

# **A RESTORATION PLAN FOR THE COONAMESSETT RIVER:**

Options for the demonstration project in the lower Coonamessett River

Demonstration Plan developed by:

Coonamessett River Park Coalition  
Natural Resource Conservation Service  
Mass. Wetland Restoration Program  
Falmouth Dept. of Natural Resources

Dr. Linda Deegan, Wendi Buesseler, Bob Golder  
Beth Schreier, Don Liptack  
Tim Smith  
Mark Patton, Chuck Martinson

## Introduction

Falmouth has the opportunity to be a regional leader in wetland and river restoration. This is our opportunity to create a naturally functioning coastal groundwater fed river, a special ecosystem unique to Cape Cod.

The overall goal of this draft restoration plan is to restore the Coonamessett River to ecological health by enhancing and naturalizing the existing River in the context of the current landscape. What does restoring the river to ecological health involve? It means restoring the natural vegetation of the riverbanks to improve habitat for fish, both herring, trout and native forage fishes. It means converting areas adjacent to the river away from human dominated activities to species-rich wetlands such as wet meadows, a regionally threatened ecosystem. This diversity in vegetation in turn supports a variety of wildlife such as insects, reptiles, mammals, and amphibians. It means reconfiguring the river itself to allow it to meander, to develop deep pools and reconnect to its streamside wetlands and buffer zones.

In discussions with federal and state agencies one thing became clear, the restoration of the Coonamessett is an exciting prospect and all the agencies hopes this project moves forward. The following agencies and personnel assisted in the development of this restoration plan based on site visits to the Coonamessett River, accepted practice standards for wetland and river restoration and their experience:

AGENCY	PERSONNEL
Natural Resource Conservation Service	Don Liptack, Beth Schreier
Mass Wetland Restoration Program	Tim Smith
US Army Corps of Engineers, Ecological Restoration Program	Larry Oliver
Mass. Division of Marine Fisheries, Herring Biologist	Phil Brady
Falmouth Dept. of Natural Resources	Mark Patton, Chuck Martinson
Mass. Dept. of Fish and Game, Stream Fish biologist	Steve Hurley
Northeast Instream Habitat Restoration Program, University of Massachusetts	Piotr Parasiewicz, Professor
Local Wetland Consultants	Mario DeGregorio and Don Schall
Local Coonamessett River expert	Carl Breivogal (long standing advocate for herring and fish in the Coonamessett River)
Local Fish Conservationists active in the restoration of the Quashnet Rive	Bob Golder and Fran Smith

These experts unanimously agreed on several points that defined the restoration plan:

- 1) Water quality will be improved to levels more suitable for fish and wildlife by restoring natural wetlands that clean and purify water and by removing inputs of nutrients, herbicides, pesticides and sand.
- 2) Without natural wetlands adjacent to the river, the river would not be restored.
- 3) River flow must be returned to a natural cycle and water returned to the main river channel and adjacent wetlands, instead of diverted through perimeter and lateral ditches.
- 4) Herring must have a clear and unambiguous path to Coonamesett Pond and Flax Pond; ditches that divert fish and culverts and other water control structures that are no longer needed should be removed.
- 5) Instream habitat needs to be improved by narrowing the channel, increasing the depth and adding gravel and coarse woody debris that will provide suitable substrate for food items, spawning habitat and protection from birds for fish.

## **Overview of plan**

This restoration plan combines both natural and active restoration activities to achieve the desired goals within the 5-year time frame as specified in the Consensus Restoration Plan. “Natural” or passive restoration means allowing the plants that already occur on the bogs to flourish. A plant survey conducted by two local botanists found over 50 native plants already growing on Lower Bog. Allowing these plants to grow without suppression from herbicides or being mowed or cut down by harvesting machines will allow them to grow unimpeded. Merely ending cranberry operations on these bogs will be a major step towards restoration.

Active restoration activities are focused on two areas. One is to create a variety of landscapes or habitats on the riparian areas by changing the topography of the land. The wetland surface has been artificially flattened and elevated to facilitate cranberry cultivation. Even slight changes in elevation on the land will create different habitats. Plant communities will be different on the higher, drier ground than in lower, wetter depression areas. This variety offers diverse wildlife species plants for shelter, food, nesting material. For example, burr reed, which grows in the river channel, is an excellent food source for ducks and other waterfowl. Meanwhile, bayberry shrubs, which prefer drier, sandy soils, are an important food source for migrating birds.

Creating a more natural river channel is the second focus of the active piece of the plan. Narrowing the river channel and installing deflectors to create varying depths in the river channel will provide a variety of water habitats. Creating pools in some spots, riffles in others, and planted shrub overhangs with shrubs will cool water temperatures; provide fish spawning habitat and protection from predators. Adding gravel and coarse woody debris to the channel creates blue back herring and trout spawning areas and attracts food sources for fish while also allowing animals such as turtles to use the logs to access the water or sun themselves.

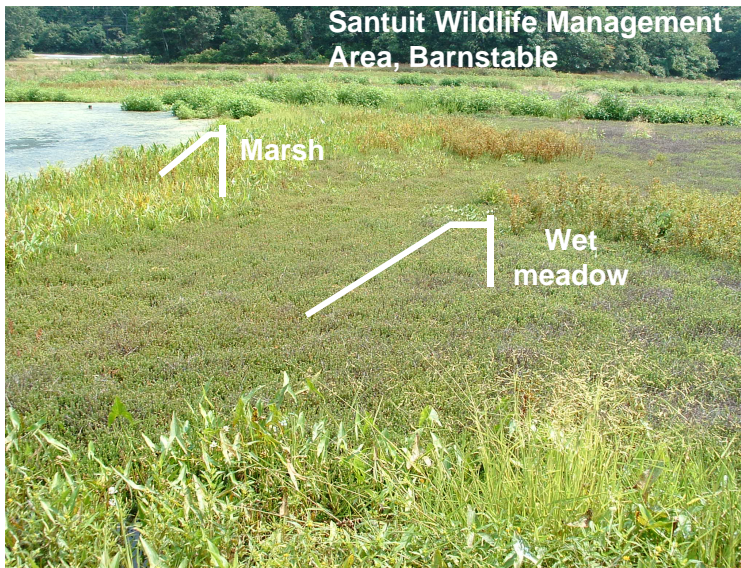
## Implementation

The Restoration Plan is a combination of natural and active restoration practices. “Natural” or passive restoration is the least expensive option and will result in immediate benefits. For example, the cranberry industry suggests that beds not extensively treated with herbicides will revert to a naturally diverse wetland community (Profiles for Cranberries in New Jersey). Instream channel improvements such as deepening will take longer, perhaps 3 to 10 years to see significant improvements, while perimeter and lateral ditches may take decades to fill. Active restoration will accelerate the recovery of the River by enhancing the natural restoration processes. We can do more or less active restoration, depending on the timeframe in which we would like to see results, the benefits likely to be seen, and the funding available. This restoration plan takes a moderate approach that combines some active restoration with natural restoration. A summary of the combination of restoration activities recommended for each Management Unit within the Demonstration Project is presented in Table 1 while below we provide a more detailed narrative.

### ***LOWER BOG MANAGEMENT UNIT***

#### **Stream Wetland Restoration**

Three wetland types are proposed for this area (see map): wet meadows (sedges and grasses whose roots are in wet soil), shallow emergent marsh (short grasses, sedges and rushes covered by 6 inches or so of water) and deep emergent marsh (tall grasses, rushes and sedges that are covered by 6 to 30 inches of water). Wet meadows have wet soil, but can be walked upon in tennis shoes in the summer without getting your feet wet.



Santuit River cranberry bog after 3 years of natural restoration with no management for control of shrubs or trees.

Most of the wetlands will be restored by natural restoration. A survey of plants in the Lower, Middle and Flax Pond bogs found that over 50 species of native wetland plants are already growing there (Sept. 2004, Table 1). Having these pioneer plants already in place is important as they provide a seed source for their spread. A survey of local bogs retired from agriculture demonstrates that within 2 to 3 years a diverse plant community can be established (Santuit River photograph). The Santuit River Wildlife



Management area provides an example of what we could expect the Coonamessett River to look like in 2 to 3 years under natural restoration. A variety of plants that prefer to be submerged in water grow along the edge of the water edge of the water. Farther away from the water is a wet meadow still dominated by cranberry plants with other native species.



Marsh vegetation along the edge of the river provides habitat complexity.

Slightly higher elevations that would mimic natural streamside levees and help to focus the stream channel may be created with the excavated soil and bushes such as high bush blueberry or bay berry, planted (Map). These areas would also be appropriate areas for walking paths along the stream.

Marsh and shrub vegetation along the edges of the river will provide more habitat for songbirds, protection from predators for fish, and spawning habitat, as well as shade to help keep river temperatures low. Like a pearls on a gold chain, isolated small clusters of shrubs, chosen for their value to wildlife, small stature (less than 15 ft at mature height) and non-spreading character, will be strung along the river. Pearl islands of shrubs will be planted about every 200 ft in conjunction with the instream channel deflectors and j-hooks as recommended for successful instream modification.

Some shrubs, such as bayberry and high bush blueberry, will be allowed to naturally develop in

the interior sections of the wet meadow.



An example of a bayberry bush growing in an actively restored cranberry bog wet meadow.

## Creation of Pond Habitats

To increase the diversity of habitats suitable for wading birds, waterfowl, songbirds, turtles and amphibians, off channel bays and ponds with shallow and deep areas will be created in the Lower Bog (see Map for example placement of ponds) and the elevations



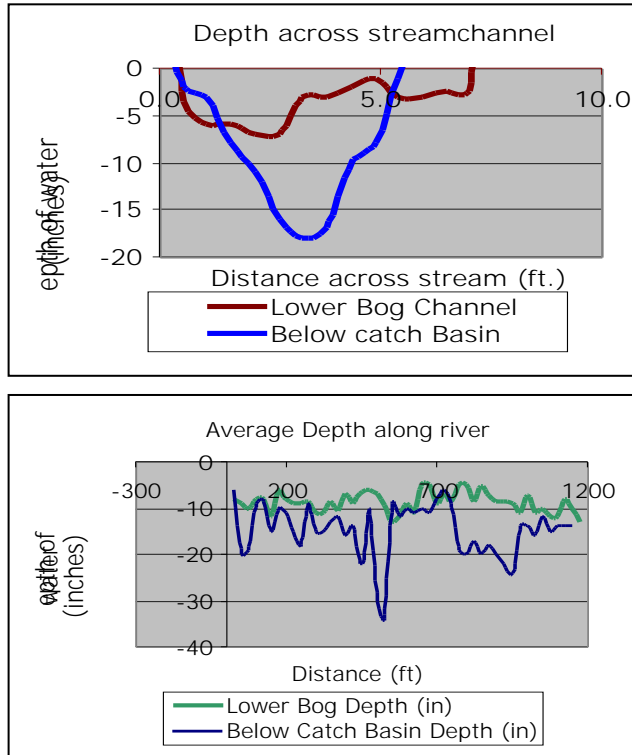
Wading birds along the shallow margin of a pond.

contoured to create shallow and deep marsh and streamside levees. The addition of sand over the years has created artificially high wetland elevations, especially at the bottom of Lower Bog on the east side where the plant community is dominated by undesirable species.

The plan proposes creation of two 0.2 acre ponds, one on the east and one on the west side of the river. Ponds will have a variety of depth ranging from 1 to 4 ft, with side grades of 6:1 or 10:1 (Figure). Gentle sloping sides resist invasion

by undesirable plants (NRCS Conservation Practice Standard). Ponds will be connected to the main river by small streams that will be developed using the existing ditch system as a basis, but perhaps increasing the sinuosity and softening the slopes. Preference will be given to ditches that have substantial groundwater inputs, such as on the west side of Lower Bog.

## Instream channel modifications

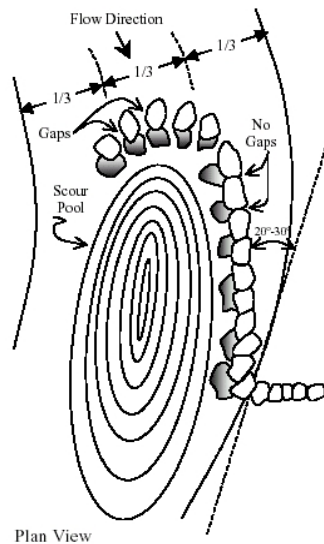


The main problems with the River in this section is that it is too flat across the channel at any point, too wide, lacks deep pools, and has too much sandy bottom and not enough gravel for spawning and habitat (See water depth figures). The river in Lower bog is only half the depth of the river below the catch basin. The deepest area was less than 1/3<sup>rd</sup> the depth of below the catch basin. Instream modifications to correct these problems include channel deflectors or J-hooks, coarse woody debris and gravel placement (Map). All instream channel modification will occur between late October and early April to avoid conflicts with herring migration.

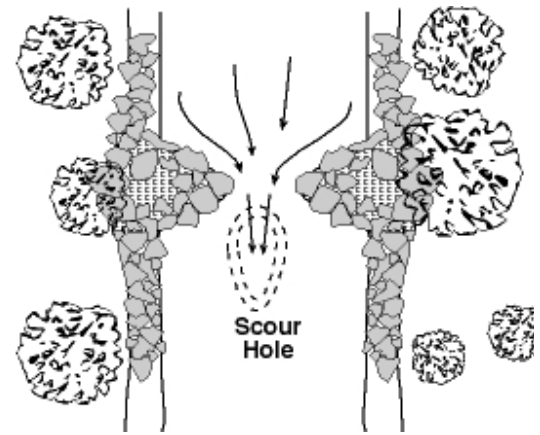
The channel has one major obstruction to herring migration - the berm and water level control structure separating Lower and Middle Bog. Redesign of this area of wetland is essential for the Flax Pond herring run (See below) and should be done in conjunction with careful consideration to removing this berm and water level control structure. Falmouth DNR personnel have

requested as many instream structures be removed as possible for lower long-term maintenance and better fish passage. If this structure is not removed, it will need to be repaired as it is currently not designed properly and sits too high relative to water flow.

Deflectors and J-hooks will be used to narrow the channel, increase flow velocities and deepen the channel. The general pattern of alternating shallow and deep areas found in the stream below the catch basin will be used as a guide for reconstructing the stream channel (Figure). All materials will be of local origin to provide a more natural look. Proposed locations for about 12 deflectors take advantage of existing constrictions or locations of areas known to block herring migration because of their shallow depth, such as immediately upstream of the catch basin. Deflectors used to create meanders or narrow the width of a low-flow channel will be placed on alternating banks a distance



Typical J-hook construction to create deep



Parallel deflectors used to narrow the stream channel and increase current speed.

equal to

five to seven stream widths apart and live plantings incorporated into deflectors to stabilize and reinforce the deflector. Live plantings are not only beneficial in establishing the deflectors but will also restore a more natural biotic habitat and moderate temperature regimes.

Coarse woody debris will consist of tree stumps with roots to provide underwater complexity in created pool habitat and large logs that will emerge from the water up onto the adjacent wetlands to create haul out areas for turtles. Haul out logs for turtles will be placed near the sand excavation pit in the middle of Lower Bog as this area will be managed as a turtle nesting area. Final locations for these structures will be selected based on an instream assessment of current velocities and stream profiles.

Gravel will be added to the stream in areas of appropriate current velocities for blueback herring spawning and in upwelling areas for brook trout. Blueback herring are known to spawn in a section of the Coonamessett River (Mark Patton and Chuck Martinson, personal communication). Blueback herring are known to spawn in areas just above the reach of tidal influence making the Lower Bog section a prime area for restoration. The attributes of known spawning areas in the Coonamessett River along with known general habitat requirements of blueback herring will be used to select locations for gravel additions in the Lower Bog area.



## FLAX BOG 2 MANAGEMENT UNIT

### Stream Wetland Restoration



Photograph of Flax Pond Bog 2 showing the extensive natural wetlands already in place and the pond in the center of the bog.

The same 3 wetland types  
I restoration in the wetland habitat of Flax Pond is proposed because of the expansion of the pond in the center of the bog.

### Creation of Pond Habitats

Flax Bog 2 has a pond in the center that has been expanding over time. No pond creation was suggested as this existing pond provides areas for the continued development of shallow and deep emergent marsh.

### Instream channel modifications



Perimeter ditch on north side of Flax bog 2 showing the steep sides that pose a long-term erosion problem.

The major problems with the Flax Pond 2 management unit are impediments to herring migration due to poor culvert construction and the routing of water through a maze of perimeter and lateral ditches. The restoration plan proposes a designated migration route for herring and that all other lateral and perimeter ditches be plugged or filled to increase water flow through the herring route (Map). The proposed herring route is through the middle of the bog to avoid the maintenance of the perimeter ditch on the west side and to provide a vegetated buffer on both sides of the route the herring use. An extremely steep slope bounds the west perimeter

ditch and erosion into the perimeter ditch will be a long-term problem. This ditch should be filled and the slope regarded to be 6:1 (NRCS Conservation Practice Standard). Water from all ditches should be focused down the central path to increase water flow to naturally help keep this channel open. This includes plugging or filling ditches just after the water enters Bog 2 from Flax pond. The edges of this central channel may be softened with some bends if desired to create a more natural look.

The area of ditches near the exit needs to have obstructions removed (See photo), lateral and perimeter ditches need to be plugged and the culvert exiting Flax Bog 2 needs to be enlarged and properly sited. The proposed route through Flax Bog 1 provides for vegetated cover on either side of the migration path and allows for an existing erosion problem to be fixed. A berm should be placed on the east side of the migration route to separate the stream from cranberry practices. The culvert exiting Bog 1 needs to be fixed as erosion into this area from the steep bank affects fish passage. It was beyond the intent of this plan to propose a solution to the culvert passing under the main road, however, it is within the scope of the NRCS mandate to work with DPW to craft a solution. After Flax stream passes under the road and down the slope to the main Coonamessett River series of “quickie” fixes have been placed in the stream to solve fish passage problems. These need to be removed and a suitable long-term solution installed. When the stream is no longer manipulated and held for cranberry cultivation, different solutions become available. Down slope as the stream enters the Middle Bog area, the perimeter ditches north and south of the stream need to be plugged and the culvert removed to allow the stream and fish clear passage to the main river channel.



Various obstructions have been placed in ditches and channels over the years. These need to be removed and the maze of ditches reduced to a single designated migration route.



## ***MIDDLE BOG MANAGEMENT UNIT***

Restoration of the eastern portion of Middle Bog is part of the second demonstration project proposed for Middle Bog. Here we provide only general guidance as there may be special considerations that are needed to be compatible with the berm project.

### **Stream Wetland Restoration**

The east side of Middle bog has many of the same management issues as Lower Bog, thus similar restoration practices can be applied. The wetlands will be restored to a combination of wet meadow in the higher elevation areas away from the main river channel and shallow and deep marsh will be restored along the rivers edge. Perimeter ditches will be filled or plugged to focus the water through the wetland and into the main stem channel and to provide a clear migration route for herring.

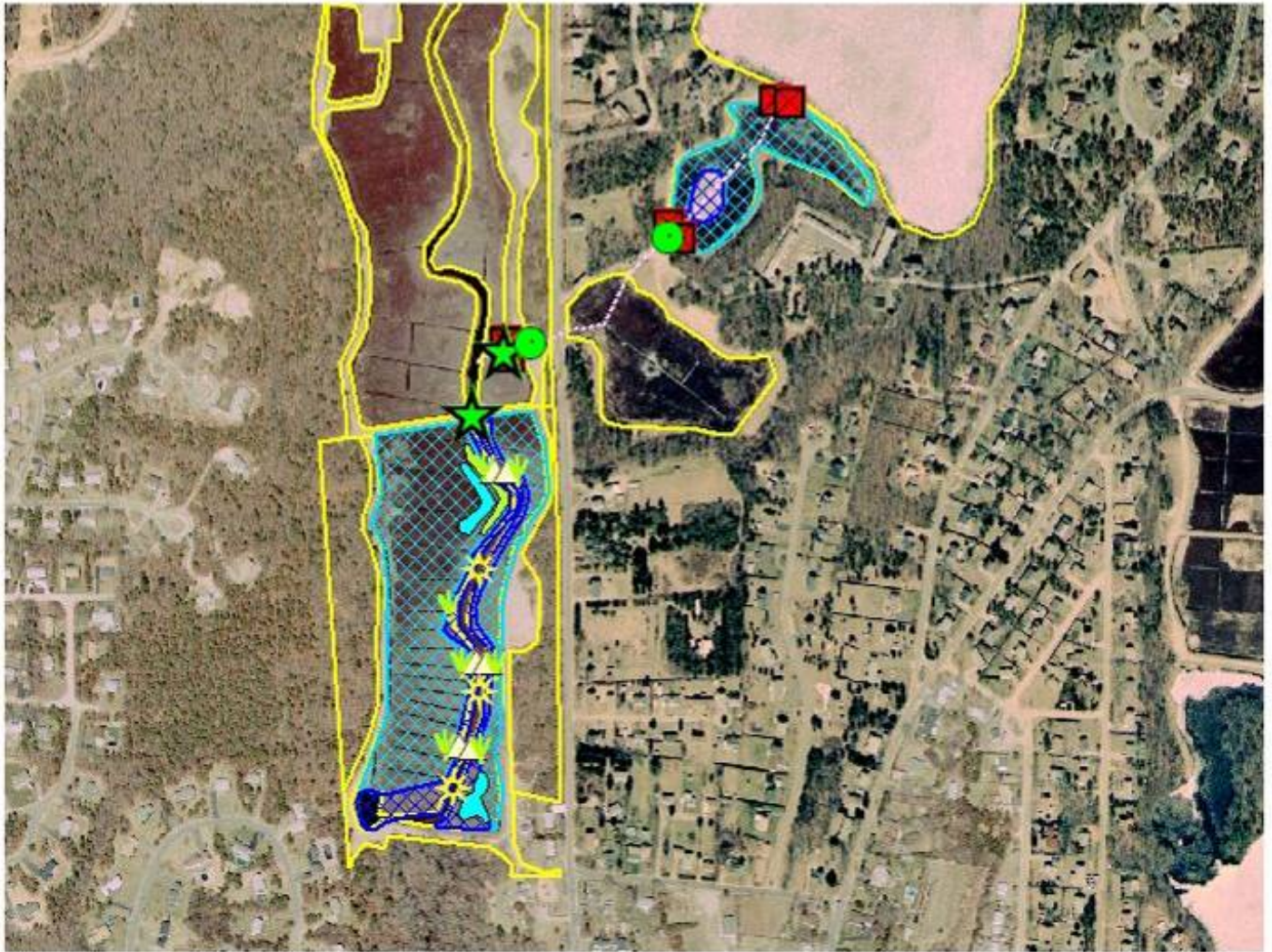
### **Creation of Pond Habitats**

Because of the narrow linear nature of this restoration section, no pond development is proposed.

### **Instream channel modifications**

Instream channel modifications including deflectors, J-hooks, coarse woody debris and turtle haul out logs will be used to narrow, deepen and create more structure in the stream channel. Gravel will be added where appropriate.

# Complete Restoration



0 600 1200 1800 2400 Feet

-  Shrub
-  Woody Debris Structure
-  Deflector
-  Remove Obstructions
-  Remove Culvert
-  Plug or Fill Ditch
-  Race Fish Route
-  Pond/Cpt 1.dhp
-  Stream Side Levee/Cpt 2.dhp
-  Shallow and Deep Marsh
-  Pond/Cpt 2.dhp
-  Wet Meadow
-  Contour Line.dhp

Map prepared by Rachael Phillips, USDA-NRCS on 10/06/04.

**Table 1. NATURAL RESOURCE CONSERVATION SERVICE  
WETLANDS RESERVE PROGRAM  
CONSERVATION PLAN SCHEDULE OF OPERATIONS**

Town of Falmouth – Coonamesset River		Barnstable County
Item No.	Field	Planned Conservation Treatment
1	All	The primary purpose of this project is to restore and protect the wetland and river resources to provide habitat for wetland dependent fish and wildlife; water quality protection; and aesthetic quality.
		<b>RESTORATION PRACTICES</b>
2	Lower Bog	<p>This wetland will be restored to a mix of wet sedge meadow, shallow emergent marsh and deep emergent marsh. To create the shallow and deep emergent marsh areas, shallow depressions will be excavated. Depressions will be irregularly shaped; have a variety of depths and should be a maximum of 4 feet in depth to provide habitat for ducks. Side slopes should be as gentle as possible, with minimum grades of 6H:1V. More gentle side slopes of 20H:1V can create habitat for shore birds. Wetland areas will be connected to the river to promote access by fish for habitat and for mosquito control as per Natural Resource Conservation Service Conservation Practice Standards and MA Dept. of Mosquito Control Standards.</p> <p>Existing water flows will allow for the development of a deep fresh marsh and a shallow fresh marsh in Lower Bog. Prior to excavation, surface soil (topsoil) will be removed from area and stockpiled nearby. Spoil material will be removed and deposited in upland area, placed adjacent to the river to mimic a natural levee or used to fill perimeter ditches. If the spoils are to be used to re-create a levee, the shallow depressions can be located parallel to the river to mimic oxbow wetlands. After excavation, stockpiled topsoil will be placed in excavated depressions to act as a seed source.</p>
3	River	<p>To narrow the channel and increase stream velocities (and ultimately increasing the channel depth) J-hooks or log frame deflectors will be installed along the river. Wetland plants and shrub plantings will be done in conjunction with the revetments to protect the side slopes from accelerated velocities and to provide stream shading and a source of woody debris for the stream. Suggested plantings include: buttonbush, red-stemmed dogwood, winterberry, elderberry (all with fruit desired by wildlife). Buttonbush and dogwood can be planted as dormant woody cuttings, stakes or posts.</p> <p>Large woody debris will be added to the stream to create sunning and climb out areas for turtles, deep eddy pools that provide protection from bird predators for fish, structure that is used as spawning substrate by insects, fish and amphibians, and provide food for the insects that form the base of the food web.</p> <p>Gravel will be added to sections of the stream with flow velocities appropriate for the spawning of Blueback herring and identified upwelling inputs of cold ground water for spawning of native brook trout.</p>
4	East Middle Bog	Eliminating side ditches to focus the water into the main channel; regrading side slopes near berm to create a more gentle slope; Restore wetland to a mix of wet meadow, shallow emergent marsh and deep emergent marsh. To create the shallow and deep emergent marsh areas, shallow depressions will be excavated. Consider removing culvert separating Lower and Middle bog to eliminate an unneeded structure from the river course and reduce maintenance.
5	Flax Bog 2	<p>This wetland will be allowed to naturally return to a wet meadow, with a central pond surrounded shallow emergent marsh. The amount of natural wetlands currently present (Sept. 2004) in the bog indicate that no active management will be needed to achieve the desired result in 5 years.</p> <p>A single channel for water flow to allow for a direct and deeper channel will connect Flax Pond to the Coonamessett River. This will be accomplished by plugging both side ditches.</p>
6	Buffers	Buffer –Throughout the buffer area, including currently mown roadways, ecological succession to warm season grasses will be allowed to occur. Buffers are currently planted to



		<p>non-native, exotic grasses. Buffers will be seeded to native warm season grasses such as little bluestem, switchgrass, deertongue, and broomsedge to provide nesting habitat for grassland nesting birds. Native wildflowers will be added warm season grass seed for greater aesthetics and to provide food for grassland birds. To maintain the buffer in grassland, periodic annual mowing may be done after the nesting season.</p> <p>All west and south facing unvegetated sand slopes will remain as potential turtle nesting sites.</p>
		<b>OPERATION AND MAINTENANCE</b>
7	Lower Bog, East Middle Bog	<p>To prevent encroachment of woody species, vegetative disturbance will be required approximately every 3 years. Methods of disturbance can include: spot treatment of undesirable species by pulling, cutting or herbicide treatment. mowing, or prescribed burning. Grassy upland buffer can be mowed annually – more frequent mowing is not desirable if you want to provide wildlife habitat.</p>

## **Management Plan**

The following only briefly touches on some important aspects of a management plan for the restoration parcels. Ultimately, a more detailed plan will be developed following the example of management plans for other town owned parcels such as the Coonamessett Reservation and Dupee parcels. However, maintenance of a restored Coonamessett River will take less effort than the current situation as we will be establishing a natural community and the restoration has been designed to take advantage of the natural ecosystem processes.

### **Volunteers**

Volunteers will of course be a vital part of the overall management as they are for all Town conservation land. Every parcel needs a few heros – dedicated people who stick to it through thick and thin. Wendi Buesseler, Carl Breivogal, Cheri Holdren, Deborah Seigel are dedicated local heros who have worked for over 10 years to maintain the integrity of the River, the herring run and other fish and wildlife, and have pledged to continue. Over 100 other folks have volunteered to put time and efforts into immediate restoration activities and continued management and monitoring (See Appendix of Volunteers). Approximately 25 people participated in the first every Herring Count this past spring, with about 5 people per day spending at least one hour at the river. Over twenty new volunteers added their name to this list in the 2 weeks prior to the submission of this report.

### **Water level**

Because we have designed the restored river to follow natural water flows, there is no need to manipulate the water flows for any reason other than herring. Because water level manipulations for cranberry cultivation will no longer occur, the Town herring warden will spend less time monitoring and re-adjusting the boards in the river.

### **Monitor for undesirable plant species – non-native invasive plants and trees**

The best way to control undesirable plant species is to prevent their establishment through monitoring and immediate removal. The best situation is to start with a site that has as few of the undesirable species as possible and then keep it clean.

No non-native invasive plant species were found in a survey conducted in Sept 2004 or by the ongoing Invasive Plant Survey by the Town of Falmouth in the wetlands of the Coonamessett River. Thus, no initial efforts at eradicating an existing problem are needed. To control potential invasive species, the bogs will be surveyed annual for invasive species and any invasive plant species found removed by hand by the group of volunteers until a more detailed protocol is developed. Plants of particular concern are Phragmites, Purple Loosestrife and Japanese Knotweed.

Tree seedlings will be removed by hand annually. The Management plan developed by the NRCS for the Coonamessett River restoration suggests removal every three years will be sufficient and the Management Plan for the Cape Cod Hospital restored cranberry wetland calls for removal every five years. Measurements of the tree seedlings on the Lower Bog in October 2004 has shown that pine seedlings grow to a height of 18 inches in 3 years and are easily pulled by hand. The volunteer group will

organize annual tree removal parties to remove red maples, pine trees and willows annually for a period of five years. At that time, efforts needed to control invasive plants or trees will be better known and the removal schedule will be modified to reflect this level of effort.

## Mowing

Mowing annually or even only once every two years will be sufficient to maintain the buffer areas because they will be converted to native grasslands. These native grasses will be better for wildlife because they provide seed and do not mat down in snow thus providing good winter shelter. Grassed buffers provide nesting habitat for grassland nesting birds, therefore any mowing will be done in the late fall.

## Dumping and trash removal

Following the example of the 300 Committee, land stewards will be appointed to the parcels to provide land stewardship. Dumping and trash removal is less of an issue on these lands because they are adjacent to many houses compared to other more secluded lands in Falmouth.

## How will we measure success?

Success will be measured using four “yard sticks”. One will be the amount of native wetland plants growing on the restored parcels. The second is the increased physical structure and habitat diversity of the in-stream channel and vegetated edge habitats. The third is improving stream water quality. The fourth is maintaining the vistas with minimal maintenance.

### Native Wetland Plants

The Natural Resource Conservation Service measures the success of a wetland restoration project when 75% of the area is in native wetland species. Using the Cape Cod Hospital Cranberry Bog Restoration Plan as a model, six 15’ circular plots will be evaluated annually for vegetation cover. The density, type of vegetation, abundance and coverage will be measured on each plot near the end of the growing season.

### In-stream Restoration

One of the prime objectives of the channel restoration effort is to narrow the width and increase the depth of the channel in an effort to increase fish habitat suitability. To evaluate this cross sectional profiles will be conducted every 200 feet before the restoration and compared to profiles taken 2 years and 5 years post-restoration and downstream of the catch basin. Maximum depth in the cross section will also be measured every 50 ft and compared to pre-restoration profiles and downstream areas. Dr. Steve Hurley (Mass. Dept. of Fish and Game) has offered to conduct surveys to assess fish use before and after restoration. He will do triple pass electro-fishing similar to what he does annually on the Quashnet River at three locations before and after the restoration in conjunction with the measurements of physical structure.

### Water Quality

One of the fundamental reasons to restore the river is to decrease the flow of nutrients to Great Pond and to increase water quality in the River to better support fish and wildlife. Once cultivation is discontinued, Approximately 200 lbs of N per year will not be added to Lower and Flax Pond 2 bogs, thus immediately lowering the N loading to Great Pond. Other water quality indicators such as temperature, insects and fish in the stream, water flow and nutrient concentrations can be monitored as indicators of restoration success. The Coonamessett River Park Coalition has been monitoring temperatures every 2 hours at 4 locations in the River using recording thermometers and will continue to do so for the next 5 years. Students in the Semester in Environmental Sciences at MBL have measured aquatic life in the stream as part of their program and will also continue to do so for the next 5 years. Water flow and nutrient concentrations measurements are part of an ongoing monitoring program to estimate N loading to Coastal embayments.

## Bog vistas

To demonstrate that bog vistas are maintained we will take digital photographs of the site from fixed positions and compare the height of the vegetation and the percentage of the wetlands with vegetation height of less than 3 feet in these photographs. Shrub height will be measured. If trees and shrubs occupy a small portion of the landscape and the upland on either side of the river is clearly visible in the photographs, the vista will be considered maintained. Examples of restored cranberry bogs that meet these criteria are provided below.



Cape Cod Hospital Restored Cranberry Bog after 6 years. October, 2004. This bog was restored by



Quashnet River between Mashpee bogs and John's Pond, 2004.

## Cost of Restoration Plan

The planning estimate for restoration of Lower Bog and Flax Bog 2 is approximately \$20,000. This should be considered a very preliminary planning estimate, as there are still several decisions to be made that will affect the final estimate. If we choose more active restoration than is currently proposed (for example, more wetland plantings as suggested by Tim Smith) the estimate will change.

Below we provide cost estimates provided by the NRCS for those activities for which they had sufficient information to cost out at this time. Labor was not included in these estimates. Some aspects of the restoration plan are possible to cost out at this time while others are optional. The cost of obtaining permits is not included.

Restoration Practice	Total Cost
1. Shallow pond depression areas 2 @ 0.25 acre each, 2.5 deep ave. =1,811 cubic yards @ \$7/cy =	\$12,924
2. Water control structures removed (per fishery review and cranberry compatibility) 2 @ \$1000 =	\$2000
3. Ditch filling along east side of Middle Bog 400 lf x 1.5 ft x 3 ft= 67 cy @ \$7/cy	\$468
4. Native shrub plantings for river riparian areas @ \$15/planting @ 50 plants	\$250
5. Native wetland grass seeding @ \$250/acre @ 2 acres	\$500
6. In river fish habitat structures - deflectors, J-hooks or overhead cover structures 12 @ \$350 ea. (price estimate from Fran smith)=	\$4,200
<b>Total</b>	<b>\$20,342</b>

## Funding

Restoration need not be costly, but if money is needed, an almost bewildering array of government and private funding options are available (See Funding Appendix). Due to the herring run, the regional significance of the River and the current use of the land, this restoration ranks as high priority for four programs:

- 1) Massachusetts Wetland Restoration Program
- 2) Natural Resource Conservation Service Wetland Reserve Program
- 3) NOAA Anadromous Fish Restoration Program
- 4) Army Corps of Engineers Aquatic Ecosystem Restoration

Other priority potential funding sources are:

- 5) US Fish and Wildlife Partners for Wildlife Program
- 6) National Fish and Wildlife Foundation
- 7) 5-Star Restoration Partnership Grants
- 8) American Rivers Grant
- 9) Trout Unlimited Partnership Grant
- 10) Ducks Unlimited
- 11) Fish America Partnership Grant
- 12) Gulf of Maine Partnership Grants
- 13) Massachusetts Riverways Program

Below is a description of the first four programs and what they could provide for the Coonamessett River Restoration Plan, if that funding program was used exclusively. However, it is important to note that none of the programs are mutually exclusive and that the agencies routinely work together and can create the best funding package for the Town. An example of a combined plan for a large restoration project in the Town of Barnstable is given below.

### **1) Massachusetts Wetland Restoration Program**

Massachusetts Wetlands Restoration Program provides support to priority restoration projects. The Coonamessett River Restoration is a designated priority restoration project and the MWRP has already provided about \$45,000 dollars for studies of the hydrology and ecology of the river. According to Tim Smith (Project Manager/Wetland Scientist), projects that cost \$100,000 to \$500,000 are par for the course in MA.

MWRP would work with the Town to provide whatever assistance is needed including technical assistance (engineering, biological assessments, hydrological evaluations, surveying), project design, and project monitoring, help applying for and obtaining permits; finding funding, implementing public education and outreach; and overall project management. Any funding provided by this program is considered match for any other federal or private funding program.

Two examples of local small projects funded by the this program are:

--Mary Chase Marsh, Eastham; 15 acres salt marsh; \$40,000 completely paid by state and federal money.

--Wings Neck, Bourne; 8 acre salt marsh; \$95,000 mostly state/federal/corporate money, town contributed \$15,000 worth of construction services.

Below is an example of a large restoration project, the Bridge Creek Salt Marsh Restoration Project, Town of Bourne, put together by the Massachusetts Wetland Restoration Program by partnering with other federal and private agencies.

Source	Cash	In-Kind
MA Wetlands Restoration Program	\$ 202,256	
Natural Resource Conservation Service	\$ 195,000	
Corporate Wetlands Restoration Partnership	\$ 37,850	\$ 53,800
Gulf of Maine NOAA Partnership Grant	\$ 100,000	
NOAA Habitat Restoration Program	\$ 30,000	
Ducks Unlimited	\$ 15,000	
Partners for Fish and Wildlife	\$ 5,000	
Watershed Roundtable	\$ 50,000	
Town of Barnstable		\$ 27,000
MA Transportation and Construction		\$ 2,000
Total	\$ 432,850	\$ 82,800

## 2) Natural Resource Conservation Service Wetland Reserve Program

The Wetland Reserve Program (WRP) program is dedicated to the restoration of natural wetlands degraded by agricultural practices. Under this program, the Town could be paid to restore the Coonamessett River. The Wetlands Reserve Program pays 100% of the costs of restoring a wetland AND pays a lump sum to the owner for a conservation easement that is equal to the agricultural value of the land (up to \$5,000 per acre). Massachusetts has money targeted for cranberry bog restoration and flow-through bogs are a regional and national priority. WRP will pay for all phases; surveying, design, construction, etc. There are no monetary limits to the program and in 2004 Mass WRP had money they did not spend.

The Wetland Reserve Program also makes a long-term commitment to the restoration and provides follow-up monitoring (See Appendix) and can provide additional funding to make sure the restoration meets the goals of the plan. There are three program participation options: 10-year restoration cost-share agreements, 30-year conservation easements, and permanent easements.

*Permanent Easement.* In addition to paying for the easement, the USDA pays 100 percent of the costs of restoring the wetland. The Town could receive between \$45,000 and \$65,000 for the easement. Don Liptack and Beth Scheirer (NRCS agents) agreed that the Coonamessett River bogs are not top quality agricultural land based on the extent of weeds and the low harvest. They are considered no better than 'average', thus based on recent appraisals of similar bogs in Massachusetts we could expect to receive approximately \$2000 per acre. If the Town enrolled the Lower Bog and Flax Bog 2 into this program (22.8 acres according to NRCS map) we could receive approximately \$46,000. If East Middle Bog is included (another 10 acres) the payment would be \$66,000. The NRCS would then pay the entire cost of the restoration plan.

*30-Year Easement.* Easement payments through this option are 75 percent of what would be paid for a permanent easement. USDA also pays 75 percent of restoration costs.

*10-year Restoration Cost-share Agreement.* This is an agreement (generally for a minimum of 10 years) to re-establish degraded or lost wetland habitat. USDA pays 75 percent of the cost of the restoration. The 25% match can be in-kind and is usually does not require a cash payment from the Town.



### **3) NOAA Anadromous Fish and Habitat Restoration Program**

National Oceanic and Atmospheric Administration (NOAA) Fisheries Restoration Center funds locally driven, on-the-ground habitat restoration projects. NOAA technical staff works closely with concerned communities to strengthen the development and implementation of sound projects. Project proposals are reviewed by NMFS technical staff, and awards are made on a competitive basis. Restoration of anadromous fish is a priority for funding.

### **4) Army Corps of Engineers- Aquatic Ecosystem Restoration**

A site visit with Larry Oliver (October 5, 2004) verified that the Coonamessett River would easily qualify as a project for this program because of the involvement of a river, many water control structures and a regionally significant herring run. Under this program, the Corps may plan, design and build projects to restore aquatic ecosystems for fish and wildlife. Projects conducted in New England under this program have included salt and fresh water wetland restoration, anadromous fish passage and dam removal, river restoration, and nesting bird island restoration.

Once the Town requests help from the Corp, The Corps of Engineers prepares a Preliminary Restoration Plan paid for by the federal government. This is a 3 to 5 page document that describes the project benefits and contains an initial schedule and budget. Project design and construction cost are shared 65% Federal 35% non-Federal. The entire non-Federal share of the project cost may include work in-kind or the value of real estate necessary to implement the project. Larry suggested that in many cases the real estate credit meets the requirement for local cost share. The Corps will prepare all engineering plans and do all the work necessary to obtain federal permits (Corps, EPA, NMFS, CZM) required for the project and the Town would be responsible for obtaining town permits. The Corps then manages implementation of the project.

General Plant Survey -- Lower and Flax Bog -- Sept. 26, 2004  
This is not a comprehensive survey but an initial characterization.

By Dr. Mario DeGregorio, author of Cape Cod Wildflowers: A Vanishing Heritage  
and Dr. Donald Schall, Wildlife biologist, and President of the Botanical Club of Cape Cod & the Islands,  
Pres.

Arrowed-leaved tear-thumb	Northern St. John's Wort
Aster, Bushy or small white	Pilewort or Fireweed
Aster, New York	Poison Ivy
Aster, Patens	Purple Gerardia
Northern Bayberry	Red Cedar
Begger's Ticks	Red Maple
Blackberry	Rice Cut Grass
Blue eyed Grass	Scrub Pine
Broom Sedge	Sensitive Fern
Bur-reed	Shallow Rush
Canada Blue-joint Grass	Slender Fragrant Goldenrod
Canna Rush	Smartweed
Chairmaker's Rush	Smoke Grass
Cinquefoil	Soft or Common Rush
Cranberry	Spike Rush
Deer Tongue Grass	Steeplebush
Dewberry	Swamp Rose
Duckweed	Umbrella Sedge
Fringed Sedge	Velvet Grass
Ground nut	Water horehound
High Bush Blueberry	Water-willow
Horsetail	Wild Iris
Jewelweed	Willow
Joe Pye Weed	Willow-herb
Lanced Leaf Violet	Wool Sedge
Manna Grass	
Marsh Bed Straw	
Marsh Fern	
Meadowsweet	
Mild Water Pepper	
Narrow Leaved Goldenrod	

## Appendix I: Coonamessett River Volunteers

Restoration of the Coonamessett River will require more than just sound plans and good intentions. Those listed below agree to be "**Coonamessett River Volunteers**" and provide some of the physical labor that will be needed under any restoration plan. They have all given their names in commitment to helping the Coonamessett Restoration Working Group and the Town of Falmouth in organized field days starting in 2004, should assistance be needed for clean up activities, weeding, river and wetlands restoration, assist in fisheries management, etc.

	Name
1	Adams, Seth
2	Annett, Brendan
3	Bassett, Jeffrey
4	Bassett, Leonard
5	Beardsley, Bob
6	Benstead, Jonathan
7	Berman, Herb
8	Beverly, Olive
9	Bothner, Michael
10	Brand, Stephen
11	Breivogel, Carl
12	Breivogel, Elizabeth
13	Brink, Nancy
14	Brodziak, Jon
15	Buesseler, Ken
16	Buesseler, Wendi
17	Cira, John
18	Clark, David
19	Conte, Maureen
20	Cooper, Margaret
21	Craddock, Paul
22	Crockett, Chris
23	Crusius, John
24	Culbertson, Jennifer
25	Dalzell, Lyn
26	Davis, Betsy
27	Davis, Ted
28	Deegan, Linda
29	DeRaadt, Deborah
30	Dyess, Cecil
31	Dyess, Veronica
32	Emslie, Peggy
33	Enos, Bill
34	Fanger, Barbara
35	Fanger, Jerry
36	Fleer, Alan
37	Fox, MaryKay
38	Galbraith, Nan
39	Garritt, Hap
40	Garritt, Leah
41	Garritt, Margot
42	Golder, Robert Jon
43	Gove, Debbie

44	Gravel, Richard
45	Gulmann, Lara
46	Handy, Brian
47	Harnish, Chelsea
48	Harnish, Chris
49	Heather Furey
50	Herbst, Ralph
51	Hogg, Nelson
52	Holdren, Cheryl
53	Holdren, John
54	Houghton, Richard
55	Houghton, Susan
56	Hughes, Terry
57	Jewett, David
58	Jewett, Donna
59	Keoughan, Pat
60	Knee, Abigail
61	Koopmans, Dirk
62	Kroeger, Kevin
63	Laderman, Aimlee
64	Lamborg, Carl
65	Lawrence, Corey
66	Leschen, Alison
67	Lewis, Bob
68	Lindell, Scott
69	Lopes, Bill
70	Lowell, Nick
71	Lund, Dave
72	Lund, Katie
73	MacNary, Don
73	MacNary, Don
75	MacNary, Julie
76	MacRae, Gail
77	McLaughlin, Don
78	McNaught, Mike
79	Miller, Gary
80	Miller-Sims, Vanessa
81	Muller, Joan
82	Murphy, Rev. Robert F.
83	Neill, Chris
84	Netto, Mike
85	Nicholas, Rachel
86	Nicolas, Rachel
87	Noble, Abigail

88	Norman, Donald
89	Otter, Marshall
90	Pandya, Dina
91	Patrick, Matthew
92	Payne, Richard
93	Payne, Sheila
94	Pollini, Pam
95	Ramakrishna, Anjali
96	Ramakrishna, Kilaparti
97	Robb, Alison
98	Roche, Greg
99	Romano, Camille
100	Rose, Cynthia
101	Rose, Steve
102	Schwarzman, Beth
103	Scott, Chris

104	Scott, Neal
105	Siegel, Deborah
106	Soles, Felicity
107	Stacey, DeRuiter
108	Stearns, Alan
109	Stecher, Bernard
110	Stetson, Judy
111	Sutherland, Dave
112	Teuten, Emma
113	Thorrold, Andra
114	Thorrold, Simon
115	Turner, Lou
116	White, Alan
117	Wilcox, Heidi
118	Zawoysky, Mary

## **Appendix 2: NRCS WETLANDS RESERVE PROGRAM MONITORING GUIDELINES**

With the acquisition of the conservation easement, NRCS is making a long-term commitment to restore and maintain the easement and its biological functions and values in accordance with the goals and objectives of WRP. Monitoring WRP sites is necessary to ensure that full wetland functions and values are achieved and maintained. It is recommended that staff familiar with wetland restoration; management and wildlife assist in collecting the information. Partners with technical expertise can participate in the monitoring activities. Landowners should be encouraged to attend.

The information obtained through the monitoring process should be used to assess the effectiveness of the restoration activities and to modify restoration plans and request funding for operational and maintenance activities where applicable.

The following procedures are to be followed in monitoring WRP sites (per Subpart G of the WRP manual).

### **10-Year Restoration Agreements**

During practice installation, site should be visited as often as necessary to ensure success. After the practices are established, the site should be visited once a year for the life of the agreement and the WRP Monitoring Checklist should be completed. The site should also be visited after any significant weather or other potentially damaging event.

### **30-Year and Permanent Easements**

During practice installation, site should be visited as often as necessary to ensure success. After installation, sites are to be visited annually until practices are successfully established. After establishment WRP sites will be monitored annually with an onsite visit or through remote sensing using current slides, aerial photography, etc. (if imagery is appropriate to allow easement assessment). At a minimum, onsite visits must occur at least once every 3 years. The WRP Monitoring Checklist is required to be completed each year.

In addition to monitoring the biological functions and values of the site and inspecting the site for easement violations, on an annual basis the ownership of the land encumbered by the easement will be verified. If the ownership has changed, the new owner(s) must be contacted and provided with a copy of the warranty easement deed. If personal contact is not possible, a certified receipt return letter should be used and records kept of the contact.

Because wetlands are dynamic systems, monitoring may reveal that the management plan developed for the site needs to be modified. Because habitat management and manipulation (e.g., pulling boards to lower water levels, mowing to control succession, etc.) are part of the rights that were purchased by NRCS under the easement, NRCS can actively pursue such actions or can allow the area to respond to natural rainfall and succession. If the landowner wants to manage the project area, the compatible use process must be used and NRCS will provide an easement management plan and guidelines.

**UNITED STATES DEPARTMENT OF AGRICULTURE**  
**Natural Resources Conservation Service**  
**WRP MONITORING CHECKLIST**

Review Date: \_\_\_\_\_ Landowner: \_\_\_\_\_

Contract No.: \_\_\_\_\_ Reviewer: \_\_\_\_\_

1. **Has ownership changed?** Yes No  
If yes, were easement requirements reviewed with new owner? Yes No
2. **Was landowner present during this review?** Yes No
3. **Is easement boundary clearly marked and identifiable?** Yes No  
If no, what actions are needed?
4. **Are easement conditions being met (no encroachment, dumping, cropping, etc.)?**  
Yes No  
If no, describe and document with photographs.
5. **Are compatible use authorizations being followed?** Yes No  
If no, describe and list corrective measures.
6. **Is planned hydrology present?** Yes No  
If no, describe the actions needed and complete the practice and cost worksheet.
7. **Are objectives of the migratory bird program being achieved (i.e., adequate hydrology, nesting cover, etc, for shorebirds, waterfowl, neo-tropical songbirds)?**  
Yes No  
If no, describe the actions needed and complete the practice and cost worksheet.
8. **If threatened and endangered species were part of the selection criteria, have their habitat elements been restored?**  
Yes No  
If no, describe the actions needed and complete the practice and cost worksheet.
9. **Are planned vegetation restoration goals being achieved (i.e., desired vegetation being established, control of invasive exotics)?**  
Yes No  
If no, describe the actions needed and complete the practice and cost worksheet.
10. **Are restoration practices being properly operated and maintained?**  
Yes No  
If no, describe the actions needed and complete the practice and cost worksheet.
11. **Are there opportunities to enhance wildlife habitat components?**  
Yes No  
If yes, identify the actions and complete the practice and cost worksheet.
12. **Does the landowner have any concerns or suggestions regarding the easement?**  
Yes No  
If yes, describe the concerns/suggestions.

**Additional Observations**

### **Appendix III: NRCS Coonamessett River Restoration - Planting Plan Notes**

1. Consider stockpiling topsoil to spread over disturbed areas --- good as seed source
2. Could harvest donor plugs of sod from desirable wetland vegetated areas
3. Could do a combination of top soiling and planting
4. If supplemental plantings or seeding is to be done, use species that are characteristic of the various wetland community types (per MA Natural Heritage)
5. See NRCS Wetland Restoration, Enhancement and Management manual for specifics

#### **Plant Species Suggestions**

##### **Deep Emergent Marsh**

- Wool grass (*Scirpus cyperinus*) – irregularly to seasonally inundated or saturated; seed, rhizome, bare root plant or container; used as cover and food by waterfowl
- Rice cut grass (*Leersia oryzoides*) – irregularly, seasonally or permanently inundated up to 0.5 ft or saturated; use seed, bare root or peat pot
- Common three square (*Scirpus pungens*) – seasonally, regularly to permanently inundated up to 0.5 ft or saturated; use dormant rhizomes, bare root plant, peat pot or container
- Arrowhead (*Sagittaria latifolia*) – regularly to permanently inundated up to 2.0 ft or saturated; use tuber, bare root plant or container (mallards and muskrats can quickly eat all planted tubers)
- Soft rush (*Juncus effusus*) – regularly to permanently inundated up to 1.0 ft or saturated; use seed, rhizome, plug, bare root plant or container
- Arrow arum (*Peltandra virginica*) – regularly to permanently inundated up to 1.0 ft or saturated; use bare root seedling, dormant bulb, bare root plant or container
- Marsh smartweed (*Polygonum hydropiperoides*) – regularly to permanently inundated up to 1.0 ft or saturated; use seed or plugs
- Soft stem bulrush (*Scirpus validus*) – regularly to permanently inundated up to 1.0 ft or saturated; use seed, dormant rhizome, bare root plant or container

##### **Shallow Emergent Marsh**

- Bur-reed (*Sparganium americanum*) – regularly to permanently inundated up to 0.5 ft or saturated; bare root plant; seeds consumed by waterfowl, muskrat, beaver
- Tussock sedge (*Carex stricta*) – seasonally, regularly or permanently inundated up to 0.5 ft; use seed, or bare root plant
- Pennsylvania smartweed (*Polygonum pennsylvanica*) – regularly to permanently inundated up to 0.5 ft or saturated; use seed or container
- Wool grass (*Scirpus cyperinus*) – irregularly to seasonally inundated or saturated; seed, rhizome, bare root plant or container; used as cover and food by waterfowl

##### **Upland Buffer**

- Winterberry (*Ilex verticillata*) – irregularly to seasonally inundated or saturated; seed, rooted cutting, container, balled and burlapped
- Red-osier Dogwood (*Cornus stolonifera*) – irregularly to seasonally inundated or saturated; seed, bare root plant, container, balled and burlapped
- Buttonbush (*Cephalanthus occidentalis*) – irregularly to permanently inundated up to 3ft or saturated; seedling, plug, bare root, unrooted and rooted cuttings, container