, and faculty of the University of Rhode Island.

The selected plans will improve the aquatic habit of up to 57 acres of the shoaled-in salt ponds through selective dredging, planting of eelgrass, and establishing sedimentation basins to prevent future shoaling and subsequent loss of restored and existing eelgrass beds. The dredged material consists of fine sand and is suitable for placement along nearby beaches.

Restoring the migratory pathway of herring and other anadromous species to Cross Mills Pond in Charlestown will further improve the ecosystem through the restoration of about 20 acres of spawning habitat. This will in turn increase the forage base for predator species in and in the vicinity of Cross Mills Pond, Cross Mills Brook, Ninigret Pond, and Block Island Sound.

The incremental cost analysis performed during the study determined that the selected plans for implementation are all cost effective. A plan is “cost effective” when for a given output there are no other plans that provide the same level of output at a lower cost. A plan is also cost effective when for a given cost there are no other plans that provide greater output. A “best buy” plan is one that for a given output all plans that provide less output do so at a higher incremental cost per unit. Though not a “best buy” when considered as a whole, the sum of all restoration efforts in Ninigret (lower sedimentation basin only), Winnapaug, and Quonochontaug ponds are cost effective and the Locally Preferred Plans by the non-Federal sponsor, the Rhode Island Coastal Resources Management Council. The Winnapaug and Quonochontaug pond restoration efforts, taken separately, are “best buy” plans in themselves. The non-Federal sponsor has expressed its support of the project and is seeking funding from the State legislature to cost share in the initial construction as well as to meet its responsibility for 100% of the operation and maintenance costs.

The Feasibility Study determined that there is a Federal and non-Federal interest in environmental restoration along the south coast of Rhode Island. The District Engineer recommends that the selected plans be implemented in accordance with the Feasibility Report recommendations at an estimated first cost of $7.6 million (see summary table below). The Federal share of this cost is $4.9 million and the non-Federal share is $2.7 million. This is in accordance with Federal statute, which requires that environmental restoration projects be constructed at 65 percent Federal cost and 35 percent non-Federal cost. This recommendation is subject to the non-Federal sponsor securing the necessary lands, easements, and rights of way for construction and assuming future operation, repair, rehabilitation, and replacement of the project, which is currently estimated at $91,500 annually.

Recommended Projects
Summary Table

Project	Dredging Amounts(cy)	Restored Area (acres)	Disposal Options	Total Cost of Project	Non-Federal Share (35%)	Annual Maintenance
Ninigret Pond	156,700	39.76	Charlestown Town Beach/Two Dewatering Sites	$4,168,500	$1,459,000	$45,400
Winnapaug Pond	75,100	12.07	Misquamicut Beach	$1,625,700	$569,000	$23,000
Quonochontaug Pond	48,900	5.21	East Beach/Dewatering Site	$1,225,900	$429,100	$23,100
Cross Mills Pond	--	20.0	--	$552,400	$193,300	--
Totals	**280,700**	**77.04**	**--**	**$7,572,500**	**$2,650,400**	**$91,500**

Rhode Island South Coast Habitat Restoration
Feasibility Report

Table of Contents

Rhode Island South Coast Feasibility Report

List of Tables

Rhode Island South Coast Feasibility Report

List of Figures

Introduction

A. Background

There are nine coastal ponds located along the south coast of Rhode Island (see Figure 1). The coastal ponds are managed by the Rhode Island Coastal Resources Management Council (RICRMC) through their Special Area Management Plan (SAMP). The barrier beaches between the coastal ponds and the ocean are dynamic features that are constantly being reshaped through wave and wind activity, longshore transport of sand, and sea level rise. As early as the 1600's the ponds were being manipulated seasonally; breaching them in the spring and fall when water levels were high. This was done to ensure the passage of migratory fish and provide brackish conditions necessary for various fish and shellfish species (e.g., oysters, blue crab, herring). After being breached the ponds were temporarily subjected to tidal influence, causing some sedimentation to occur inside the ponds. In between breachings, the breach would fill back in naturally and the pond would return to a more fresh water state only to be breached again.

Five of the nine south coastal ponds were given permanent armored breachways during this century. The Point Judith Pond breachway was constructed in 1910, the Ninigret Pond breachway in 1952, and the Winnapaug and Quonochontaug Pond breachways during the 1950's. Green Hill Pond's permanent access to the ocean was established in 1962 when a connecting channel between it and Ninigret Pond was constructed.

The effects of changing the inlets from seasonal to permanent have been extensive. The coastal ponds during the height of the spring freshet were two to three feet higher than they are today (Holland, 1910). The ponds are now permanently affected by ocean tides. Other hydrologic changes include more rapid flushing of the ponds and episodes of extreme low water during times of sustained northwest winds. The overall habitat of the ponds has changed from one that is seasonally brackish to a high salinity environment. This has had a dramatic effect on the fish and wildlife resources of the ponds. Prior to the permanent inlets, widgeon grass thrived throughout the area. Several important fisheries have declined due to the reduction in range of habitat types, a change in the type and amount of food organisms, and a rise in the level of shellfish predators. Conversely, the new saltwater environment has provided for the expansion of other species such as eelgrass, scallops, scup, and flounder.

The most prevalent problem that has arisen with the permanent breachways is an increased rate in sedimentation in the ponds. Permanent breachways allow the longshore movement of sand, in conjunction with everyday tides and storm events, unfettered access through the inlets and into the ponds. This sedimentation has resulted in the creation of flood tidal shoals that continually expand and change shape (see Figure 2). The flood tidal shoals have and continue to encroach on valuable eelgrass and shellfish habitat. The flood tidal shoal in Ninigret Pond has evolved to the point that it has the potential to separate the pond in two within several decades. The State of Rhode Island attempted in the early 1980's to stop the movement of sand into Ninigret Pond through selective dredging in the breachway and on the flood tidal shoal. These efforts met with some limited success, however shoaling in the pond continues.

B. Study Authority

The Rhode Island South Coast study was authorized by a resolution adopted by the Committee on Environment and Public Works of the United States Senate on August 2, 1995. The resolution is as follows:

> "Resolved by the Committee on Environment and Public Works of the United States Senate, that the Secretary of the Army is hereby directed to review the report on the Land and Water Resources of the New England-New York Region, transmitted to the President of the United States by the Secretary of the Army on April 27, 1956, and subsequently published as Senate Document numbered 14, Eighty-fifth Congress, as modified by Senate Public Works Committee Resolution on September 12, 1969, Ninety-first Congress, with a view to determine whether modification of the recommendations contained therein are advisable in the interest of improved flood control, frontal erosion, coastal storm damage reduction, watershed, stream and ecosystem habitat viability, and other purposes, in the area from Watch Hill (Westerly), Rhode Island to Narragansett, Rhode Island."

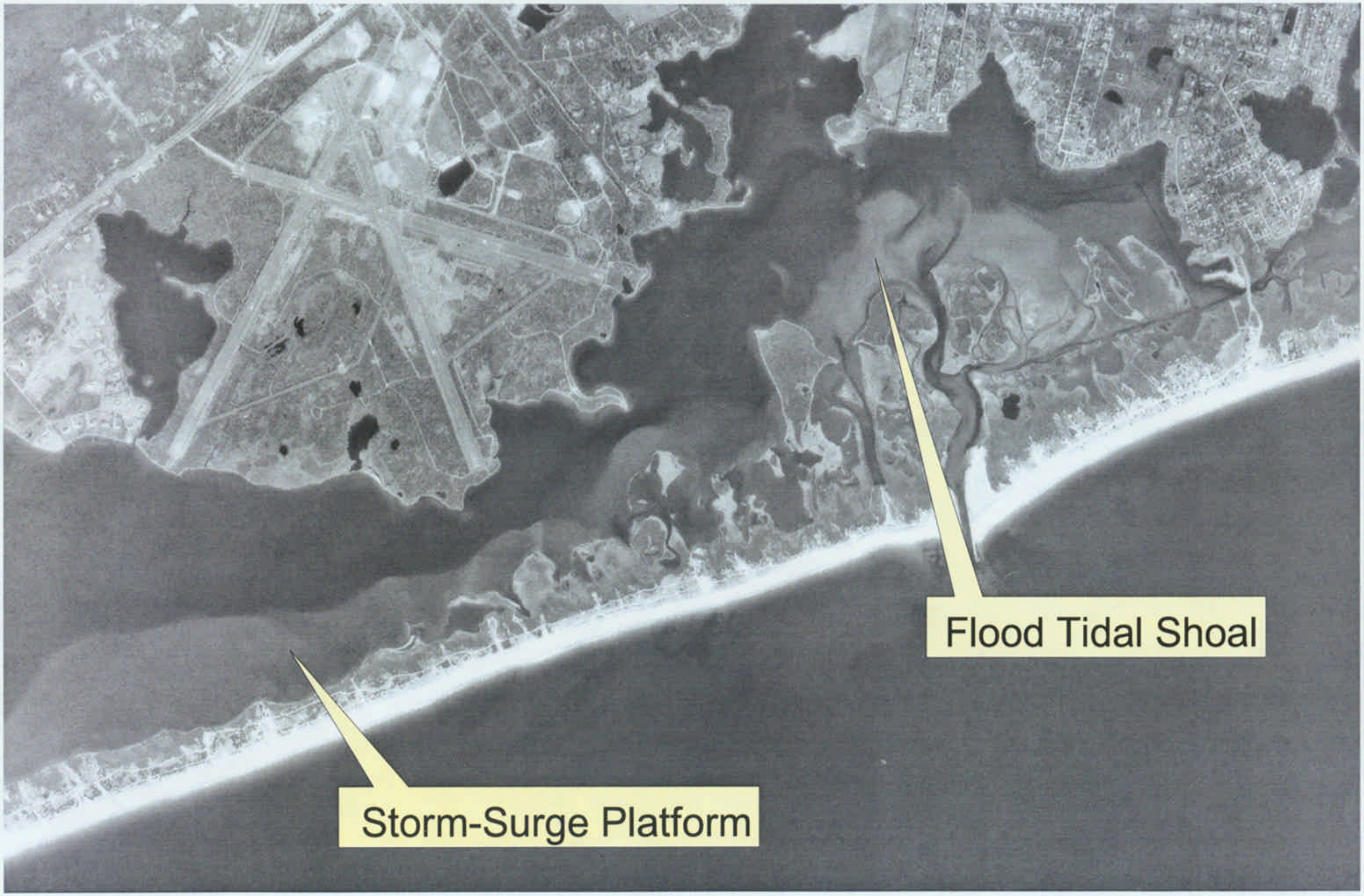
C. Study Purpose and Scope

The purpose of this Feasibility Study was to determine the most technically and economically feasible; and socially, environmentally, and culturally acceptable project, if any, to restore valuable aquatic habitat in the form of eelgrass, fish, and shellfish habitat in Ninigret, Winnapaug, and Quonochontaug ponds. The feasibility study also evaluated opportunities to improve nesting bird habitat through nourishment of the barrier beaches, and restoration of fish passage at Cross Mills Pond in Charlestown. An anadromous fish passage site at Factory Pond and a salt marsh restoration site were part of the original study scope of work as well, but both were later dropped at the request of the study sponsor.

The focus of the investigation was placed on Ninigret, Winnapaug, and Quonochontaug ponds because these were the sites where existing restoration needs best matched Corps authorities. Three of the other coastal ponds (Maschaug, Trustom, and Card) do not have permanent connections to the ocean, may only occasionally be breached, and are more subject to upland runoff or other water quality issues (fecal contamination). Two other ponds (Green Hill, Potter) are actually linked to the ocean through connections to adjoining coastal ponds and, again, were dominated by water quality issues. Point Judith Pond has a permanent breachway and is periodically dredged as a result of existing Federal and state navigation projects in the area. The recently completed Galilee Salt Marsh Restoration Project (68 restored acres) is also located in

Rhode Island South Coast
Location Map

Figure 1



Shoal Formations
In
Ninigret Pond

Figure 2

this pond. For these reasons, Point Judith Pond was not the focus of additional ecosystem restoration efforts during this investigation.

Water resources studies undertaken by the Corps of Engineers are conducted in two phases - a reconnaissance phase (completed in November 1997) and a feasibility phase. The two-phase study procedure is designed to encourage non-Federal participation throughout the study process and to increase the certainty that planned projects will be implemented.

The scope of the feasibility phase included the following:

1. To conduct detailed engineering, economic, environmental, and cultural investigations to support plan formulation and evaluation;

2. To identify the National Ecosystem Restoration (NER) plan, National Economic Development (NED) plan, or Locally Preferred plan, as applicable;

3. To identify environmental restoration projects, eligible for Corps participation, that produce high priority environmental outputs and that are incrementally justified;

4. To comply with National Environmental Policy Act (NEPA) requirements by preparing an Environmental Assessment;

5. To estimate costs and benefits to a level of detail suitable for project justification, if applicable;

6. To determine the appropriate construction cost-sharing arrangements and obtain non-Federal support, as necessary;

7. To prepare appropriate documentation for Federal project authorization; and

8. To recommend favorable projects for authorization and construction, if appropriate.

D. Prior Studies, Reports, and Projects

Several studies have been conducted over the last thirty years that have focussed mainly on storm damage reduction and navigation improvements in the study area.

The restoration of Misquamicut Beach in Westerly was initially authorized by the River and Harbor and Flood Control Act of July 3, 1958. The work entailed widening 3,250 feet of beach to a 150-foot width and installation of sand fences. The work was completed in 1960 and subsequently incorporated into the Westerly multipurpose project authorized by the Flood Control Act of 1965. This led to the development of a comprehensive plan to restore and protect Misquamicut Beach, but due to a lack of local interest further improvements were never constructed and the 1965 project was subsequently deauthorized in January 1986.

A Bulletin published by the Corps' Coastal Engineering Research Center (CERC) in 1966 (Volume II, 1965-66) contained an article titled "Study of Pilot Beaches in New England for the Improvement of Coastal Storm Warning" dealing primarily with Misquamicut Beach. Another CERC report, "Beach Changes At Misquamicut Beach Rhode Island, 1962-1973", was published in November 1984.

In 1983 the town of Westerly requested that the Corps examine a proposal to adopt and dredge a Federal navigation channel through the Weekapaug inlet into Winnapaug Pond. Due to a lack of local interest in pursuing that project the study was terminated before any recommendations could be made.

A report entitled "Developing Policies To Improve the Effectiveness of Coastal Flood Plain Management" dated July 1989 was developed by ICF Incorporated, a consultant to the New England/New York Coastal Zone Task Force. One of the report's conclusions was that, from a government perspective, beach nourishment might be the optimal policy for the beaches in Westerly for flood damage reduction.

A reconnaissance study of the Misquamicut Beach area was completed in January 1994. The study was conducted under the authority contained in Section 103 of the River and Harbor Act (RHA) of 1962. Due to the high cost (greatly exceeded the Section 103 Federal spending limit) of the flood damage reduction plan identified in the study no sponsor was identified willing to participate in further investigations.

A preliminary examination of providing a stable navigation inlet into Quonochontaug Pond was conducted in July 1925. The investigation examined a navigation channel 75 feet wide by 10 feet deep (MLW) through the inlet and 6 feet deep into the pond. A 1,300-foot jetty on the east side of the inlet was also included in the analysis. The improvements were determined to be unfavorable for implementation.

The Corps conducted an investigation in 1995 of potential future effects of coastal flooding on the town of Charlestown. The study was conducted under the Corps Flood Plain Management Services Program. The study focussed on the economic impact of potential flood damages to residential structures within the coastal 100-year flood plain.

Extensive studies and construction of navigation improvements have taken place in the area of Point Judith Pond in Narragansett. Initial navigation surveys of the Pond date back to 1873. The 6,970-foot long main breakwater was authorized in the RHA of 1890. The 2,240-foot long east shore breakwater was authorized in the RHA of 1907. The 3,640-foot long west shore breakwater was authorized in the RHA of 1910. Work was initiated on the first of three breakwaters in 1891. Survey reports in 1897 and 1909 examined the feasibility of dredging a navigation channel into the Pond, but the work was never done. The RHA of 1948 authorized the Corps to establish various channels and anchorages in the upper and lower portions of the Pond, construction of which took place in 1950. Extension of the 15-foot deep entrance channel was authorized under Section 107 of the RHA of 1960 and completed in 1977. Additional channel widening and extension were recommended under Section 107 in 1989; however, the work was never completed due to the unavailability of a suitable disposal site.

The RHA of 1954 authorized the widening of Sand Hill Cove Beach (located within the protective confines of the Point Judith Harbor of Refuge), the construction of five groins and a protective dike. Some of the work was completed in 1955. Portions of the project left inactive at the time were deauthorized in 1977.

Existing Conditions

A. Physical Setting

The study area is located along the south coast of Rhode Island, Washington County. As shown in Figure 3, the specific area of study for the Rhode Island South Coast Feasibility Study consists of Ninigret, Green Hill, Winnapaug, and Quonochontaug ponds, and a stream crossings at Cross Mills Pond. Study efforts concentrated on the salt pond breachways, flood tidal shoals, habitats surrounding the shoals, and barrier beaches facing Long Island Sound. The sizes of each of the salt ponds are: Ninigret Pond (1,711 acres), Green Hill Pond (431), Winnapaug Pond (446), and Quonochontaug Pond (732 acres).

The study area comprises about eleven miles of the coast between the Misquamicut section of Westerly and the Green Hill section of South Kingstown. The three communities impacted by this feasibility study are Westerly, Charlestown, and South Kingstown; all located about thirty-five miles southwest of Providence, the capitol of Rhode Island. The study area is about six to twelve miles from the Connecticut state border. Major roadways in the vicinity include U.S. Route 1 and Interstate Highway 95.

Several state and federally regulated reserve or park areas can be found in the study area. Ninigret Park, the Ninigret National Wildlife Refuge, and the Ninigret Conservation Area are all highly valued and protected areas at the largest of the salt ponds. A Rhode Island Department of Environmental Management recreation area is located at the Ninigret breachway and is heavily used by beachgoers, campers, and fishermen. Misquamicut Beach and East Beach are heavily used state recreational beach located in Westerly and Charlestown, respectively. Quonochontaug Pond State Park is located at the pond's breachway. Public parking and boat ramps are provided at the Ninigret and Quonochontaug breachways.

B. Geological Setting

An understanding of the geologic history of the south coast of Rhode Island was key to making informed decisions during the feasibility study. As glaciers retreated from the area some 14,000 years ago and as sea level rose, a series of headlands and barrier beaches were formed along what is now the south coast of Rhode Island (SAMP, 1999). Headlands are sand and gravel deposits formed from the deposition of glacial till directly and/or glacial meltwater and streams. Several of these headlands have outcrops of bedrock. As the ice retreated, rising oceans with their associated wind, wave, and storm forces began forming barrier beaches in between the higher headlands. These spits gradually connected the headlands and formed coastal lagoons or salt water systems behind them. The barrier beaches consist of sand and gravel and were subject to occasional breaching by storms. Several of the headlands have beaches in front of them as well; however, there are no coastal lagoons or ponds behind them. The barrier beaches are migrating landward in response to storm surge and sea level rise. Storm surge causes the barrier beaches to be overtopped by the ocean or more often, water and sediment flow

Rhode Island South Coast Study Area

Figure 3

through surge channels to the back of the barrier. This sediment is then deposited on the backside of the barrier system and in the coastal lagoon; forming what is called a storm-surge platform. These depositional areas can range from one to three meters in depth. The platforms form the foundation for the migrating barrier. These overwash platforms are quite evident and can be seen in Figure 2.

Barrier beach migration is a constantly changing interplay between two realms: energy and sand. Energy along the south coast of Rhode Island is provided by longshore currents (which are produced as a result of waves striking the shore at an angle), normal wave action, tides (semi-diurnal, two highs and lows per 24 hour 12 minute cycle), storms and storm surge (Nor'easters, Sou'easters, and hurricanes the most influential in shoreline change), and sea level rise (SAMP, 1999). Longshore currents tend to move in a west to east direction. However, flood tides along the south coast move in an east to west direction, while ebb tides move in a west to east direction. Each time the ocean level rises on a flood tide, water is swept through the breachways into the coastal ponds. Sediment is also carried into the breachways during the incoming tides and is especially heavy during storm events. Since the tidal prism is flood dominant (the force of the water is stronger going in through the breachway than when it is leaving), sediment in the breachways is worked into the ponds where it is deposited and forms flood tidal deltas. As indicated earlier, these flood tidal deltas exist to varying degrees in each of the ponds that were studied.

The sand that supplies the growth of these flood tidal deltas is primarily from the barrier beaches which are being eroded and moved toward the breachways by the forces mentioned above. Sea level rise, which some are estimating in this area to be eighteen inches above the current 0 feet National Geodetic Vertical Datum (NGVD) (SAMP, 1999) by the year 2100, will increase the rate at which the foredunes along the barrier beaches are subject to everyday tidal and storm induced erosion. This will have a dramatic impact on the amount of overwash and flood tidal shoaling that occurs inside the coastal ponds.

Finally, extensive studies have been conducted on shoreline change along the south coast of Rhode Island. The SAMP describes studies that highlight shoreline change rates for the period of record from 1939 to 1985. The rates range from a maximum of 1.14 meters per year of erosion in some areas of the barrier beach system to 0.53 meters per year of deposition in others. These rates are an average and were found to be highly dependent on discreet storm events, with not much change taking place during periods of less storm activity. The SAMP also displays the average annual shoreline change which is a valuable resource for pinpointing areas of heavy erosion over time and an indicator of where the placement of sand would be most logical.

C. Environmental Setting

The salt ponds region is a very diverse habitat that includes forests, fields, freshwater wetlands, rivers, streams, saltmarsh, intertidal flats, salt ponds, and barrier beaches. Most species native to the state at large, are also found in this area. Salt marshes are considered one of the most productive habitats, providing nutrients to consumers, nursery habitat, and filtration capabilities for sediment and nutrients. The fact that the salt ponds are physically connected to upland ponds, freshwater marshes, wet meadows, bogs, scrub shrub and freshwater wetlands, allows additional input of detritus material; making them even more productive in relation to the food chain. The low marsh areas are dominated by smooth cordgrass, a source of detritus for various marine species, waterfowl, and various other shorebirds. Prior to the permanent breachways, salinity levels were lower such that widgeongrass (*Ruppia maritima*) dominated as the submerged aquatic vegetation (SAV). However with the change in habitat brought on by establishing a permanent inlet to the ocean, eelgrass (*Zostera marina*) is now the predominant SAV.

Eelgrass is considered one of the most important coastal habitats along the Atlantic coast from Maine to North Carolina. Eelgrass is an important plant in many of the Rhode Island salt ponds. It forms extensive meadows, creating valuable habitat throughout much of the shallow part of these estuaries. Like other seagrasses, eelgrass is limited in its distribution at least in part by depth (Duarte 1991). Eelgrass contributes to a healthy estuary in several ways. Eelgrass beds are nursery areas for many commercial and recreational fisheries species, including bay scallops, cod, winter flounder, blue mussels, blue crabs and lobsters. Eelgrass acts as a filter of coastal waters, taking up nutrients and contaminants from the water and causing suspended sediment to settle. Eelgrass is part of the food chain: as the plants age and break down, they become part of the detritus that is eaten by small crustaceans, which in turn are preyed upon by fish. However, in many areas eelgrass habitats have declined or disappeared as a result of greater shoreline housing development, which leads to increased nutrient loading to bays and coastal waters (Short and Burdick 1996).

The coastal ponds and associated estuaries are valuable habitats for many species of fish and wildlife. The ponds provide valuable nursery habitat for many species that spend most of their life cycle in the ocean. The SAMP lists over one hundred finfish and shellfish species that are dependent on the salt ponds. Many species of shorebirds, including the Piping Plover (a Federally threatened species), utilize the study area for migratory stopovers, wintering, and/or breeding. The special habitat of the salt pond provides the only nesting areas for the following species: Clapper Rail, Sharp-tailed Sparrow, Seaside Sparrow, Least Bittern, Virginia Rail, and the Marsh Wren. Most of these birds require the range of unvegetated mudflats to shallow vegetated water and sandy beaches that can be found in and around the salt ponds. Waterfowl, including American Black Duck, Canvasback, Bufflehead, and Canada Goose, continue to use the salt ponds during migration and as a winter residence. Use of the ponds by these species has declined since the addition of the permanent breachways due to the reduction in widgeongrass, a primary food source for waterfowl, and foraging areas impacted by shoaling. Other species that now thrive in the salt ponds are wintering loon and osprey.

Over the years, the fisheries of the salt ponds have been considered their most important feature. However, quahog, oyster, and flounder populations have been in decline recently. It is surmised that this is a result of overfishing and degradation of the water quality in the ponds. The leading source of water quality degradation is failing and sub-standard on-site sewage disposal systems that contribute to contaminated runoff and groundwater. Other sources include street runoff, lawn fertilizers, and domestic animals. Since the ponds are primarily fed by groundwater, most pollutants, particularly nutrients, are carried through the soil and into the ponds. Elevated nitrogen levels in the ponds produced conditions conducive to excessive algae growth. With minimal tidal flushing, algae bloom conditions have been reported to occur more frequently due primarily to the vast size of the tidal ponds in relation to the breachways and to a lesser extent shoaling in the breachways and on the flood tidal deltas. A major problem with an algae bloom is that it creates other water quality problems: it depletes dissolved oxygen levels, stressing aquatic life, and also causes nutrients to leach from the sediment, further accelerating the growth of algae. When large quantities of algae die-off, the organic material settles to the bottom creating a nutrient source for future blooms which perpetuate the problem. In addition, significant algae growth limits rooted plant growth (eelgrass) since it blocks out sunlight that is needed by those plants.

The State of Rhode Island has and continues to implement stricter controls on septic system installation and upgrades through the SAMP in order to reduce the amount of nutrients and other pollutants that are affecting the coastal ponds through the groundwater.

D. Historical/Cultural Setting

For thousands of years prior to the arrival of Europeans, the Narragansett Indian Tribe occupied what are today Charlestown and the surrounding vicinity along the south coast and interior of Rhode Island. The Narragansetts subsisted through hunting, fishing, and agriculture. As it was in the past, the town of Charlestown remains the center of Narragansett culture today as the seat of the tribal government and home to historic sites and locations that are in continual use today (Rhode Island Historical Preservation Commission (RIHPC) 1981:1, 5).

Adrian Block was the first European to explore Narragansett Bay, the southern coast of Rhode Island, and the offshore island bearing his name in 1614. Shortly thereafter, Dutch traders established trading posts and settlements along the coast. By the eighteenth century, Charlestown was primarily an agricultural settlement. The area north of Route 1, “a hilly, wooded landscape punctuated by ponds and many swamp areas [and which] was farmed in past centuries”, may characterize this. Surviving farms and farmhouses are reminders of this era. The coastal area south of Route 1, which comprises the present study area, was the earliest area settled and the most prosperous throughout Charlestown’s history, particularly along Old Post Road. Cultural resources within this area include old houses, former stagecoach taverns, churches, schoolhouses, an Indian fort, summer cabins, motels, a former Naval Air Station (now a National Wildlife Refuge), several large estates, and a variety of recent summer colonies and communities (RIHPC 1981: 19).

The fish passage site at the Cross Mills is located within the Cross Mills or Charlestown Village Historic District, an important early transportation and industrial area. The Narragansett Indian Tribe has also expressed concern regarding the presence of ancestral cultural resources in association with the study area. In compliance with Section 106 of the National Historic Preservation Act and 36 CFR 800, the Corps has formally entered into consultation with the Narragansett Tribal Historic Preservation Officer concerning this study. Coordination has also been initiated with the Rhode Island State Historic Preservation Officer (RI SHPO).

Problem Identification and Opportunities

A. Statement of Problem

As agreed upon with the non-Federal sponsor, RICRMC, resolution of the following problems was to be the focus of this Feasibility Study effort.

Sedimentation rates in the coastal ponds have increased greatly since the addition of permanent breachways, resulting in the loss of many acres of productive aquatic habitat. The long shore transport of sand along the barrier beaches is swept through the breachways and into the ponds on incoming tides, particularly after storm activity. As water velocities drop, sediment entering the breachway is deposited in the ponds forming flood tidal deltas. It is estimated that the shoaling rate in Ninigret Pond has doubled since the breachway was constructed (Boothroyd et al., 1981). Settling basins were at one time established in the Winnapaug and Ninigret breachways by the State. However, the basins have since filled in and no longer function due to a lack of maintenance. The flood tide deltas are quite extensive; making navigation difficult, and eliminating viable shellfish and finfish habitat, in the form of eelgrass.

Seagrass habitat (i.e., eelgrass beds) is an extremely valuable ecological resource (see “C. Environmental Setting” in the previous section). A recent phenomenon that has captured the interest of seagrass scientists and managers is the global trend of regional declines in seagrass abundance (Kemp 2000). The geographic scope of this trend is staggering and most of the declines appear to be related to human-induced disturbances (Kemp 2000). Major epicenters for seagrass loss are adjacent to areas of dense human habitation including Europe, Australia, and North America (see Kemp 2000 for additional references). Although significant temporal changes in seagrass growth may be related to hydrologic changes associated with natural climatological changes, human manipulation of the regional hydrology may also be (at least partially) responsible for recent massive reductions in seagrass abundance (Fourqurean and Robblee 1999). Therefore, the national (as well as global) interest in seagrass restoration is at an all time high to attempt to stem the trend of these massive declines.

Eelgrass is submerged aquatic vegetation as defined by the Clean Water Act and therefore is a Special Aquatic Site under Section 404 Guidelines of the Act - and by extension a federally significant resource. In the context of the Rhode Island Ecosystem, over 90% of the historical eelgrass resources have been lost to dredging and poor water quality impacts in the last century. The Environmental Protection Agency, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service have been conducting pilot restoration projects in the system to bring back this resource. The coastal salt ponds' carrying capacity for commercial and recreational fisheries (finfish and shellfish) resources is greatly dependent on the nursery and forage function of the eelgrass beds. Scallops, winter flounder and anadromous forage species are all dependent on the structure of eelgrass and its epiphytes.

The beaches and dunes along the south coast of Rhode Island vary in size and shape seasonally, due to the erosive nature of storm and tidal action. The material taken from the ponds will be used to nourish the nearshore area, existing beaches, and if possible, improve the habitat for various species of nesting birds.

Two small coastal fish runs are impeded by road crossings at Cross Mills Pond in Charlestown and Factory Pond in South Kingstown. Restoration of anadromous fish runs will increase the forage base for predator species in and in the vicinity of Cross Mills Pond, Cross Mills Brook, Ninigret Pond, and Block Island Sound. The Factory Pond site was eventually dropped from further study at the sponsor's request. It will be constructed using the design developed during the Feasibility Study and funds provided by the National Oceanic and Atmospheric Administration (NOAA).

An apparent restricted salt marsh was also originally included in the scope of this Feasibility Study. The marsh in question is located at the east end of Quonochontaug Pond and separated from the pond by Quonochontaug Road. Investigations early in the Feasibility Study determined that the marsh in question was not a salt marsh to begin with but was and continues to be a healthy cattail marsh. Therefore, as agreed with RICRMC, this site was dropped from further investigation.

B. Opportunities In Response To Problems

Problems and opportunities are derived from current areas of public concern and from future concerns that would be a consequence of predicted conditions in the study area in the absence of Federal measures to address these consequences. The following opportunity statements are in response to problems in the study area.

The first set of statements reflect how the problems defined can enhance, through corrective measures, the National Ecosystem Restoration (NER) account and possibly to a lesser extent, the National Economic Development (NED) account. A Federal project could:

- Restore valuable aquatic habitat in the form of eelgrass beds in Ninigret, Winnapaug, and Quonochontaug Ponds.
- Possibly improve shorebird nesting habitat through nourishment of the barrier beaches and waterfowl habitat in the intertidal foraging areas around the ponds.
- Restore fish passage opportunities at Cross Mills Pond and connecting ponds and streams to Ninigret Pond, Charlestown.
- Indirectly, improve recreational boating access to the salt ponds.

In addition to the NER objective, other planning considerations are Regional Economic Development, and Other Social Effects. A Federal project could:

- Contribute to the enhancement of the well being of people through their physical, historical, and cultural environments.

- Enhance the economic strength, recreational opportunities, and well being of the area.

- Minimize any short-term negative impacts on residents of the area.

C. Planning Constraints

Planning constraints are limitations that are incorporated into the planning process. These limitations are based on a wide range of concerns such as natural conditions, social and environmental factors, economic limits, and legal and regulatory restrictions.

The following generalized constraints were found to be relevant to the study. The formulated plans should:

- Be consistent with the geographic limitations of the study area;

- Avoid or minimize negative impacts to the existing aquatic habitats in and around the coastal ponds including plant and animal life, and historical resources;

- Address the concerns and desires of the effected communities;

- Be consistent with the requirements of local, State, and Federal regulatory agencies.

At the beginning of the Feasibility Study, a technical team was formed that included the Corps study team members, RICRMC, the Rhode Island Department of Environmental Management, NOAA, the U.S. Fish and Wildlife Service, and faculty of the University of Rhode Island. This group examined alternatives for restoration that were scientifically based, that built upon existing scientific data, that avoided "gross" changes to the currently existing salt pond ecosystem, and that were in keeping with the SAMP. This approach quickly identified several constraints that shaped our plan formulation. These include:

1. The salt ponds were to remain permanently open to the influence of the tides.

2. The current tide range in the ponds was to remain as unchanged as possible.

3. Due to the dynamic nature of the barrier beaches and salt ponds, the technical team avoided plans that included "hard" structures (e.g., revetment, jetties, groins etc.).

4. Much of the recent losses of eelgrass are in the extremities of the ponds and are results of water quality (groundwater) issues associated with upland development. As a result of item 2 above, this water quality issue has and will continue to be handled by the State's new regulations regarding the replacement of on-site waste disposal systems.

5. Water quality conditions near the flood tidal deltas are more than adequate for eelgrass restoration efforts. This is evidenced by the healthy beds located in these areas of the ponds and the water quality sampling conducted during the Feasibility Study. Our restoration efforts were to focus on and around the tidal deltas.

6. Prior hydrodynamic studies (Olsen, 1981) conducted by the University of Rhode Island indicated that deepening the Ninigret breachway uniformly across its length from the ocean to the interior of the pond would result in increased shoaling and salinity in the pond. A "threshold" or controlling depth in the breachway (of around – 3 feet mean low water) is to remain in place (SAMP, 1999). Formulation and modeling of sediment capture areas needed to be sensitive to this criterion.

7. Restoration alternatives for anadromous fish runs to Cross Mills Pond were severely limited by development around the pond and downstream area of the brook.

Plan Formulation

A. Project Goals and Objectives

Prior to conducting this investigation it was important to establish to a clear set of goals and objectives. These statements form the basis of project design and evaluation and are the basis for developing performance criteria for project monitoring and success. Goals refer to the target characteristics to be restored, such as hydrology or wetland flora. Objectives are more precise, such as the species composition of the various communities of biota to be restored. The goals and objectives for this Feasibility Study are outlined below.

1. Project Goals

a. The project goal is to restore the modern historic aquatic habitat of Ninigret, Winnapaug, and Quonochontaug ponds. More specifically, this entails the restoration of eelgrass habitat to the flood tidal delta areas of these ponds. Eelgrass is a highly recognized marine habitat that has benefits to a variety of species including winter flounder, scallops, crabs, lobsters and other shellfish and finfish communities (e.g., eels). This goal will be achieved by restoring the necessary physical, chemical, and biological conditions to the flood tidal deltas of the coastal salt ponds, while minimizing adverse effects on sensitive resources (e.g., juvenile winter flounder and shorebird feeding habitats).

b. The second goal is to restore riverine migratory corridors associated with the investigated salt ponds, specifically, at Cross Mills Pond located north of Ninigret Pond.

2. Project Objectives

The objectives supporting these goals are:

a. Restore robust eelgrass densities to the flood tidal shoal areas at Ninigret, Winnapaug, and Quonochontaug ponds.

b. Protect the newly restored eelgrass habitat from future adverse shoaling. This objective includes the benefit of protecting existing eelgrass beds in the ponds as well.

c. Restoration efforts will in all cases minimize impacts to existing winter flounder spawning and nursery habitats as well as shorebird foraging areas.

d. Restoration of passage to Cross Mills Pond for anadromous fish species.

B. Eelgrass Restoration Alternatives

Alternative 1. No Action Alternative/Without Project Condition

Evaluation of this alternative is a requirement of the National Environmental Policy Act (NEPA) and Corps of Engineers policy. It allows the project team to make its decisions considering likely future conditions without the project. The “No Action” alternative entails no improvements to the study area. If no Federal involvement takes place in the areas identified above, then the following conditions are expected to exist in the future.

Continued shoaling in the breachways and the associated expansion of the flood tidal deltas will result in further loss of valuable subaquatic vegetation (eelgrass) and associated shellfish, plant, and animal communities for both Ninigret and Quonochontaug ponds. Eelgrass growth models for Ninigret and Quonochontaug Ponds predict that if the no action alternative is selected, eelgrass in the areas surrounding the shoals will persist for a limited time with low to moderate growth and then eventually be eliminated by sedimentation (Short, 2001). No eelgrass is currently present in Winnapaug Pond; therefore, the no action alternative will allow this condition to persist.

The results of the Flood Tidal Shoal Evolution study (see section D.5) were used to estimate the growth rate of the flood tidal shoal in each pond for the without project condition. The Ninigret Pond shoal is expected to grow at an average rate of 4,900 cubic meters (or 52,745 square feet, assuming a three-foot deep shoal) per year. The Winnapaug and Quonochontaug pond’s shoals are expected to grow at an average rate of 2,300 cubic meters (or 24,758 square feet, assuming a three-foot deep shoal) per year. Using these figures, the study team was able to determine the estimated amount of existing eelgrass habitat that can be expected to be lost in the future without the project. The study team felt that trying to determine anything beyond this (e.g., future water quality conditions and overall physical geometry of the ponds) was speculative at best and not an efficient way of conducting this analysis.

Increased erosion of the shoreline in developed areas will result in a reduction in the area of beach and dune habitats and their associated value to wildlife.

Alternative 2. Construct a sedimentation basin

Constructing a sedimentation basin in the breachway of each pond will (if properly maintained) substantially reduce shoaling in the ponds. The technical team believed that this was a critical feature to any future restoration efforts in the ponds. A sedimentation basin was constructed in the past in Ninigret Pond, functioned for several years, but without proper maintenance, filled in and is no longer affective. Though this alternative does not restore eelgrass habitat to the shoal areas directly, it does prevent the future loss of existing eelgrass beds adjacent to them.

Alternative 3. Plant eelgrass on the existing shoal and construct a sedimentation basin

Under this alternative eelgrass will be planted on suitable areas of the flood tidal shoals of the ponds. A sedimentation basin will also be constructed in each pond to severely reduce any further sand from encroaching on the pond.

The eelgrass growth models for Ninigret and Quonochontaug Ponds predict that just planting eelgrass across the shoals would initially add eelgrass biomass to the system. However, the biomass would quickly be eliminated and any surviving eelgrass would exist at sparse densities over deep areas of the shoals until eliminated (about six years) by natural disturbance. Growth models (Short, 2001) for eelgrass in all of the ponds predict that planted eelgrass is optimized at depths of 0.75 to 1.0 meter below mean low water (MLW) and that reduced sedimentation rates are crucial to the restored plants' survival.

Under this alternative, eelgrass will only be planted in a small portion of the restoration areas in Winnapaug Pond. Currently, only approximately 15% of the areas selected for restoration in Winnapaug Pond have sufficient depth for eelgrass plants to grow optimally. The restoration areas in Ninigret and Quonochontaug Ponds currently are not deep enough to support optimal eelgrass growth.

Various depths of dredged sedimentation basins were considered under each alternative that included this feature. The depth that was recommended was based on a present worth analysis of the cost of maintaining the basins over time.

Under this alternative, benefits would be generated by substantially reducing the sedimentation rate and adding eelgrass acreage to the deeper restoration areas of Winnapaug Pond. There are no benefits to Ninigret or Quonochontaug Ponds under this alternative.

Alternative 4. Dredge the shoal, construct a sedimentation basin, and plant eelgrass

Under this alternative, the flood tidal shoal areas in the ponds will be dredged to a specified depth, eelgrass will be planted in the newly dredged areas, and sedimentation basins will be constructed to reduce future shoaling.

Eelgrass growth models for all three pond restoration areas predicted that the optimal depth for eelgrass (depth at which eelgrass is most productive) was approximately 0.75 to 1.0 meter below MLW. The models predicted that eelgrass production was greatly reduced at depths of 0.5 meter or less due to photoinhibition (too much light). Since most of the flood tidal shoal areas are shallower than the optimal depth for eelgrass, dredging these areas is necessary for the proper re-establishment of the plants.

Research into the parameters affecting eelgrass growth indicates that depth, sedimentation/erosion rate, and water clarity have the greatest affect. Water quality data optained in recent years as well as that developed by URI (Granger, Nixon, and Allen, 2000) indicated the water quality to be very good for eelgrass growth around the flood tidal deltas. Benefits would be generated by changing the sedimentation rate and deepening the shoal area to optimize eelgrass growth. The dredging depth (to 0.75 to 1.0 meters below MLW) is based on the optimal depth for eelgrass growth under expected conditions for the site.

C. Anadromous Fish Passage Restoration Alternatives

Alternative 1. No Action Alternative/Without Project Condition

Without restoration, the potential benefits of fish passage, including increased numbers of fish for food chain and human use, will continue unchanged. The without project condition will be that the migrating river herring and eels will be unable to pass upstream to Cross Mills Pond. The fish cannot negotiate the existing culvert due to its length (circuitous route around a block of buildings) and lack of light. Without any restoration, the fish will continue to gather at the base of the downstream end of the culvert, south of Post Road and will be required to spawn in whatever habitat may be present in the lower sections of Cross Mills Brook.

Alternative 2. Trap and Transport Fish to Cross Mills Pond

In this alternative, river herring will be trapped downstream of the existing barrier (i.e. the re-routed culvert underneath Post Road) and transported a short distance to Cross Mills Pond using a portable tank (i.e. truck mounted or on wheels). A trapping and/or holding facility will need to be constructed in order to collect the migrating adult alewives for transfer, and a portable transport tank made available for the migration season. In addition, vehicle and/or personnel access will need to be constructed at both the downstream trapping/holding area (Cross Mills Brook) and the upstream release area at Cross Mills Pond. An agreement will need to be established with the State of Rhode Island to provide personnel to accomplish the work during the migration season. Trap and transport activity will take place for approximately six weeks, between April 15 and May 30 each year. At least two personnel per day will be needed to accomplish the work. The juvenile fish are able to negotiate downstream through the existing culvert during the late summer.

The benefit of this alternative is that it will avoid the costlier (potential) initial construction costs of a fishway. However, it will require the permanent manual transfer of fish to Cross Mills Pond each year in order to maintain and/or establish an anadromous fisheries run. In addition, although these species will be restored to Cross Mills Pond, it would be not be a self sustaining population, but dependent upon the yearly transfer of these fish beyond the upstream barrier. Also, manually transferring these fish is less efficient than the fish moving through a fish ladder, in that there is mortality associated with the transfer, resulting from netting, holding (i.e. crowding) and predation (i.e. from the concentration of the fish in the holding area while awaiting transfer).

Alternative 3. Construction of Fishway

In this alternative, a fishway (two aluminum fish ladders, a concrete sluiceway, and a concrete box culvert under the road – see Figure 8) will be constructed, allowing migration of anadromous fish beyond the existing culvert that currently hinders upstream passage. This will allow the fish to migrate directly to upstream spawning habitat, and will restore runs of anadromous fish to their historic habitat of Cross Mills Pond and Brook.

D. Studies Conducted in Support Plan Evaluation

During the Feasibility Study quite a number of scientific efforts were undertaken in order to assist in the evaluation of the restorative alternatives listed above. A number of these more significant efforts and their results are listed below.

1. Winter Flounder Survey – A winter flounder egg survey was conducted (ENSR, Marine and Coastal Center) in early March 1999. The purpose of the survey was to determine if the flood tidal shoals were used by winter flounder as spawning habitat. The study found very few winter flounder eggs on the shoals, leading to the conclusion that dredging of the shoals will not result in the loss of spawning habitat.

2. Water Quality and Seagrass Observations – Water quality sampling and eelgrass abundance measurements were conducted (Steve Granger, URI, Graduate School of Oceanography) from the spring of 1999 to the spring of 2000. The purpose of this effort was threefold: to document the abundance (by depth) of eelgrass around the flood tidal deltas, measure several baseline water quality parameters (total suspended solids, dissolved inorganic nitrogen and phosphorous, chlorophyll-a, and light attenuation) that historically correlate with the growth and survival of eelgrass, and compare the water quality data collected to that of the Rhode Island Pond Watchers between 1985 and 1994. The study determined that existing eelgrass flourished in the 0.75 to 1.0 meters MLW range in the ponds and that future restoration efforts were dependent on the interplay of nutrient inflows and the mitigating influences of water exchange with Rhode Island Sound.

3. Shellfish Survey – A shellfish survey of the flood tidal shoals was conducted in July 1999 by RIDEM (Mr. Art Ganz, Division of Fish and Wildlife). The survey determined that very few shellfish existed on the flood tidal shoals of Winnapaug and Quonochontaug ponds. More shellfish was detected on the Ninigret Pond tidal shoal. Some loss of shellfish, apart from transplanting, may take place as a result of dredging the Ninigret flood tidal shoal.

4. Shorebird Survey – A shorebird survey was conducted (URI, Department of Natural Resources Science) between August and October 1999. Coordination with the

U.S. Fish and Wildlife Service resulted in this survey being done. The survey determined that a significant number of migratory shorebirds, including gulls, terns, sandpipers, and plovers, utilize the flood tidal shoal areas for foraging. This information resulted in a reduction in the scope of restoration efforts by avoiding all intertidal areas on the shoals. Each flood tidal shoal area was surveyed (GPS) in 2000 to determine the extent of intertidal areas and all subsequent restoration plan footprints were altered to include a dredging buffer.

5. Flood Tidal Shoal Evolution Study – A study of the evolution of the flood tidal deltas was conducted by URI, Department of Geology (Dr. Jon Boothroyd). This effort created a digital map of the growth of the shoals between 1939 and 1995 using archived aerial photographs. This information was then used to determine an average shoaling rate for each pond. Shoal rates varied from year to year, but the average rate for Ninigret Pond was found to be about 4,900 cubic meters per year (assumed 1 meter depth) and 2,300 cubic meters per year for both Winnapaug and Quonochontaug ponds.

6. Sedimentation Sampling Study – A sedimentation study, developed in coordination with Dr. Jon Boothroyd, was undertaken to measure actual shoaling rates in each pond between May and November 1999. Fiberglass rods were deployed in several locations throughout each pond and measured periodically to determine levels of shoaling and/or erosion. Although the results of the study were inconclusive, the data that was generated was useful in the Eelgrass Assessment Study conducted by Dr. Fred Short. ENSR also conducted tide and velocity measurements in the ponds that were useful to our hydrodynamic modeling efforts (see Appendix I).

7. Eelgrass Assessment Study – This effort modeled the alternatives developed for the Feasibility Study. Developed and run by Dr. Fred Short of the University of New Hampshire, the model used information developed by Short, Granger, and Boothroyd to simulate eelgrass growth in the ponds under each alternative. The model is based on a prior version developed by Short that now takes into account temperature, light, turbidity, and nutrients. Outputs for each alternative were measured as biomass of eelgrass at various depths. Optimum eelgrass growth is reached in Ninigret and Winnapaug pond at a depth of about 0.75 meters below MLW and at a slightly deeper depth of about 1.0-meter below MLW in Quonochontaug Pond.

8. Sediment Analysis of Proposed Dredging Sites – A sediment sampling plan was developed in conjunction with RIDEM to determine the grain size of sediments proposed for dredging. Four-foot long cores in the restoration areas and ten-foot long cores in the sedimentation basins were taken from the ponds in January 2001 by Battelle, a subcontractor to the Corps. The sediments were analyzed and found to consist mainly of fine gray sand, with small amounts of shell hash intermixed. All of the samples were suitable for beach disposal (<10% fine material) except for the sample taken in the upper sedimentation basin (48% fines) in Ninigret Pond. Subsequent coordination with RIDEM determined that material from the upper basin in Ninigret Pond will need to be disposed of at a suitable upland site. The results of the sediment core analysis can be found in Appendix B of the Environmental Assessment.

9. Hydrodynamic Analysis – A two-dimensional hydrodynamic computer model (Surface Modeling System, SMS) was developed by the Corps of Engineers for each pond to analyze the impact of proposed dredging conditions on circulation (velocity magnitude and direction, tidal elevation, etc.) and sediment transport. Physical data collected for the modeling effort included extensive topographic and hydrographic survey data, and measurements of water surface levels and peak velocities over various tide cycles. The model was used to compare existing conditions in the ponds to the various alternative restoration plans as well as to determine the optimal location and size of the sedimentation basins (see Appendix I).

E. Final Array of Alternative Plans Evaluated

Using the information developed during the study, the study team was able to finalize the list of alternatives that was evaluated in detail.

Though construction of a sedimentation basin by itself does not result in restored acres of eelgrass, it was determined to be a viable alternative in that it does meet the objective of protecting existing eelgrass beds. Therefore, this alternative was kept in the comparative analysis. Also, the Hydrodynamic Analysis (Appendix I) determined that there a two areas for locating sedimentation basins in Ninigret Pond. The lower or southern basin, located nearest the breachway entrance, is capable of trapping most of the sediment. The upper or northern basin, located further inside the pond has the ability to trap most of the finer material that passes over the first basin. The analysis will include alternatives that utilize the lower basin feature by itself and a combination of the lower and upper basins. It makes no sense to utilize the upper basin only.

Due to the large size of the Ninigret Pond flood tidal shoal (about 39.76 acres excluding the intertidal areas) it was decided that fractions of the total site would be evaluated. This was done in consideration of the non-Federal sponsor who may or may not be able to afford restoration of the entire site. Therefore, the full, 2/3, and 1/3 of the site were evaluated as alternatives. The other two ponds had total restoration areas of only 12.07 acres (Winnapaug) and 5.21 acres (Quonochontaug). Due to the relatively small size of these restoration sites they were only evaluated at the full amount.

Finally, the trap and transport alternative for migratory fish restoration was dropped from further consideration. This was done due to site limitations. The available area surrounding the Cross Mills Brook is very narrow and not conducive to construction of trap and transport facilities. The difficulties and costs of securing lands to implement this alternative were found to be too great for the limited benefits to be gained.

Table 1 below shows the full array of alternatives that were evaluated in detail during the Feasibility Study.

Table 1
Alternative Plans

1. No Action
2. Construct Lower Sedimentation Basin – Ninigret Pond
3. Construct Lower & Upper Sedimentation Basins – Ninigret Pond
4. Construct Sedimentation Basin – Quonochontaug Pond
5. Construct Sedimentation Basin – Winnapaug Pond
6. Plant Eelgrass and Construct Lower Sedimentation Basin – Ninigret Pond
7. Plant Eelgrass and Construct Lower & Upper Sedimentation Basins – Ninigret Pond
8. Plant Eelgrass and Construct Sedimentation Basin – Quonochontaug Pond
9. Plant Eelgrass and Construct Sedimentation Basin – Winnapaug Pond
10. Dredge Shoal, Plant Eelgrass, Construct Lower Basin – Ninigret Pond (1/3)
11. Dredge Shoal, Plant Eelgrass, Construct Lower & Upper Basins - Ninigret Pond (1/3)
12. Dredge Shoal, Plant Eelgrass, Construct Lower Basin - Ninigret Pond (2/3)
13. Dredge Shoal, Plant Eelgrass, Construct Lower & Upper Basins – Ninigret Pond (2/3)
14. Dredge Shoal, Plant Eelgrass, Construct Lower Basin - Ninigret Pond (All)
15. Dredge Shoal, Plant Eelgrass, Construct Lower & Upper Basins – Ninigret Pond (All)
16. Dredge Shoal, Plant Eelgrass, Construct Basin – Quonochontaug Pond
17. Dredge Shoal, Plant Eelgrass, Construct Basin – Winnapaug Pond
18. Construct Fish Passage at Cross Mills Pond

Evaluation of Alternative Plans

A. Quantity Development

As described above, there are basically three variations or combinations of constructable plans that are being considered for the salt ponds.

Figures 4 through 6 show the general layout of the eelgrass restoration, sedimentation basin, and disposal areas considered for each pond. The extents of the restoration areas shown are the maximum areas that were found to be restorable. They are basically an outline of what is left of the flood tidal shoal after the intertidal and navigable channel areas are removed. The sedimentation basins are each roughly three acres in size and were located in areas of the breachway that were determined by the hydrodynamic analysis to be accreting, or non erosive.

Most of the material to be dredged from the restoration and basin areas was found to be fine sand, suitable for disposal along the beaches. The one exception, however, was the material that has shoaled in at the upper basin area in Ninigret Pond. This sand was found to contain upwards of 48% fines and is not suitable for beach disposal. The sediment grain size data collected at the restoration, basin, and beach disposal sites can be found in Appendices B and C of the Environmental Assessment.

In order to accommodate the disposal of any fine (not suitable for beach fill) material as well as the non-Federal sponsor's desire to have the option of transporting some of the dredged sand to other areas along the coast for beach nourishment, we proposed two potential upland dewatering sites east of the Ninigret Pond breachway. The diked area adjacent to the breachway is about 1.6 acres in size and can contain about 13,000 cy of material. The one further to the east is about 1.3 acres in size and can hold about 10,000 cy of sand.

Figure 7 shows the location and Figure 8 the layout of the anadromous fish passage at Cross Mills Pond. This design was developed by the U.S. Fish and Wildlife Service, Engineering Field Office in Newton Corner, Massachusetts. Mr. Richard Quinn designed the proposed fishway with topographic survey data provided by the Corps of Engineers.

Appendix II, Engineering Quantities, provides a detailed description of each of the alternatives that were examined. Figures in the appendix show the restoration and sedimentation basin layouts, with accompanying buffer zones to ensure that the MLW line was avoided at the deepest proposed depth. Much of the survey data shown was developed using the Scanning Hydrographic Operational Airborne Lidar Survey System (SHOALS). As can be seen though, the shallowest areas in the ponds, where most of the restoration will take place, SHOALS had trouble registering good data. This required that the team go obtain additional survey on the shoals themselves using hand held GPS. Several contours were collected this way, including the intertidal (low water) line and the edge of the shoal. These surveys were linked to our knowledge of tide heights for each pond on the day the contours were surveyed. This additional survey data was used to approximate the depth of the restoration areas and develop quantities. The survey data in the area of the sedimentation basin, based on our knowledge of the ponds, seemed reasonable for use in developing quantities. The beach profiles shown in the appendix are based on surveyed profiles that were provided by the RICRMC. Finally, the appendix also lists the quantities for various depths of dredging as well as the proposed fishway.

B. Cost Development

The next step in the evaluation process was to develop costs for the various alternatives. A detailed explanation of the costs developed for the Feasibility Study can be found in Appendix III. Using the quantities developed for the various alternatives, tables of cost estimates for various project depths and the fishway were estimated. Tables 1 through 4 in Appendix III are self-explanatory. Diked dewatering site costs estimates were also completed. The initial dredging estimates were calculated assuming a 14" hydraulic dredge plant. Even though the team understood the possible physical constraints of getting such a large piece of equipment into some of the salt ponds (especially Ninigret Pond as it is the most shallow), it was agreed to use these preliminary estimates for the incremental analysis portion of the study. More refined estimates, based on a shallower draft dredge plant (8 inch "mudcat") were completed on the alternatives that were eventually selected for implementation (see Tables 1a., 2a., and 3a. and the Current Working Estimates developed using MCACES software found in Appendix III).

C. Benefits of Alternative Plans

Benefits for alternative plans are based on a unit of measurement. In many cases, acres can be used as a simple and efficient unit of measure. For this Feasibility Study, the unit of measure that was chosen was acres of eelgrass habitat restored.

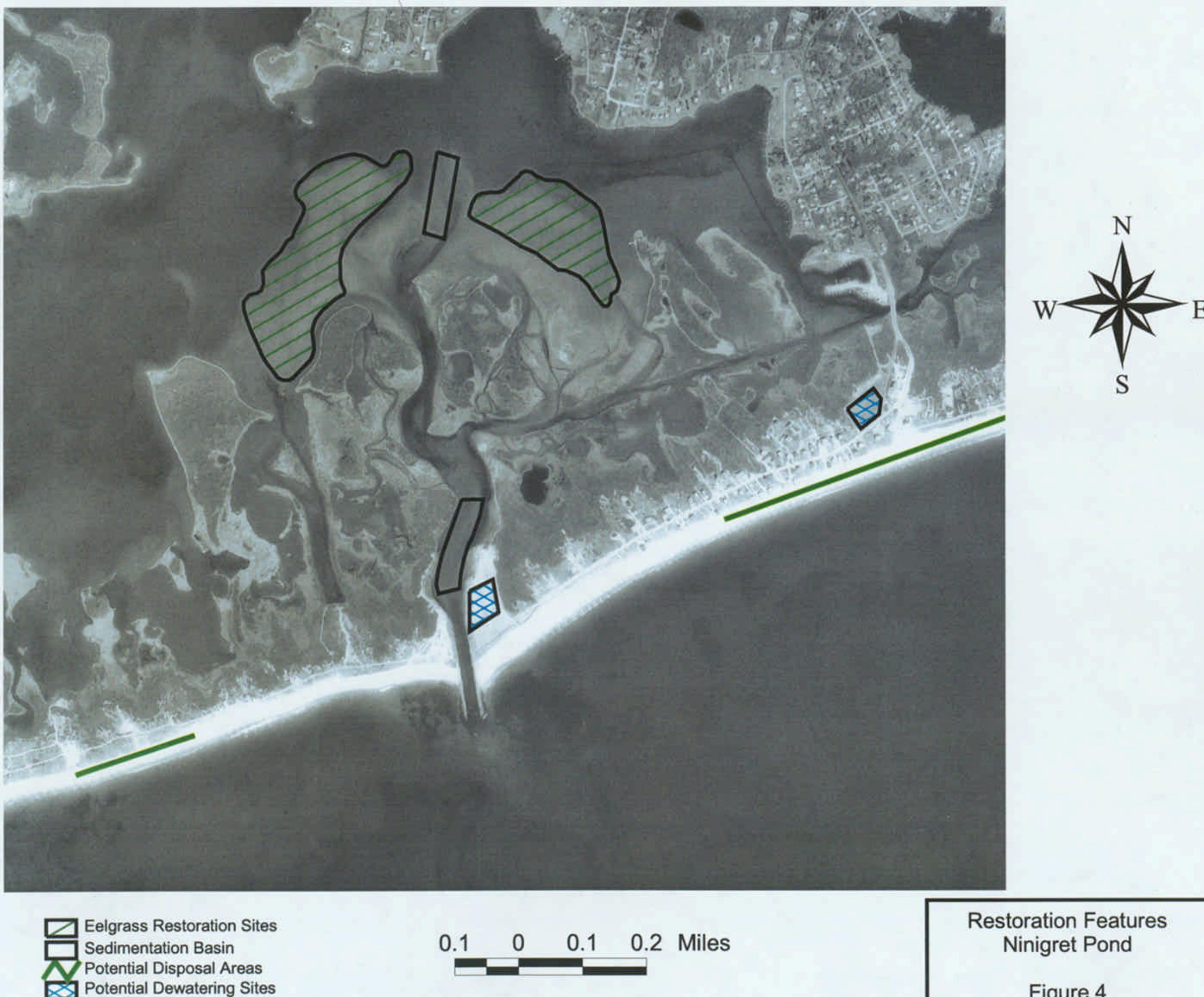
Some of the criteria built into the analysis that may not be apparent from other sections of the report include:

1. Even though the planting ratio for one restored acre is 0.5, it was decided that this constitutes a fully restored acre.

2. For comparative purposes, 1.0 acres of fish passage restoration is equivalent to 0.5 acres of restored eelgrass habitat. Since a fishway will open up approximately 20 acres of fish habitat, this is equivalent to 10 acres of eelgrass habitat units.

3. Each environmental project's economic life is 25 years.

4. As indicated in Appendix I, Hydrodynamic Analysis, the sedimentation basins proposed for each pond are not expected to "trap" all the material that passes through them. In fact, the appendix lists the efficiencies for each basin as: Ninigret lower basin (65%), Ninigret upper basin (20%), Winnapaug basin (80%), and Quonochontaug basin (70%). However, these are only estimates and it was our judgement that we cannot



Restoration Features
Ninigret Pond

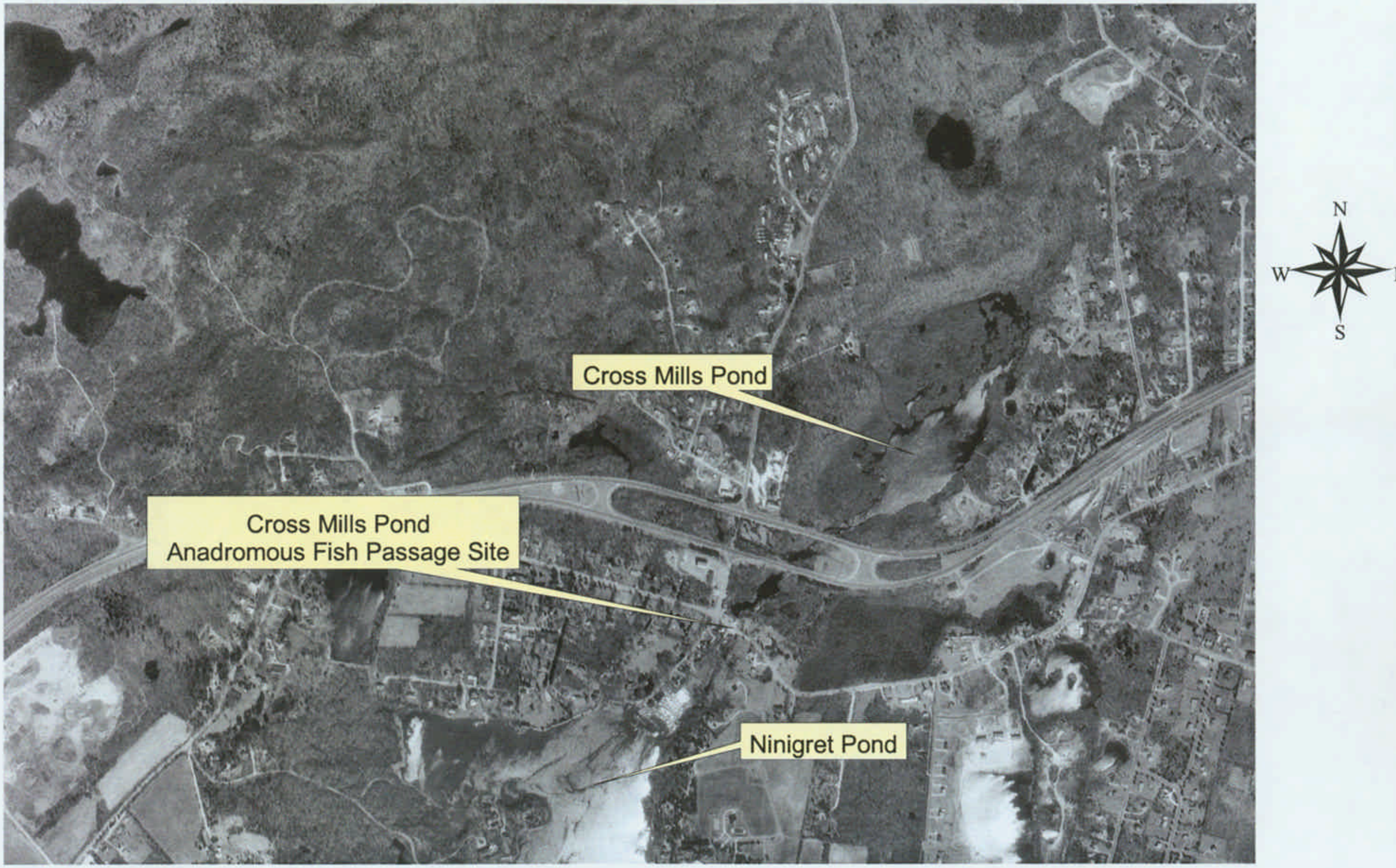
Figure 4

Restoration Features
Winnapaug Pond

Figure 5

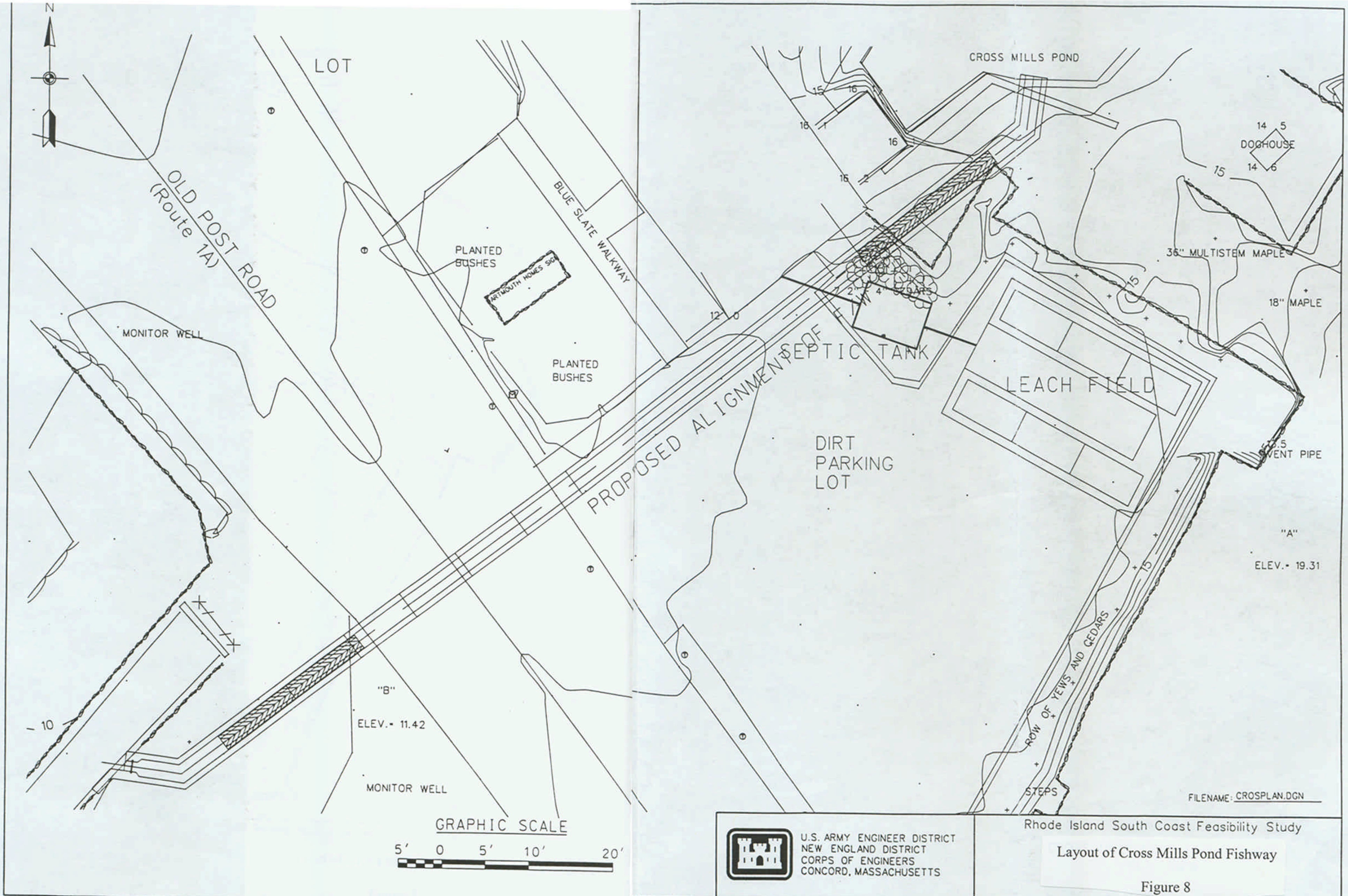
Restoration Features
Quonochontaug Pond

Figure 6



Location of
Cross Mills Pond Fishway

Figure 7



Layout of Cross Mills Pond Fishway

Figure 8

expect any better efficiency from these basins given the physical (narrow) constraints of the sites. Therefore, for our benefits analysis it was decided that the two sedimentation basins at Ninigret Pond will have an efficiency of 100% [(65% + 20%)/85%] and the Winnapaug and Quonochontaug basins will have an efficiency of 88% [(70% + 80%)/2/85%). The Ninigret lower basin by itself was assigned an efficiency of 76% (65%/85%).

5. The benefits associated with protecting existing eelgrass beds were adjusted by applying an "equivalency" factor to reflect the fact that the eelgrass beds surrounding each shoal are not uniform in coverage or density. A 0.5 factor was applied at Ninigret, a 0.25 factor at Quonochontaug, and a 0.0 factor at Winnapaug (there is no existing eelgrass in Winnapaug Pond).

6. Finally, alternatives 6, 7, and 8 involve planting eelgrass on the existing shoal. The growth model developed for this study indicated that in order to establish eelgrass on the existing shoal, then a depth of 0.75 meters below MLW, or greater, is necessary. Currently only the Winnapaug shoal has even a portion (15%) of its shoal with that depth. Therefore there is no added benefit to just planting for Ninigret and Quonochontaug ponds.

Using these criteria, the habitat units to be restored were calculated for each alternative. An example of how different habitat units were calculated is listed below. In each case a progressively more difficult calculation is laid out. Table 2, which can also be found in Appendix D, Incremental Analysis, of the Environmental Assessment, summarizes the habitat benefits for each of the alternatives.

<u>Alternative 2 - Ninigret Pond (dredge lower basin)</u>:

52,745 ft^2 (shoaling rate) x 25 years (project life) x 1acre/43,560ft^2 x 0.5 equivalency factor x 0.76 efficiency factor = <u>11.47 acre benefit</u>

<u>Alternative 9 - Winnapaug Pond (dredge basin and plant)</u>:

[24,758 ft^2 (shoaling rate) x 25 years (project life) x 1acre/43,560ft^2 x 0.0 equivalency factor x 0.88 efficiency factor]
+
[0.15 (percent plantable) x 12.07 acres (total restoration area) x 0.88 efficiency factor] = <u>1.60 acre benefit</u>

<u>Alternative 11 – Ninigret Pond (dredge lower & upper basins, dredge 1/3 shoal, plant)</u>:

[52,745 ft^2 (shoaling rate) x 25 years (project life) x 1acre/43,560ft^2 x 0.5 equivalency factor x 1.0 efficiency factor]
+
[1/3 (fraction of shoal dredged) x 39.76 acres (total restoration area) x 1.0 efficiency factor] = <u>28.25 acre benefit</u>

Table 2
Alternative Plans & Associated Benefits

Alternatives	Habitat Units (Acres)
1. No Action	0.00
2. Construct Ninigret Lower Basin	11.47
3. Construct Ninigret Basins	15.00
4. Construct Quonochontaug Basin	3.09
5. Construct Winnapaug Basin	0.00
6. Construct Lower Basin & Plant –Ninigret	11.47
7. Construct Basins & Plant –Ninigret	15.00
8. Construct Basin & Plant –Quonochontaug	3.09
9. Construct Basin & Plant –Winnapaug	1.60
10. Construct Lower Basin, Dredge Shoal, & Plant-Ninigret (1/3)	21.61
11. Construct Basins, Dredge Shoal, & Plant-Ninigret (1/3)	28.25
12. Construct Lower Basin, Dredge Shoal, & Plant-Ninigret (2/3)	31.74
13. Construct Basins, Dredge Shoal, & Plant-Ninigret (2/3)	41.51
14. Construct Lower Basin, Dredge Shoal, & Plant-Ninigret (All)	41.88
15. Construct Basins, Dredge Shoal, & Plant-Ninigret (All)	54.76
16. Construct Basin, Dredge Shoal, & Plant-Quonochontaug	7.69
17. Construct Basin, Dredge Shoal, & Plant-Winnapaug	10.65
18. Construct Fish Passage at Cross Mills Pond	10.00

The report originally listed the opportunity of possibly improving nesting bird habitat through nourishment of the barrier beaches. As the feasibility study developed and the disposal sites were identified, it became apparent that this benefit was not worth quantifying. That is due to the fact that disposal of dredged material will take place in the intertidal portion of the beaches, and therefore, the overall size of the beaches should not be incresed. Even if some of the material were pushed up onto the beach by wave action, we still do not believe there will be a tangible benefit to nesting birds. The beaches chosen for disposal are all high traffic (passive and active recreation) use areas; typically not the best for promoting nesting bird habitat. This is evidenced by the fact that the vast majority of known nesting sites, for Federally listed threatened or endangered species, in the project area are at remote locations where beach nourishment is not being considered (due to distance and access to the site, and exposure to having the sand re-enter the breachway). This is not to say that the local sponsor, at the time of construction, would be prevented from taking some of the material that might be stockpiled and moving it to a spot higher on the beach to try and encourage some nesting. The study team just believes that those efforts will see very limited success and are therefore not worth trying to quantify as project benefits.

The study team also considered other beneficial categories, specifically storm damage reduction and increased recreational use of the beach. The RICRMC, using known erosion rates, was able to quantify that if unchecked continued loss of the barrier beaches over the 25 period of analysis could have potentially serious impact on an estimated thirty private properties in the Charlestown Beach area, and parking lots and roads at Charlestown and Misquamicutt beaches as well. The dredged material that will be placed in the itertidal portion of the beach consists of medium to fine sand, which is not very compatible with the existing course beach sands. Much of the material is expected to wash out into the nearshore area forming offshore bars. Such bars currently exist in the area and consist of similar material. This disposal method is in fact putting the sand back into the littoral system, and not building a sustainable storm damage reduction feature. For these reasons, no additional recreation or storm damage reduction benefits were taken.

D. Costs of Alternative Plans

In a similar fashion, the total cost for each alternative was developed. Total costs were developed so that a "true" comparison of alternatives could take place and are used to conduct the incremental cost analysis (Appendix D of the Environmental Assessment). The total cost of each alternative includes: the initial dredging cost, planting costs, and discounted maintenance costs.

Initial dredging costs are taken from Tables 1, 2, 3, and 4 of Appendix III.

Maintenance frequency, which is dependent on the initial depth of the sediment basins, was developed by dividing the amount of initial material removed from the basin by the shoaling rate minus any efficiency losses. Table 3 summarizes the maintenance recurrence intervals for each of the ponds versus the starting depths of each of the sedimentation basins.

Table 3
Estimated Maintenance Interval
Of Sedimentation Basins (Years)

	Depth (MLW)					
	- 3	**- 4**	**- 5**	**- 6**	**- 7**	**- 8**
Ninigret (lower)	2	3	5	7	8	10
Ninigret (upper)	8	12	17	21	26	32
Winnapaug	2	4	6	8	10	13
Quonochontaug	1	3	5	7	10	13

Once the maintenance frequency was calculated, the discounted maintenance costs were calculated and added to the initial construction cost. In almost all cases the alternative that was found to be the least costly was when the sedimentation basin was initially dredged to –8 feet MLW. The one exception being that the 5-foot upper basin in Ninigret Pond was selected by default due to the limited upland dewatering site capacity at the site (23,000 cy).

Finally, eelgrass planting costs (including monitoring costs) were calculated. A $40,000 per acre cost for initial planting was used. This cost is based on a combination of factors including: actual cost for prior restoration efforts, the development of alternative restoration methods (e.g., seeding), and field conditions. Monitoring costs for the restoration effort for Ninigret Pond were estimated at $30,000 for the first year and $10,000 per year for the next two. Similarly, Winnapaug and Quonochontaug monitoring efforts were estimated at $15,000 for the first year and $5,000 per year for the next two. These figures were discounted to reflect the time value of dollars spent in the future. Based on a 0.5 planting ratio, as discussed above, the full planting of the Ninigret Pond restoration area is:

> $40,000/acre x 39.76 acres x 0.5 (planting ratio) + $45,347 (discounted monitoring costs) = $840,547 total cost of planting

E. Cost/Benefit Comparison of Alternative Plans

Table 4 compares the alternative costs and benefits of each of the plans.

Table 4
Cost/Benefit Comparison of Alternative Plans

Alternatives	**Total Cost** (000's)	**Habitat Units** (Acres)
1. No Action	0.00	0.00
2. Construct Ninigret Lower Basin	1,236.8	11.47
3. Construct Ninigret Basins	1,642.3	15.00
4. Construct Quonochontaug Basin	920.3	3.09
5. Construct Winnapaug Basin	919.5	0.00
6. Construct Lower Basin & Plant –Ninigret	1,236.8	11.47
7. Construct Basins & Plant –Ninigret	1,642.3	15.00
8. Construct Basin & Plant –Quonochontaug	920.3	3.09
9. Construct Basin & Plant –Winnapaug	955.7	1.60
10. Construct Lower Basin, Dredge Shoal, & Plant-Ninigret (1/3)	2,126.4	21.61
11. Construct Basins, Dredge Shoal, & Plant-Ninigret (1/3)	2,504.4	28.25
12. Construct Lower Basin, Dredge Shoal, & Plant-Ninigret (2/3)	2,915.6	31.74
13. Construct Basins, Dredge Shoal, & Plant-Ninigret (2/3)	3,321.1	41.51
14. Construct Lower Basin, Dredge Shoal, & Plant-Ninigret (All)	3,732.3	41.88
15. Construct Basins, Dredge Shoal, & Plant-Ninigret (All)	4,137.8	54.76
16. Construct Basin, Dredge Shoal, & Plant-	1,325.8	7.69

Quonochontaug		
17. Construct Basin, Dredge Shoal, & Plant-Winnapaug	1,825.9	10.65
18. Construct Fish Passage at Cross Mills Pond	269.0	10.00

The costs shown in Table 4 were used to develop an incremental cost curve (see Appendix D, Environmental Assessment). A required part of the feasibility study, an incremental cost analysis examines how the costs of additional units of environmental output increase as the level of environmental output increases. The incremental cost analysis compared all of the alternatives against each other; resulting in a series of 162 comparable combinations.

The incremental analysis identified cost effective solutions. Cost effective solutions are those increments or combinations of alternatives that result in the same output, or number of habitat units, for the least cost. An increment is cost effective if there are no others that cost less and provide the same, or more, habitat units. Alternatively, for a given increment cost, there will be no other increments that provide more habitat units. This analysis identified 17 cost effective combinations. Of the seventeen cost effective plans, five were also identified as "best buy" plans. For each best buy plan there are no other plans that will give the same level of output at a lower incremental cost. Table 5 lists the best buy plans.

Table 5
Incremental Cost Curve
"Best Buy" Plans

Description	**Habitat Units**	**Cost**	**Avg. Cost**	**Inc. Cost**	**Inc. Output**	**Inc. Cost**
	(acres)	($000's)	($000's/acre)	($000's)	(acres)	per output
No Action	0.0	0.0	0.0	0.0	0.0	0.0
Alternative 18	10.0	269.0	26.9	269.0	10.0	26.9
Alternatives 18 & 15	64.8	4,406.8	68.0	4,137.8	54.8	75.5
Alternatives 18, 15, & 17	75.5	6,232.7	82.6	1,825.9	10.7	170.6
Alternatives 18, 15, 17, & 16	83.2	7,558.5	90.8	1,325.8	7.7	172.2

In Table 5, incremental cost per unit increases with output, or habitat units. The first 10 acres have an incremental cost of $26,900 per acre. This increment consists of providing fish passage to Cross Mills Pond. The second increment increases eelgrass acreage by 54.8

acres and has an incremental cost of $75,500 per acre. This plan consists of constructing two sediment basins, shoal dredging, and planting of eelgrass at Ninigret Pond, in addition to the fish passage at Cross Mills Pond. The third increment increases the restoration acreage by 10.7 acres at a cost of $170,600 per acre. This plan adds to the previous increment by providing basin construction, shoal dredging, and eelgrass planting at Winnapaug Pond. The fourth, and final, increment adds to the previous increment by providing basin construction, shoal dredging, and planting at Quonochontaug Pond. This plan adds an additional 7.7 acres of eelgrass restoration at an incremental cost of $172,200 per acre.

F. Selected or Locally Preferred Alternative

Discussions with RICRMC determined that the locally preferred plan is the total of plans presented at the bottom of Table 5, excluding the upper basin in Ninigret Pond. The reasons for excluding the upper basin feature were: the material that will be excavated is very fine and unsuitable for beach disposal and the channel may migrate in this area making the basin obsolete over time. Although this plan is not a best buy plan, if Ninigret Pond, Quonochontaug Pond, and Winnapaug Pond are considered to be separate projects (they are all physically independent and span two separate towns), this locally preferred plan is cost effective. This plan will result in 12.9 fewer acres of overall restoration and cost $405,500 less over the life of the project. Considered separately, basin construction, shoal dredging, and eelgrass planting at Quonochontaug Pond and Winnapaug Pond are still best buy plans with the incremental costs shown in Table 5.

DESCRIPTION OF SELECTED PLAN(S)

The selected plans for implementation are described as follows:

A. Ninigret Pond

Aquatic habitat, in the form of eelgrass, will be restored to the flood tidal shoal of Ninigret Pond.

About 39.76 acres of the flood tidal shoal, as shown on Figure 4, will be dredged to a depth of about 0.75 meters (2.5 feet) below MLW. This will require the removal of about 107,000 cy of sand. The quantity estimates for the restoration area and sedimentation basin are based on a one-foot vertical to six-foot horizontal side slope of the dredge cut. This is necessary to prevent sloughing and subsequent loss of the intertidal and bordering saltmarsh areas. The material will most likely be removed by hydraulic means and be pumped directly, via pipeline through the breachway and along the beach, to the nearby Charlestown Beach area for disposal. The dredged material will be deposited in the intertidal zone of the beach and be shaped by wave action. The beach profiles shown in Appendix II were developed to approximate the capacity of each disposal area. The resulting beach profiles will not resemble the figures shown in Appendix II as the material will be spread out over the intertidal and subtidal zones along the beaches. This is due to the fact that the material being placed is medium to fine sand and that dredged material protruding seaward of the existing beach face will concentrate wave action and speed erosion of the newly placed material. The State of Rhode Island will also have the option of utilizing two nearby potential dewatering sites in order to retain the ability to use some of this material for beach nourishment purposes at other locations. The two dewatering sites provide about 23,000 cy of capacity. Development of a continuously operating dewater/removal (truck sand to beaches for final disposal) scenario, possibly in the area of the proposed dewatering site or on the high part of the beach near the breachway, would expand the capacity of the dewatering option and possibly lower overall project costs. This concept will be explored further during the Plans & Specification phase. Pipeline routes and staging areas will also be finalized during the Plans & Specifications stage. A sedimentation basin, about 3.5 acres in size and 8 feet deep at MLW will also be dredged at the proposed location in the breachway. This will require the removal of about 49,000 cy of sand and it will be disposed of in a similar manner.

Eelgrass will be transplanted (and/or seeded) in the dredged restoration areas by removing plugs of eelgrass from nearby healthy donor beds (see Section VI.A.2. of the Environmental Assessment). Depending on the spacing (2.0, 1.0, or 0.5 meters) chosen for transplanting, the impact to existing eelgrass beds will vary between 0.08, 0.34, and 1.33 acres, respectively. The restored beds will be planted in mosaics of patches (at a 0.5 ratio) throughout the restoration area to mimic natural beds and to allow the beds to coalesce through succession. Monitoring of the effort (by the Corps) will take place for three consecutive growing seasons to ensure success of the project.

Operation and maintenance of the project will be the responsibility of the non-Federal sponsor, the RICRMC. The sedimentation basin will require periodic maintenance. We have estimated a minimum of every ten years based on known shoaling rates and the initial depth of the basin. The maintenance frequency may be more frequent if there is an increase in the amount of coastal storm activity or a portion of the basin is subject to heavy, localized shoaling. In any event, the non-Federal sponsor has stated that it is pursuing funding to respond to the maintenance needs of the project in the future. As has been discussed on several occasions, it may be beneficial to the State to own and operate its own small, dredge equipment to respond to the needs of this as well as other salt ponds in the region.

B. Winnapaug Pond

Aquatic habitat, in the form of eelgrass, will be restored to the flood tidal shoal of Winnapaug Pond.

About 12.07 acres of the flood tidal shoal, as shown on Figure 5, will be dredged to a depth of about 0.75 meters (2.5 feet) below MLW. This will require the removal of about 41,736 cy of sand. The quantity estimates for the restoration area and sedimentation basin are based on a one-foot vertical to six-foot horizontal side slope of the dredge cut. This is necessary to prevent sloughing and subsequent loss of the intertidal and bordering saltmarsh areas. The material will most likely be removed by hydraulic means and be pumped directly, via pipeline along the backside of the pond, to the Misquamicut State Beach area for disposal. The dredged material will be deposited in the intertidal zone of the beach and be shaped by wave action. The beach profiles shown in Appendix II were developed to approximate the capacity of each disposal area. The resulting beach profiles will not resemble the figures shown in Appendix II as the material will be spread out over the intertidal and subtidal zones along the beaches. This is due to the fact that the material being placed is medium to fine sand and that dredged material protruding seaward of the existing beach face will concentrate wave action and speed erosion of the newly placed material. A sedimentation basin, about 2.8 acres in size and 8 feet deep at MLW will also be dredged at the proposed location in the breachway. This will require the removal of about 33,399 cy of sand and it will be disposed of in a similar manner. Pipeline routes and staging areas will be finalized during the Plans & Specifications stage.

Eelgrass will be transplanted (or possibly seeded) to the dredged restoration areas by removing plugs of eelgrass from nearby healthy donor beds (see Section VI.A.2. of the Environmental Assessment). Depending on the spacing (2.0, 1.0, or 0.5 meters) chosen for transplanting, the impact to existing eelgrass beds will vary between 0.03, 0.10, and 0.40 acres, respectively. The restored beds will be planted in mosaics of patches (at a 0.5 ratio) throughout the restoration area to mimic natural beds and to allow the beds to coalesce through succession. Monitoring of the effort (by the Corps) will take place for three consecutive growing seasons to ensure success of the project.

Operation and maintenance of the project will be the responsibility of the non-Federal sponsor, the RICRMC. As in Ninigret Pond, the sedimentation basin will require periodic maintenance. We have estimated a minimum of every thirteen years based on known shoaling rates and the initial depth of the basin. The maintenance frequency may be more frequent if there is an increase in the amount of coastal storm activity or a portion of the basin is subject to heavy, localized shoaling. In any event, the non-Federal sponsor has stated that it is pursuing funding to respond to the maintenance needs of the project in the future. As has been discussed on several occasions, it may be beneficial to the State to own and operate its own small, dredge equipment to respond to the needs of this as well as other salt ponds in the region.

C. Quonochontaug Pond

Aquatic habitat, in the form of eelgrass, will be restored to the flood tidal shoal of Quonochontaug Pond.

About 5.21 acres of the flood tidal shoal, as shown on Figure 6, will be dredged to a depth of about 0.75 meters (2.5 feet) below MLW. This will require the removal of about 14,958 cy of sand. The quantity estimates for the restoration area and sedimentation basin are based on a one-foot vertical to six-foot horizontal side slope of the dredge cut. This is necessary to prevent sloughing and subsequent loss of the intertidal and bordering saltmarsh areas. The material will most likely be removed by hydraulic means and be pumped directly, via pipeline through the breachway and along the shore, to the East Beach area for disposal. The dredged material will be deposited in the intertidal zone of the beach and be shaped by wave action. The beach profiles shown in Appendix II were developed to approximate the capacity of each disposal area. The resulting beach profiles will not resemble the figures shown in Appendix II as the material will be spread out over the intertidal and subtidal zones along the beaches. This is due to the fact that the material being placed is medium to fine sand and that dredged material protruding seaward of the existing beach face will concentrate wave action and speed erosion of the newly placed material. Development of a continuously operating dewater/removal (truck sand to beaches for final disposal) scenario, in the area of the DEM parking lot adjacent to the breachway, could lower overall project costs. The site is small though and the concept will need to be explored further during the Plans & Specification phase. Pipeline routes and staging areas will also be finalized during the Plans & Specifications stage. A sedimentation basin, about 3.4 acres in size and 8 feet deep at MLW will also be dredged at the proposed location in the breachway. This will require the removal of about 33,974 cy of sand and it will be disposed of in a similar manner.

Eelgrass will be transplanted (or possibly seeded) to the dredged restoration areas by removing plugs of eelgrass from nearby healthy donor beds (see Section VI.A.2. of the Environmental Assessment). Depending on the spacing (2.0, 1.0, or 0.5 meters) chosen for transplanting, the impact to existing eelgrass beds will vary between 0.01, 0.05, and 0.17 acres, respectively. The restored beds will be planted in mosaics of patches (at a 0.5 ratio) throughout the restoration area to mimic natural beds and to allow the beds to coalesce through succession. Monitoring of the effort (by the Corps) will take place for three consecutive growing seasons to ensure success of the project.

Operation and maintenance of the project will be the responsibility of the non-Federal sponsor, the RICRMC. As in Ninigret Pond and Winnapaug Pond, the sedimentation basin will require periodic maintenance. We have estimated a minimum of every thirteen years based on known shoaling rates and the initial depth of the basin. The maintenance frequency may be more frequent if there is an increase in the amount of coastal storm activity or a portion of the basin is subject to heavy, localized shoaling. In any event, the non-Federal sponsor has stated that it is pursuing funding to respond to the maintenance needs of the project in the future. As has been discussed on several occasions, it may be beneficial for the State to own and operate its own small, dredge equipment to respond to the needs of this as well as other salt ponds in the region.

D. Cross Mills Pond

Aquatic habitat, in the form of restored anadromous fish habitat, will be restored to Cross Mills Pond in Charlestown.

Historically, river herring spawned in Cross Mills Pond; migrating to and from the ocean via Cross Mills Brook and Ninigret Pond. With the construction of the mill at the downstream end of Cross Mills Pond, and the later re-routing of the historical stream channel around the mill through a culvert to the west and underneath the Old Post Road, these fish were no longer able to migrate upstream to spawn in Cross Mills Pond. The proposed fishway will provide upstream passage starting at the downstream side of the existing culvert, traveling straight across Post Road, and ending at Cross Mills Pond behind the original mill building. The state is currently stocking the pond with herring. About 20 acres of anadromous fish habitat will be restored with the construction of the proposed fishway (see Figure 8).

The project will consist of approximately 100 feet of concrete lined channel extending from the section of Cross Mills Brook downstream from the Post Road, to Cross Mills Pond at the former mill building. The old mill building currently houses Dartmouth Homes Realty and Edwards Investments. The channel will consist of an initial section of steeppass fish ladder leading to a pre-cast concrete culvert, which will pass under the road (for approximately 40 feet). The channel will continue as an open precast concrete channel, which will pass through the western edge of the building's parking lot to a second section of steeppass fish ladder, and then to an exit channel that enters Cross Mills Pond through the existing concrete headwall, adjacent to the former water inlet structure to the mill. A detailed breakdown of the quantities needed for this project can be found in Table 6 of Appendix II, Engineering Quantities. The fishway will be operated seasonally to take advantage of the migration times. The primary discharge for the pond will continue to be the existing west-side sluiceway and culvert system.

The fishway will pass through the parking lot of the real estate and investment building, which utilizes a septic system. In order to avoid passing through the newly constructed leachfield and septic tank, the fishway will run in between the septic system and the building. However, the open channel will cross the septic line itself, requiring that approximately two feet of septic pipe remain permanently exposed. The pipe will be provided with a protective sleeve. This was determined to be the most feasible means for constructing the fishway and avoids the impossible alternatives of routing it the extra distance around the leachfield or relocating the septic system itself. This has been coordinated with the Charlestown Wastewater Management and Conservation commissions (see Appendix A of the Environmental Assessment).

Operation and maintenance of the project will be the responsibility of the non-Federal sponsor, the RICRMC. Maintenance efforts for the fishway will be minimal, consisting mainly of clearing debris and setting the boards to control seasonal flow. In any event, the non-Federal sponsor has stated that it will have the financial ability to respond to the maintenance needs of the project in the future and will coordinate with RI DEM with regard to stocking of the of the pond.

E. Impacts of Selected Plans

The purpose of the selected restoration projects is to restore previously existing estuarine communities to Ninigret, Winnapaug, and Quonochontaug ponds. Specifically, eelgrass beds will be expanded to areas of the flood tidal shoal where they currently don't exist. Existing eelgrass beds will be protected from further shoaling. Anadromous fish habitat will be restored to Cross Mills Pond. Except for some minor short-term negative effects, the selected plans will have positive effects on the environment. Listed below is a summary of some of the impacts of the selected plans. A more detailed account can be found in the Environmental Assessment and Appendix I.

1. Wetlands and Vegetation

The most direct effect of the selected plans will be the change in the depth of about 57 acres of subtidal areas in the footprint of the restoration areas. The net environmental effect of these changes will be positive due to the fact that relatively low value sandy subtidal habitat will be replaced by higher value subtidal eelgrass habitat. The benefits of restoring eelgrass to the coastal ponds include: 1) creating critical habitat and breeding ground for a variety of marine life; 2) increasing the commercial fishing potential of the ponds by providing habitat for a number of commercially important fishery species (e.g., bay scallop, blue crab, summer flounder, winter flounder, weakfish, and blue mussels); 3) increasing the natural nursery potential of the area for a variety of marine species; 4) increasing storm and shoreline protection through eelgrass' ability to reduce wave energetics; 5) increasing the filtering systems of the ponds by using the eelgrass to trap and filter sediments and pollutants from the water column; and 6) increasing the amount of prime recreational fishing in the ponds.

A consequence of the environmental restoration of eelgrass to the coastal ponds will be the impacts to the existing eelgrass beds that will serve as donor beds and/or seed sources for the restoration areas. It is anticipated that if the project is accomplished entirely through transplanting procedures (removing plugs of eelgrass from healthy beds for placement in the restoration areas) approximately 0.12, 0.49, or 1.90 acres of wild stock could be removed (depending on the spacing desired) from existing beds for use in the transplanting effort. Harvesting of eelgrass will be conducted in numerous individual small collections from the densest beds available. The actual ratio of seeded to transplanted areas will be determined in the Plans & Specifications phase of the project and is dependent upon the results of ongoing seeding projects. Enforcement/protection of the restoration areas is an issue that will also need to be addressed during Plans & Specifications.

The proposed fishway at Cross Mills Pond is not expected to have any permanent long-term impacts on the terrestrial or aquatic vegetation in the project area. A portion of the excavation will be the removal of material in a previously disturbed section of residential/commercial seeded lawn, and the rest will be the removal of the asphalt roadbed in order to place the concrete sluiceway and culvert.

2. Shellfish

The project will have temporary minor adverse effects on shellfish and other benthic invertebrates in the coastal ponds during construction. Immobile benthic organisms in the direct footprint of construction activities will be destroyed. However, larval and adult recruitment will quickly recolonize the disturbed substrates to a community that is similar in species composition, population density, and biomass to that previously present. Construction activities will be timed to avoid peak shellfish spawning seasons (1 June through 1 September). Additionally, the restoration of eelgrass to the ecosystems will improve the quality of the habitat for benthic organisms, including shellfish, by stabilizing the substrate, increasing the structural variety of the habitat, and increasing aquatic productivity.

The effects on the benthic communities from dredged material disposal in the intertidal portion of nearby beaches will be minimal. Species located in this high energy sandy environment are highly adapted at burrowing through shifting sands and should be able to avoid burial. The expected movement of portions of the deposited material offshore by wave action is not anticipated to impact the nearshore benthic communities, as the movement will be gradual.

3. Fish

Restoration of eelgrass will have positive long-term effects on fisheries. The overall quantity of estuarine aquatic habitat available to fish will increase. In addition, the increase in estuarine productivity will benefit fish that feed directly on the detritus formed by eelgrass and benthic organisms in the subtidal area. The improvement in aquatic productivity and populations lower in the food web will enhance the support of fish higher in the food web, including commercial fish.

The spawning of winter flounder in the coastal ponds should not be significantly affected by the project. Given the low number of eggs and the documented reproductive adaptation of not spawning in areas where larvae may be flushed offshore (see Environmental Assessment Section VI.A.4), it is anticipated that impacts to flounder spawning will be minimal.

Twenty acres of spawning habitat will be made available to river herring and other anadromous and/or catadromous species (e.g., eels) in Cross Mills Pond. This will not only provide an increased forage base in Cross Mills pond for resident predator species such as largemouth bass and chain pickerel (which were found in Cross Mills Brook); but may also enhance the forage base in Ninigret Pond and/or Block Island Sound for estuarine and marine species which inhabit the area.

4. Wildlife

The short-term impacts to the avian communities associated with the coastal ponds will be minimal, while the long-term benefits (the restoration of eelgrass at each of the ponds and subsequent increase in productivity) are expected to be extremely advantageous. The impact for all types of wildlife, including bird species, will be the temporary disturbance of habitat during the field construction period. Any birds present at these areas during construction will be able to relocate to another adjacent habitat easily. No loss of breeding habitat will occur as a result of the selected plans. The benefits associated with the selected plans for bird species include the increased productivity of the ecosystem, which should increase the foraging potential of the habitat.

The intertidal habitats of the salt ponds support two Federally and State listed species, the endangered Roseate tern and the threatened Piping Plover. The terns feed over the subtidal areas of the ponds and rest upon the intertidal areas of the ponds, while the plovers forage on intertidal areas of the ponds and nest on sandy beach areas just below the dune scarp.

In order to avoid impacts to the listed species, dredging areas will not include intertidal habitat and construction will not occur during the times of year when these species are present (1 April through 31 August). Design measures will be implemented to ensure that the intertidal habitats are not lost due to sloughing at the edges of the dredged areas. The dredged material will be placed in the intertidal portion of the beaches and, as the beach size should not increase, additional nesting activity in the area should not either. No threatened or endangered species inhabit the area of Cross Mills Brook and Cross Mills Pond. Therefore, there will be no adverse impacts on threatened or endangered species from any of the proposed plans.

5. Recreation and Aesthetics

The restoration of eelgrass in the coastal ponds will greatly enhance the recreational value of the ponds. The project will improve the recreational fishery harvesting potential by increasing the shellfish seed population available to the nearby heavily used intertidal flats. Important fish species such as flounder and white hake utilize eelgrass as nursery areas for their juvenile life stages and will benefit from increases in the areas of eelgrass beds.

The general increase in the quality of habitats will also improve the value of the site for passive recreational use such as bird watching.

Temporary impacts to the accessibility of the dredging and disposal areas will be necessary. Boating may be restricted or delayed during dredging periods as the breachways are very narrow. Additionally, any sites (e.g., parking lots) that may be used to dewater dredged material will be unavailable for use during the construction time frame. Beach access may be restricted to vehicular traffic during construction and use of the hydraulic pipeline. Pedestrian traffic may be restricted in the outfall area of the pipeline for safety concerns. However, the rest of the beach area should remain accessible to pedestrians.

6. Water Quality

Dredging operations in the project areas will not have significant long-term impacts on the turbidity levels or water column chemistry. The amount of turbidity generated during a dredging operation depends upon the physical characteristics of the sediments to be removed, ambient currents, and the type of dredging equipment. The removal of sandy material from the shoaled areas and sedimentation basins will temporarily resuspend sediments into the water column. These sediments are expected to settle in a short period of time because of the coarseness (88-100% sand) of the material to be removed (see Appendix B of the Environmental Assessment). This will result in localized and short-term increases in turbidity during the dredging operation.

The dewatering sites will be designed (during the Plans & Specifications phase) to minimize the amount of suspended material that can re-enter the receiving water. Temporary short-term increases in turbidity at the beach disposal areas are expected to occur as the material is sorted by wave action.

The proposed fishway is not expected to have any long-term negative effects on the quality of Cross Mills Brook and Cross Mills Pond. Actual work in the stream channel itself will be minimal, and limited to tie-in of the constructed fishway to the pond and downstream discharge in Cross Mills Brook. Most of the work involves excavation outside of the stream and therefore will not impact the water quality of the stream. In addition, proper erosion control measures will be in place to prevent siltation in the stream from runoff.

7. Hydrodynamics Effects

The hydrodynamic model (see Appendix I) determined that the effects of the proposed dredging in Ninigret Pond may have a slight effect on the tidal prism in Ninigret Pond. Comparisons between proposed and existing conditions show that water levels at high tide increase 0.15 to 0.2 feet for normal monthly tide conditions. This amounts to about a 15% change in the tidal prism. Velocities in the breachway dropped from 2.6 feet per second (fps) under the existing condition to about 1.6 fps with the proposed lower sedimentation basin. The 10-year tidal flood event was simulated to determine the effect of dredging in the Ninigret/Green Hill pond system. The increase in high tide elevation between existing and proposed conditions varied from 0.35 to 0.45 feet in the extremities of the pond. This slight increase in the storm driven high tide elevation is not viewed as significant to properties adjacent to the pond due to the fact that similar dredging has been done in the past (1985) without causing a problem. Also, the setup of water and/or waves caused by wind could provide similar magnitude of water level change depending upon the wind's direction, strength and duration. Storm events having tide heights significantly greater than the 10-year event (estimated 50 and 100 year events) were not analyzed as the barrier beaches will, in combination with wave and wind effects, become inundated and the breachways have far less or no controlling effect on flooding.

For both Winnapaug and Quonochontaug ponds, the change in elevation for a spring tide event was nearly immeasurable (less 0.1-foot) resulting in a nearly immeasurable tidal prism change. The increase in elevation for an estimated 10-year tidal flood condition under proposed conditions was also less than a 0.1-foot.

The major improvement for all the ponds will be in the circulation pattern in the immediate vicinity of the dredged restoration and sedimentation basin areas.

8. Sediment Composition

Dredging the shoals and sedimentation basins and planting eelgrass in the ponds will slightly alter the sediment composition of the ponds. The sedimentation basin sediments will remain similar to the existing sediments, as the basins will be designed to capture the sandy material that moves into the ponds through the breachways. The shoal areas will be dredged and planted with eelgrass and should not initially change the sediment composition. Over time, the restored eelgrass beds may tend to baffle the water and cause the deposition of some sediment that may move through the area. Sediment composition at any location will depend upon the sediment source, the hydraulic regime, and the topography of the bottom (Thayer, et al. 1984). Sediment chemistry is not expected to be negatively affected by dredging operations. Sediment composition in the disposal areas will not be impacted.

9. Historic and Archaeological Resources

A letter from the Rhode Island Historical Preservation & Heritage Commission (dated May 17, 1999) "determined that the above-referenced project will have no effect on any significant cultural resources…" This letter is included in the pertinent correspondence section of the main report (attached to the Environmental Assessment). The New England District formally coordinated revised project alternatives and plans with the RI State Historic Preservation Officer (SHPO) by letter dated July 24, 2001. As no further comments from the SHPO were received within 30 days of correspondence, we can assume that their prior determination is valid and significant cultural resources are not at risk.

In the mean time, the Narragansett Tribal Historic Preservation Officer (THPO), in a letter dated March 28, 2001, expressed his concerns for the protection of cultural resources in the area of planned impact. The extent of these resources may require further oversight and monitoring by the THPO during construction. At an on-site meeting with members of the Narragansett Tribe on May 18, 2001, concerns were raised concerning the possibility of ancestral remains or cultural resources in association with the fish passage project within the Cross Mills area. No evidence of intact archaeological resources is present at the Cross Mills fish passage site. The Tribe will be given the opportunity to monitor construction in this area. In addition, the Tribe expressed interest in monitoring the pumping of sand for beach nourishment purposes. The Corps is forwarding for approval a Programmatic Agreement (PA) between the District, the Tribe, and the Coastal Resources Management Council for the purpose of mitigating potential impacts to significant Narragansett cultural resources that may be discovered during construction. The Narragansett THPO or an authorized representative will conduct monitoring of sand placement at the three ponds and other areas of cultural significance during project construction. Further consultation, in accordance with the National Historic Preservation Act of 1966, as amended, and 36 CFR 800, may be required in areas where tribal resources are identified as stipulated within the aforementioned PA.

10. Traffic

The selected plans of improvement will have minor temporary effects on traffic during the construction period. Impacts will be minimized by avoiding construction during the summer tourism season.

F. Summary of Coordination, Public Views, and Comments

Coordination for an undertaking of this size has been of vital concern to both the Corps and the RICRMC throughout the Feasibility Study. Many meetings have been held between members of the Corps, RICRMC, Federal and state congressional staff, Federal and state agencies, members of the Technical Advisory Team (including University of Rhode Island participants), Narragansett Tribe representatives, and the public. Formal public meetings were held in October 2000 and August 2001 to inform the local constituency of our findings to date and present the list of alternatives being evaluated in detail.

In addition to the RICRMC, the other groups and interests mentioned above have supported the proposed restoration plans throughout the study process. Federal and state congressional staffs have continuously been informed of the study's progress and have taken an active role in the funding of the study. Many of these groups have actually assisted in the study's data gathering efforts. The Rhode Island Salt Ponds Coalition has been instrumental in providing periodic updates on the Feasibility Study through their newsletter.

The most significant issue raised during the study was the effect proposed dredging would have on migratory bird habitat. The U.S. Fish and Wildlife Service (March 22, 1999) raised these concerns early in the process and we were able to formulate around the intertidal areas that these birds use for foraging.

Pertinent correspondence generated during the study can be found in Appendix A of the Environmental Assessment.

Implementation of Selected Plans

A. Ninigret Pond

As mentioned previously, initial cost estimates were developed for the project based on a 14" dredge plant. Final cost estimates for the selected plans were "refined" by basing the estimate on an 8" hydraulic "mudcat" dredge plant. This equipment can be trailered and has a very shallow draft; making it more practicable in the salt pond environment. Table 6 is reflective of the current working estimate (see Appendix III) for the project in Ninigret Pond. Variations in the unit cost of dredging are a result of such factors as: pumping distance, square footage of the dredging area, type and amount of material, working conditions, and duration of construction. Escalation is another name for the inflation of prices. Verification is any pre-bid task that may need to be done by a contractor (e.g., field measurements or sediment samples). An eelgrass replenishment cost is included to account for a portion (assumed 50% of the area initially planted, over the first three years) of the restoration effort that may not initially succeed. The Real Estate line item for each project is a combination of estimated construction easement costs, relocation costs (for staging areas and temporary pipelines), and acquisition costs (cost of acquiring the easements). Detailed cost information is also listed in Appendices III and IV.

Table 6
Initial Construction Cost Estimate
Ninigret Pond

Dredging Mobilization & Demobilization		=	$ 53,300
Dredging 39.76 acres for Eelgrass Restoration	107,535 cy @ $8.34/cy	=	897,300
Dredging of Lower Sedimentation Basin	49,164 cy @ $9.88/cy	=	485,700
Eelgrass Planting Cost (19.88 acres)		=	621,900
Eelgrass Monitoring Costs		=	52,000
Eelgrass Replenishment Cost (9.94 acres)		=	393,800
Subtotal		=	$2,504,000
Contingency (20% of subtotal)		=	500,800
Escalation & Verification		=	212,800
Plans & Specifications		=	142,000
Engineering During Construction		=	36,600

Supervision & Administration	=	142,700
Real Estate Costs	=	45,400
Total Initial Investment	=	$3,584,300

Not included in the initial investment cost are the optional dewatering site construction costs. The cost of constructing the dewatering dike nearest the breachway is estimated to be about $237,200 (10,200 cy x $23.25/cy). The other containment facility will cost slightly less, $192,700, as it is a smaller facility (1.6 acres vs 1.3 acres). Adding about 36% in contingencies and overheads to these figures results in an additional cost for this project feature of about $584,200. The total cost estimate for Ninigret Pond, including the dewatering sites, is $4,168,500. The cost of pumping some of the sand to these dewatering sites is already captured in the above estimate.

B. Winnapaug Pond

Table 7 shows the current working estimate for the project in Winnapaug Pond (based on a shallow draft "mudcat" dredge plant). It includes dredging, eelgrass planting, and real estate costs associated with the initial construction. Detailed cost information is also listed in Appendices III and IV.

Table 7
Initial Construction Cost Estimate
Winnapaug Pond

Dredging Mobilization & Demobilization		=	$ 40,600
Dredging 12.07 acres for Eelgrass Restoration	41,736 cy @ $8.43/cy	=	352,000
Dredging of Sedimentation Basin	33,399 cy @ $9.63/cy	=	321,700
Eelgrass Planting Cost (6.04 acres)		=	234,000
Eelgrass Monitoring Costs		=	21,700
Eelgrass Replenishment Cost (3.02 acres)		=	95,700
Subtotal		=	$1,065,700
Contingency (20% of subtotal)		=	213,100
Escalation & Verification		=	91,400
Plans & Specifications		=	103,500

Engineering During Construction	=	26,700
Supervision & Administration	=	79,500
Real Estate Costs	=	45,800
Total Initial Investment	=	$1,625,700

C. Quonochontaug Pond

Table 8 shows the current working estimate for the project in Quonochontaug Pond (based on a shallow draft "mudcat" dredge plant). It includes dredging, eelgrass planting, and real estate costs associated with the initial construction. Detailed cost information is also listed in Appendices III and IV.

Table 8
Initial Construction Cost Estimate
Quonochontaug Pond

Dredging Mobilization & Demobilization		=	$ 34,200
Dredging 5.21 acres for Eelgrass Restoration	14,958 cy @ $13.89/cy	=	207,700
Dredging of Sedimentation Basin	33,974 cy @ $9.00/cy	=	305,900
Eelgrass Planting Cost (2.60 acres)		=	95,700
Eelgrass Monitoring Costs		=	21,700
Eelgrass Replenishment Cost (1.30 acres)		=	47,800
Subtotal		=	$ 713,000
Contingency (20% of subtotal)		=	142,600
Escalation & Verification		=	61,100
Plans & Specifications		=	104,000
Engineering During Construction		=	15,200
Supervision & Administration		=	52,800

Real Estate Costs	= 137,200
Total Initial Investment	= $1,225,900

D. Cross Mills Pond

Table 9 shows the current working estimate for the project at Cross Mills Pond. It includes all labor, materials, and real estate costs associated with the initial construction. Detailed cost information is also listed in Appendices III and IV.

Table 9
Initial Construction Cost Estimate
Cross Mills Pond Fishway

Mobilization & Demobilization	= $ 9,200
Site Work	= 12,100
Fishway Construction	= 127,600
Concrete Culvert	= 74,800
Subtotal	= $223,700
Contingency (20% of subtotal)	= 44,700
Escalation & Verification	= 19,200
Plans & Specifications	= 151,900
Engineering During Construction	= 12,100
Supervision & Administration	= 22,600
Real Estate Costs	= 78,200
Total Initial Investment	= $552,400

E. Non-Federal Responsibilities

The full range of non-Federal responsibilities will be determined during the Plans & Specifications phase of the project and listed in detail in the Project Cooperation Agreement. Some of the non-Federal responsibilities include:

- The non-Federal sponsor shall contribute 35 percent of total project costs.

- The non-Federal sponsor shall provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the non-Federal sponsor must provide for the implementation, operation, and maintenance of the project, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the implementation, operation, and maintenance of the project.

- The non-Federal sponsor shall receive credit toward its share of total project costs for the value of the lands, easements, rights-of-way, suitable borrow and dredged or excavated material disposal areas, and relocations that the Government determines the non-Federal sponsor must provide for the implementation, operation, and maintenance of the project.

- The non-Federal sponsor shall not use Federal funds to meet its share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

- The non-Federal sponsor shall operate, maintain, repair, replace, and rehabilitate the entire project, at no cost to the Government, in a manner compatible with the project's authorized purposes.

- The non-Federal sponsor shall hold and save the Government free from all damages arising from the implementation, operation, maintenance, repair, replacement and rehabilitation of the project, and any project related betterments, except for damages due to the fault or negligence of the Government or its contractors.

Implementation costs for the four recommended projects are described in Tables 6 through 9. The breakdown of the estimated cash contribution required of the non-Federal sponsor is shown in Table 10.

Table 10
Non-Federal Sponsor's Project Costs

Project	Total Cost of Project	Non-Federal Share (35%)	Real Estate Costs	Non-Federal Cash Contribution
Ninigret Pond	$4,168,500	$1,459,000	$45,400	$1,413,600
Winnapaug	$1,625,700	$569,000	$45,800	$523,200
Quonochontaug	$1,225,900	$429,100	$137,200	$291,900
Cross Mills	$552,400	$193,300	$78,200	$115,100
Totals	**$7,572,500**	$2,650,400	$306,600	**$2,343,800**

Conclusions

The Rhode Island South Coast Feasibility Study has determined that aquatic habitat restoration in Ninigret, Winnapaug, and Quonochontaug ponds along the southern coast of Rhode Island is both feasible and cost effective. The selected plans will improve the aquatic habit of up to 57 acres of the shoaled-in salt ponds through selective dredging, planting of eelgrass, and establishing sedimentation basins to prevent future shoaling and subsequent loss of restored and existing eelgrass beds. The dredged material consists of medium to fine sands and is suitable for placement along nearby beaches. Eelgrass, from a national perspective, is very important because of its high ecological value to shellfish, fish, and wildlife. The restoration efforts in the ponds will have direct benefit to the fisheries of Block Island Sound as a whole. Restoring the migratory pathway of herring and other anadromous species to Cross Mills Pond in Charlestown will further improve the ecosystem through the restoration of about 20 acres of spawning habitat. Increased use of the pond by anadromous fish will also provide fisheries and wildlife benefits to both Ninigret Pond and Block Island Sound.

The incremental cost analysis performed during the study determined that the selected plans for implementation are cost effective. Alternatives 14, 16, 17, and 18 are the preferred alternatives by the non-Federal sponsor, the Rhode Island Coastal Resources Management Council. The non-Federal sponsor has expressed its support of the project and is seeking funding from the State legislature to cost share in the initial construction as well as to meet its responsibility for 100% of the operation and maintenance costs.

NEPA documentation required for implementation of the proposed actions, in the form of an integrated Environmental Assessment and a Finding of No Significant Impacts, is included in this report.

This Feasibility Study was conducted under a General Investigation authority. The sum total cost of the four projects being recommended for implementation is about $7.6 million. Congress, through Section 206 of the Water Resources Development Act of 1966 (P.L. 104-303), has given the Corps of Engineers direct authority to implement aquatic ecosystem restoration projects, not to exceed a per project total cost of $7.7 million. Given the size and cost of the projects being recommended, it was decided to terminate the efforts under the current General Investigation authority and recommend implementation under the Section 206 authority.

Recommendations

I recommend that the four aquatic habitat restoration projects described in this report be approved and implemented. In my judgement, the selected projects are a justifiable expenditure of Federal funds and appropriate for implementation under the authority provided by Section 206 of the Water Resources Development Act of 1996.

It is also recommended that no further study be conducted under this General Investigation authority at this time.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are authorized for implementation funding.

_________	_________________________
Date	Brian E. Osterndorf Colonel, Corps of Engineers District Engineer

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FINAL

Environmental Assessment,
Clean Water Act
Section 404(b)(1) Evaluation,
and Finding of No Significant Impact

Rhode Island South Coast Habitat Restoration Project
Charlestown, South Kingston, and Westerly, Rhode Island

June 2002

Prepared by
New England District
Corps of Engineers
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TABLE OF CONTENTS

ENVIRONMENTAL ASSESSMENT

I. INTRODUCTION

The purpose of this Environmental Assessment (EA) is to present information on the environmental features of the project area and to review design information to determine the potential impacts of the proposed restoration projects. This Environmental Assessment describes project compliance with the National Environmental Policy Act of 1969 (NEPA) and all appropriate Federal and State environmental regulations, laws, and executive orders. Methods used to evaluate the environmental resources of the area include biological sampling, sediment analysis, review of available information, and coordination with appropriate environmental agencies and knowledgeable persons. This report provides an assessment of environmental impacts and alternatives considered along with other data applicable to the Clean Water Act Section 404 (b) 1 Evaluation requirements.

A. PROJECT LOCATION

This project involves the ecosystem restoration of coastal lagoons and the restoration of a migratory fish passage in Rhode Island (Figure 1). The project area encompasses a portion of the southern coast of Rhode Island from Watch Hill to Narragansett (approximately 22 miles in length). The specific project areas include sites along the breachways and flood tidal shoals of Ninigret, Winnapaug, and Quonochontaug Ponds, as well as a section of Cross Mills Brook. Five areas for eelgrass restoration are located in Winnapaug Pond (Figure 2), three areas are located in Quonochontaug Pond (Figure 3), and two areas are located in Ninigret Pond (Figure 4). The sedimentation basins, located in the breachways of each pond (Figures 2-4), are also included in the project area. A site, located to the north of Ninigret Pond in Cross Mills Brook, which will be used for fish passage restoration to Cross Mills Pond (Figure 5), is also included in the project area.

B. PROJECT AUTHORIZATION

The Rhode Island South Coast Feasibility Study was authorized by a resolution adopted by the Committee on Environment and Public Works of the United States Senate on August 2, 1995. The resolution follows:

"Resolved by the Committee on Environment and Public Works of the United States Senate, that the Secretary of the Army is hereby directed to review the report on the Land and Water Resources of the New England-New York Region, transmitted to the President of the United States by the Secretary of the Army on April 27, 1956, and subsequently published as Senate Document numbered 14, Eighty-fifth Congress, as modified by Senate Public Works Committee resolution on September 12, 1969, Ninety-first Congress with a view to determine whether modification of the recommendations contained therein are advisable in the interest of improved flood control, frontal erosion, coastal storm reduction, watershed, stream and ecosystem habitat viability, and other purposes, in the area from Watch Hill (Westerly), Rhode Island to Narragansett, Rhode Island."

II. PURPOSE AND NEED FOR THE ACTION

The purpose of this project is to: 1) restore subtidal aquatic habitat, in the form of eelgrass beds and their associated values to fish and wildlife, to the flood tidal shoal areas of Ninigret, Quonochontaug, and Winnapaug Ponds; and 2) restore anadromous fish passage to Cross Mills Pond. The following sections detail the purpose and need for each restoration component.

A. EELGRASS RESTORATION PROJECT AREA

Historically, coastal ponds on the south shore of Rhode Island have had seasonal connections to the ocean produced by the dynamics associated with the movements of the barrier spits that separate them from the sea. Natural disturbances (i.e., storm events) periodically closed these connections making access for vessel navigation problematic and decreasing the influence of tidally driven seawater. To alleviate navigation problems and to increase flushing rates within the coastal ponds, the seasonal tidal inlets into the ponds were changed to permanent breachways in the early 1950's by the state of Rhode Island.

The construction of breachways into the coastal ponds had dramatic effects upon the dynamics of the ecosystem. Documented changes include: water levels within the ponds dropping by approximately two feet (0.6 m) as the ponds equilibrated with sea level; changes in the salinity regimes of the ponds; the changing of the dominant submerged aquatic vegetation community from a widgeon grass (*Ruppia maritima*) dominated community to an eelgrass (*Zostera marina*) dominated community; and changes in the faunal structure and associated food webs of the ponds. Many of the observable effects were due to the increased salinity levels brought about by year-round tidal flushing.

Currently, the most serious problems experienced by the coastal pond ecosystems include: the rapid increase in the rate of sedimentation in the ponds' main inlet channels and the formation of large flood tidal deltas; and water quality degradation associated with eutrophication related to upland development. Limited tidal flushing in the ponds, when coupled with upland nutrient loading, allows algal biomass to accumulate to a level that reduces available light for the eelgrass community and depletes oxygen levels throughout the ponds. Increased sedimentation buries grass beds and decreases water depth, thus reducing available eelgrass habitat. It is this latter problem that the feasibility study focuses on. See Section V.A.1. for a description of the historic extent of eelgrass in the coastal ponds.

Seagrass habitat (i.e., eelgrass beds) is an extremely valuable ecological resource (see Section V.A.1). A recent phenomenon that has captured the interest of seagrass scientists and managers is the global trend of regional declines in seagrass abundance (Kemp 2000). The geographic scope of this trend is staggering and most of the declines appear to be related to human-induced disturbances (Kemp 2000). Major epicenters for seagrass loss are adjacent to areas of dense human habitation including Europe, Australia, and North America (see Kemp 2000 for additional references). Although significant temporal changes in seagrass growth may be related to hydrologic changes associated with natural climatological changes, human manipulation of the regional hydrology may also be (at least partially) responsible for recent massive reductions in seagrass abundance (Fourqurean and Robblee 1999). Therefore, the national (as well as global) interest in seagrass restoration is at an all time high to attempt to stem the trend of these massive declines.

Eelgrass is submerged aquatic vegetation (SAV) as defined by the Clean Water Act and therefore is a Special Aquatic Site under Section 404 Guidelines of the Act - and by extension a federally significant resource. In the context of the Rhode Island Ecosystem, over 90% of the historical eelgrass resources have been lost to dredging and poor water quality impacts in the last century. EPA, NMFS and USFW have been conducting pilot restoration projects in the system to bring back this resource. The coastal salt ponds' carrying capacity for commercial and recreational fisheries (finfish and shellfish) resources is greatly dependent on the nursery and forage function of the eelgrass beds. Scallops, winter flounder and anadromous forage species are all dependent on the structure of eelgrass and its epiphytes.

B. FISH PASSAGE RESTORATION AREA

Historically, anadromous river herring (including both alewives and blueback herring) spawned in Cross Mills Pond, migrating upstream from Block Island Sound, through Ninigret Pond and up Cross Mills Brook. With the construction of the mill and the re-routing of the stream to the west, these fish no longer migrate through the re-routed culvert. Currently, river herring still migrate upstream but do not pass beyond the re-routed culvert, due to the various obstacles and curves encountered underground, as well as the lack of light in the long culvert. Today, in order for them to pass upstream they would need to be trapped and/or hand netted and carried to the pond. The proposed project will provide upstream fish passage by constructing an alternative pathway directly to the pond. This new fishway will involve placing two sections of aluminum steeppass fishway alongside new, shorter portions of concrete culvert and channel. The new fishway will be enclosed as it passes under the Post Road but open for the remaining section. Anadromous fishes will be allowed unimpeded access, during spawning season, to Cross Mills Pond, without manual netting; restoring the historic runs. This will have a positive effect on the fisheries as well as the entire ecosystem as the restoration of anadromous fish runs will increase the forage base for predator species in and in the vicinity of Cross Mills Pond, Cross Mills Brook, Ninigret Pond, and Block Island Sound.

III. PROPOSED PLAN

A. EELGRASS RESTORATION PROJECT AREA

The recommended alternatives for the project are described in detail in Section IV of this report. The proposed plan for the salt pond projects involves the construction of a sedimentation basin and removal of sediment from the shoal to restore proper elevation to reestablish eelgrass. Portions of the dredged areas of the shoals will be planted with eelgrass to provide the starter population for the shoal area (Figures 2-4).

Sedimentation basins will be dredged to a depth of up to 8 feet (2.4 m) below Mean Low Water (MLW) and will be designed to catch the majority of the sandy sediment that enters the ponds through the permanent breachways. The existing shoaling areas will be dredged to an approximate depth of 2.5 to 3.25 feet (0.75-1.0 m) below MLW, the optimal depth for eelgrass to grow and thrive as predicted by growth models. The dredged portions of the tidal shoal areas will then be planted with eelgrass from donor beds (either directly or through seeding techniques) in the pond system. The maximum projected aerial extent of the restored eelgrass beds are: 39.76 acres for Ninigret Pond; 12.07 acres for Winnapaug Pond; and 5.21 acres for Quonochontaug Pond.

B. FISH PASSAGE RESTORATION AREA

This restoration project involves the construction of a new fishway in the area of the historic channel of Cross Mills Brook in order to provide upstream passage of anadromous fishes into Cross Mills Pond. Historically, river herring spawned in Cross Mills Pond; migrating to and from the ocean (Block Island Sound) via Cross Mills Brook (through Ninigret Pond). With the construction of the mill at the downstream end of Cross Mills Pond, and the later re-routing of the historical stream channel around the mill through a culvert to the west and underneath the Old Post Road, these fish were no longer able to migrate upstream to spawn in Cross Mills Pond. The proposed fishway will provide upstream passage starting at the downstream side of the existing culvert, traveling straight across Post Road, and ending at Cross Mills Pond behind the original mill building.

The fishway is part of the Rhode Island South Coast Ecological Restoration Project; designed to restore various degraded habitats in the south coast region (including the salt pond areas and their associated tributaries) to their historical condition. The project will consist of approximately 100 feet (30.4 m) of channel extending from the section of Cross Mills Brook downstream from the Post Road, to Cross Mills Pond at the former mill building, which currently houses Dartmouth Homes Realty and Edwards Investments. The channel will consist of an initial section of steeppass fish ladder leading to a pre-cast concrete culvert, which would pass under the road (for approximately 40 feet). This would continue as an open precast concrete channel, which would pass through the western edge of the building's parking lot to a second section of steeppass fish ladder, and then to an exit channel that would enter the Pond through the existing concrete headwall, adjacent to the former water inlet structure to the mill. The fishway would be operated seasonally to take advantage of the migration times. The project will result in the restoration of about 20 acres of spawning habitat. The primary discharge from the pond would still be through the existing west-side sluiceway and culvert system (see Figure 5).

The fishway will pass through the property of the real estate and investment building, which uses a subsurface disposal system (septic system) for sewage disposal. In order to avoid passing through the newly constructed leachfield and septic tank, the fishway is proposed to run alongside the building. However, the open channel will cross the septic line itself, requiring that approximately two feet of septic pipe remain permanently exposed over the open channel. Therefore, as part of the project, the pipe will be provided with some type of protective sleeve. This is the most feasible alternative for construction of the fishway, and avoids the impossible alternatives of routing it the extra distance around the leachfield or relocating the septic system itself.

IV. ALTERNATIVES CONSIDERED

A. EELGRASS RESTORATION PROJECT AREA

Alternative 1. No Action Alternative/Future Without Project Conditions

Evaluation of a No Action Alternative is a requirement of the National Environmental Policy Act (NEPA) and Corps of Engineers policy. It allows the project team to make its decisions considering likely future conditions without the project. The No Action Alternative involves no improvements to the sites, and therefore, is a continuation of the process of shoaling and loss of existing eelgrass habitat.

Under the No Action Alternative, the existing eelgrass and associated shellfish, plant and animal communities will experience various rates of decline until the shoal and associated environmental conditions achieve some equilibrium. Eelgrass growth models for Ninigret and Quonochontaug Ponds predict that if the no action alternative is selected, eelgrass in the areas surrounding the shoals will persist for a limited time with low to moderate growth and may eventually be eliminated by sedimentation (Short, 2001 – See Appendix E). No eelgrass is currently present in Winnapaug Pond. Therefore, the no action alternative would allow this condition to persist.

Alternative 2. Construct sedimentation basin

Constructing a sedimentation basin in the breachway of each pond will (if properly maintained) substantially reduce shoaling in the ponds. Though this alternative does not restore eelgrass habitat to the shoal areas, it does prevent the future loss of existing eelgrass beds adjacent to them.

Alternative 3. Plant eelgrass on the existing shoal and construct the sedimentation basin

Under Alternative 3 eelgrass would be planted on the suitable areas of the shoals (areas with depths of approximately 2.5 feet (0.75 meters)) of the ponds and sedimentation basins would be constructed in each pond to reduce the sedimentation rate.

Various depths of dredging the sedimentation basins were also considered. The depth that was recommended was based on a present worth analysis of the cost of maintaining the basins over time. Eelgrass growth models for Ninigret and Quonochontaug Ponds predict that just planting eelgrass across the shoals would initially add eelgrass biomass to the system. However, the biomass would quickly be eliminated and any surviving eelgrass would exist at sparse densities over deep areas of the shoals until eliminated (about six years) by natural disturbance. Growth models for eelgrass in all of the ponds predict that planted eelgrass could survive at depths of 2.5 feet – 3.25 feet (0.75 to 1.0 meter) below MLW and that the reduced sedimentation rates would be crucial to the plants' survival.

Under Alternative 3, eelgrass would only be able to be planted in a small portion of the restoration areas in Winnapaug Pond. Currently, only approximately 15% of the areas selected for restoration in Winnapaug Pond have sufficient depth for eelgrass plants to grow optimally. The restoration areas in Ninigret and Quonochontaug Ponds currently are not deep enough to support optimal eelgrass growth.

Under this alternative, benefits would be generated by substantially reducing the sedimentation rate and adding eelgrass acreage to the deeper areas of Winnapaug Pond. There are no benefits to Ninigret or Quonochontaug Ponds under this alternative.

Alternative 4. Dredge the shoal, construct the sedimentation basin, and plant eelgrass

Under Alternative 4, the tidal shoal areas in the ponds would be dredged to a specific depth, eelgrass would be planted in the newly dredged areas, and sedimentation basins would be constructed to reduce sedimentation. Dredging the shoals to depths ranging from 1.5 feet to 6 feet (0.5 meters to 2.0 meters) below MLW to increase the depth of the overlying water was considered for this alternative. Additionally, dredging the sedimentation basins to different depths was also considered.

Eelgrass growth models for all three pond restoration areas predicted that the optimal depth for eelgrass (depth at which eelgrass is most productive) was approximately 2.5 feet (0.75 meters) below MLW. The models predicted that eelgrass production was reduced at depths of 1.5 feet (0.5m) or less because of photoinhibition (lower growth rates because of too much light). Since most of the shoal areas are shallower than the optimal depth for eelgrass, dredging these areas is necessary for the establishment of the plants. This alternative also produces the largest amount of habitat units (i.e., eelgrass acres).

Under this alternative, the research into existing conditions and parameters affecting eelgrass and other habitat values have indicated that depth, sedimentation/erosion rate, and water clarity affect eelgrass survival and growth. Benefits would be generated by changing the sedimentation rate and deepening the shoal area to optimize growth. The dredging depth (2.5 feet (0.75 meters) below MLW) is based on the optimal depth for eelgrass growth under expected conditions for the site.

Based upon the benefits generated from dredging the sedimentation basin, dredging the shoal areas, and planting eelgrass, alternative 4 is the locally preferred option for this project.

B. FISH PASSAGE RESTORATION AREA

Alternative 1. No Action Alternative/Future Without Project Conditions

The without project condition would be that the up-migrating River Herring and eels would be unable to pass through the existing culvert, which has been re-routed and enclosed passing underneath the Post Road. Without the project, the fish will continue to gather at base of the culvert downstream from the road and require netting and/or trapping and trucking in order to access Cross Mills Pond, or for the river herring, be required to spawn in whatever habitat may be present in the lower sections of Cross Mills Brook.

Alternative 2. Trap and Transport Fish to Cross Mills Pond

In this alternative the, up-migrating river herring would be trapped downstream from the existing barrier (i.e. the re-routed culvert underneath the Post Road) and would be transported the short distance to Cross Mills Pond using a portable tank (i.e. truck mounted or on wheels). A trapping and/or holding facility would be constructed in order to collect the up-migrating adult alewives for transfer, and a portable transport tank would be made available for the migration season. In addition, vehicle and/or personnel access would be constructed at both the downstream trapping/holding area (Cross Mills Brook) and the upstream release area at Cross Mills Pond. An agreement would be set up with the State of Rhode Island DEM to provide personnel to accomplish the work during the migration season. This would be for approximate period between April 15 through May 30 each year, and would require at least two personnel per day to accomplish the work.

The benefit of this alternative is that it would avoid the costlier construction of a fishway. However, it will require the permanent manual transfer of fish to Cross Mills Pond each year in order to maintain and/or establish an anadromous fisheries run. In addition, although these species will be restored to Cross Mills Pond, it would be not be a self sustaining population, but dependent upon the yearly transfer of these fish beyond the upstream barrier. Also, manually transferring these fish is less efficient than the fish moving through a fish ladder, in that there is mortality associated with the transfer, resulting from netting, holding (i.e. crowding) and predation (i.e. from the concentration of the fish in the holding area while awaiting transfer).

Alternative 3. Construction of Fishway

In this alternative, the proposed fishway described in Section III.B would be constructed, allowing upstream migration of anadromous fishes beyond the existing discharge culvert (downstream from the Post Road) in Cross Mills Brook. This will allow the fish to migrate to upstream spawning habitat, and will restore runs of anadromous fishes to their historic habitat of Cross Mills Pond and Brook.

Based upon the benefits generated from restoring the anadromous fish runs to Cross Mills Pond and Brook, Alternative 3 is the preferred alternative.

V. AFFECTED ENVIRONMENT

A. EELGRASS RESTORATION AREA

1. GENERAL AND HISTORIC CONDITIONS

Eelgrass, *Zostera marina* L., is considered to form an important habitat and to provide crucial functions and values to the coastal waters of New England (Short, 2001). Over the past decade several New England states have implemented projects to conserve and restore eelgrass habitat. In the past, the three Rhode Island coastal ponds under consideration for this project (Ninigret, Quonochontaug, and Winnapaug Ponds) contained extensive eelgrass beds (Wright et al. 1949). However, with shoaling and reductions in water quality, eelgrass and its associated fauna have decreased in extent and abundance. Sedimentation within the ponds has shoaled many areas where eelgrass formerly existed, creating areas too shallow or with sand movement too rapid for eelgrass to persist.

In Ninigret Pond, a gradual decline in eelgrass populations has been documented over the last 40 years, largely a result of increased nutrient loading from housing development (Short et al. 1996), but also with documented losses occurring as the tidal shoal (or delta) has expanded. In 1949 eelgrass in Ninigret Pond was characterized as "excellent east of the breachway" as well as extending to the head of Cross Mill Cove and into the western basin, but not along the shallow southern shore (Wright et al. 1949). Quonochontaug Pond has less documentation of its historic eelgrass coverage, but in 1949 it was reported to be "especially good on the shoulders of the sand shoal that drops off quickly to the north from the breachway entrance into the pond proper. It is not abundant on the shoal itself, but stands remain fairly good up to the eastern end of the pond" (Wright et al. 1949). Additionally, eelgrass was found in isolated stands along the northern shore of Quonochontaug Pond and sporadically to the western reaches, where it was in "only moderately good condition" (Wright et al. 1949). Eelgrass was certainly more extensive than the few patchy beds that currently persist at the edge of the tidal shoal today in Quonochontaug Pond (Wright et al. 1949, Granger et al. 2000). Winnapaug Pond (formerly called Brightman's Pond) is reported to have had extensive eelgrass beds historically (Wright et al. 1949), but in recent studies by the University of New Hampshire and the University of Rhode Island, none were found. In 1949, eelgrass was characterized as "excellent" in the eastern part of Winnapaug Pond and the pond was reported to have "a considerable growth of eelgrass" (Wright et al. 1949).

Eelgrass is considered one of the most important coastal habitats along the Atlantic coast from Maine to North Carolina. Eelgrass is an important plant in many of the Rhode Island salt ponds. It forms extensive meadows, creating valuable habitat throughout much of the shallow part of these estuaries. Like other seagrasses, eelgrass is limited in its distribution at least in part by depth (Duarte 1991). Eelgrass contributes to a healthy estuary in several ways. Eelgrass beds are nursery areas for many commercial and recreational fisheries species, including bay scallops, cod, winter flounder, blue mussels, blue crabs and lobsters. Eelgrass acts as a filter of coastal waters, taking up nutrients and contaminants from the water and causing suspended sediment to settle. Eelgrass is part of the food chain: as the plants age and break down, they become part of the detritus that is eaten by small crustaceans, which in turn are preyed upon by fish. However, in many areas eelgrass habitats have declined or disappeared as a result of greater shoreline housing development, which leads to increased nutrient loading to bays and coastal waters (Short and Burdick 1996).

2. WETLANDS, VEGETATION, AND COVER TYPES

The Rhode Island coastal ponds are fringed by typical New England salt marsh communities. The dominant vegetation types in these marshes include *Spartina alterniflora, S. patens,* and *Distichlis spicata*. *Phragmites australis* is also commonly found in these marshes also.

The subtidal areas of the coastal ponds support various species of submerged aquatic vegetation (SAV) and macroalgae. SAV species include eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*). Since the permanent breachways were constructed, eelgrass has historically been the dominant SAV species in the ponds and has been studied extensively in Ninigret Pond. Documented declines in Ninigret Pond (Short et. al 1996) have been attributed to anthropogenically related eutrophication, and it is suspected that SAV populations in the other coastal ponds are following the same trends.

Documenting long-term trends in eelgrass acreage in the coastal ponds is difficult. Approximate estimations of seagrass coverage through various monitoring techniques can be used, however they are essentially “snapshots” of existing conditions. Short et al. (1996) estimated long-term patterns of distribution for eelgrass in Ninigret Pond, however the other coastal ponds have not been studied as intensively. Comparing distributions between years is difficult due to the fact that seagrass beds shift within their habitat on varying scales (from days to decades) (Fonseca et al. 1998). However, when large scale declines are evident (as in Short et al., 1996) these snapshot distributions are very useful. Granger et al. (2000) approximated percent coverage of eelgrass for the areas adjacent to the project areas within the coastal ponds and found several large areas of 75-100% cover in Ninigret Pond, three small areas of 50-100% in Quonochontaug Pond, and no eelgrass in Winnapaug Pond.

3. BENTHIC INVERTEBRATES AND SHELLFISH

Benthic Invertebrates

Benthic invertebrate communities were sampled with 32 cm^2 cores within the proposed project area in each of the three ponds. Samples were taken in three habitat types in each project area: intertidal areas, shallow subtidal areas/eelgrass beds, and deep subtidal areas (Pratt, 2000). Additional samples were obtained for community analysis from the subtidal areas within the sedimentation basins. The sedimentation basins were sampled with a $0.04m^2$ VanVeen grab.

The Quonochontaug Pond intertidal (high sand) community was dominated by polychaetes and bivalves and is considered to be a typical sand flat assemblage. The dominant organisms were the polychaetes *Paraonis fulgens*, *Scolelepis squamata*, and *Spiophanes bombyx* and the bivalve *Tellina agilis.* The shallow subtidal areas of Quonochontaug Pond (a mix of sand bottom and eelgrass beds) were dominated by oligochaetes, the polychaetes *Capitella capitata*, *Polydora cornuta*, and the amphipods *Ampelisca abdita* and *Microdeutopus gryllotalpa*. A larger number of species were present in the shallow subtidal community when compared to the intertidal habitat, representing a fairly sharp demarcation. Conversely, a gradual transition occurs from the shallow subtidal areas into the deep subtidal areas. The deep subtidal habitats (fine grained silt) of Quonochontaug Pond were dominated by the amphipod *Ampelisca abdita* and the polychaetes *Capitella capitata* and *Streblospio benedicti*. The macroinvertebrate communities of the Quonochontaug Pond sedimentation basin were very similar to the shallow subtidal habitats. The sedimentation basin was dominated by the polychaetes *Paraonis fulgens* and *Capitella capitata* and the bivalve *Gemma gemma*.

The samples for the Ninigret Pond intertidal community (high sand) were dominated by bivalves and polychaetes. The dominant organisms were the bivalve *Gemma gemma* and the polychaete *Paraonis fulgens.* The shallow subtidal areas in Ninigret Pond (a mix of silt, sand, and eelgrass bottom) were dominated by the polychaete *Capitella capitata* and the amphipod *Ampelisca abdita*, while the deep subtidal areas (silt bottom) were dominated by the polychaete *Capitella capitata* and the amphipod *Microdeutopus gryllotalpa*. The shallow subtidal areas had relatively high species diversity and richness, while the deep subtidal areas were dominated by one species. One species of commercial importance, the soft-shelled clam (*Mya arenaria*), was noted in both the intertidal and shallow subtidal habitats of Ninigret Pond. Two potential sedimentation basin areas were sampled in Ninigret Pond. The area to the north was dominated by the polychaetes *Paraonis fulgens* and *Capitella capitata* and the bivalves *Gemma gemma* and *Tellina agilis.* This area had a large number of species present along with a large number of individuals. In contrast, the sedimentation basin area closer to the mouth of the breachway had relatively few species and a low number of individual organisms. The dominants in this sedimentation basin included the polychaete *Paraonis fulgens* and nemertean worms.

Winnapaug Pond intertidal and shallow subtidal samples were combined in data analysis because of a lack of eelgrass in the shallow subtidal areas. These sand flat areas were dominated by the polychaetes *Neanthes arenaceodentata, Capitella capitata*, and *Polydora cornuta*, oligochaetes, the amphipod *Pseudohaustoris caroliniensis* and the bivalve *Gemma gemma*. These sandy areas contained a relatively high diversity of species. However, the number of individuals collected was low when compared with the communities from the other coastal ponds. The deep subtidal areas (silt bottom) of Winnapaug Pond had low diversity and were dominated by the polychaetes *Capitella capitata* and *Polydora cornuta*. The proposed area for the Winnapaug Pond sedimentation basin also had low diversity and few individual organisms. Dominants in the Winnapaug Pond sedimentation basin included the polychaetes *Paraonis fulgens* and *Leitoscoloplos fragilis.*

Shellfish

Results of a Rhode Island Department of Environmental Management study (Ganz, 1999) indicate that shellfish resources in the flood tidal shoal areas of Quonochontaug Pond and Winnapaug Pond were minimal. Hard clams (*Mercenaria mercenaria*) were present in low numbers in both ponds, while soft-shelled clams (*Mya arenaria*) were present in low numbers at Winnapaug Pond. Both Quonochontaug and Winnapaug Pond support commercial and recreational soft-shelled clam fisheries. However, the shellfish resources for these fisheries occur outside of the project area. Additionally, a private shellfish aquaculture operation produces hard clams and oysters (*Crassostrea virginica*) in Winnapaug Pond approximately one mile away from the breachway.

The Ninigret Pond flood tidal shoal area does support patchy distributions of hard calms, soft-shelled clams, surf clams (*Spisula solidissima*), and razor clams (*Ensis directus*). Ganz (1999) reported that while the shellfish were patchy in their distribution, they existed in quantities sufficient to support a recreational fishery. Areas of Ninigret Pond beyond the shoal support a commercial and recreational shellfish fishery as well as three commercial shellfish aquaculture operations.

4. FISH

The salt ponds of Rhode Island support typical near coastal New England fish assemblages. Over 100 species of estuarine and marine fish have been documented in the coastal ponds (Stoligitis et al., 1976; Satchwill and Sisson, 1990; and Sisson and Satchwill, 1991). Kilifish (*Fundulus* spp.), needle fish (*Strongylura marinus*), silversides (*Menidia* spp.), and sheepshead minnows (*Cyprinodon variegatus*) are prevalent through out the ponds. Fish species of note for their commercial and recreational fishery value include winter flounder (*Pseudopleuronectes americanus*), tautog (*Tautoga onitis*), white perch (*Morone americana*), and American eel (*Anguilla rostrata*) (Olsen and Lee, 1982).

Currently, the most significant finfish resource in the coastal ponds is the winter flounder (*Pseudopleuronectes americanus*). The winter flounder is an estuarine dependent species that inhabits brackish estuaries and near-shore waters along the Atlantic coast of North America (Labrador to Georgia). The Rhode Island salt ponds are believed to be the spawning grounds and nursery areas for a major portion of the Block Island Sound winter flounder population (Olsen and Lee, 1985). Migration into the ponds occurs as offshore waters cool during the fall and emigration from the pond occurs in the spring as the ponds warm. The greatest concentrations of winter flounder in the ponds occur between December and March.

Male and female winter flounder generally reach sexual maturity at 3 years of age and fecundity (number of eggs produced each year) increases with body size. Small females produce about 500,000 eggs per year while larger females can produce around 1,500,000. In New England, reproduction occurs in estuaries from January to May with peak activity during February and March. Winter flounder are of particular concern to this project because of the fact that their eggs are demersal (unlike the floating eggs of all other local flatfish, eggs of the winter flounder clump together in masses on the bottom).

Sampling for winter flounder eggs (in March) in the tidal shoals of the project areas (ENSR, 1999) revealed that the abundance of eggs was minimal. Ninigret Pond contained the largest concentration of winter flounder eggs (n = 35), while Quonochontaug Pond and Winnapaug Pond contained considerably less (n = 12 and n = 7, respectively). While this study was limited temporally, it does concur with the findings of Crawford and Carey (1985) who reported that winter flounder eggs are most likely to be found in areas where larvae would be least likely to be flushed out to sea.

Additionally, anadromous and catadromous fish use the coastal ponds as pathways to and from upland streams in the vicinity of the ponds. Both the river herring (*Alsoa aestivalis* and *Alosa pseudoharengus*) and the American eel (*Anguilla rostrata*) rely on the coastal ponds for access to upland streams.

5. WILDLIFE

Mammals

Mammals with historical accounts in the area and appropriate geographical ranges that are likely to occur adjacent to the project area include red fox (*Vulpes fulva*), mink (*Mustela vison*), raccoon (*Procyon lotor*), skunk (*Mephitis* sp.), chipmunk (*Tamias striatus*), coyote (*Canis latrans*), several species of squirrels, and white-tailed deer (*Odocoileus virginianus*).

Birds

A survey of the avian fauna was conducted during the fall of 1999 at the areas of the coastal ponds proposed for restoration (Paton and Trocki, 1999). The primary objectives of the survey were to document the species that occurred in the project areas and to document the presence of two Federally listed species, the Roseate tern (*Sterna dougallii*) and the Piping Plover (*Charadrius melodus*) in the project areas. The survey revealed that the bird populations of all three coastal ponds were very similar. A total of 49 species were observed throughout the study areas with the most common including: herring gulls, semipalmated plovers, common terns, great black-backed gulls, semipalmated sandpipers, double-crested cormorants, laughing gulls, and sanderlings.

Piping plovers were detected at all three coastal ponds. Throughout the study period, a total of 42 piping plovers were recorded at Ninigret Pond, 2 at Winnapaug Pond, and 4 at Quonochontaug Pond. Roseate terns were only recorded from two of the ponds, with 51 being recorded from Ninigret Pond and 5 being recorded from Quonochontaug Pond. No roseate terns were observed in Winnapaug Pond.

Amphibians and Reptiles

Amphibians do not occur within the tidal portion of the coastal ponds as salt water has detrimental effects upon their highly permeable skin. Reptiles, including turtles and snakes, are common inhabitants of the salt pond area. Snapping, spotted, and eastern painted turtles generally inhabit the upland freshwater areas of the watershed, but have been documented to range into the brackish water and saltmarsh habitats of the coastal ponds. The northern diamond back terrapin (*Malaclemys terrapin*) is an estuarine turtle that has historically been found in the coastal ponds. However, the historical records most likely represent wandering turtles and not viable populations of this species (Raithel, 1995). Only the northern water snake is known to exist in the semi-aquatic fresh and/or saltwater habitats in the area.

6. THREATENED AND ENDANGERED SPECIES

The intertidal habitats of the Rhode Island coastal ponds (Ninigret, Quonochontaug, and Winnapaug) support two Federally and State listed species, the endangered Roseate tern (*Sterna dougallii*) and the threatened Piping Plover (*Charadrius melodus*) (See USFWS correspondence – Appendix A). A recent bird survey of the area (Paton and Trocki, 1999) reported finding roseate terns at Ninigret and Quonochontaug Pond, while none were observed at Winnapaug. Piping Plovers were observed at all three ponds.

Both the roseate tern and piping plover utilize the coastal ponds from approximately April 1 through August 31 (USFWS, 1994). The terns feed over the subtidal portions of the shoal areas within the ponds and rest upon the intertidal portions of the shoals. The plovers forage on the intertidal portions of the shoal areas and nest on beaches just below the dune scarp.

National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the Rhode Island Department of Environmental Management concur with this assessment of threatened and endangered species. See Appendix A for correspondence.

7. RECREATION AND AESTHETICS

The coastal ponds of Rhode Island are valuable ecological resources that are utilized by the public as recreational shellfishing and fishing areas, recreational boating areas (including boat launching), hiking areas, and public swimming areas.

The ponds' natural histories and historical pasts lend themselves to the rich tourism industry of coastal Rhode Island. The aesthetic scenery provided by the coastal ponds not only benefits the residents of the coastal communities, but attracts tourists from around the world.

8. WATER QUALITY

The two principal forms of water pollution in the coastal ponds are bacterial contamination and high levels of nitrogen. The majority of bacterial contamination originates from failing and sub-standard on-site sewage disposal systems (OSDS) while the excess levels of nitrogen come from urban runoff and OSDS leachate.

Studies by Granger et al. (2000) on the water quality of the coastal ponds are summarized in Table 1. Results of their study indicate that the light attenuation of the ponds, and therefore their suitability as seagrass habitat, is contingent upon the interplay between nutrient inflow, the resulting stimulation of primary production, and the mitigating influences of water exchange with Rhode Island Sound.

Currently, the coastal ponds are classified as Class SA water according to State of Rhode Island water quality standards for salt water. Class SA waters are designated for shellfish harvesting for direct human consumption, primary and secondary contact recreational activities, and fish and wildlife habitat. They are suitable for aquaculture uses, navigation and industrial cooling and have good aesthetic value.

Table 1. Mean annual values of water quality parameters from Ninigret, Quonochontaug, and Winnapaug Ponds (Granger, et al., 2000).

	Ninigret	Quonochontaug	Winnapaug
Temperature (^{o}C)	17.3	15.3	16.7
Salinity (psu)	29.8	31.2	30.6
Dissolved Oxygen (mg/l)	9.2	8.8	8.6
Chlorophyll *a* (μg/l)	7	2.6	3.5
Total Suspended Solids (mg/l)	6.7	7.2	8.2
Extinction coefficiant,-k (m)	-0.73	-0.52	-0.79
Ammonia (μM)	0.5	0.9	0.7
Nitrate	0.2	0.5	0.8
Nitrite	0.01	0.1	0.1
Dissolved Inorganic Nitrogen (μM)	0.7	1.5	1.5
Dissolved Inorganic Phosphorus (μM)	0.2	0.6	0.4

9. SEDIMENT COMPOSITION

Sediment sampling of the eelgrass restoration areas and sedimentation basins for Ninigret, Quonochontaug, and Winnapaug Ponds was conducted between January 10 and January 12, 2001. Sediments were analyzed for grain size and water content (Appendix B). Additional data on sediment composition and sedimentation rates that were collected in May of 1999 as part of a survey of the sedimentation rates of the ponds are included in this section as well (ENSR, 2000 – Appendix B).

Seven sediment samples from the Ninigret Pond shoals and sedimentation basin areas (to a depth of 4 feet in the shoals and 8.4 feet in the sedimentation basins) revealed that the majority of the substrate was composed of predominately sandy material (<12% fines). Two stations, N6 and N5 (Figure 4), had sandy-silty material with N6 having approximately 48% fines and N5 having approximately 18% fines. Grain size data from the sedimentation rate study (for cores to a depth of 20 cm) also revealed that the shoals were composed of mainly sandy material. Four stations, NP-6, NP-7, NP-11, and NP-12 had high levels of fine material, 36%, 74%, 31%, and 84% respectively. However, these stations were located at the extreme edges of the shoaling areas (NP-6 and NP-11) and outside the shoaling areas (NP-7 and NP-12). Sedimentation rates for the flood tidal shoal area of Ninigret Pond were calculated to be approximately 1.1 cm per year.

Four sediment samples from the Quonochontaug Pond shoals and sedimentation basin (to a depth of 4 feet in the shoals and 9.1 feet in the sedimentation basin) (Figure 3) revealed that the majority of the substrate was composed of predominately sandy material (<10% fines). Two stations at Quonochontaug Pond (Q1 and Q4) were sectioned at various depths because of obvious layering seen in visual inspection of the cores. Grain size analysis revealed that Q1 was composed of predominately sand throughout and that Q4 was composed of predominately sand in the first 2' of substrate and contained between 16.4% and 20% fines below 2'. Grain size data from the sedimentation rate study (for cores to a depth of 20 cm) also revealed that the shoals were composed of mainly sandy material. Two cores (QP-4 and QP-6) had substantial amounts of fine-grained material, however, both stations were located outside of the shoaling areas. Sedimentation rates for the flood tidal shoal area of Quonochontaug Pond were calculated to be approximately 2.5 cm per year.

Four sediment samples from the Winnapaug Pond shoals and sedimentation basin (to a depth of approximately 4 feet in the shoals and 9.1 feet in the sedimentation basin) (Figure 2) revealed that the majority of the substrate was composed of predominately sandy material (<12% fines). Grain size data from the sedimentation rate study (for cores to a depth of 20 cm) also revealed that the shoals were composed of mainly sandy material. Only one station (WP-7 with 64% fines) had substantial fine-grained material present, however this station was located outside of the shoal areas. Sedimentation rates for the flood tidal shoal area of Winnapaug Pond, which were much higher than Ninigret and Quonochontaug Ponds, were calculated to be approximately 21.9 cm per year.

10. AIR QUALITY

The entire state of Rhode Island is designated a non-attainment zone of ozone (O_3) and is part of the Northeast Ozone Transport Region which extends northeast from Maryland and includes all six New England states. Non-attainment zones are areas where the National Ambient Air Quality Standards (NAAQS) have not been met. Nitric oxide (NO), hydrocarbons, oxygen (O_2), and sunlight combine to form ozone in the atmosphere. Nitrogen oxides are released during the combustion of fossil fuels.

11. ESSENTIAL FISH HABITAT

Pursuant to the Magnuson-Stevens Fishery Conservation and Management Act and amended by the Sustainable Fisheries Act of 1996, an Essential Fish Habitat (EFH) consultation is necessary for this project. EFH is broadly defined as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity.” The coastal ponds fall into this category and thus have the potential to provide habitat for fish species in the area.

As stated in NMFS EFH source documents (NMFS 2001), eight federally managed species have the potential to occur within the project area. These include: larval haddock *(Melanogrammus aeglefinus);* juvenile and adult red hake *(Urophycis chuss);* all life stage of winter flounder *(Pleuronectes americanus);* all life stage of windowpane flounder *(Scopthalmus aquosus);* larval, juvenile and adult Atlantic sea herring *(Clupea harengus);* adult and juvenile bluefish *(Pomatomus saltatrix);* adult and juvenile summer flounder *(Paralicthys dentatus);* and all life stages of scup *(Stenotomus chrysops).*

A preliminary assessment of the project areas in the coastal ponds indicates that there will be minimal negative impacts to Essential Fish Habitat. See section IV.A.14 for detailed descriptions of the anticipated effects to species with EFH designations in the area.

12. HISTORIC AND ARCHAEOLOGICAL RESOURCES

The project area encompasses the communities of Charlestown, South Kingstown, and Westerly, Rhode Island. For thousands of years prior to the arrival of Europeans, the Narragansett Indian Tribe occupied what is today Charlestown and the surrounding vicinity along the south coast and interior of Rhode Island. The Narragansetts subsisted through hunting, fishing, and agriculture. As it was in the past, the town of Charlestown remains the center of Narragansett culture today as the seat of the tribal government and home to historic sites and locations that are in continual use today (Rhode Island Historical Preservation Commission (RIHPC) 1981:1, 5).

According to John Brown, Narragansett Tribal Historic Preservation Officer, the Narragansetts have always occupied this region as far back as more than 30,000 years ago (John Brown, personal communication 2001). When Europeans arrived in Rhode Island, they encountered both the Narragansett and the Niantic Tribes which practiced a seasonal form of resource exploitation where interior resources were exploited in the winter, while settlement closer to the ocean in summer provided marine resources. In general, Native American sites in the Charlestown area include villages, campsites, forts, and burial grounds. Significant historical sites within the Charlestown area include the Village of the Narragansett Indians Historic Area bounded by Routes 2 and 112 on the east, Route 1 on the south, King's Factory Road on the west, and Route 91 on the north, the Cross Mills Historic District on Post Road, and the Royal Burial Ground of the Narragansetts on Narrow Lane (RIHPC 1981: 5-6). In conversations with John Brown, Narragansett burial sites may be located in the vicinity of the proposed study area.

Adrian Block was the first European to explore Narragansett Bay, the southern coast of Rhode Island, and the offshore island bearing his name in 1614. Shortly thereafter, Dutch traders established trading posts and settlements along the coast. By 1660, Narragansett Country in today's Washington County and including the communities of North and South Kingstown along the western shore of Narragansett Bay was included in the so-called Pettaquamscutt Purchase which wrestled control of these lands away from Native Americans (RIHPC 1981:6-7).

By the eighteenth century, Charlestown was primarily an agricultural settlement. This may be characterized by the area north of Route 1, "a hilly, wooded landscape punctuated by ponds and many swamp areas [and which] was farmed in past centuries." Surviving farms and farmhouses are reminders of this agrarian era. Other historic properties within this interior area include mill sites, old roadways, a former granite quarry, several small summer colonies, a wildlife refuge, and a state park developed by the Civilian Conservation Corps in the 1930's (RIHPC 1981: 19).

The coastal area south of Route 1 which comprises the present study area was the earliest area settled and the most prosperous throughout Charlestown's history, particularly along Old Post Road. Cultural resources within this area include old houses, former stagecoach taverns, churches, schoolhouses, an Indian fort, summer cabins, motels, a former Naval Air Station, several large estates, and a variety of recent summer colonies and communities (RIHPC 1981: 19).

A review of archaeological site files at the RIHPC revealed numerous pre-Contact and historic period archaeological sites within the vicinity of the study area, although none were specifically noted within proposed project improvement locations. The proposed fish passage project at the Cross Mills is located within the Cross Mills or Charlestown Village Historic District, an important early transportation and industrial area. The Narragansett

Indian Tribe has also expressed concern for the presence of ancestral cultural resources in association with this area. Other cultural resources of significance to the Narragansett Indian Tribe including burial sites are concentrated throughout Charlestown and in proximity to the proposed project (John Brown, personal communication, 2001). In compliance with Section 106 of the National Historic Preservation Act and 36 CFR 800, the Corps has formally entered into consultation with the Narragansett Tribal Historic Preservation Officer concerning this study. Coordination has also been initiated with the Rhode Island State Historic Preservation Officer (RI SHPO).

B. FISH PASSAGE RESTORATION PROJECT AREA

1. GENERAL AND HISTORIC CONDITIONS

Cross Mills Pond is located in the Town of Charlestown Rhode Island, approximately one mile upstream from Ninigret Pond on the south coast of Rhode Island. It is a freshwater pond, which connects to Ninigret Pond (a salt pond) via Cross Mills Pond Brook. The upper section of the pond is approximately 0.02 square miles. Cross Mills Brook flows out of the uppermost section of the pond and underneath three culverted roadways, before entering Ninigret Pond. Another small tributary, Yawgansk Brook that drains the western part of the drainage area, joins the middle section of the pond between the two highway interchanges. The lower section of Cross Mills Pond Brook has been rerouted from its original course, and is contained in a concrete culvert. The existing culvert passes underneath the parking lot of a small office building, and then under the Post Road (Route 1A), for a distance of approximately 40 feet. The culvert discharges on the downstream side of Route 1A and then flows freely for approximately 0.21 miles into Ninigret Pond.

Cross Mills Pond lies in the area of the Rhode Island South Coast Salt Ponds, and is considered a Special Management Area by the Rhode Island Coastal Resources Management Council. This area is characterized by a barrier beach, which forms the seaward boundary of a series of salt ponds. The barrier beach extends approximately 18 miles along the southern coastline (Block Island Sound) of the state, from Point Judith to Watch Hill. The ponds, or lagoons that lie behind them, connect to Block Island Sound by small inlets and/or culverted streams which traverse the barrier at various locations. Generally, the relief consists of a rise in elevation at the barrier itself, then flattening shoreward. In the immediate vicinity of Ninigret Pond the topography is relatively flat, but begins to rise along Cross Mills Pond Brook, to an elevation of approximately 12 feet at Cross Mills Pond (over a distance of approximately one mile). At the northern boundary of Cross Mills Pond the terrain becomes more rolling, rising to approximately 100 feet to Border Hill and surrounding uplands. It appears that groundwater seepage from the surrounding hillside (Border Hill) may provide much of the water to Cross Mills Pond and its fringing wetlands. The underlying geology and soils in the vicinity of Ninigret Pond and Cross Mills Pond consists primarily of glacial outwash.

2. TERRESTRIAL HABITAT

Approximately 50% of the area in the immediate vicinity of Cross Mills Pond is forested/vegetated upland, with the other 50% being residential property and highways. Three primary roadways traverse the Cross Mills Brook on its way to Ninigret Pond, and as noted above, the lower section is developed and artificially routed below the most downstream highway. The upper section of the pond (north) is bordered by the rapidly ascending slope of Border Hill. The upper slope of the hillside is vegetated/forested upland, with the primary species being dense growths of hardwoods including maple and oak. In addition, stands of white and red pine are present in some sections. In addition, greenbrier is present throughout much of the area. The lower slopes give way to the fringing wetland, with scrub shrub wetland vegetation prevailing in the sections bordering the pond. Scrub shrub vegetation in the area surrounding the pond includes willow, alder, dogwood, witch hazel, and sweet pepper bush. Moving closer to the pond the predominant species become more of palustrine emergent type, which can include cattail (*Typha*), sedges (*Carrix*), skunk cabbage (*Symlocarpus*), and Pickerel Weed (*Pontederia*). Aquatic bed vegetation is present at the edges. Aquatic bed vegetation can include water lily (*Nuphar*), bladderwort (*Utricularia*) and pondweed (*Potamogeton*).

3. AQUATIC HABITAT

Aquatic vegetation in Cross Mills Brook includes those emergent and aquatic bed wetland species noted above. These include Pickerelweed, cattail (*Typha*), sedges, for the emergent species, and water lily, pondweed and *Utricularia* for the aquatic bed species. Much of the fringing wetlands bordering the northernmost section of the pond, including the scrub shrub and palustrine emergent areas, contain plant species that help to buffer the pond from the effects of contaminants that may be washed in from the watershed. The root systems and emerging stalks and plant stems not only physically trap high levels of sediment and silt, but also the plants themselves utilize excess nutrients that may also be washed in. These areas of fringing wetlands occur not only in the upper sections of Cross Mills Pond, but along the lower area of Cross Mills Brook, as well as along Yawgansk Brook.

4. BIOLOGICAL RESOURCES

a. FISH

The Salt Pond area as well as the inflows (which includes Cross Mills Pond and Brook) provide habitat for various life stages of a variety of freshwater, saltwater and estuarine fish species. A listing of the species which includes over one hundred different marine and/or estuarine finfish species that have been found in the Salt Ponds can be found in Stoligitis et al. (1976), and Satchwill and Sisson (1990 and 1991). In addition the freshwater tributaries and upstream ponds provide habitat for an additional assemblage of freshwater fishes, and currently and historically have provided habitat for several anadromous (and catadromous) species as well.

The Rhode Island DEM sampled the section of Cross Mills Brook between Ninigret Pond and the first upstream obstruction (at the lower section of Cross Mills Pond) in August of 1999. Fish species collected represented a typical warm water assemblage. In addition some anadromous (and catadromous) fishes were collected (i.e., blue-back herring and American eel). Warm water species collected include banded sunfish, largemouth bass, banded killifish, golden shiner, pumpkinseed, redfin pickerel, alewife, chain pickerel, and bluegill. The presence of the catadromous and anadromous fishes (American eel and river herring respectively) indicates that there is acceptable habitat to support these fishes (including water quality criteria) and that these fish would benefit by the construction of a fishway into Cross Mills Pond. Currently, the existing culvert blocks the upstream migration of these species, and requires manual netting and lifting in order to transport them beyond the dam into Cross Mills Pond. If upstream fish passage were provided, migrating eels and river herring would be able to gain unimpeded access to spawning habitat (herring) and rearing habitat (American eel) in Cross Mills Pond.

Using the 20-acre size of Cross Mills Pond and a common formula utilized by the Maine Department of Marine Resources (personal communication - Thomas Squires, 1999) that one surface acre of pond can provide habitat for approximately 235 alewives, the amount of alewives that could be supported would be approximately 4,700. These fish would provide additional forage to other freshwater species that may be present in Cross Mills Pond, as well as forage to the many marine and estuarine species inhabiting Ninigret Pond and Block Island Sound as they migrate in and out of the system.

b. MAMMALS

The semi-developed location of Cross Mills Pond limits the types and numbers of terrestrial wildlife species to those that can exist in close proximity to areas of human population. These include smaller mammals such as gray squirrel, muskrat, beaver, otter, cottontail rabbit, woodchuck and raccoon. In local areas of less human population, mammalian species include (in addition to the above) white tailed deer, red fox and gray fox.

c. BIRDS

The various habitats within the salt pond region are utilized by numerous avian species including year round residents, neotropical migrants, and migratory waterfowl. However, the species that are most common to the area are those known to require specific salt marsh/pond habitats. These may include Clapper Rail, Sharp-tailed Sparrow, and Seaside Sparrow (Enser 1992). In addition, emergent areas in these salt marshes dominated by cattails, (*Typha* sp.) may provide the unique habitats utilized by Least Bittern, Virginia Rail, Sora and Marsh Wren. In addition, numerous shorebird species can be found utilizing the habitat of the barrier beach which forms the outer boundaries of the salt pond area. Migratory waterfowl species that utilize the salt pond habitats during migration and as winter habitat include American Black Duck, which breeds in the salt pond area, and is considered a species of concern by the USFWS. Other waterfowl that can be found there include mallard duck, canvasbacks, bufflehead, mergansers, Goldeneye, Scaup, Redheads, Canada Geese, and Mute Swan. A non-native species, the Mute Swan that was introduced from Europe, has proliferated in the salt pond region, and has competed with existing species of waterfowl in the area.

One species common to the area, the Osprey, whose populations had been reduced to near extinction in the late 1960's, is now more abundant on the south coast of Rhode Island. These birds nest at the tops of dead trees or utility poles, and have been found in and around Ninigret Pond. In addition, resident game species common to the less populated areas include ruffed grouse, and ring necked pheasant.

d. REPTILES AND AMPHIBIANS

The watershed of Ninigret Pond, which includes Cross Mills Pond and Brook, as well as Yawgansk Pond and Brook provides habitat for various reptile and amphibian species. Vernal pools within the watershed provide necessary amphibian habitat, as well as the fringing wetlands surrounding Cross Mills Pond and Yawgansk Pond and their outflows. In addition, the fringing areas of Ninigret Pond near the freshwater inflows serve as habitat. Amphibian species that may be found in these areas include many of the frogs and toads common to the rest of the state, such as American toad, spring peeper, grey tree frog, bullfrog, green frog, wood frog, and pickerel frog. Common salamanders that may be found in this area include spotted, two lined and redback salamander. Generally these amphibians are not found in the more saline areas of the watershed (i.e. the salt ponds themselves) due to the drying effects of saltwater on their highly permeable skin.

Reptiles common to the watershed include turtles and snakes, which inhabit many of the freshwater ponds and wetlands, in the watershed, as well as some of the wooded upland areas (i.e. snakes). Some of turtle species are also able to inhabit the estuarine areas as well as the freshwater ponds, and are therefore found in the salt ponds. Turtle species common to the watershed include common snapping turtle, stinkpot turtle, spotted turtle, eastern painted turtle, wood turtle, and eastern box turtle. Snapping turtle, as well as spotted and eastern box turtles can also be found in both fresh and brackish portions of the estuary, and may be found in salt marshes near Ninigret Pond.

In addition, the diamond back terrapin, a state listed threatened turtle species has been found in the Salt Pond area, with two individuals historically recorded in Ninigret Pond. However, it has been theorized that these may have represented individuals that had migrated into the area, and not populations since the closest documented population of this species occurs in Barrington's Hundred Acre Cove in the Connecticut River Estuary (RICRMC, 1997).

Snakes common to the watershed of the Salt Pond area include the eastern garter snake, hognose snake, northern water snake, milk snake, northern brown snake, eastern ribbon snake and northern ringneck snake. Most of these are upland/terrestrial species, and therefore are not found in the wetland and/or aquatic habitat in the area, with the exception of the northern water snake which inhabits aquatic and semi-aquatic sites in fresh and saltwater (DeGraf and Rudis 1986).

5. THREATENED AND ENDANGERED SPECIES

The Rhode Island coastal ponds (Ninigret, Quonochontaug, and Winnapaug) support two Federally and State listed species, the endangered Roseate tern (*Sterna dougallii*) and the threatened Piping Plover (*Charadrius melodus*) (See USFWS correspondence – Appendix A). The Cross Mils Pond fishway project area has no identified listed species. Recent coordination with the U.S. Fish and Wildlife Service supports this assessment of federally listed or proposed, threatened and endangered species under the jurisdiction of the U.S. Fish and Wildlife Service. (See correspondence in Appendix A)

6. WATER QUALITY

a. HYDROLOGY

Cross Mills Pond is supported by runoff from the surrounding vegetated uplands as well as from groundwater seepage through the relatively porous glacially deposited soils. Much of the groundwater infiltration to the pond originates from Border Hill, which bounds the pond on its northern side. Large areas of wetlands extend from the fringes of the pond to the bases of the surrounding slopes presumably supported by these groundwater seeps. In addition, a small stream enters the most upstream section of the pond from the adjacent northwest hillside. Also the middle section (which lies between the two roadways) is fed by a small tributary, Yawgansk Brook, which originates in a small pond, and flows for approximately 0.5 miles; draining the western part of the watershed. The drainage area for Cross Mills Pond is approximately 0.50 square miles, and most of it encompasses undeveloped vegetated upland, with the exception of the drainage of Yawgansk Brook, which is more developed. The residential development within the watershed uses on site disposal systems (i.e. septic systems) for disposal of domestic waste. When these systems fail, they can discharge high levels of nitrogen and phosphorus into the groundwater, which can ultimately enter nearby water-bodies and streams causing eutrophication. It is presumed that some of the septic systems in the watershed are in disrepair and are contributing nutrients to Cross Mills Pond and Ninigret Pond.

b. WATER QUALITY

Generally the salt pond area of the south coast of Rhode Island is considered to be eutrophic. Development in the watershed, and the fact that all of this development is dependent upon on site sewage disposal systems has contributed elevated nutrient levels to the groundwater (primarily nitrogen and phosphorus), as well as higher levels of coliform bacteria. Ninigret Pond is eutrophic as a result of development in the watershed, and it is presumed that Cross Mills Pond, being in that watershed may suffer from similar impacts. Groundwater in the vicinity of Ninigret Pond has been found to contain nitrogen levels that are over 100 times higher than background levels in other areas without watershed development. The calculated annual nitrogen loading levels into Ninigret Pond have been estimated as 29,595 kg of nitrogen per year, and is the highest loading level of all of nine salt ponds in the region. The largest contributor of nitrogen into this system comes from septic systems, which contribute approximately 60% of the nitrogen to the pond via groundwater. Other sources of nitrogen to the pond include stormwater runoff (over impervious surfaces resulting from development in the watershed), which can carry in other contaminants as well such as road salt and petroleum hydrocarbons.

High levels of these nutrients, primarily nitrogen, can cause excessive plant growth in the form of dense blooms of microalgae, and/or aquatic macrophytes. Generally, one or two types of highly prolific species will prevail in these blooms choking out many of the species, which would normally inhabit these water bodies. Often, beds of macrophytes in littoral areas of a lake or pond which provide spawning and nursery habitat for many fish species (i.e. eelgrass in a salt pond), can become “choked out by the over abundance of some of these blooming species. In addition, when these more prolific species die, the decaying organic material can deplete the dissolved oxygen levels in the water column, negatively affecting aquatic habitat. The decaying organic material can also affect the bottom substrate, covering it and suffocating benthic organisms utilized by fish and/or other aquatic organisms as food sources. The same impacts to the benthic substrate can also occur by excessive growth of some filamentous algal species along the littoral cobbles and rocks, which may be present and provide habitat for various benthic organisms.

Water Quality in Cross Mills Pond itself is subject to the same impacts from watershed development that affect Ninigret Pond. However since less of the watershed of Cross Mills Pond is developed, there is less of a problem with eutrophication that may result from higher levels of nitrogen and phosphorus. Much of the surrounding land is forested upland, with little development and therefore no on site disposal systems, although the western section that drains into Yawgansk Brook, contains more development. Measurements of dissolved oxygen, temperature, pH and conductivity in Cross Mills Brook collected in August of 1999 by the Rhode Island DEM are presented below in Table 2. These generally appeared to be within the habitat suitability limits for most warmwater fish species. In support of this was the presence of the warmwater fishes noted in the fisheries section of this EA.

Table 2. Water Quality Measurements Collected in Cross Mills Brook by Rhode Island DEM, August 19, 1999**.**

Dissolved Oxygen Mg/L	**Water Temp. C^o**	**pH (units)**	**Conductivity (uS/cm)**
8.53	25.2	6.54	136

c. LITTORAL/RIVERINE PROCESSES

Currently, water from Cross Mills Pond is artificially routed through a channel system that winds underneath Route 1A. After passing under Route 1A, the culvert rejoins the existing channel of Cross Mills Brook and flows into Ninigret Pond. The enclosed culvert prohibits the upstrean migration of anadromous fishes. The historical channel of Cross Mills Brook is currently blocked by the remains of the old mill. The proposed project will reroute the outflow of Cross Mills Pond to its approximate historic location and provide historic fish passage.

7. SEDIMENT COMPOSITION

Substrate in Cross Mills Pond consists primarily of the parent glacial outwash material that underlies the area. It is characterized primarily by fine sand and mixed cobbles, and is overlain with finer organic material originating from the fringing wetlands as well as the plant material found within the pond itself. Cross Mills Brook cuts a channel from the pond through this similar material, and discharges into Ninigret Pond. During times of higher flow, much of this sandy material from the streambed and surrounding watershed, including Yawgansk Brook is carried from Cross Mills Brook into Ninigret Pond, and deposited at the mouth of the brook. This has created a small delta, which has become vegetated wetland at the confluence with Ninigret Pond. It is presumed that a significant amount of this material could also be sediment carried in by road runoff into Yawgansk Brook, which cuts between two sections of highway and by a small development. Yawgansk

Brook itself has washed sediment into the middle portion of Cross Mills Pond, which has also created a small wetland.

8. HISTORIC AND ARCHAEOLOGICAL RESOURCES

See section V.A.12 for an account of the historic and archaeological resources.

C. DISPOSAL AREA FOR EELGRASS RESTORATION

1. GENERAL AND HISTORIC CONDITIONS

The areas selected for disposal of the project's dredged material include several sandy nearshore beach habitats that are used extensively as recreational beaches. These areas are located adjacent to shoreline that is developed with tracks of beach houses and cottages and recreational facilities such as bathhouses and parking lots.

Also, several potential areas were considered for the dewatering of some of the dredged material. These areas are currently used as public access parking lots and are both in the vicinity of the Ninigret Breachway (Figure 4). The RIDEM Public Access Parking Lot is approximately 1.6 acres in size, while the Town Beach Parking Lot is approximately 1.3 acres.

2. WETLANDS, VEGETATION, AND COVER TYPES

The beach disposal areas (Figures 2-4) are high-energy beaches that typically do not support vegetative growth. Dune systems that are located directly adjacent to the beaches are valuable ecosystem components and support a variety of plants species. Typical New England dune plants include: beach grass (*Ammophila brevigulata*), beach pea (*Lathyrus japonicus*), and beach plum (*Prunus maritima*). Both potential dewatering areas are currently utilized as parking lots and contain no vegetation.

3. BENTHIC INVERTEBRATES AND SHELLFISH

Benthic Invertebrates

Core samples were taken from the four potential beach disposal areas on November 7, 2000 to assess the benthic community structure of the beaches. Samples were located in the low intertidal and high intertidal zones.

The communities at all sites were typical of high-energy sand beach assemblages. The communities were dominated by nematodes and oligochaetes, organisms that are adapted to using the interstitial spaces (between grain spaces) associated with sandy substrates. Other macrofauna present in the core samples included the polychaete *Scolelepis squamata* and the crustaceans *Haustorius canadensis* and *Emerita talpoida*.

Shellfish

The surf calm, *Spisula solidissima*, is a suspension feeder that inhabits high-energy beaches. Surf clams burrow upright in the sand at the lowest intertidal level just below the surface. The clams feed on suspended particles in the surf. Although no surf clams were present in the November sampling effort, it is highly likely that they inhabit the lower intertidal zones of the beach areas.

4. FISH

A variety of fish species are found in the nearshore environment of coastal Rhode Island. However, few species can live in the high-energy environments associated with the wave swept beaches. The sand launce (*Ammodytes americanus)* is an efficient burrower and can be found in the surf zone. The sand launce is an important forage fish for near shore species such as blue fish, striped bass, and rays.

The areas designated for material disposal are primarily exposed beaches and high intertidal areas that do not support diverse fish assemblages.

5. WILDLIFE

Mammals

Mammals with historical accounts in the area and appropriate geographical ranges that are likely to occur adjacent to the disposal and dewatering areas include red fox, mink, raccoon (*Procyon lotor*), skunk, chipmunk (*Tamias striatus*), coyote, several species of squirrels, and white-tailed deer (*Odocoileus virginianus*).

Birds

Avian fauna present at the disposal areas and dewatering area will be similar to the communities described for the project area. See section V.A.5. (Birds) for a description of the bird communities.

Amphibians and Reptiles

Amphibians and reptiles do not normally inhabit the areas selected for beach disposal. Areas adjacent to the disposal area make contain representatives of the communities described in section V.A.1 (Amphibians and Reptiles).

6. THREATENED AND ENDANGERED SPECIES

The areas designated for beach disposal and material dewatering for this project are not likely to contain any Federally or State listed threatened or endangered species. While the piping plovers prefer to nest on the upper portions of sandy beaches, the areas in which nourishment will occur are heavily used recreational beaches or in front of beachfront homes. Additionally, the majority of the material will be placed in the intertidal/low subtidal portions of the beach and should not create preferred nesting habitat for plovers. Meetings between the USACE, USFWS, and local ornithological experts determined that these areas are extremely disturbed by human activities and that the material will be placed in appropriate areas and therefore would not support piping plover nesting.

7. RECREATION AND AESTHETICS

The beach disposal areas (Figures 2-4) are currently used as recreational beaches. These beaches are used for a variety of activities including swimming, sunbathing, fishing, hiking, and camping. These beaches support a large summer population of tourists. The dewatering area is currently used as a public access parking lot.

8. WATER QUALITY

Currently, the waters adjacent to the areas designated for beach disposal are classified as Class SA water according to State of Rhode Island water quality standards for salt water. Class SA waters are designated for shellfish harvesting for direct human consumption, primary and secondary contact recreational activities, and fish and wildlife habitat. They are suitable for aquaculture uses, navigation, and industrial cooling and have good aesthetic value.

9. SEDIMENT COMPOSITION

Sediments from four potential beach disposal areas were collected on November 7, 2000. Grain size analysis revealed that all disposal areas were characterized by sediments that contained predominantly coarse to fine grained sands (Appendix C). No silt or clay particles were seen in the sediments. Since the material at the disposal area consisted of sandy material, no chemical testing was preformed because of the unlikelihood of contamination.

10. AIR QUALITY

The entire state of Rhode Island is designated a non-attainment zone of ozone (O_3) and is part of the Northeast Ozone Transport Region which extends northeast from Maryland and includes all six New England states. Non-attainment zones are areas where the National Ambient Air Quality Standards (NAAQS) have not been met. Nitric oxide (NO), hydrocarbons, oxygen (O_2), and sunlight combine to form ozone in the atmosphere. Nitrogen oxides are released during the combustion of fossil fuels.

11. ESSENTIAL FISH HABITAT

The beach areas selected for material disposal and the areas selected for dewatering contain no essential fish habitat.

12. HISTORIC AND ARCHAEOLOGICAL RESOURCES

See section V.A.12 for an account of the historic and archaeological resources.

D. DISPOSAL AREA FOR FISH PASSAGE

The excavation of the project will involve the removal of approximately 210 cubic yards of soil as well as 40 square yards of asphalt from the roadway. Although 80 cubic yards will be replaced once the culvert has been installed, the remaining 130 cubic yards will be disposed of at a suitable off site disposal area to be determined. The asphalt will also be disposed of appropriately.

VI. ENVIRONMENTAL CONSEQUENCES

A. EELGRASS RESTORATION

1. GENERAL

The purpose of this project is to restore the previously existing estuarine community and its value for fish and wildlife. Except for some minor short-term negative effects, this project will have positive effects on the environment. The areas of eelgrass beds in the coastal ponds will be expanded and current beds threatened by the expansion of the shoaling areas will be protected. Additionally, lost estuarine aquatic productivity will be restored, the value of the sites for shellfish, fish, and wildlife will be increased, and the recreational and aesthetic qualities of the sites will be improved. From a national perspective, eelgrass restoration is very important because of the very high ecological value of eelgrass beds and the relatively limited zone within which they can occur. Detailed effects of the project are described in the following sections.

2. WETLANDS, VEGETATION, AND COVER TYPES

This project will vastly improve the vegetation resources in the project areas. The goal of the restoration project is to increase the amount of eelgrass in the coastal ponds and to reduce the amount of unvegetated fine-sand subtidal habitat. The benefits of restoring eelgrass to the coastal ponds include: 1) creating critical habitat and breeding ground for a variety of marine life; 2) increasing the commercial fishing potential of the ponds by providing habitat for a number of commercially important fishery species (e.g., bay scallop, blue crab, summer flounder, winter flounder, weakfish, and blue mussels); 3) increasing the natural nursery potential of the area for a variety of marine species; 4) increasing storm and shoreline protection through eelgrass' ability to reduce wave energetics; 5) increasing the filtering systems of the ponds by using the eelgrass to trap and filter sediments and pollutants from the water column; and 6) increasing the amount of prime recreational fishing in the ponds.

Approximately 40 acres of eelgrass are proposed to be restored at Ninigret Pond, 12 acres at Winnapaug Pond, and 5 acres at Quonochontaug Pond. The restoration areas will be located adjacent to the existing channels in the ponds. These areas are currently severely shoaled by large quantities of sandy material that enters the ponds via the breachways. Temporary impacts to water quality will occur during construction period. Slight increases in turbidity caused by the dredging of the sandy sediment will occur (See section VI.A.8. – Water Quality). However, turbidity levels will decrease quickly as the plume associated with the sandy material will dissipate rapidly. No adverse effects to the existing vegetation from these increased turbidity levels are expected in the ponds.

The most direct effect of the project will be the change in the depth of subtidal areas in the footprint of the restoration areas. The net environmental effect of these changes will be positive due to the fact that relatively low value sandy subtidal habitat will be replaced by higher value subtidal eelgrass habitat. The optimal depth to which the restoration areas should be dredged has been determined by modeling studies conducted by Short (2001 – See Appendix E), who recommended a depth of between 0.75 m and 1.0 m for optimal eelgrass growth. Given the appropriate depth, Short (2001 – See Appendix E) concluded that eelgrass could thrive in the restoration areas and provide a seed source for other areas within the ponds. Dredging the shoal areas and allowing natural eelgrass recolonization (non-transplantation) was considered, however, "jump starting" the eelgrass beds through transplanting and/or seeding will yield productive beds sooner and will increase the productivity of the ecosystem at a faster rate than natural succession. Additionally, no eelgrass beds (and therefore no seed source) currently exist at Winnapaug Pond making natural recruitment highly unlikely.

A consequence of the environmental restoration of eelgrass to the coastal ponds will be the impacts to the existing eelgrass beds that will serve as donor beds and/or seed sources for the restoration areas. It is anticipated that if the proposed project (57 total acres) is accomplished entirely through transplanting procedures (removing plugs of eelgrass from healthy beds for placement in the restoration areas) approximately 0.12, 0.49, or 1.90 acres of wild stock could be removed from existing beds for use in the transplanting effort. Harvesting of eelgrass would be conducted in numerous individual small collections from the densest beds available. This estimate of acreage impacted is based on planting approximately half of the restoration areas (29 acres planted out of 57 total) with 0.017 m^2 planting units (eelgrass plug) spaced at various lengths apart. Based on planting unit information described by Fonseca et. al (1998), the calculated number of planting units needed for planting 29 acres at 2.0, 1.0 and 0.5m spacing would be 29,352, 117,408, and 469,635 units respectively. Planting at high density (0.5m spacing) achieves more rapid coalescence, however, the impacts to donor beds is significantly higher. Eelgrass beds will be planted in mosaics of patches throughout the restoration area to mimic natural beds and to allow the beds to coalesce through succession.

Fonseca et al. (1998) reports that no long term impacts (> 1 year) should occur to donor beds if numerous individual small collections are harvested as opposed to large sections of the bed. Fonseca et al. (1998) also reports that while not documented, *Zostera* spp. would most likely recolonize small harvest patches quickly (< 0.25 m^2 patches returning to normal density within 1 year) because of their (relatively) high growth rate and seed production. Based upon this information, it is anticipated that the impacts to the donor beds will not be significant.

Modified monitoring efforts based on Fonseca's (1998) methods will be used to determine the success of the restoration. Survival, areal coverage, and density estimates will be monitored for three years following planting. Criteria will be established to measure the success of the initial planting effort, and if not met, subsequent replanting will occur.

Harvesting of eelgrass seeds and their subsequent planting in the restoration areas may also be used in the restoration effort. However, at the writing of this environmental assessment, results of experimental seed plots in other Rhode Island estuarine systems are not available to assess the effectiveness of this method. If positive results are gleaned from current seeding experimentation, portions of this project may use the seeding technology. The impacts to the existing eelgrass beds from seed harvesting are negligible (Steve Granger, pers. comm. 2001).

3. BENTHIC INVERTEBRATES AND SHELLFISH

The project will have temporary minor adverse effects on shellfish and other benthic invertebrates in the coastal ponds during construction. Immobile benthic organisms in the direct footprint of construction activities will be destroyed. However, larval and adult recruitment will quickly recolonize the disturbed substrates to a community that is similar in species composition, population density, and biomass to that previously present. Additionally, the restoration of eelgrass to the ecosystems will improve the quality of the habitat for benthic organisms, including shellfish, by stabilizing the substrate, increasing the structural variety of the habitat, and increasing aquatic productivity.

The benthic communities and shellfish resources not directly impacted by construction would experience minor effects due to a small increase in turbidity and suspended solids (See Water Quality Section). The benthic communities in the vicinity of the project consist primarily of subsurface deposit feeders and suspension (filter) feeders (Pratt, 2000). The deposit feeders should be relatively unaffected by the short-term increases in turbidity and the small changes in substrate depth. The suspension feeders, which feed on materials suspended in the water column, will be slightly affected by changes in turbidity. However, most suspension feeders (including shellfish) are able to adjust to short term increases in suspended sediments by temporarily closing their feeding apparatus and resuming feeding when turbidity levels return to normal. Therefore, construction impacts to benthic invertebrates and shellfish are expected to be minimal.

The effects of the beach renourishment on the benthic communities in the disposal areas will be minimal. Species located in this high energy sandy environment are highly adapted at burrowing through shifting sands and should be able to avoid burial. The expected movement of portions of the deposited material offshore by wave run-up is not anticipated to impact the nearshore benthic communities, as the movement will be gradual.

4. FISH

The potential impacts of the project to fish resources is expected to be limited to physical effects, as dredging operations are not likely to have an effect on water chemistry. The physical effects of the construction effort will be the removal of material and the associated increases in turbidity levels around the dredging areas (which are expected to be minimal, as the material is predominately sand). Since fish are mobile, they can avoid the relatively small areas of increased turbidity that may result from construction. Additionally, fish would be able to avoid areas where removal of sediment is occurring.

The spawning of winter flounder in the coastal ponds should not be significantly affected by the project. In a flounder habitat description, Klein-MacPhee (1978) reported that spawning winter flounder prefer muddy sand especially where patches of eelgrass occur, but are also found on clean sand, clay, and pebbles or gravel. Crawford and Carey (1985) also indicated they found flounder eggs clumped on gravel substrate or attached to fronds of algae in

Point Judith Pond. Additionally, Crawford and Carey (1985) reported that winter flounder prefer to spawn in areas that are not flushed heavily so that eggs and larvae can be retained in the estuarine system and not transported offshore. Surveys of the coastal ponds for winter flounder eggs (in March) on the tidal shoals of the project areas (ENSR, 1999) revealed that the abundance of eggs was minimal. Therefore, given the low number of eggs and the documented reproductive adaptation of not spawning in areas where larvae may be flushed offshore, it is anticipated that impacts to flounder spawning will be minimal.

The project would have positive long-term effects on fisheries. The overall quantity of estuarine aquatic habitat available to fish will increase. In addition, the increase in estuarine productivity will benefit fish that feed directly on the detritus formed by eelgrass and benthic organisms in the subtidal area. The improvement in aquatic productivity and populations lower in the food web will enhance the support of fish higher in the food web, including commercial fish.

The effects of the beach renourishment on the fish species in the vicinity of the disposal areas will be minimal. Species located in this high energy sandy environment are highly adapted for living in shifting sands and avoiding burial. The expected movement of portions of the deposited material offshore by wave run-up is not anticipated to impact nearshore fish assemblages, as the movement will be gradual.

5. WILDLIFE

Mammals

Mammals inhabiting the areas surrounding the shoal area restoration sites may experience minor benefits from the increase in productivity of the nearby estuarine habitat. Raccoons, skunks, otters, and mink may experience an increase in the quality of available food resources with the general increase in fish populations. They are expected to experience overall minor positive impacts.

Birds

The short-term impacts to the avian communities associated with the coastal ponds will be minimal, while the long-term benefits (the restoration of eelgrass at each of the ponds and subsequent increase in productivity) are expected to be extremely advantageous. The impact for all types of wildlife, including bird species, will be the temporary disturbance of habitat during the field construction period. Wildlife can temporarily leave the project area and retreat to the adjacent surrounding habitats. Construction operations associated with this project will avoid the time of year the shoals are used by migrating shorebirds (1 April through 31 August) and will avoid dredging intertidal areas that are used as foraging grounds by species of concern.

Impacts associated with the dredge material disposal areas are expected to be minimal, as the sites selected are heavily used recreational beaches and existing parking lots. Additionally, the majority of the material will be placed in the intertidal/low subtidal portions of the beach. Winter migrants such as ducks and geese that may present at these areas during construction will be able to relocate to another adjacent habitat easily. No loss of breeding habitat would occur as a result of the proposed project. Therefore, any threat to local bird species, continued existence, or decline in populations is not anticipated.

The benefits associated with this project for bird species include the increased productivity of the ecosystem, which should increase the foraging potential of the habitat.

6. THREATENED AND ENDANGERED SPECIES

The intertidal habitats of the Rhode Island coastal ponds (Ninigret, Quonochontaug, and Winnapaug) support two Federally and State listed species, the endangered Roseate tern (*Sterna dougallii*) and the threatened Piping Plover (*Charadrius melodus*) (See USFWS correspondence – Appendix A).

The terns feed over the subtidal areas of the ponds and rest upon the intertidal areas of the ponds, while the plovers forage on intertidal areas of the ponds and nest on sandy beach areas just below the dune scarp.

In order to avoid impacts to the listed species, dredging areas will not include intertidal habitat and construction will not occur during the times of year when these species are present (1 April through 31 August). Design measures will be implemented to ensure that the intertidal habitats are not lost due to sloughing at the edges of the dredged areas. The beach nourishment areas designated for disposal of the dredged material are heavily used recreational beaches that do not support plover nesting. Additionally, the majority of the material will be placed in the intertidal/low subtidal portions of the beach and should not create preferred nesting habitat for plovers. Therefore, it is anticipated that this project will not likely adversely impact any threatened or endangered species.

See Appendix A for correspondence regarding the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and the Rhode Island Department of Environmental Management concurrence with this assessment of the impacts to threatened and endangered species.

7. RECREATION AND AESTHETICS

The restoration of eelgrass in the coastal ponds should greatly enhance the recreational value of the ponds. Seagrass beds form extremely productive aquatic ecosystems that function as refugia, energy sources, and habitat for many commercially and recreationally important species. The project should improve the recreational fishery harvesting potential by increasing the shellfish seed population available to the nearby heavily used intertidal flats. Additionally, the scallop, a popular recreational shellfish species, may benefit from the increase in eelgrass abundance as a portion of the scallops' life cycle is reliant upon these beds. Important fish species such as flounder and white hake have been documented to utilize eelgrass as nursery areas for their juvenile life stages (Heck et al. 1989) and would benefit from increases in the areas of eelgrass beds. The general increase in the quality of habitats will also improve the value of the site for passive recreational use such as bird watching.

Temporary impacts to the accessibility of various areas in the dredging, dewatering, and disposal areas will be necessary. Since the breachways are very restricted areas, boating traffic may be restricted or delayed during dredging periods. Additionally, the sites (parking lots) that will be used to dewater the dredged material will be unavailable for use during the construction time frame. Beach access may be restricted to vehicular traffic during construction and use of the hydraulic pipeline. Pedestrian traffic may be restricted in the outfall area of the pipeline for safety concerns. However, the majority of the beach area that the pipeline will extend will be accessible to pedestrians.

Aesthetic impacts to the sites are anticipated to be minimal and will be limited to periods of construction. Machines and pipelines used to dredge the sandy material from the shoals will be present in the dredging areas and pipelines and their associated sandy discharge will be present on the recreational beaches slated as disposal sites. However, construction will be avoided during the peak recreation use months (June-August) of the ponds. Therefore aesthetic impacts are expected to be minimal.

8. WATER QUALITY

Dredging operations in the project areas will not have significant long-term impacts on the turbidity levels or water column chemistry. The amount of turbidity generated during a dredging operation depends upon the physical characteristics of the sediments to be removed, ambient currents, and the type of dredging equipment. The removal of sandy material from the shoaled areas and sedimentation basins will temporarily resuspend sediments into the water column. These sediments are expected to settle in a short period of time because of the coarseness (88-100% sand) of the material to be removed (Appendix B). This will result in localized and short-term increases in turbidity during the dredge operation.

Bohlen et. al (1979) has found that during dredge operations with a large volume bucket dredge, material concentrations within the dredge induced plume decreases rapidly and approaches background levels within approximately 2,000 feet. In a study conducted by the U.S. Army Corps of Engineers Waterways Experiment Station (USACE, 1986), sediments were measured adjacent to and downstream of a hopper dredging operation, and found that levels did not exceed 700 mg/l and that concentrations of suspended material dropped off rapidly approximately 3,000 feet from the project area. Studies of sediment resuspension with various dredge types throughout the United States are summarized in Tables 3 and 4.

A hydraulic cutterhead dredge would be used to remove the shoals in the salt ponds. As stated above, the hydraulic dredge would cause a temporary short-term increase in turbidity and suspended solids in the vicinity during construction, which could temporarily affect water quality. As shown in Table 3, resuspension of sediments from the operation of open-bucket clamshell dredges is typically higher than that from most cutterhead dredges (USACE, 1986). However, larger amounts of material are resuspended in effluent at the dewatering site when a hydraulic cutterhead dredge is used. These suspended solids may be transferred to the receiving site water if dewatering site overflows. Additionally, temporary short-term increases in turbidity at the beach disposal areas are expected to occur as the material is worked over (sorted) by waves.

Table 3. General Characteristics of Suspended Sediments Fields Around Two Commonly Used Dredge Types

Dredge Type	Suspended Solids Concentration (mg/L)		Suspended Solids Plume Length (m)	
	Surface	**Bottom**	**Surface**	**Bottom**
Bucket	0-700	<1,100	100-600	<1,000
Cutterhead	0-150	<500	0-100	<500

LaSalle, 1988

Table 4. Down-current Suspended Solids Concentrations[1] for Various Dredge Types and Distances from Dredging Operations (USACE, 1986)

Dredge Type	**Downcurrent Within 100 feet (mg/l)**	**Downcurrent Within 200 feet (mg/l)**	**Downcurrent Within 400 feet (mg/l)**
Cutterhead	25 to 250	20 to 200	10 to 150
Clamshell Open Bucket	150 to 900	100 to 600	75 to 350
Clamshell Enclosed Bucket	50 to 300	40 to 210	25 to 100

[1]Suspended solids concentrations were adjusted for background concentrations

(USACE, 1986)

9. SEDIMENT COMPOSITION

Dredging the shoal areas and the sedimentation basins of the project areas and planting eelgrass in the ponds will slightly alter the sediment composition of the ponds. It is anticipated that the sedimentation basin sediments will remain similar to the existing sediments, as the basins will be designed to capture the sandy material that moves into the ponds through the breachways. The areas of the ponds where the current shoals exist will be dredged and planted with eelgrass and should not initially change the sediment composition. However, over time the sediments associated with the eelgrass beds will shift to include finer sediment particles. The increase in fine material will be caused by the effects of eelgrass on water flow dynamics. Water currents will slow in the vicinity of the beds and promote sedimentation. Sediment chemistry is not expected to be negatively affected by dredging operations because of the sandy nature of the sediment. Sandy material tends to settle rapidly following suspension and does not accumulate contaminants readily.

Sediment composition in the disposal areas will not be impacted. The RI Department of Environmental Management (Water Quality Section) determined that the dredged material is suitable for beach nourishment at the selected disposal areas (Section A).

10. AIR QUALITY

The project will have no long-term impacts on air quality. During construction, equipment operating on the site will emit pollutants including nitrogen oxides that can lead to the formation of ozone. Rhode Island has no permit requirements for construction projects. In order to minimize air quality effects during construction, construction activities will comply with applicable provisions of the Rhode Island Air Quality Control Regulations pertaining to dust, odors, construction, noise, and motor vehicle emissions.

11. HISTORIC AND ARCHAEOLOGICAL RESOURCES

During the initial Public Notice stage of this study, the RI SHPO responded by letter dated May 17, 1999, that they felt the proposed habitat restoration improvements would have no effect upon significant cultural resources. As the alignment of proposed dredging locations and study alternatives have been slightly modified since that time, New England District formally coordinated revised project alternatives and plans with the RI SHPO by letter dated July 24, 2001. As no further comments from the SHPO were received within 30 days of correspondence, we can assume that their prior determination is valid and significant cultural resources are not at risk. Formal consultation has been conducted with the Narragansett Indian Tribe and the Tribal Historic Preservation Officer (THPO). The Narragansett THPO in a letter dated March 28, 2001 has expressed his concerns for the protection of cultural resources in the area of planned impact. The extent of these resources may require further oversight and monitoring by the THPO during construction. At an on-site meeting with members of the Narragansett Tribe on May 18, 2001, concerns were raised concerning the possibility of ancestral remains or cultural resources in association with the fish passage project within the Cross Mills area. No evidence of intact archaeological resources is present at the Cross Mills fish passage site. The Tribe will be given the opportunity to monitor construction in this area. In addition, the Tribe expressed interest in monitoring the pumping of sand for beach nourishment purposes. The Corps is forwarding for approval a Programmatic Agreement (PA) between the District, the Tribe, and the Coastal Resources Management Council for the purpose of mitigating potential impacts to significant Narragansett cultural resources that may be discovered during construction. The Narragansett THPO or an authorized representative will conduct monitoring of sand placement at the three ponds and other areas of cultural significance during project construction. Further consultation may be required in areas where tribal resources are identified as stipulated within the aforementioned PA.

12. FLOODING

Hydrodynamic modeling done as part of this study determined that the proposed project in Ninigret Pond may increase high tide levels by about 0.15 to 0.2 feet during normal monthly tides and 0.35 to 0.45 feet during a 10-year storm tide event. The change in high tide levels was immeasureable for normal monthly tides in Winnapaug and Quonochontaug Ponds and less than 0.1 feet for the 10-year storm event. Therefore, this project will have minimal or no impacts on flooding or floodplains.

13. TRAFFIC

The project would have minor temporary effects on traffic during the construction period. Impacts will be minimized by avoiding construction during the summer tourism season.

14. ESSENTIAL FISH HABITAT

Potential impacts to essential fish habitat from the eelgrass restoration portion of this project include temporary increases in turbidity from dredging activities, loss of small portions of subtidal sand flat, and the temporary loss of benthic organisms associated with the dredged material. The impacts from the dredging process (turbidity and loss of benthos) are expected to be short-term and localized, as the material is predominately sand (less turbidity/low contamination) and benthic recolonization is generally a rapid process. Positive impacts from the project will be the restoration of approximately 57 acres of eelgrass, prime fish habitat, to the coastal ponds.

EFH for larval haddock is designated in this area. However, larval haddock are generally found in deeper waters than those found in the coastal ponds. Therefore, no impacts to haddock EFH are anticipated

EFH is designated within the project area for red hake juveniles and adults. Juvenile red hake are most often observed in low temperature ($<16^{o}$), high salinity waters (31-33 ppt), while adult red hake are generally observed in waters between 10 and 130 meters deep. This project is expected to have minimal effects on EFH for red hake.

EFH is designated within the project area for all life stages of the winter flounder. The eggs of winter flounder, which are demersal, are typically found at depths of less than 5 meters in bottom waters in a broad range of salinities (10-30 ppt). Spawning, and therefore the presence of eggs, occurs from February to June. EFH for larvae, juveniles, and adults includes bottom habitats of mud and fine-grained sandy substrate in waters ranging from 0.1 to 100 meters in depth. Spawning adults are typically associated with similar substrates in less than 6 meters of water. Although winter flounder EFH is located within the project area, juveniles and adults are very mobile and would be able to flee from the construction area once activities commence. Flounder adults and juveniles will have ample opportunity to avoid any potential impact. No significant impacts to flounder food resources (macrobenthic invertebrates) are expected from this project. Minimal amounts of eggs and larvae may be affected by sediment removal and the associated turbidity during construction activities. However, any impacts that occur will be localized and short term. Therefore, no more than minimal impacts on all life stages of the winter flounder EFH is anticipated as a result of this project.

EFH is designated within the project area for all life stages of the windowpane flounder. Eggs are buoyant and typically found in the water column in water depths of 1 meter to 70 meters. Larvae are found in pelagic waters. Juveniles and adults prefer bottom habitats of mud or fine-grained sand and can be found in salinities ranging from 5.5 ppt to 36 ppt. Seasonal occurrences in the project area are generally from February to November, with peaks in occurring May and October. Although EFH for the windowpane is within the project area, this species is broadly distributed in north and mid-Atlantic waters from the

Gulf of Maine to Cape Hatteras. Any disruption of EFH will be associated with the construction activities and therefore will not be long-term. As was the case with the winter flounder, windowpane flounder adults and juveniles should be able to avoid any potential impacts because of their mobility. Eggs and larvae will only have the potential to be impacted by localized, short-term turbidity associated with the construction activities. Therefore, no more than minimal impact on all life stages of windowpane flounder EFH is anticipated as a result of this project.

EFH is designated within the project area for Atlantic sea herring larvae, juveniles, and adults. Larvae, juvenile and adults typically prefer depths of 15 to 130 meters, depths that are considerably deeper than those found within the project area. No more than minimal impact is expected to occur to Atlantic sea herring EFH.

EFH is designated within the project area for bluefish juveniles and adults. Although juveniles and adults are found in the surface waters of mid-Atlantic estuaries from May through October, EFH for this species is mostly pelagic waters over the Continental Shelf. Bluefish adults are highly migratory and are generally found in salinities greater than 25 ppt. No more than minimal impact on bluefish EFH is anticipated as a result of the proposed project.

EFH is designated within the project area for juvenile and adult summer flounder. Eggs and larvae of summer flounder are generally found offshore and should not be found in the project area. Juvenile summer flounder utilize estuarine areas for nurseries and can be found in very shallow waters with salinities ranging from 1 – 30 ppt and temperatures greater than 22^{o}C. Adults migrate into shallow coastal and estuarine systems during the warm summer months and then move offshore during colder months. Although summer flounder may occur in the project area, adults and juveniles should be able to avoid any potential impacts because of their mobility. Therefore, no more than minimal impacts to summer flounder EFH is anticipated as a result of this project.

EFH is designated in the project area for all life stages of Scup. Scup eggs, larvae, juveniles, and adults have the potential to occur in estuarine systems during the spring and summer months. All life stages prefer salinities greater than 15 ppt. Eggs and larvae are found in water temperatures between $12\text{-}23^{o}$C and juveniles and adults can be found in waters with temperatures grater than 7^{o}C. Eggs and larvae are pelagic with a gradual transition to the demersal adult stage. Adults will also use structured areas for foraging and refuge. No more than minimal impacts to Scup EFH is anticipated as a result of this project.

B. FISH PASSAGE RESTORATION AREA

1. GENERAL

The proposed installation of a fishway along Cross Mills Brook will not have any long-term adverse effects on the general environment of the Cross Mills Pond and Brook areas. It will provide fish passage to Cross Mills Pond by the restoration of the channel to its approximate historical route. This will involve excavation of an approximately 100-foot long and 6-foot deep trench along the eastern side of the building housing Dartmouth Homes Realty and Edwards Investments on Old Post Road, continuing across the road to rejoin the downstream section of Cross Mills Brook at the existing culvert. Approximately 130 cubic yards of soil will be removed from the site as well as 40 square yards of asphalt and concrete from the existing roadway. The fishway will include a section of precast culvert that passes under the road. The road will then be backfilled and re-paved once the work was completed.

2. TERRESTRIAL ENVIRONMENT

a. TOPOGRAPHY

The project will have no long-term effect on the local topography in the project area, with exception of some possible re-grading of a small section of the property. The project involves the excavation of a previously disturbed area and the construction of a fishway, which will function during spawning season by the seasonal rerouting of flow through the approximate historic stream course. The entire project is approximately 100 feet long and 5 feet wide, and will not significantly affect the existing topography of the area surrounding Cross Mills Brook and Cross Mills Pond.

b. GEOLOGY

The proposed project is not expected to have any permanent long-term impacts on the geology of the surrounding area. The proposed construction will involve the removal of topsoil in order to place the channel for the fishway. It will not involve the blasting or removal of any underlying bedrock in the project area.

c. VEGETATION

The proposed project is not expected to have any permanent long-term impacts on the terrestrial vegetation in the project area. A portion of the excavation will be the removal of material in a previously disturbed section of residential/commercial seeded lawn, and the rest will be the removal of the asphalt roadbed in order to place the concrete sluiceway and Steep pass fish ladder. After construction is completed, the section of the lawn will be back-filled and re-seeded.

d. WILDLIFE

The proposed project is not expected to have any long-term negative impacts on the terrestrial wildlife populations in the surrounding area. The excavation will be of a previously disturbed area with limited habitat value (i.e. the lawn of the real estate building) and a section of highway that has no significant habitat value. Any associated impacts, such as those related to the noise of the earth moving equipment, will be temporary and of short duration. It is expected that any species that may be affected by the noise levels (i.e. forced to leave any former habitat) will return to the area once the project has been completed.

3. AQUATIC ENVIRONMENT

a. HYDROLOGY

The proposed construction of the fishway is not expected to have any long-term negative effects on existing water levels, as well as the inflow and outflow of Cross Mills Brook and Pond. In addition, the proposed project is not expected to have any long-term negative affects on the hydrology of Ninigret Pond. The actual construction of the project will be done during the summer low flow season, and most of the work will be done outside of the existing stream channel. When the project is completed, water from Cross Mills Brook will be seasonally diverted to discharge through the new fishway in order to allow upstream migration of returning anadromous fishes. In addition, the former channel will be maintained to function during extreme flood events to allow additional discharge from the Pond; helping to prevent flooding and maintain the pond at a more constant level.

b. WATER QUALITY

The proposed project is not expected to have any long-term negative effects on the quality of Cross Mills Brook and Cross Mills Pond. Actual work in the stream channel itself will be minimal, and limited to opening the original channel at the outflow of Cross Mills Pond, and rejoining the former channel at the discharge point of the existing culvert in Cross Mills Brook. This stream work will be done during the summer low flow season. Most of the work involves the construction and excavation of an additional channel, which is actually outside of the stream and therefore will not impact the water quality of the stream. In addition, proper erosion control measures will be in place to prevent siltation in the stream from runoff.

c. LITTORAL/RIVERINE PROCESSES AND SEDIMENT CHEMISTRY

The proposed project is not expected to have any long-term negative impacts on the littoral processes of Cross Mills Pond and the riverine processes of Cross Mills Brook. The water flowing out from Cross Mills Pond will be seasonally re-routed adjacent to its historical outflow where a water control structure once existed. In addition, this seasonal re-routing of the outflows through the fishway is actually an approximate restoration of the flow of Cross Mills Brook through its historical stream channel. As noted previously, proper erosion control measures will be used during and after construction (until stabilization) and the minimal in-water work will be accomplished during the summer low flow season (also utilizing appropriate erosion control measures).

4. BIOLOGICAL RESOURCES

a. AQUATIC VEGETATION

The proposed construction of a fishway in Cross Mills Brook is not expected to have any long-term negative impacts on the aquatic vegetation in Cross Mills Pond and Cross Mills Brook. As noted previously, most of the work will be done outside of the stream channel and/or the pond, and the final tie in will be done at locations in the stream and Pond which have been either previously disturbed or have existing control structures. The section of the pond where the fishway will enter consists of a pre-existing concrete headwall. Excavation of the mud bank adjacent to the headwall will be minimal, and any disturbed vegetation is expected to re-colonize the small section once the project has been completed. The section of the stream channel to be excavated is also small, and the banks in the area will be expected to re-vegetate and stabilize once the project has been completed.

b. REPTILES AND AMPHIBIANS

The proposed project is not expected to have any long-term negative impacts upon reptiles and amphibians inhabiting the areas of Cross Mills Pond and Cross Mills Brook. The entire fishway is proposed to be constructed in areas of previously disturbed upland with the exception of the tie in locations. As noted these tie in locations in both the streambed and the Pond have very small footprints and are also in areas of limited habitat value. Any impacts to habitat will be localized and temporary.

c. AVIAN SPECIES

The proposed project is not expected to have any long-term negative impacts upon the avian species inhabiting the area. As noted, most of the work will be done in disturbed upland areas already utilized for commercial purposes. Actual in-water work will be minimal and restricted to the summer low flow period, outside of the nesting time for any migratory waterfowl that may nest in and around Cross Mills Pond.

In addition, the restoration of anadromous fishes to Cross Mills Pond will provide an increased forage base to Ninigret Pond as the migrating river herring move through it on their way to spawn. This will have an overall positive effect on the productivity of the ecosystem, and may benefit piscivorous avian species such as Osprey, which are known to inhabit the salt pond region.

d. FISHERIES

The proposed construction of the fish ladder at Cross Mills Pond is expected to have a positive effect on the fish populations in Ninigret Pond, Cross Mills Pond, (and Cross Mills Brook) as well as Block Island Sound. With the provision of fish passage to Cross Mills Pond, river herring as well as other anadromous and/or catadromous fishes will have access to their historical spawning habitat (or forage habitat for catadromous eels) and will repopulate the pond. This will not only provide an increased forage base in Cross Mills pond for resident predator species such as largemouth bass and chain pickerel (which were found in Cross Mills Brook); but may also enhance the forage base in Ninigret Pond and/or Block Island Sound for estuarine and marine species which inhabit the area. Striped bass have been known to feed on migrating river herring as they enter the estuary (Loesch, 1987). The restoration of these species to their historical habitat will have a beneficial effect on the entire ecosystem (as noted previously in the section on Avian species) as well as on the fisheries of Cross Mills Pond, Cross Mills Brook, Ninigret Pond and Block Island Sound.

5. THREATENED AND ENDANGERED SPECIES

The proposed project is not expected to have any long-term negative effects on any threatened and endangered species in the project area. Recent coordination with the National Marine Fisheries Service as well as the U. S. Fish and Wildlife Service has indicated that no threatened or endangered species inhabit the area of Cross Mills Brook and Cross Mills Pond.

6. HISTORIC AND ARCHAEOLOGICAL RESOURCES

See section VI.A.11 for impacts to historic and archaeological resources.

C. CUMULATIVE IMPACTS

Cumulative impacts are those resulting from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions. Past and current activities in the coastal ponds include a wide variety of uses. However, the main use of the ponds is passive recreation. Reasonably foreseeable future actions include the continuation of current activities as well as a potential expansion of efforts to limit nutrient input into the ponds.

The primary cumulative impact of the proposed action when considered with other activities in the coastal ponds is the positive impact of improving the habitat quality of Rhode Island's coastal pond ecosystems. Habitat restoration coupled with improved water quality would foster numerous ecological benefits such as increases in prime fish and shellfish habitat as well as providing an additional primary production source to the ecosystem.

Impacts to the eelgrass beds in the coastal ponds may occur in the future if other projects were to target the existing populations as donor beds for projects outside of the coastal ponds. However, it is anticipated that the donor eelgrass beds for this project would recover quickly (~1 year) if small planting units are taken randomly throughout hearty beds as opposed to harvesting large patches. These impacts may be avoided or lessened if current technological advancements in seeding procedures prove to be viable, as seed harvesting and planting have little to no impacts associated with them.

SECTION VII – ENVIRONMENTAL JUSTICE

No significant adverse impacts to children, minority or low income populations are anticipated as a result of this project. The environmental effects of this project are occurring in coastal areas without these populations.

SECTION VIII - REFERENCES

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IX. COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

Federal Statutes

1. Archaeological Resources Protection Act of 1979, as amended, 16 USC 470 et seq.

Compliance: Issuance of a permit from the Federal land manager to excavate or remove archaeological resources located on public or Indian lands signifies compliance.

2. Preservation of Historic and Archeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: Project has been coordinated with the State Historic Preservation officer. Impacts to archaeological resources will be mitigated.

3. American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.

Compliance: Must ensure access by native Americans to sacred sites, possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

4. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: Public notice of the availability of this report to the Environmental Protection Agency is required for compliance pursuant to Sections 176c and 309 of the Clean Air Act.

5. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Compliance: A Section 404(b)(1) Evaluation and Compliance Review has been incorporated into the project report. An application shall be filed for State Water Quality Certification pursuant to Section 401 of the Clean Water Act.

6. Coastal Zone Management Act of 1782, as amended, 16 U.S.C. 1451 et seq.

Compliance: A CZM consistency determination shall be provided to the State for review and concurrence that the proposed project is consistent with the approved State CZM program.

7. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the U.S. Fish and Wildlife Service (FWS) and/or National Marine Fisheries Service (NMFS) has been completed pursuant to Section 7 of the Endangered Species Act.

8. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: Applicable only if report is being submitted to Congress.

9. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Public notice of availability to the project report to the National Park Service (NPS) and Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

10. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the FWS, NMFS, and State fish and wildlife agencies signifies compliance with the Fish and Wildlife Coordination Act.

11. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Public notice of the availability of this report to the National Park Service (NPS) and the Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

12. Marine Protection, Research, and Sanctuaries Act of 1971, as amended, 33 U.S.C. 1401 et seq.

Compliance: Applicable if the project does involves the transportation or disposal of dredged material in ocean waters pursuant to Sections 102 and 103 of the Act, respectively.

13. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: Coordination with the State Historic Preservation Office signifies compliance.

14. Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3000-3013, 18 U.S.C. 1170

Compliance: Regulations implementing NAGPRA will be followed if discovery of human remains and/or funerary items occur during implementation of this project.

15. National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.

Compliance: Preparation of an Environmental Assessment signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact or Record of Decision is issued.

16. Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: No requirements for projects or programs authorized by Congress. The proposed aquatic ecosystem restoration project is being conducted pursuant to the Congressionally-approved authority.

17. Watershed Protection and Flood Prevention Act as amended, 16 U.S.C 1001 et seq.

Compliance: Floodplain impacts must be considered in project planning.

18. Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.

Compliance: Coordination with the Department of the Interior to determine projects impacts on designated Wild and Scenic Rivers must occur.

19. Magnuson-Stevens Act, as amended, 16 U.S.C. 1801 et seq.

Compliance: Coordination with the National Marine Fisheries Service and preparation of an Essential Fish Habitat (EFH) Assessment signifies compliance with the EFH provisions of the Magnuson-Stevens Act.

Executive Orders

1. Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971

Compliance: Coordination with the State Historic Preservation Officer signifies compliance.

2. Executive Order 11988, Floodplain Management, 24 May 1977 amended by Executive Order 12148, 20 July 1979.

Compliance: Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2).

3. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Public notice of the availability if this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

4. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: Not applicable to projects located within the United States.

5. Executive Order 12898, Environmental Justice, 11 February 1994.

Compliance: Not applicable, the project is not expected to have a significant impact on minority or low income population, or any other population in the United States.

6. Executive 13007, Accommodation of Sacred Sites, 24 May 1996

Compliance: Not applicable unless on Federal lands, then agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites.

7. Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. 21 April, 1997.

Compliance: Not applicable, the project would not create a disproportionate environmental health or safety risk for children.

8. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.

Compliance: Consultation with Indian Tribal Governments, where applicable, and consistent with executive memoranda, DoD Indian policy, and USACE Tribal Policy Principles signifies compliance.

<u>Executive Memorandum</u>

1. Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: Not applicable if the project does not involve or impact agricultural lands.

2. White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.

Compliance: Consultation with Federally Recognized Indian Tribes, where appropriate, signifies compliance. The project has been coordinated with the Narragansett Indian Tribe.

X. COORDINATION

A public notice was released for this project on April 16, 1999 and coordination meetings have been held between Federal and State agencies to discuss various aspects of this project. The following agencies that have been contacted for this project include:

Federal agencies:

U.S. Environmental Protection Agency
Region 1
J.F.K. Federal Building
Boston, MA

U.S. Fish and Wildlife Service
Ralph Pill Building
Concord, NH

National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA

State agencies:

Rhode Island Department of Environmental Management

Rhode Island Coastal Resources Management Council

State Historic Preservation Office

Narragansett Indian Tribe

Tribal Historic Preservation Office

Additionally, public meetings were held on October 10, 2000 and August 14, 2001 for public discussion of this project.

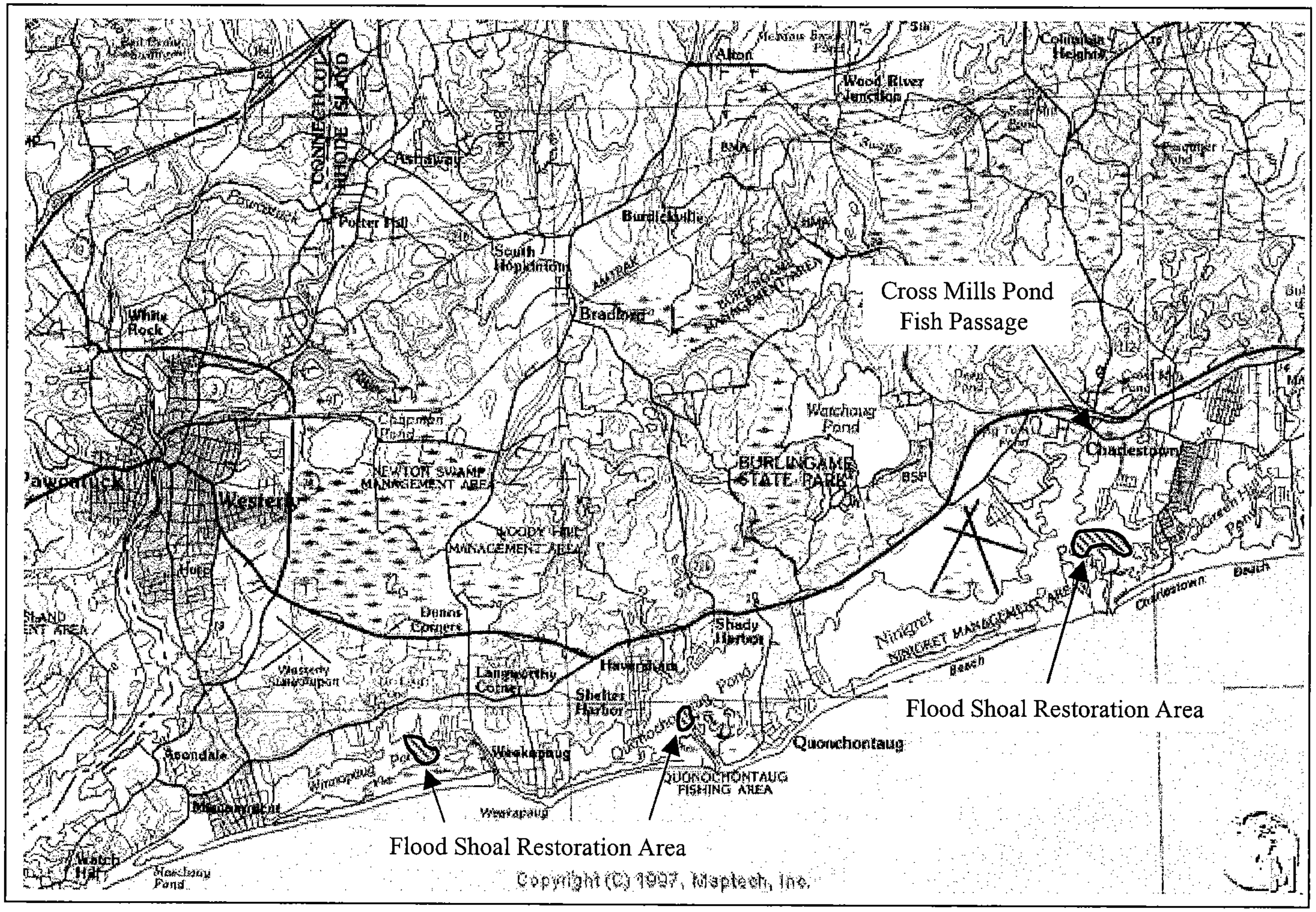
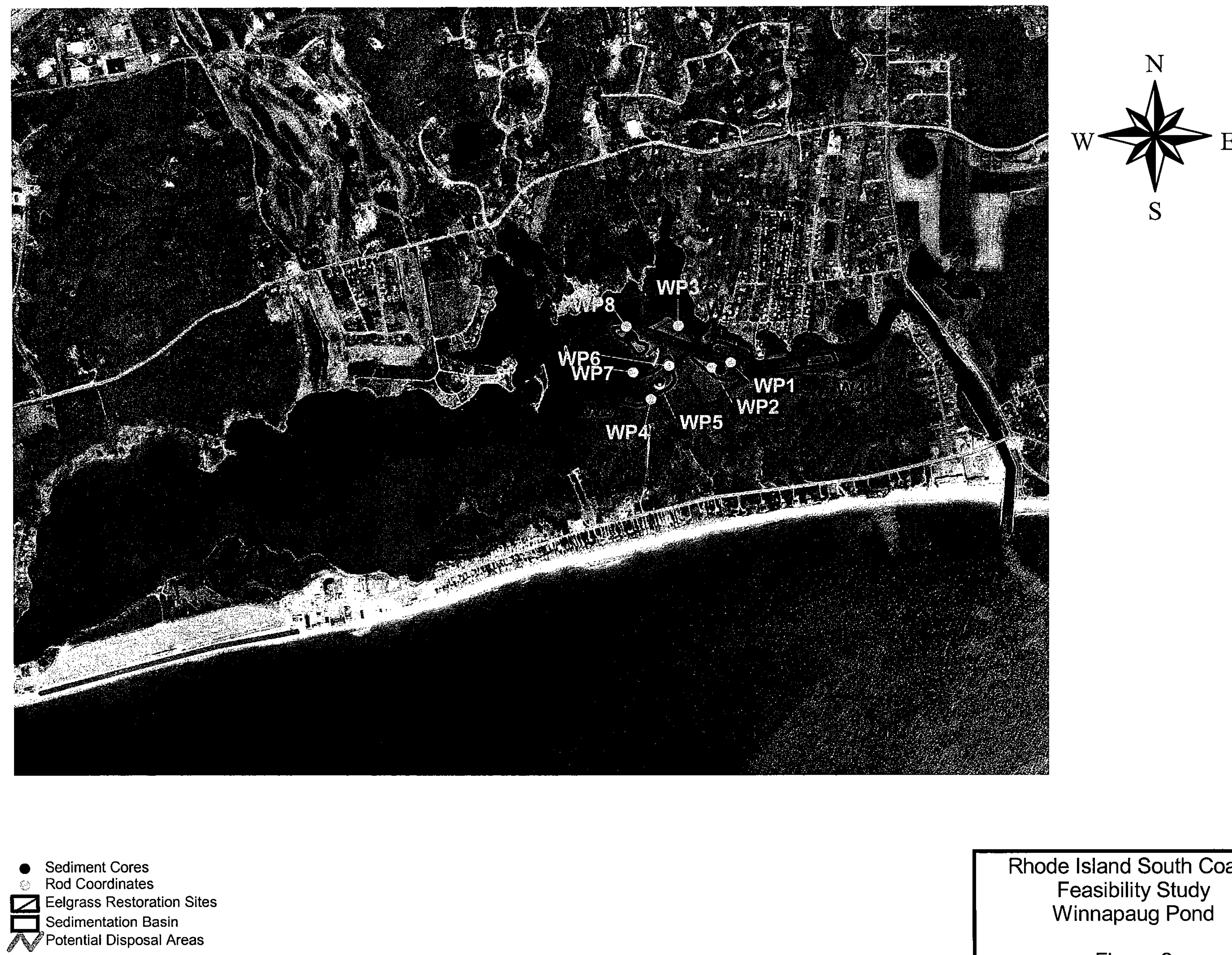
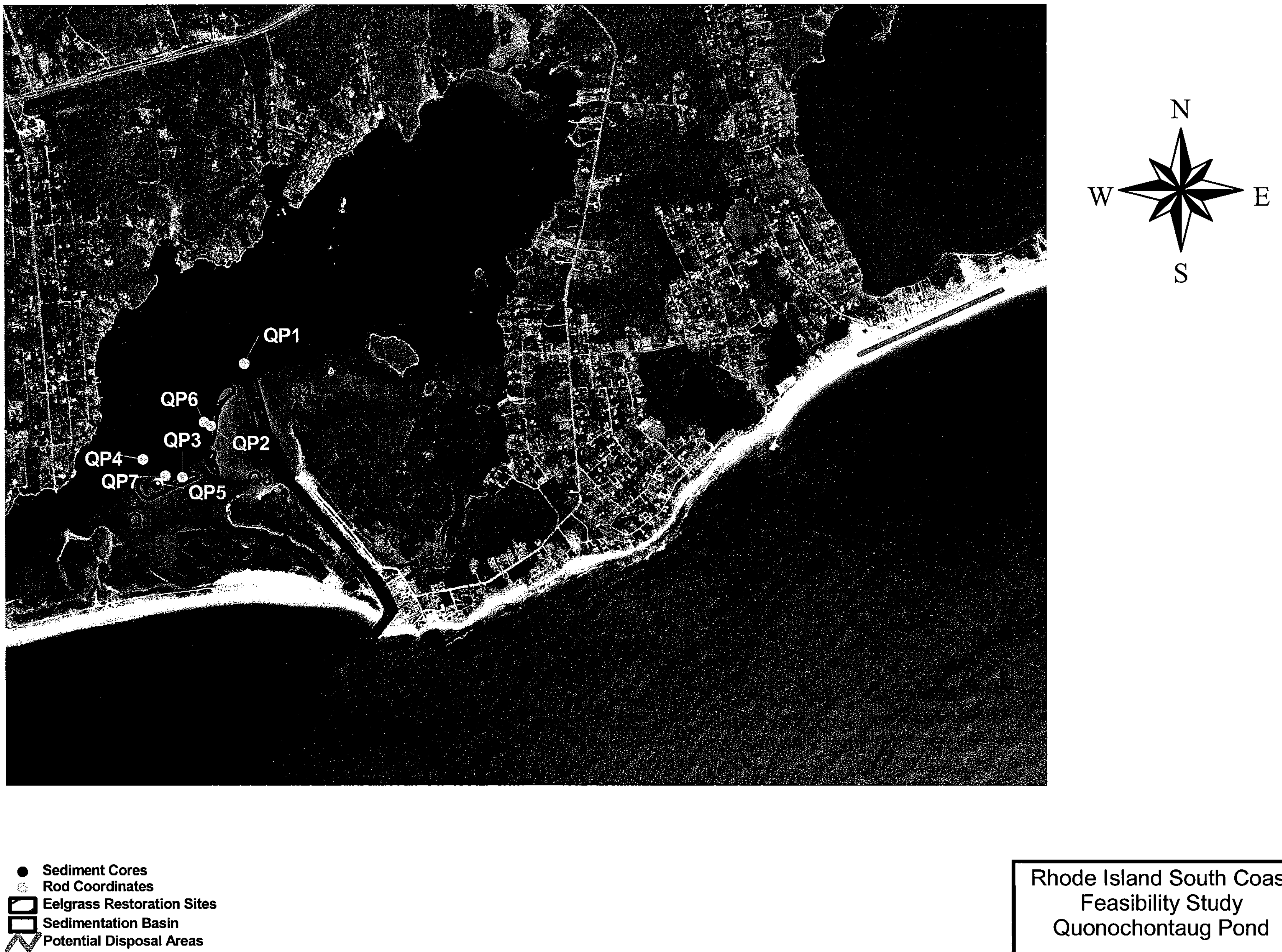


Figure 1
Rhode Island South Coast Feasibility Study
Location Map



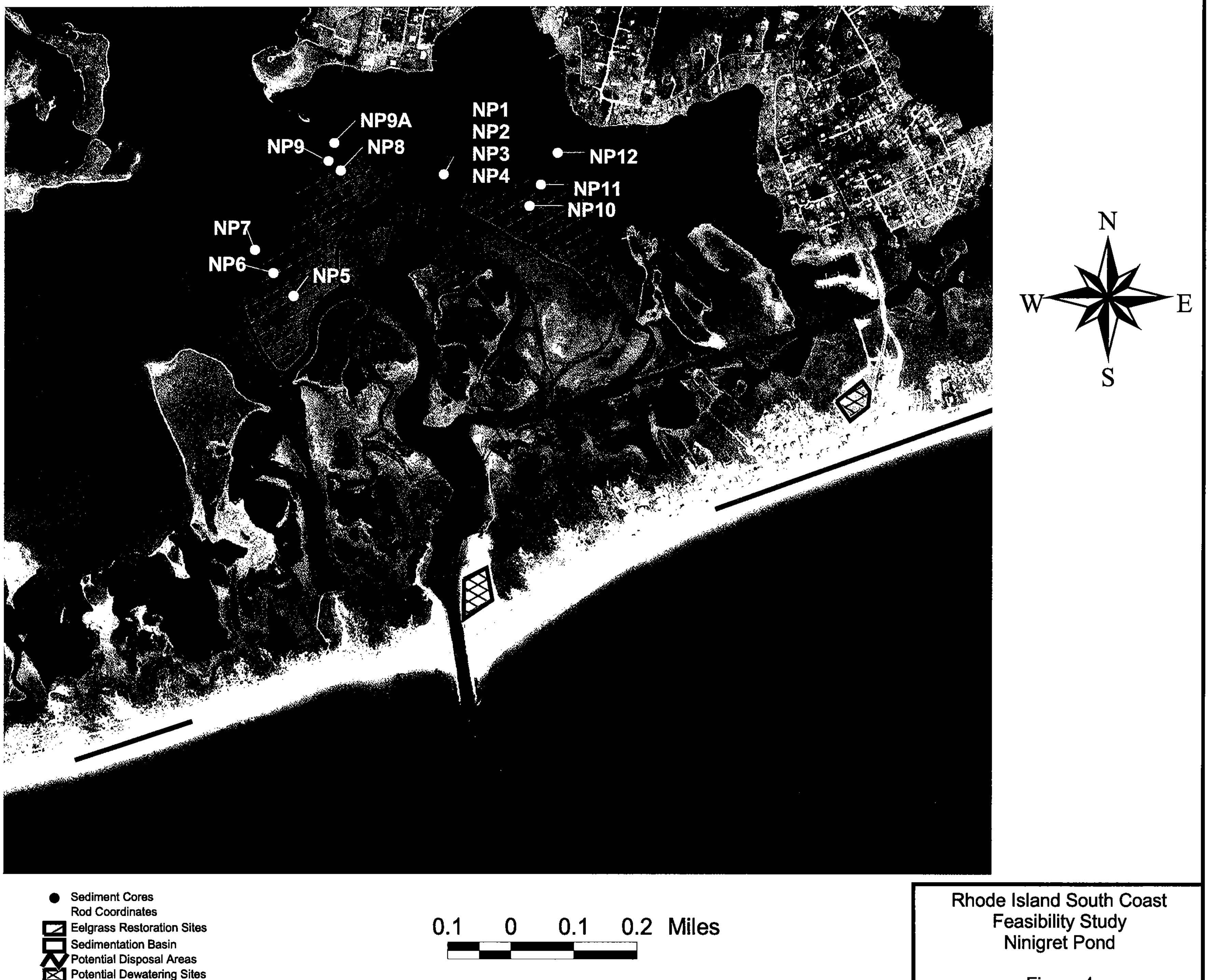
Rhode Island South Coast
Feasibility Study
Winnapaug Pond

Figure 2



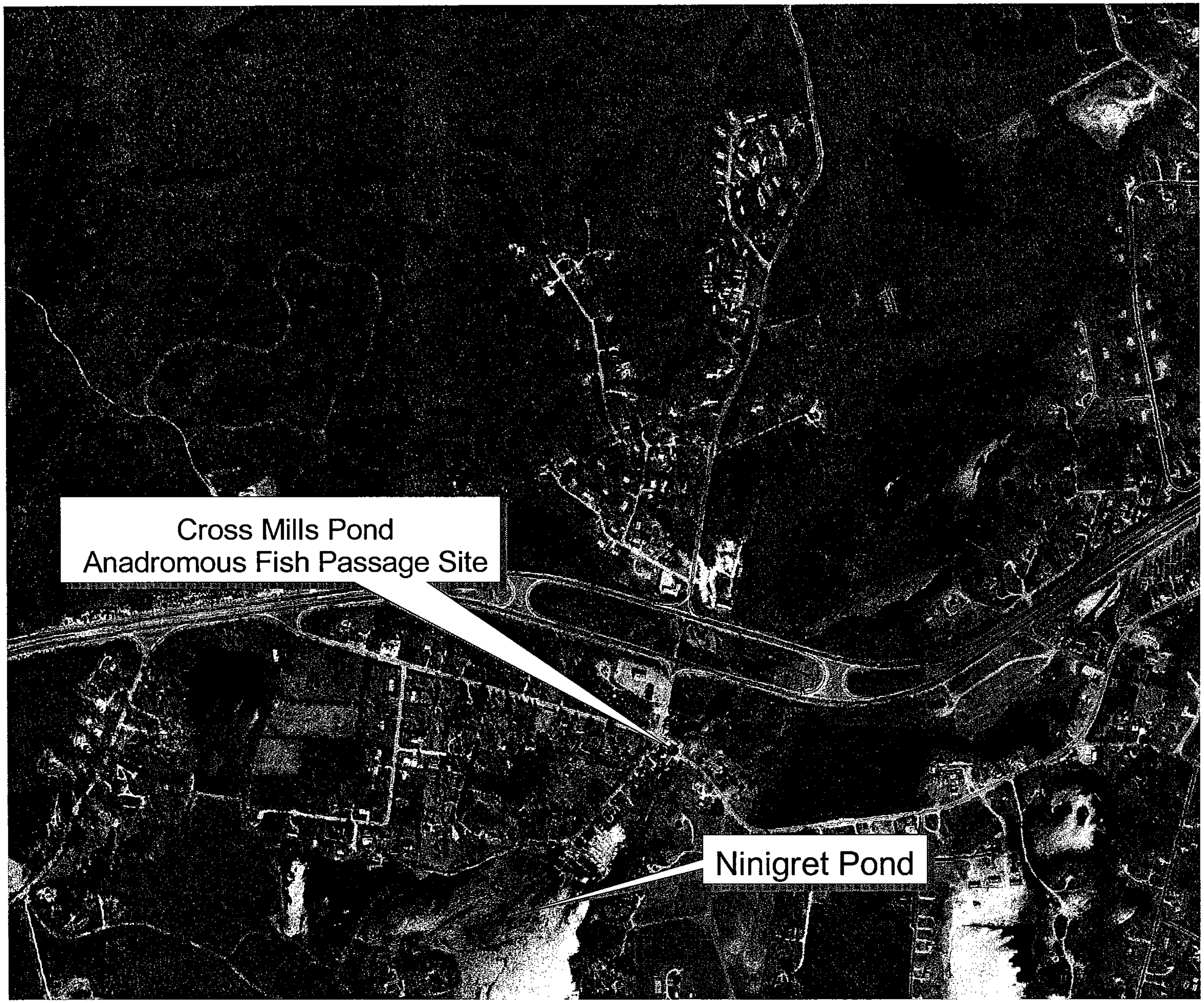
Rhode Island South Coast
Feasibility Study
Quonochontaug Pond

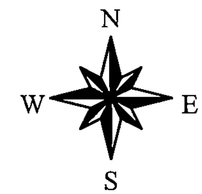
Figure 3



Rhode Island South Coast
Feasibility Study
Ninigret Pond

Figure 4





Rhode Island South Coast
Feasibility Study
Cross Mills Pond Fish Passage

Figure 5

FINDING OF NO SIGNIFICANT IMPACT

The proposed Rhode Island South Coast Habitat Restoration Project would restore approximately 57 acres of eelgrass habitat to the Rhode Island coastal ponds and would restore one migratory fish passage to an upland pond. Approximately 40 acres of eelgrass habitat would be restored in Ninigret Pond, 12 acres in Winnapaug Pond, and 5 acres in Quonochontaug Pond. The fish passage restoration project would restore the migratory fish pathway to Cross Mills Pond.

Four alternatives were considered for the eelgrass restoration. The alternatives included: 1) a No Action Alternative which would make no improvements to the project area, and therefore, allow the continuation of the shoaling process and the loss of existing eelgrass habitat; 2) the construction of a sedimentation basin in the breachway of each pond to reduce shoaling; 3) planting eelgrass on the suitable areas of the shoals of each pond and the construction of sedimentation basins to reduce shoaling; and 4) dredging the tidal shoal areas in the ponds, planting eelgrass in the newly dredged areas, and constructing sedimentation basins to reduce shoaling. Additionally the construction of a fish ladder to restore anadromous fish runs to Cross Mills Pond was also considered along with the eelgrass restoration. Alternatives for the fish ladder included: 1) a No Action Alternative which would make no improvements to the project and would not restore fish runs to Cross Mills Pond; 2) a trap and transfer alternative that would physically trap anadromous fish and transport them across the existing barrier, and 3) the construction of a fish ladder that would allow upstream migration of anadromous fishes beyond the existing discharge culvert in Cross Mills Brook.

This Environmental Assessment has been prepared in accordance with the National Environmental Policy Act of 1969 and all applicable environmental statutes and executive orders. My determination that an Environmental Impact Statement is not required is based upon the following information contained in the Environmental Assessment and the following considerations:

1. Based on physical analyses, the material in the project area will have no significant adverse effect upon existing water quality at the dredging or disposal areas

2. The project will not affect any State or Federally threatened, endangered, or rare species, pursuant to the Endangered Species Act. Dredging activities will be limited to times when the project area is not utilized by the threatened and endangered species identified in the area. Additionally, no intertidal habitats within the project area will be dredged to avoid impacts to threatened and endangered species.

3. While up to approximately 2 acres of existing eelgrass may be removed from donor beds for transplantation efforts, it will be used to create approximately 57 acres of eelgrass habitat (over the life of the project) that will provide a seed source for other unvegetated areas of the ponds.

4. As a result of coordination with the State Historic Preservation Office, it has been determined that no cultural resources will be impacted by the proposed dredging or restoration efforts. The Narragansett Indian Tribe has also been coordinated with concerning impacts to cultural resources.

5. Impacts to biological resources will be minimized by not allowing dredging to occur during peak shellfish spawning seasons.

Based on my review and evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that implementation of the proposed Rhode Island South Coastal Habitat project will have no significant direct, indirect, or cumulative impacts on the quality of the human or natural environment. Because no significant environmental impacts will result, an Environmental Impact Statement is not required and will not be prepared

___________________	___________________________
Date	Brian E. Osterndorf Colonel, Corps of Engineers District Engineer

CLEAN WATER ACT SECTION 404 (b)(1) EVALUATION

NEW ENGLAND DISTRICT
US ARMY CORPS OF ENGINEERS, CONCORD, MA
CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

PROJECT: Rhode Island South Coast Habitat Restoration Project

PROJECT MANAGER: Mr. Christopher Hatfield EXT. 7-8520

FORM COMPLETED BY: Mr. Todd Randall EXT. 7-8518

DESCRIPTION: The proposed Rhode Island South Coast Habitat Restoration Project would restore approximately 57 acres of eelgrass to the Rhode Island coastal ponds and would restore one migratory fish passage to an upland pond. Approximately 40 acres of eelgrass would be restored in Ninigret Pond, 12 aces in Winnapaug Pond, and 5 acres in Quonochontaug Pond. The fish passage restoration project would restore the migratory fish pathway to Cross Mills Pond.

NEW ENGLAND DISTRICT
U.S. ARMY CORPS OF ENGINEERS, CONCORD, MA

EVALUATION OF SECTION 404(b)(1) GUIDELINES

PROJECT: Rhode Island South Coast Feasibility Study

1. Review of Compliance (Section 230.10(a)-(d)).

a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose;

X______ YES   _______ NO

b. The activity does not appear to: 1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of Federally listed threatened and endangered species or their critical habitat; and 3) violate requirements of any Federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies);

X______ YES   _______ NO

c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2);

X______ YES   _______ NO

d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see section 5).

X______ YES   _______ NO

2. Technical Evaluation Factors (Subparts C-F).

	N/A	Not Significant	Significant
a. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C).			
1) Substrate		X	
2) Suspended particulates/turbidity		X	
3) Water		X	
4) Current patterns and water circulation		X	
5) Normal water fluctuations		X	
6) Salinity gradients	X		
b. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D).			
1) Threatened/ endangered species		X	
2) Fish, crustaceans, mollusks and other aquatic organisms in the food web		X	
3) Other wildlife		X	
c. Potential Impacts on Special Aquatic Sites (Subpart E).			
1) Sanctuaries and refuges		X	
2) Wetlands		X	
3) Mud flats	X		
4) Vegetated shallows		X	
5) Coral reefs	X		
6) Riffle and pool complexes	X		
d. Potential Effects on Human Use Characteristics (Subpart F).			
1) Municipal and private water supplies	X		
2) Recreational and commercial fisheries		X	
3) Water-related recreation		X	
4) Aesthetics		X	
5) Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves		X	

3. Evaluation and Testing (Subpart G).

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

1) Physical characteristics........................... X
2) Hydrography in relation to known or anticipated sources of contaminants..................... X
3) Results from previous testing of the material or similar material in the vicinity of the project.. ______
4) Known, significant sources of persistent pesticides from land runoff or percolation....................................... ______
5) Spill records for petroleum products or designated hazardous substances (Section 311 of CWA)...... X
6) Public records of significant introduction of contaminants from industries, municipalities, or other sources..…………………………… ______
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities.. ______
8) Other sources (specify).........................…______

List appropriate references.

The Environmental Assessment of the Rhode Island South Coast Feasibility Study, Charlestown, South Kingston, and Westerly, Rhode Island.

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to require constraints. The material meets the testing exclusion criteria.

X	______
YES	NO

4. Disposal Site Delineation (Section 230.11(f)).

a. The following factors, as appropriate, have been considered in evaluating the disposal site.

1) Depth of water at disposal site..................X____
2) Current velocity, direction, and variability at disposal site....................X____
3) Degree of turbulence..............................X____
4) Water column stratification.......................X____
5) Discharge vessel speed and direction...______
6) Rate of discharge.................................______
7) Dredged material characteristics (constituents, amount, and type of material, settling velocities)...............X___
8) Number of discharges per unit of time.._____
9) Other factors affecting rates and patterns of mixing (specify)...................____

List appropriate references.

The Environmental Assessment of the Rhode Island South Coast Feasibility Study, Charlestown, South Kingston, and Westerly, Rhode Island.

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or size of mixing zone are acceptable.

YES	NO
X	

5. Actions To Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.

YES	NO
X	

6. Factual Determination (Section 230.11).

A review of appropriate information as identified in items 2 - 5 above indicates that there is minimal potential for short or long term environmental effects of the proposed discharge as related to:

	YES	NO
a. Physical substrate (review sections 2a, 3, 4, and 5 above).	X	
b. Water circulation, fluctuation and salinity (review sections 2a, 3, 4, and 5).	X	
c. Suspended particulates/turbidity (review sections 2a, 3, 4, and 5).	X	
d. Contaminant availability (review sections 2a, 3, and 4).	X	
e. Aquatic ecosystem structure, function and organisms(review sections 2b and c, 3, and 5)	X	
f. Proposed disposal site (review sections 2, 4, and 5).	X	
g. Cumulative effects on the aquatic ecosystem.	X	
h. Secondary effects on the aquatic ecosystem.	X	

7. Findings of Compliance or Noncompliance.

a. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines.

X_____ _______
YES NO

____
Date

____
Brian E. Osterndorf
Colonel, Corps of Engineers
District Engineer

APPENDIX A – PERTINENT CORRESPONDENCE AND COMMENT RESPONSES

Part I

Pertinent Correspondence

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, R.I. 02879-1900
(401) 277-2476

May 1, 1998

Mr. Christopher Hatfield
US Army Corps of Engineers
696 Virginia Road
Concord, MA 01742

Re: Signed copies of the Feasibility Study Cost Sharing Agreement and Project Study Plan for the Rhode Island South Coast Feasibility Study.

Dear Mr. Hatfield:

Please find enclosed six (6) signed copies of the Feasibility Study Cost Sharing Agreement and Project Study Plan for the Rhode Island South Coast Feasibility Study. As I understand the process, you will be forwarding at least one signed copy to us for our records. If you have any questions, please do not hesitate to contact me at 401-222-2476.

Sincerely,

Laura M. Ernst

Laura M. Ernst, Marine Resources Specialist
Coastal Resources Management Council

LME/lme

Enclosures (6)

cc: Grover Fugate, CRMC
Jeff Willis, CRMC
Joe Klinger, CRMC

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, R.I. 02879-1900
(401) 277-2476

June 29, 1998

Post-it™ brand fax transmittal memo 7671

To Chris Hatfield	# of pages ▸ 4
Co.	From Laura Ernst
Dept.	Co.
Fax #	Phone #
	Fax #

Mr. Chris Hatfield, Project Manager
Army Corps of Engineers
696 Virginia Road
Concord, MA 01742

Re: Comments on the Rhode Island Coastal Salt Pond Shoal Area Restoration Preliminary Alternatives, Goals, Objectives, Performance Criteria and Methods.

Dear Mr. Hatfield:

Following are the Rhode Island Coastal Resources Management Council's comments on the Rhode Island Coastal Salt Pond Shoal Area Restoration: Preliminary Alternatives, Goals, Objectives, Performance Criteria and Methods. CRMC appreciates your coordination of this project and continuing cooperation with CRMC staff.

In all honesty, the outline is very brief and does not provide the level of detail that CRMC expected. It is not clear that ACOE staff have spent an adequate amount of time examining the available information and formulating an approach to the data collection and analysis necessary to determine where and how eelgrass and scallops should be restored. Furthermore, it is not evident that the ACOE considered some of the recommendations made at the April Technical Team meeting which CRMC organized to assist the ACOE in their preparations.

General Comments

In general, CRMC is concerned that the outline does not indicate how the collected data will help the study team determine where to restore eelgrass. Although the parameters suggested for monitoring are essential in making the decision about restoration sites, there should be a formula for determining how these pieces of information will help us determine site suitability. Each of the Alternatives refers to restoring eelgrass on the shoal area. It is my recollection from the Technical Team meeting that restoring eelgrass directly on the entire shoal area may not be the best location because of the potential for sedimentation. However, adjacent areas where eelgrass existed historically may be possibilities (see enclosed overlay map).

CRMC asked the URI Graduate School of Oceanography and Rhode Island Sea Grant (Mr. Stephen Granger) and the Rhode Island Department of Environmental Management, Division of Fish and Wildlife (Art Ganz) to suggest restoration approaches for eelgrass and scallops (Their recommendations follow). CRMC feels that this information should be included in the outline along with the specific comments provided below, and sent out for the Technical Team to review prior to the July 1st meeting. If time does not allow for this, CRMC recommends the ACOE hold two meetings.

Mr. Art Ganz of the DEM Fish and Wildlife recommends site selection for scallop restoration is critical, and he has a series of historical scallop planting and harvesting sites in each pond which have been learned and demonstrated over the years. CRMC recommends that the ACOE establish their monitoring stations in these sites. Mr. Ganz suggests planting a good number in the southwest end of each pond, so that the prevailing southwest wind driven currents distribute the larvae throughout the pond. The rest should be planted on eelgrass beds. Overall there should be a planting restoration site in the southwest end, mid-pond and a site adjacent to the "newly restored breachways". He recommends both free planting and caged scallops at teach site. Specific potential sites are the southwest corner of Ninigret Pond, somewhere adjacent to the entrance of Foster Cove, and at the old oyster bar immediately near Nopes Island (within the spawner sanctuary), and west of Bill's Island. Winnapaug Pond is more complicated because once firm substrates and eelgrass beds no longer exist. This will have to be discussed.

Mr. Steve Granger is still developing his comments on how data collection for eelgrass restoration should be done. These comments will be forthcoming.

CRMC realizes that the ACOE does not yet have the necessary aerial photographs to determine where existing eelgrass is located. However, there are historical maps which identify the extent and location of eelgrass beds. This data should be utilized to identify sampling stations. Sampling stations should be based on the location of historical eelgrass beds and existing field data (the Salt Pond Watchers data (1985-1995). It is important for the purposes of our meeting in July to identify Zones 1-5 and the transition zones on a map, and to clarify the criteria used to determine these sites. CRMC would be happy to assist the ACOE in preparing these maps using GIS. In addition to the Zones, the sampling sites for the eelgrass and scallop measurements should be indicated.

The ACOE should identify the methods which will be used for doing the measurements which are part of the Priorities. A detailed timetable should be part of the outline. It would be helpful to the meeting participants and CRMC to know when the ACOE expects different sampling elements to occur, during what season, and who will be doing the sampling (how many people) etc. In addition to this, CRMC would like the ACOE to identify those Priorities which can be accomplished together, i.e., current measurements and sedimentation measurements for eelgrass and scallops to occur on the same day, at the same time etc.

There are many terms used in the outline which are not clear. For instance in Alternative 1, what is meant by "...until the shoal and associated environmental conditions achieve an equilibrium"? In Alternative 2, the phrase "vertical component of the habitat" is vague and should be clarified. Do you mean that eelgrass won't grow as well, or as high etc.? How will Alternative 3 reduce suspended sediment?

Specific Comments on Priorities

Eelgrass Density, Page 3 - What is the predicted range? Why is September the month sampling should be done, when maximum biomass in the salt ponds is reached during June or July depending on water temperatures? Is the three years after implementation a monitoring requirement, and if so, is that supposed to be part of this outline? If so, perhaps a separate section on monitoring would be appropriate.

Eelgrass Height, Page 4 - A depth sounder equipped with the Roxanne program may be appropriate for measuring eelgrass height. The method of measurement for each Priority should be indicated so that the ACOE can utilize any resources CRMC or the state may have available.

Current Measurements and Sedimentation Rate, Page 4 - Current measurements must be done considering the horizontal segment of flow. Please refer to Dr. Jon Boothroyd's paper titled "Geology of Microtidal Lagoons: Rhode Island," in *Marine Geology*, 63 (1985) 35-76 for further explanation and reference. Also, suspended solids should measured should occur at the time of current measurements.

Substrate, Page 5 - Why are you collecting one core at 20cm depth if we are dredging to at least three feet to return to pre-shoal conditions? Or do you mean every 20cm? Also, why collect in the channel where we most certainly will not be planting/seeding eelgrass? Perhaps the edges of the channel?

Water column nitrate concentration, Page 6 - Why is this Priority 3? This should be a priority 1.

Sedimentation Rate and turbidity, Page 6 - Why is this repeated here when it is on page 4 under Sedimentation Rate? Same thing with Substrate (Priority 1) on Page 6, this is already on page 5 as a Priority 2 and on page 4 under Eelgrass Height.

Finally, the format of the outline is difficult to understand. For instance, on Page 6, the second Objective 2) Restore bay scallops looks like it falls under Priority 3. I would suggest formatting the different sections (Goal, Objectives, Performance Criteria) something similar to the following:

I. Goal:
II. Objective I: Restore eelgrass.
A. Performance Criteria
    1. Priority 1
        a. Method
III. Objective II: Restore Bay Scallops

G:\USERS\POLICY\ACOE_RES\DATA\OUTLN.WPD

A. Performance Criteria
   1. Priority 1
      a. Method

In addition, please date and add page numbers to the outline and list the names of the preparers so that CRMC staff and others can use the information for referring to the document. There is only one goal

CRMC appreciates the opportunity to comment on the outline and looks forward to finalizing an approach to the data collection and methodology prior to our July 9th meeting.

Sincerely,

Laura M. Ernst

Laura M. Ernst, Marine Resources Specialist
Coastal Resources Management Council

cc: Grover Fugate, CRMC
Jeff Willis, CRMC
Joe Klinger, CRMC

G:\USERS\POLICY\ACOE_RES\DATA\OUTLN.WPD

July 21, 1998

Engineering/Planning Division
Planning Branch

Mr. John Brown, Chairman
Narragansett Indian Land and
Water Resource Commission
P.O. Box 108
Kenyon, Rhode Island 02836

Dear Mr. Brown:

I am writing this letter in response to your telephone conversation with Mr. Christopher Hatfield, of my staff, on July 16, 1998. As he indicated, the Rhode Island South Coast Feasibility Study was initiated this past May. The study is a cost shared effort (50%/50%) between the U.S. Army Corps of Engineers and the Rhode Island Coastal Resources Management Council (RICRMC). The study will determine the feasibility of restoring aquatic habitat in Ninigret/Green Hill, Quonochontaug, and Winnapaug Ponds; restoration of anadromous fish passage to Cross Mills and Factory Ponds; and restoration of a tidally restricted salt marsh at the east end of Quonochontaug Pond. The study is expected to take two years to complete. At the end of the study, plans for restoration that are recommended for construction will enter a final design phase before construction.

A detailed scope of work for the Feasibility Study has been agreed upon between the U.S. Army Corps of Engineers and RICRMC. The scope of work lists the various activities, in general, that will need to take place in order to learn the information needed for the assessment of these various restoration sites. One of the activities that would be of special interest to you is Cultural Resource Studies. This activity is conducted by Mr. Marcos Paiva of our Evaluation Branch to identify potentially significant prehistoric and historic archaeological sites, and historic structures within the study areas for the purpose of Section 106 compliance. His efforts will entail determining existing conditions and impacts of alternative plans upon historic resources. Cultural resource studies will be well coordinated with the various groups, including the Narragansetts, interested in the historic and cultural value of the study areas, as per our Section 106 responsibilities. Please note that Mr. Paiva is also acting as the New England District Tribal Coordinator.

As we are better able to define the alternatives to be studied, later this or early next year, this office will be contacting you as part of this coordination effort. We would welcome Narragansett tribal input on the study area's land and water resources since you have historic and ancestral ties to and experience in this area. In the mean time, if you have any questions please feel free to contact the study manager, Mr. Christopher Hatfield, at (978) 318-8520 or Mr. Marcos Paiva at (978) 318-8796.

Sincerely,

H. Farrell McMillan, P.E.
Chief, Engineering/Planning Division

cf:
Mr. Hatfield(doc:brown.wpd)
Mr. Marcos PAIVA
Eng/Plng Files, Bldg. 2

August 19, 1998

Engineering/Planning Division
Evaluation Branch

FIELD(1)

Dear FIELD(2):

The purpose of this letter is to begin coordination for a U.S. Army Corps of Engineers Feasibility Study of restoration of coastal habitats along the coast of Rhode Island between Point Judith and Westerly, and inform you of an upcoming site visit. Our partner in this effort is the Rhode Island Coastal Resources Management Council. A copy of this letter has been furnished to Ms. Laura Ernst of the Rhode Island Coastal Resources Management Council.

The study consists of salt pond restoration projects in Ninigret/Green Hill, Winnapaug, and Quonochontaug Ponds; one salt marsh restoration project in Quonochontaug Pond; and fish passage restoration projects in Factory Pond (South Kingstown) and Cross Mills Pond (Charlestown). The Reconnaissance Report and the Feasibility Study Project Study Plan are enclosed to provide you with a brief explanation of the study.

A site visit for environmental agencies is scheduled for Thursday, September 3, 1998, at 10:00 a.m. We will begin the meeting at the Charlestown Breachway to Ninigret Pond in Charlestown, Rhode Island. My staff will provide a brief overview of the projects at the meeting, and will provide your organization with an early opportunity to comment on the projects and exchange information.

Please contact Mr. Larry Oliver of my staff at (978) 318-8347 if you will be sending a representative to the site visit, or if you have any questions about the project.

Sincerely,

-S-

H. Farrell McMillan, P.E.
Chief, Engineering/Planning Division

Enclosures
CF: Oliver, Hatfield, Read File, Eng/Plng Div file ***(c:cordstvs.frm)***

SAME LETTER SENT TO:

Mr. Michael Bartlett
U.S. Fish and Wildlife Service
New England Field Offices
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

Mr. Robert Mendoza
Environmental Protection Agency
Rhode Island State Office
J.F.K. Federal Building
Boston, Massachusetts 02203-2211

Mr. Christopher Mantzaris
National Marine Fisheries Service
One Blackburn Drive
Gloucester, Massachusetts 01930

Ms. Alicia M. Good, Director
Department of Environmental Management
Division of Water Resources
235 Promenade Street
Providence, Rhode Island 02903

Mr. John Stolgitis, Chief
Department of Environmental Management
Division of Fish and Wildlife
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, Rhode Island 02879

Ms. Carolyn Weymouth
Department of Environmental Management
Office of Environmental Coordination
235 Promenade Street
Providence, Rhode Island 02903

Mr. Rick Enser
Rhode Island Natural Heritage Program
Department of Environmental Management
235 Promenade Street
Providence, Rhode Island 02903

Mr. Kevin Nelson
Department of Administration
Office of Strategic Planning
One Capitol Hill
Providence, Rhode Island 02908

Mr. Charlie Hebert
U.S. Fish and Wildlife Service
Coastal Ecosystems Program
Charlestown, Rhode Island 02813

Mr. Andrew Milliken
U.S. Fish and Wildlife Service
Coastal Ecosystems Program
Charlestown, Rhode Island 02813

Mr. Peter Colosi
National Marine Fisheries Service
One Blackburn Drive
Gloucester, Massachusetts 01930

Mr. Jon Reitzman, Director
Department of Environmental Management
235 Promenade Street
Providence, Rhode Island 02903

Mr. Ernest M. Zmyslinski
Town of Westerly Planner
45 Broad Street
Westerly, Rhode Island 02891

Mr. George Hibbard
Town Administrator
Town of Charlestown
4540 South County Trail
Charlestown, Rhode Island 02813

Mr. Stephen Alfred
Town of South Kingstown
180 High Street
Wakefield, Rhode Island 02879

SAME LETTER SENT TO:
(Continued)

Mr. John Brown, Chairman
Narragansett Indian Land and
Water Resource Commission
P.O. Box 108
Kenyon, Rhode Island 02836

Ms. Virginia Lee
URI Coastal Resources Center
South Ferry Road
Narragansett, Rhode Island 02882

Dr. Jon Boothroyd
URI Geology Department
Green Hall
Kingstown, Rhode Island 02881

Copy Furnished:

Ms. Laura Ernst
Rhode Island Coastal Resources
Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, Rhode Island 02879

September 11, 1998

Engineering/Planning Division
Planning Branch

Honorable John H. Chafee
United States Senator
Ten Dorrance Street
Suite 221
Providence, Rhode Island 02903-2018

Dear Senator Chafee:

In the temporary absence of our District Engineer, Colonel Michael W. Pratt, I am responding to your letter dated August 14, 1998, and offer the following comments.

After the reconnaissance investigation, the New England District and the Rhode Island Coastal Resources Management Council, the non-Federal sponsor of the study, developed the scope of work for the Rhode Island South Coast Feasibility Study. This scope of work identified the alternatives that would be considered for further analysis. In identifying these alternatives, it was necessary to consider both the environmental issues of the alternatives and the potential implementation costs. Since there is limited Federal and State study funding for further analysis of alternatives, we agreed that only projects that were both implementable environmentally and within projected construction and operation budgets would be evaluated.

The construction of a siphon or multiple breachways to improve overall pond flushing was considered during the development of the scope of work for the Rhode Island South Coast Feasibility Study. However, the Rhode Island Coastal Resources Management Council was concerned that the potential implementation costs, which your constituent recognizes as an expensive option, would exceed the funding that it would have available. For this reason, we agreed that this alternative would not be included in further analysis.

If you have any further questions, please feel free to contact me at (978) 318-8222 or the Study Manager, Mr. Christopher Hatfield, at (978) 318-8520.

Sincerely,

John L. Rovero
Lieutenant Colonel, Corps of Engineers
Acting District Engineer

Copy Furnished:

Honorable John H. Chafee
United States Senate
Washington, DC 20510-3902

cf:
Mr. Hatfield (doc:chafee.wpd)
PAO
EA-Mr. Deleppo
Reading File
CENAD-EX (Mr. Giovinco)
CENAD-ET (Mr. Tosi)
Eng/Plng Files

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Southern New England-New York Bight
Coastal Ecosystems Program
Shoreline Plaza, Route 1A
P.O. Box 307
Charlestown, RI 02813
Phone: (401) 364-9124
FAX: (401) 364-0170
Email: R5ES_SNENYBCEP@MAIL.FWS.GOV

September 15, 1998

Chris Hatfield
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Dear Mr. Hatfield,

After attending the site visit to the proposed restoration sites on the south coast of Rhode Island, we have a few comments and suggestions. These comments are technical assistance only and do not alter or supercede the Service's official position pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; 16 U.S.C. 661 et seq.).

Salt Ponds

The salt pond restoration projects that are proposed for Ninigret, Quonochontaug, and Winnapaug Ponds involve the replacement of shallow, unvegetated subtidal or intertidal habitat on the flood tidal deltas with deeper subtidal habitats suitable for the planting of eelgrass. Although these flood tidal deltas were formed as a result of the breachways, they have become valuable habitat for fish and wildlife. The Feasibility Study should assess the impacts on those fish and wildlife species presently using the flood tidal deltas and balance these impacts against the benefits to be realized from the restoration of deeper subtidal habitats and eelgrass beds. Of particular concern are the existing shorebird and waterbird concentration areas that occur on these flood tidal deltas and adjacent salt marshes. Shorebirds and waterbirds that utilize these areas for feeding and roosting include the federally threatened piping plover (*Charadrius melodus*) and federally endangered roseate tern (*Sterna dougallii*). The shorebird concentration area near the Charlestown Breachway is considered one of the most important on the south shore of Rhode Island. Also of concern are impacts to winter flounder (*Pleuronectes americanus*) spawning and nursery areas and to existing shellfish beds. The preliminary alternatives summary that was passed out during the site visit did not include any alternatives that involve dredging the channel and only part of the shoal and restoring eelgrass to the dredged area. Several alternatives that involve dredging only portions of the shoals that are determined to be of lesser value to fish and wildlife should be considered. Sensitive areas such as shorebird concentration areas could be identified and avoided. An analysis of alternatives of timing of dredging and dredge material disposal to minimize impacts to fish and wildlife should also be conducted.

Any dredging alternative must include the creation or enhancement of sediment basins and a commitment that the sediment basins and breachways will be maintained in order to avoid the shoaling problems that exist at present.

The placement of dredged material from the shoal areas on the beach could provide short term enhancement of the beach for use by piping plover depending on timing, location, and other factors. Ninigret Conservation Area and Quonochontaug Beach both have steep beach faces that may limit the suitability of available beach habitat for nesting. Also, the eastern end of Quonochontaug Beach is experiencing erosion that appears to be related to the breachway. The Feasibility Study should assess how these beach habitats will be changed by the placement of dredged material. Other beach habitat enhancement options that were discussed at earlier meetings include the creation of more suitable plover nesting and feeding habitat by creating surge channels and overwash areas in the primary dunes. The feasibility of this habitat enhancement technique should be assessed as part of the study.

Fish passage

Both of the fish passage projects that we visited (Cross Mills Pond and Factory Pond) appear to be feasible projects assuming the affected landowners agree. Fish passage above these impediments to upper Cross Mills and Factory Ponds should be investigated. Removing all impediments to the upper reaches of these systems should be included in these proposed projects. Further documentation of the species and abundance of anadromous fish use below these barriers would also be helpful.

Marsh Restoration

It may be possible to enhance portions of the marsh located east of West Beach Road in Quonochontaug by restoring hydrology and controlling *Phragmites*. The Feasibility study should determine and map the existing hydrology, elevation, and vegetation of the entire wetland complex and determine the vegetational history. Restoring the area to a brackish cattail (*Typha* spp.) marsh may be more realistic and more appropriate than restoring it to a salt marsh. Several rare marsh nesting birds including American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exilis*), and marsh wren (*Cistothorus palustris*) nested in the southern end of this marsh complex in the 1980s. Restoring the *Phragmites*-dominated marshes south of West Beach Road (near the breachway) to cattail marshes should also be considered.

Monitoring

The feasibility study should set specific goals and develop monitoring and performance standards for each of the restoration projects to assess whether these goals have been achieved.

Availability of Data

Much of the data collected as part of the feasibility study will be valuable to other federal, state, and local agencies for other projects and should be made easily available. The mapping of eelgrass beds and bathymetry in the ponds, for example, should be made available to other agencies in GIS format.

Thank you for the opportunity to visit the sites and comment on the proposed restorations. Please let me know if you have any questions or would like additional information.

Sincerely,

Andrew Milliken
Fish and Wildlife Biologist

cc:

Larry Oliver, US ACOE
Laura Ernst, RI CRMC
Charlie Hebert, Refuge Manager, USFWS Rhode Island National Wildlife Refuges Complex
Greg Mannesto, USFWS Rhode Island Field Office

February 5, 1999

Engineering/Planning Division
Evaluation Branch

Mr. Robert Mendoza
Environmental Protection Agency
Rhode Island State Office
J.F.K. Federal Building
Boston, Massachusetts 02203-2211

Dear Mr. Mendoza:

The U.S. Army Corps of Engineers is conducting a General Investigation to consider alternatives to restore coastal habitats at several locations along the coast of Rhode Island between Westerly and Narragansett. Our partner in this effort is the Rhode Island Coastal Resources Management Council. The purpose of this letter is to formally request your comments on the project prior to completing our environmental assessment.

The projects considered in this study include restoration of eelgrass and related habitat values on flood tidal shoals at three coastal salt ponds and restoration of fish passage to two freshwater ponds connected to salt ponds. The salt ponds are Ninigret, Quonochontaug and Winnapaug Ponds. The fish passage projects are located on the brook leading from Ninigret Pond to Cross Mills Pond and on the brook between Green Hill Pond and Factory Pond. Location maps are enclosed to aid in your review.

The salt pond restoration projects focus on restoring eelgrass in areas buried by flood tidal shoals near the entrances to the ponds. Historically, the salt ponds were managed by local residents who opened temporary breachways between the ocean and the ponds. During the 1950's, permanent, stabilized openings were constructed in Ninigret, Quonochontaug, and Winnapaug Ponds. The permanent breachways increased the salinity, altering the brackish habitat. This made the salt ponds more suitable for such species as eelgrass and scallops. However, with shoaling and reductions in water quality, these species have decreased in vigor and abundance. The breachways also increased sedimentation rates, resulting in the loss of productive aquatic habitat. Settling basins at one time existed in the Winnapaug and Ninigret breachways. However, the basins have filled in and no longer function.

As presently envisioned, restoration will most likely be accomplished through a combination of selective dredging, re-establishing a sedimentation basin to control future shoaling, and planting eelgrass in the dredged areas. The shoal areas in each pond are shown on the enclosed figures. The sand dredged from the shoals will most likely be placed on nearby barrier beaches. We will investigate the possibility of restoring shorebird habitat with this dredged material.

The fish passage projects for Factory Pond in South Kingstown and Cross Mills Pond (and associated ponds) in Charlestown are smaller in scope. Anadromous fish (e.g., herring) passage will be enhanced by constructing fish passage structures that allow fish migration across man-made barriers.

Please contact Mr. Larry Oliver of my staff at (978) 318-8347 if you have any questions or require additional information about this project.

Sincerely,

Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division

Enclosures

Copy Furnished:

Ms. Laura Ernst
Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, Rhode Island 02879

CF: Oliver, Hatfield, Read File, Eng/Plng Div file ***(c:RIGENC~1))***

SAME LETTER SENT TO:

Mr. Robert Mendoza
Environmental Protection Agency
Rhode Island State Office
J.F.K. Federal Building
Boston, Massachusetts 02203-2211

Mr. Kevin Nelson
Department of Administration
Office of Strategic Planning
One Capitol Hill
Providence, Rhode Island 02908

Mr. Ernest M. Zmyslinski
Town of Westerly Planner
45 Broad Street
Westerly, Rhode Island 02891

Mr. George Hibbard
Town Administrator
Town of Charlestown
4540 South County Trail
Charlestown, Rhode Island 02813

Mr. Stephen Alfred
Town of South Kingstown
180 High Street
Wakefield, Rhode Island 02879

Mr. John Brown, Chairman
Narragansett Indian Land and
Water Resource Commission
P.O. Box 108
Kenyon, Rhode Island 02836

February 9, 1999

Engineering/Planning Division
Evaluation Branch

Mr. Michael Bartlett
U.S. Fish and Wildlife Service
New England Field Offices
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

Dear Mr. Bartlett:

The U.S. Army Corps of Engineers is conducting a General Investigation to consider alternatives to restore coastal habitats at several locations along the coast of Rhode Island between Westerly and Narragansett. Our partner in this effort is the Rhode Island Coastal Resources Management Council. The purpose of this letter is to formally request your comments on the project pursuant to the Fish and Wildlife Coordination Act of 1934, as amended.

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The fish passage projects for Factory Pond in South Kingstown and Cross Mills Pond (and associated ponds) in Charlestown are smaller in scope. Anadromous fish (e.g., herring) passage will be enhanced by constructing fish passage structures that allow fish migration across man-made barriers.

Please contact Mr. Larry Oliver of my staff at (978) 318-8347 if you have any questions or require additional information about this project.

Sincerely,

Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division

Enclosures

Copy Furnished:

Ms. Carolyn Weymouth
Department of Environmental Management
Office of Environmental Coordination
235 Promenade Street
Providence, Rhode Island 02903

Ms. Laura Ernst
Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, Rhode Island 02879

CF: Oliver, Hatfield, Read File, Eng/Plng Div file ***(c:rifwca~1))***

Mr. Michael Bartlett
U.S. Fish and Wildlife Service
New England Field Offices
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

Mr. Peter Colosi
National Marine Fisheries Service
One Blackburn Drive
Gloucester, Massachusetts 01930

Mr. George Welley, Acting Director
Department of Environmental Management
235 Promenade Street
Providence, Rhode Island 02903

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Administration
STATEWIDE PLANNING PROGRAM
One Capitol Hill
Providence, RI 02908 - 5872

February 12, 1999

Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division
Department of the Army
New England District, Corps of Engineers
696 Virginia Road
Concord, MA 01742

Dear Mr. Hitch,

That you for the opportunity to comment on the salt marsh restoration projects for Ninigret, Quonochontaug, and Winnapaug Ponds, and the fish passage projects for Factory Pond and Cross Mills Pond.

We believe the projects will further several important State Guide Plan goals and policies, among them are:

- Maintain and upgrade resources essential to the commercial and sport fishing industry.
- Protect and preserve tidal marshes and shellfish beds.
- Preserve, develop, and where possible, restore the resources of the coastal region in order to maximize benefits from its variety of assets.
- Expand the anadromous fish restoration program.
- Preserve and protect significant coastal and island resources, including coastal marshlands, sand dunes, sand beaches, and wildlife habitats.
- More effectively manage commercially, recreationally, and ecologically, important estuarine-dependent living resources.

We look forward to the completion of your environmental assessment.

Yours truly,

Kevin J. Nelson

Kevin J. Nelson
Principal Planner, Statewide Planning Program

February 18, 1999

Engineering/Planning Division
Planning Branch

Mr. Grover J. Fugate, Director
Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
4804 Tower Hill Road
Wakefield, Rhode Island 02879-1900

Dear Mr. Fugate:

It has become apparent that one of the potential restoration projects that we originally agreed to include in the Rhode Island South Coast Feasibility Study is not a viable restoration site.

As you know, a marsh, separated from the east end of Quonochontaug Pond by Quonochontaug Road in Charlestown, appeared to be a tidally restricted salt marsh and was included in the Feasibility Study.

However, after having visited the site in early January and examining aerial photography from the 1930s, it is clear that the marsh in question is a rather large and healthy cattail marsh. This was difficult to detect from the ground during the September 3, 1998 coordinated site visit due to a large stand of phragmites that bordered the road. Some of the representatives at that meeting stated they thought the marsh behind the phragmites stand to be a freshwater, cattail marsh. Currently, there is a one foot tide range on the pond side of the road and a six to eight inch tide range on the back side of the road.

It is our recommendation that we drop this site from further consideration as a restoration site. We can discuss this further and visit the site together, if need be, at some time in the near future. In the mean time, we suggest that the funding for this portion of the study be retained in the event we decide it could be used to help fund other study tasks. If you have any questions please contact me or the Study Manager, Mr. Christopher Hatfield at (978) 318-8500 or (978) 318-8520, respectively.

Sincerely,

Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division

Cf:
Mr. Hatfield (fugatehat)
Eng/Plng Files

U.S. FISH & WILDLIFE SERVICE

United States Department of the Interior

U.S. Department of the Interior 1849•1999

FISH AND WILDLIFE SERVICE
New England Field Office
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

March 22, 1999

Kenneth Hitch, Chief
Engineering/Planning Division
U.S. Corps of Engineers
696 Virginia Road
Concord, Massachusetts 01742-2751

Dear Mr. Hitch:

This responds to your February 5, 1999 letter requesting information on the presence of federally-listed and proposed endangered or threatened species in relation to the General Investigation to consider alternatives to restore coastal habitats at several locations along the coast of Rhode Island between Westerly and Narragansett, Rhode Island. The following comments are also provided in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The threatened piping plover (*Charadrius melodus*) and federally-endangered roseate tern (*Sterna dougallii*) are known to occur in the project area. Piping plovers arrive in early March and by early April begin to establish territories (USFWS, Piping Plover Recovery Plan, 1996). Plover nests are situated above the high tide line on coastal beaches, sandflats at the end of sandspits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, and on washout areas cut into or between dunes. Nest sites are shallow scraped depressions in substrates ranging from fine grained sand to mixtures of sand and pebbles, shells or cobble. Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under stands of American beachgrass (*Ammophila breviligulata*) or other vegetation. Eggs may be present on the beach from mid-April to late July. Broods may move hundreds of yards from the nest site during their first week of life. Feeding areas include intertidal portions of ocean beaches, washover areas, mudflats, sandflats, wrack lines, and shorelines of coastal ponds, lagoons, or saltmarshes. One of the major plover foraging areas is on the flood tidal shoals proposed for dredging. Plovers migrate south in August. Therefore, dredging should be restricted from mid-March to mid-August.

Roseate terns migrate through Rhode Island waters in the vicinity of the proposed project, but have not nested in the state since 1984 (USFWS, Roseate Tern Recovery Plan, First Update, 1998).

No other federally-listed or proposed threatened and endangered species under the jurisdiction of the U.S. Fish and Wildlife Service are known to occur in the project area, with the exception of occasional transient bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons (*Falco peregrinus)*. However, we suggest that you contact Rick Enser of the Rhode Island Natural Heritage Program, 235 Promenade St., Providence, Rhode Island 02908, at 401-222-2776, for information on state-listed species that may be present.

Preparation of a Biological Assessment or further consultation with us under Section 7 of the Endangered Species Act may be required. Because of the lack of detailed plans regarding the project alternatives, we cannot make a determination of whether the project may adversely affect listed species. Please contact this office when detailed plans have been developed. A list of federally-designated endangered species in Rhode Island is enclosed for your information.

At this time, not enough information is available to provide extensive comments on the fish and wildlife impacts of the proposed alternatives. In general, the flood tidal shoals at Ninigret Pond are more important to shorebirds than the flood tidal shoals at Winnapaug or Quonochontaug Ponds. According to Chris Raithel, Endangered Species and Nongame Project Leader for Rhode Island, these shoals represent one of the three most important areas in the state for shorebirds. Thousands of migratory shorebirds have been recorded using the area. Furthermore, the site is used as foraging habitat by piping plovers. In view of the above, the Service recommends against dredging of the flood tidal shoals at Ninigret Pond.

The placement of dredge material on the beaches needs to be studied very carefully. Attempts to stabilize dunes prevents the formation of blowouts that are one of the preferred nesting habitats of piping plover. In addition, the placement of large, steeply sloping dunes may create actual barriers for chick movement, preventing plover chicks from accessing feeding areas or cover. Therefore, these activities have the potential to adversely affect breeding piping plovers.

The flood tidal shoals have become valuable fish and wildlife habitat. A survey needs to be completed documenting current use of these areas. The survey should consider impacts to winter flounder (*Pleuronectes americanus*) spawning and nursery areas and existing shellfish beds. Alternatives that involve dredging only portions of the flood tidal shoals should be evaluated. If the primary project purpose is to restore eelgrass in the ponds, other areas besides the flood tidal shoals should be evaluated for restoration.

The provision of fish passage to Factory Pond and Cross Mills Pond will result in additional spawning habitat for river herring. A complete analysis of the riverine and pond systems needs to be completed to determine if any impediments to fish passage need to be corrected. For example, the stream to Factory Pond near the corner of Green Hill Road and Matunuck-Schoolhouse Road has two shelves that could be impediments to upstream migration of river herring.

The salt marsh restoration proposed at the east end of Quonochontaug Pond should only be considered on the west side of West Beach Road. The area east of West Beach Road should not be considered for salt marsh restoration because it currently has only a narrow band of Phragmites along the road while the majority of the area is a cattail marsh. An evaluation of the restoration potential of some smaller ponds along the coastal study area needs to be completed. These ponds are being invaded by Phragmites and it may be possible to restore these Phragmites-dominated areas to native vegetation.

A set of restoration goals needs to be developed. Plans to monitor the restoration should be designed to determine whether agreed upon goals are met. Monitoring should be conducted for a minimum of five years. There should be enough flexibility in the plans so that adjustments can be made if goals are not being met.

Thank you for your cooperation and please contact Greg Mannesto of our Rhode Island Office at (401) 364-9124 if we can be of further assistance.

Sincerely yours,

Michael J. Bartlett
Supervisor
New England Field Office

Enclosure

CC: Corti Collins, NMFS
Peter Holmes, EPA
Rick Enser, DEM
Chris Raithel, DEM
Reading file

ES: GMannesto:3-22-99:401:364:9124

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN RHODE ISLAND

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Atlantic coastal waters and rivers
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic straggler in southern New England
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic straggler in southern New England
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer resident
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident
Turtle, Atlantic ridley*	Lepidochelys kempii	E	Oceanic summer resident
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	T	Entire state, occasional
Falcon, American peregrine	Falco peregrinus anatum	E	No current nesting; entire state-migratory
Plover, Piping	Charadrius melodus	T	Atlantic coast, Washington and Newport Counties
Roseate Tern	Sterna dougallii dougallii	E	Atlantic coast
MAMMALS:			
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp. (all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS:			
NONE			
INSECTS:			
Beetle, American burying	Nicrophorus americanus	E	Washington
Beetle, northeastern beach tiger	Cicindela dorsalis dorsalis	T	Washington, extirpated
PLANTS:			
Small Whorled Pogonia	Isotria medeoloides	T	Providence, Kent Counties
Gerardia, Sandplain	Agalinus acuta	E	Washington

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service

Rev. 6-15-98

April 6, 1999

Engineering/Planning Division
Planning Branch

Mr. Grover J. Fugate, Director
Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
4804 Tower Hill Road
Wakefield, Rhode Island 02879-1900

Dear Mr. Fugate:

I am writing this letter to update you regarding the financial status of the Rhode Island South Coast Feasibility Study.

As the study has progressed and detailed sampling plans have been developed, it has become clear that certain Environmental Studies will cost more than originally estimated in order for us to evaluate the feasibility of improvements in the coastal ponds. Coordination with the various technical experts in the fields of seagrass restoration and geology has made it clear to us that the relationship between sedimentation and eelgrass growth is critical to our assessment. This will involve a determination of sedimentation rates at various locations around the flood tidal deltas, during normal and storm conditions. A sedimentation sampling plan was developed in cooperation with Mr. Joe Klinger of your office and Dr. Jon Boothroyd of the University of Rhode Island. This sediment sampling, along with an update of Dr. Boothroyd's historical shoaling rate determination, current measurements, and increased eelgrass sampling, all contribute to potentially higher expenditures (about $75,000) in the Environmental Studies subaccount.

Fortunately, I do not believe that increased expenditures in this area will result in a financial shortage for the overall study. As I indicated in my letter dated February 18, 1999, the salt marsh restoration site has been dropped from further consideration, leaving the funding for that effort (about $135,000) unused. The U.S. Fish and Wildlife Studies subaccount (about $30,000) is also anticipated to be underutilized. As discussed between the study manager, Mr. Christopher Hatfield, and Ms. Laura Ernst of your staff, the best course of action appears to be to use some of these underutilized funds to finance the added costs as described above. The Feasibility Study Cost Sharing Agreement and Project Study Plan do not preclude us from shifting funding in this way, as long as you are in agreement.

Please inform me, by correspondence, of your agreement with this strategy. If you have any questions, please call Mr. Hatfield at (978) 318-8520.

Sincerely,

Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division

Cf:
Mr. Hatfield (costs)
Eng/Plng Div

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, R.I. 02879-1900
(401) 277-2476

April 8, 1999

Mr. Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division
Department of the Army
New England District, Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Re: Response to letter regarding the financial status of the Rhode Island South Coast Feasibility Study.

Dear Mr. Hitch:

Thank you for your letter of April 6, 1999 regarding the financial status of the Rhode Island South Coast Feasibility Study. My staff and I agree with your assessment of the salt marsh restoration site and concur that $75,000 should be used to cover the cost of the sedimentation sampling and historical shoaling rate determination. However, since there will still be a balance of $60,000 as yet unaccounted for in the Feasibility Study (from the Salt Marsh Restorations Study), we would like to be notified if and when this money needs to be reallocated. Because the local municipalities are supporting the Feasibility Study, CRMC is obligated to inform them of any changes as we proceed.

CRMC appreciates the efforts of your staff to coordinate the South Coast Feasibility Study and to keep the CRMC Project Manager up to date with the sampling plans and other aspects of the Study. If you have any questions regarding this letter, please contact Laura Ernst, Project Manager at (401)222-2476. Thank you.

Sincerely,

Grover J. Fugate, Executive Director
Coastal Resources Management Council

cc: Chris Hatfield, Army Corps of Engineers

US Army Corps
of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Public Notice

Date: April 16, 1999
Comment Period Closes: May 17, 1999

RHODE ISLAND SOUTH COAST FEASIBILITY STUDY
GENERAL INVESTIGATION OF HABITAT RESTORATION

CHARLESTOWN, WESTERLY, AND SOUTH KINGSTOWN, RHODE ISLAND

Interested parties are hereby notified that the Army Corps of Engineers, New England District, is conducting an investigation to evaluate alternatives to restore eelgrass and associated estuarine habitats and fish passage at various locations along the south coast of Rhode Island from Westerly to Point Judith. (See Figure 1.) The project sponsor is the Rhode Island Coastal Resources Management Council. The work is authorized under a resolution adopted by the Committee on Environment and Public Works of the United States Senate dated August 2, 1995. Attachment No. 1 lists pertinent laws, regulations, and directives.

Project Description

Restoration efforts of two types are included in this study. A major portion of the study will focus on restoration of eelgrass beds in the vicinity of flood tidal shoals at the entrance of Ninigret, Quonochontaug, and Winnapaug Ponds. The study will also examine fish passage restoration between Ninigret Pond and Cards Pond, and Factory Pond. Project locations are shown on Figure 1.

The salt pond restoration projects focus on restoring eelgrass in areas buried by flood tidal shoals near the entrances to the ponds. Historically, the salt ponds were managed by local residents who periodically opened temporary breachways between the ocean and the ponds. During the 1950s, permanent, stabilized openings were constructed in Ninigret, Quonochontaug, and Winnapaug Ponds. The permanent breachways increased the salinity, altering the brackish habitat. This made the salt ponds more suitable for such species as eelgrass and scallops. However, with shoaling and reductions in water quality, these species have decreased in vigor and abundance. The breachways caused sedimentation rates to increase, resulting in the loss of productive aquatic habitat. Sedimentation basins at one time existed in the Winnapaug and Ninigret breachways. However, the basins have filled with sediment and no longer function.

As presently envisioned, restoration will most likely be accomplished through a combination of selective dredging, re-establishing a sedimentation basin to control future shoaling, and planting eelgrass in the dredged areas. The flood tidal shoal areas in each pond are shown on Figure 1. The sand dredged from the shoals will most likely be placed on nearby barrier beaches. The study will investigate the possibility of restoring shorebird habitat with this dredged material.

The fish passage projects for Factory Pond in South Kingstown and Cross Mills Pond (and associated ponds) in Charlestown are smaller in scope. Anadromous fish (e.g., herring) passage will be enhanced by constructing fish passage structures that allow fish migration across man-made barriers.

Purpose of the Work: The purpose of this project is to restore estuarine habitat and fish passage and the associated values to fish and wildlife habitats. Eelgrass provides important habitat for finfish, shellfish, and other aquatic animals. Anadromous fish are important commercial, recreational, and ecological resources. Modifying obstacles to fish passage will enhance their populations.

Additional Information: Additional information may be obtained from Mr. Christopher Hatfield or Mr. Larry Oliver, New England District, U.S. Army Corps of Engineers, 696 Virginia Road, Concord, Massachusetts 01742-2751, telephone numbers (978) 318-8520 and (978) 318-8347, respectively.

Coordination: The proposed work is being coordinated with the following Federal, State, and local agencies.

U.S. Fish and Wildlife Service
National Marine Fisheries Service
U.S. Environmental Protection Agency
Rhode Island Coastal Resources Management Council
Rhode Island Department of Environmental Management
Rhode Island Department of Administration, Office of Strategic Planning
Rhode Island Natural Heritage Program
Rhode Island Historic Preservation Office
Towns of Westerly, Charlestown, and South Kingstown, Rhode Island
Narragansett Indian Land and Water Resources Commission

Environmental Impacts: An Environmental Assessment and Finding of No Significant Impact will be prepared and will be available for public review upon request. A determination has been made that an Environmental Impact Statement for the proposed restoration project is not required under the provisions of the National Environmental Policy Act of 1969.

Clean Water Act: A Clean Water Act, Section 404(b)(1) evaluation will be completed for the project. State Water Quality Certification will be obtained prior to implementation.

Endangered Species: Coordination with the U.S. Fish and Wildlife Service and National Marine Fisheries Service will be conducted in compliance with the Endangered Species Act of 1973 to determine whether there are Federally listed endangered or threatened species in the area of the proposed projects. Coordination with the Rhode Island Natural Heritage Program will also be conducted to determine whether there are State-listed species in the project area.

Cultural Resources: The proposed work is being coordinated with the Rhode Island State Historic Preservation Officer in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended.

Executive Order 11988 Floodplain Management: This project must be located in the floodplain to achieve the project purpose.

Alternatives: Alternatives to the proposed actions, including the No Action Alternative, are being considered in the study process. For the salt pond restoration projects, the alternatives include various combinations of dredging the flood tidal shoals and construction of settling basins. If no action is taken by any authority to control sedimentation and restore the eelgrass habitats, continued loss of eelgrass in the vicinity of the shoals is expected to occur. Existing shoal habitats will continue to exist at less than optimum habitat quality. The only alternative to fish passage restoration being considered is the No Action Alternative. If no action is taken by any authority to restore fish passage, the improvements in fish and wildlife resource value that would be generated with the project would not be achieved.

Any person who has an interest that may be affected by the proposed project may request a public hearing. The request must be submitted in writing to me within 30 days of the date of this notice and must clearly set forth the interest that may be affected and the manner in which the interest may be affected by the activity.

Please bring this notice to the attention of anyone you know to be interested in the project. Comments are invited from all interested parties and should be directed to me at 696 Virginia Road, Concord, Massachusetts 01742-2751, ATTN: Environmental Resources Section within 30 days of this notice.

Michael W. Pratt
Colonel, Corps of Engineers
District Engineer

Attachment 1

PERTINENT LAWS, REGULATIONS AND DIRECTIVES

The proposed activity will be reviewed in accordance with the following laws and executive orders as applicable:

Federal Statutes

Preservation of Historic and Archaeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1431 et seq.

Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Marine Protection, Research, and Sanctuaries Act of 1972, as amended, 33 U.S.C. 1401 et seq.

National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 et seq.

Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Watershed Protection and Flood Prevention Act, as amended, 16 U.S.C. 1001 et seq.

Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271 et seq.

Executive Orders

Executive Order 11988, Floodplain Management, 24 May 1977, amended by Executive Order 12148, 20 July 1979.

Executive Order 11990, Protection of Wetlands, 24 May 1977.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 11 February 1994.

Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, 21 April 1997.

Executive Memorandum

Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

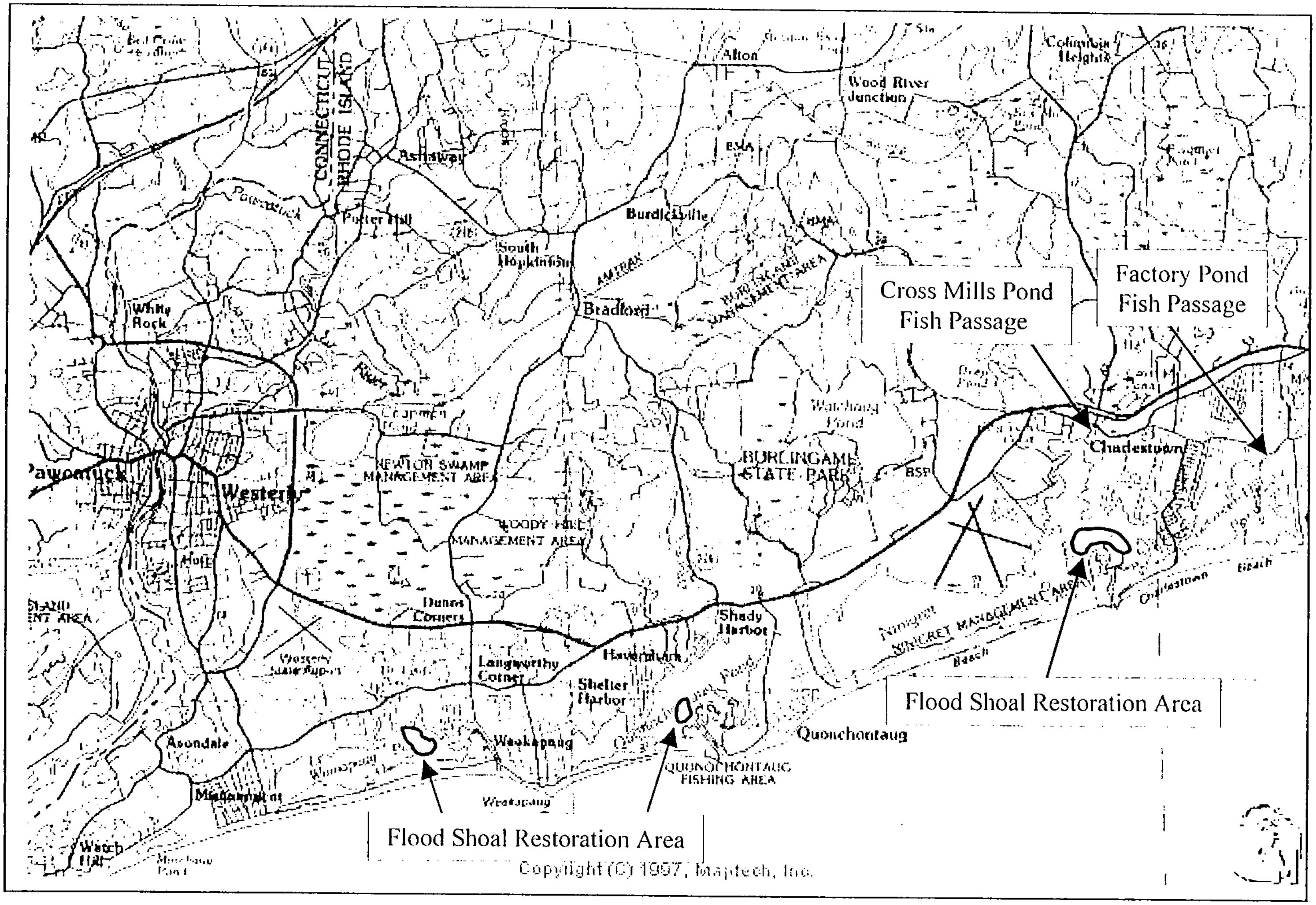

Figure 1
Rhode Island South Coast Feasibility Study
Location Map

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
HISTORICAL PRESERVATION & HERITAGE COMMISSION
Old State House • 150 Benefit Street • Providence, R.I. 02903-1209
Preservation (401) 222-2678 FAX (401) 222-2968
Heritage (401) 222-2669 TDD (401) 222-3700

17 May, 1999

Michael Pratt
US Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742

RE: Habitat Restoration
Charltestown, Westerly, and South Kingstown, RI

Dear Mr. Pratt:

The Rhode Island Historical Preservation and Heritage Commission has determined that the above-referenced project will have no effect on any significant cultural resources (those listed on or eligible for listing on the National Register of Historic Places).

These comments are provided in accordance with Section 106 of the National Historic Preservation Act. If you have any questions, please contact Charlotte Taylor, Staff Archaeologist, or Richard Greenwood, Project Review Coordinator for this office.

Very truly yours,

Charlotte Taylor (for)

Edward F. Sanderson
Executive Director
Deputy State Historic
Preservation Officer

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767 TDD 401-831-5508

June 1, 1999

Colonel Michael W. Pratt, District Engineer
US Army Corps of Engineers/New England District
696 Virginia Road
Concord, MA 01742-2751

Subject: Rhode Island South Coast Feasibility Study General Investigation of Habitat Restoration - Charlestown. Westerly and South Kingstown, RI

Dear Colonel Pratt:

This letter is in response to the public notice dated April 16, 1999 regarding the South Coast Habitat Restoration Project. The Rhode Island Department of Environmental Management (RIDEM) recognizes the need for this project and is very support of its objectives. Staff of our Division of Fish and Wildlife have been involved with this project since its inception and look forward to continuing to participate as the project goes forward. Our Division of Water Resources and our Natural Heritage Program also have strong interest in the project.

As you are aware, the chosen project alternative or alternatives must comply with the RI Water Quality Regulations, including Antidegradation requirements. The Department has the following concerns regarding water quality.

- Adverse water quality impacts to existing uses associated with the tidal shoals (State waters);
- Adverse water quality impacts to existing uses associated with fish species as a result of dredging (temporary resuspension as well as long-term changes to the character of these areas);
- Adverse water quality impacts associated with existing shore bird habitat within the project area.

The existing uses associated with the project areas must be identified during the project study phase and the Environmental Assessment must address any potential adverse water quality impacts that may be associated with the final proposed project.

Maintenance of sediment basins is a critical issue. Provision for maintenance of basins should be incorporated into any final proposed project scope. When developing a maintenance plan for the basins, consideration must be given to disposal areas and frequency of dredging

This concludes RIDEM's comments at this juncture. As more specific information becomes available to the Department, we may identify additional concerns. We look forward to coordinating closely with you as this project progresses. Please feel free to contact the Office of Technical and Customer Assistance or any of our other programs should you have questions or should you identify ways in which we may be of assistance to you.

Thank you for your efforts on this worthwhile project.

Sincerely,

Ronald Gagnon

Ronald Gagnon, Chief
Office of Technical and Customer Assistance

August 31, 1999

Engineering/Planning Division
Evaluation Branch

Mr. Michael Bartlett
U.S. Fish and Wildlife Service
New England Field Offices
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

Dear Mr. Bartlett:

I am writing to follow up on communication between our staffs concerning threatened and endangered species issues related to the Rhode Island South Coast Feasibility Study, and to confirm with you that we are beginning work on a Biological Assessment for the project. Your letter of March 22, 1999, indicated that threatened piping plover and federally listed as endangered roseate terns are known to occur in the project area. You also recommended against dredging of the flood tidal shoals at Ninigret Pond because of their importance to migrating shorebirds and foraging piping plovers.

The goal of the salt pond restoration projects is to restore eelgrass to areas buried by flood tidal shoals near the entrances to the ponds. We feel it is likely that some portion of the shoals can be removed to allow successful restoration of important eelgrass habitat while avoiding adverse effects on threatened and endangered species. We appreciate your concerns regarding shorebird use of the shoals, but we feel that information on shorebird use should be collected to design a project that restores eelgrass while minimizing potential impacts to shorebirds and threatened and endangered species.

To assess use of the flood tidal shoals by shorebirds and, in particular, piping plovers, we have developed the enclosed scope of work in communication with Mr. Greg Mannesto of your Rhode Island Office. The scope of work was coordinated with the Rhode Island Division of Fish and Wildlife; the Coastal Resources Management Council; the University of Rhode Island, Department of Natural Resources Science; the Rhode Island Audubon Society; and the Salt Pond Coalition. The work is being performed under the direction of Dr. Peter Paton of the University of Rhode Island. This ongoing shorebird survey will serve as the basis for our Biological Assessment.

I would like to suggest an alternative (to the 180-day period specified in the regulations) time period for preparation of the Biological Assessment of 315 days so that the completion date would be January 31, 2000. Additionally, since more than 90 days have passed since you provided the list of threatened and endangered species for this project, I ask that you verify the current accuracy of the species list.

Please contact Mr. Larry Oliver of our Environmental Resources Section at (978) 318-8347 if you have any questions or require additional information about the survey or this project.

Sincerely,

Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division

Enclosures

Copy Furnished:

Ms. Carolyn Weymouth
Department of Environmental Management
Office of Environmental Coordination
235 Promenade Street
Providence, Rhode Island 02903

Ms. Laura Ernst
Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, Rhode Island 02879

Mr. Greg Mannesto
U.S. Fish and Wildlife Service
P.O. Box 307
Charlestown, RI 02813

CF: Oliver, Hubbard, Hatfield, Read File, Eng/Plng Div file ***(Oliver/fwsbirdsurveyltr)***

Jan 3, 2000
~~December 22, 1999~~

Engineering/Planning Division
Evaluation Branch

Mr. Christopher Powell
RI Division of Fish and Wildlife
Marine Fisheries
150 Fowler Street
Wickford, RI 02852

Dear Mr. Powell:

I am writing to respond to your December 15, 1999, memorandum to Mr. Larry Oliver, of my staff, concerning winter flounder sampling for the Rhode Island South Coast Feasibility Study. You indicated that you felt additional sampling is needed. I would like to respond to the specific points in your memorandum.

Although our contractor was unable to complete all of the sampling described in their statement of work, we feel that the sampling that was performed in combination with our knowledge of winter flounder and the way they use these salt ponds is sufficient to indicate that spawning would not be impacted by the eelgrass restoration alternatives we are developing. The purpose of this sampling was to determine whether an area of unknown importance to winter flounder, but with some potential to serve as a spawning area, was in fact used for winter flounder spawning. The sampling was stopped because it became too late in the year to sample with a likelihood of finding eggs. Our decision that additional sampling is not required is based as much on information you provided related to this sampling effort, as to the results of the sampling.

It's not clear why your memorandum indicated that you disagree with the conclusion of the contractor's report that "very few winter flounder eggs were found in the flood tidal shoal samples or in those sites chosen as potential winter flounder spawning areas" since that was in fact the case. We agree with you that the results either indicate that the temporal sampling coverage was inadequate, or the shoals are not spawning areas. The remainder of this letter provides information that may help to distinguish between these two possibilities.

We also concurred with the contractor's statement that "eggs found in the shoal samples were most likely carried there by tidal currents." Only 1 or 2 individual eggs were collected on the shoals and winter flounder eggs normally stick together in closely massed clusters. We feel this suggests that spawning either does not occur on the shoals during the time when we sampled, or is not very successful.

Regarding eelgrass and winter flounder spawning sites, you indicate that, "Spawning in eelgrass in Rhode Island is not likely as most, if not all, eelgrass is gone by February and March. One would not expect to see eelgrass in Ninigret Pond in March." Based on our discussions with researchers at the University of Rhode Island, a substantial amount of eelgrass biomass remains in portions of the ponds through March. In addition, the highlighted portion of the journal article you sent to us to indicate areas of the pond likely to be winter flounder spawning sites indicates that, "The gravel and cobble bottom of this region of [Ninigret] pond is densely covered with algae and eelgrass, prime winter flounder spawning habitat." Crawford and Carey (1985) also indicated they found most eggs clumped on gravel substrate or attached to fronds of algae in Point Judith Pond.

The page from the report you provided also states that the "surveys of likely spawning areas with the egg sled in March of 1983 and 1984 found eggs only in the west basin [of Ninigret Pond]." The west basin is well removed from the area that would potentially be dredged for the eelgrass restoration project. Similarly, the stations you provided us as "likely winter flounder spawning sites" in each of the other ponds were not located near the shoals or sandy overwash areas. The sites you identified were located in coves in northern sections of the ponds, remote from the shoals and tidal inlets. These locations were similar to parts of Point Judith Pond where Crawford and Carey (1985) identified confirmed winter flounder spawning sites. Their paper implied that winter flounder spawning in sites where larvae would be least likely to be flushed out to sea was a reproductive adaptation. Our conversation with a local fisherman corroborated that the shoals are not spawning areas in the ponds.

We agree that, considering the high productivity of these coastal ponds for winter flounder, it is important to understand when and where winter flounder are spawning in the ponds to properly manage the fishery. If the Division of Fish and Wildlife conducts sampling this winter, we will gladly incorporate the data into the restoration study; however, based on the information available to date, we do not believe the shoals are important winter flounder spawning areas. As we have developed information about the likely project alternatives, it has become clear that any changes we make would very likely increase the quality of the habitat for winter flounder spawning, rather than negatively impact it.

Please contact Mr. Larry Oliver of my staff at (978) 318-8347 if you have any additional questions or comments about this sampling effort or environmental aspects of the Rhode Island South Coast Feasibility Study in general.

Sincerely,

Mr. Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division

CF:
Oliver
Hatfield
Hubbard
Read File
Eng/Plng Div File
(Oliver/Powell response)

January ~~14~~ 21, 2000

Engineering/Planning Division
Evaluation Branch

Mr. Michael Bartlett
U.S. Fish and Wildlife Service
New England Field Offices
22 Bridge Street, Unit #1
Concord, New Hampshire 03301-4986

Dear Mr. Bartlett:

I am writing to provide you a field survey report produced to support our Biological Assessment for the shoal area restoration of the Rhode Island South Coast Feasibility Study. In addition, I would like to suggest that we extend the completion date for the Biological Assessment to match the completion date for the draft Environmental Assessment. We previously suggested completing the Biological Assessment on January 31, 2000; the draft Environmental Assessment is scheduled to be complete in the fall of 2000. Based on the potential for adverse effects that we foresee at this stage, we expect the consultation process to conclude with Informal Consultation, rather than a Biological Opinion.

You provided a list of threatened and endangered species that indicated that threatened piping plover and federally-listed as endangered roseate terns are known to occur in the project area. The attached report confirms that piping plovers and roseate terns, as well as large numbers of shorebirds use the shoals and their surroundings at Ninigret and Quonochontaug Ponds. Piping plovers and abundant shorebirds were also found at Winnapaug Pond, but no roseate terns were detected; however, the large numbers of other tern species suggest that roseate terns may also use Winnapaug Pond.

Based on discussions among our design team and experts on plover and tern use of these ponds, we do not anticipate the project will have an adverse effect on the listed threatened and endangered species as long as we do not deepen intertidal areas. At this point, we intend to avoid impacts to all shorebirds and restore eelgrass by dredging only subtidal areas. We expect the effects of subtidal eelgrass restoration on terns, including roseate terns, to be positive due to an anticipated increase in forage species.

Please contact Mr. Larry Oliver of our Environmental Resources Section at (978) 318-8347 if you have any questions or require additional information about the survey, the Biological Assessment, or this project.

Sincerely,

Kenneth E. Hitch, P.E.
Chief, Engineering/Planning Division

Enclosure

Copy Furnished:

Ms. Carolyn Weymouth
Department of Environmental Management
Office of Environmental Coordination
235 Promenade Street
Providence, Rhode Island 02903

Ms. Laura Ernst
Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
4808 Tower Hill Road
Wakefield, Rhode Island 02879

Mr. Greg Mannesto
U.S. Fish and Wildlife Service
P.O. Box 307
Charlestown, Rhode Island 02813

CF: Oliver, Hubbard, Hatfield, Read File, Eng/Plng Div File ***(Oliver/birdsurveyresults)***

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, R.I. 02879-1900

(401) 783-3370
FAX: (401) 783-3767

April 18, 2000

Mr. John R. Kennelly
Deputy Chief, Engineering/Planning Division
Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

RE: Rhode Island Coastal Feasibility Study.

Dear Mr. Kennelly:

Thank you for the recent quarterly financial summary for the Rhode Island South Coastal Feasibility Study. Our records indicate that the summary is accurate. I would like to thank you and your staff for the high level of technical and professional expertise you have given this project and my staff over the last three years. Chris Hatfield and Larry Oliver in particular have proven to be extremely supportive and energetic about the Feasibility Study and attending public meetings to inform Rhode Island residents about the South Shore project. My staff and I look forward to the completion of the environmental studies and the draft feasibility report. If you need to contact me for any reason I can be reached at 401-783-3370.

Sincerely,

Grover J. Fugate, Executive Director
Coastal Resources Management Council

GJF/jmm
cc: Janet Coit, Senator Chafee's Office
William Hubbard, ACOE
Laura Ernst, CRMC

May 10, 2000

Engineering/Planning Division
Planning Branch

Mr. Charles Beck, Town Council President
Town of Charlestown
4540 South County Trail
Charlestown, Rhode Island 02813

Dear Mr. Beck:

We request that the Town Council provide the Corps of Engineers with their opinion on the feasibility of a proposal to restore anadromous fish passage to Cross Mills Pond in Charlestown. This proposal was developed as a result of the Rhode Island South Coast Feasibility Study, which we are working on in conjunction with the Rhode Island Coastal Resources Management Council.

The Rhode Island South Coast Feasibility Study was initiated in May 1998 with the intent of investigating various environmental restoration projects between Watch Hill and Narragansett. One of the potential projects that was identified by the State was the restoration of anadromous fish, specifically blueback herring, to Cross Mills Pond. This species of fish, prior to the mill being constructed at the end of the pond and more recently flows being diverted around the old mill building through several hundred feet of culvert, used to migrate to the pond to spawn. A plan was developed with the help of the U.S. Fish and Wildlife Service and the State's Division of Fish and Wildlife to reestablish a migration pathway for the fish.

As shown on the enclosed plans, a fishway would be constructed to the east side of the building housing Dartmouth Homes Realty and Edwards Investments (#4433 & #4435 Old Post Road). A steeppass (aluminum) fish ladder located on the south side of Old Post Road would allow fish to enter a newly constructed precast concrete culvert under the road. After travelling about 40 feet in the culvert, the fish would negotiate 35 feet of open (precast concrete) channel in the building's parking lot before initiating the second steeppass fish ladder and finally entering the pond. This fishway would be operated seasonally to take advantage of the migration times. The primary discharge from the pond would still be through the existing west-side sluiceway and culvert system.

The owner of the property involved has expressed a verbal interest in the project. However, he also informed us that his recently upgraded septic system is located to the east of the proposed fishway. As shown on the plan, the fishway can be constructed to avoid the septic tank and leachfield, but the open channel would cross the septic line. This would mean that about two feet of septic line would be permanently exposed across the open channel and the fish would pass below it. The pipe could be reinforced with some type of sleeve to protect it from being damaged both during construction or regular operation of the fishway.

Since the septic system cannot be relocated and there are no alternative locations for the fishway, your input on the permanently exposed septic line is of vital importance to our moving ahead with this proposal. If you have any questions or require additional information, please feel free to contact the Study Manager, Mr. Christopher Hatfield, at (978) 318-8520.

Sincerely,

John R. Kennelly
Deputy Chief, Engineering/Planning Division

Enclosures

Copies Furnished(w/encls):

Ms. Laura Ernst
Rhode Island Coastal
Resources Management Council
Oliver H. Stedman
Government Center
4808 Tower Hill Road
Wakefield, Rhode Island 02872

Mr. Phillip Edwards
Rhode Island Department
of Environmental Management
Great Swamp Field Office
P.O. Box 218
West Kingston, Rhode Island 02892

Cf:
Mr. Hatfield(cross mills)

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, R.I. 02879-1900

(401) 783-3370
FAX: (401) 783-3767

June 30, 2000

Mr. Chris Hatfield
Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

RE: Disposal of Dredged Material in Quonochontaug and Ninigret Ponds for Salt Marsh Creation.

Dear Mr. Hatfield:

Thank you for bringing our attention to the possible need for another dredge material disposal location for the South Shore Habitat Restoration Project. RI Coastal Resources Management Council staff discussed your proposal to use two channel like areas in Quonochontaug and Ninigret Ponds for salt marsh creation. Although salt marsh restoration is an initiative of the CRMC, filling of deep water habitats that already support fish and wildlife to create salt marsh is not supported by the RI Coastal Resources Management Program. These areas are also used extensively by recreational boaters, fishermen, birders and other members of the public who would be adversely impacted by disposing dredge material from the tidal deltas.

CRMC staff suggest that the ACE, in coordination with CRMC, identify private and other public entities who would be willing to truck sand away after de-watering for the purposes of beach replenishment. If we can get an estimate of the amount of sand needed for other beach areas, we might be able to address any excessive amounts not accounted for in beach replenishment projects proposed by the Feasibility Study.

If you have any questions regarding this letter, please contact Laura M. Ernst of my staff at 401-783-7350. Thank you again for your commitment to the South Shore Habitat Restoration Project.

Sincerely,

Grover J. Fugate, Executive Director
Coastal Resources Management Council

GJF/jms

MARCIA D. CARSTEN
Town Clerk
Clerk of Probate Court

4540 SO. COUNTY TRAIL
CHARLESTOWN,
RHODE ISLAND 02813

Tel (401) 364-1200
Fax (401) 364-1238

TOWN OF CHARLESTOWN

July 13, 2000

John R. Kennelly
Deputy Chief
Engineering/Planning Division
Department of the Army
New England District, Corps of Engineers
696 Virginia Road
Concord, Massachusetts 01742-2751

RE: FISH PASSAGE
CROSS MILLS POND

Dear Mr. Kennelly:

In response to your letter dated May 10, 2000 enclosed please find an Advisory Opinion submitted to the Town Council from the Charlestown Wastewater Management Commission and from the Conservation Commission.

Sincerely,

Marcia D. Carsten

Marcia D. Carsten, CMC
Town Clerk

Cc: Honorable Town Council

June 26, 2000

To: Charlestown Town Council

From: Charlestown Wastewater Management Commission

Re: Request for Advisory Opinion on the Fish Passage at Cross Mill Pond

Pursuant to your request forwarded to us by Marcia Carsten, the commission has reviewed the written description and plans for the construction of the fish passage and ladder.

Though the commission believes that the plans as described are acceptable, we propose the following recommendations:

1. the sleeve be made of a heavy gauge material.
2. the diameter of the sleeve be large enough so that the sewer pipe may be removed or replaced without need to disturb the sleeve.

The commission sees no problem with ice flows or storm water affecting the exposed pipe since the passage will be used only on a seasonal schedule when the fish migrate to spawn in the spring.

Because these plans involve a septic system, the RI DEM ISDS division will, in all likelihood, need to be contacted for final approval.

We are pleased to submit this advisory opinion.

Roger W. Pease, Chairman

CONSERVATION
COMMISSION

TOWN OF CHARLESTOWN

4540 SO. COUNTY TRAIL
CHARLESTOWN,
RHODE ISLAND 02813

Tel (401) 364-1225
Fax (401) 364-1238

June 30, 2000

Charlestown Town Council
4540 South County Trail
Charlestown, RI 02813

Dear Honorable Town Council:

At our regular Conservation Commission meeting on June 27, the Commission voted to endorse the Army Corps of Engineers proposal to restore an anadromous fish passage to Cross Mills Pond. Regarding the exposed septic pipe, we believe there is probably an acceptable engineering solution for this problem and we trust the Corps will determine what that is.

Since there is going to be an effort to improve this pond, we would also suggest that a drainage culvert, located at the corner of Rt. 1 and Cross Mills Rd. (across from the salt barn), be altered to prevent refuse and trash from entering the pond. This type of improvement may have the added benefit of preventing road runoff, such as motor oil and gasoline, from entering the pond and possibly contaminating the fish the Corps hopes to attract back to the pond. Though this is not part of the Corps proposal, we hope that they, or RIDOT, will seriously consider our request.

Sincerely,

Clifford L. Vanover

Clifford L. Vanover, Chairman
Conservation Commission

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

July 18, 2000

Mr. John R. Kennelly, Deputy Chief
Engineering/Planning Division
New England District, Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Dear Mr. Kennelly:

Thank you for your letter of June 5, proposing a sampling protocol for the Corp's South Coast Feasibility Study on restoring salt pond habitats, including eelgrass. The three locations for the eelgrass restoration projects are Ninigret, Quonochontaug, and Winnapaug Ponds.

The sampling protocol calls for collection of five cores in the shoal areas of Ninigret Pond and three each in Quonochontaug and Winnapaug Ponds. Surface grab samples to determine sediment suitability are also proposed for the beach renourishment areas.

We have reviewed the sampling proposal and believe it to be satisfactory for determining whether the material is suitable for beach nourishment. However, the Corps may want to consider performing limited water quality testing for determining the ability of the ponds to respond to the eelgrass planting effort. We look forward to the implementation of this coastal habitat restoration project. If you have any questions, please contact Melvin P. Holmes of my staff at (617) 918-1397.

Sincerely,

Robert E. Mendoza, Director
Rhode Island State Program

cc: Christopher Deacutis, PhD, RI DEM
Terry Walsh, RI DEM
Dave Reese, CRMC

December 22, 2000

Engineering/Planning Division
Evaluation Branch

Mr. John Brown, Tribal Historic Preservation Officer
Narragansett Indian Tribe
Post Office Box 700
Wyoming, Rhode Island 02898

Dear Mr. Brown:

The U.S. Army Corps of Engineers, New England District, is preparing a Feasibility Study for habitat restoration and fish passage improvements along the south coast of Rhode Island. In accordance with the Department of Defense American Indian and Alaska Native Policy, Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), Corps Engineer Regulations 1105-2-100 (Native American Considerations), and the National Historic Preservation Act of 1966, as amended (36 CFR 800), and on the behalf of the District Commander, we would like to formally initiate consultation with the Narragansett Tribe on the Rhode Island South Coast Feasibility Study.

In conversations with Mr. Doug Harris of your staff, it was suggested that the current project description and copies of the latest maps and plans be forwarded to your office for review and comment. Enclosed is a detailed project description together with copies of the latest figures and plans for the proposed habitat restoration alternatives. Briefly, study elements include aquatic habitat restoration in Ninigret, Winnapaug, and Quonochontaug Ponds and the restoration of migratory fish passage at Factory Pond in South Kingstown and Cross Mills Pond in Charlestown. Further detail and project locations are depicted on the enclosed project description and draft plans. In addition, two potential upland disposal sites, one at the DEM parking lot located at the Quonochontaug Pond breachway and the other within State/town conservation land just north of the Winnapaug restoration area, are under evaluation for the disposal of dredged material. These locations are visible on the enclosed maps, though neither is specifically identified due to the uncertainty that either site will be found feasible for use.

If you have any further questions or comments on the enclosed information or would like to arrange a site visit to any of the locations, please feel free to contact Mr. Marc Paiva of my staff, the District Tribal Coordinator and Archaeologist, at (978) 318-8796 or the Project Manager, Mr. Christopher Hatfield at (978) 318-8520. We look forward to further consultation with the Narragansett Indian Tribe on this important project.

Sincerely,

John R. Kennelly
Deputy Chief, Engineering/Planning Division

Enclosures

Copy furnished (without enclosures):
Mr. Edward F. Sanderson, Executive Director
Rhode Island Historic Preservation Commission
150 Benefit Street
Providence, Rhode Island 02903

CF: Paiva, Ring, Oliver, Hubbard (email), Hatfield, Read File, Eng/Plng Division File
(Paiva/RISC-NarragansettTHPO-letter.doc)

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, R.I. 02879-1900

(401) 783-3370
FAX: (401) 783-3767

January 19, 2001

Mr. John Kennelly, Chief
Planning Branch
Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Re: Removal of Factory Pond Stream Anadromous Fish Passage from the Rhode Island South Coast Feasibility Study.

Dear Mr. Kennelly:

Please find enclosed a letter to the RI Coastal Resources Management Council from the NOAA Restoration Center. As part of the restoration effort following the North Cape oil spill, the NOAA Restoration Center will be funding the construction of the Factory Pond stream anadromous fish passage project. Consequently, the RICRMC does not see any reason to proceed further with that portion of the Army Corps of Engineers Feasibility Study that pertains to the Factory Pond site. If you require further information, please do not hesitate to contact Laura M. Ernst at 401-783-7350. Thank you.

Sincerely,

Grover J. Fugate, Executive Director
Coastal Resources Management Council

Enclosure

Cc: Laura M. Ernst, CRMC
Chris Hatfield, US Army Corp of Engineers

January 29, 2001

Engineering/Planning Division
Evaluation Branch

Ms. Theresa Hayward-Bell, Tribal Historic Preservation Officer
Mashantucket Pequot Tribal Historic Preservation Office
Mashantucket Pequot Museum and Research Center
110 Pequot Trail
Mashantucket, Connecticut 06339

Dear Ms. Hayward-Bell:

The U.S. Army Corps of Engineers, New England District, is preparing a Feasibility Study for habitat restoration and fish passage improvements along the south coast of Rhode Island. In accordance with the Department of Defense American Indian and Alaska Native Policy, Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), Corps Engineer Regulations 1105-2-100 (Native American Considerations), and the National Historic Preservation Act of 1966, as amended (36 CFR 800), and on the behalf of the District Commander, we would like to formally initiate consultation with the Mashantucket Pequot Tribal Nation on the Rhode Island South Coast Feasibility Study. We understand that portions of Mashantucket Pequot Tribal ancestral lands lie within the proposed project area in the towns of Westerly and Charlestown, Rhode Island. Please note that we have previously initiated consultation with the Narragansett Indian Tribe.

Enclosed is a detailed project description together with copies of the latest figures and plans for the proposed habitat restoration alternatives. Briefly, study elements include aquatic habitat restoration in Ninigret, Winnapaug, and Quonochontaug Ponds and the restoration of migratory fish passage at Factory Pond in South Kingstown and Cross Mills Pond in Charlestown. Further detail and project locations are depicted on the project description and draft plans. In addition, two potential upland disposal sites, one at the Department of Environmental Management parking lot located at the Quonochontaug Pond breachway and the other within State/town conservation land just north of the Winnapaug restoration area, are under evaluation for the disposal of dredged material. These locations are visible on the enclosed maps, though neither is specifically identified due to the uncertainty that either site will be found feasible for use.

If you have any further questions or comments on the enclosed information or would like to arrange a site visit to any of the locations, please feel free to contact Mr. Marc Paiva, the District Tribal Coordinator and Archaeologist, at (978) 318-8796 or the Project Manager, Mr. Christopher Hatfield at (978) 318-8520. We look forward to further consultation with the Mashantucket Pequot Tribal Nation on this important project.

Sincerely,

John R. Kennelly
Deputy Chief, Engineering/Planning Division

Enclosures

Copies furnished (without enclosures):

Mr. Edward F. Sanderson, Executive Director
Rhode Island Historic Preservation Commission
150 Benefit Street
Providence, Rhode Island 02903

Mr. John Brown, Tribal Historic Preservation Officer
Narragansett Indian Tribe
Post Office Box 700
Wyoming, Rhode Island 02898

CF: Paiva, Ring, Oliver, Hubbard (email), Hatfield, Read File, Eng/Plng Division File
(Paiva/RISC-PequotTHPO-letter.doc)

NITHPO

Narragansett Indian Tribal Historic Preservation Office

Narragansett Indian Longhouse
P. O. Box 700
Wyoming, Rhode Island 02898

28 March 2001

Marc Paiva
District Coordinator & Archaeologist
Engineering/Planning Division
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

RE: Rhode Island South Coast Feasibility Study Project

Dear Marc:

Pursuant to Executive Order 13175, Army Corps Regulations 1105-2-100, 36 CFR 800 and your inquiry, by this letter, NITHPO is formally initiating consultion with the Army Corps of Engineers on the Rhode Island South Coast Feasibility Study.

The Narragansett Indian Tribe does have concerns for the protection of cultural resources in the area of planned impact. The extent of the cultural resources may well require archaeological investigation with NITHPO oversight and monitoring. At your convenience, we would like to meet with you in South County to commence said consultation with a review of the overall plans.

Sincerely,

John Brown
Tribal Historic Preservation Officer

July 17, 2001

Engineering/Planning Division
Planning Branch

Mr. Robert Varney
US Environmental Protection Agency, Region I
J.F.K. Federal Building
Boston, Massachusetts 02203

Dear Mr. Varney:

I am writing in reference to the proposed Rhode Island South Coast Habitat Restoration project.

Enclosed please find a draft copy of the main report and Environmental Assessment (EA), and other supporting documentation, for the proposed project for your review and comment as required under the Clean Air Act and Clean Water Act. The draft EA and its appendices include maps of the proposed dredging and disposal areas, results of sediment sampling and testing, resource characterization studies of the dredging and disposal areas, and copies of all coordination documents from Federal, State and local agencies and interests, including the public notice.

We request that comments be provided to this office within 30 days of receipt of this letter.

If you have any questions concerning this request, please contact the project manager, Mr. Chris Hatfield at (978) 318-8520, or Mr. Todd Randall at (978) 318-8518.

Sincerely,

John R. Kennelly
Deputy Chief, Engineering/Planning Division

Enclosure

Copies Furnished: see attached sheet

July 17, 2001

Engineering/Planning Division
Planning Branch

Mr. Christopher Mantzaris
National Marine Fisheries Service
One Blackburn Drive
Gloucester, Massachusetts 01930

Dear Mr. Mantzaris:

I am writing in reference to the proposed Rhode Island South Coast Habitat Restoration project.

Enclosed please find a draft copy of the main report and Environmental Assessment (EA), and other supporting documentation, for the proposed project. The draft EA and its appendices include maps of the proposed dredging and disposal areas, results of sediment sampling and testing, resource characterization studies of the dredging and disposal areas, and copies of all coordination documents from Federal, State and local agencies and interests, including the public notice.

Please accept this letter, and its enclosures, as the New England District's request for Consultation under Section 7 of the Endangered Species Act, and for recommendations on Essential Fish Habitat under the Magnuson-Stevens Fishery Conservation and Management Act amendments. We request that this information be provided to this office within 30 days of receipt of this letter.

If you have any questions concerning this request, please contact the project manager, Mr. Chris Hatfield, at (978) 318-8520 or Mr. Todd Randall at (978) 318-8518.

Sincerely,

John R. Kennelly
Deputy Chief, Engineering/Planning Division

Enclosure

Copies Furnished: see attached sheet

July 17, 2001

Engineering/Planning Division
Planning Branch

Mr. Michael Bartlett
U.S. Fish & Wildlife Service
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

Dear Mr. Bartlett:

I am writing in reference to the proposed Rhode Island South Coast Habitat Restoration project.

Enclosed please find a draft copy of the main report and Environmental Assessment (EA), and other supporting documentation, for the proposed project. The draft EA and its appendices include maps of the proposed dredging and disposal areas, results of sediment sampling and testing, resource characterization studies of the dredging and disposal areas, and copies of all coordination documents from Federal, State and local agencies and interests, including the public notice.

Please accept this letter, and its enclosures, as the New England District's request for Consultation under Section 7 of the Endangered Species Act. We request that your response be provided to this office within 30 days of receipt of this letter.

If you have any questions concerning this request, please contact the project manager, Mr. Chris Hatfield at (978) 318-8520, or Mr. Todd Randall at (978) 318-8518.

Sincerely,

John R. Kennelly
Deputy Chief, Engineering-Planning Division

Enclosure

Copies Furnished: see attached sheet

July 24, 2001

Engineering/Planning Division
Planning Branch

Mr. Edward F. Sanderson, Executive Director
Rhode Island Historic Preservation Commission
150 Benefit Street
Providence, Rhode Island 02903

Dear Mr. Sanderson:

I am writing in reference to the proposed Rhode Island South Coast Habitat Restoration project located in Charlestown and Westerly, Rhode Island. Your office previously responded by letter dated May 17, 1999 stating that no significant cultural resources will be impacted by the project. Please note that the Corps is continuing formal consultation with the Narragansett Indian Tribe concerning this study. Further correspondence will be forthcoming on the results of our continuing collaboration with the Tribal Historic Preservation Officer. At this time, further evaluation may be required for the Cross Mills Pond area as well as monitoring of sand placement in conjunction with the project.

Enclosed please find a draft copy of the main report and Environmental Assessment (EA), and other supporting documentation, for the proposed project. The draft EA and its appendices include maps of the proposed dredging and disposal areas, results of sediment sampling and testing, resource characterization studies of the dredging and disposal areas, and copies of all coordination documents from Federal, State and local agencies and interests, including the public notice.

If you have any questions, please contact the project manager, Mr. Chris Hatfield at (978) 318-8520, or Mr. Marc Paiva, project archaeologist at (978) 318-8796.

Sincerely,

John Kennelly
Deputy Chief, Engineering/Planning Division

Enclosures

Copies Furnished: see attached sheet

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, R.I. 02879-1900

(401) 783-3370
FAX: (401) 783-3767

July 26, 2001

Mr. John R. Kennelly, Deputy Chief
Army Corps of Engineers
Engineering/Planning Division
696 Virginia Road
Concord, MA 01742-2751

RE: Statement of Financial Capability for the Rhode Island South Coast Habitat Restoration Project.

Dear Mr. Kennelly:

The Rhode Island Coastal Resources Management Council is committed to obtaining the financial resources as the non-federal sponsor to complete the Construction Phase of the Rhode Island South Coast Restoration Project. CRMC has requested the necessary funds through its Capital Budget process based on the Army Corps of Engineers cost estimates as of July 2001. Following are the Capital Budget amounts requested by CRMC for the state's 35% commitment for the total costs of the Construction Phase:

FY 02 (July 01-June 02):	$181,000
FY 03 (July 02-June 03):	$932,267
FY04 (July 03-June 04):	$932,267
FY 05 (July 04-June 05):	$932,267
Total:	$2,977,801

Currently, CRMC has $181,000 in its FY 2002 budget to send to the ACE by June 30, 2002.

CRMC is also pursuing funds to maintain the Rhode Island South Coast Restoration Project through the Capital Budget planning process by requesting $750,000 to purchase a dredge. CRMC intends to purchase a small mobile dredge with an 8" to 10" pump that can be readily transported by flat bed truck/trailer. This dredge would be used primarily for the maintenance of the state breachways, sediment basins, and flood tidal deltas of the South County salt ponds, as well as for habitat restoration projects and oil spill management for these same ecosystems.

CRMC will strive to fulfill its financial obligations for the Construction Phase of the Rhode Island South Coast Restoration Project through its funding requests in the Capital Budget. If you have any questions regarding this process, please contact me at 401-783-3370. Thank you.

Sincerely,

Grover J. Fugate

Grover J. Fugate, Executive Director
Coastal Resources Management Council

Cc: Governor Lincoln Almond
Stephen P. McAllister, State Budget Officer
Representative Antonio J. Pires, House Finance Committee
Senator Frank T. Caprio, Senate Finance Committee
Michael O'Keefe, House Fiscal Advisor
Brenda Whalen, Senate Fiscal Advisory Staff
Jeff Willis, CRMC
Laura M. Ernst, CRMC
Chris Hatfield, ACE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

October 23, 2001

John R. Kennelly, Deputy Chief
Engineering/Planning Division
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 01742-2751

Dear Mr. Kennelly:

This responds to your July 17, 2001 letter requesting our review of the proposed Rhode Island South Coast Habitat Restoration Project for potential adverse effects on federally-listed and proposed endangered or threatened species. We reviewed the July 2001 Draft Feasibility Report and Environmental Assessment as well as the revised Final Draft Environmental Assessment for the Rhode Island South Coast Habitat Restoration Project (sent electronically on September 28, 2001). Our comments are provided in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543), and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.).

Our letter to your agency of March 22, 1999 identified the presence of the federally-listed threatened piping plover (*Charadius melodus*) and endangered roseate tern (*Sterna dougallii*) within the project area. The proposed project may affect these listed species by impacts from the dredging of intertidal areas that serve as foraging habitat and the disposal of dredged material.

Piping plovers forage in the intertidal zones of all three ponds proposed for restoration: Winnapaug, Quonochontaug and Ninigret, and roseate terns forage on Quonochontaug and Ninigret Ponds (Draft Feasibility Report and Environmental Assessment, page EA-16). The proposed buffer of approximately 18-20 feet between proposed dredge areas and intertidal foraging habitat may not be sufficiently protective. To avoid adversely affecting listed species as well as other migratory shorebirds, we recommend that a 100-foot buffer be established between the restoration sites and the intertidal habitat. Moreover, the proposed dredge areas should be clearly marked with stakes and reviewed by the U.S. Fish and Wildlife Service for concurrence before dredging. After an on-site inspection of each staked area, we may recommend increasing the buffer to protect listed species.

Since dredging will not occur between April 1 and August 31, direct adverse effects to piping plovers and roseate terns are not anticipated.

Currently, the proposed dredge disposal sites, Charlestown Town Beach, Misquamicut Beach and East Beach, do not appear to be suitable piping plover breeding habitat due to their narrow configurations. Piping plovers have not been documented to breed at any of these sites (S. Paten, USFWS pers. comm. 2001). However, the disposal of dredge material may create suitable piping plover nesting habitat if a wider beach profile is developed. In this case, it is likely that plovers will be attracted to the disposal areas and will attempt to nest. Without adequate management of breeding piping plovers, recreational activities may adversely affect adult plovers and their young. Protective measures, such as the implementation of Service piping plover management guidelines (see enclosed) should be incorporated into the project design in order to avoid adverse effects. Based on discussions with your staff (T. Randal, telephone communication on October 12, 2001 with S. von Oettingen of this office), a site visit will be coordinated in order to assist in our determination of whether suitable habitat will be created. Until we have additional information on the beach profiles above mean high tide for each of the proposed dredge disposal areas, we cannot determine whether there will be adverse effects on piping plovers. Therefore, we cannot concur with your "not likely to adversely effect" determination reached in the Final Draft EA of September 28, 2001.

The Service is concerned about the loss of shellfish resources in the proposed dredge areas, and recommend that shellfish be transplanted to suitable sites prior to dredging. Does the incremental analysis include an assessment of the negative impacts of the dredging on natural resources such as shellfish?

The report states that as much as 1.9 acres of wild eelgrass beds could be affected when plants are harvested for transplanting to restoration sites. How many acres of eelgrass currently exist in the ponds and where are the transplants coming from? What are the negative impacts to the eelgrass area being used for wild stock? Eelgrass does not currently grow in Winnapaug Pond, and we have concerns that it probably will not grow there until water quality is improved in the pond. If it cannot be demonstrated that there is a reasonably good chance of successful eelgrass establishment in Winnapaug Pond, it should be eliminated from the present restoration proposal.

The construction of the anadromous fish passage at Cross Mills Pond is the best restoration element of this project and is strongly supported by the Service. It could stand alone as a separate project if the other alternatives are not found feasible.

On page 22, the report states that the eelgrass beds surrounding each shoal are not uniform in coverage or density. How much eelgrass exists around each shoal area and what is its health? What will the impacts of the dredging be on this existing eelgrass?

We appreciate the opportunity to provide these comments. If you have any questions concerning this letter, please contact Greg Mannesto at (401) 364-9124 for Fish and Wildlife Coordination Act comments and Susi von Oettingen at (603) 223-2541 for endangered species comments.

Sincerely,

Kenneth C Carr

Kenneth C. Carr
Acting Supervisor
New England Field Office

Enclosure

Part II

Correspondence Received During Review of Draft Feasibility Report/Environmental Assessment

Summary of Responses to Draft Review Comments

Responses to US Fish and Wildlife Service (October 23, 2001):

1. USFWS recommends a 100-foot buffer between the restoration areas and the intertidal habitat. The 1:6 side slopes proposed for each of the ponds should be sufficient to minimize sloughing of the intertidal areas. Additionally, a buffer of 100-feet would lower the slope to approximately 1:30. This would significantly reduce the amount of restoration area in all three ponds. This issue will be revisited during plans and specifications to ensure that sloughing of the intertidal areas are kept to a minimum.

2. The restoration areas will be marked with stakes prior to construction for review by the USFWS.

3. The beaches are not expected to widen as a result of this project and its disposal activities. Therefore, no plovers are expected to be attracted to the disposal sites. Material will be placed in the high intertidal areas and should be redistributed in the intertidal and shallow-subtidal beach zones. A site visit to the beach disposal areas with Ms. Susi von Oettingen of USFWS was conducted in November, 2001. Ms. Oettingen confirmed that the placement of material in the disposal sites was "not likely to adversely affect" any endangered species.

4. A shellfish study of the proposed restoration sites by Ganz (1999) found minimal shellfish resources present in Winnapaug and Quonochontaug ponds. Ninigret Pond had a larger resource than the other ponds, however, it was stated that the shellfish in Ninigret have a very patchy distribution. The transplantation of these shellfish would be extremely difficult as they are not concentrated near one another and they are located in areas inaccessible to harvesting (Art Ganz, personal communication).

5. No. The incremental analysis includes project costs and units of habitat restored.

6. If eelgrass transplanting is utilized, wildstock donor plants will come from existing beds in the ponds. The effects to the donor beds are summarized in section VI.A.2 of the Environmental Assessment. Current estimates of total eelgrass in each of the ponds are currently unavailable. However, Granger et. al (2000) (See Appendix A of Appendix 1) surveyed the eelgrass beds in the vicinity of the shoal areas in each of the ponds. Healthy beds (ranging from 75-100% cover) exist in the subtidal regions of Ninigret Pond, while beds in fair condition (25-50% cover) exist in subtidal areas of Quonochontaug Pond. No eelgrass currently exists in Winnapaug Pond.

7. Eelgrass growth models by Dr. Fred Short (see EA Appendix E), which incorporated existing water quality data, predicted that eelgrass can be established in Winnapaug Pond.

8. See response #6.

9. The impacts of dredging to vegetation (eelgrass) will be minimal. The material to be dredged is mainly sand and will settle rapidly. Long term increases in turbidity are not expected. This is detailed in section VI.A.2 and VI.A.8 of the EA.

Responses to Town of Westerly Comments (March 25, 2002):

1. We understand that the quantities of material proposed to be dredged are slightly higher than the estimated capacity of Misquamicut Beach listed in the draft report, specifically Appendix II. The recommended disposal plan is to pump the material into the nearshore zone (below high water line) of the beach. The proposed disposal area does not pose any capacity limitations, as the material will be washed out into the intertidal and subtidal zones. In any event, the Corps can work with the Town to have some of the dredge material stockpiled for use at the other two Town owned sites located to the east of Misquamicut Beach. This will be done during the design stage of the project.

2. The Corps will finalize pipeline routes for dredging activities during the development of Plans & Specifications. The Corps will coordinate this with the Town during that time.

3. The proposed disposal activities are not intended to change the existing beach profile. Therefore, we believe that whatever rip currents exist now will continue to occur in the area.

Response to Richard J. Ryan (March 27, 2002):

The Corps study team and those involved in the feasibility study have been aware of the navigation hazards associated with the seaward end of the Ninigret Pond breachway. However, the Corps is proposing an aquatic habitat restoration project for Ninigret Pond that includes work in the breachway (sedimentation basin) and the pond (selected dredging and eelgrass restoration). The Corps has no authority to include removal of the navigation hazards (boulders) as part of the recommended project. The boulders could be removed as part of a "Work for Others" effort at 100% non-Federal cost. The Corps will coordinate with the non-Federal sponsor (RI Coastal Resources Management Council), during the design phase of the restoration project, to determine their interest in initiating a "Work for Others" contract.

Response to Matthew J. McHugh (undated letter):

The Corps study team disagrees that the subject of placement of dredged sediments was carried out for the sake of "ease or political convenience". The study's technical team worked with state and University of Rhode Island experts in the area of shoreline change to determine the best place for disposal. Beaches were selected that were relatively nearby (construction ease and cost), publicly owned, experiencing erosion, and would not result in the material quickly being reintroduced to the breachways. The study also proposes several upland dewatering sites as an option at Ninigret Pond. This was done to allow for the flexibility of stockpiling a portion of the dredged material and making it available to surrounding communities for their use. Material that is dewatered and stockpiled at the upland sites would need to be trucked to its ultimate destination. The final decision as to how much material will be piped directly to beaches versus dewatered and trucked to other locations will be made during the design stage of the project.

Responses to Rhode Island Department of Environmental Management (April 4, 2002):

1.

a. The Feasibility Report is not required to demonstrate that the non-Federal sponsor (RICRMC) has secured all necessary lands, easements, and rights-of-way for the projects. The report does identify the potential lands, easements, and rights-of-way needed and their associated costs. The real estate requirements will be more fully examined during final design and executed by the non-Federal after entering into formal agreement with the Corps to construct the project.

b. The non-Federal sponsor has indicated in prior correspondence (July 26, 2001) that they are "committed to obtaining the financial resources" to construct the project and is "pursuing" additional funding to maintain the project through the purchase/operation of a portable dredge.

c. The commitment letter referenced in 1.b. is sufficient for the Corps to move ahead with final design of the project.

d. See responses above.

2. The recommended plan for Ninigret Pond does not include dredging of the upper basin for the reasons stated. If RICRMC wishes to pursue the upper basin as a project feature, they and the Corps are aware of the disposal requirements.

3. The paragraph above Table 3 sufficiently explains how the maintenance intervals were calculated and is sufficient for the report.

4. Sentence revised.

5. Noted.

6. Noted.

Responses to Cooper Law Associates (April 15, 2002):

1. When the scope of studies for the feasibility effort were developed, Foster Cove was not even listed as a potential site of concern. Therefore, it was not included in the study and will not be part of any of our restoration efforts at Ninigret Pond. Just looking at the

physical constraints (e.g., very small inlet in conjunction with a small tidal range) of Foster Cove, it appears it will be very difficult to alleviate the water quality and habitat problems that exist there.

Responses to the Town of Charlestown (April 19, 2002):

1. The silty dredge material from the inner basin in Ninigret Pond was determined by the RI Department of Environmental Management to be too fine for beach/nearshore disposal. If this basin were dredged then a suitable upland site would need to be found. No such disposal site was pursued during the feasibility study for the following reasons:

a. Most of the silty material (at the lower dredging depths) is native material from the pond bottom that was covered by the delta as shoaling took place. This native material is very fine sands and silts deposited prior to the delta migration that did not originate from the beach side of the barrier system.

b. There is also no guarantee that when this basin is dredged that the channel location will remain constant. In fact, history shows that this end of the channel tends to migrate. Each time the channel end migrated a new basin would need to be dredged that would encounter the same disposal issues. This was not desirable to the RICRMC who will be responsible for maintaining the restoration project.

2. Figure 4 of the Environmental Assessment (EA) shows the lower basin in Ninigret Pond to be located more to the north than Figure 4 of the Main Report. The basin was originally placed in this location using the hydrodynamic model developed during the feasibility study. Several members of the technical study team (professors from URI) felt that the basin should be located closer to the breachway. Their reasons for this adjustment are results from prior modeling of the pond and practical knowledge of the area's response to dredging at the same location in 1985. It was agreed among the study team to move the same sized basin (to avoid last minute changes in quantity estimates in the report) slightly to the south, as shown on Figure 4 of the Main Report. In any event, there is no physical reason we cannot explore expanding the size of the basin during the final design phase to capture some of the shoaling at the first bend in the channel.

3. See response to Mr. Ryan's boulder removal comment above. As this is an environmental restoration project we will not have authority to work in areas beyond what are shown in the recommended plans. Therefore, dredging of the entire breachway channel would need to be treated in the same manner as the boulder removal.

4. The Corps agrees that the future maintenance of the project is critical to the success of the project.

Responses to Rhode Island Coastal Resources Management Council (April 19, 2002):

General Comments

1. Noted. The Main Report and Appendix II were modified to reflect the most current sediment disposal plan.

2. The Granger Report, specifically Figure 3, represents the percentage of eelgrass coverage found at various sampling points in Ninigret and Quonochontaug ponds. The figure shows that coverage varied by depth in each pond. When taken alone, Figure 3 does show the best eelgrass coverage occurs from 0.75m to 1.5m in Ninigret and 1.5m to 2.5m in Quonochontuag. This does not predict optimum eelgrass growth. What is not shown through this figure is the sample's density or biomass; factors that were measured and predicted through Fred Short's model. Fred Short's model and report, taking into account all growth factors, found that optimum growth will take place at Ninigret at a depth of 0.75m and that this same dredging depth would be "satisfactory" at the other two ponds. This was the basis of our choosing the 0.75m depth for the recommended plans. Short's report will be included in the final version of the Environmental Assessment.

3. The team did consider other beneficial categories, specifically storm damage reduction (or erosion) and increased recreational use of the beach. The material that we are placing on the beach is medium to fine sands that is not compatible to the existing course beach sands. As the current disposal plan calls for disposal in the intertidal zone, much of the disposal material is expected to washout into the nearshore area forming offshore bars. Such bars currently exist in the area and consist of similar material. Therefore, what we are in fact doing is not building up the beach but instead putting this sand back into the littoral system. For these reasons, we were not confident in taking either additional recreation or storm damage reduction benefits.

The grain size data for the disposal sites can be found in Appendix C of the Environmental Assessment.

4. Agreed. The report reflects the option of seeding and this will be further developed during the final design phase.

5. Noted.

Specific Recommendations:

Syllabus

1. Spelling revised.

Feasibility Report

1. Sentence revised.

2. Sentence revised.

3. Sentence revised.

4. See response to General Comment #2.

5. Paragraph revised.

6. The dewatering time refers to the upland dewatering sites and not the beach areas or any other open-ended dewatering situation that may be developed during the Plans & Specifications phase.

7. Sentence revised.

8. Section revised.

9. Enforcement/protection of the restoration areas is an issue that will need to be addressed during the Plans & Specifications phase.

10. Section revised.

11. Noted. We will not be building-up the beaches and therefore should not have a problem with additional plovers nesting in the area.

12. Recreation access will be limited to an extent. The Main Report and EA will be amended to reflect this.

Environmental Assessment

1. Noted.

2. Two individuals. Noted.

3. Effects of material disposal are detailed in section VI.A.3 of the Environmental Assessment. The effects on benthos and shellfish will be the same, as we have expected the material to distribute itself in the intertidal zone all along.

4. Noted.

5. The beaches chosen for disposal are all high traffic (passive and active recreation) use areas that are not conducive to promoting nesting bird habitat. This is evidenced by the fact that the vast majority of known nesting sites, for Federally listed threatened or endangered species, in the project area are at remote locations where beach nourishment is not being considered (due to distance and access to the site, and exposure to having the sand re-enter the breachway).

6. Noted. See Comment 12 of the Main Report.

7. Noted.

Appendix 1 Hydrodynamic Analysis

1. Paragraph revised to reflect response to comment #1 from Town of Charlestown. Boothroyd shoaling comment – Noted.

2. Sentence revised.

3. Yes, the Winnapaug channel was verified in the field.

4. Sentence revised.

5. Figure revised.

6. Figures revised.

7. Figures revised.

Engineering Quantities

1. This disposal approach will not effect pipeline placement (pipe routed above high tide line). The profiles and quantities calculated were more of an exercise to demonstrate approximate capacity. Since the material will be primarily washed into the intertidal and subtidal zones, the actual capacities will probably be something greater than that calculated.

2. Paragraph revised.

3. The ultimate destination of the dredged material will be fully developed during the design phase.

4. Figure revised.

5. Figure revised.

SHELTER HARBOR FIRE DISTRICT
WESTERLY, RHODE ISLAND 02891

P.O. Box 159
Gladstone, NJ 07934-0159

Finn M. W. Caspersen, Moderator
908-781-3030 (Fax) 908-781-3044

March 21, 2002

U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Attention: Colonel Brian E. Osterndorf, District Engineer

Re: Rhode Island South Coast Habitat Restoration Project – Charlestown, South Kingstown and Westerly, Rhode Island

Gentlemen:

I am writing this letter to you in my capacity as Moderator of the Shelter Harbor Fire District, on behalf of that Fire District, in response to your Public Notice dated March 4, 2002 for the Rhode Island South Coast Habitat Restoration Project – Charlestown, South Kingstown and Westerly, Rhode Island.

The Fire District, which borders Quonochontaug Pond in Westerly, Rhode Island, has been a long time proponent of conservation practices and has an extensive record of protecting and preserving the environment. In particular, it has been active with the United States Department of Interior Fish and Wildlife Service project regarding the management of piping plovers at Weekapaug Barrier Beach (Quonochontaug Beach).

In light of the foregoing, the Fire District hereby confirms its strong support of the U.S. Army Corps of Engineers proposal to restore shallow subtidal habitat for submerged aquatic vegetation in the three coastal salt ponds, one of which is Quonochontaug Pond.

Very truly yours,

Shelter Harbor Fire District

By: ______________________
Finn M. W. Caspersen. Moderator

cc: Mr. Christopher Hatfield, Engineering/Planning Division

Town of Westerly

TOWN HALL, 45 BROAD STREET, WESTERLY, RI 02891
Tel. (401) 348-2500 Fax (401) 348-2571

March 25, 2002

Christopher Hatfield
Engineering / Planning Division
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742

RE: Rhode Island South Coast Habitat Restoration Project

Dear Mr. Hatfield:

Please accept this letter as official comment from the Town of Westerly on the above-referenced project. We are particularly interested in that portion of the Draft Feasibility Report that calls for restoration of eelgrass beds in Winnapaug Pond, and the pumping of approximately 75,135 cubic yards of sand from the proposed flood shoal restoration area to the inter-tidal zone located directly in front of Misquamicut State Beach.

While the Corps' plans do not currently call for placement of this dredged sand anywhere but on Misquamicut State Beach, we believe there is merit in extending beach sand replenishment to two other areas located directly in front of Town-owned beach properties that are east of the State Beach. The first tract, consisting of Assessor's Map 166 / Lots 4, 5 and 6 is separated from the State Beach by a single privately-owned parcel that is only 75 feet in width. The second tract, consisting of Assessor's Map 167 / Lot 40 is located approximately 1,500 feet from the State Beach. Since Appendix II, Table 4 in the Corp's draft General Investigation Report suggests that Misquamicut State Beach has a capacity to handle only about 61,894 cubic yards of sand, we believe that the Corps' detailed engineering design effort should study the feasibility of placing excess amounts of dredged sand on these town-owned beach properties.

The study report notes that a proposed pipeline extending from Winnapaug Pond to Misquamicut State Beach will be routed across Atlantic Avenue. The Town is concerned about maintenance of traffic along Atlantic Avenue and would like the opportunity to review and comment on final pipeline design and placement. To facilitate pipeline location, we can provide you with property maps and land ownership information. At the appropriate time, you are encouraged to contact Public Works Superintendent John Fusaro and Tax Assessor Charles Vacca at (401) 348-2500.

We appreciate the opportunity to review initial plans for this habitat restoration project, and look forward to working with the Army Corps of Engineers on its successful completion.

Sincerely,

Pamela T. Nolan

Pamela T. Nolan
Town Manager

TO: ***Town Planner***

FROM: ***Westerly Conservation Commission***

DATE: ***March 25, 2002***

RE: ***Rhode Island South Coast Habitat Restoration Project***

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1. The Westerly Conservation Commission has reviewed the proposed alternatives and recommends Alternative 4 for Winnapaug salt pond. (Dredge the shoal; construct the sedimentation basin and plant eelgrass).

2. In addition, the following comments apply:

   i. The proposed disposal area of dredged material for beach restoration in Westerly is shown to be at the State Beach on Atlantic Avenue. This disposal/restoration area should include the Town's newly acquired former Armenakes property and the Westerly Town Beach.

   ii. How would the beach restoration effect rip currents at the disposal and adjacent area?

Andre Boris, Chairman
Westerly Conservation Commission

Cc: Honorable Town Council

March 27, 2002

U.S. Army Corps of Engineers
696 Virginia Rd.
Concord, MA 01742

Dears Sirs:

I am a recreational boater who traverses through the Charlestown Breachway from Niniget Pond into Block Island Sound during the boating season. I operate an 18' inboard-outboard Four Winns bow-rider runabout and pay considerable dockage fees within Ninigret Pond for the boat. I have lived in Charlestown, RI for 24 years.

Two years ago, I decided to get a boat to take advantage of the recreational opportunities available on the ocean. Over the past two seasons, I have hit a rock located at the end of the breachway twice. These events have caused me to limit my boating trips to around high tide; significantly reducing the number of trips I am able to make throughout the boating season.

The first time I hit it, exiting Ninigret Pond, the boat's propeller was damaged to the extent that I had to turn around immediately after exiting the breachway and return to my dock. This maneuver was at some risk given the fact that other boaters were also in a queue behind me exiting the pond. The propeller had to be replaced before I could take another trip in the boat.

The second time I hit the rock, the prop was completely stripped and I lost steerage and the ability to propel the boat through the breachway. I was fortunate on that day that the tide was incoming and I was able to drift into the breachway and then jump into the water and pull the boat to the boat launch. I was lucky that day. I may not be the next time.

This second hit caused not only damage to my prop but rendered my boat inoperable due to extensive damage to the drive shaft. This collision with the rock came at considerable expense and risk to myself and my wife, who was accompanying me.

Exiting, and entering, the breachway is a challenging maneuver even under the best of conditions. Having to try to factor in the location of this rock and to try to estimate whether there is sufficient tide to allow safe passage over it is extremely problemmatic.

A recent newspaper article (Providence Journal, Sect. C, p. 1, March 26, 2002) indicated that State Representative Eugene Garvey has asked The Corps to "expand the federally-funded South Shore Habitat Restoration Project to include removing dozens of large rocks in the Charlestown Breachway that are potential hazards to boaters". I would like to add my voice in support of this proposal and serve as testimony that the hazards are not potential, but have already been experienced by many boaters; myself included.
I am hopeful that you will seriously consider expanding the scope of this project. The outcome would significantly improve boating safety.

Sincerely,

Richard J. Ryan

Richard J. Ryan
49 Atlantis Drive, Box 632
Charlestown, RI 02813
(401)364-6979

Stewards
For the
Coastal Environment

Salt Ponds Coalition

P.O. Box 875, Charlestown, RI 02813
Phone: (401) 322-3068
E-Mail: Saltpondscoaltion@hotmail.com
Website: www.saltpondscoalition.org

To preserve the coastal ponds: Point Judith, Potter, Card, Trustom, Green Hill, Ninigret, Quonochontaug, Winnapaug, Maschaug

March 28, 2002

Dear Colonel Osterndorf:

The Salt Ponds Coalition board has reviewed the U.S. Army Corps of Engineers "Rhode Island South Coast Habitat Restoration" Feasibility Report & Environmental Assessment draft. We completely endorse this study and its recommendations. We strongly believe that the timely implementation of this project is critical to the continued health of Ninigret Pond, Quonochontaug Pond, and Winnapaug Pond.

It is our hope and concern that the Rhode Island State budget contains the necessary funding needed to insure the full implementation of this critical project. We are fully aware of the financial effects of our economic downturn; unfortunately the health of our Salt Ponds cannot wait! Southern Rhode Island's economy is driven by tourism with our Salt Ponds and beaches being the major attractions.

Our Salt Pond Watchers, founded in 1985, were the first volunteer marine water quality monitoring group in the U.S. They sample the salt ponds biweekly, from June through September and supply water quality data to local communities, RIDEM, CRMC, URI Cooperative Extension and Water Watch, URI Coastal Resource Center/Sea Grant, and EPA. The recipients use the data to help make decisions regarding public use of the salt ponds, zoning requirements in pond watersheds and the development of wastewater management programs. On April 19th our Salt Pond Watchers will be honored with the Senator John H. Chafee Conservation Award by the Environment Council of Rhode Island.

The Salt Ponds Coalition with its 400+ members is the steward of our precious and unique Salt Ponds. We stand ready to work with everyone concerned to insure this critical project is fully funded and implemented on schedule. We ask for your assistance in keeping the necessary funds in our Rhode Island budget to insure the full and speedy implementation of this critical project for our Salt Ponds.

Thank you for your consideration,

Cece Gamwell
President

Vic Dvorak
Executive Director

Christopher Hatfield
US Army Corps of Engineers
New England District
Attn: Engineering/ Planning Division
696 Virginia Road
Concord, MA 01742-2751

Re: Public Comment US Army Corps Proposal for Rhode Island Coastal Pond Restoration Sites

Dear Mr. Hatfield,

I believe that your plan will work to better protect the natural environment of Ninigret, Winnapaug and Quonochontaug Ponds. The re-establishment of shallow sub tidal eelgrass habitat and a fish passage restoration will bring life back to our ponds. The plan could also have an ancillary benefit of offering us an opportunity to help abate the significant erosion of our beaches caused by coastal storms.

The Corps estimates that over 280,000 cubic yards of sandy sediment will be dredged from the three ponds. Where that sediment finally ends up could be of crucial importance for the protection of the environment, homes, businesses and recreational beaches along the southern coast of Rhode Island continually threaten by winter storms. The plan does not fully address the re-location of this sandy residue and is unclear as to what beach areas will receive the sediment.

The US Army Corp of Engineers, RIDEM and CRMC, in conjunction with public input, need to carefully study and consider which areas of South County's beaches have the greatest need and will gain the greatest benefit from the removed sandy sediment and not the simply choose areas of easy or political convenience.

Sincerely,

Matthew J. McHugh
91 Seabreeze Terrace
Wakefield, RI 02879

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767 TDD 401-831-5508

April 4, 2002

Colonel Brian Osterndorf, District Engineer
US Army Corps of Engineers, New England District
696 Virginia Road
Concord, MA 01742-2751

RE: Rhode Island South Coast Habitat Restoration Project - Feasibility Report and draft Environmental Assessment

Dear Colonel Osterndorf:

The Rhode Island Department of Environmental Management (RIDEM) has received and reviewed the Feasibility Report and the draft Environmental Assessment (dEA) on the RI South Coast Habitat Restoration Project. The project, as proposed, consists of two components, subtidal habitat restoration (eelgrass restoration) in Ninigret, Winnapaug and Quonochontaug coastal ponds and restoration of anadromous fish passage to Cross Millls Pond in Charlestown, RI. RIDEM has worked closely with the Army Corp of Engineers, the US Fish & Wildlife Service, the National Oceanic and Atmospheric Administration (NOAA), the Environmental Protection Agency, the University of Rhode Island and the RI Coastal Resources Management Council on this project since its inception. The planning and research leading to the current proposal is the joint effort of these agencies and the University. RIDEM is strongly supportive of the project and confident that project goals and objectives outlined in the Feasibility Report (Plan Formulation, Section A, page 15) can be successfully accomplished.

The proposed plan for the salt pond restoration projects involves the construction of a sediment basin and removal of sediment from the shoal to restore proper elevation to reestablish eelgrass. Portions of the dredged areas of the shoals will be planted with eelgrass to provide the starter population for the shoal area. RIDEM notes that appropriate maintenance of the sediment basins over time by removal of accumulated sediments is the critical factor in the continuing success of these projects.

The fish ladder will allow river herring access to valuable nursery and spawning habitat with close proximity to the ocean. The proposed project will enhance the river herring population and increase the state's accessible anadromous habitat.

RIDEM has the following comments, questions and requests for clarification.

Feasibility Report Syllabus

- How does the non-federal sponsor demonstrate that RI has "secured the necessary lands, easements and right-of-ways?

- How does the non-federal sponsor demonstrate that RI has assumed future operation, repair, rehabilitation and replacement of the project?
- Who assumes responsibility for determining whether this demonstration is adequate?
- Will the project go forward if there is not demonstration that the non-federal sponsor can provide for future maintenance of the sedimentation basins?

Sediment Analysis of Proposed Dredging Sites

Page 20

- For the sediment to be dredged from the upper basin of Ninigret Pond, the applicant must identify a suitable permanent upland disposal location. This means that the disposal location should be consistent with the future requirements of the RI Dredge Regulations that are now under development. Coordination with the Office of Technical and Customer Assistance is recommended prior to identifying a disposal site.

Description of Selected Plan(s)

- Volume calculations should be provided for the sedimentation basins to show that suggested clean-out frequencies were estimated appropriately.

Page 33

- For clarity, "Winnapaug Pond" should be added to the second sentence of the last paragraph, to read "As in Ninigret Pond *and Winnapaug Pond,* the sediment basin will require periodic maintenance."

Page 34

- For the fishway channel, it appears that it may be problematic to retain two feet of septic pipe in an exposed state, even with a protective sleeve.

Page 37

- A condition of RIDEM's Water Quality Certification for this project will be that dredging will be prohibited from intertidal habitat and dredging in identified areas will not occur during the times of year when the Roseate tern and the threatened Piping Plover are present (1 April through 31 August). Prior to issuance of any Water Quality Certification, the RIDEM Water Quality Certification Program will need to review the design measures proposed to ensure that the intertidal habitats are not lost due to sloughing at the edges of the dredged areas.

This concludes RIDEM's comments on the Feasibility Report and draft Environmental Assessment. The Department of Environmental Management. We congratulate the ACOE and our other partners on the exemplary job that has been done in bringing this project forward to this point and we look forward to the start of work.

Please feel free to contact me if I can provide any assistance or should questions arise.

Sincerely,

Ronald Gagnon

Ronald Gagnon, Chief
Office of Technical & Customer Assistance

Cc: J. Reitsma
D. Borden
A. Good
M. Grant
T. Gray

Robert B. MacDougall
CDR, USN (Ret.)
Town Administrator
Administrator@CharlestownRI.org

TOWN OF CHARLESTOWN

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April 19, 2002

Mr. Christopher Hatfield
Attn: Engineering/Planning Division
U.S. Army Corps of Engineers, N.E. District
696 Virginia Road
Concord, MA 01742-2751

Re: R.I. South Coast Habitat Restoration Project

Dear Mr. Hatfield.

On behalf of the Town of Charlestown, we would like to congratulate you on a well -presented and informative Feasibility Report & Environmental Assessment of the R. I. South Coast Habitat Restoration Project. This project, which the late Senator John Chafee sponsored, was a response to the concern that the people of Charlestown had regarding the continuing accumulation of sediment in the coastal ponds.

Although this project is a habitat restoration project, it addresses the main issue of concern, which is the accumulation of sedimentation. We recognize the fact that sedimentation cannot be stopped and unchecked it will continue to destroy habitat. The Town's main concern is to remove the accumulated sedimentation and put in place a responsible maintenance project for the future.

The report outlined the primary goal of restoring eel grass which was lost due to the shoaling - in of the inlets of the coastal ponds. Additionally, a fish passage was added to this project by Rhode Island Fish & Wildlife.

The Town of Charlestown has no objections to the proposed Fish Passage as outlined in Alternative Plan #18. We recognize and appreciate the alteration that you have already incorporated into the design, based on the concerns expressed by the Charlestown Wastewater Management Commission.

Obviously the Town will not comment on the plans relating to Winnapaug Pond as it is located outside of Town. The proposed plan (# 16) selected for Quonochontaug Pond addresses the Town's concerns without any objections.

Several alternatives for Ninigret Pond were presented in the report with Alternative #14 proposed.

The Town objects to this selection and prefers alternative #15. The primary difference is the addition of the inner basin. The Town feels that the inner basin will be beneficial in collecting sedimentation and increasing the life of the restoration. It appears from the report that the inner basin was eliminated due to the small grain size of the sediment sample taken from the proposed site. This grain size was stated not suitable for beach nourishment. However, this sedimentation originated from the beach side and we feel returning to its source should be acceptable.

Additional concern with the presented plan was the change in design of the lower basin of Ninigret Pond. Several pictures in the report show the lower basin reaching farther to the north than the final plan. It is our opinion that this basin be enlarged as originally presented in the plan. This opinion is based on the experience of the past dredging of the basin. The original dredging in the 50's and again in 1985 resulted in rapid filling of the basin. It appeared that the basin filled within two years of dredging. It would be more beneficial to the overall efficiency of the project to dredge the lower basin to the far reaches of the inlet as originally shown.

The hydrodynamic modeling of the breachway system that was part of the report appeared to be inconclusive when weighing all the exceptions that were stated in the plan. It seems to the Town, that the most important concept that was stated in the plan was the need for follow-up maintenance. In our quest to control the sedimentation, a 1994 Town proposal sought a small dredge for this purpose. This Town proposal was the beginning of the process that initiated this study.

In the Town's opinion, the most efficient way to implement this project and insure its longevity would be to incorporate the following elements in the habitat restoration of Ninigret Pond.

Select Alternative Plan #15, modified to include:

> Dredge lower basin as originally shown in Figure 4.
>
> Utilize larger dredge as done in 1985 to dredge lower basin.
>
> > Removal of rocks at entrance would need to be incorporated to allow safe passage of dredge through breachway.
> > (Allocation being sought through Sen. Reed's Office)
>
> Dredge channel into upper basin to 3 feet Below Mean Low Water and 30 feet wide in order to assist movement of dredge and associated equipment and assure direct flow of sediment to basin.

The Town of Charlestown appreciates the opportunity to comment on this report and hopes to continue to be involved in the process as it nears completion. Please contact Mr. Rob Lyons, Chairman, Charlestown Coastal Pond Commission if you have any questions or comments.

Sincerely,

Robert MacDougall
Town Administrator

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

COASTAL RESOURCES MANAGEMENT COUNCIL
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, R.I. 02879-1900

(401) 783-3370
FAX: (401) 783-3767

May 2, 2002

Mr. Chris Hatfield, Project Manager
US Army Corps of Engineers, New England Division
696 Virginia Road
Concord, Ma 01742-2751

Dear Mr. Hatfield:

Thank you for the opportunity to review the Army Corps of Engineers *Rhode Island South Coast Habitat Restoration Feasibility Report and Environmental Assessment.* The project is crucial to the health of the pond ecosystems, and will provide benefits for the fish, wildlife and human populations who utilize the ponds and south shore beaches. We look forward to moving on to the next phase of the project.

At this point the CRMC supports phasing in the different segments of this project. The Cross Mills Pond Fish Passage and restoration of eelgrass to the flood tidal delta of Ninigret Pond are the highest priority. This should be followed by restoration of eelgrass to the Winnapaug Pond flood tidal delta and finally to restoration in Quonochontaug Pond.

The following are the Rhode Island Coastal Resources Management Council's comments on the *Rhode Island South Coast Habitat Restoration Feasibility Report and Environmental Assessment*: If there are any questions or you need to clarify any of the comments please contact Janet Freedman (j_freedman@crmc.state.ri.us) or Tracy Silvia (T_Silvia@crmc.state.ri.us) of my staff at 401-783-3370.

General Comments:

1. At the November 13, 2001meeting with USF&W for examining impacts of the sediment disposal on piping plover habitat, it was determined that if we created wider beaches it would trigger a management plan (see Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the US Atlantic Coast to Avoid Take under Section 9 of the Endangered Species Act). Part of this plan includes roping off potential plover habitat prior to nesting time. Since the proposed disposal areas are on public beaches it was decided that both in

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COOPER LAW ASSOCIATES
Attorneys and Counsellors at Law

April 15, 2002

Christopher Hatfield,
Engineering/Planning Division
U.S. Army Corps of Engineers
New England District Office
696 Virginia Road
Concord, MA 01742-2751

Re: Foster Cove Restoration

Dear Mr. Hatfield:

As President of the Foster Cove Improvement Association (FCIA), I would like to bring a matter of considerable concern to your attention. The entrance to Foster Cove, a part of Ninigret Pond, is rapidly being sealed by sediment build-up. In addition, the Cove is shallowing at an alarming rate and ultimately, will be separated from the salt water influx. At low tide, the level of water at the entrance to Foster Cove is approximately 4 to 6 inches, which may not be enough to allow for complete tidal flushing of the entire Cove. In our opinion, this presents a direct and immediate threat to the ecosystem of the Cove, including water quality, shellfish habitat and wildlife sanctuary. It also poses a threat to commercial and recreational shell fishing and boating activities.

It is my understanding from recent press accounts that the U.S. Army Corps of Engineers plans to address similar sedimentation problems in the salt ponds by carrying out a dredging campaign. Foster Cove has one of the most pristine ratings by the Rhode Island Department of Environmental Protection, and in consideration thereof, the Foster Cove Improvement Association hopes that you will include Foster Cove as a high priority in your campaign.

It is our hope that you will be able to devote resources to address this situation. We would be happy to meet with you to offer any assistance we can. Please keep us informed as to any developments with regard to Foster Cove.

Thank you in advance for your anticipated efforts with regard to this matter.

Respectfully,

David A. Cooper

David A. Cooper

DAC/ac

the interest of the birds and the public that the sediment would be disposed in the intertidal/ nearshore environment. The only exception to this disposal plan was at South Kingstown Town Beach which was not deemed good habitat. Sand will be trucked rather than pumped onto the beach at that location. These plans are addressed in the environmental assessment but not in the feasibility report or the section on engineering quantities. Changes need to be made to reflect the revised disposal plans throughout the report. Will the revised plans have an impact on costs and real estate acquisitions/easements?

2. The Granger et al. report (Appendix A) shows that one size does not fit all as far as the optimum depth for eelgrass growth in the ponds. In Ninigret Pond the thickest stands were found growing between 0.75 m and 1.5 m below mean sea level, whereas in Quonochontaug Pond the optimum depth was 1.5 m to 2.5 m below mean sea level. Mean sea level was defined as 0.5 feet NGVD for all ponds using ACOE SHOALS bathymetric data in feet for Quonochontaug and meters for Ninigret.

This is contradicted in the Short report. Short's model shows an optimum depth for eelgrass growth between 0.75 m and 1.0 m MLW for all ponds. In fact, simulated eelgrass leaf growth rate in Quonochontaug Pond at 2.0 m was less than half of the growth at 0.75 or 1.0 m. This is consistent with your comments that the eelgrass at lower depths in Quonchontaug Pond was abundant but not robust. Short's data was used for the project design and should be included in this report. He also clarifies some of the issues on bathymetry.

3. There is an erosion benefit to adding sand to the nearshore environment. The most damaging storms on the RI coast are the ones that occur in a series. Does the ACOE have any studies that quantify the value of offshore sand bars as erosion control features? Also, where is the grain size data from the beach grab samples?

4. The options of seeding eelgrass rather than relying entirely on transplants needs to be explored in more detail.

5. The barriers are NOT glacial features.

Specific Recommendations:

Syllabus:

First page. South Kingstown is spelled wrong (Kingston).

Feasibility Report

Page 2, last paragraph: Sentence should read "Two other ponds (GREEN HILL, Potter)", not (Ninigret, Potter).

Page 6, 3rd paragraph: Add East Beach to state recreational beaches

Page 8. 3rd paragraph: Should read, "Waterfowl, including American Black Duck, Canvasback, Bufflehead, and Canada Goose...", not Bufflehead Duck or CANADIAN goose.

Page 19, D. 2: "The study determined that existing eelgrass flourished in the 0.75 to 1.0 meter MLW..." The Granger et al. study determined that eelgrass flourished in 0.75 to 1.25 meters below mean sea level in Ninigret Pond and between 1.5 and 2.5 meters below mean sea level (between 1.0 m and 2.0 m MLW) in Quonochontaug Pond. The Short report found that 0.75 to 1.00 m depth (MLW) would yield optimum eelgrass growth conditions in the ponds.

Page 30, F: Another reason for excluding the upper basin is that the present channel will migrate before the 32 year lifespan of the basin, making the basin obsolete.

Page 31, 1st paragraph: Dredge material disposal will be in the intertidal and subtidal section of beach. Dewatering time was estimated to take a few months (Engineering Section). Is that a fair estimate? If so, will continuous dewatering/removal be an option? Will continuous dewatering be done on the beach or in the dewatering facility?

Page 32. B, 2nd paragraph: Dredge material disposal will be in the intertidal and subtidal section of beach.

Page 33. C, 2nd paragraph: Dredge material disposal will be in the intertidal and subtidal section of beach.
3rd paragraph: Add that monitoring of eelgrass for three consecutive growing seasons will be done by the Army Corps of Engineers.

Page 35 and elsewhere in the EA, last paragraph, impacts: Consequence of the restoration to the ponds. How will the restored beds be protected during the initial phases? Enforcement? Closed areas? Signage?

Page 36, 3: State why the spawning of winter flounder in the coastal ponds will not be significantly affected.

Page 37. 4: Piping Plover nesting begins in March, before heavy use of the beaches. It was my impression from the USF&W was that if you build it they will come.

Page 36-40: windows:
To avoid avian impacts 4/1-9/1 will be avoided, which will also avoid shellfish impacts (6/1-9/1). Fishery impacts are expected to be minimal. Tourism impacts are also minimal due to the avoidance for avian and shellfish (June-August beach season). However, depending on the disposal process, and timeframe, impacts to recreational fishermen may be expected. The beachfront of the south shore salt ponds is heavily used, both by vehicular and pedestrian traffic (pedestrian scup fishermen early on which will be avoided by the avian protection window). The post-beach season from ~9/15-12/1 is a huge recreational use. Vehicles use the beach fronts and surf fishermen are everywhere. Possible impacts? Have they been notified? The RIMS group have year-round vehicular access for fishing, as well.

Environmental Assessment:

EA 21 B. 1: Barriers are **NOT** glacial features. The second and third p aragraphs need to be reworded.
2nd paragraph: "This area is characterized by a *barrier/headland system. The barriers* form the seaward boundary of a series of salt ponds. The barrier/*headland system* extends .....
3rd paragraph: Delete everything except the last sentence.

EA 24, diamondback terrapin: "with two species historically recorded"....shouldn't this be "two INDIVIDUALS"?

EA 28. 3: Benthic Invertebrates and Shellfish. What is the impact on benthic communities with the modified dredge material disposal plan?

EA 34, birds: "such as ducks, geese, and scaup". Should read "waterfowl" or "ducks and geese", scaup is a duck. Or did they mean scup?
6. Threatened and Endangered Species: The beaches do support plover nesting. There are usually no crowds when they pick their nesting sites.

EA 35, recreation and aesthetics, second paragraph: have recreational fishing access/use of the beachfront during the off-beach season been addressed?

EA 43. Section VII: Can this be reworded? Do you mean that nobody lives on the flood tidal deltas and intertidal/subtidal disposal areas?

Appendix 1 Hydrodynamic Analysis:

Page 3, 1st paragraph: A second reason for not considering the upper sediment basin in Ninigret Pond is that the channel depositing material into the upper sediment basin is likely to migrate, as it has in the past. This would make the upper basin obsolete well before its projected lifespan. It should be made clear that only the lower sediment basin will be considered throughout the report.

Last paragraph: Boothroyd's accumulation rates assume a 1 meter depth. For Quonochontaug Pond this may underestimate of the amount of sediment.

Page 8, 1st paragraph: Switch positions for (1.2 feet) and 40 cm in first paragraph.

Page 13.C.1, 3rd paragraph: Was the Winnapaug channel configuration verified in the field?

Page 20. 2nd paragraph: "placement of the sediment basin is, in general, perpendicular to the direction of flood flow". Do you mean the leading edge of the sediment basin? The basins are parallel to flood flow.

Figure 1: You **MUST** cite Boothroyd and Galaghan, 1998 on this figure.

Figures 2-4: Indicate that these are derived from the SHOALS survey.

Figures 28-30: Use the most recent project maps (Figures 2-4 in the Feasibility Report)

Engineering Quantities:

Primary Disposal – Beach Nourishment: The material will be placed seaward of and lower than MHW except at South Kingstown Town Beach. How will this affect the pipe placement? Capacities for identified disposal areas?

Alternative Disposal – De-watering Locations: Remove reference to the Winnapaug Pond dewatering site.

Table 4: The capacity of both dewatering areas is 23,000 cubic yards and the feasibility report suggests that it may be possible to have continuous dewatering and removal of sediment. All this sand should be made available to South Kingstown for disposal in high erosion areas.

Ninigret Pond Plan: Add 2nd de-watering area and extend Primary Disposal Beach Nourishment area.

Winnapaug and Quonochontaug Ponds Plan: Add East Beach Primary Disposal Beach Nourishment area. Remove the Winnapaug dewatering site.

Sincerely,

Grover Fugate, Executive Director
Coastal Resources Management Council

/lam

cc: J. Willis, CRMC
T. Silvia, CRMC
J. Freedman, CRMC

APPENDIX B – SEDIMENT TEST RESULTS

Table 2. Listing of Field Data for the RI South Coast Feasibility Study.

Sample ID	Date	Time	Northing Rhode Island NAD 1983	Easting Rhode Island NAD 1983	Latitude N	Longitude W	Water Depth (ft)	MLW* Depth (ft)	Core Penetration (ft)	Core Recovery (ft)
W1	1/11/01	0955	91,623.7	251,025.5	41º 20.0673'	71º 46.8353'	2.75	-0.25	5.3	5.0
W2	1/11/01	1030	91,049.7	251,407.1	41º 19.9730'	71º 46.7515'	3.0	+0.4	4.6	4.6
W3	1/11/01	1110	91,204.4	252,196.7	41º 19.9989'	71º 46.5791'	4.1	-0.5	4.2	4.1
W4	1/11/01	1150	91,309.2	253,260.8	41º 20.0167'	71º 46.3467'	4.0	-0.8	9.7	9.1
Q2	1/11/01	1435	93,250.1	265,913.9	41º 20.3423'	71º 43.5835'	1.75	-0.2	5.0	4.9
Q3	1/11/01	1500	92,547.7	265,843.5	41º 20.2266'	71º 43.5985'	1.7	-0.5	4.4	3.4
Q1	1/11/01	1525	92,244.7	265,108.9	41º 20.1764'	71º 43.7588'	2.0	-1.1	4.1	3.6
Q4	1/11/01	1555	93,302.7	266,457.3	41º 20.3512'	71º 43.4648'	7.0	-6.4	10.0	9.2
N3	1/12/01	0940	102,188.5	288,486.0	41º 21.8221'	71º 38.6550'	1.4	+1.6	4.4	4.2
N2	1/12/01	1005	102,870.7	288,748.4	41º 21.9345'	71º 38.5979'	1.7	+1.6	5.0	4.75
N1	1/12/01	1030	103,273.4	289,024.4	41º 22.0009'	71º 38.5377'	1.1	+2.0	4.6	4.25
N4	1/12/01	1100	103,076.8	290,441.9	41º 21.9689'	71º 38.2278'	4.3	-0.5	4.25	4.0
N7	1/12/01	1215	100,746.1	290,038.3	41º 21.5850'	71º 38.3152'	3.5	-0.4	10.0	8.4
N6	1/12/01	1250	103,280.7	289,812.3	41º 22.0023'	71º 38.3655'	1.6	+1.2	10.0	8.3
N5	1/12/01	1430	102,687.9	291,009.5	41º 21.9050'	71º 38.1036'	0.6	+1.2	4.2	4.0

*MLW depths were calculated based on Watch Hill Point tide table.

Table 3. Samples Collected for the RI South Coast Feasibility Study

Parameter	Planned Number of Stations	Planned Samples per Station	Planned Total Samples	Actual Samples per Station	Actual Total Samples
Cores	15	1	15	1	15

Table 4. Summary of Grain Size Results.

Client Sample ID	Client Sample ID	Gravel #4 (%)	Coarse Sand #10 (%)	Medium Sand #40 (%)	Fine Sand #200 (%)	Silt 0.074-0.005 mm (%)	Clay <0.005 mm (%)	Water Content (%)	USCS Classification
Ninigret Pond	N1 (0-4')	0.00	0.01	3.38	92.36	1.94	2.30	19	SP
	N2 (0-4')	0.00	0.01	0.61	86.45	9.53	3.40	34	SM
	N3 (0-4')	0.00	0.30	0.47	89.99	4.84	4.40	32	SP-SM
	N4 (0-4')	0.00	0.05	2.72	84.61	7.42	5.20	34	SM
	N5 (0-4')	0.00	0.16	1.19	80.67	12.57	5.40	35	SM
	N6 (0-8.3')	0.21	0.03	0.44	51.37	35.96	12.00	58	SM
	N7 (0-8.4')	2.15	0.58	13.34	83.69	0.24		6	SP
Winnapaug Pond	W1 (0-4.0')	0.00	0.10	1.04	92.55	2.41	3.90	31	SP-SC
	W2 (0-4.0')	0.00	0.00	1.93	94.64	0.23	3.20	28	SP
	W3 (0-4.0')	0.00	0.44	6.99	89.38	1.29	1.90	25	SP
	W4 (0-9.1')	0.34	0.20	1.24	86.39	5.52	6.30	39	SP-SC
	Q1-A (0-2.6')	0.00	0.16	3.49	87.94	3.20	5.20	27	SP-SC
	Q1-B (2.6-3.6')	3.19	1.66	28.83	65.52	0.80		22	SP
	Q2 (0-4.0')	0.00	0.00	0.55	95.02	0.43	4.00	30	SP
	Q3 (0-3.4')	0.00	0.35	2.13	90.26	2.06	5.20	22	SP-SC
Quonochontaug Pond	Q4-A (0-1.6')	0.00	0.29	1.43	95.25	0.23	2.80	24	SP
	Q4-B (1.6-2.1')	2.58	6.91	42.77	46.58	1.17		14	SP
	Q4-C (2.1-6.3')	0.00	0.25	2.00	76.98	12.77	8.00	57	SM
	Q4-D (6.3-6.9')	7.85	2.71	5.97	65.65	7.32	10.50	54	SC-SM
	Q4-E (6.9-9.1')	5.05	0.67	1.41	76.37	9.49	7.00	43	SC-SM

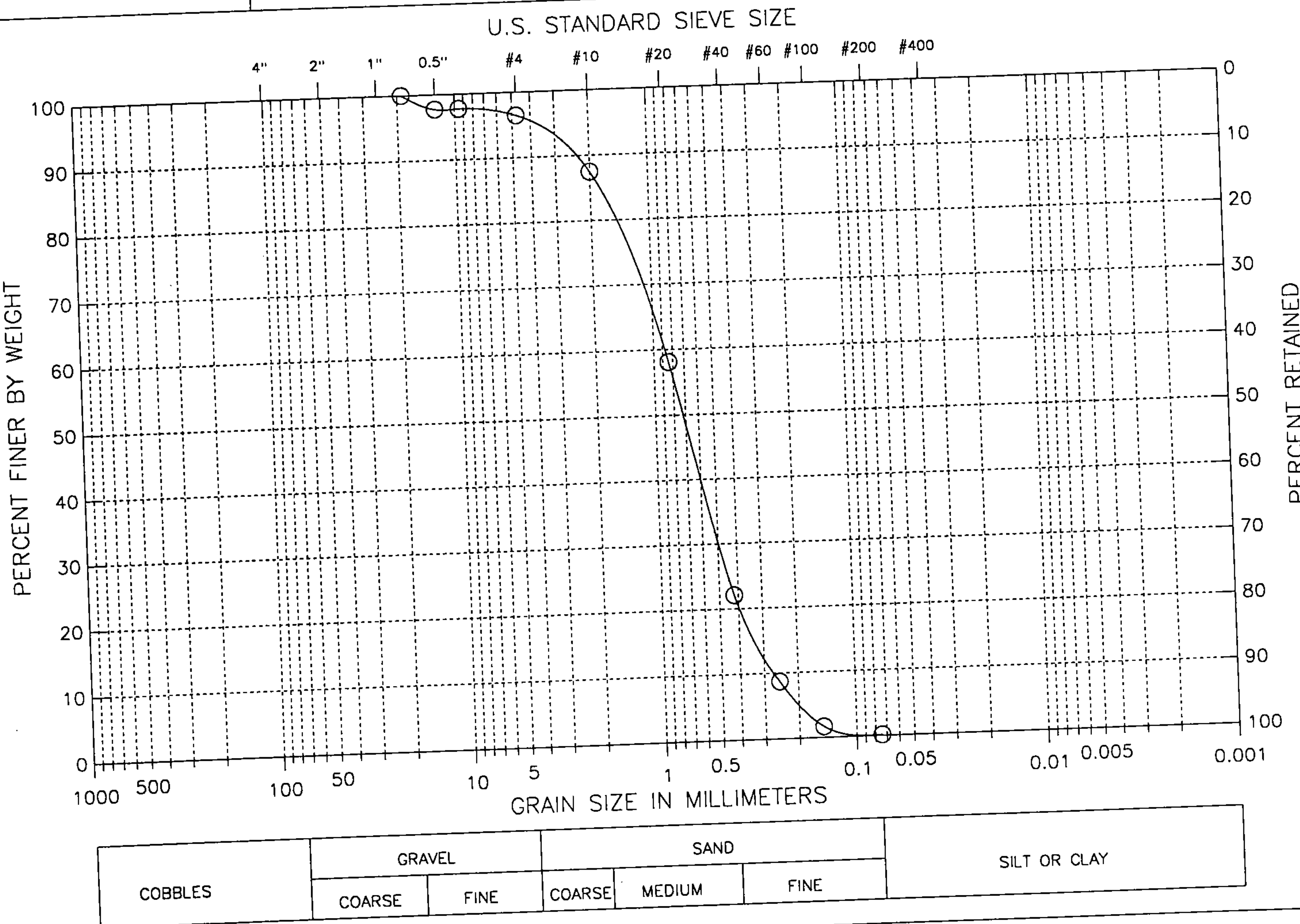
Sediment Grain Size Analysis Summary
Client: ACOE
Project: R.I. Rod Measurements
Project No. 9000-213
Date: July 1999

Smaller →

	%	%	%	%	PHI PERCENT													Std
Sample ID	Gravel	Sand	Silt	Clay	<-1	0	1	2	3	4	5	6	7	8	9	10	Mean	Dev
NP-1(S)	0.4	85.1	8.3	6.2	0.42	0.19	0.33	0.98	34.01	49.55	8.30	0.00	0.00	6.23	0.00	0.00	3.43	1.27
NP-2(E)	0.0	88.2	7.9	3.9	0.00	0.06	0.06	0.65	43.75	43.66	7.88	0.00	0.00	3.94	0.00	0.00	3.28	1.07
NP-3(N)	0.2	84.8	10.6	4.5	0.17	0.02	0.42	0.81	32.05	51.46	10.55	0.00	0.00	4.52	0.00	0.00	3.43	1.12
NP-4(W)	0.0	86.6	8.9	4.5	0.02	0.09	0.11	0.49	35.52	50.41	8.91	0.00	0.00	4.45	0.00	0.00	3.39	1.09
NP-5	0.0	95.0	3.3	1.7	0.00	0.03	0.13	2.09	70.73	22.00	3.34	0.00	0.00	1.67	0.00	0.00	2.85	0.83
NP-6	0.3	63.3	30.1	6.0	0.28	0.28	0.48	1.26	17.42	44.19	4.01	12.03	8.02	6.01	2.00	4.01	4.36	1.95
NP-7	0.4	25.3	50.5	23.9	0.40	0.82	0.48	7.33	10.06	6.56	18.59	13.28	13.28	5.31	5.31	18.59	5.63	2.63
NP-8	0.0	93.4	3.3	3.3	0.02	0.02	0.07	7.69	66.32	19.33	3.28	0.00	0.00	3.28	0.00	0.00	2.84	1.05
NP-9	0.0	85.5	10.4	4.2	0.00	0.23	0.54	1.25	27.34	56.11	10.38	0.00	0.00	4.15	0.00	0.00	3.45	1.08
NP-10	0.0	91.6	4.2	4.2	0.00	0.10	0.25	4.97	66.04	20.19	4.22	0.00	0.00	4.22	0.00	0.00	2.94	1.14
NP-11	0.0	68.7	17.2	14.1	0.03	0.33	0.41	1.34	30.60	36.06	9.37	3.12	3.12	1.56	1.56	12.49	4.28	2.34
NP-12	0.2	15.3	53.5	31.0	0.20	1.24	0.62	1.10	3.75	8.57	19.72	16.91	11.27	5.64	11.27	19.72	6.21	2.40
QP-1	0.3	93.1	4.9	1.6	0.33	1.75	3.73	15.17	56.64	15.78	4.95	0.00	0.00	1.65	0.00	0.00	2.55	1.13
QP-2	0.0	94.7	4.0	1.3	0.01	0.23	0.59	9.95	67.97	15.94	3.99	0.00	0.00	1.33	0.00	0.00	2.69	0.87
QP-3	0.0	86.4	9.7	3.9	0.00	0.02	0.68	16.33	47.84	21.51	9.73	0.00	0.00	3.89	0.00	0.00	2.93	1.26
QP-4	0.0	32.4	38.6	29.0	0.00	0.19	0.42	0.58	5.31	25.86	9.66	9.66	9.66	9.66	6.44	22.54	6.06	2.50
QP-5	0.0	94.3	3.8	1.9	0.00	0.06	1.38	22.87	53.52	16.42	3.83	0.00	0.00	1.92	0.00	0.00	2.58	1.04
QP-6	0.1	79.5	15.4	5.1	0.05	0.09	0.12	0.53	32.86	45.89	6.82	3.41	3.41	1.71	1.71	3.41	3.75	1.66
WP-1	0.1	99.9	0.0	0.0	0.08	0.99	11.09	61.67	25.46	0.71	0.00	0.00	0.00	0.00	0.00	0.00	1.64	0.65
WP-2	0.1	99.9	0.0	0.0	0.05	0.00	0.80	21.59	66.02	11.53	0.00	0.00	0.00	0.00	0.00	0.00	2.38	0.60
WP-3	0.0	85.7	8.9	5.4	0.02	0.12	0.27	2.10	53.42	29.79	8.92	0.00	0.00	5.35	0.00	0.00	3.21	1.24
WP-4	0.0	100.0	0.0	0.0	0.00	0.11	0.66	24.60	63.66	10.98	0.00	0.00	0.00	0.00	0.00	0.00	2.35	0.61
WP-5	0.0	100.0	0.0	0.0	0.00	0.00	0.23	11.86	70.33	17.58	0.00	0.00	0.00	0.00	0.00	0.00	2.55	0.55
WP-6	0.0	91.9	8.1	0.0	0.00	0.04	0.12	7.84	63.27	20.65	8.08	0.00	0.00	0.00	0.00	0.00	2.79	0.73
WP-7	0.2	35.4	33.9	30.5	0.24	0.95	0.54	2.24	12.43	19.24	10.16	10.16	10.16	3.39	3.39	27.10	5.81	2.78
WP-8	0.2	99.8	0.0	0.0	0.22	0.61	4.63	73.72	20.06	0.77	0.00	0.00	0.00	0.00	0.00	0.00	1.65	0.55

APPENDIX C - DISPOSAL AREA SEDIMENT TEST RESULTS

Boring No. : STA 1 Sample No.: Ninigret East Test Method ASTM D 422 Filename : NINEAST1	Project : Rhode Island Feasibility Project No.: GTX-3188 Location: Rhode Island Date : Mon Nov 13 2000



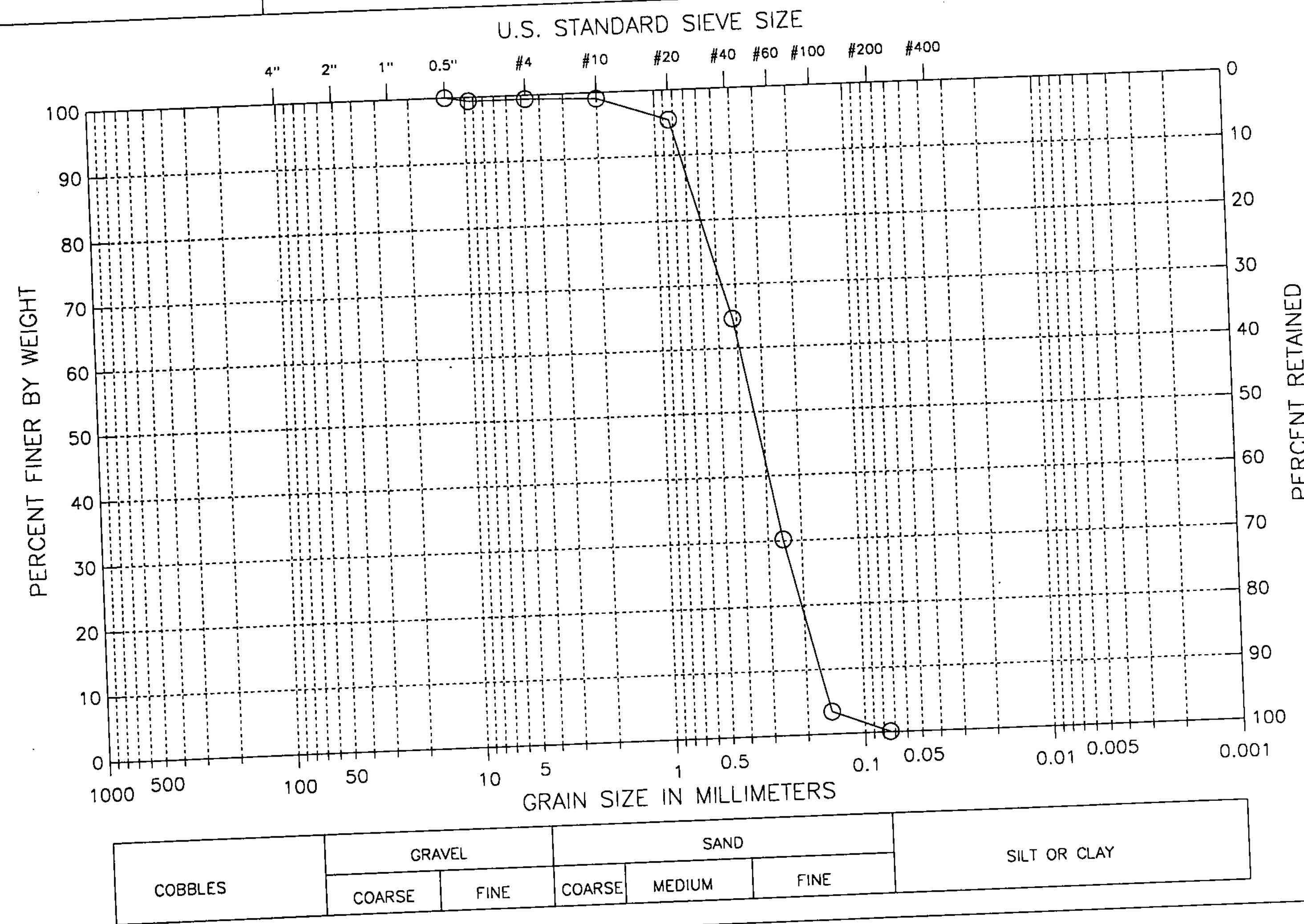
Classification :
(SP) Poorly graded sand

Visual Description :
Moist, olive brown/reddish sand

Remarks :
Ninigret East STA 1

Figure 1

	Boring No. : STA 2 Sample No.: Ninigret East Test Method ASTM D 422 Filename : NINEAST2	Project : Rhode Island Feasibility Project No.: GTX−3188 Location: Rhode Island Date : Mon Nov 13 2000

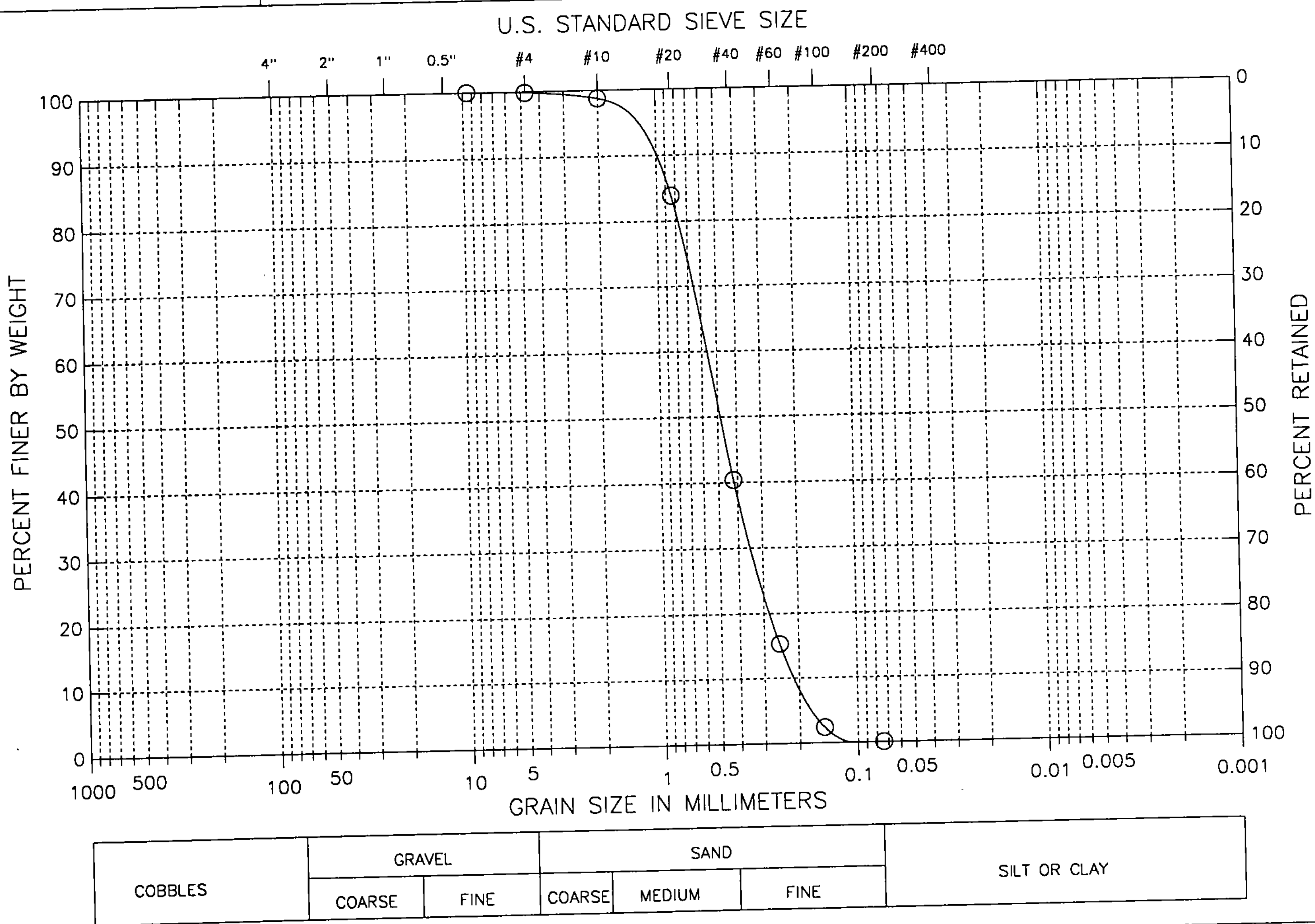


Remarks :
Ninigret East STA 2

Classification :
(SP) Poorly graded sand
Visual Description :
Moist, grayish brown sand

Figure 2

Boring No. : STA 3 Sample No.: Ninigret East Test Method ASTM D 422 Filename : NINEAST3	Project : Rhode Island Feasibility Project No.: GTX-3188 Location: Rhode Island Date : Mon Nov 13 2000

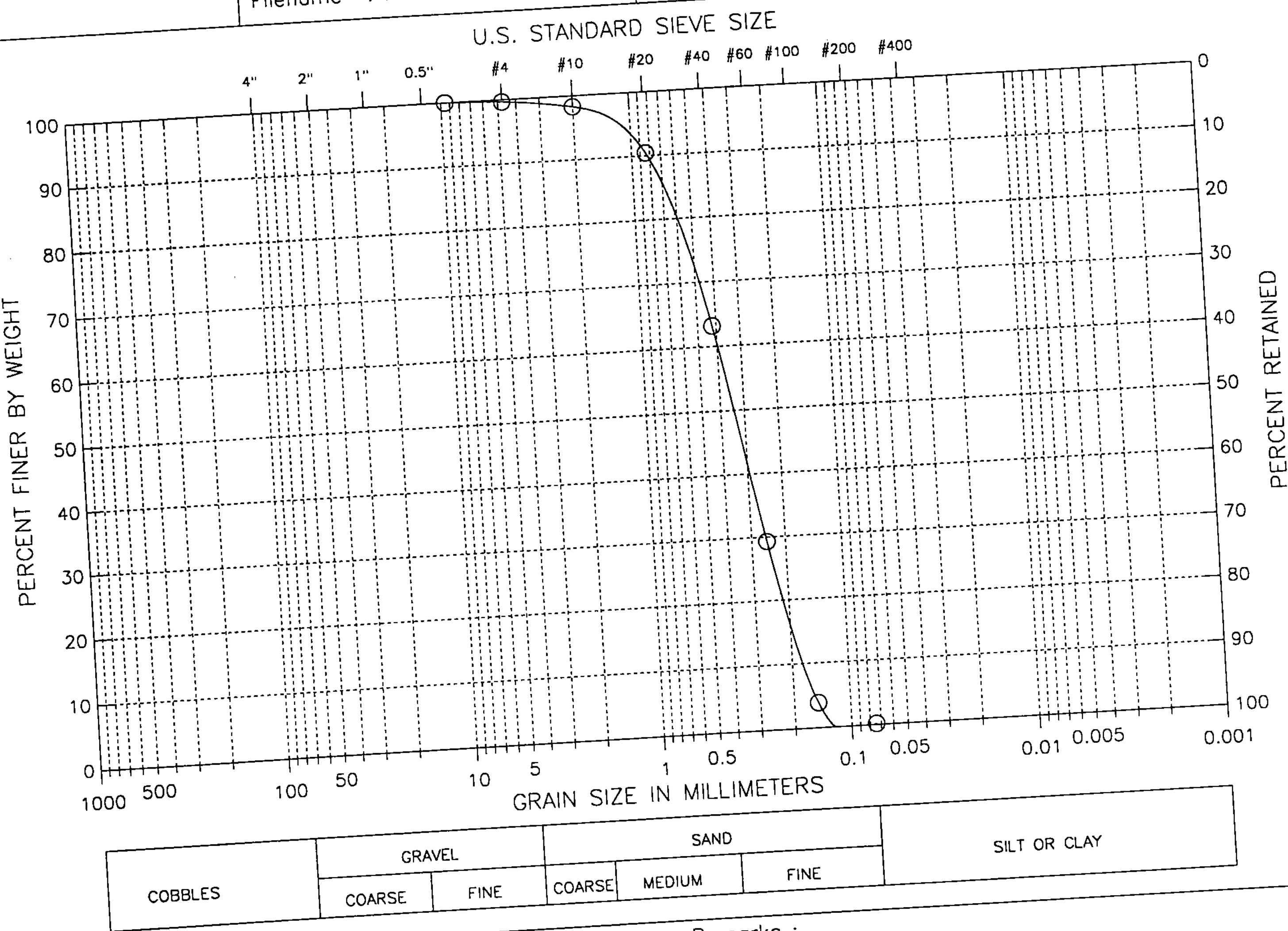


Classification :
(SP) Poorly graded sand
Visual Description :
Moist, light reddish/brownish/gray sand

Remarks :
Ninigret East STA 3

Figure 3

Boring No. : STA 4 Sample No.: Ninigret East Test Method ASTM D 422 Filename : NINEAST4	Project : Rhode Island Feasibility Project No.: GTX-3188 Location: Rhode Island Date : Mon Nov 13 2000

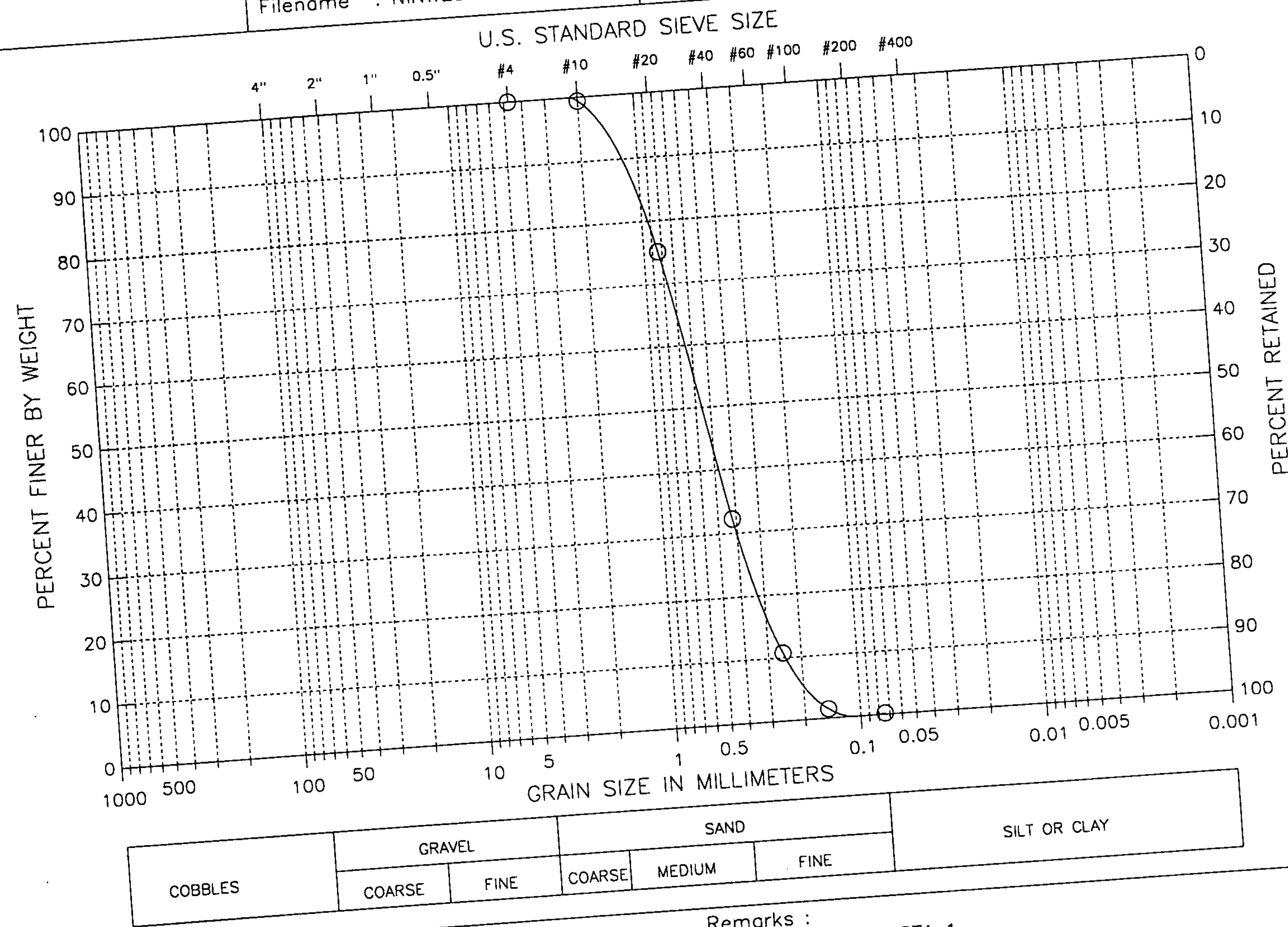


Remarks :
Ninigret East STA 4

Classification :
(SP) Poorly graded sand
Visual Description :
Moist, light brown sand

Figure 4

Boring No. : STA 1 Sample No.: Ninigret West Test Method ASTM D 422 Filename : NINWEST1	Project : Rhode Island Feasibility Project No.: GTX-3188 Location: Rhode Island Date : Mon Nov 13 2000



Remarks :
Ninigret West STA 1

Classification :
(SP) Poorly graded sand
Visual Description :
Moist, light brown/red sand

Figure 5

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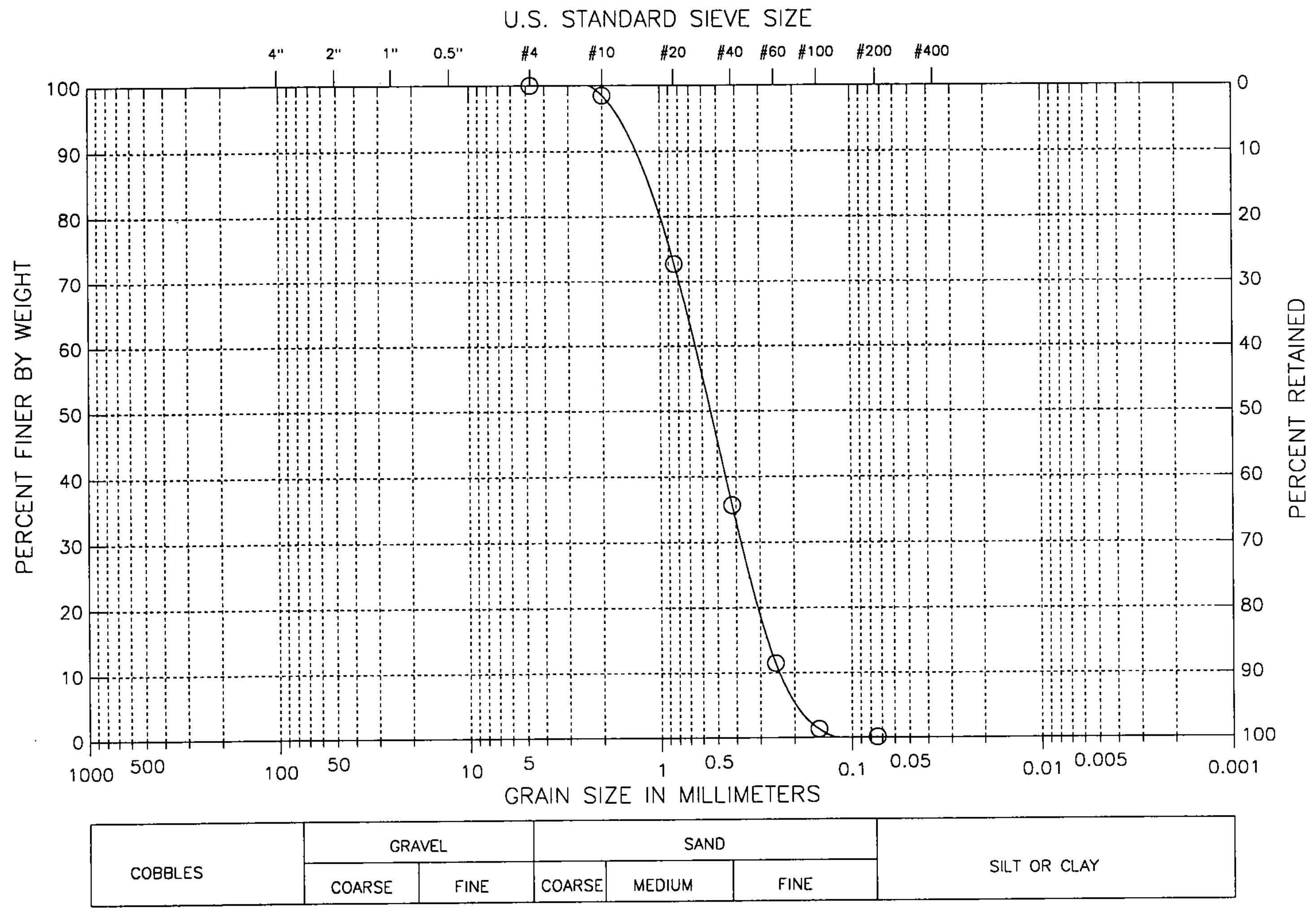
Boring No. : STA 2	Project : Rhode Island Feasibility
Sample No.: Ninigret West	Project No.: GTX-3188
Test Method ASTM D 422	Location: Rhode Island
Filename : NINWEST2	Date : Mon Nov 13 2000

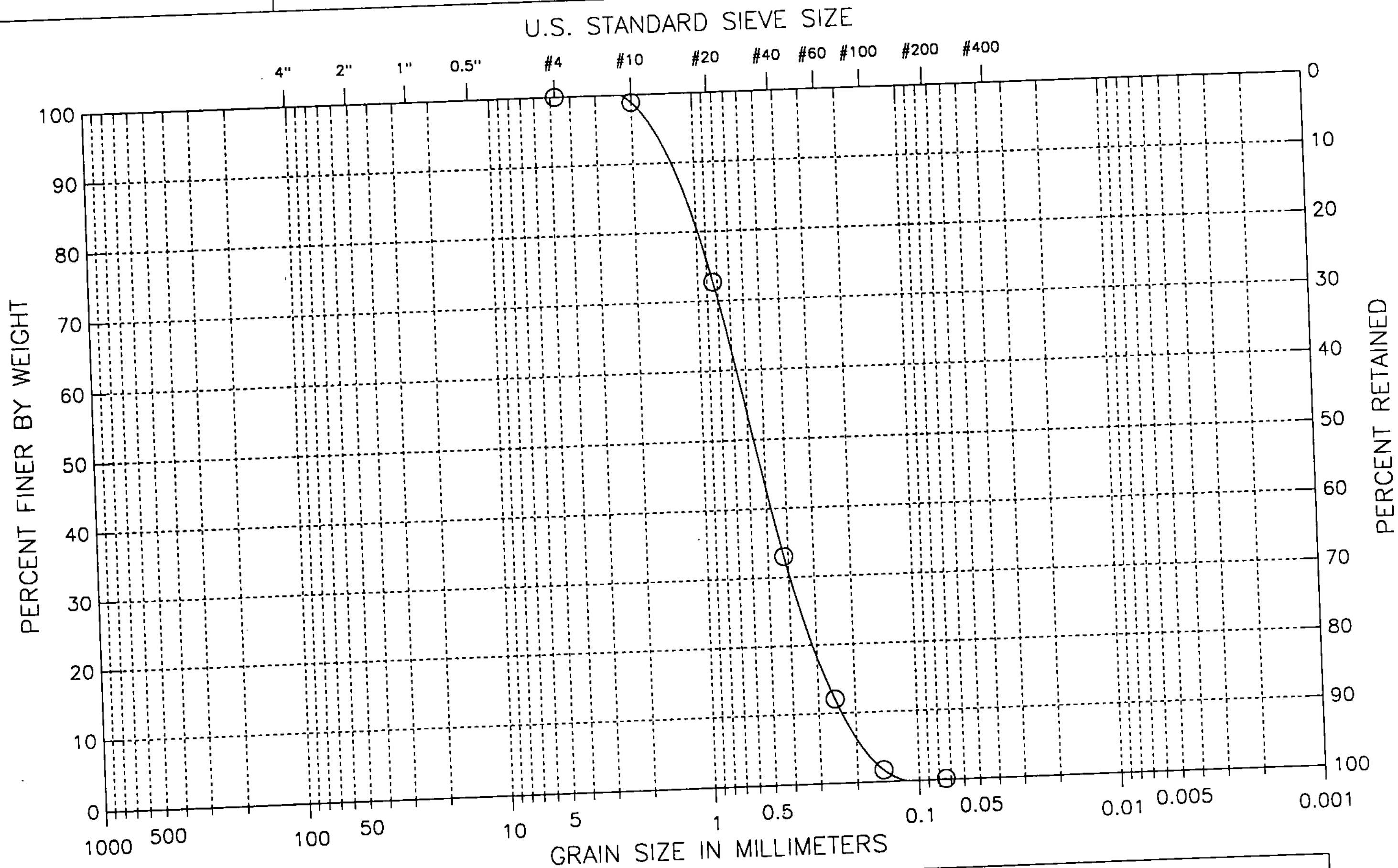


Classification :
(SP) Poorly graded sand
Visual Description :
Moist, brown/red sand

Remarks :
Ninigret West STA 2

Figure 6

Boring No. : STA 3	Project : Rhode Island Feasibility
Sample No.: Ninigret West	Project No.: GTX-3188
Test Method ASTM D 422	Location: Rhode Island
Filename : NINWEST3	Date : Mon Nov 13 2000



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Classification :
(SP) Poorly graded sand

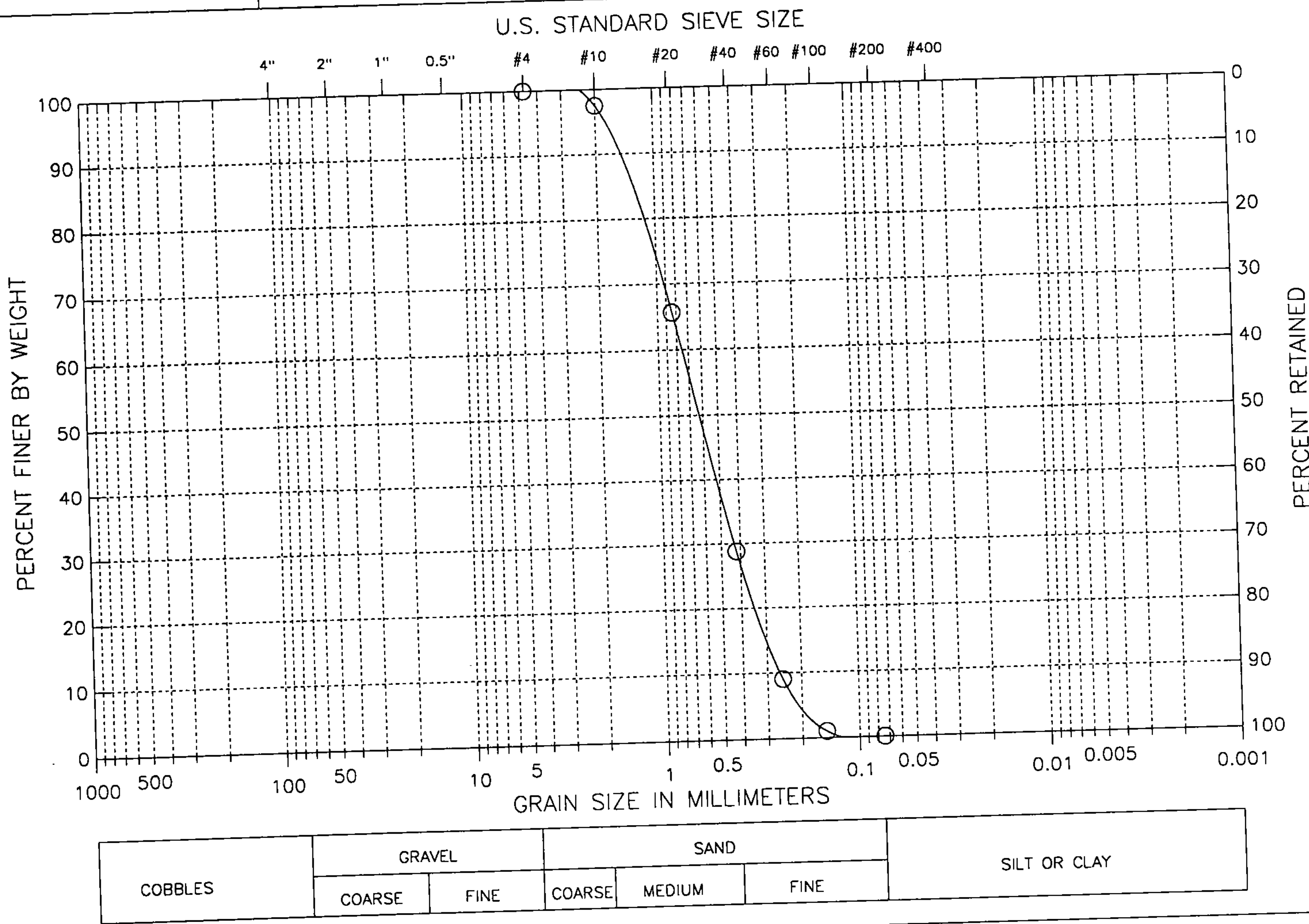
Visual Description :
Moist, light brownish red sand

Remarks :
Ninigret West STA 3

Figure 7

Boring No. : STA 4
Sample No.: Ninigret West
Test Method ASTM D 422
Filename : NINWEST4

Project : Rhode Island Feasibility
Project No.: GTX-3188
Location: Rhode Island
Date : Mon Nov 13 2000

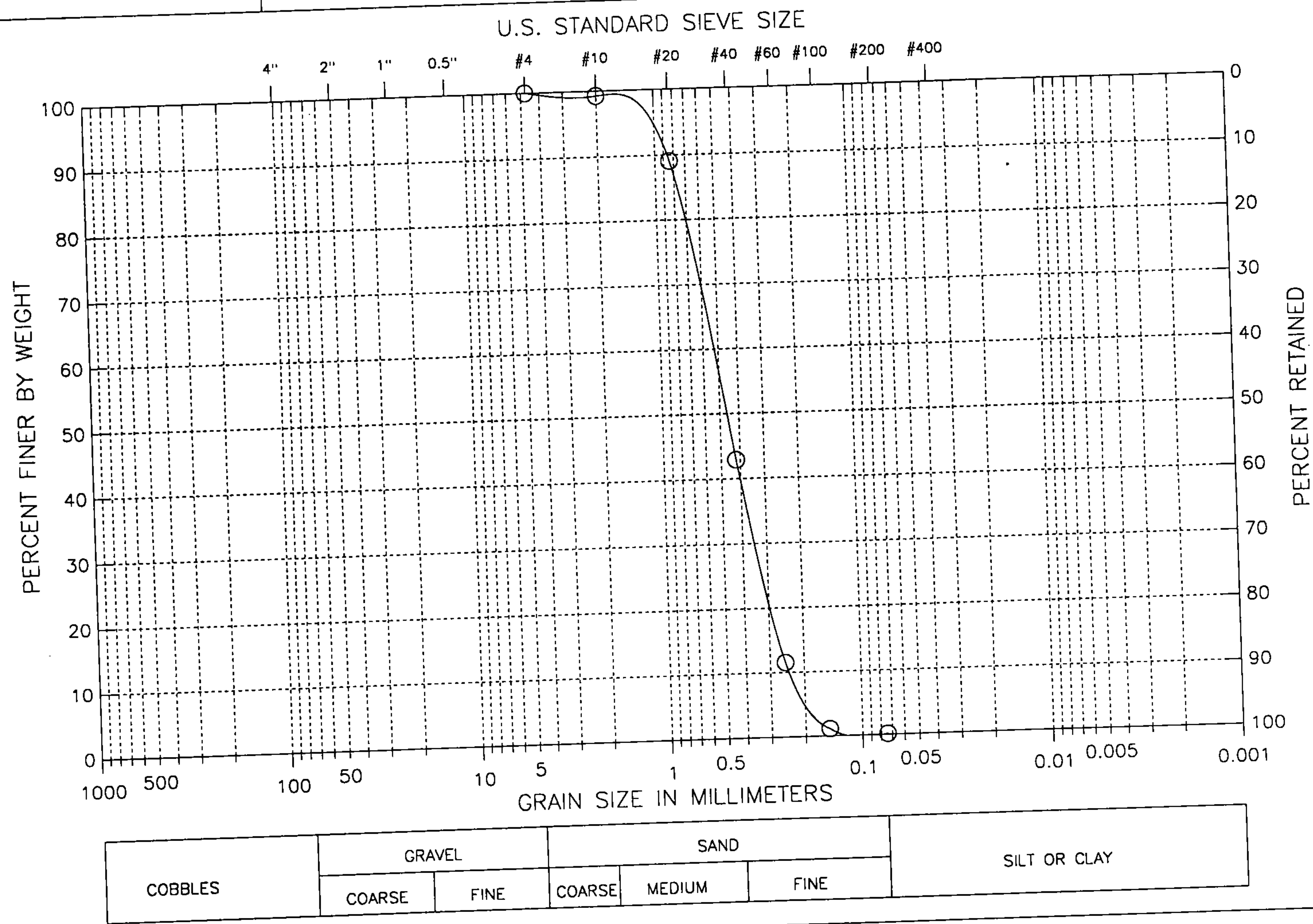


Classification :
(SP) Poorly graded sand
Visual Description :
Moist, light brown sand

Remarks :
Ninigret West STA 4

Figure 8

Boring No. : STA 1	Project : Rhode Island Feasibility
Sample No.: Quonochontaug	Project No.: GTX-3188
Test Method ASTM D 422	Location: Rhode Island
Filename : QUONSTA1	Date : Mon Nov 13 2000

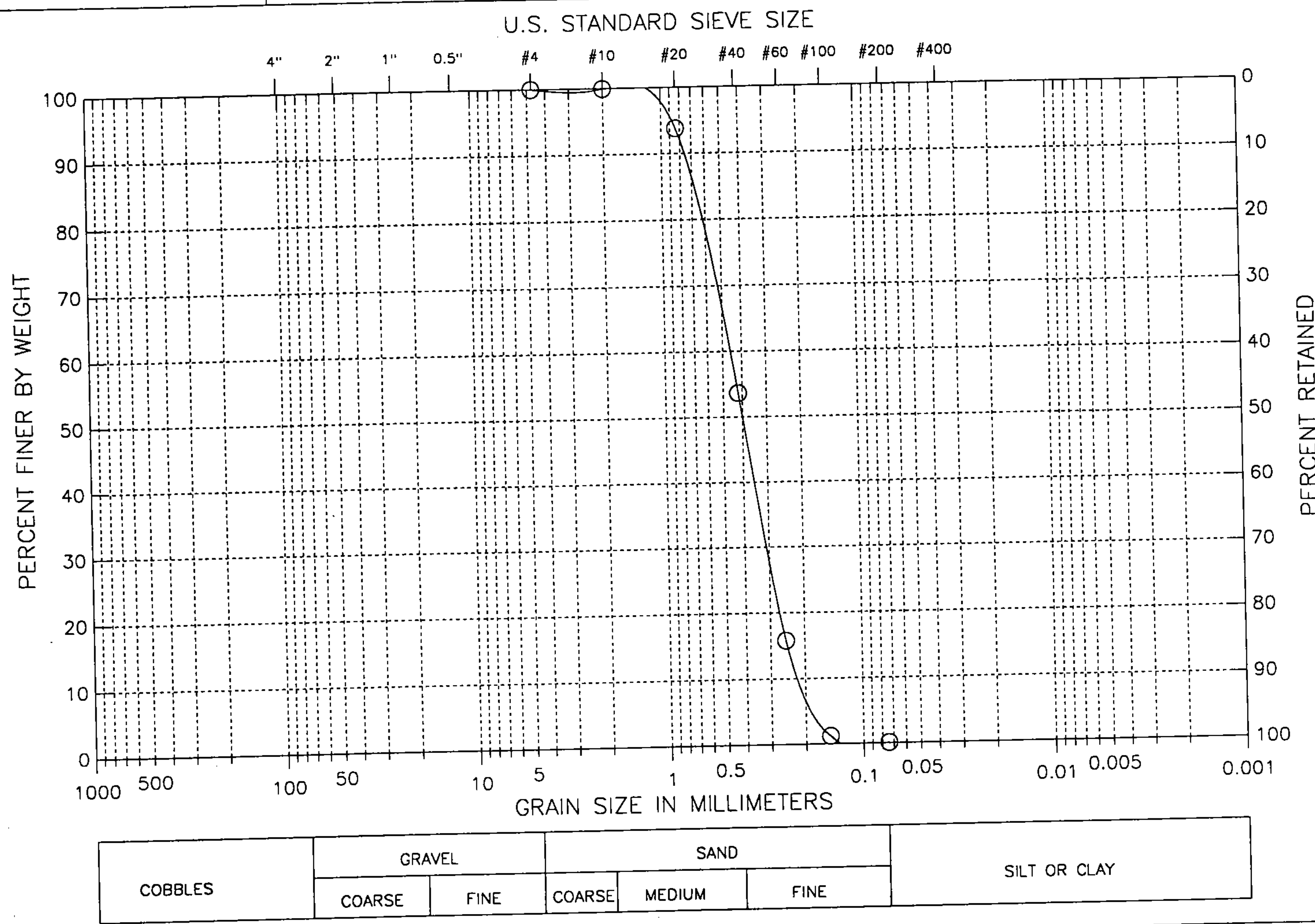


Remarks :
Quonochontaug STA 1

Classification :
(SP) Poorly graded sand
Visual Description :
Moist, brown/light gray/red sand

Figure 9

Boring No. : STA 2 Sample No.: Quonochontaug Test Method ASTM D 422 Filename : QUANSTA2	Project : Rhode Island Feasibility Project No.: GTX-3188 Location: Rhode Island Date : Mon Nov 13 2000



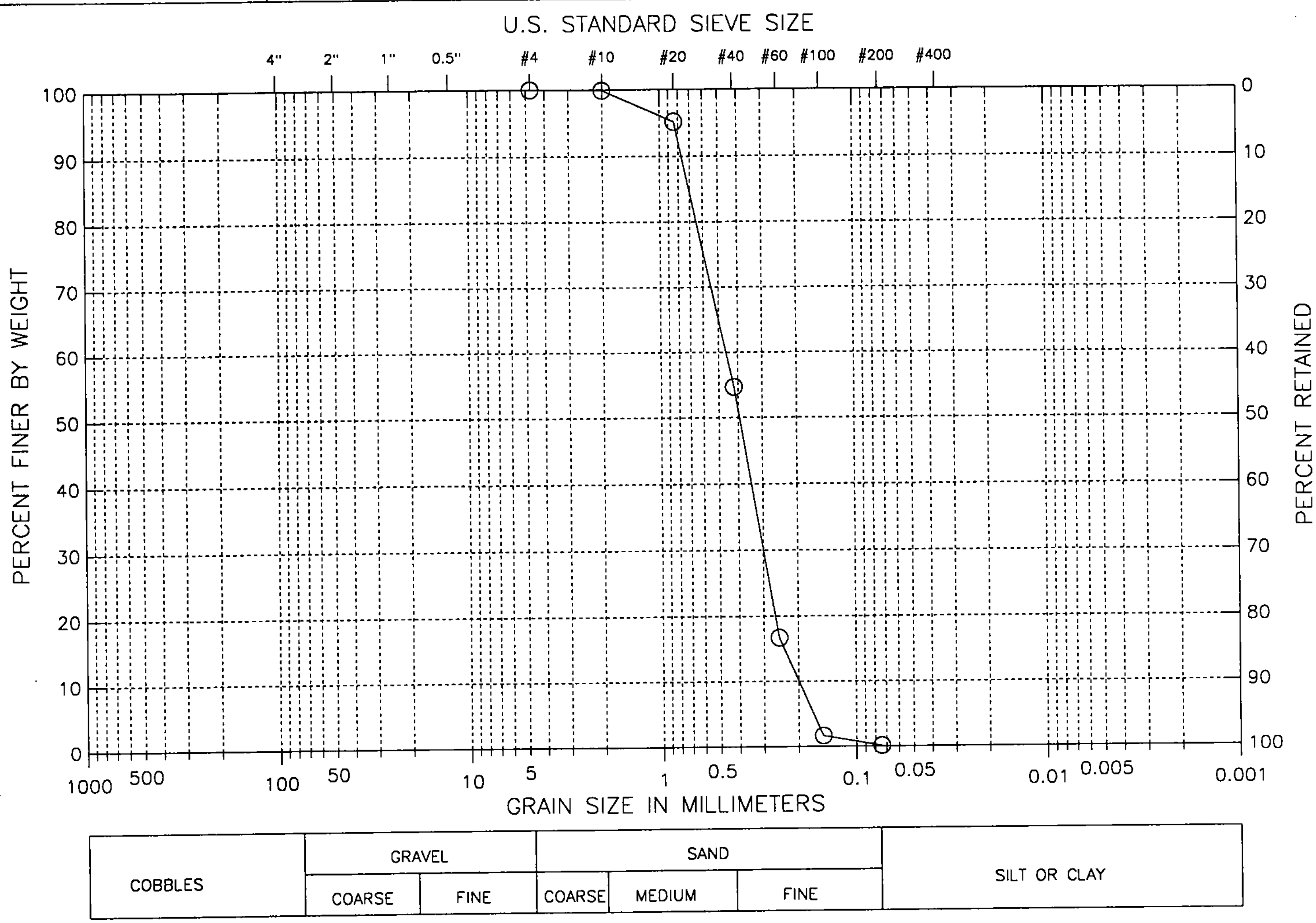
Classification :
(SP) Poorly graded sand

Visual Description :
Moist, light grayish brown/red sand

Remarks :
Quonochontaug STA 2

Figure 10

Boring No. : STA 3 Sample No.: Quonochontaug Test Method ASTM D 422 Filename : QUANSTA3	Project : Rhode Island Feasibility Project No.: GTX-3188 Location: Rhode Island Date : Mon Nov 13 2000



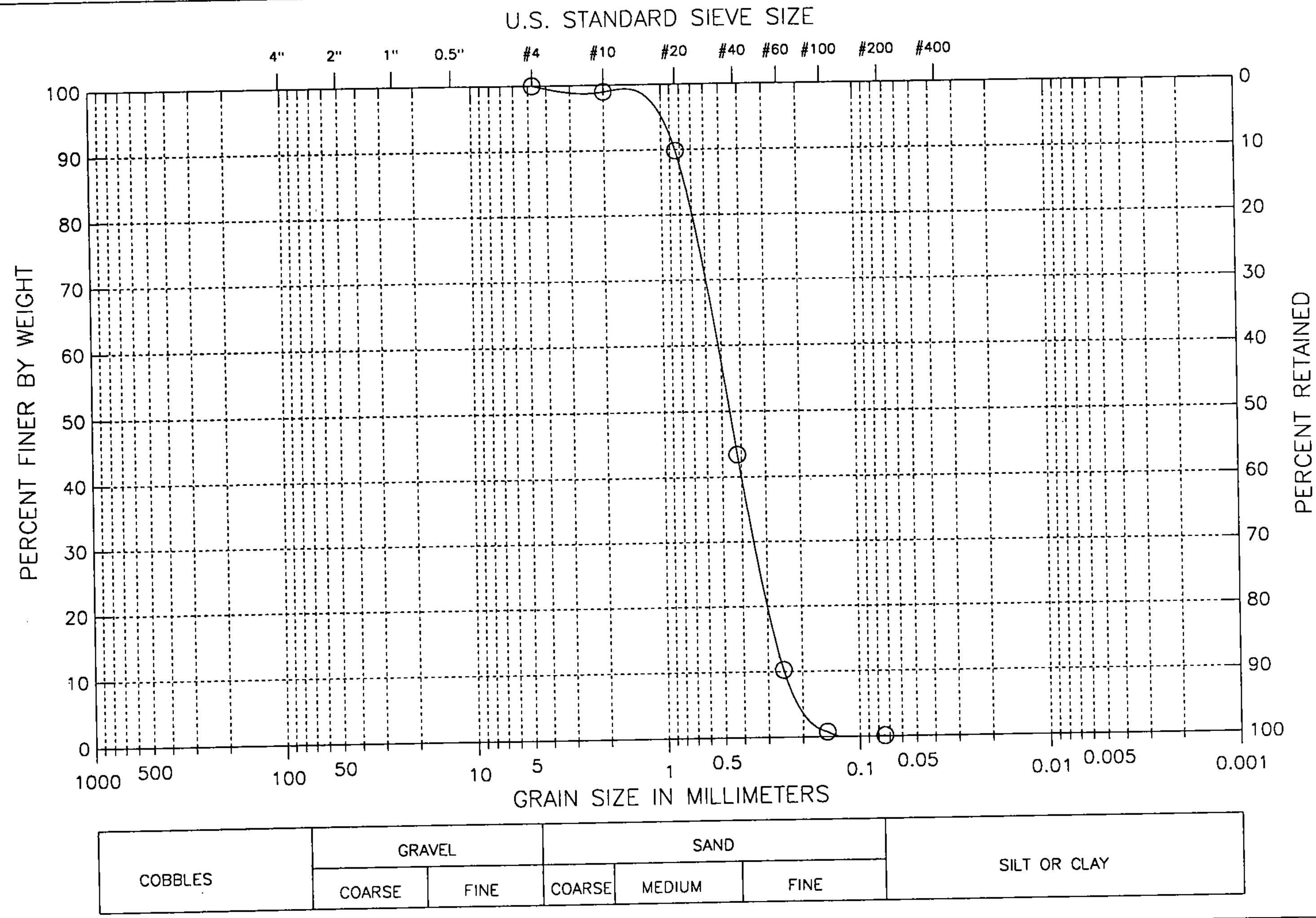
Classification :
(SP) Poorly graded sand

Visual Description :
Moist, light grayish/red sand

Remarks :
Quonochontaug STA 3

Figure 11

Boring No. : STA 4	Project : Rhode Island Feasibility
Sample No.: Quonochontaug	Project No.: GTX-3188
Test Method ASTM D 422	Location: Rhode Island
Filename : QUONSTA4	Date : Mon Nov 13 2000



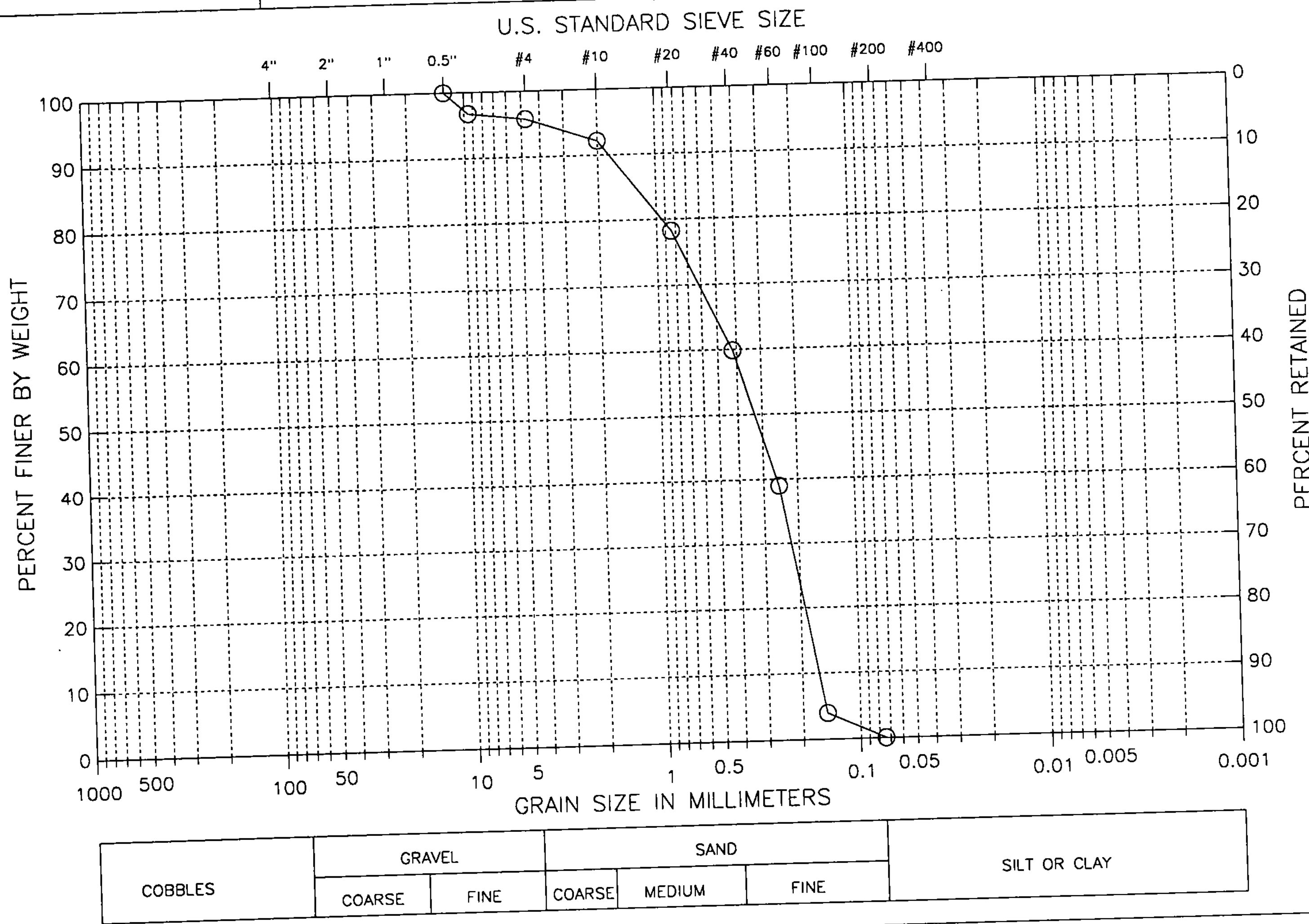
Classification :
(SP) Poorly graded sand

Visual Description :
Moist, light grayish brown/red sand

Remarks :
Quonochontaug STA 4

Figure 12

	Boring No. : STA 1 Sample No.: Winnapaug Test Method ASTM D 422 Filename : WINNSTA1	Project : Rhode Island Feasibility Project No.: GTX-3188 Location: Rhode Island Date : Mon Nov 13 2000



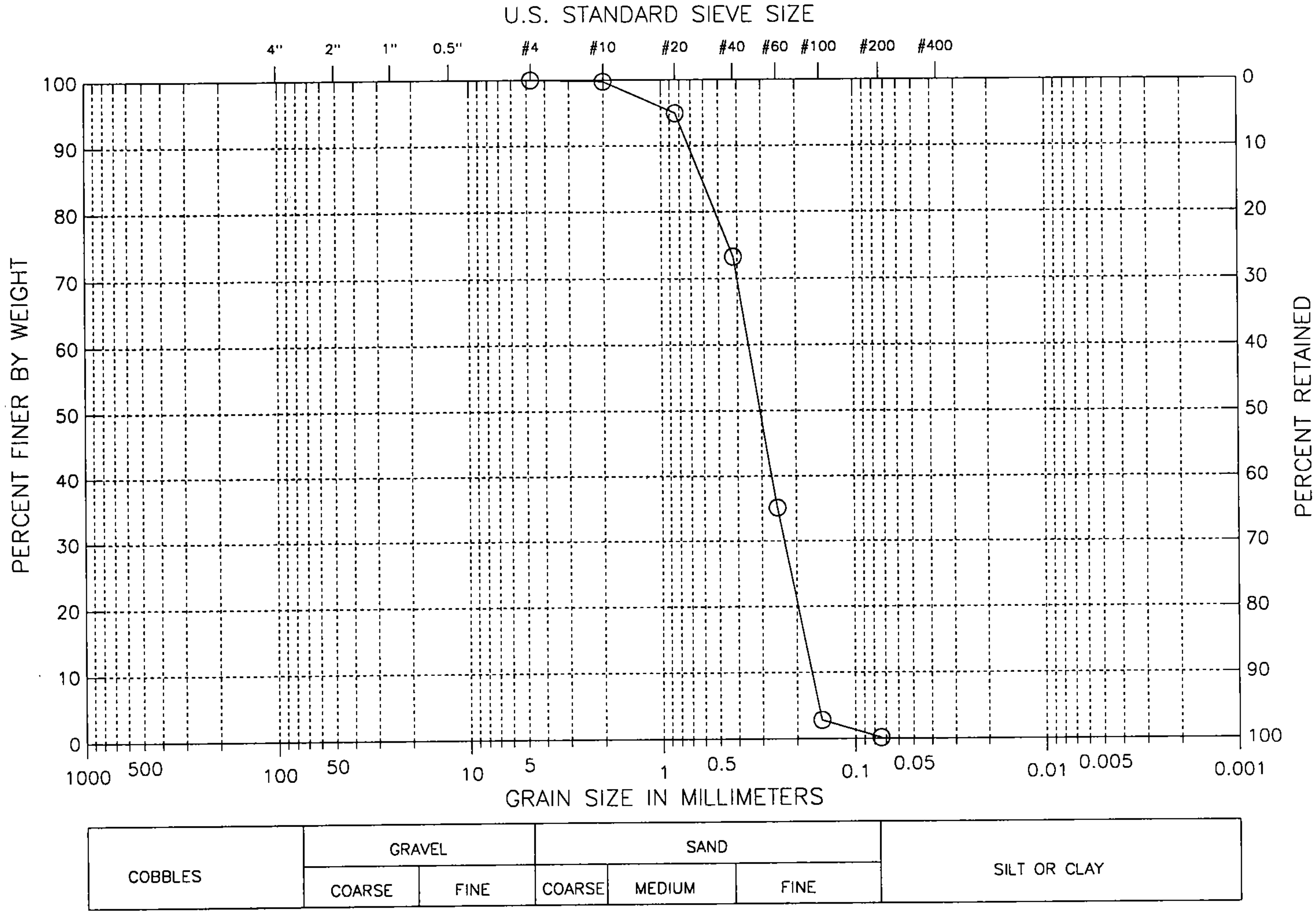
Classification :
(SP) Poorly graded sand

Visual Description :
Moist, olive brown/red sand

Remarks :
Winnapaug STA 1

Figure 13

	Boring No. : STA 2 Sample No.: Winnapaug Test Method ASTM D 422 Filename : WINNSTA2	Project : Rhode Island Feasibility Project No.: GTX–3188 Location: Rhode Island Date : Mon Nov 13 2000

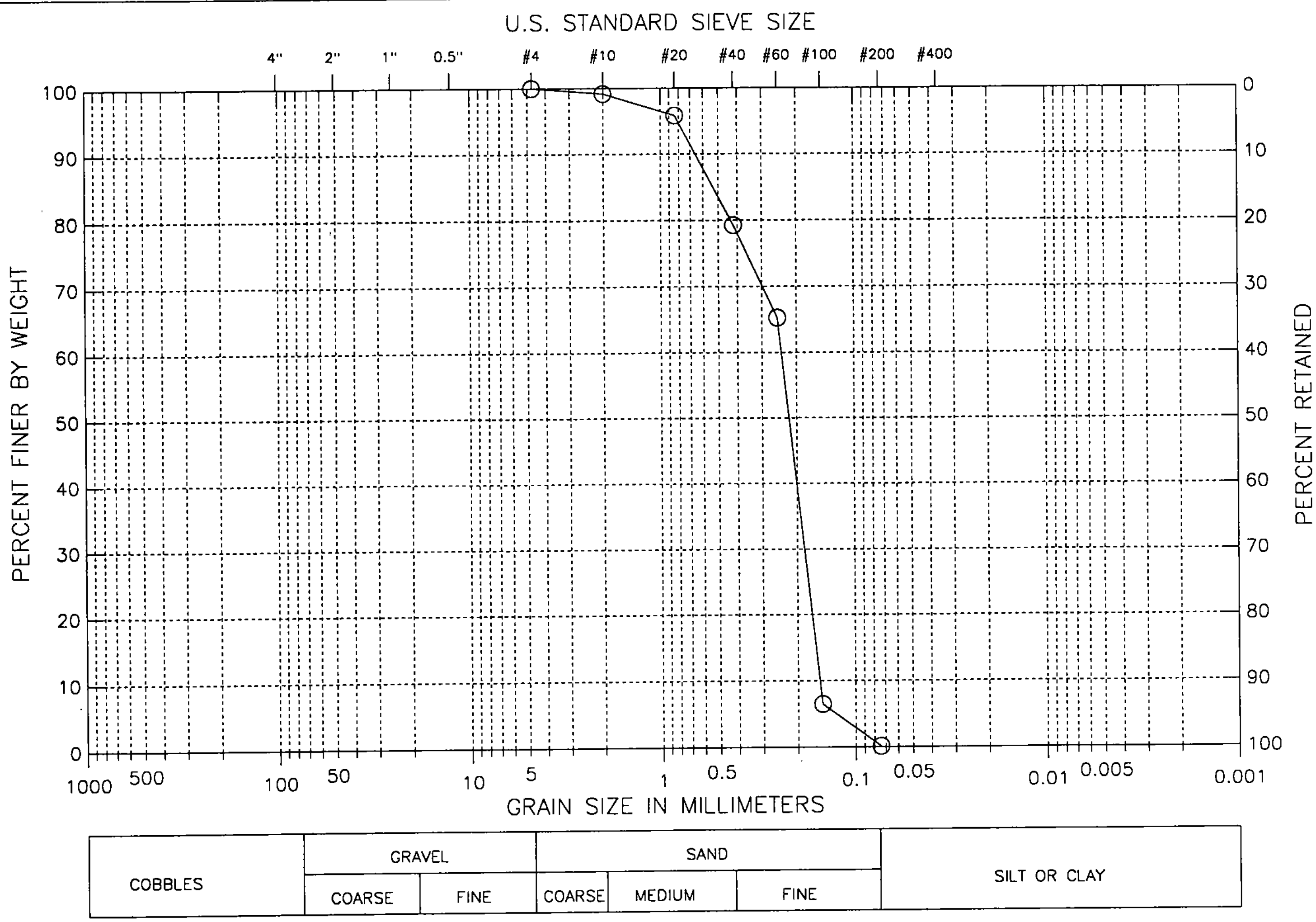


Classification :
(SP) Poorly graded sand
Visual Description :
Moist, light brown/red sand

Remarks :
Winnapaug STA 2

Figure 14

Boring No. : STA 3	Project : Rhode Island Feasibility
Sample No.: Winnapaug	Project No.: GTX-3188
Test Method ASTM D 422	Location: Rhode Island
Filename : WINNSTA3	Date : Mon Nov 13 2000



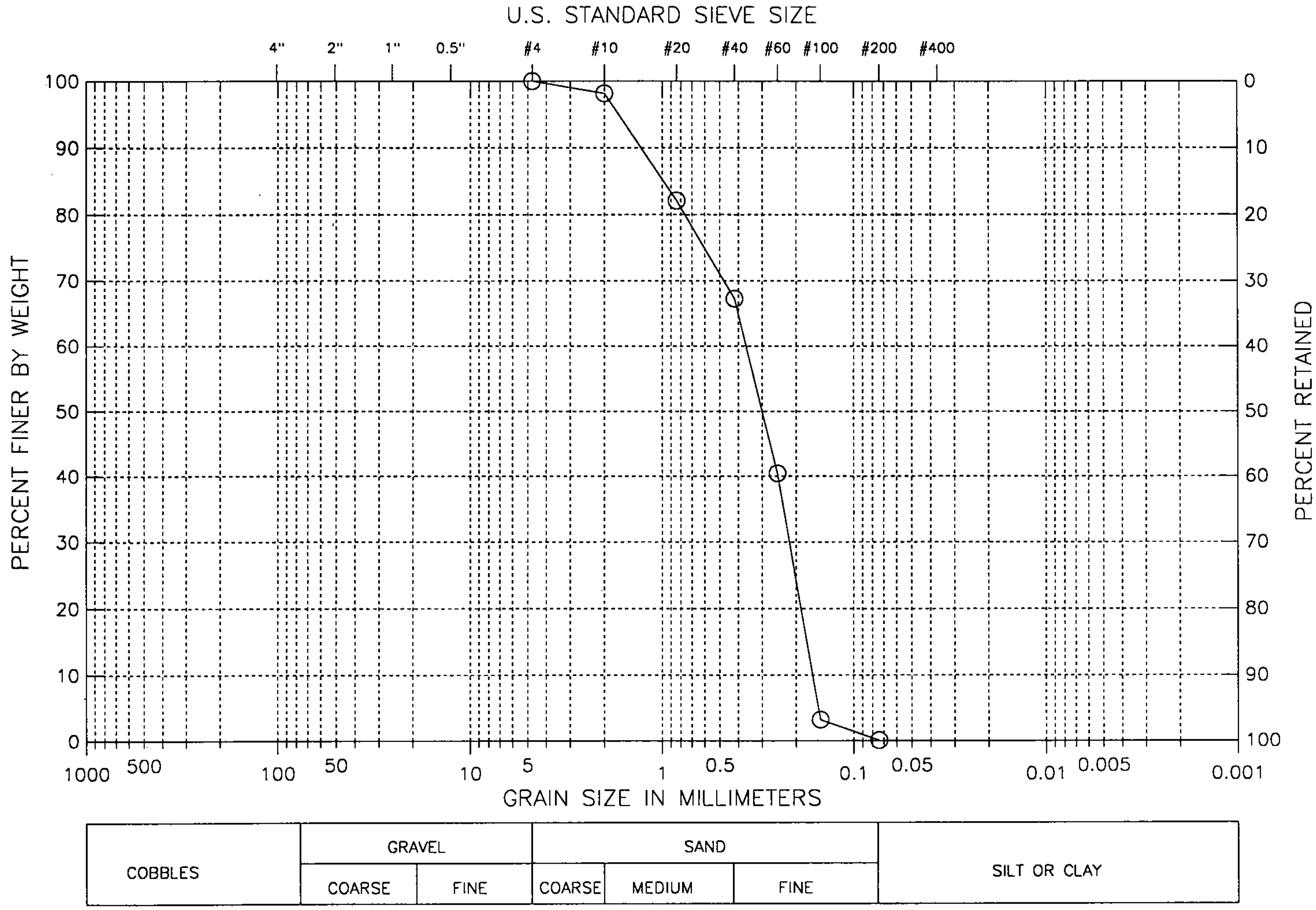
Classification :
(SP) Poorly graded sand

Visual Description :
Moist, light brown/red and light gray sand

Remarks :
Winnapaug STA 3

Figure 15

	Boring No. : STA 4 Sample No.: Winnapaug Test Method ASTM D 422 Filename : WINNSTA4	Project : Rhode Island Feasibility Project No.: GTX-3188 Location: Rhode Island Date : Mon Nov 13 2000



Classification :
(SP) Poorly graded sand
Visual Description :
Moist, light grayish/brown/red sand

Remarks :
Winnapaug STA 4

Figure 16

APPENDIX D – INCREMENTAL ANALYSIS

Incremental Analysis
for
Rhode Island South Coast Feasibility Study
Charlestown and Westerly, Rhode Island

June, 2001

Prepared by:
New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, Massachusetts

Incremental Analysis
For Rhode Island South Coast Feasibility Study
Charlestown and Westerly, Rhode Island

TABLE OF CONTENTS

Incremental Analysis
for
Rhode Island South Coast Feasibility Study
Charlestown and Westerly, Rhode Island

INTRODUCTION

This report documents the incremental analysis performed by the New England District of the Corps of Engineers for the salt pond eelgrass and riverine migratory corridor restoration portions of the Rhode Island South Coast Feasibility Study. The incremental analysis evaluates alternatives for modifying existing habitats on flood tidal shoals at the entrance to Ninigret, Quononchontaug, and Winnapaug Ponds to restore estuarine habitat for fish and wildlife. The restoration sites presently support very little or no eelgrass, which was once plentiful in the vicinity of the existing flood tidal deltas. Restoration of former habitats in the vicinity of the shoals would be accomplished through a combination of selective dredging, re-establishing a sedimentation basin to control future shoaling, and planting eelgrass in the dredged areas.

The purpose of this incremental analysis is to display and evaluate the fish and wildlife habitat benefits and incremental costs of various restoration alternatives. The incremental cost associated with an alternative is the added cost for each additional unit of benefit. The information generated in this analysis will help to identify the best restoration alternatives.

This incremental analysis displays the ecological outputs of alternative plans and compares their marginal costs. Although fish and wildlife resources may have both economic and ecological value, this document focuses on the ecological benefits of the restoration project. Corps of Engineers guidance for performing incremental analyses describes fish and wildlife resources with substantial non-monetary, ecological value as Environmental Quality (EQ) resources. Fish and wildlife resources with substantial commercial and/or recreational value may also be considered National Economic Development (NED) resources.

ENVIRONMENTAL QUALITY OBJECTIVES (MISSION, GOALS, AND OBJECTIVES)

Ninigret, Quononchontaug, and Winnapaug Ponds historically contained extensive eelgrass beds. These habitats were degraded to sandy subtidal and intertidal habitats over time after permanent breachways were constructed to connect the ponds to the ocean. These restoration projects are intended to restore eelgrass habitats in the areas where the shoals are now, and maintain the growth of existing or new eelgrass by intercepting new shoal material as it is moves into the ponds. The project is not intended to restore eelgrass in areas outside those directly affected by the shoals. However, a small improvement in flushing may occur with the project, which could create some minimal improvement in conditions for eelgrass growth in other areas of the pond.

Historically, local residents managed the salt ponds by seasonally opening temporary breachways in order to promote the growth and harvest of certain brackish water resources (e.g., widgeon grass and oysters). During the 1950s, permanent, stabilized openings were constructed in Ninigret, Quonochontaug, and Winnapaug Ponds. The permanent breachways increased the salinity, altering the brackish habitat. The breachways also increased sedimentation rates, resulting in losses of eelgrass habitat. Settling basins, intended to control the rate of shoaling, existed in the Winnapaug and Ninigret Pond breachways at one time. However, the basins have filled with sediment and are no longer functional.

Goals and Objectives

Prior to beginning a restoration project it is important to establish and agree to goals and objectives. These statements form the basis of project design and evaluation and are the basis for developing performance criteria for project monitoring and success. Goals refer to the target characteristics to be restored, such as water quality, hydrology, or wetland flora and fauna. Objectives are more precise, such as the specific characteristics of water quality to be achieved or the species composition of the various communities of biota to be restored. Performance indicators, which are developed as the project progresses and are the basis of the monitoring plan, are specific, measurable quantities such as pH or concentration of chlorophyll in a water sample. The goals and objectives for restoration of the salt pond shoal areas are outlined below. Due to the differences among alternatives considered the goals and objectives are relatively general.

Project Goal

The project goal is to restore the modern historic aquatic habitat of Rhode Island's coastal salt ponds. This includes eelgrass restoration to the flood tidal delta areas of Ninigret, Winnapaug, and Quonochontaug ponds. Eelgrass is a highly recognized marine habitat that has benefits to a variety of species including winter flounder, scallops, crabs, lobsters and other shellfish and finfish communities (e.g., eels). This goal will be achieved by restoring the necessary physical, chemical, and biological conditions to the flood tidal deltas of the coastal salt ponds, while minimizing adverse effects on sensitive resources (e.g., juvenile winter flounder and shorebird feeding habitats).

The aquatic habitat restoration of the Rhode Island coastal ponds also includes restoration of riverine migratory corridors. The specific improvement identified here is the installation of a fish ladder at Cross Mills Pond Brook in the Ninigret Salt Pond. This will restore the migratory spawning corridor for numerous anadromous and catadromous fisheries.

Project Objectives

The objectives supporting this goal are:

1) Restore robust eelgrass densities to the flood tidal shoal areas at Ninigret, Winnapaug, and Quonochontaug ponds.
2) Protect the newly restored eelgrass habitat from future adverse shoaling. This objective includes the benefit of protecting existing eelgrass beds in the ponds as well.
3) Restoration efforts will in all cases minimize impacts to existing winter flounder spawning and nursery habitats as well as shorebird foraging areas.
4) Installation of an Alaskan steeppass fishway will open the Cross Mill Pond brook to fisheries migration and spawning.

UNITS OF MEASUREMENT AND MODELS

Once the project goals and objectives are established, and alternative means of achieving them are formulated, the units of measurement must be determined. More than one unit of measurement may be used in an incremental analysis as long as the same units are used for describing increments addressing a single objective. In many cases, acres can be used as a simple and practical unit of measure.

In the case of the salt pond eelgrass restoration areas, units will be measured by acreage of eelgrass restored. Fish passage value will assume that 1 acre of fish passage restoration will be equal to 0.5 acres of eelgrass restoration. This allows an incremental comparison of the ecological benefits.

The model used to evaluate existing and alternative eelgrass habitats was the “Eelgrass Growth Simulation Model” developed by Dr. Fred Short of the Jackson Estuarine Research Laboratory of the University of New Hampshire.

ENVIRONMENTAL PLAN INCREMENTS

Three alternatives have been identified for achieving the project goal and that allow the study team to incrementally evaluate and display the benefits of various project options. The alternatives are the same for each salt pond under consideration.

Alternative 1. No Action Alternative/Future Without Project Conditions

Evaluation of a No Action Alternative is a requirement of the National Environmental Policy Act (NEPA) and Corps of Engineers policy. It allows the project team to make its decisions considering likely future conditions without the project. The No Action Alternative involves making no change to the shoal areas or the influx of sand into the ponds or the fisheries migration passage.

The benefits of all other alternatives are measured against the future without project conditions. This alternative would occur if none of the parameters that we can change with the project will create conditions that will allow eelgrass growth and survival, anadromous fisheries migration, or if no action is the preferred alternative due to cost or impacts of the other alternatives.

Under the No Action Alternative, the existing eelgrass and associated shellfish, plant, and animal communities and current fisheries migrations will experience various rates of decline until the shoal and associated environmental conditions achieve some equilibrium. Eelgrass growth models for Ninigret and Quonochontaug Ponds predict that if the no action alternative is selected, eelgrass in the areas surrounding the shoals will persist for a limited time with low to moderate growth and may eventually be eliminated by sedimentation (Short, 2001). No eelgrass is currently present in Winnapaug Pond. Therefore, the no action alternative would allow this condition to persist. Additionally, no improvements in fisheries migration and spawning would occur.

Alternative 2. Construct sedimentation basin

Constructing a sedimentation basin in the breachway of each pond will (if properly maintained) substantially reduce shoaling in the ponds. Though this alternative does not restore eelgrass habitat to the shoal areas, it does prevent the future loss of existing eelgrass beds adjacent to them.

Alternative 3. Plant eelgrass on existing shoal area and construct sedimentation basin

Under this alternative, eelgrass would be planted on the shoal and a sedimentation basin would be constructed in the breachway of each pond to reduce sedimentation. The benefits to be gained include the restoration of eelgrass habitat to the flood tidal shoals as well as the protection of the eelgrass restored. The sedimentation basin would also substantially reduce shoaling in the ponds (if properly maintained) and subsequently reduce the amount of existing eelgrass that is lost each year.

Research into existing conditions and parameters affecting eelgrass and other habitat values indicates that depth will affect eelgrass growth. The eelgrass site selection model used in this investigation (Short, 2001) found that planting eelgrass at depths less than half a meter will not be effective due to the physical effects (e.g., photoinhibition, waves, sedimentation) of the shallow depths of the shoals.

Alternative 4. Dredge the shoal, construct the sedimentation basin, and plant eelgrass

Under Alternative 4, the shoal would be dredged to increase the depth of the overlying water, eelgrass would be planted on the deepened shoal area, and a sedimentation basin would be constructed to reduce sedimentation.

Benefits would be generated by substantially reducing sedimentation in the ponds (benefit for both newly established and existing eelgrass beds) and deepening the shoal area to ensure that grass growth is maximized. The optimum dredging depth was based on the maximum growth (biomass) expected at a particular depth as determined by the eelgrass growth model (Short, 2001).

Alternatives 2, 3, and 4 with Fish Passage Restoration

The above alternatives (2-4) will each be examined with the addition of the fishway installation.

DISPLAY OF BENEFITS AND COSTS

Incremental Cost Curve

In this section, the costs of the alternative restoration plans are compared with the environmental benefits, within the framework of an incremental cost analysis, to display the most cost effective alternatives. An incremental cost analysis examines how the costs of additional units of environmental output increase as the level of environmental output increases. For this analysis, the environmental outputs are measured in habitat units. The analysis is in accordance with IWR Report 95-R-1, Evaluation of Environmental Investments Procedures Manual-Interim: Cost Effectiveness and Incremental Cost Analyses, May 1995; and ER 1105-2-100, Planning Guidance Notebook, Section 3-5, Ecosystem Restoration, April 2000. The program IWR-PLAN, developed for the Institute for Water Resources (IWR), was used to conduct the analysis.

An incremental cost curve can be identified by displaying cost effective solutions. Cost effective solutions are those increments that result in same output, or number of habitat units, for the least cost. An increment is cost effective if there are no others that cost less and provide the same, or more, habitat units. Alternatively, for a given increment cost, there will be no other increments that provide more habitat units.

Management plans to improve environmental conditions include sedimentation basin construction, shoal dredging, and planting of eelgrass at three sites. The sites are Ninigret Pond, Quonochontaug Pond, and Winnapaug Pond. Site locations, project costs, and the number of habitat units, or acres, created by each plan are shown in Table 1. The costs shown in Table 1 are planning level estimates and are for comparative purposes only. Basin construction costs include initial dredging and maintenance. Costs are discounted at an interest rate of 6 3/8 %. This interest rate, as specified in the Federal Register, is to be used by Federal agencies in the formulation and evaluation of water and land resource plans for the period October 1 2000 to September 30 2001. The project economic life is considered to be 25 years.

Table 1. Plan Increments.

Designation	Alternative	Total Cost ($000)	HU (Acres)	Average Cost ($000)
A0	No Lower Basin Project at Ninigret	0.0	0.0	
A1	Construct Lower Basin at Ninigret	1,236.8	11.5	107.8
B0	No Lower Basin and Dred/Planting Project at Ninigret	0.0	0.0	
B1	Construct Lower Basin and Dredge/Plant at Ninigret	2,126.4	21.6	98.4
B2	Construct Lower Basin and Dredge/Plant at Ninigret	2,915.6	31.7	91.9
B3	Construct Lower Basin and Dredge/Plant at Ninigret	3,732.3	41.9	89.1
C0	No Construction of Both Basins	0.0	0.0	
C1	Construct Both Basins at Ninigret	1,642.3	15.0	109.5
D0	No Basin Construction and Dredge/Planting at Ninigret	0.0	0.0	
D1	Construct Both Basins and Dredge/Plant at Ninigret	2,504.4	28.3	88.6
D2	Construct Both Basins and Dredge/Plant at Ninigret	3,321.1	41.5	80.0
D3	Construct Both Basins and Dredge/Plant at Ninigret	4,137.8	54.8	75.6
E0	No Fish Passage at Ninigret	0.0	0.0	
E1	Construct Fish Passage at Ninigret	269.0	10.0	26.9
F0	No Basin at Quonochontaug	0.0	0.0	
F1	Construct Basin at Quonochontaug	920.3	3.1	298.0
G0	No Construction and Dredge/Planting at Quonochontaug	0.0	0.0	
G1	Construct Basin and Dredge/Plant at Quonochontaug	1,325.8	7.7	172.5
H0	No Basin and Planting at Winnapaug	0.0	0.0	
H1	Construct Basin and Plant at Winnapaug	955.7	1.6	598.4
I0	No Basin, Dredging and Planting at Winnapaug	0.0	0.0	
I1	Construct Basin, Dredge and Plant at Winnapaug	1,825.9	10.7	171.4

Column 1 shows increment designators. Each letter represents a management plan. The number represents the plan activity level. Plan A is the construction of the lower basin at Ninigret Pond. Plan B is the construction of the lower basin along with dredging the shoal and planting at Ninigret. Besides the no project, three activity levels are evaluated corresponding to 1/3, 2/3 and the entire shoaled area. Plan C is the same as Plan A, except that the upper basin would also be excavated. Plan D is the same as Plan B, only includes both upper and lower basins. Plan E is the construction of a fish passage. Plan F is the construction of a sedimentation basin at Quononchontaug Pond. Plan G calls for shoal dredging and planting along with basin construction.   Plan H is the construction of a sedimentation basin and planting at Winnapaug Pond. Plan I would add shoal dredging and planting to basin construction at Winnapaug. There are three sites being evaluated both individually and in combination with each other. Plans A, B, C, and D cannot be combined as they are mutually exclusive. However, they can be combined with E, F, G, H and I. Plans F and G are mutually exclusive, but they can be combined with Plans A, B, C, D, E, H and I. Likewise, Plans H and I cannot be combined with each other, but can be combined with Plans A, B, C, D, E, F, and G. Thus, including no project increments, there are

162 actual combinations being evaluated. A brief plan description is shown in column 2. Project cost and the number of habitat units created by the plan, acres of eelgrass, are shown in columns 3 and 4, respectively. Column 5 shows the average cost, or cost per habitat unit.

Figure 1 shows all cost effective plans and best buy plans. There are 17 cost effective plans. In Figure 1, alternatives are arrayed along the horizontal axis by increasing number of habitat units with corresponding plan cost shown on the vertical axis. Figure 2 shows best buy plans which are the incremental cost curve. As in Figure 1, the horizontal axis represents habitat units created by each project, or plan. However, the vertical axis represents the incremental cost per incremental output as output increases with project size. Best buy plans are a subset of cost effective plans. For each best buy plan there are no other plans that will give the same level of output at a lower incremental cost. There are 5 best buy plans.

Increments that comprise the best buy plan curve are described in Table 2. This is the incremental cost curve which is the desired result. Incremental cost and incremental output are the changes in cost and output when the cost and output of each successive plan in terms of increasing output are compared. Incremental cost per output is the change in cost divided by the change in output, or incremental output, when proceeding to plans with higher output. Table 2 shows incremental cost, incremental output and incremental cost per incremental output.

Figure 1

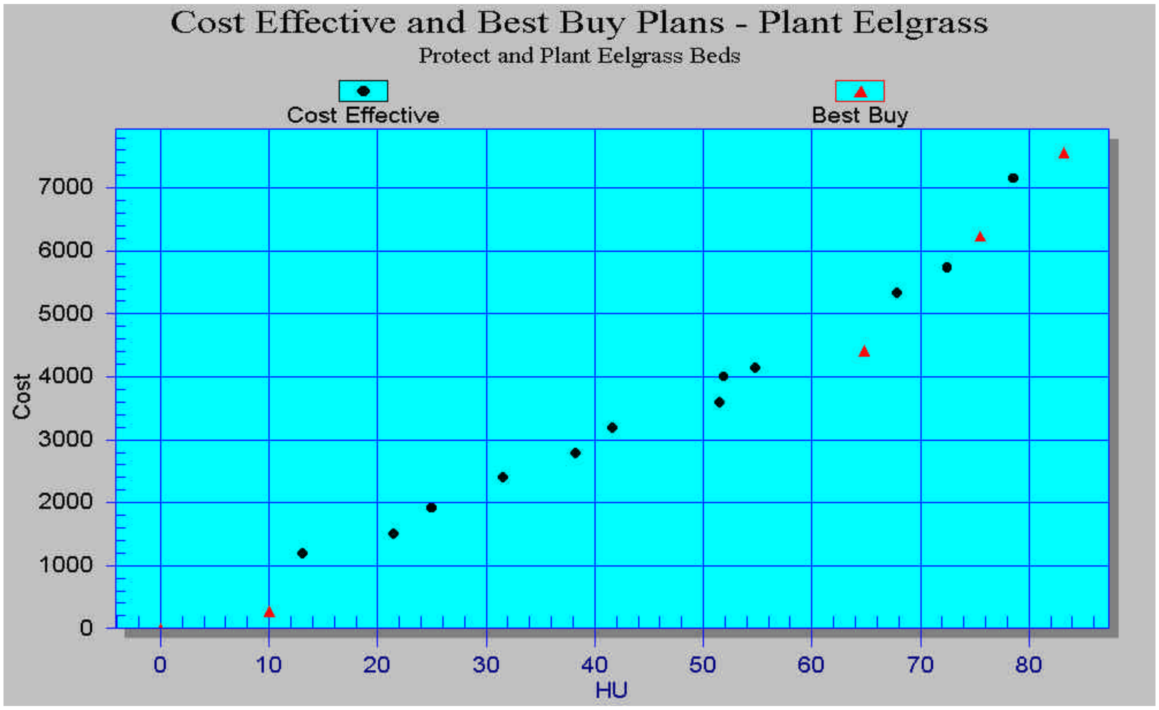


Figure 2

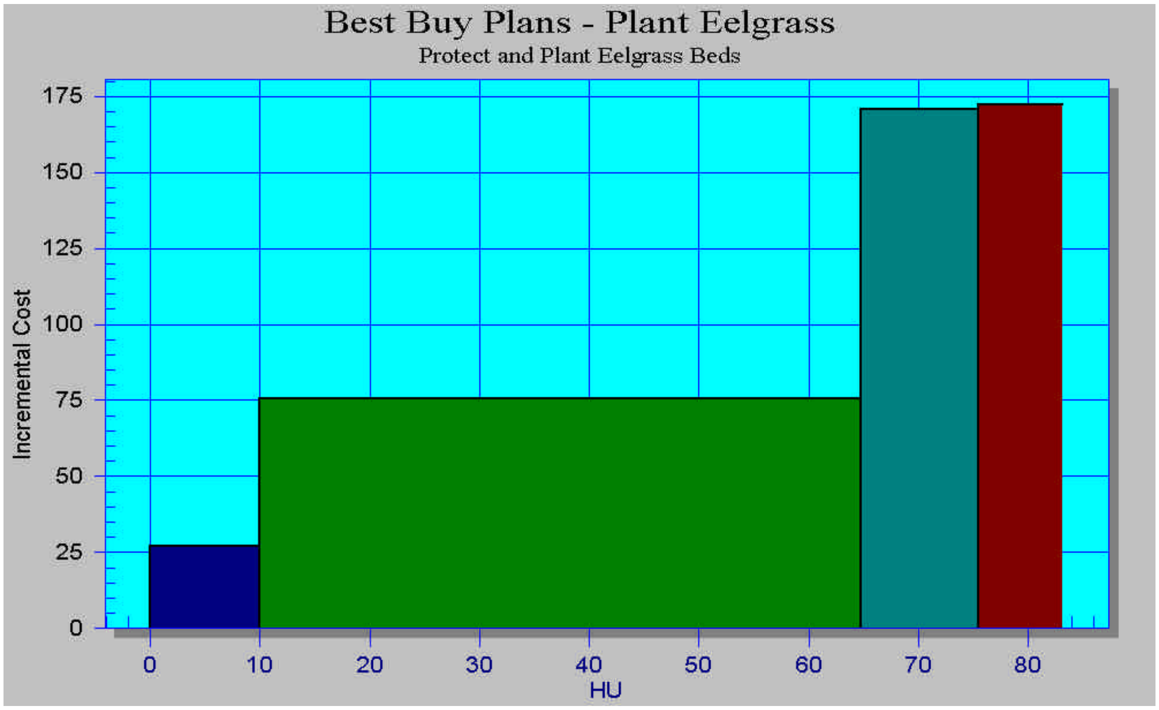


Table 2. Incremental Cost Curve Best Buy Plans.

Description	HU	Cost	Avg. Cost	Inc. Cost	Inc. Output	Inc. Cost
	(acres)	($000)	($000/acre)	($000)	(acres)	per Output
No Project						
A0 B0 C0 D0 E0 F0 G0 H0 I0	0.0	0.0	0.0	0.0	0.0	0.0
A0 B0 C0 D0 E1 F0 G0 H0 I0	10.0	269.0	26.9	269.0	10.0	26.9
A0 B0 C0 D3 E1 F0 G0 H0 I0	64.8	4,406.8	68.0	4,137.8	54.8	75.5
A0 B0 C0 D3 E1 F0 G0 H0 I1	75.5	6,232.7	82.6	1,825.9	10.7	170.6
A0 B0 C0 D3 E1 F0 G1 H0 I1	83.2	7,558.5	90.8	1,325.8	7.7	172.2

In the incremental cost curve shown above in Table 2 and in Figure 2, incremental cost per unit increases with output, or habitat units. Development of the incremental cost curve facilitates the selection of the best alternative. The question that is asked at each increment is: is the additional gain in environmental benefit worth the additional cost? The first 10 acres have an incremental cost of $26,900 per acre. This increment would consist of fish passage construction at Ninigret Pond. The second increment would increase eelgrass acreage by 54.8 acres and has an incremental cost of $75,500 per acre. This plan would consist of construction of two sediment basins, shoal dredging and planting of eelgrass at Ninigret Pond, in addition to the construction of a fish passage. The third increment would increase acreage by 10.7 with a cost of $170,600 per acre. This plan would add to the previous increment basin construction, dredging and eelgrass planting at Winnapaug Pond. The fourth, and final, increment would add to previous increment basin construction, dredging and planting at Quonochontaug Pond. This plan would add an additional 7.7 acres of eelgrass at an incremental cost of $172,200 per acre.

RECOMMENDATIONS

The locally preferred plan is to construct only a lower basin at Ninigret Pond along with dredging the shoal and planting eelgrass. Although this plan is not a best buy plan, if Ninigret Pond, Quonochontaug Pond, and Winnapaug Pond are considered to be separate projects, the locally preferred plan is cost effective. This plan would range in cost from $2,126,400 to $3,732,300 over the life of the project and provide a benefit from 21.6 acres to 41.9 acres of eelgrass. Considered separately , basin construction, shoal dredging, and eelgrass planting at Quonochontaug Pond and Winnapaug Pond would still be best buy plans with the incremental costs shown in Figure 1 and Table 2.

REFERENCES

Short, F. T. 2001. Rhode Island Coastal Salt Pond Eelgrass Assessment Report. Report submitted to US Army Corps of Engineers. University of New Hampshire, Jackson Estuarine Laboratory, Durham, NH

APPENDIX E – EELGRASS GROWTH MODELING REPORT

Rhode Island Coastal Salt Pond

Eelgrass Assessment Report

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September 18, 2000

Rhode Island Coastal Salt Pond Eelgrass Assessment Plan

Table of Contents

List of Tables and Figures

Figure 11. Sensitivity analysis of the eelgrass growth model to variation in low Kd values. Model simulation for 4 years of eelgrass growth at a depth of 1 m with Kd values of 0.75 and 0.40.

Figure 12. Model simulation for 4 years of biomass (red), total eelgrass growth (yellow) and relative growth (green) at a depth of 1 m with a Kd value of 0.75.

Figure 13. Eelgrass leaf biomass for 1 m depth area off the shoal in Ninigret Pond. Field data from 1974 and 1999 and model simulation.

Figure 14. 10-year simulation of existing eelgrass on the shoal of Ninigret Pond with no transplanting.

Figure 15. Simulation of eelgrass growth and biomass, showing eelgrass die-off due to sedimentation after six years (without transplanting) on the shoal of Ninigret Pond.

Figure 16. Simulation of transplanted eelgrass growth and biomass, showing eelgrass die-off due to sedimentation after six years on the shoal of Ninigret Pond.

Figure 17. Simulation of transplanted eelgrass growth and biomass, with reduced sedimentation due to dredging of the sedimentation basin, showing continuing eelgrass growth at low biomass on the shoal of Ninigret Pond.

Figure 18. Simulation of eelgrass growth rate over a one year period at five depths with a Kd value of 0.75, representing the clear water conditions expected on the Ninigret Pond shoal area.

Figure 19. Simulation of eelgrass growth rate over a one year period at five depths with a Kd value of 0.75, plotted against available light at the canopy. Trend lines for each depth are regression of the full year's data from Figure 18.

Figure 20. Simulated eelgrass leaf biomass in July (from the same simulations as Figure 18) plotted against water depths, showing maximum leaf biomass at a depth of 0.75 m.

Rhode Island Coastal Salt Pond Eelgrass Assessment Plan

Introduction

Eelgrass, *Zostera marina* L., is considered to form an important habitat and to provide crucial functions and values to the coastal waters of New England (Short et al. 2000). Over the past decade several New England states have implemented projects to conserve and restore eelgrass habitat. Ninigret, Quonochontaug, and Winnapaug Ponds, the three Rhode Island coastal salt ponds under study, were investigated to consider alternatives to restore their important eelgrass habitat values, including habitat for flounder and scallops. In the past, all three ponds contained extensive eelgrass beds (Wright et al. 1949). However, with shoaling and reductions in water quality, eelgrass and its associated fauna have decreased in extent and abundance. Sedimentation within the ponds has shoaled many areas where eelgrass formerly existed, creating areas too shallow or with high sedimentation rates and sand movement too rapid for eelgrass to persist.

In Ninigret Pond, a gradual decline in eelgrass populations has been documented over the last 40 years, largely a result of increased nutrient loading from housing development (Short et al. 1996), but also with documented losses occurring as the tidal shoal (or delta) has expanded. In 1949 eelgrass in Ninigret Pond was characterized as "excellent east of the breachway" as well as extending to the head of Cross Mill Cove and into the western basin, but not along the shallow southern shore (Wright et al. 1949). Quonochontaug Pond has less documentation of its historic eelgrass coverage, but in 1949 it was reported to be "especially good on the shoulders of the sand shoal that drops off quickly to the north from the breachway entrance into the pond proper. It is not abundant on the shoal itself, but stands remain fairly good up to the eastern end of the pond" (Wright et al. 1949). Additionally, eelgrass was found in isolated stands along the northern shore of Quonochontaug Pond and sporadically to the western reaches, where it was in "only moderately good condition" (Wright et al. 1949). Eelgrass was certainly more extensive than the few patchy beds that currently persist at the edge of the tidal shoal today in Quonochontaug Pond (Wright et al. 1949, Granger et al. 2000). Winnapaug Pond (formerly called Brightman's Pond) is reported to have had extensive eelgrass beds historically (Wright et al. 1949), but in both our study and that of the University of Rhode Island, none were found. In 1949, eelgrass was characterized as "excellent" in the eastern part of Winnapaug Pond and the pond was reported to have "a considerable growth of eelgrass" (Wright et al. 1949).

Eelgrass is considered one of the most important coastal habitats along the Atlantic coast from Maine to North Carolina. Eelgrass is an important plant in many of the Rhode Island salt ponds. It forms extensive meadows, creating valuable habitat throughout much of the shallow part of these estuaries. Like other seagrasses, eelgrass is limited in its distribution at least in part by depth (Duarte 1991). Eelgrass contributes to a healthy estuary in several ways. Eelgrass beds are nursery areas for many commercial and recreational fisheries species, including bay scallops, cod, winter flounder, blue mussels, blue crabs and lobsters. Eelgrass acts as a filter of coastal waters, taking up nutrients and contaminants from the water and causing suspended sediment to settle. Eelgrass is part of the food chain: as the plants age and break down, they become part of the detritus that is eaten by small crustaceans, which in turn are preyed upon by fish. However, in many areas eelgrass habitats have declined or disappeared as a result of greater shoreline housing development which leads to increased nutrient loading to bays and coastal waters (Short and Burdick 1996).

The study presented here provides the scientific basis for evaluating alternatives for the restoration of eelgrass habitat in the shoal or delta areas of Ninigret, Quonochontaug and Winnapaug Ponds (Figure 1) by identifying the conditions for optimal eelgrass growth. The approach to identifying such conditions was to use a computer simulation model for eelgrass growth and productivity to predict the eelgrass response to the five restoration alternatives outlined by the U.S. Army Corps of Engineers. The simulation model used is based on a carbon flow model originally developed for Ninigret Pond (Short 1980) which was expanded and modified to incorporate above- and below-ground growth of eelgrass in response to environmental factors of temperature, light, turbidity, and nutrients (Short 1981). This model has formed the basis of the submerged plant sector (Boumans et al. in prep) of the General Ecosystem Model (GEM), developed as part of the Spatial Modeling Program now being used in several sites across the U.S. (Costanza et al. 1990, Costanza and Maxwell 1991).

Using the five alternatives as initial conditions within the simulation model, we evaluated their ability to support long-term eelgrass survival in the shoal areas of these three important coastal ponds in Rhode Island. Additionally, the recommendations of the study were designed to enhance the restoration of bay scallops to these Rhode Island coastal ponds and to minimize the impacts to winter flounder spawning and nursery habitat.

Before the simulation model of eelgrass growth could be undertaken, a field study of the existing eelgrass in the vicinity of the tidal shoals of Ninigret and Quonochontaug Ponds was needed to create a scientific basis for judging the differences in benefits of the various restoration alternatives. No eelgrass study was possible in Winnapaug Pond because the pond presently supports no known eelgrass population, but measurements of light attenuation and sedimentation (both important factors in eelgrass restoration) were made in all three ponds, including Winnapaug Pond. The field assessment was carried out in the summer of 1999 through the combined efforts of the University of Rhode Island (URI) and the University of New Hampshire (UNH). Historical data, combined with the field collections and analysis of their results, were then used to establish initial conditions for simulation modeling of eelgrass growth under the various restoration alternatives. Using the model, we then evaluated restoration alternatives and identified the optimum depth for restoration of eelgrass to the tidal shoal areas of all three of these Rhode Island coastal salt ponds.

In addition to the simulation model, a site selection model (Short et al. in review) was used to evaluate conditions affecting eelgrass survival, including sedimentation rates, light extinction coefficients, depth, and sediment composition. The site selection model provided a framework for evaluating the various conditions that limit the growth and establishment of eelgrass at a restoration location. This analysis yielded a GIS framework to evaluate data available from the three ponds. In particular, the site selection model was used to analyze the ponds' bathymetry and compare this information to the data layers for eelgrass distribution under historic conditions.

The Restoration Alternatives

Based on field work, historical data, and modelling analysis, predictions were made about the characteristics of eelgrass growth for each of the alternatives for the restoration of eelgrass on the tidal shoals of the Rhode Island salt ponds. The restoration alternatives, as outlined by the Corps of Engineers, are as follows:

Alternative 1

A projection of eelgrass habitat loss under the "no action" alternative described by the Corps of Engineers, coupled with their sedimentation rate and sediment transport numbers. Application of the eelgrass growth model was made to existing conditions on the shoal to evaluate the current limitations to eelgrass growth and the likelihood of long-term eelgrass survival.

Alternative 2

A projection of the eelgrass outcomes given eelgrass transplanting on the shoal without dredging the shoal. As in Alternative 1, above, application of the eelgrass growth model was made to conditions on the shoal where eelgrass currently does not grow to determine the possibility of establishing new eelgrass beds through transplanting into existing conditions.

Alternative 3

Evaluation of the project's Alternative 2 with projected reduced sediment accretion rates on the shoal, due to dredging of the sedimentation basin. This alternative was simulated to test the impacts of reduced suspended sediment load. It is not expected that water clarity conditions would improve following dredging of the sedimentation basin.

Alternatives 4 and 5

Using the site selection model and the eelgrass growth model to determine the optimum depth for dredging the shoal with the construction of the sedimentation basin. Incremental evaluation of these models to different dredge depths was conducted to allow an evaluation of the restoration potential (survival) of eelgrass as well as the success of eelgrass growing at a given depth. To assess the maximum dredge depth scenario (depth of original substrate), the model was evaluated using the original depth of substrate under the tidal shoal to determine the survival and growth potential of eelgrass at that depth.

Methods for Eelgrass Analysis

Historical Data

The data used for the scientific assessment of eelgrass growth conditions in the Rhode Island salt ponds included the results of extensive biological field sampling conducted primarily in Ninigret Pond over the past 40 years (Figure 2). We used four major historical data sets of eelgrass habitat assessment (Short, Burdick, Granger and Nixon, 1996), as follows: 1) pond-wide observations from the early 1960s (percent cover data, Brown 1962); 2) year-round monitoring of eelgrass distribution, biomass, and density (including a station adjacent to the tidal shoals) for 1973-4 (Short 1976); 3) a pond-wide survey of eelgrass and macroalgal abundance for 1979-80 (standing stock data, Thorne-Miller and Harlin 1984), and, finally ; 4) a pond-wide assessment of eelgrass biomass, density and macroalgal abundance for 1992 (Short et al. 1996). The 1992 study in particular provided field data for the shoal areas in question in Ninigret Pond. The biomass and percent eelgrass cover data was used for establishing historic eelgrass distributions and as a basis for modelling the growth and biomass of eelgrass in Ninigret Pond. These four studies, in conjunction with the ongoing water quality and eelgrass monitoring of the coastal ponds by Steve Granger at URI provided a very substantial data set adequate, when combined with site selection and growth modelling, to select the optimum restoration alternative for eelgrass growth and biomass.

Based on detailed assessments of biomass, percent cover, and shoot density from the 1992 sampling (Short et al. 1996 and unpublished), the eelgrass distribution maps (Figure 2) for the four dates, 1960, 1974, 1980, and 1992, were standardized and converted to units of eelgrass biomass (g dry wt m^{-2}). In 1960 (Brown 1962), cover classes of 0-20, 40-60, 60-80, and 100 percent were determined to be equivalent to leaf biomasses of <40, 40-80, 80-160, and >160 g dry wt m^{-2}, respectively. For the data available from 1974 (Short 1976), classes of scattered/patchy, low density, moderate density, and high/very high density were equivalent to leaf biomasses of <40, 40-80, 80-160, and >160 g dry wt m^{-2}, respectively. The 1980 data (Thorne-Miller and Harlin 1984) measured maximum standing crop of eelgrass leaves, roots plus rhizomes, and detritus and were converted to leaf biomass estimates using the 1992 data such that standing crop of 200, 400, 700, and 1100 g dry wt m^{-2} was reflected a leaf biomass of <40, 40-80, 80-160, and >160 g dry wt m^{-2}, respectively. The 1992 (Short et al. 1996) leaf biomass categories were based on actual measurements of eelgrass leaf biomass.

Field Collection

Present-day eelgrass conditions (water quality) in the three coastal ponds were assessed by the URI team and further assessed by UNH measurements of light extinction. The assessment presented here, using the historical data (above), took into consideration newly collected and processed information by URI. The joint UNH-URI analysis in the effort to determine the best alternative for eelgrass restoration was fully collaborative. That is, field surveys included both UNH and URI personnel, data was shared between the two groups, and numerous discussions and exchanges occurred.

In addition to the URI field sampling, we utilized sedimentation rate information collected by ENSR. The UNH team measured eelgrass abundance on the tidal shoals at the sites of the sedimentation measurements. These sampling efforts were coordinated with the U.S. Army Corps of Engineers and the water quality assessment group from URI.

The light extinction coefficient, Kd, is a measure of the attenuation of light as it passes through the water column. Low Kd values (e.g., 0.4) indicate very clear water, while high Kd values (above 2) indicate very turbid water. It is important to bear in mind this inverse relationship of the value of Kd with water clarity and realize that the lower the Kd value, the clearer the water. It should be noted that light attenuation in water is an exponential decay function: the effects of Kd are greatest at intermediate depths, while in very shallow water Kd does not substantially alter light availability.

Light extinction coefficients (Kd) in the three ponds were measured in mid through late summer of 1999 using two Onset ™ light intensity recorders, positioned vertically 0.75m apart with the top recorder approximately 1.0m below the surface, at selected stations in each pond (Figures 3, 4, and 5). One station (the westernmost light meter in Ninigret Pond) was co-located with an URI light monitoring station. The recorders were left in place for approximately two weeks and continuously recorded light intensity at 10 minute intervals until algal fouling negatively impacted the light signal. For two stations in Ninigret Pond and one in Quonochontaug Pond, the light meters were in place from July 27 - August 13, 1999; for Winnapaug Pond, the light meter was in place from August 4 - 16, 1999. Light extinction coefficients (Kd) were calculated from the differences in light levels at the two light intensity recorders at each station.

Eelgrass collections were made in July of 1999 at Ninigret and Quonochontaug Ponds. Samples were collected at each of the sedimentation rod stations (Figures 3, 4, and 5); no eelgrass was present at the stations in Winnapaug Pond. Three replicate samples were collected at each station by placing a 1 m^2 quadrat, divided evenly into 16 squares, haphazardly at each rod location, estimating eelgrass percent cover of shoots growing in each square and averaging the 16 estimates. Then one square containing eelgrass was randomly selected and sampled for eelgrass weight, shoot count and length. Eelgrass biomass and density estimates for each of the rod stations were made by averaging the three replicate quadrat (1/16th m^2) estimates of percent cover times 16 times leaf weight and shoot count, respectively. Eelgrass samples were transported to the University of New Hampshire and processed using standard operating procedures (Short 1992). Shoots were counted for density, specified as vegetative or reproductive, measured for length, and then dried at 60°C for 24 hr and weighed for biomass determination.

Site Selection Model

At UNH, we have developed and tested a site selection model for determination of optimal eelgrass restoration sites (Short et al. in review). The model is designed to take into consideration all of the design parameters listed by the Corps of Engineers: physical, chemical, and biological characteristics of the habitat. The model first considers historical data along with limited field observations and mapping, and then determines a transplant suitability index (TSI) in which measurements of actual field light conditions are used (in this case information obtained from current and past water quality monitoring efforts). In lieu of test transplanting typically required for the TSI, we used the historical data and depth relationships available from past studies to yield information about eelgrass survival under various depth conditions. In this non-traditional application of the site selection model (in the sense that the sites of the shoals are pre-determined), we used the site selection model to optimize the depth condition for selection of the best restoration alternative.

Using GIS, the site selection model evaluated the depth distributions of eelgrass in Ninigret and Quonochontaug Ponds and compared them using digital overlay to the eelgrass distribution in each pond. The resulting analysis for Ninigret Pond showed contours of eelgrass cover within different depth ranges. The analysis was conducted for eelgrass distributions in 1974 and 1992. The pond's bathymetry was provided by the U.S. Army Corps of Engineers and calibrated to the historical depth information. Additionally, the GIS was used to calculate the area in hectares of eelgrass in Ninigret Pond for 1974 and 1992, showing the change in eelgrass area over time.

Eelgrass Growth Model

Beyond determining the depth range for eelgrass, it is important to be able to predict how well eelgrass will grow under the environmental conditions of each pond and each proposed restoration alternative. I have developed an eelgrass growth model (Short et al. in prep.) in Stella™ that incorporates the major physical requirements of eelgrass growth into a computer simulation. The model allows prediction of eelgrass growth as affected by the various restoration alternatives in the areas where eelgrass would be restored on the tidal shoals. This analysis goes beyond survival (as predicted by the site selection model, above) and looks at how well eelgrass will grow, providing a multivariate model that predicts eelgrass growth. The model was developed from an early eelgrass growth model (Short, 1980) and modified to incorporate up-to-date literature-based information on the relationships among environmental variables and eelgrass growth (Short et al., 1997).

The eelgrass growth model evaluates stocks of leaf biomass and root-rhizome biomass over time on a daily time-step, under the control of varying environmental conditions including light with a cloud cover factor, temperature, water depth, and season. In the model, leaf biomass is produced as a function of light and temperature and the translocation of carbohydrates from root-rhizome biomass. Again within the model, leaf biomass is lost through respiration, consumption, leaf turnover, and seasonal leaf fall. The below ground root and rhizome biomass in the model is produced by translocation of carbohydrates from leaf biomass and lost through respiration and temperature-controlled mortality. In each case, the numerical equations driving these relationships in the model are derived from experimental studies in my laboratory and the available literature.

This eelgrass growth model is currently the basic submerged macrophyte component of a spatial modeling study of eelgrass change in the Great Bay Estuary, NH. (http://swan.cbl.umces.edu/GrBay/spatial/spatial_output.html)

Results and Discussion

The results presented here focus on Ninigret Pond because of the available historic information on the pond and because it remains an eelgrass-dominated pond. Quonochontaug Pond and Winnapaug Pond were also analyzed and the results are presented.

Bathymetry data acquired from the U.S. Army Corps of Engineers survey and historic data (Coastal Resources Center, 1974) for Ninigret Pond is plotted to show depth distributions (Figure 6). The shoal areas with the intertidal flats are clearly evident. The deeper areas shown as dark blue along the southern shore of the pond do not match the historic data and may be an artifact of the aerial imaging methodology. The average depth of the pond from this bathymetry data was calculated to be 1.03 meters.

The eelgrass distributions for Ninigret Pond from 1974 and from 1992 (from Short et al. 1996) were combined with the bathymetry information (Figure 6) using GIS to create a map for each year indicating the depth range of eelgrass coverage for that time period (Figure 7). For every pixel where eelgrass was found, the water depth was determined from the bathymetry overlay, and the depth was assigned to the eelgrass at that location. In 1974, the total area of eelgrass in Ninigret Pond was 454 hectares. In 1992, the total area of eelgrass in Ninigret Pond was 317 hectares. The primary loss of eelgrass area was in the shallow parts of the pond less than 1 meter deep, as seen by comparing the histograms in Figure 7. One of the areas of particular eelgrass loss evident in this analysis is from the shoal area of the pond (Figure 7).

Field data for Ninigret Pond included the collection of light data for determining water column light extinction coefficients, and eelgrass abundance data for comparison to the sedimentation data. Extinction coefficients (Kd) were calculated from the available light data and the longer term light record available from the RI Pond Watchers program (Table 1). In addition, URI calculated Kd from its own light monitoring data; comparison to the graphic output from URI of the range of Kd values suggests that they are similar to those of UNH. For Ninigret Pond, the minimum of the average Kd values from 1988-99 was 0.75, and the maximum average value was 1.51; again, it is important to bear in mind that higher Kd values indicate less light penetration into the water column. These values were used to establish the Kd values for model simulation of pond light levels. In the model simulations, Kd = 0.75 was used as the baseline light extinction coefficient because it represented the closest estimate of typical water clarity conditions likely to occur over the tidal shoal in Ninigret Pond. Figure 3 shows that the light meters were located away from the shoals to provide adequate depth for light measurements in an eelgrass habitat. As a result the Kd values do not reflect the greater clarity of Block Island Sound water that penetrates the ponds. Water clarity near the inlet to the pond where the tidal shoals are located would be greater (lower Kd) than that recorded at the stations off the shoal. Since water on the tidal shoal is at least half the time derived directly from offshore, the Kd value of 0.75 represents the water clarity condition for at least half the time, and likely much more. On an outgoing tide, water clarity could range from an average of 0.75 to 1.51, but given the shallow nature of the pond and the tidal records in the channel off the tidal shoal (URI light data 1999), few periods of high Kd (or poor water clarity) would be expected on the shoal. Additionally, to identify the best water quality conditions of water coming from Block Island Sound, the minimum Kd value from the entire light record was tested in model simulations: Kd = 0.40.

Eelgrass sampling from the tidal shoal of Ninigret Pond, at the sites of the sedimentation rods (Figure 3), showed a range of eelgrass cover from 0 to 100% (Table 2). Two sites had 100% eelgrass cover; these were stations 3 (NP6) and 4 (NP7). At these sites, healthy eelgrass populations showed high biomass and shoot density ranging from 337 - 379 g/m^2 and 464 - 1605 $shoots/m^2$, respectively. Station 6 (NP 9) had 56% cover and a biomass of 90 g/m^2. All other sites had low eelgrass cover and abundance (Table 2). The eelgrass data collected on and near the tidal shoals were compared to depth information for Ninigret Pond and to the sediment flux measurements (the average positive values from the three sampling intervals) derived from the sedimentation sampling (Table 2). Eelgrass height (Table 2) and shoot weight (Figure 8) showed a positive but not significant correlation with water depth; larger plants of eelgrass are found in deeper water, although this data is from depths ranging from shallow areas measuring 18 cm to 34 cm, and other factors may influence plant height. Eelgrass seems to be inhibited in size at very shallow depths. This relationship is used in the model to determine the depth at which eelgrass will not survive. Eelgrass percent cover (Table 2) and canopy height (Figure 9) both declined with increasing sediment flux.

The average depth (m) of the rod stations (Table 2) on the existing shoal was determined as depth at MLW, based on estimated water depths and tidal ranges from the U.S. Army Corps of Engineers (faxed memo from Don Wood to Sheldon Pratt, 7/22/99). From these data (Table 2), the eelgrass biomass on the shoal (assuming an average shoal depth of 0.2 m, based on the U.S. Army Corps of Engineers' bathymetry and field observations) was calculated as the average biomass at stations 5, 6 and 8; these three stations have an average depth of 0.20 m. The average biomass for these three shoal stations was 30 g/m^2, with a high degree of variability (ranging from 0 to 90 g/m^2).

Growth Model: examination of restoration alternatives

The eelgrass growth simulation model (Short et al. 1997) was adapted for Ninigret Pond, RI and run in Stella™ on a Macintosh computer. The alternatives for dredging of the tidal shoal in Ninigret Pond to evaluate various depths and identify the optimal depth for eelgrass restoration (considering quality of eelgrass growth) were analyzed and distilled to identify the model simulation scenarios needed to address the various restoration alternatives.

Model Sensitivity to Kd and Depth

The effect of changes in the light attenuation coefficient (Kd) on eelgrass growth in the model was analyzed to evaluate the model's sensitivity to this important parameter that is inversely related to light availability in the pond. Although the results of this sensitivity analysis displayed in Table 3 are listed separately for each pond, the scenarios apply equally to the various ponds because of similarities in their baseline conditions. Figures 10 and 11 show model simulation of biomass and leaf growth over 4 years with a Kd = 0.75 and 0.40 on each figure. Simulations using the two Kd values produced no significant differences in eelgrass biomass (Figure 10) over the 4-year period, nor were there any significant differences in leaf growth (Figure 11). Thus, the model verifies that in shallow conditions (1 m or shallower), small differences in Kd do not substantially impact eelgrass biomass and growth. Further, simulating eelgrass growth with a Kd of 1.51 at 1 m depth also resulted in no significant change in eelgrass biomass or average summer growth rate (Table 3). The model predicts that improving the Kd value from its minimum average (0.75) to the best possible value (0.40) would not substantially improve eelgrass growth conditions on the shoal.

The sensitivity of the model to different water depths was examined through simulations at constant Kd values (Table 3). Eelgrass in the model responds to increases in water depth over 1 meter with reduced growth. Based on the equation for light extinction in water, a constant Kd produces decreased light with increasing depth. Thus, at water depths greater than 1 m, eelgrass biomass and growth in the model decrease as light levels are reduced in response to increased depth, with a constant Kd of 0.75 (Table 3).

The model illustrates a high sensitivity of eelgrass to changes in water depth beyond 1 m, but at 1 m and shallower, Kd values as high as 1.51 do not substantially inhibit plant performance. At depths shallower than 1 m, average summer growth is somewhat reduced due to photoinhibition, and increased Kd in these conditions only reduces the extent of photoinhibition. In the model, as in the natural environment, eelgrass adjusts its height in response to water depth. In shallow water, eelgrass grows shorter leaves but may compensate by increasing shoot density (Short et al. 1995). However, the model shows there is a limit to the shallow conditions that eelgrass can sustain. At very shallow depths, eelgrass leaves become very short and the plants remain sparse (Table 2) and extremely vulnerable to any additional adverse conditions (e.g., waves, sediment deposition, etc.).

Simulation of eelgrass near and on the Ninigret Pond shoal

The simulation model was first run for the conditions in the vicinity of the tidal shoal area (not on the shoal) of Ninigret Pond to test the model's ability to predict the range and pattern of seasonal growth and biomass in the area of interest (Figure 12). Figure 12 presents direct Stella output of simulated eelgrass biomass and growth over four years for Ninigret Pond. Red represents leaf biomass, which is consistently maintained at an annual maximum of about 300 g/m^2. Simulated total growth is shown in yellow (g/m^2/d). Relative growth, in green, is plotted as g/g/d; relative growth is a measure of the increase in plant weight per unit of existing plant material. Thus, the relative growth measure is independent of the size of the plant. Figure 12 demonstrates the consistency and stability of the model simulation under ambient conditions near the tidal shoal with 1 m water depth. Eelgrass biomass for a 12 month period was simulated and compared to data from 1974 that was collected in the vicinity of the tidal shoal and data that we collected in 1999 at stations 3 (NP6) and 4 (NP7) on the tidal delta

(Figure 13). The comparison demonstrated that the model is producing output within the range of the observed data. There is variability in the observed data, but the model simulation is of the right magnitude to have confidence in the analysis. This run of the model, without any tuning or adjustment other than establishing the conditions for Ninigret Pond, shows simulation results (from 275 to 310 g/m^2 biomass) in the range of all but one of the mid-summer samples from available field data (from 75 to 380 g/m^2 biomass). Typically, field data produces wider ranges of values, and many lower biomass values, than modelling results.

Simulation of eelgrass in Ninigret Pond on the shoal itself (depth of 0.2 m, based on field sampling) was run to determine the predicted persistence of eelgrass patches observed during the field program. The model predicted (Figure 14) that existing eelgrass on the shoal could persist under static conditions of shallow water without any other adverse impacts. The model predicted a biomass sustained at approximately 20 g/m^2, compared to the average eelgrass leaf biomass measured on the shoal of 30 g/m^2, albeit field measurements on the shoal showed a high degree of variability (Table 2). Thus the growth model confirms that eelgrass can grow on the shoal at a depth of 0.2 m (provided the water depth does not decrease), but the eelgrass biomass will remain relatively low.

Simulation at existing shoal depth in Ninigret Pond

Alternative 1

The first scenario is the alternative of "no dredge with existing eelgrass density" (Alternative 1 - No Action), running the eelgrass model for conditions with sedimentation of 1.1 cm per year. The sedimentation rate of 1.1 cm per year was derived from the sedimentation rod survey: the sedimentation data for Ninigret Pond was analyzed for the whole period from May through November, 1999. The positive sedimentation rates from the entire delta area, excluding outliers and questionable data, were averaged and resulted in a sedimentation rate of 0.003 cm per day, equal to 1.1 cm per year. The model was established with a light extinction coefficient of 0.75 on the shoal, a water depth of 0.2 m based on the average existing shoal depth, and a sedimentation rate of 1.1 cm/yr (Figure 15).

The simulation (Figure 15) shows eelgrass, both leaf and root biomass, persisting for about six years, and then precipitously disappearing as the water becomes too shallow due to sediment build-up. A progressive decline in rhizome biomass precedes the decline in leaf biomass. At about the six year point, the plants run out of enough below-ground reserves to continue leaf production, and the eelgrass disappears. It should be noted that the initial biomass in this scenario is very low, around 20 g/m^2, compared to what might be characterized as a lush eelgrass bed, which is typically 300 - 400 g/m^2. The sedimentation scenario used for Alternative 1 represents a “best case." If extremes in temperature or tidal condition occurred that created more exposure, these shallow water plants would disappear much faster. Given no such extreme conditions, these plants persisted in the model until the shoal reached a depth of 12 cm MLW, about six years in this alternative.

Analysis of eelgrass at the edge of the shoal and knowledge of eelgrass vertical growth rates, when combined with the above simulation, indicate that the eelgrass beyond the edge of the shoal (Table 3) would survive under sedimentation rates of 1.1 cm/y, but would decrease in both biomass and growth as the water depth decreased. Thus, the model indicates that eelgrass will survive at the edge of the shoal until sedimentation decreases the water depth to 12 cm, at which point this eelgrass will also be lost. At sites where rapid shoal formation and active sand movement are occurring, high sedimentation will bury and eliminate existing eelgrass beds.

In summary, the "no action" alternative (1) in Ninigret Pond will result in loss of eelgrass habitat both on and at the edge of the shoal.

Alternative 2

Alternative 2 is "no dredge with transplanting", an evaluation of eelgrass biomass on the shoal after transplanting, with sedimentation. The difference between this simulation (Figure 16) and the previous one (Figure 15) is that it starts with a higher biomass at a rate consistent with the biomass of eelgrass transplanting, about 60 g/m^2. Within a year, the simulation shows a reduction in biomass in this shallow water condition to around 20 g/m^2 with seasonal variations (Figure 16). At the average depth of the shoal (20 cm), the model predicts that eelgrass cannot be sustained at the transplant biomass of 60 g/m^2 and is reduced to sparse plants on the shoal. As in the sedimentation simulation of Figure 15, the plants live for about six years until the water depth gets to 12 cm. Thus, the model predicts that transplanting eelgrass onto the shoal with no dredging may temporarily increase some areas of eelgrass habitat, but they will become sparse and not thrive, dying after about 6 years under the existing sedimentation rate.

Alternative 3

Alternative 3, "no dredge with transplanting and sedimentation basin dredging," is simulated to determine the persistence of transplanted eelgrass in the shoal area under the condition of reduced sedimentation resulting from dredging of the sediment basin. In the simulation of Alternative 3, water depth is established at 0.2 m with a Kd value of 0.75 (Table 3). This alternative starts with a higher biomass than currently found on the shoal, at a rate consistent with the biomass of eelgrass transplanting, about 60 g/m^2. Even with reduced sedimentation provided by the dredging of the sedimentation basin, within a year the simulation shows a reduction in eelgrass biomass to around 20 g/m^2 with seasonal variations. As in Alternative 2, eelgrass will persist on the shoal at this relatively sparse level continuously (Figure 17). In the model, both leaf and rhizome biomass are consistent throughout the ten year period. Thus, the model predicts that transplanting eelgrass onto the shoal with no dredging and reduced sedimentation may increase some areas of eelgrass habitat, but they will remain sparse and not thrive, although they will persist if no other negative impacts were to occur; however, it is likely that periodic disturbances would completely eliminate eelgrass from the shoal. Therefore, this alternative is not likely to result in long-term restoration of eelgrass.

Alternative 3, established by the Corps of Engineers, also states that "Benefits would be generated by changing…water clarity by reducing suspended sediment as a result of building the sedimentation basin." However, based on further analysis, the Corps does not anticipate that construction of the sedimentation basin will have an effect on water clarity over the tidal shoal since the fine-grained sediments which contribute to turbidity would not be removed by the basin.

Consideration at alternative shoal depths in Ninigret Pond

Alternatives 4 and 5

Alternatives 4 and 5 are discussed together, both simulated with a Kd of 0.75: simulation of dredging depths of 0.5, 0.75, 1.0 and 1.5 m comprising Alternative 4, and simulation of the original depth of 2 m prior to shoal formation in Ninigret Pond comprising Alternative 5. Figure 18 depicts the growth rate of eelgrass over 1 year at these five depth alternatives. The variation in daily growth values reflects model simulation under conditions of varying light availability (simulated cloud cover). At a depth of 2 m (green dots), the model shows an eelgrass total plant growth maximum of almost 2 $g/m^2/d$ in the summer, less than any of the simulated growth rates for other depths. At 1.5 m (yellow triangles) and up to 1 m (blue diamonds), there is in increase in maximum summer growth rate as well as growth rate throughout the year; at 1 m depth, the maximum summer growth rate is 3.4 $g/m^2/d$, an excellent growth rate for eelgrass. At the next shallower restoration alternative depth, 0.75 m (orange dots), growth rate is slightly higher at 3.5 $g/m^2/d$ at the summer peak, but there is also a much lower growth rate on many days due to photo-inhibition. That is, the plants receive too much light and their growth is inhibited on bright days, accounting for the high scatter of orange dots in mid-summer. This effect becomes even more extreme at the 0.50 m simulation (pink squares), where summer growth shows rates as low as 1 $g/m^2/d$ although rates range over 3.5 $g/m^2/d$. Thus, these simulations of the model predict that optimum depth for growth of eelgrass occurs between 0.5 and 1.0 m.

The sediment substrate in Ninigret Pond was analyzed for grain size by GEO/PLAN Associates for the Corps of Engineers. At all sites, sediments were composed of silty sand, an excellent substrate to support eelgrass. As a result, eelgrass model simulations were run assuming appropriate and constant substrate conditions.

Taking the analysis of alternatives 4 and 5 one step further, the data is replotted with available light at the canopy on the x-axis against the Figure 18 growth rates on the y-axis (Figure 19). This plot produces clusters of points representing the different depth groups. Again, the 2 m depth simulation (green) shows the lowest eelgrass growth rate. The superimposed lines are linear regressions which represent a trend line for the data set at each depth. As the water gets shallower, the trend line shows higher and higher growth, with roughly the same slope. At the regression line for the 1.0 m (blue) and 0.75 m (orange) simulations, the slopes are the same; beyond that, at the 0.5 m (pink) simulation, the slope of the line actually decreases, indicating that there is lower eelgrass production at 0.5 m. Thus, the analysis in Figure 19 indicates that the optimal depth for eelgrass growth is between 0.75 and 1.0 m MLW. Additionally, based on the sensitivity analysis of eelgrass growth to water depth at the average Kd, average eelgrass leaf growth in July and average annual leaf growth also occur between 0.75 m and 1.0 m (Table 3).

Although it is not shown by the model simulations, eelgrass would not survive on the shoal over the long term at depths of 0.5 m and less. At these shallow depths, frequent disturbance by waves would create an unstable substrate, which would not properly anchor the eelgrass plants, particularly in the first few years after planting. This conclusion is supported by the site selection model and historical data showing a loss of eelgrass in Ninigret Pond at shallower depths.

These simulations of eelgrass growth and biomass at different water depths (Table 3) are emphasized in Figure 20, which plots eelgrass biomass for the same simulations in g/m^2 versus depth. The curve shows an apex at about 0.75 m and shows decreasing biomass at both deeper and shallower depths. Thus, this analysis of the model simulation results indicates that the optimal restoration depth for eelgrass is 0.75 m. Overall, dredging of the tidal shoal delta to a depth of 0.75 m with good water clarity conditions and no sedimentation based on continued basin dredging, represents the best possible conditions for eelgrass restoration by transplanting. Since eelgrass growth and biomass are inhibited at depths shallower than 0.75 m, the best target depth for dredging in Ninigret Pond is between 0.75 and 1.0 m MLW.

Analysis of Quonochontaug Pond

Quonochontaug Pond does have some remaining eelgrass. The eelgrass in Quonochontaug Pond is not widely distributed and is patchy, mostly appearing just off the edge of the tidal shoal (Granger unpublished). The condition of the tidal shoal in Quonochontaug Pond (Figure 1) was similar to Ninigret Pond, with rates of sedimentation double that of Ninigret Pond, based on information gathered at the sedimentation rod stations (Figure 4). The sedimentation rate of 2.5 cm per year was derived from the sedimentation rod survey: the sedimentation data for Quonochontaug Pond was analyzed for the period of June through November, 1999. The positive sedimentation rates from the entire shoal area, excluding outliers and questionable data, were averaged and resulted in a sedimentation rate of 0.007 cm per day, equal to 2.5 cm per year.

Light conditions were somewhat different from Ninigret Pond, with the average light extinction coefficient (Kd) ranging from 0.66 (average minimums) to 1.02 (average maximums) in Quonochontaug Pond (based on URI, UNH and RI Pond Watchers data). The clearest water of any of the ponds was measured in Quonochontaug Pond. The two sedimentation stations (stations 15 and 17) having eelgrass in Quonochontaug Pond in the 1999 survey registered 8 and 17 percent eelgrass cover, respectively (Table 2).

Restoration Alternatives for Quonochontaug Pond

The five restoration alternatives were analyzed using the same methodology as for Ninigret Pond (above).

Alternative 1

The "no action" alternative in Quonochontaug Pond, with no dredging or transplanting and current conditions of sedimentation, is essentially the same as in Ninigret Pond, although the higher rate of sediment flux suggests that the eelgrass existing in Quonochontaug Pond today might be more rapidly buried and eliminated by expansion of the tidal shoal than that of Ninigret Pond. No eelgrass currently exists on the Quonochontaug shoal so no model analysis is appropriate for the shoal area. The only consideration is for the eelgrass on the sloping edge of the shoal, where eelgrass exists in a depth range from 1.22 m to 2.19 m MLW. There, the simulation model was run for eelgrass growth at 1.0 m and 2.0 m, with a Kd of 1.50 (the poorest water clarity conditions measured in Quonochontaug Pond). The results of this simulation show excellent, continued eelgrass growth at 1 m and eelgrass persisting at 2 m, but with substantially reduced growth (Table 3).

Alternative 2

Alternative 2 is "no dredge with transplanting", an evaluation of eelgrass biomass on the shoal after transplanting with sedimentation. The model simulation of Alternative 1 (above) suggests that eelgrass could be transplanted in areas around the edge of the tidal shoal at depths of close to 1 m resulting in good eelgrass growth (Table 3). Eelgrass cannot be successfully transplanted in intertidal areas, which account for at least some portion of the Quonochontaug tidal shoal. Eelgrass growing (whether naturally or transplanted) around the edge of the tidal shoal in Quonochontaug Pond might be more rapidly buried and eliminated than in Ninigret Pond by the higher sediment flux levels in Quonochontaug Pond.

Alternative 3

This alternative evaluates the same scenario as Alternative 2, except for reduced sedimentation due to dredging of a sedimentation basin. The results parallel those of Alternative 2 in Quonochontaug Pond, except that the rate of loss of natural or transplanted eelgrass would be reduced around the edge of the tidal shoal if sediment flux is reduced.

Alternatives 4 and 5

Alternatives 4 and 5 are again discussed together for Quonochontaug Pond. Both were simulated with a Kd of 1.50, providing an assessment of light conditions poorer than the average of the Kd values measured in Quonochontaug Pond. The poorer water clarity value was used for Quonochontaug Pond because much of the area to be restored in this pond is located a fairly large distance from the inlet where the clearest water from Block Island Sound would improve water clarity. As importantly, the capacity of Block Island Sound water to improve water clarity in the vicinity of the shoal is less in Quonochontaug Pond because it is the deepest of the three ponds. Restoration depths were simulated at 0.75 and 1.0 m, comprising Alternative 4. Simulation of the original depth of 2 m prior to shoal formation in Quonochontaug Pond comprised Alternative 5. Similar to Ninigret Pond, at the dredge depth of 0.75 m, the eelgrass leaf growth rate is 1.37 $g/m^2/d$ at the summer peak (Table 3). Eelgrass leaf growth at 1 m depth is slightly less for the same mid-summer period, at 1.27 $g/m^2/d$. The growth at 2 m depth is less than half of the growth at 0.75 or 1 m. Thus, these simulations of the model predict that optimum depth for growth of eelgrass in Quonochontaug Pond occurs in the vicinity of 0.75 to 1.0 m.

The sediment substrate in Quonochontaug Pond was analyzed for grain size by GEO/PLAN Associates for the Corps of Engineers. At all sites, sediments were composed of silty sand, an excellent substrate to support eelgrass. As a result, eelgrass model simulations were run assuming appropriate and constant substrate conditions.

The shoal in Quonochontaug Pond is too shallow to support eelgrass, given the larger tidal range in this pond than Ninigret Pond (Table 2). In Quonochontaug Pond at low tide, the depth of the tidal shoal extends from intertidal flats in the central shoal, to shallow submerged areas, to areas of over a meter in depth at the edges of the shoal. The URI eelgrass survey of 1999 showed eelgrass is found predominantly off the delta except for one patch at a drainage area on the western side of the delta (Granger unpublished data). The eelgrass survey and the biomass sampling at the sedimentation poles suggest that the depth at which eelgrass persists in Quonochontaug Pond is 1.2 to 2.2 m MLW (Table 3). However, this eelgrass is at very low density and biomass. The majority of Quonochontaug Pond, which has no eelgrass, is deeper than this range and the shoal areas of the pond, which also have no eelgrass, are shallower.

Analysis of the model simulation results indicates that the optimal restoration depth for eelgrass biomass in Quonochontaug Pond is 0.75 to 1 m MLW (Table 3). Overall, dredging of the tidal shoal to this depth with existing water clarity conditions and no sedimentation (based on continued sedimentation basin dredging) represents the best possible conditions for eelgrass restoration in Quonochontaug Pond.

Winnapaug Pond

The condition of the tidal delta in Winnapaug Pond (Figure 1) was similar to that of Ninigret and Quonochontaug Ponds, except the delta in Winnapaug Pond extends further into the pond as a result of the location of the breachway at the east end of the pond. The rates of sedimentation in Winnapaug Pond were an order of magnitude higher than those of Ninigret and Quonochontaug Ponds, based on the sedimentation rod data. The sedimentation rate of 21.9 cm per year was derived from the sedimentation rod survey: the sedimentation data for Winnapaug Pond was analyzed for the period of May through November, 1999. The positive sedimentation rates from the entire shoal area, excluding outliers and questionable data, were averaged and resulted in a sedimentation rate of 0.06 cm per day, equal to 21.9 cm per year. The worst water clarity of all three ponds was measured in Winnapaug Pond, which currently has no eelgrass. Light conditions in Winnapaug Pond had an average extinction coefficient (Kd) ranging from 0.96 (average minimum) to 1.95 (average maximum).

The higher rate of sediment flux in Winnapaug Pond is based on a very limited data set, and it is not clear if the flux rate represents greater sediment input, greater redistribution of sediments within the pond, or insufficient data.

Restoration Alternatives for Winnapaug Pond

The five restoration alternatives were analyzed using the same methodology as for Ninigret Pond (above).

Alternative 1

The "no action" alternative in Winnapaug Pond, with no dredging or transplanting and current conditions of sedimentation, is different from both Ninigret and Quonochontaug Ponds because there is no existing eelgrass in Winnapaug Pond. A simulation was run to evaluate the potential for eelgrass to grow under the high Kd values present in the pond, thereby testing any potential for eelgrass to naturally reestablish under Alternative 1. The simulation model was run for eelgrass growth at 1.0 m and 2.0 m, with a Kd of 1.95, the highest average Kd in Winnapaug Pond. The results of this simulation show excellent eelgrass growth at 1 m and substantially reduced growth at 2 m (Table 3), suggesting that if there were a source of natural eelgrass recruitment in Winnapaug Pond and all other conditions were adequate, eelgrass could persist in Winnapaug Pond.

Alternative 2

Alternative 2 is "no dredge with transplanting", an evaluation of eelgrass biomass on the shoal after transplanting with all other conditions remaining the same. The model simulation of Alternative 1 (above) suggests that eelgrass could be transplanted at depths of close to 1 m and yield good eelgrass growth (Table 3). Eelgrass transplanted at 1 m depth areas in Winnapaug Pond might be more rapidly be buried and eliminated than eelgrass in Ninigret Pond, if the higher sediment flux levels measured in Winnapaug Pond prove to be the case.

Alternative 3

This alternative evaluates the same scenario as Alternative 2, except for reduced sedimentation due to dredging of a sedimentation basin. The results parallel those of Alternative 2 in Winnapaug Pond, except that transplanted eelgrass would have a better chance of establishment and survival under Alternative 3 because of reduced sedimentation.

Alternatives 4 and 5

Alternatives 4 and 5 are discussed together for Winnapaug Pond. Both were simulated with a Kd of 1.95 (the worst case scenario for light measured in Winnapaug Pond). The poorer water clarity value (average maximum) was used for Winnapaug Pond because much of the area to be restored in this pond is located a fairly large distance from the source of clear Block Island Sound water at the inlet. Restoration depths were simulated at 1 m for Alternative 4. Alternative 5 was comprised of simulation of the original depth of 2 m prior to shoal formation in Winnapaug Pond. The eelgrass biomass for simulation of Alternative 4 was 305 g/m^2. The eelgrass biomass for Alternative 5 was 70 g/m^2, indicating that the optimum depth for growth of eelgrass in Winnapaug Pond occurs in the vicinity of 1.0 m.

The sediment substrate in Winnapaug Pond was analyzed for grain size by GEO/PLAN Associates for the Corps of Engineers. At all sites, sediments were composed of silty sand, an excellent substrate to support eelgrass. As a result, eelgrass model simulations for Winnapaug Pond were run assuming appropriate and constant substrate conditions.

Analysis of the model simulation results indicates that the optimal restoration depth for eelgrass biomass in Winnapaug Pond is about 1 m MLW (Table 3). Overall, dredging of the tidal shoal to a depth of no more than 1 m with existing water clarity conditions and no sedimentation based on continued basin dredging, represents the best possible conditions for eelgrass restoration by transplanting in Winnapaug Pond. It is important to consider that the light extinction coefficient (Kd) values for Winnapaug Pond were obtained for a site beyond the tidal shoal and into the pond itself. The clear ocean water crossing the tidal shoal would result in more light being available to support eelgrass growth in the vicinity of the tidal shoal. Thus, the potential for eelgrass restoration in Winnapaug Pond would be the best under Alternative 4: dredging to 1 m, reduction of sediment flux, and transplanting.

Conclusions

Overall, optimum eelgrass growth on the tidal shoals of Ninigret, Quonochontaug, and Winnapaug Ponds, would be achieved by dredging shoal areas of each pond to a depth of between 0.75 and 1.0 m MLW. Dredging only to 0.75 m was shown to be optimal for Ninigret Pond and likely satisfactory for the other two ponds. The potential for successful eelgrass restoration decreases markedly at about 0.5 m depth. Although the physical factors limiting eelgrass growth below 0.75 m cannot be predicted by the eelgrass growth model, the site selection model and the potential for much greater sediment movement at shallow depths on the shoal suggests that eelgrass would not survive at shallow depths.

To summarize, the analysis has demonstrated through simulation modelling that an ideal depth for these coastal ponds is between 0.75 and 1.0 m (MLW) to yield optimum eelgrass growth conditions in the ponds. In 1974, this was the dominant depth range for eelgrass in Ninigret Pond, based on the site selection model (Figure 7) and remained an important depth range in 1992, although a range that had been impacted by sedimentation and eutrophication (Short et al. 1996). Eutrophication will continue to be a problem in these coastal ponds as a result of increased housing development in the area, affecting shallow water areas in the ponds and further eliminating eelgrass. This is in contrast to the area of the tidal shoals in each pond, where relatively clear oligotrophic water enters the ponds from Block Island Sound and would provide optimal (non-eutrophied) conditions for eelgrass restoration and growth if the proper depth is established.

Through dredging, parts of the ponds' area can be returned to a depth condition where eelgrass can be transplanted, expanding existing areas of eelgrass in Ninigret Pond and Quonochontaug Pond, and critically, creating a new seed source and a new population of eelgrass in Winnapaug Pond. Based on field investigation and modelling, for all ponds the recommended optimum alternative is to dredge the tidal shoals to a depth of 0.75 to 1 m MLW with a created sedimentation basin.

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Table 1. Light extinction coefficient (Kd) for the Rhode Island salt ponds 1987-1999.

Pond	Location	Source	Year	Min Kd	Max Kd
Ninigret		Pond Watcher	1988	0.89	1.31
Ninigret		Pond Watcher	1992	0.49	1.70
Ninigret		UNH	1992	0.93	1.55
Ninigret		Pond Watcher	1993	0.53	1.70
Ninigret	daily avg.	UNH	1999	0.68	1.41
Ninigret	daily avg.	UNH	1999	0.98	1.39
Ninigret			**Average**	**0.75**	**1.51**
Winnapaug		Pond Watcher	1987	1.15	2.39
Winnapaug		Pond Watcher	1988	0.93	1.59
Winnapaug		Pond Watcher	1989	0.96	1.67
Winnapaug	daily avg.	UNH	1999	0.79	2.14
Winnapaug			**Average**	**0.96**	**1.95**
Quonochontaug	tidal delta	Pond Watcher	1987	0.59	0.77
Quonochontaug	tidal delta	Pond Watcher	1988	0.59	0.89
Quonochontaug	tidal delta	Pond Watcher	1989	0.63	1.00
Quonochontaug	tidal delta	Pond Watcher	1992	0.85	1.06
Quonochontaug	tidal delta	Pond Watcher 2	1987	0.67	1.10
Quonochontaug	tidal delta	Pond Watcher 2	1988	0.64	0.76
Quonochontaug	tidal delta	Pond Watcher 2	1990	0.71	0.85
Quonochontaug	tidal delta	Pond Watcher 2	1991	0.40	0.46
Quonochontaug	tidal delta	Pond Watcher 2	1992	0.45	0.47
Quonochontaug	west end	Pond Watcher	1989	0.94	1.13
Quonochontaug	west end	Pond Watcher	1990	0.85	1.21
Quonochontaug	west end	Pond Watcher	1992	0.74	1.21
Quonochontaug	daily avg.	UNH	1999	0.46	2.39
Quonochontaug		**Average**		**0.66**	**1.02**

Table 3. Input and output parameters for simulation of peak biomass, average summer growth (10 days in July) and annual leaf growth in Rhode Island salt ponds.

Simulations	Inputs		Output		
	Depth(m)	Kd	Peak Biomass g/m2	Average Leaf Growth g/m2/d	Annual Leaf Growth g/m2/y
Ninigret Pond	0.50	0.75	300	1.11	356
	0.75	0.75	314	1.19	376
	1.00	0.75	307	1.51	368
	1.20	0.75	284	1.36	340
	1.50	0.75	233	1.26	279
	2.00	0.75	154	0.87	184
	1.00	0.40	306	1.33	-
	1.00	1.51	310	1.35	-
	0.70	0.70	311	1.18	-
Quonochontaug Pond	0.75	1.50	297	1.37	350
	1.00	1.50	311	1.27	370
	2.00	1.50	93	0.52	113
Winnapaug Pond	0.75	1.95	307	1.34	368
	1.00	1.95	305	1.42	365
	2.00	1.95	70	0.48	84

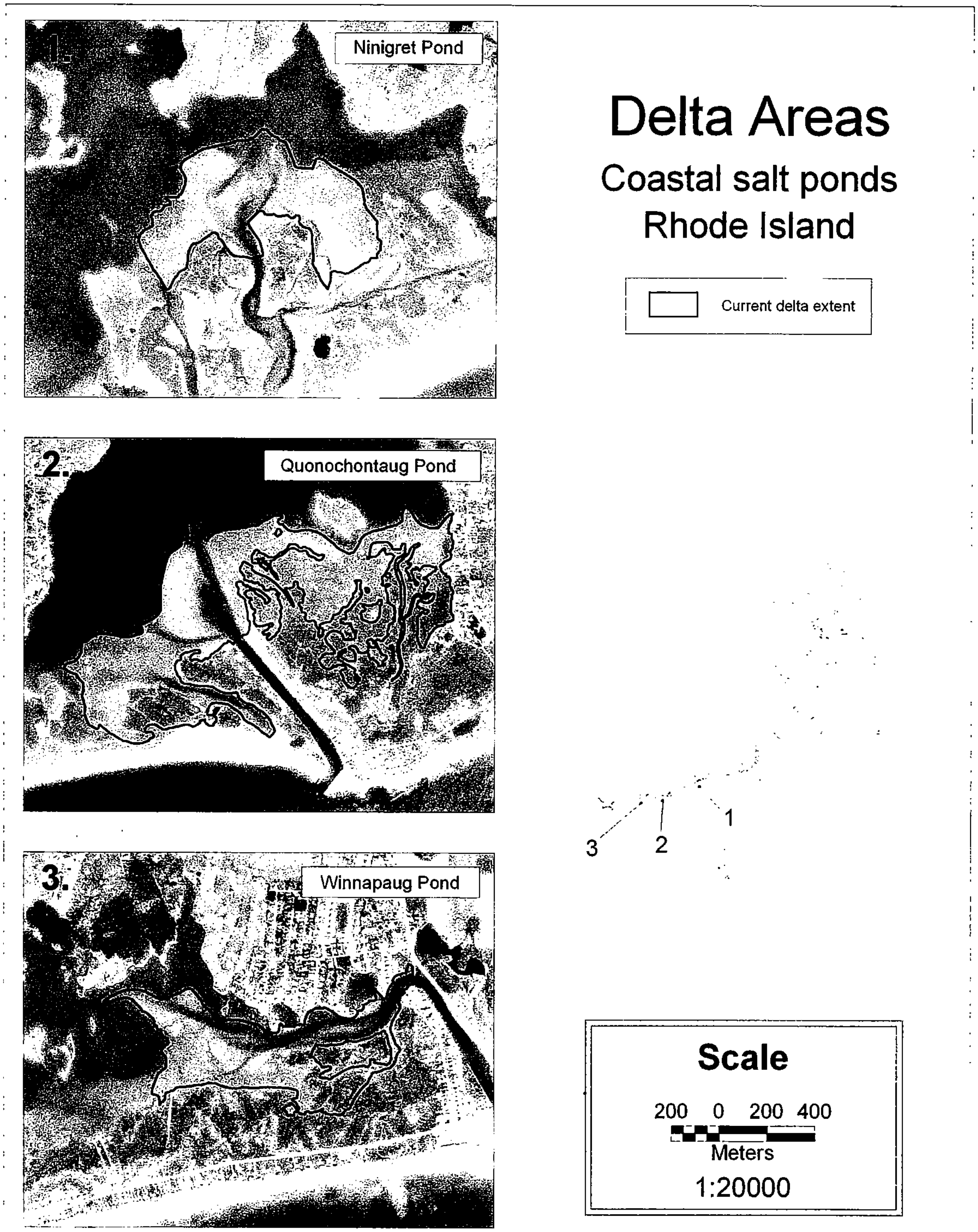

1.
Ninigret Pond
2.
Quonochontaug Pond
3.
Winnapaug Pond
Delta Areas
Coastal salt ponds
Rhode Island
Current delta extent
1
2
3
Scale
200 0 200 400
Meters
1:20000

Figure 1

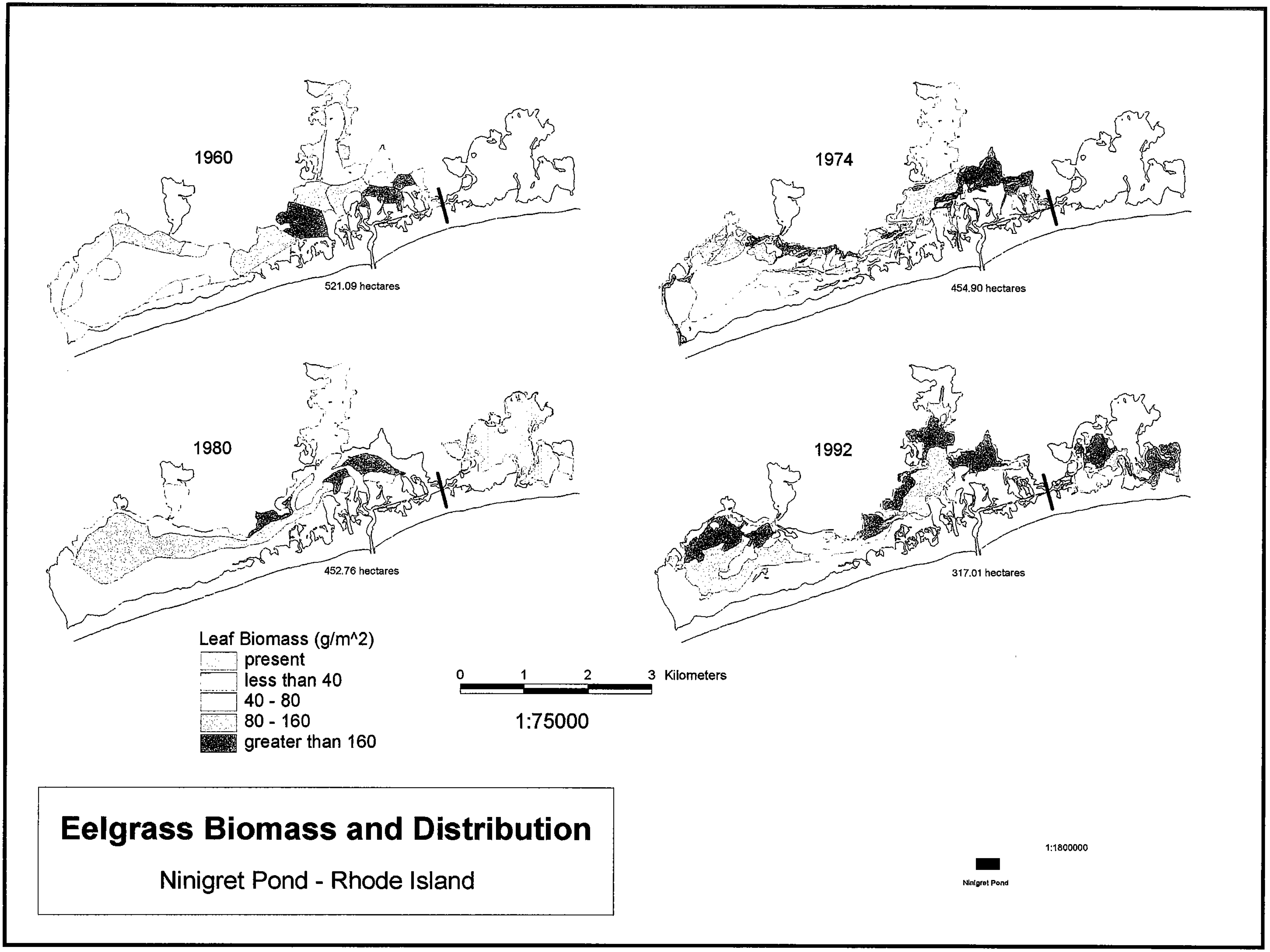

1960
521.09 hectares
1974
454.90 hectares
1980
452.76 hectares
1992
317.01 hectares
Leaf Biomass (g/m^2)
present
less than 40
40 - 80
80 - 160
greater than 160
0
1
2
3 Kilometers
1:75000
Eelgrass Biomass and Distribution
Ninigret Pond - Rhode Island
1:1800000
Ninigret Pond

Figure 2

Figure 3

Ninigret Pond

Rhode Island

Figure 4

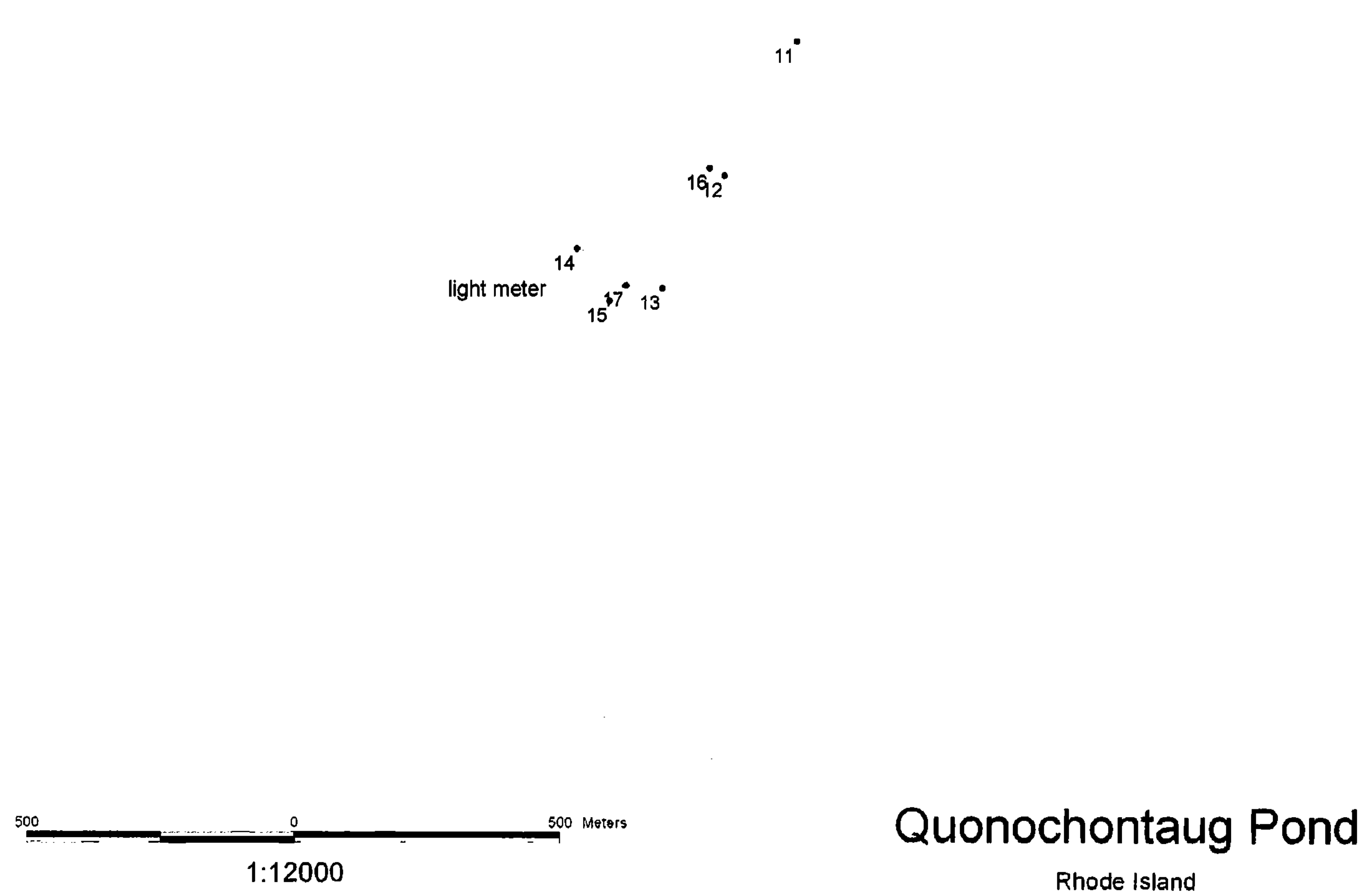

11
16
12
14
light meter
17
15
13
500
0
500 Meters
1:12000
Quonochontaug Pond
Rhode Island

Figure 5

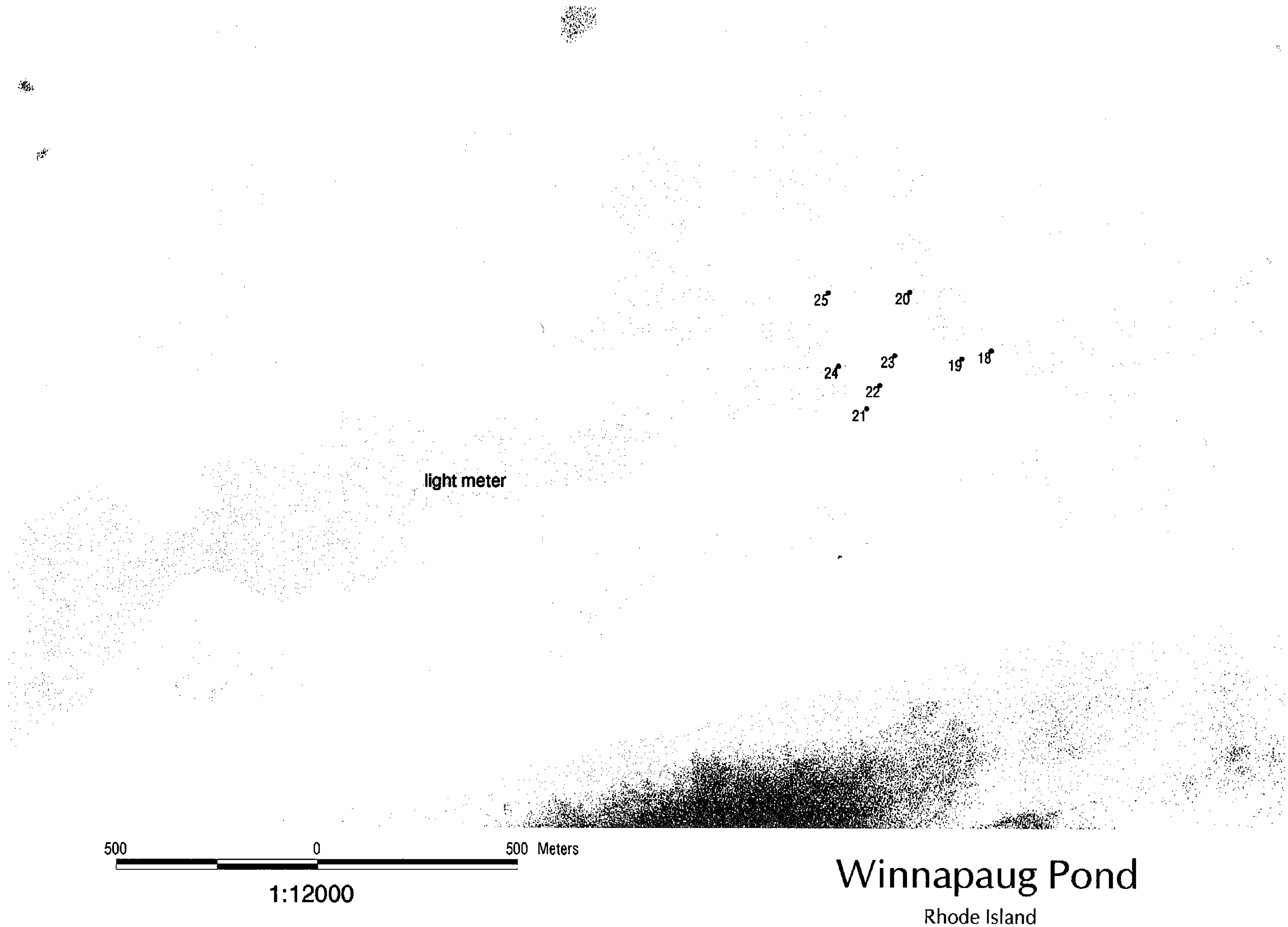
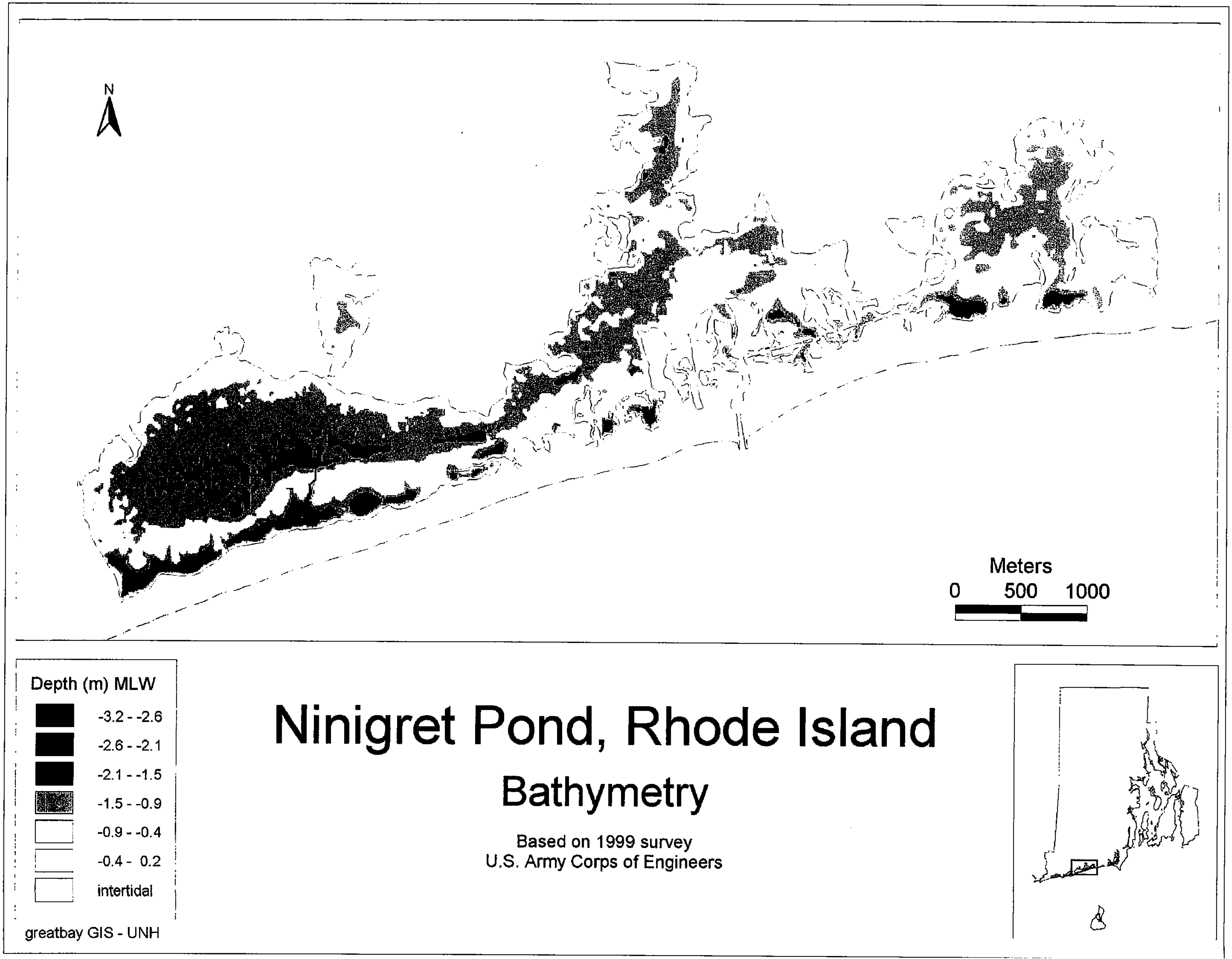

25
20
24
23
19
18
22
21
light meter
500
0
500 Meters
1:12000
Winnapaug Pond
Rhode Island

Figure 6


N
Meters
0 500 1000
Depth (m) MLW
-3.2 - -2.6
-2.6 - -2.1
-2.1 - -1.5
-1.5 - -0.9
-0.9 - -0.4
-0.4 - 0.2
intertidal
greatbay GIS - UNH
Ninigret Pond, Rhode Island
Bathymetry
Based on 1999 survey
U.S. Army Corps of Engineers

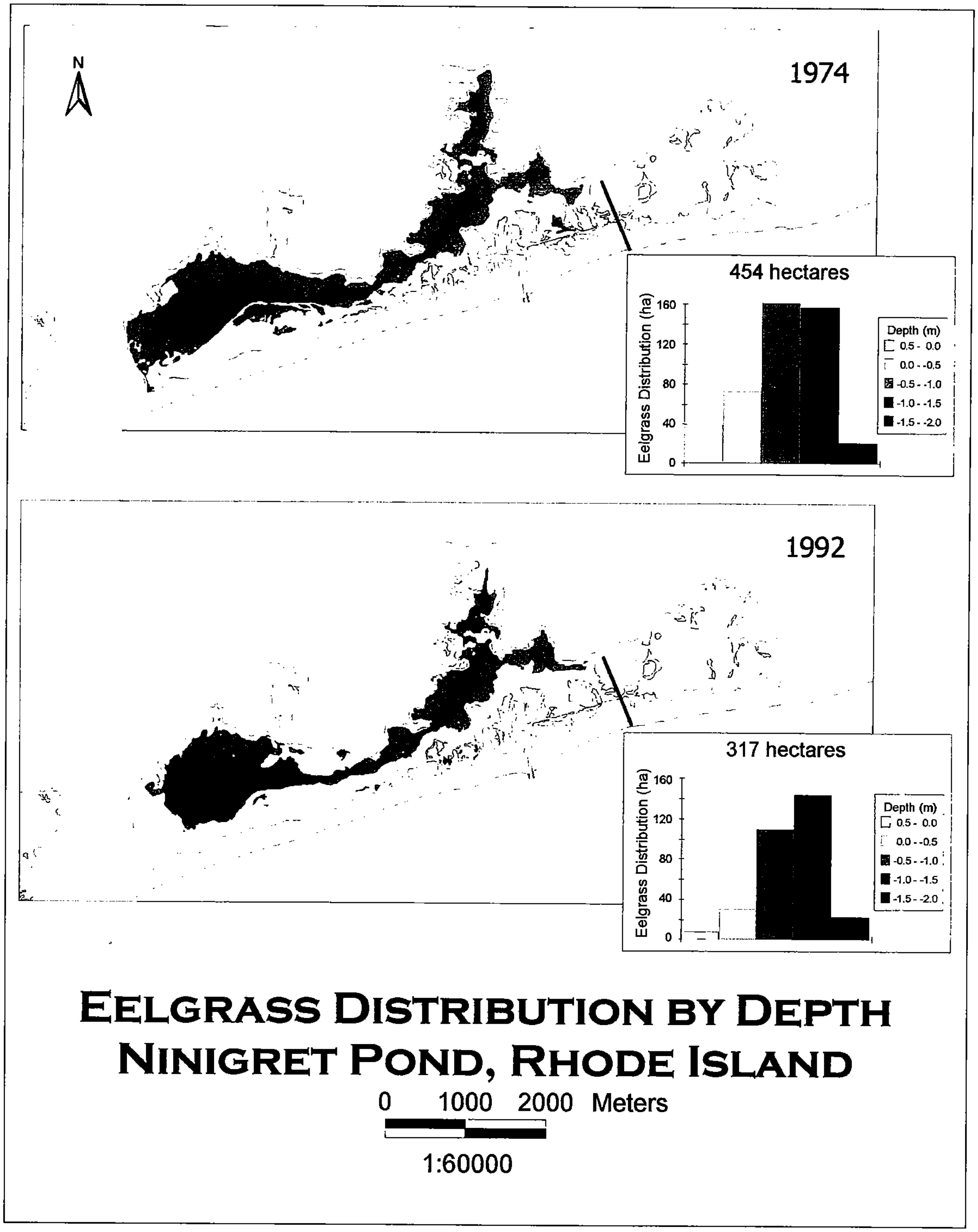

N
1974
454 hectares
Eelgrass Distribution (ha)
160
120
80
40
0
Depth (m)
0.5 - 0.0
0.0 - -0.5
-0.5 - -1.0
-1.0 - -1.5
-1.5 - -2.0
1992
317 hectares
Eelgrass Distribution (ha)
160
120
80
40
0
Depth (m)
0.5 - 0.0
0.0 - -0.5
-0.5 - -1.0
-1.0 - -1.5
-1.5 - -2.0
EELGRASS DISTRIBUTION BY DEPTH
NINIGRET POND, RHODE ISLAND
0 1000 2000 Meters
1:60000

Figure 7

Figure 8.

Shoal Eelgrass Sampling Stations -- July 1999

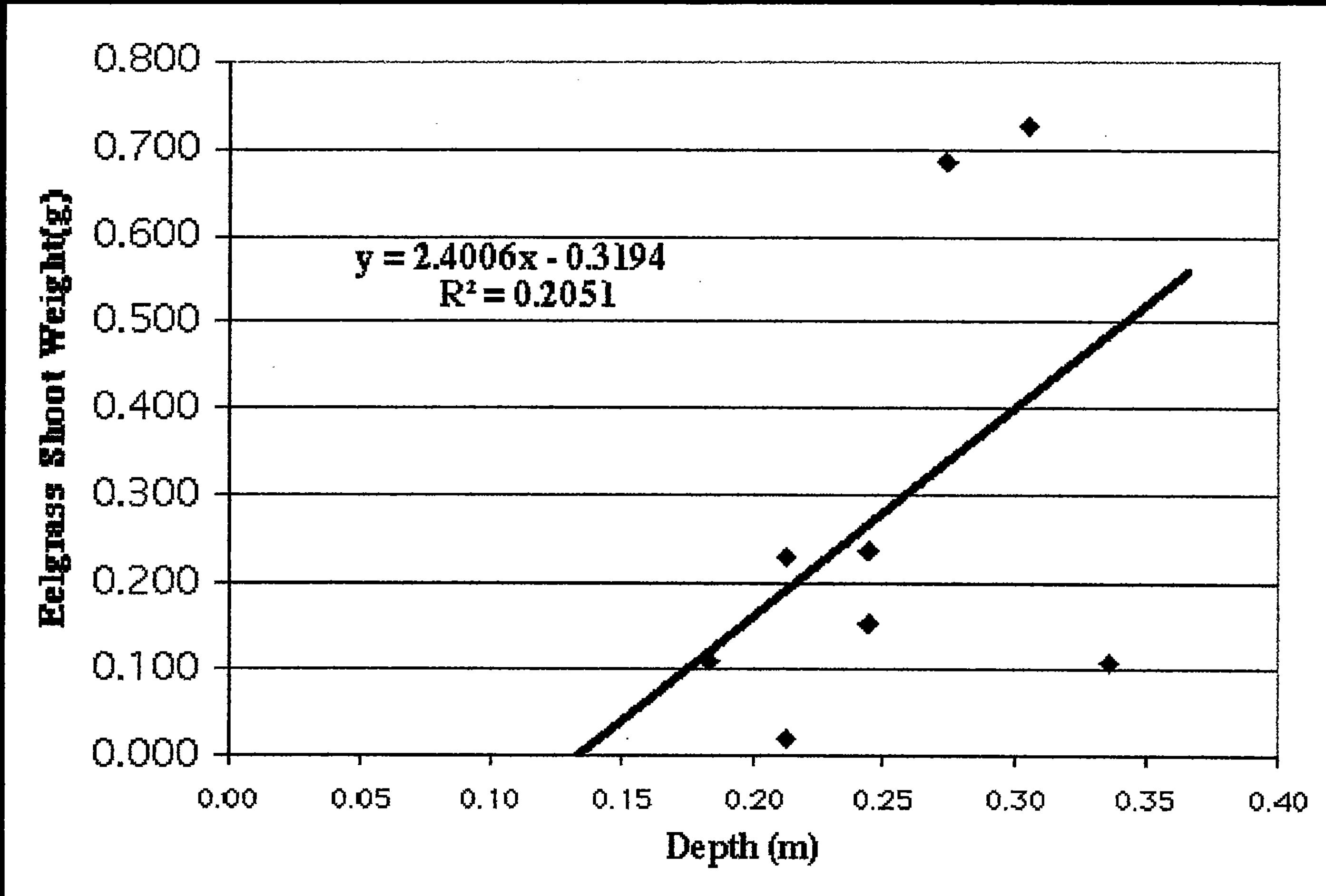
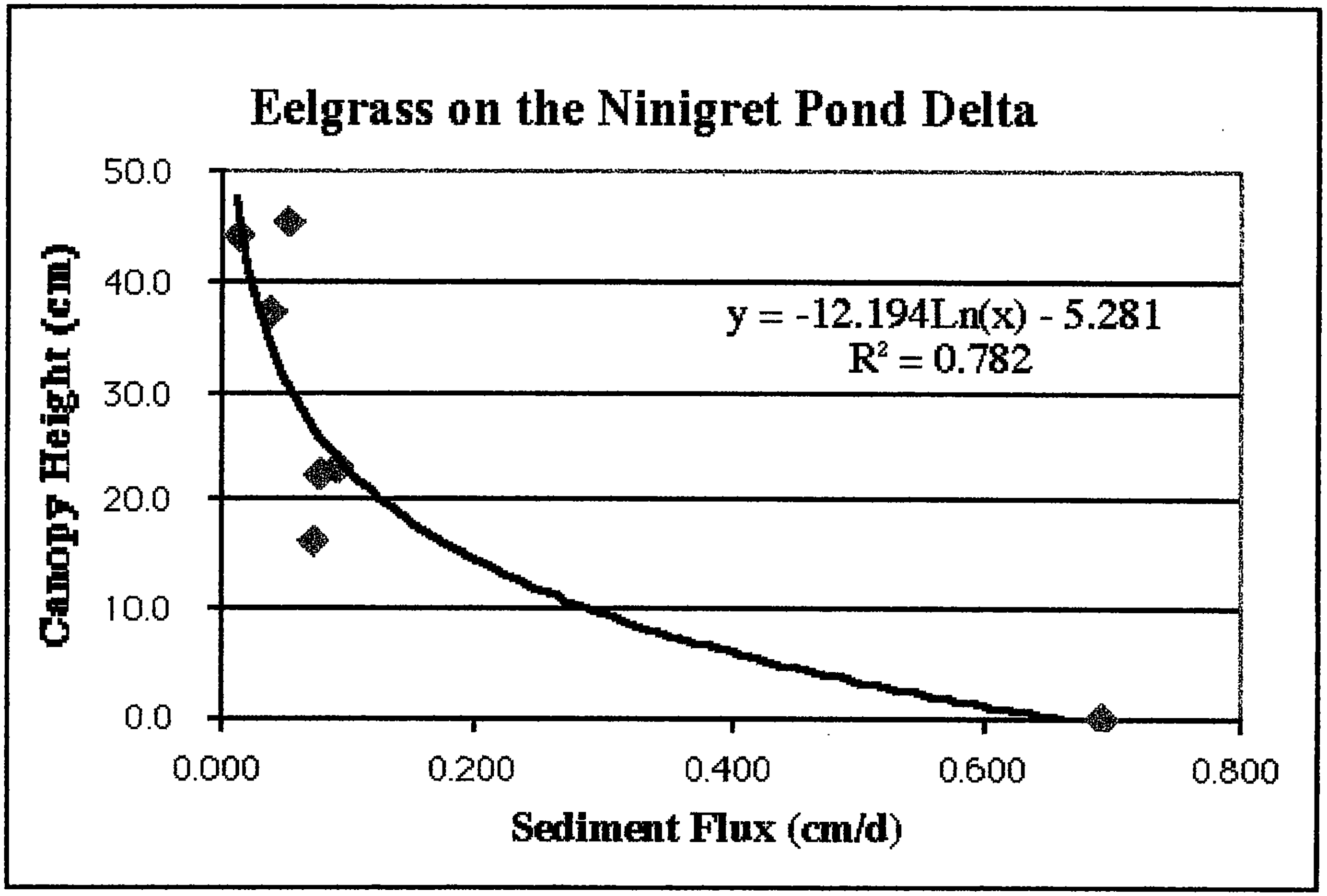
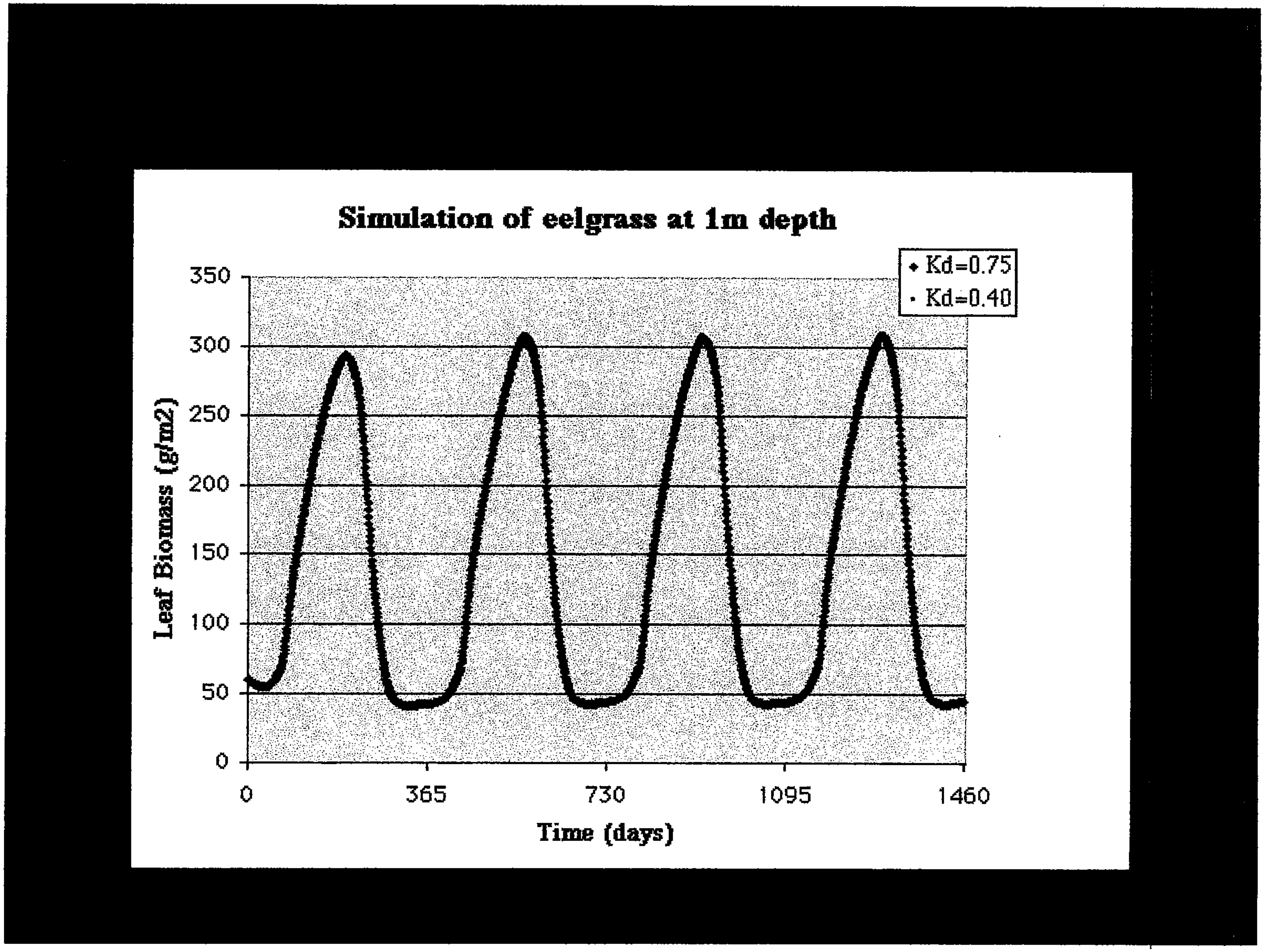


Figure 9.


Eelgrass on the Ninigret Pond Delta
y = -12.194Ln(x) - 5.281
R² = 0.782
Canopy Height (cm)
50.0
40.0
30.0
20.0
10.0
0.0
0.000
0.200
0.400
0.600
0.800
Sediment Flux (cm/d)


Simulation of eelgrass at 1m depth
Kd=0.75
Kd=0.40
350
300
250
200
150
100
50
0
Leaf Biomass (g/m2)
0
365
730
1095
1460
Time (days)

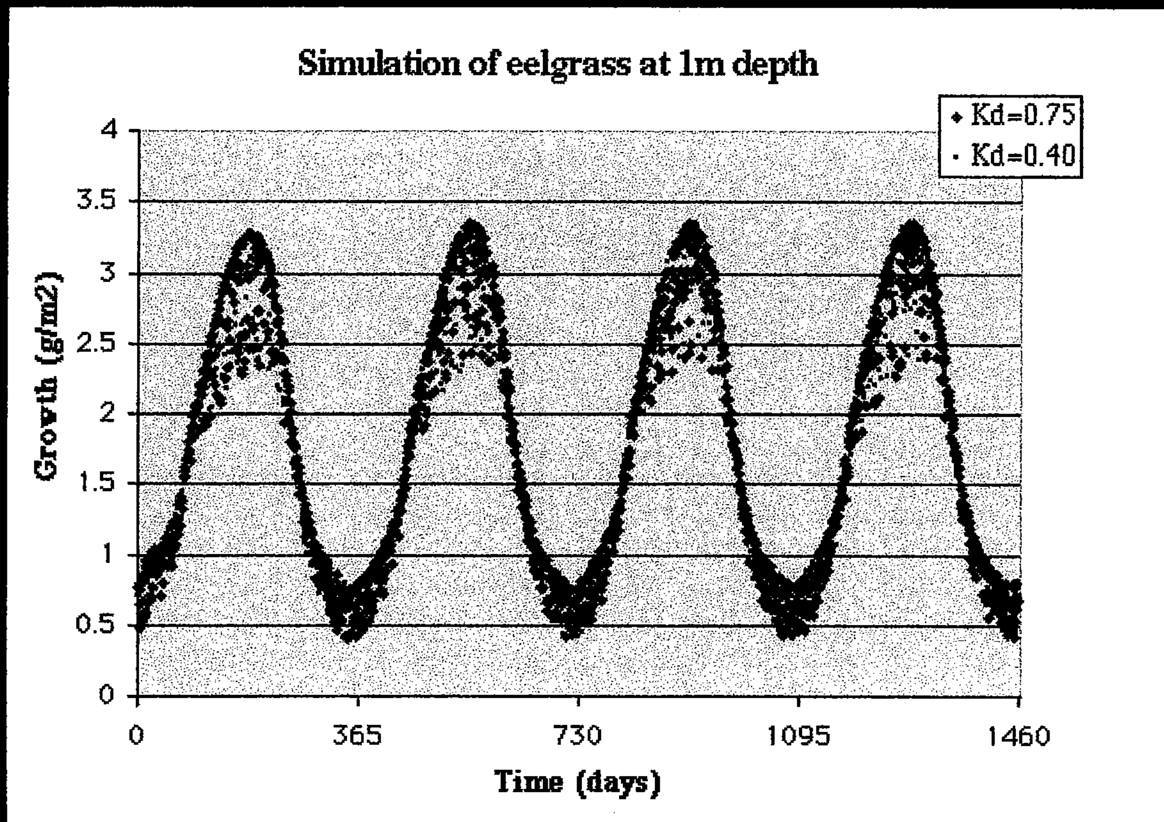
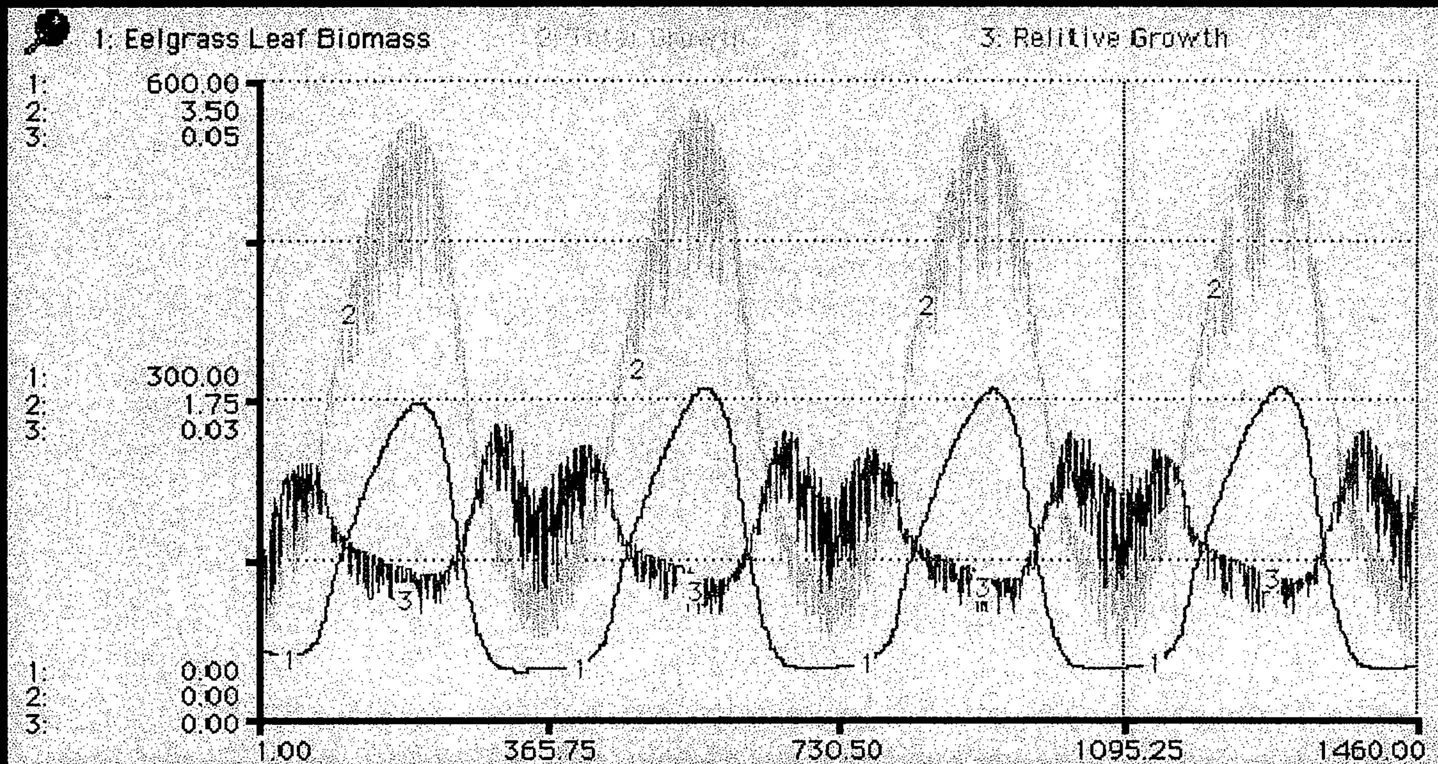
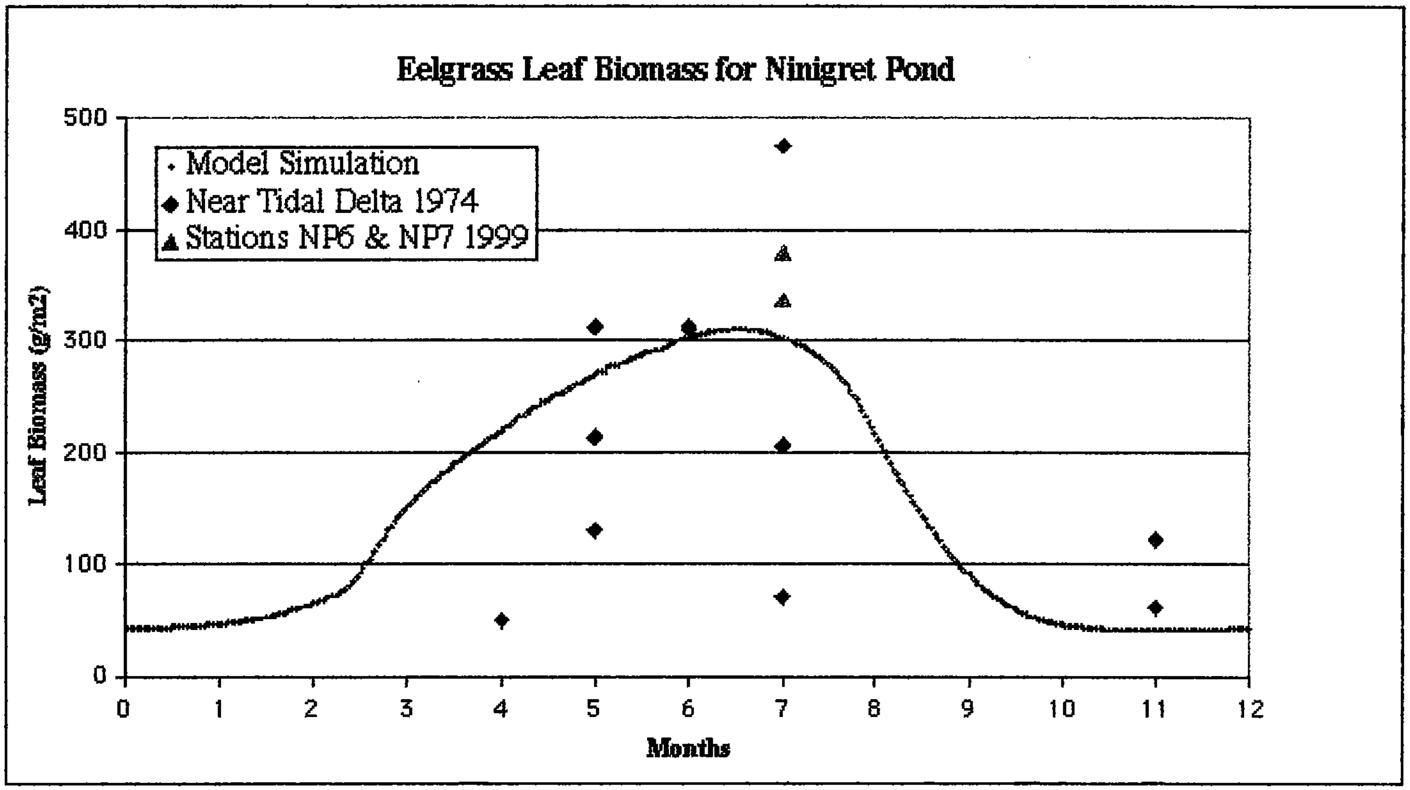

Simulation of eelgrass at 1m depth
Kd=0.75
Kd=0.40
Growth (g/m2)
0
0.5
1
1.5
2
2.5
3
3.5
4
0
365
730
1095
1460
Time (days)

Figure 12.



Simulated eelgrass biomass and growth over 4 years for Ninigret Pond

Figure 13.



Eelgrass Leaf Biomass for Ninigret Pond
Model Simulation
Near Tidal Delta 1974
Stations NP6 & NP7 1999
Leaf Biomass (g/m2)
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
10
11
12
Months

Figure 14.

Eelgrass biomass on the shoal

With <u>no sedimentation</u> resulting in <u>constant</u> water depth (SF)

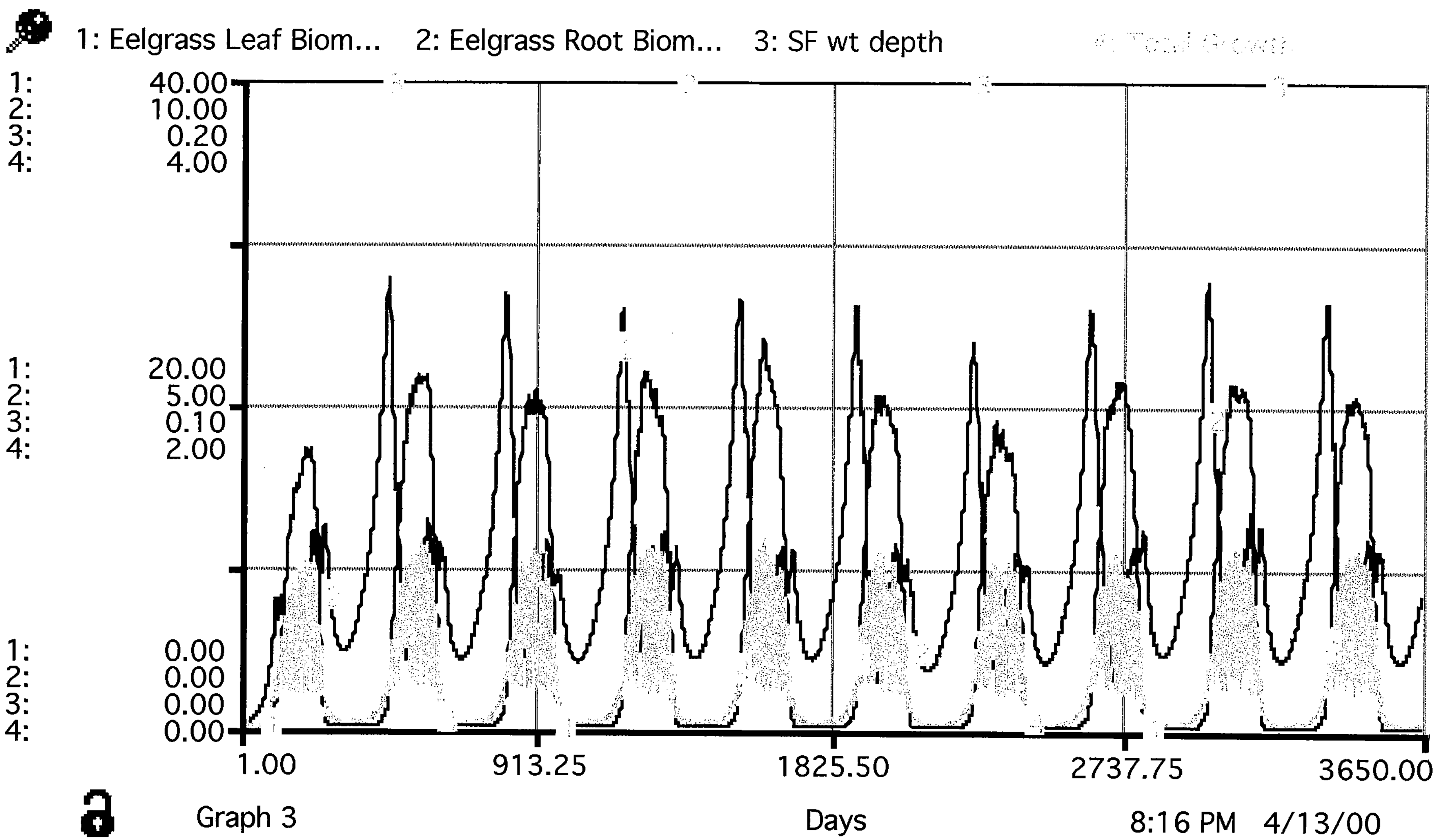


Figure 15.

Eelgrass biomass on the shoal

With 1.1cm/y sedimentation resulting in decreasing water depth(SF)

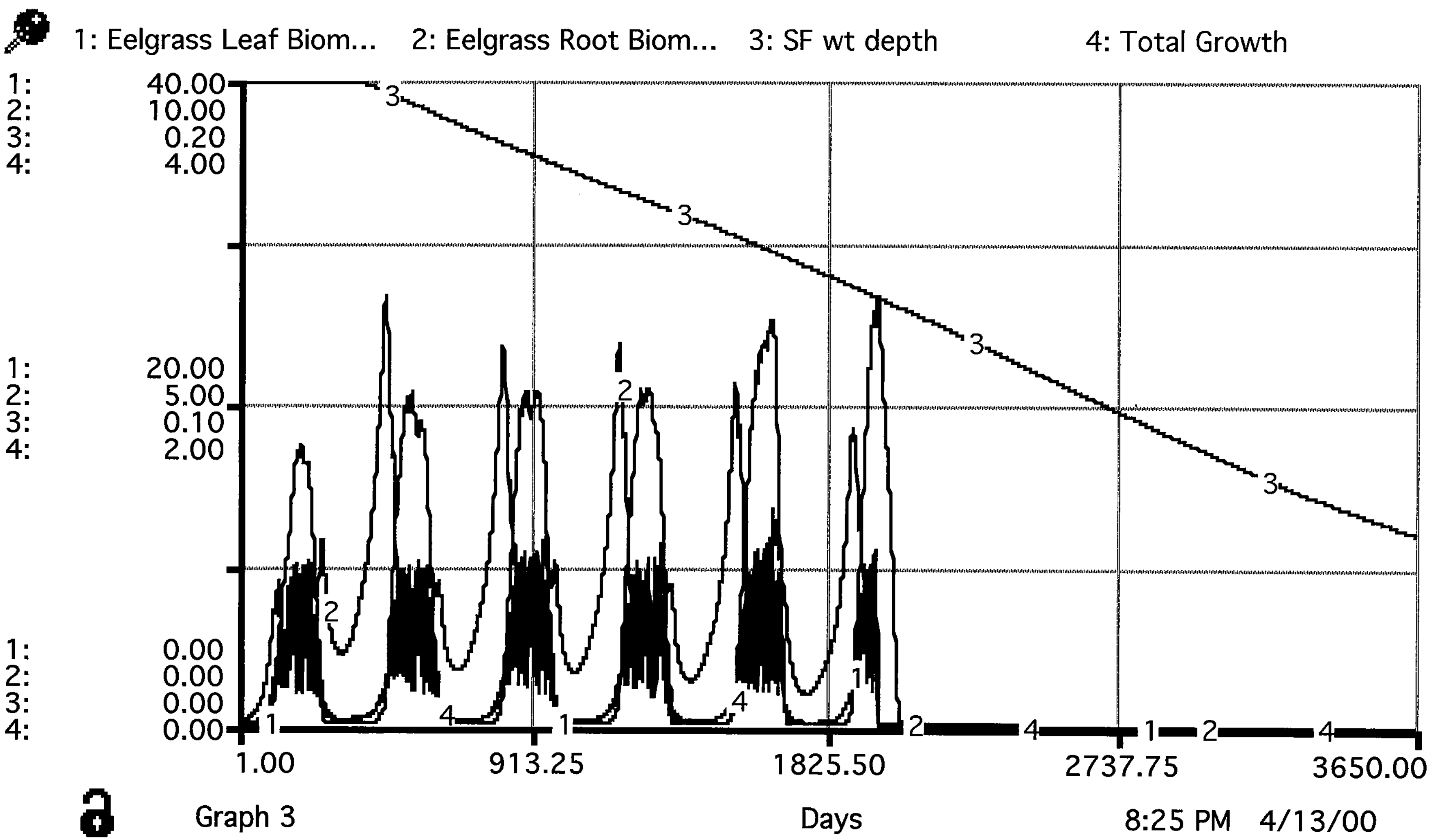


Figure 16.

Eelgrass biomass on shoal after transplanting, with increa
sedimentation causing decreasing water depth

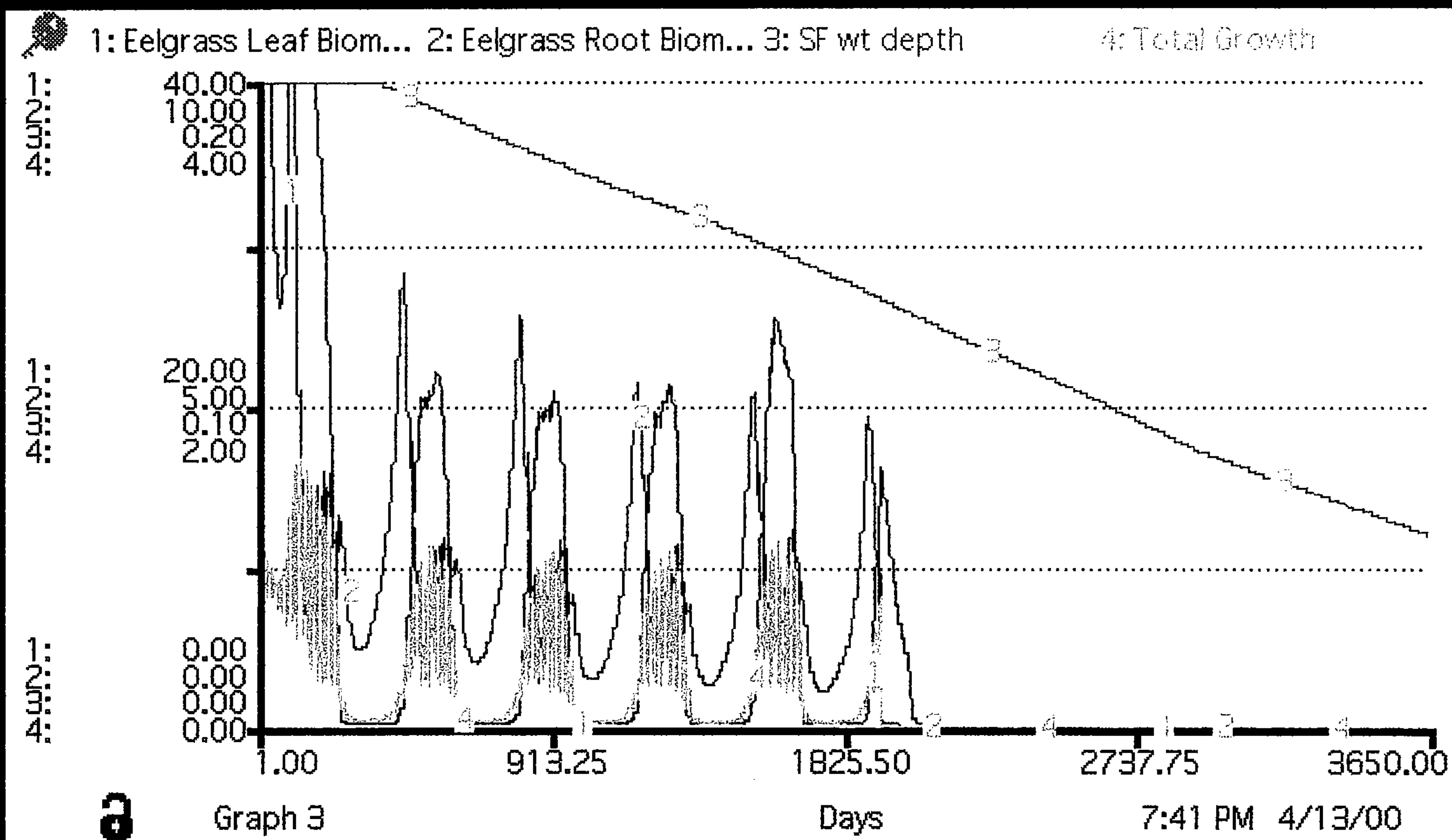


Figure 17.

Eelgrass biomass on shoal after transplanting with no sedimentation and constant water depth (20 cm)

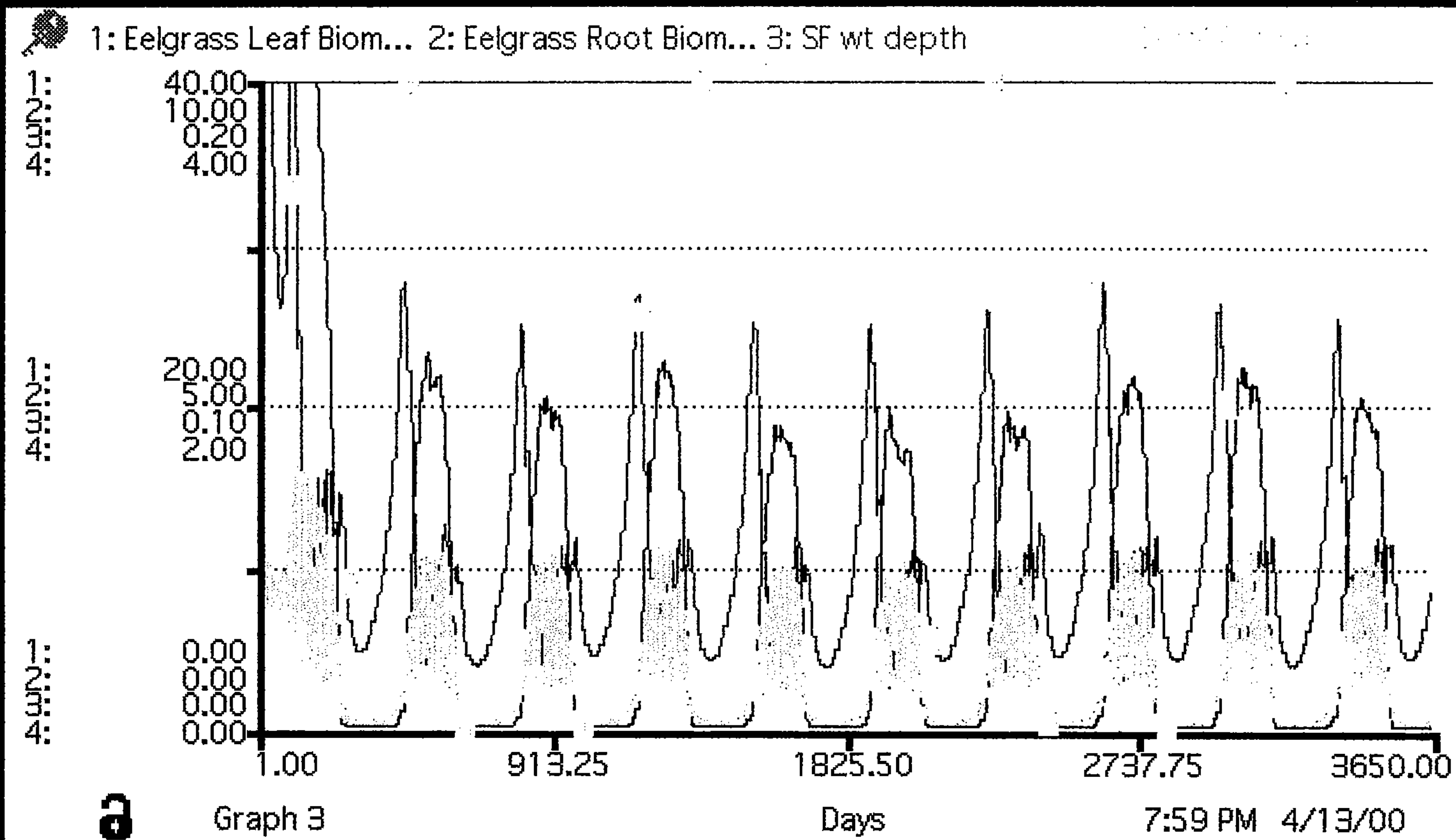


Figure 18.

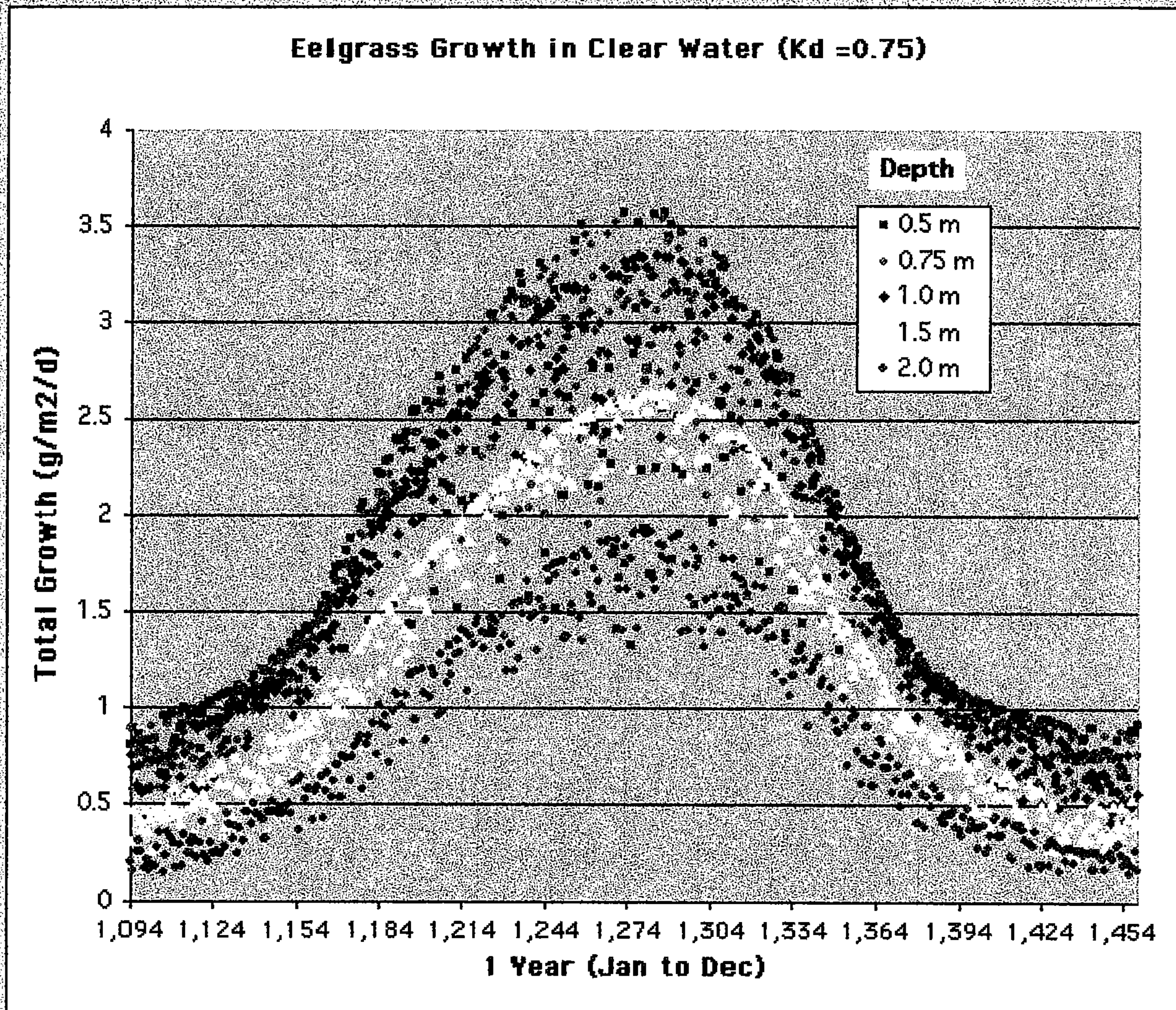

Eelgrass Growth in Clear Water (Kd =0.75)
Total Growth (g/m2/d)
4
3.5
3
2.5
2
1.5
1
0.5
0
1,094 1,124 1,154 1,184 1,214 1,244 1,274 1,304 1,334 1,364 1,394 1,424 1,454
1 Year (Jan to Dec)
Depth
0.5 m
0.75 m
1.0 m
1.5 m
2.0 m

Figure 19.

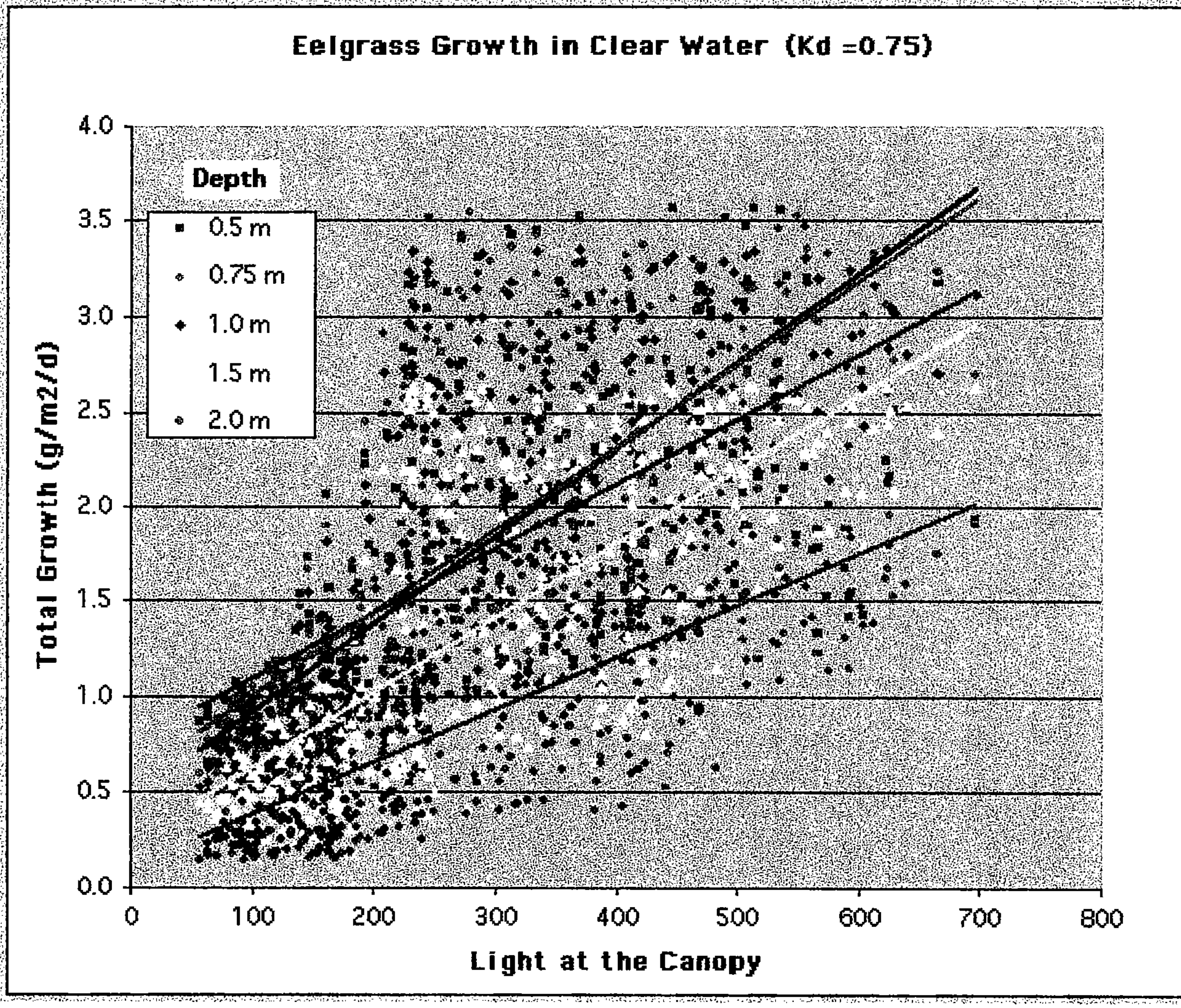
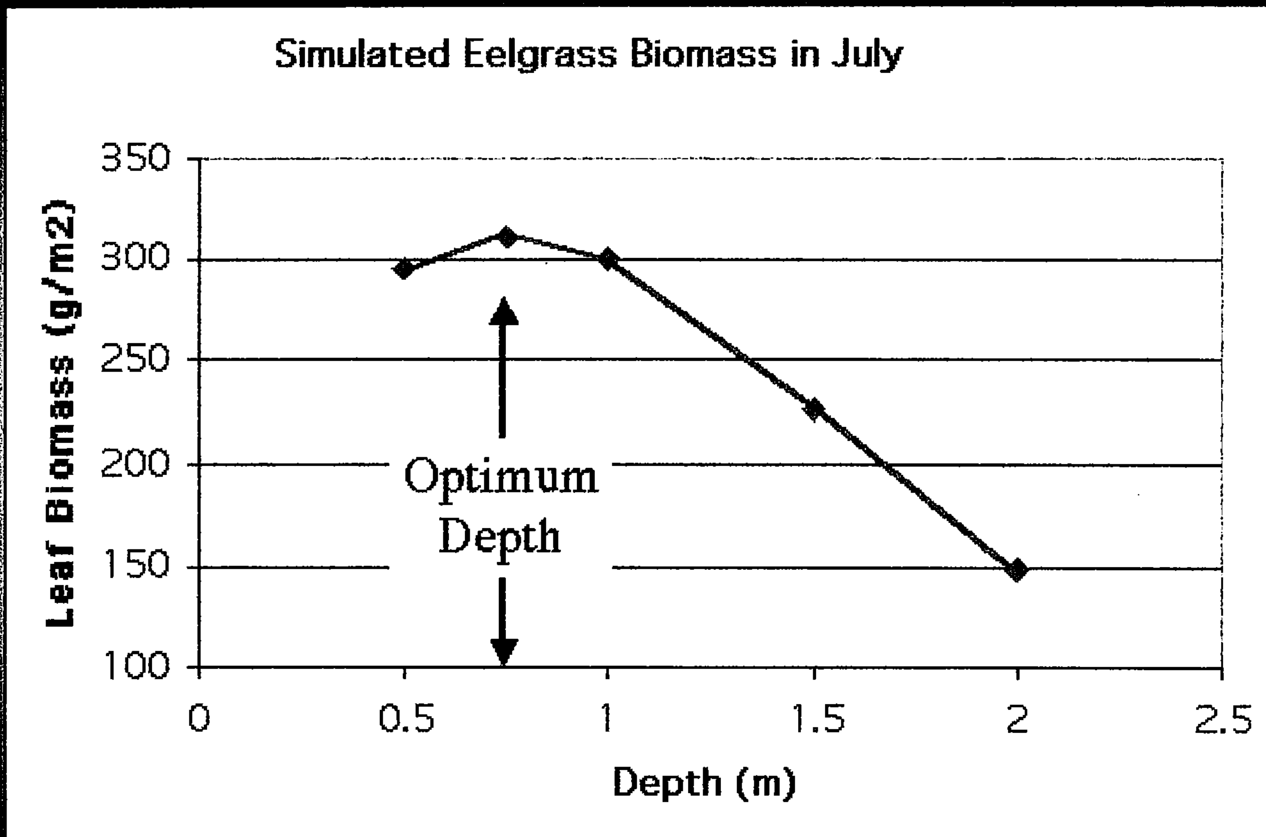

Eelgrass Growth in Clear Water (Kd =0.75)
Total Growth (g/m2/d)
Light at the Canopy
Depth
0.5 m
0.75 m
1.0 m
1.5 m
2.0 m
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
100
200
300
400
500
600
700
800

Figure 20.



Simulated Eelgrass Biomass in July
Leaf Biomass (g/m2)
350
300
250
200
150
100
0
0.5
1
1.5
2
2.5
Depth (m)
Optimum
Depth