ATLAS OF

TIDALLY RESTRICTED SALT MARSHES

IN THE
BUZZARDS BAY WATERSHED
MASSACHUSETTS

Salt marshes are among the Commonwealth's most valuable natural resources. However, many coastal wetlands around Buzzards Bay are negatively impacted by human activities that decrease tidal flow into these systems. This Atlas identifies tidally restricted salt marshes and was designed for use by municipalities, state agencies, and other organizations to initiate salt marsh restoration projects around Buzzards Bay.

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BUZZARDS BAY PROJECT NATIONAL ESTUARY PROGRAM
MASSACHUSETTS WETLANDS RESTORATION Program
MASSACHUSETTS ENVIRONMENTAL TRUST

ATLAS OF TIDALLY RESTRICTED SALT MARSHES

BUZZARDS BAY WATERSHED MASSACHUSETTS

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Acknowledgments

The *Atlas of Tidally Restricted Salt Marshes of the Buzzards Bay Watershed* is the result of a multi-agency cooperative study of tidal wetlands along the coast of Buzzards Bay in southeastern Massachusetts. The project was funded by the Massachusetts Executive Office of Environmental Affairs Wetlands Restoration Program (WRP) and the Massachusetts Environmental Trust. Additional funding was provided by the Massachusetts Department of Environmental Protection (DEP 99-04/319). Site locations, maps and data summaries published in this Atlas were developed and produced by the Buzzards Bay Project National Estuary Program, a unit of the Massachusetts Office of Coastal Zone Management. The format and text of the atlas was adapted from the *Atlas of Tidally Restricted Marshes - North Shore of Massachusetts* (WRP, 1999).

BBP staff participating in the development and production of this atlas included Joseph Costa, Mary Johnson, John Rockwell, Bernadette Taber, Tracy Warncke, and Sarah Wilkes, and David Tanguay, Bridgewater State College.

About This Atlas

Study Purpose

This study was undertaken to identify salt marsh vegetation impaired by tidal flow restrictions along the coast of Buzzards Bay, Massachusetts. Of particular concern were salt marshes that had been impacted by transportation related facilities such as roads, causeways and footpaths. These restrictions result in diminished tidal exchange in the upper reaches of a wetland system and ultimately impact the health of a salt marsh by decreasing salinity levels.

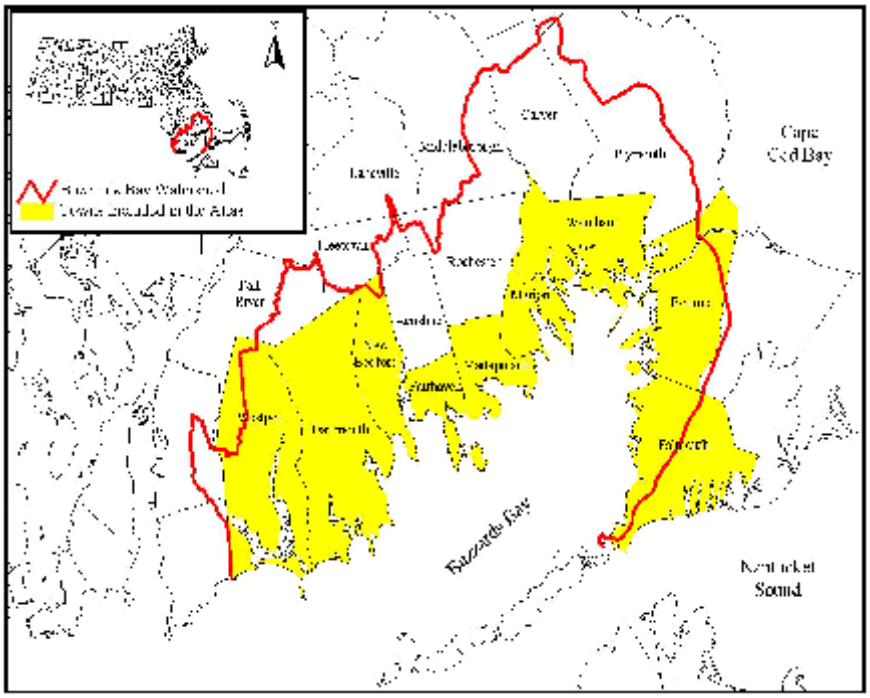


Figure 1. Study area was portions of Buzzards Bay watershed coastal communities (shaded), within the Buzzards Bay watershed (red line).

The purpose of this Atlas is to aid state and municipal officials in identifying potential tidal restrictions. Such a listing will help government officials identify potential remediation opportunities when road and bridge work is being contemplated. Although the Buzzards Bay Project made considerable efforts to identify all tidal restriction sites in Buzzards Bay, we recognize some sites may have been overlooked, and our list should not be considered definitive.

The prioritization ranking included in this report is for planning purposes. The ranking is meant to assist managers in identifying sites most likely to warrant consideration. This priority list is not meant to be a definitive evaluation of the suitability of any particular site for restoration. Our cost or remediation was based on a simplified costing model, and was considered approximate for the purposes of establishing prioritization and cost rankings. Actual costs will depend upon many variables particular to each site.

Information in the Atlas

The study area for this project encompassed the southeastern coast of Massachusetts, extending from the border of Rhode Island, to the southwestern tip of Cape Cod at Woods Hole (See Figure 1). The following nine Buzzards Bay municipalities were included: Westport, Dartmouth, New Bedford, Fairhaven, Mattapoisett, Marion, Wareham, Bourne, and Falmouth. The Atlas contains the following information:

- Maps showing locations of tidal restrictions to salt marshes along the Buzzards Bay coastline.
- Background information on tidal restrictions and methods to restore adequate tidal flow.
- Detailed information on priority restoration sites.

Distribution of the Atlas

Distribution of the atlas included single copies to the public library of each coastal community and municipal Conservation Commission. Additional copies were provided to the following municipal agencies of each community in the study area: municipal executive (mayor, town manager, selectmen), Planning Board, and Department of Public Works. It was also made available to local environmental groups and other interested parties. Additional black and white copies of this Atlas may be obtained by writing to the Buzzards Bay Project, 2870 Cranberry Highway, East Wareham, MA 02538. The Atlas is also available on the Buzzards Bay Project's website: *www.buzzardsbay.org*.

How To Use The Information in the Atlas

The *Atlas of Tidal Restricted Salt Marshes of the Buzzards Bay Watershed* documents salt marshes that have been adversely impacted by human activities, especially transportation related facilities, along the coast of Buzzards Bay in Massachusetts. This Atlas was designed for use by municipalities, state agencies, and other organizations to initiate salt marsh restoration activities at these sites when appropriate. Municipal public works departments are particularly encouraged to check this Atlas when road or bridge work is being considered. In some instances, an act as simple as replacing an old structure will have a positive environmental restoration effect. The Atlas also serves as a source of information for projects under consideration as part of the Regional Transportation Plan and those eligible for state and federal transportation funding.

Background

Coastal wetlands are primarily comprised of tidal marshes and associated intertidal habitats (e.g., mud flats, sandy beaches, and rocky shores) that occur along tidal rivers and estuarine embayments. Salt marshes are one of the most familiar and abundant type of tidal wetland. Salt marshes are regularly flooded by salt water with the lunar tidal cycle. For a few days each month, during spring tides (extra high tides that occur near full and new moons), tidal waters rise to flood the upper limits of the salt marsh. Plants growing in these wetlands have developed special adaptations for the conditions that occur during the regular flooding of saltwater. Some of these halophytes or "salt-loving plants" are listed in Appendix A. It is because of these specific environmental conditions that tidal restrictions (such as a road culvert that is too small) cause a threat to upstream salt marsh habitat. When the marsh vegetation above a tidal restriction doesn't receive the normal amount of tidal flushing, it begins to die and other more invasive species take over.

Figure 2. A healthy, unrestricted salt marsh

Coastal wetlands are among the Commonwealth's most valuable natural resources. Tidal flushing has created a highly productive environment that provides food and habitat for many creatures. Often called the ocean's farmlands, coastal wetlands provide the

foundation of a detritus-based food web that ultimately supports many coastal fish and bird species.

Figure 3. Tidal Restriction Site FH19 Bass Creek Road, Fairhaven

In addition, these wetlands provide habitat along the Atlantic Flyway for migratory waterfowl and serve as important breeding areas for many of these species. For black ducks, wetlands are used as critical overwintering areas. Tidal wetlands serve as vital nursery and spawning grounds for many commercially and recreationally important fish and shellfish species (Appendix A). Coastal wetlands also buffer the land against erosive storm-generated waves and frequently store temporary flood waters. In colonial times, salt marshes provided salt hay, which was used for fodder, mulch, insulation, packaging, and other purposes. There is a demand for the weed-free salt hay, which today is used as mulch in suburban gardens. Some salt marshes have been hayed for over 200 years.

Recognizing the value of salt marsh functions, the Commonwealth of Massachusetts passed the "Jones Act" in 1963 to protect salt marshes. This was the first law in the country adopted to protect coastal wetlands from dredging, filling, and other impacts. Prior to this time, many salt marshes were used to dispose of dredged material or filled for port development, industrial facilities, and housing. Many remaining salt marshes have been additionally degraded by minor filling, mosquito ditching, and restriction of tidal flow.

Since the 1960s, new impacts to the Commonwealth's salt marshes have been strictly controlled. In the 1970s, Massachusetts adopted the Wetlands Protection Act, which forbids development in inland or coastal wetlands unless approved by the municipal Conservation Commission, with oversight from the Department of Environmental Protection (DEP). Strict regulations under this law virtually prohibit direct adverse impacts to salt marshes. These regulatory efforts have halted most newly contemplated alterations of salt marshes in the Commonwealth. Still, there are some indirect impacts that are difficult to control, and others that may be allowed.

The importance of coastal and inland wetlands was recognized in the Buzzards Bay Comprehensive Conservation and Management Plan, a watershed plan which was approved in 1991 by the Commonwealth of Massachusetts as state policy, as well as by the US EPA. This watershed management plan established the goal of a "**Long-term increase of high-quality wetlands and coastal habitat in Buzzards Bay."** This goal was to be met through several mechanisms, including the restoration of impaired wetlands.

Until recently, there was no program in Massachusetts to address the historic destruction and degradation of these vital resources. In 1994 the Secretary of the Executive Office of Environmental Affairs established the Massachusetts Wetlands Restoration Program (WRP). The purpose of the program was to further

Figure 4. Tidal Restriction Site MT10 Old access to beach, Mattapoisett

implement the state's new policy of "no net loss of wetlands in the short-term and a net gain in the long-term."

Unlike wetland replication required under permits to compensate for wetland destruction (caused by construction and other activities), WRP's pro-active wetland restoration projects may be initiated by project sponsors who simply want to bring back our wetland heritage, or who want to help address community water quality and flooding problems or restore wildlife habitat.

This atlas, prepared by the Buzzards Bay Project, along with a similar document covering the North Shore, is part of WRP's pro-active wetland restoration efforts. WRP continues to work with environmental groups, state and federal agencies, municipalities and others on an ongoing basis to implement priority wetland restoration projects identified in these studies. The Buzzards Bay Project often acts as a facilitator of these efforts.

Both the Buzzards Bay Project and the Wetlands Restoration Program provide financial and technical support for the efforts of municipalities, landowners, and other agencies and groups that wish to undertake wetland restoration projects. Individual wetland restoration projects may be initiated under WRP's GROWetlands (Groups Restoring Our Wetlands) initiative. WRP has also organized the Wetlands Restoration Assistance Team (WetRATs), a network of volunteer wetlands scientists, to assist GROWetlands project sponsors in evaluating the restoration potential of wetland sites, designating work plans, and monitoring pre- and -post construction project sites. WRP helps GROWetlands sponsors develop goals and a work plan for restoration projects, secure project funding, organize volunteers, use restoration sites as learning laboratories for schools and groups, and to monitor restored wetlands to ensure success. Please see Appendix B for a more complete description of GROWetlands and a Project Nomination Form. Buzzards Bay Project Wetland Restoration Grants are subject to funding availability.

Impacts to Salt Marshes and Restoration Approaches

What is a Tidally Restricted Salt Marsh?

Many salt and brackish marshes are crossed by highways, local roads, and railroads of various dimensions. These transportation routes pass through tidal marshes and may cross tidal creeks or rivers at one or more locations. Bridges are required to span rivers and broad creeks, and the roadways leading to bridges are built on fill deposited in wetlands. These thoroughfares are often called causeways. Many shorter spans have been filled, with culverts installed under the roadway to allow drainage or tidal flow. Roads crossing small creeks may have the streams chanelled through box culverts, some of which are too small to pass full tidal flows necessary to maintain natural salt marsh vegetation upstream.

Culverts may be fitted with tide gates that may further restrict tidal flow or flapper valves that allow fresh water to leave the marsh but will not allow tidal flow to enter the marsh. Bridges may have similar affects if the openings are not wide enough to pass sufficient tidal water to maintain salt and brackish marshes further upstream. At some road crossings no culvert was provided and tidal flow has been eliminated altogether. These hydrologic changes significantly alter the chemical integrity of the upstream salt marsh. The once strongly saline environment changes to one that is brackish or fresh water. This freshening of the salt marsh causes a major transformation in the vegetation. Salt marsh grasses and rushes are displaced by common reed (Figure 5). Common reed often forms a monoculture, with plants growing up to, and in excess of, 12 feet. This decrease in plant diversity and the change in vegetative structure (from a low grassy meadow to a tall reedy thicket) causes a major shift in wildlife use as typical salt marsh inhabitants are replaced by fewer species. Despite some use of the reeds by more common, generalist species, it is not preferred by any species. This is in marked contrast to salt marsh vegetation which is preferred over other habitats by many wildlife species, including some of our rarer salt marsh specialists.

Restoring Tidal Flow

Where tidal flow is restricted, the main objective of salt marsh restoration is to improve tidal flow to the affected marsh. In many cases, restoration is easily accomplished by removing the restrictive feature or by providing an opening sufficient enough to allow adequate tidal flow. For example, where tidal flow is reduced by undersized culverts (too small to pass the full spring tide), simply replacing the culverts with larger ones, generally the width of the original channel, and ones of appropriate height, may be enough to restore tidal flow.

In other cases, development has taken place in low-lying areas surrounding the marsh and sometimes on fill in the marsh itself. Due to flood risk, restoring full tidal flow to these areas is not possible. However, restoration of sufficient tidal flow to flood a lower portion of the marsh on a regular basis may be possible if it can be shown that this will not increase the risk of flooding to adjacent structures. Allowing for frequent tidal flooding should be sufficient to promote the return of salt marsh vegetation in areas of high salinity (greater than 18 parts per thousand). In areas of lower salinity, improved tidal - exchange (by reconnecting the marsh to the adjacent estuary) is still beneficial. Improving tidal flow to the marsh while preventing property flooding can be accomplished by expanding the culvert size and adding a protective device, such as a self-regulating tide gate or a manually or electronically operated tide gate. These gates can establish an opening that allows passage of normal tides, but prevents entry of storm tides. Some structures can be completely closed, if necessary, to facilitate storm protection. Each proposed salt marsh restoration site should be evaluated to consider potential

Figure 5. *Phragmites australis* stand in a salt marsh.

adverse impacts such as flooding before work is begun.

Methods

Site Selection

The first phase of this project identified salt marshes where tidal restrictions were suspected to exist. By looking at aerial photographs of the Buzzards Bay coastline (false-color infra-red and black and white photos) potential sites were located. In these photos it was possible to see subtle color and texture changes in the vegetation around the salt marsh. These photo signatures were verified by looking at a photograph of a known area or by "ground-truthing" (i.e. visiting the site in the photo and comparing what was on the ground with what appeared in the aerial photograph). The study used DEP Wetland Conservancy color infrared aerial photos from spring 1993 (scale 1:12,000) acquired by the James W. Sewall Company. This photography was supplemented with 1:5,000 black and white orthographic Wetlands Conservancy maps captured in 1990 and in some instances other aerial photographs from various sources. The presence of a road or railroad embankment with common reed on the upstream side and typical salt marsh vegetation on the seaward side was used as a marker of a likely restriction. In other cases, the presence of a scouring basin on one or both sides of the embankment suggested uneven flows (e.g. too much water collecting around the restriction and increased outflows with high erosive potential). Bridges with short spans, that is where the channel was considerably narrowed by the bridge, were also viewed as potential restricting structures and scouring basins were usually evident. Common reed stands were also photo interpreted. Narrow marginal bands of common reed along the upland border of salt marshes and very small stands were not identified as they were not considered strongly indicative of a tidal restriction.

The potential restoration sites that were identified in the aerial photographs were then field checked to verify the existence of a restriction, and to collect information about the restricting structure and the affected salt marsh. On-site observation of one or more of the following conditions were considered evidence of a tidal restriction: seaward scouring basin (S), low marsh slumping (L), culvert invert problem detected (CI), *Phragmites australis* (P), ponded water on seaward side of dike or road (PS), ponded water on upstream side of dike or road (PU), seaward culvert opening submerged at mean high tide (SCS), upstream scouring basin (U), culvert broken (CB), vegetation die back (VDB), *Lythrum salicornia* (L), bank erosion (BE), or culvert clogged with debris (CD). (These codes were used in the data spreadsheet available at the Buzzards Bay Project webpage at www.buzzardsbay.org).

Field work was limited to sites with public access. Field data sheets were prepared for all 167 restriction sites. A sample of a blank 2-sided field data collection form is shown in Appendix A. Figure 6 defines some of the parameters identified in the data base.

Photographs of most restrictions were taken with a digital camera to document existing conditions and to show the range in conditions of the restricting structures. The condition of the restricting structure was rated as excellent, good, fair, or poor in relation to these examples (See Field Data). In order to accurately map each restriction, a sub-meter accuracy global positioning system (GPS) was used. The data collected in the field visits was transferred to a Geographic Information System (GIS) database to create a series of GIS maps.

A database was constructed by adding the locations of potential tidal restrictions and tidally restricted wetlands and common reed-dominated stands in tidal marshes to an existing wetland map database and transferred to USGS quadrangles. The resulting maps are used throughout this report.

The distribution of common reed (*Phragmites australis)* was mapped by creating a sketch of the area covered by Phragmites on a copy of the black and white 1:2500 orthographic sheet while in the field. Later the map was transferred by eye to 1:2500 digital orthos in ArcView™ using Wetlands Conservancy Program wetland lines as a guide. The size of these polygons was calculated by the ArcView ™ software.

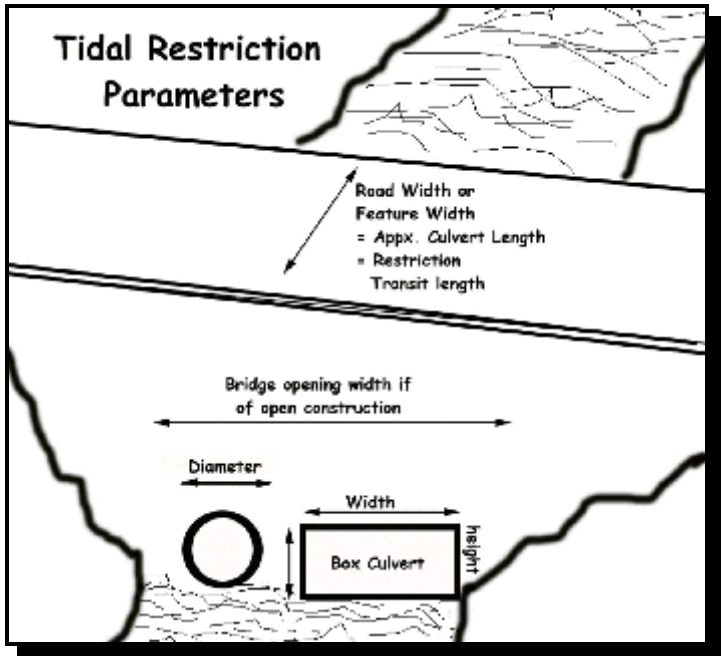


Figure 6. Generalized view of a culvert tidal restriction showing selected parameters inventoried in tidal restriction database.

Prioritization Methodology

Cost Prediction Assumptions

Due to the fact that it would not be cost effective to perform detailed costs analyses for the remediation of all 167 tidal restrictions identified in this Atlas, a simplified method for identifying the top priority sites was developed.

The basis of our cost analysis was the assumption that the cost of remediation was roughly a function of the size of the new culvert, particularly the volume (new culvert cross sectional area multiplied by culvert length) of the upgraded restriction. Culvert length was assumed to be 20% longer than road width or from actual measurement. In calculating the size of the replacement culvert, we used the following assumptions:

1) Culverts <=15" diameter (i.e. <1.25 sq. ft. cross section) would be tripled in diameter.
2) Culverts >15" diameter or box culverts would be doubled in diameter.

Whether or not the culvert passed under a road, and whether or not the road was paved were also major factors in determining costs. For culvert replacement work under paved roads, Equation 1 (shown below) and our estimate of new culvert volumes (new cross-section area x length) was used. This equation was created by forcing a curve upon the handful of local case studies shown in Fig.7.

Equation 1: $ cost =

The case studies in Fig. 7 were a mix of actual projects and hypothetical situations. For example, point "A" in Fig. 7 was based on an actual culvert replacement funded by the Buzzards Bay Project. Specifically it represented the replacement of a dilapidated culvert with a new concrete 4 foot by 8 foot culvert under a paved 25-foot wide rural road, with some tasks handled by a municipal DPW and some by a private contractor. Points "B" and "C" in figure 7 represent cost adjustments estimated by the project foreman assuming the new culvert had dimensions of 4 feet by 8 feet and 4 feet by 10 feet, respectively. Point "D" and the surrounding points represent hypothetical estimates of the replacement of a 1 foot culvert with a 3 foot culvert on a coastal road in a variety of situations.

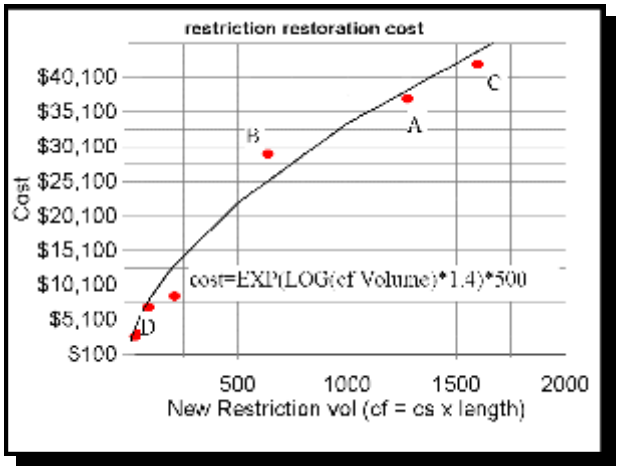


Figure 7. A simple cost prediction curve for estimating costs of new culverts based upon several case studies.

In the actual work representing point A, costs were greatly controlled by the fact that the municipal DPW undertook a considerable share of the work. For any given project, those undertaken solely by DPWs may be completed for one half or more of the prediction of Equation 1. Conversely, projects wholly completed by private contractors may cost twice as much or more. Our cost equation represents the intermediate case.

Figure 8. Frequency of scores for cost effectiveness based on dollars per acre criteria.

Costs for unpaved roads were assumed to be one half the cost in Equation 1. Costs for culverts under railroad tracks were assumed to be four times the cost in Equation 1. Costs for culvert installation in dikes and berms were assumed to be one half the cost estimated in Equation 1. Culverts under road bridges with openings less than 10 feet across were assumed to be triple the costs in Equation 1. The $1,000 constant in the equation was meant to cover a minimum set of expenses associated with the preparation of designs and permitting.

For projects not involving or requiring culverts, specifically sites with a restriction opening >10 feet, such as filled in channel entrances and bridges, a different cost estimate of remediation was used. This was done because these kinds of projects involve either dredging, change in the structure of the bridge base if present, or both. These costs are very variable, with dredging usually being the least expensive option. For bridge repair work that would involve expanding the opening under the bridge, $3000 per foot of bridge width is probably a good first order approximation. For dredging under a bridge or in a shoaled channel

entrance, $500 per foot of channel width is probably also a good first order approximation. Because actual costs would be very site specific, $3000 per foot of channel width was used for all non-culvert restrictions greater than 10 feet to developed cost scores for prioritization purposes in this Atlas.

Although municipal conservation commissions or Buzzards Bay Project staff may assist municipal DPWs in their permit applications, for each project we assumed $1,500 to cover incidental permit costs. We also assumed 10% of construction costs would be needed for designs or engineering plans. These are the basis of the terms in Equation 1. In reality, costs in these situation are extremely site specific, but in practical terms these total remediation cost estimates are sufficiently high that these adjustments do not appreciably affect cost scores.

Finally, our costs were sent to area DPWs to review, with the offer to change the estimates in the Atlas if the DPWs could provide better cost figures. However, no municipality was able to provide these estimates without specific engineering plans in hand.

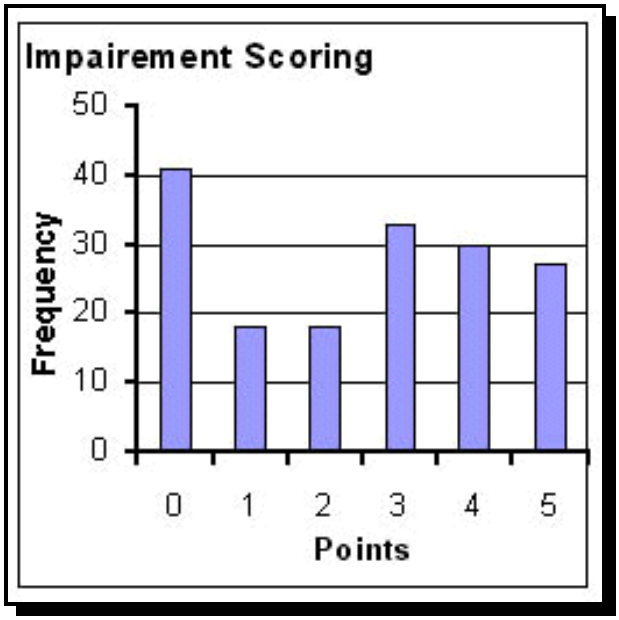


Figure 9. Frequency of scores for wetland impairment. Impairment was based on percent coverage of the marsh by the invasive species Phragmites.

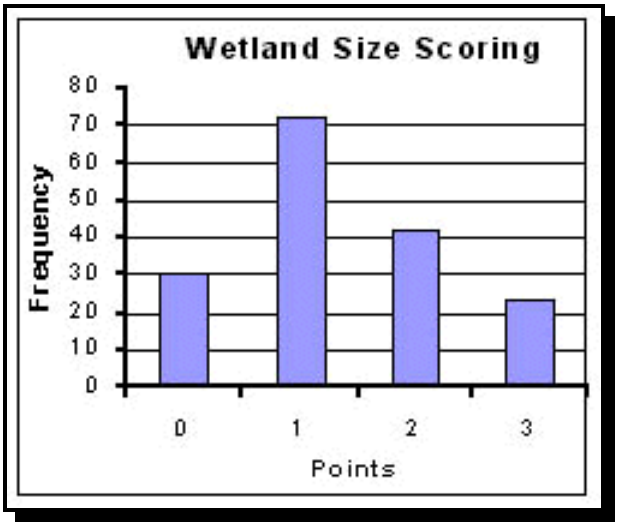


Figure 10. Frequency of Scores for wetland size criteria.

Criteria for scoring

The cost effectiveness of a project was determined by dividing the cost estimate by the total number of acres of wetland affected by the restriction. Figure 8 shows the scoring criteria and distribution of scores for each restriction using this grading system.

Wetland Impairment scoring

The degree of wetland impairment was characterized as the percent of wetlands effected by the restriction. It was presumed that impacted wetland areas were those that were mainly composed of the invasive nuisance species *Phragmites*, which tends to replace salt marsh vegetation that is experiencing restricted tidal flow. Figure 9 shows scoring criteria and the distribution of scores for each restriction using our approach.

Wetland Size scoring

Independent of the degree of impairment, or the cost effectiveness (cost per acre of a project), some

consideration of wetland size is important. That is to say, it may be more desirable to restore a 100 acre wetland site, even if it only contains 10% *Phragmites*, than to restore a ½ acre site, even if it is composed of 40% *Phragmites*. For this reason, the scoring in Fig. 10 was included to address wetland size.

Other criteria

Other scoring criteria were as follows:

Restriction on public road/property	3 points - town road
	2 points - state road
Benefits a public wetland	1 point
Benefits anadromous fish run	4 points
Designated rare/endangered habitat	2 point
Adverse impacts to special resources	-5 points

The scoring of adverse impacts to special resources was based on best professional judgement. While increases in salinity by definition will result in the loss or death of certain freshwater species, it is undesirable to increase salinity where habitat for freshwater endangered species are found, where the salinity of a pond will change, or where anadromous fish spawning areas are lost. These and other reasons are justification for the subtraction of points from the scoring system.

The awarding of points for enlarging restrictions under public property (3 points for municipal, 2 points for state property) was based on the fact that it is far easier to remediate a publicly owned site because of logistical, cost, permitting, and funding reasons. Small culverts can greatly affect anadromous fish runs, so the highest number of bonus points are given for this criteria. If the structure was a bridge, or did not actually impair a herring run, no points were given in this category. If the restriction benefits a publicly owned wetland, or if the area is designated as rare or endangered species habitat by the Natural Heritage and Endangered Species Program, 2 points were given.

Results and Priority Restoration Sites

In Tables 1 and 2 that follow, a list and ranking of all sites are shown. The section that follows these tables includes profiles of selected sites (mostly high priority) in the inventory. Sites receiving a score of 11 points or higher, were considered high priority site, 9-10 points, a medium priority site, and 8 points or less, a low priority site. Using these criteria, of the 167 sites inventoried, 39 were high, 51 were medium, and 77 sites low. Such a ranking is subjective, and primarily for planning purposes. In practical terms, work at any of these sites can be justified if a property owner is willing to undertake the work, costs are low, or special opportunities arise. The purpose of these priority scoring was to assist in identifying sites for further study, not a final evaluation of which sites are most appropriate or most suitable for remediation. The profiles of selected sites are not given in any particular order or priority.

Results

Table 1. Results: Summary of all sites sorted by municipality and restriction site ID.

Site #	Priority Score	Town	Estimated Cost	Wetland Area (ac)	Restriction Feature Name	Channel/Restricted Wetland Name	Type of Restricting Structure	Culvert type	Culvert Condition	Explain Condition of Culvert
BN01	5	Bourne	$33,420	0.5	Railroad		railroad culvert	Terracotta	fair	
BN02	3	Bourne	$28,125	4.6	Private Road to Toby Isl.		culvert/Road	Concrete	good	broken in places
BN03	7	Bourne	$3,851,500	14.6	Rt.6 Bridge	Buttermilk Bay	bridge	N/A		one was chipped
BN04	7	Bourne	$2,751,500	14.6	Railroad Bridge next to Rt.6	Buttermilk Bay	bridge	N/A		
BN05	11	Bourne	$386,500	4.6	Bridge, Red Brook Drive		bridge/culvert/old wall	Cemented Stone	good	
BN06	8	Bourne	$16,261	12.2	Seabreeze Drive		culvert	concrete	poor	wing wall downstream side in bad shape
BN07	0	Bourne	$8,926	0.0	Culvert Private Road		culvert	Concrete	poor	squished, filled w/ debris, dn streamside
BN08	10	Bourne	$30,465	12.2	Culvert, Mashnee Rd		culvert	Corr. Alumn.	good	culvert broken into 2 pieces
BN09	9	Bourne	$617,500	91.2	Shore Road		bridge	N/A		head wall collapsed into culvert
BN10	6	Bourne	$562,500	94.4	Railroad Bridge		bridge	N/A		old but in fine shape
BN11	12	Bourne	$16,358	31.8	Dam Rd.		culvert, tide gate	Corr.Metal	poor	broken tidegate, culvert cracked in some
BN12	13	Bourne	$10,699	46.2	Railroad		culvert	Corr.Metal	good	tide gate stuck 4" open
BN13	10	Bourne	$16,261	0.9	Shore Rd.		culvert	Concrete	fair	
BN14	9	Bourne	$496,500	49.4	Shore Rd. Bridge	Pocassett River	bridge	N/A		upstream side clogged with debris
BN15	12	Bourne	$28,973	8.2	Wings Neck Road		culvert	concrete	fair	
BN16	11	Bourne	$17,870	3.8	Kenwood Rd.		culvert	Corr. Metal	good	broken bottom on dnstream end of culvert
BN17	9	Bourne	$6,606	0.4	Rock Wall		dike	Corroded Metal		culvert too small, almost 100% all fresh-
BN18	11	Bourne	$32,382	0.0	culvert, Garnet Ave	to pond at head of	culvert	concrete	fair	culvert too small and intentionally blocked
BN20	8	Bourne	$65,343	0.0	Megansett Road	Red Brook Harbor	culvert	stone		
BN21	4	Bourne	$14,698	0.2	Scraggy Neck		road	none		
BN22	9	Bourne	$20,038	5.7	Dirt Road		culvert	terracotta		
DA01	9	Dartmouth	$1,211,500	93.6	Bridge St.	Apponagansett Bay	bridge/road	N/A	N/A	recently rebuilt
DA02	12	Dartmouth	$551,500	246.1	Gulf Road	Dike Creek or	bridge	N/A	N/A	recently rebuilt
DA03	10	Dartmouth	$19,325	4.9	Smith Neck Rd.	Padananam Salt Marsh	culvert/road	Concrete	fair	
DA04	9	Dartmouth	$18,093	85.6		Nonquit Marsh	culvert	Concrete	poor	much broken
DA05	10	Dartmouth	$88,597	85.6	Barrier beach	Nonquit Marsh	culvert	Concrete	excellent	almost new
DA06	11	Dartmouth	$8,465	10.1		Cowyard Marsh	culvert/road	Concrete	good	
DA07	11	Dartmouth	$8,465	10.1		Cow Yard Marsh	culvert/road	Concrete	poor	partially buried in mud
DA08	10	Dartmouth	$10,742	23.9	Nicholas Driveway	Cow Yard Marsh	culvert	Concrete	excellent	new
DA09	11	Dartmouth	$661,500	164.7	Little River Road	Little River	bridge	N/A	N/A	cracks, spalling many areas
DA10	11	Dartmouth	$7,347	8.7	Common Drive	Gaffney Rd. Marsh	culvert	PVC	excellent	
DA11	11	Dartmouth	$6,606	6.3	Little Beach Rd.	Allen's Pond	culvert/road	Concrete	poor	1/2 buried at one end
DA12	9	Dartmouth	$71,481	10.9		Georges Pond	culvert	Corr. Metal	poor	will be replaced soon w/ R.C.D.
DA13	9	Dartmouth	$5,632	2.1	Common Drive		dike	none	N/A	old stone foundation
DA14	10	Dartmouth	$38,563	6.3	Star of the Sea Drive		culvert	Concrete	good	fairly new
DA15	13	Dartmouth	$11,112	6.3	Old Road		culvert	Old Stone	poor	road washed out on all sides, stone culvert
FA01	0	Falmouth	$4,291	0.0	Private Road to Penzance Pt.		culvert	Terracotta	good	Phrag on upstream edge
FA02	4	Falmouth	$62,336	0.0	Rock Wall	Mill Pond	wall	none		200 ft broken wall top portion missing, old

FA03	0	Falmouth	$7,082	0.0	Private Driveway		culvert/Wall	Corr.Metal	fair	driveway, water pooled at inland base, hole
FA04	5	Falmouth	$6,070	0.0	2nd Private Driveway		culvert	Concrete	poor	metal rusting, submerged, water passes
FA05	9	Falmouth	$16,261	0.8	Road		culvert	Corr.Metal	fair	culvert not visible, covered by rocks
FA06	8	Falmouth	$16,261	0.2	Road		culvert	Corr. Metal	fair	too low, and small, clogged w/debris.
FA07	9	Falmouth	$29,351	7.8	Racing Ave.		culvert/tide gate	Terracotta	fair	upstream opening blocked by big slab of
FA08	10	Falmouth	$10,261	2.2	Valley Road		culvert	Terracotta	fair	too small, covered, clogged
FA09	11	Falmouth	$19,022	4.7	Road/Culvert		culvert	Terracotta	good	2/3 submerged w/ rocks on upstream side
FA10	13	Falmouth	$17,616	2.3	Woodneck Rd.		road	N/A		barrier beach road with no culverts/ pond
FA11	9	Falmouth	$47,700	5.0	Santuit Rd.	Potter's Hole	bridge	N/A		fresh water upstream
FA12	9	Falmouth	$67,500	5.0	Bayview Rd.		bridge	N/A		beach access road, no culverts
FA13	9	Falmouth	$34,674	0.9	Bayview Rd.		culvert	Terracotta	poor	badly broken, too high to drain upstream
FA14	12	Falmouth	$1,321,500	25.5	Quaker Rd.		bridge	N/A		bridge being rebuilt
FA15	8	Falmouth	$276,500	13.4		West Falmouth Harbor	bridge	N/A		Channel opening too small, chanlle= 75 ft,
FA16	8	Falmouth	$1,321,500	6.3			bridge	N/A		old cracked
FA17	6	Falmouth	$159,561	3.4	Railroad		culvert	Corr. Metal	fair	Big pool on upstream side, sandbar in
FA18	8	Falmouth	$14,468	5.0	Beach Culvert		culvert		poor	old culvert between waater and pond
FA19	8	Falmouth	$29,275	3.3	Road/Culvert		culvert		fair	small culvert (new) across pond, old
FA20	5	Falmouth	$79,805	4.6	Railroad/Culvert		culvert		poor	too small for flow
FA21	4	Falmouth	$183,408	2.1	Railroad/Culvert		culvert		good	working well, needs second pipe
FA22	5	Falmouth	$24,457	25.5	Road /Culvert		culvert		poor	24" concrete culverts washed out
FA23	13	Falmouth	$1,189,500	25.5	Bridge/Footpath	Old Silver Beach	bridge, foot			
FA24	5	Falmouth	$168,155	1.8	Quaker Road Culver		culvert		good	freshwater pond upstream flowing to tidal
FA25	1	Falmouth	$14,566	0.6	Garret Ave	Red Brook Harbor	culvert	iron		
FH01	2	Fairhaven	$6,070	0.9	Private Drive		culvert	Corr. Metal	excellent	looks new
FH02	10	Fairhaven	$8,149	2.2	Private Drive		culvert	Concrete	good	
FH03	10	Fairhaven	$386,500	19.3	Peirces Point Bridge		bridge	N/A	N/A	old but very passable in daily use
FH04	8	Fairhaven	$250,845	1.4			bridge/culvert	Stone	good	no apparent flaws
FH05	8	Fairhaven	$45,648	1.3			culvert	Concrete	good	ice damage, no material under wingwalls
FH06	7	Fairhaven	$19,577	3.3	Island View Road		culvert/road	Concrete	good	new construction
FH07	7	Fairhaven	$19,577	0.8	Island View Road		culvert/road	Concrete	good	new construction
FH08	3	Fairhaven	$15,425	1.5			culvert/barrier beach	Concrete	fair	Culvert washed away in hurrican
FH08A	5	Fairhaven	$106,204	3.2	Raymond St. Beach		bridge	N/A		wooden walk way
FH09A	10	Fairhaven	$22,732	2.3	Grand View Ave		culvert/road	Concrete	poor	submerged and partially blocked
FH09B	11	Fairhaven	$6,070	25.2	Widemarsh Road		culvert	Concrete	good	
FH10	10	Fairhaven	$22,732	1.6	Shore Drive and parking lot		culvert\road\parking	unknown	fair	
FH11	7	Fairhaven	$68,788	19.6	Hurricane Dike @ Egypt Lane	Atlas Tack	culvert in Hurricane	Concrete	good	1/4 blocked at high end by stones
FH12	4	Fairhaven	$6,606	0.2	Windward Lane		culvert/road	Concrete	poor	completely under-not visible may be stone
FH13	9	Fairhaven	$11,711	0.4	Camp Seaspace Lane		culvert	Concrete	unknown	not visible
FH14	10	Fairhaven	$13,195	10.6	Camp Seaspace Lane		culvert/road	Concrete	fair	
FH15	11	Fairhaven	$6,606	10.2	Windward Lane		culvert/road	unknown	poor	looks old
FH16	7	Fairhaven	$50,823	1.8	West Island Causeway		culvert/road	Concrete	excellent	some stone blocking ne culvert by 1/4
FH17	11	Fairhaven	$13,195	20.2			culvert/footpath	unknown	poor	mosquito ditch filling in from overwash pan
FH18	14	Fairhaven	$15,780	13.7	Fir Street		culvert/road	Concrete	fair	Road to beach
FH19	13	Fairhaven	$26,790	2.2	Bass Creek Road		culvert	Concrete	fair	one end clogged w/ vegetation
FH20	8	Fairhaven	$8,822	6.8			culvert/path	Aluminum	fair	partially burried
FH21	8	Fairhaven	$8,822	5.7			culvert/path	Corr. Metal	fair	rocks blocking both inverts

FH21A	8	Fairhaven	$8,822	6.0			culvert/path	Corr. Metal	fair	
FH22	10	Fairhaven	$17,455	17.4	Winsegansett St.		culvert/road	Concret	poor	1/4 blocked by stones
MN02	8	Marion	$13,930	0.1	Aucoot Ave.		culvert	concrete	poor	chipped culvert, upstream headwall
MN05	6	Marion	$11,711	0.2			culvert	concrete	good	
MN06	10	Marion	$15,988	0.5	Bayberry Lane		culvert	concrete	good	no flow
MN07	10	Marion	$15,988	0.7	Quelle Road		culvert	Terracotta	fair	not restrictive anymore
MN08	10	Marion	$30,801	7.8	Route Six		culvert	Stone	poor	old stones, some loose inside
MN09	10	Marion	$21,076	6.6	Creek Rd.		culvert	Concrete	fair	some degradation at seward end
MN10	3	Marion	$15,084	0.4	Boat yard Lane	Hammets Cove	culvert	unknown	poor	can't see culvert
MN12	8	Marion	$7,984	3.5	Tide Box		culvert	Plastic	excellent	all brand new
MN13	8	Marion	$10,769	1.2	Road to Practice area Kittansett		culvert	Clay	poor	doesn't pass water based on size
MN14	9	Marion	$5,490	2.4	3rd Fairway cart path		culvert	ABS plastic	good	new
MN15	9	Marion	$6,374	2.4	3rd Fairway cart path		culvert	Concrete	poor	partially buried (1/2)
MN16	8	Marion	$14,468	2.4			culvert	Clay	poor	buried partially blocked at one end
MN17	9	Marion	$5,490	2.4	Patch to 17th Green		culvert	Clay	poor	can't see culverts mostly blocked
MN18	8	Marion	$12,822	2.4			culvert	Concrete	poor	1/2 buried
MN19	9	Marion	$9,480	2.7	17th Fairway Kittansett		culvert	Clay	poor	Bottom of culvert above channel eleva-
MN20	9	Marion	$9,480	3.0	17th Fairway Kittansett		culvert	unknown	fair	all buried
MN21	12	Marion	$25,221	29.1	Path to 4th Green		culvert	plastic	poor	culvert road will be removed this summer
MN22	14	Marion	$20,504	29.1	Kittansett 3rd Hole		culvert w/ flap gate	concrete	good	has flapgate, continually blocked by
MN23	12	Marion	$15,988	2.3	Bayberry Lane		culvert	unknown	good	
MN24	9	Marion	$15,988	2.1	Quelle Lane		culvert	unknown	good	
MT01	9	Mattapoisett	$6,070	8.7	Cecella Lane		culvert	PVC	good	
MT02	9	Mattapoisett	$6,070	8.7	Cecella Lane		culvert	PVC	excellent	
MT03	12	Mattapoisett	$76,676	32.7	Mattapoisett Neck Road		culvert	Concrete	good	100 foot wide, narrows to 30 ft. to 40
MT04	9	Mattapoisett	$54,485	21.4	Mattapoisett Neck Road		culvert	Concrete	poor	
MT05	9	Mattapoisett	$100,111	21.4	Mattapoisett Neck Road		culvert	Concrete	good	road crosses large marsh
MT06	10	Mattapoisett	$33,861	22.7	Old Mattapoisett Neck Rd.		culvert	Concrete	poor	Needs immediate attention, collapsed
MT07	6	Mattapoisett	$661,500	26.5	Old Railroad Bridge	Eel Pond	bridge	N/A		Roadway built on causeway w/bridge in
MT08	7	Mattapoisett	$28,464	3.8	Club House	Eel Pond	culvert, Tide Gate	metal	poor	broken tide gate stuck open
MT09	4	Mattapoisett	$205,701	25.5	Old Railroad Bridge	Eel Pond	bridge, culvert	Stone	excellent	submerged culvert
MT10	7	Mattapoisett	$8,822	1.3	old access area to beach		culvert	Corr. Metal	poor	culvert submerged at low tide
MT11	5	Mattapoisett	$15,988	2.6	Private road		culvert	ABS plastic	excellent	new looking road
MT12	7	Mattapoisett	$37,370	2.6	Private road		culvert	Corr.	poor	changes material over long expanse,
MT13	9	Mattapoisett	$14,947	7.7	stones across channel		culvert, rock wall	none		submerged culvert, 2 ft. length, basically
MT14	5	Mattapoisett	$93,296	4.5	Angelica Ave		culvert	Concrete	good	remains of earthen/stone dam
MT15	8	Mattapoisett	$10,636	9.8	Pribvate Beach Road		culvert	concrete	good	
MT16	11	Mattapoisett	$16,562	11.0	Aucoot Rd.		culvert	concrete	good	Aucoot road channel dug out
MT17	7	Mattapoisett	$12,074	2.0	Rock wall		wall, rock	none	NA	rock wall w/ missing sections, channel
MT18	4	Mattapoisett	$26,361	6.0	cart path		culvert	Iron	poor	collapsed
MT19	3	Mattapoisett	$42,908	6.4	old dike		culvert	Corroded Metal	good	flapgate
MT20	0	Mattapoisett	$11,814	0.1	cart path		fill	none	NA	collapsed, clogged
MT21	0	Mattapoisett	$9,480	0.1	#4 Fairway		culvert	unknown	poor	collapsed, clogged
MT22	3	Mattapoisett	$9,480	1.1	clubhouse cart path		culvert	unknown	good	new culvert
MT23	8	Mattapoisett	$10,345	2.0	Dirt Road to DEM Reserve	Shaws Cove	culvert	Corr. Alumn.	good	Culvert and Fill need to be removed, road
NB01	5	New Bedford	$1,651,500	16.9		Acushnet River	bridge	N/A	N/A	No Phrag, upper limit of tidal exchange

NB02	6	New Bedford	$5,501,500	19.5	Wood St.	Acushnet River	bridge	N/A	N/A	
NB03	11	New Bedford	$1,101,500	83.4	Coggeshall Street Bridge	Acushnet River	bridge	N/A	N/A	bridge built out into river on stone pier
NB04	9	New Bedford	$4,401,500	83.4	I-195	Acushnet River	bridge	N/A	N/A	
NB05	8	New Bedford	$19,801,500	83.4	Pope's Island Bridge	Acushnet River	bridge	N/A	N/A	Phrag upstream
NB06	8	New Bedford	$8,801,500	83.4	Pope's Island Bridge	Acushnet River	bridge	N/A	N/A	
NB07	8	New Bedford	$8,801,500	83.4	Pope's Island Bridge	Acushnet River	bridge	N/A	N/A	
NB08	9	New Bedford	$3,026,500	83.4	Shaw Cove Drive	New Bedford Harbor	dike	none	N/A	hurricane barrier
WH01	9	Wareham	$1,651,500	203.5	Rt.6 Bridge	Weweantic River	bridge/road	N/A		recently reconditioned
WH01B	9	Wareham	$1,101,500	203.5	Rt.6 Bridge	Weweantic River	bridge	N/A		recently reconditioned
WH02	2	Wareham	$397,500	0.0	Railroad ROW Bridge	Sippican River	bridge	N/A		no bridge left, piers rotting in place
WH03	8	Wareham	$91,611	3.2	Blackmore Pond Rd.	Cohakatt Brook	bridge/road	N/A		
WH04	5	Wareham	$15,571	0.2	Fishermans Cove Rd		fill	none	NA	developed area, cemented bank
WH05	9	Wareham	$2,201,500	67.5	Onset Ave	Broad Cove	bridge	N/A		One of lanes is 1/2 filled by sand bar
WH06	9	Wareham	$1,101,500	64.8	East Blvd	Broad Cove	bridge	N/A		Very rusted Iron bridge
WH07	12	Wareham	$21,265	12.2	Camp St.	Mud Cove	culvert	Concrete	good	Road washed out on downstream side.
WH08	11	Wareham	$6,070	6.1	Gomez Way	Shell Point Bay	culvert	Concrete	good	Old road thru marsh
WH09	8	Wareham	$6,657	3.3	Baker's Island Road	Shell Point Bay	road	none		
WH10	11	Wareham	$26,790	34.7	Indian Neck Road	Crooked River	culvert/Road	Unknown	poor	Whirlpool visible on downstream opening
WH11	14	Wareham	$10,412	29.0	Allen Rd.		culvert	Concrete	fair	Underground water pipe spraying out into
WH12	2	Wareham	$155,238	0.6	Railroad		railroad/culvert	concrete	fair	
WH13	7	Wareham	$54,695	1.3	Narrows Road	Wareham River	culvert/road	concrete	fair	boxed headwall upstream
WH14	10	Wareham	$1,926,500	184.1	Minot Ave	Wareham River	bridge	N/A		culvert end submereged
WH14B	11	Wareham	$551,500	184.1	Minot Ave	Wareham River	bridge	N/A		two openings (WH14) converge into one
WH15	10	Wareham	$1,101,500	184.1	Railroad	Wareham River	bridge	N/A		
WH16	14	Wareham	$47,763	36.6	Sandwich Rd., Rt 6		culvert	Concrete	poor	structure broken, not visible on river side
WH17	12	Wareham	$386,500	25.8	Sandwich Rd., Rt 6	Agawam River	bridge	Concrete		
WH18	11	Wareham	$9,558	14.7	Woods of Wareham Rd	Broad Marsh River salt	road	none		Old road to island app. 5 ft. above marsh.
WH19	5	Wareham	$4,401,500	2.0	I-195	Sippican River	bridge	N/A		No Phrag upstream, turns fresh
WH20	6	Wareham	$2,201,500	14.9	I-195	Cohackett Brook	bridge	N/A		
WH21	8	Wareham	$1,651,500	44.8	I-195	Weweantic River	bridge	N/A		
WH22	8	Wareham	$20,504	2.4	Sunset Island Blvd		road	Concrete		
WP01	7	Westport	$26,790	5.0	River Road	Cockeast Pond	culvert	Corr.Metal	poor	rotten on bottom side
WP02	11	Westport	$11,826	3.1	Old Road	Hulda Cove	culvert	Stone	good	very old road but in good condition
WP03	8	Westport	$10,121,500	511.6	Rt.88 Bridge	Westport River	bridge	N/A	N/A	
WP04	3	Westport	$15,430	0.2	Cadman's Neck Rd.		culvert	Concrete	poor	half full of stone
WP05	11	Westport	$9,797	225.8	Spooner Drive/Cadman's Neck Rd.		culvert	Concrete	good	
WP06	12	Westport	$3,081,500	225.8	Hix Bridge	Westport River	bridge	N/A	N/A	recently rebuilt

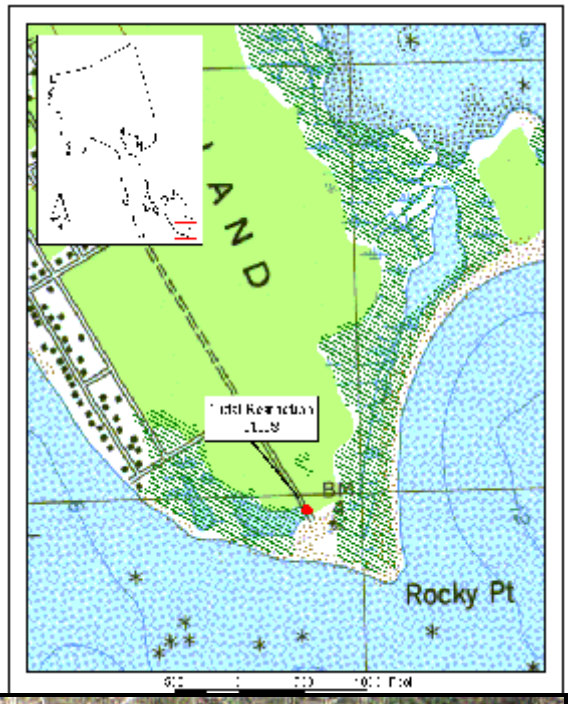
Table 2. Results: All sites with Prioritization Scores greater than 10, sorted by score and cost

Site #	Priority Score	Town	Estimated Cost	Wetland Area (ac)	Restriction Feature Name	Chan-nel/Restricted Wetland Name	Type of Restricting Structure	Culvert type	Culvert Condition	Explain Condition of Culvert
WH11	14	Wareham	$10,412	29.0	Allen Rd.		culvert	Concrete	fair	Underground water pipe spraying out into channel
FH18	14	Fairhaven	$15,780	13.7	Fir Street		culvert/road	Concrete	fair	Road to beach
MN22	14	Marion	$20,504	29.1	Kittansett 3rd Hole		culvert w/ flap gate	concrete	good	has flapgate, continually blocked by storms
WH16	14	Wareham	$47,763	36.6	Sandwich Rd., Rt 6		culvert	Concrete	poor	structure broken, not visible on river side
BN12	13	Bourne	$10,699	46.2	Railroad		culvert	Corr.Metal	good	tide gate stuck 4" open
DA15	13	Dartmouth	$11,112	6.3	Old Road		culvert	Old Stone	poor	road washed out on all sides, stone culvert
FA10	13	Falmouth	$17,616	2.3	Woodneck Rd.		road	N/A		barrier beach road with no culverts/ pond created on
FH19	13	Fairhaven	$26,790	2.2	Bass Creek Road		culvert	Concrete	fair	one end clogged w/ vegetation
FA23	13	Falmouth	$1,189,500	25.5	Bridge/Footpath	Old Silver Beach	bridge, foot			
MN23	12	Marion	$15,988	2.3	Bayberry Lane		culvert	unknown	good	
BN11	12	Bourne	$16,358	31.8	Dam Rd.		culvert, tide gate	Corr.Metal	poor	broken tidegate, culvert cracked in some places
WH07	12	Wareham	$21,265	12.2	Camp St.	Mud Cove	culvert	Concrete	good	Road washed out on downstream side.
MN21	12	Marion	$25,221	29.1	Path to 4th Green		culvert	plastic	poor	culvert road will be removed this summer
BN15	12	Bourne	$28,973	8.2	Wings Neck Road		culvert	concrete	fair	
MT03	12	Mattapoisett	$76,676	32.7	Mattapoisett Neck Road		culvert	Concrete	good	100 foot wide, narrows to 30 ft. to 40
WH17	12	Wareham	$386,500	25.8	Sandwich Rd., Rt 6	Agawam River	bridge	Concrete		
DA02	12	Dartmouth	$551,500	246.1	Gulf Road	Dike Creek or	bridge	N/A	N/A	recently rebuilt
FA14	12	Falmouth	$1,321,500	25.5	Quaker Rd.		bridge	N/A		bridge being rebuilt
WP06	12	Westport	$3,081,500	225.8	Hix Bridge	Westport River	bridge	N/A	N/A	recently rebuilt
FH09B	11	Fairhaven	$6,070	25.2	Widemarsh Road		culvert	Concrete	good	
WH08	11	Wareham	$6,070	6.1	Gomez Way	Shell Point Bay	culvert	Concrete	good	Old road thru marsh
DA11	11	Dartmouth	$6,606	6.3	Little Beach Rd.	Allen's Pond	culvert/road	Concrete	poor	1/2 buried at one end
FH15	11	Fairhaven	$6,606	10.2	Windward Lane		culvert/road	unknown	poor	looks old
DA10	11	Dartmouth	$7,347	8.7	Common Drive	Gaffney Rd.	culvert	PVC	excellent	
DA06	11	Dartmouth	$8,465	10.1		Cowyard Marsh	culvert/road	Concrete	good	
DA07	11	Dartmouth	$8,465	10.1		Cow Yard Marsh	culvert/road	Concrete	poor	partially buried in mud
WH18	11	Wareham	$9,558	14.7	Woods of Wareham Rd	Broad Marsh River	road	none		Old road to island app. 5 ft. above marsh. No culverts.
WP05	11	Westport	$9,797	225.8	Spooner Drive/Cadman's Neck Rd.		culvert	Concrete	good	
WP02	11	Westport	$11,826	3.1	Old Road	Hulda Cove	culvert	Stone	good	very old road but in good condition
FH17	11	Fairhaven	$13,195	20.2			culvert/footpath	unknown	poor	mosquito ditch filling in from overwash pan
MT16	11	Mattapoisett	$16,562	11.0	Aucoot Rd.		culvert	concrete	good	Aucoot road channel dug out
BN16	11	Bourne	$17,870	3.8	Kenwood Rd.		culvert	Corr. Metal	good	broken bottom on dnstream end of culvert
FA09	11	Falmouth	$19,022	4.7	Road/Culvert		culvert	Terracotta	good	2/3 submerged w/ rocks on upstream side
WH10	11	Wareham	$26,790	34.7	Indian Neck Road	Crooked River	culvert/Road	Unknown	poor	Whirlpool visible on downstream opening
BN18	11	Bourne	$32,382	0.0	culvert, Garnet Ave	to pond at head of	culvert	concrete	fair	culvert too small and intentionally blocked with rock
BN05	11	Bourne	$386,500	4.6	Bridge, Red Brook Drive		bridge/culvert/old wall	Cemented	good	
WH14B	11	Wareham	$551,500	184.1	Minot Ave	Wareham River	bridge	N/A		two openings (WH14) converge into one
DA09	11	Dartmouth	$661,500	164.7	Little River Road	Little River	bridge	N/A	N/A	cracks, spalling many areas
NB03	11	New Bedford	$1,101,500	83.4	Coggeshall Street Bridge	Acushnet River	bridge	N/A	N/A	bridge built out into river on stone pier

FAIRHAVEN: Town Beach Entrance, West Island

Tidal Restriction Site FH18

Score = 14, Ranking = High



Site Description

Restriction FH18 was created by the construction of a parking lot which is used for the town beach and the DEM state reservation. The salt marsh behind the barrier beach was filled to create this parking lot. In order to maintain drainage for the marshes on the west side of the road, a perimeter ditch was dug around the parking lot and a culvert placed under Fir Street. The wetlands to the west and north are privately owned, and mapped as habitat for rare & endangered species by the Natural Heritage & Endangered Species Program.

General Information

The restriction consists of a circular, 10" diameter, concrete culvert. The culvert is located under Fir Street, a 30 ft wide, paved road leading to the Fairhaven Town Beach on West Island.

- Culvert condition - fair
- Restriction width - 10 inches
- Restriction length - 36 feet
- Channel width - 4 feet
- Acres of wetlands affected - 13.7
- Acres of *Phragmites* - 1.5

Culvert under Fir Street, upstream side

Estimated Remediation Cost

Total estimated cost - $15,800
Cost per acre - $1,160

Culvert under Fir Street, downstream side

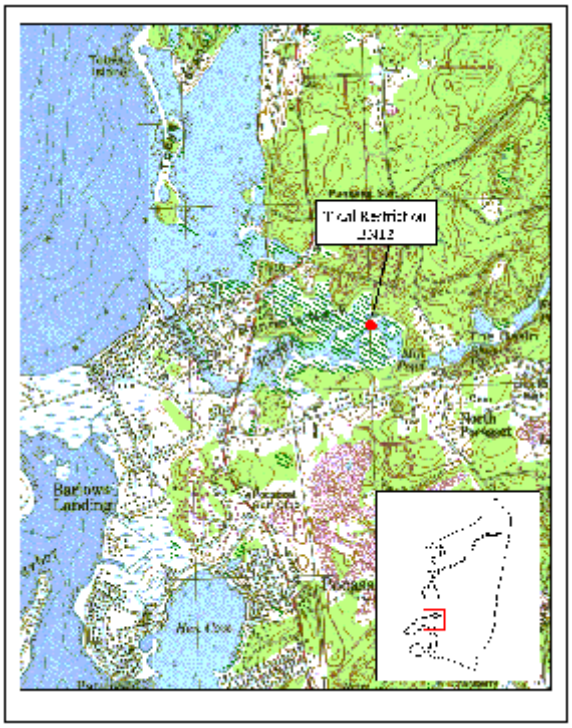
Comments

This site has generated interest among several agencies.

BOURNE: Rail Line Salt Marsh Area

Tidal Restriction Site BN12

Score = 13, Ranking = High



Site Description

Restriction BN12 is the result of two culverts located under a railroad track. The first, an aluminum culvert appears fairly new and is at a slightly lower elevation than the second culvert. The second culvert is made of concrete and is badly damaged. The surrounding wetlands include an anadromous fish run and it is also mapped as habitat for rare & endangered species by the Natural Heritage & Endangered Species Program. Both the restriction and affected wetland are on private property.

General Information

The restrictions consist of two circular culverts, one 48" diameter corrugated aluminum and one 30" concrete culvert. The culverts are located under a twenty foot wide railroad track. There is an existing tide gate which is stuck 4" open, and consists of a rotting board on rusting hinges.

- Culvert condition - aluminum - good, concrete - poor
- Restriction width - 2.7 feet
- Restriction length - 12 feet
- Channel width - unknown
- Acres of wetlands affected - 46.20
- Acres of *Phragmites* - 0

Tidal Restriction BN12b

Tidal Restriction BN12a

Estimated Remediation Cost

Remediation cost - $10,700
Cost per acre - $232

Comments

This site is one of a number of restrictions in the Towns of Bourne and Falmouth caused by the old railroad track bed. Culvert replacement under the railroad bed will require participation and permission of the Massachusetts Department of Transportation.

WAREHAM: Allen Road restriction on Crooked River

Tidal Restriction Site WH11

Score = 14, Ranking = High

Site Description

Restriction WH11 is the result of an 18" culvert under Alden Road. The restriction is on town property and the wetland is privately owned.

General Information

This restriction consists of a circular, concrete culvert with a diameter of 18". The culvert is located under Allen Road, a 30 foot wide paved road. Presently, the culvert is nearly buried by debris. On the south side of Alden Road, sediment has accumulated blocking the channel and the culvert. An underground water pipe sprays out into the channel.

- Culvert condition - fair
- Restriction width - 1.5 feet
- Restriction length - 36 feet
- Channel width - 3 feet
- Acres of wetlands affected - 29.0
- Acres of *Phragmites* - 8.6

Tidal Restriction WH11

Estimated Remediation Cost

Total estimated cost - $10,400
Cost per acre - $359

Comments

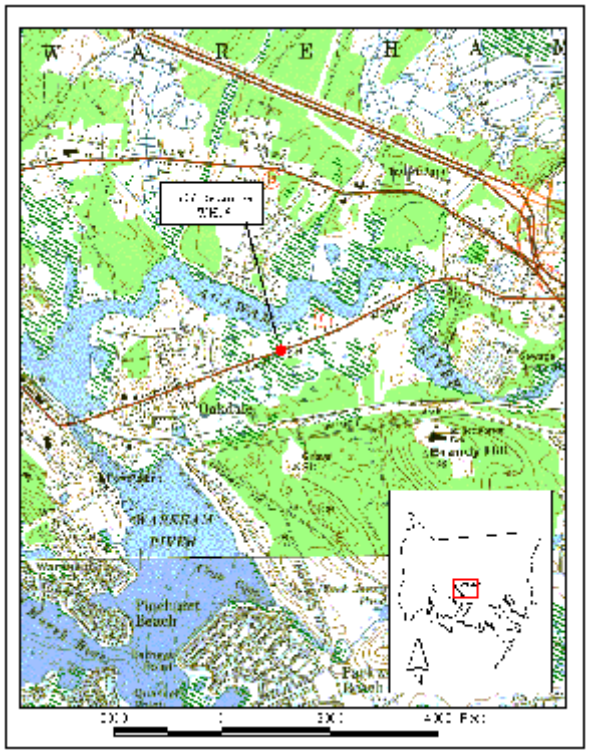
A four foot open box culvert and expansion of the channel could benefit this site.

Tidal Restriction WH11

WAREHAM: Route 6, Agawam Oakdale Marsh

Tidal Restriction Site WH16

Score = 14, Ranking = High



Site Description

Restriction WH16 is the result of a culvert under State Route 6. The adjacent wetland is privately owned and the area is habitat for rare & endangered species as mapped by the Natural Heritage & Endangered Species Program.

General Information

This restriction consists of a circular, 36" diameter, concrete culvert under a 36 foot wide, paved road. The headwalls on the structure are badly broken.

- Culvert condition - poor
- Restriction width - 3 feet
- Restriction length - 43.2 feet
- Channel width - unknown
- Acres of wetlands - 36.6
- Acres of *Phragmites* - 9.7

Estimated Costs for Repairs

Total estimated cost - $47,800
Cost per acre - $1,310

Comments

Tidal Restriction WH16

FALMOUTH: Little Sippewisset Marsh Area

Tidal Restriction Site FA10

Score = 13, Ranking = High

Site Description

Tidal Restriction FA10 is located on town property, however, the affected wetland system is private. This restriction is a result of Woodneck Road. The area surrounding the restriction falls within habitat for rare & endangered species habitat as identified by the Natural Heritage & Endangered Species Program.

General Information

Restriction FA10 is caused by Woodneck Road. There is no culvert present at the site.

- Road condition - Fair
- Restriction width - at least 150 feet
- Restriction length - 18 feet
- Channel width - unknown
- Acres of wetlands affected - 2.31
- Acres of *Phragmites* - 2.31

Estimated Remediation Cost

Total estimated cost - $17,600
Cost per acre - $7,630

Comments

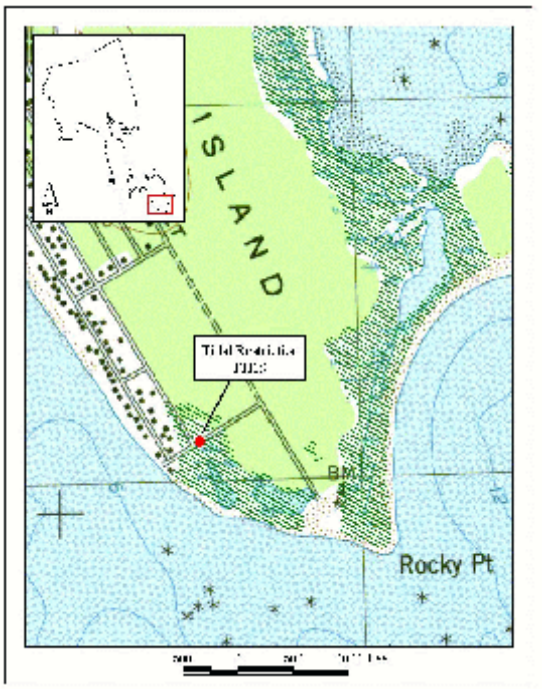
Woodneck Road, restriction FA10

Marsh area affected by FA10

FAIRHAVEN: Bass Creek Road, West Island

Tidal Restriction Site FH19

Score = 13, Ranking = High



Site Description

Tidal Restriction FH19 is caused by an undersized culvert located under Bass Creek Road, on West Island. Phragmites can be found upstream of the culvert in an area that ...

General Information

Tidal Restriction FH19 is caused by an undersized 16 inch culvert located under Bass Creek Road, a paved 30 foot wide road in the West Island area of the Town.

- Culvert condition - fair
- Restriction width - 16 inches
- Restriction length - 36 feet
- Channel width - 2 feet
- Acres of wetlands affected - 2.2
- Acres of *Phragmites* - 1.7

Estimated Costs to Remediate Restriction

Remediation cost - $26,800
Cost per acre - $12,100

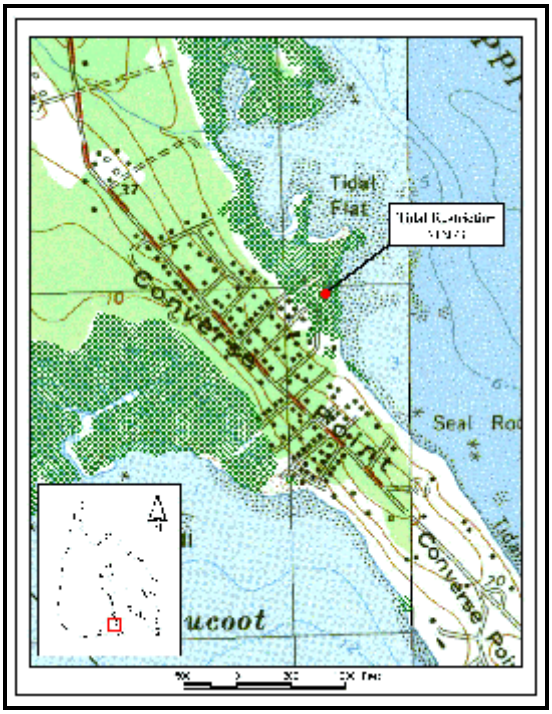
Comments

Replacement of this undersized culvert may be a cost effective mechanism for reducing *Phragmites* at this site.

MARION: Converse Point, Bayberry Lane

Tidal Restriction Site MN23

Score = 12, Ranking = High



Site Description

Tidal Restriction MN23 is caused by an undersize culvert under a dirt road.

General Information

Restriction MN22 consists of a circular, concrete, 24" diameter culvert. The culvert is located under Bayberry Lane

- Culvert condition - good
- Restriction width - 2 feet
- Restriction length - 14 feet
- Channel width - 8 feet
- Acres of wetlands affected - 2.3
- Acres of *Phragmites* - 0.6

Estimated Remediation Costs

Remediation cost - $16,000
Cost per acre - $6,950

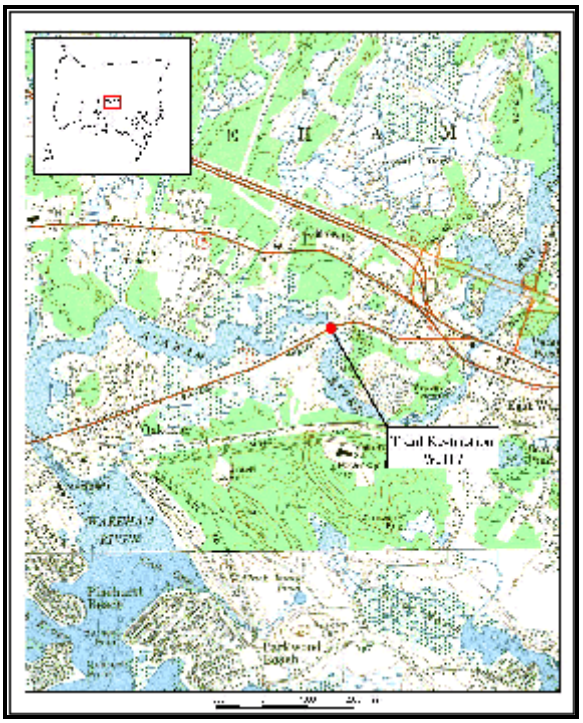
Comments

Although a relatively small area is affected by this restriction, a remediation project would be easy to implement.

WAREHAM: Rt 6, Agawam River Crossing

Tidal Restriction Site WH17

Score = 12, Ranking = High



Site Description

Tidal Restriction WH17 is caused by the Route 6 bridge crossing the estuary portion of the Agawam River.

General Information

Restriction WH17 old concrete bridge with a small opening relative to the size of the River.

- Bridge condition - Fair
- Restriction width - 35 feet
- Restriction length - 40 feet
- Channel width - 100 feet
- Acres of wetlands affected - 25.8
- Acres of *Phragmites* - 13.7

Estimated Costs to Remediate Restriction

Remediation cost - $387,000
Cost per acre - $15,000

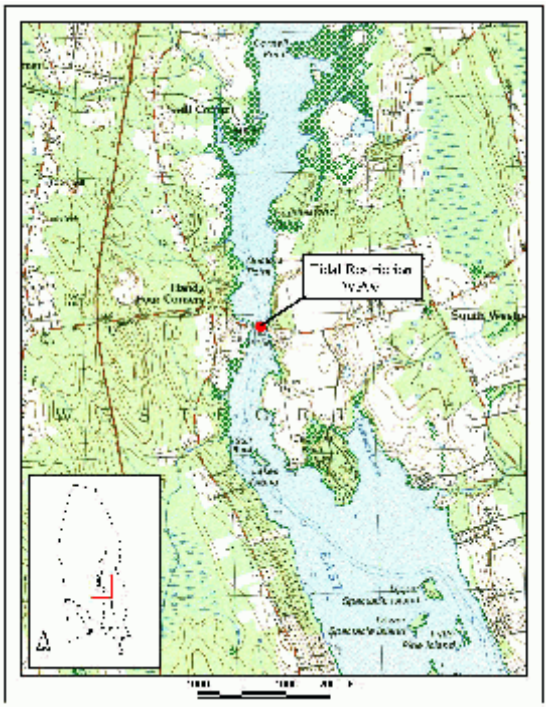
Comments

This site, like a number of bridge restrictions included in this report, became high priorities because of the large area of potential wetland habitat area affected. Whether expansion of the restriction, or dredging of the channel would be beneficial to salt marsh habitat will require further study. Improved flushing may be relevant to water quality above the bridge because the municipal treatment plant discharges 1000 meters upstream of this site.

WESTPORT: Hix Bridge

Tidal Restriction Site WP06

Score = 13, Ranking = High



Site Description

Tidal Restriction WP06 is caused by fill material under the Hix Bridge creating a damming effect and impeding tidal flow. A separate report is available from the Buzzards Bay Project describing this restriction. Essentially, however, large granite blocks were toppled in the river as a result of the old Hix Bridge destruction by the Hurricane of 38, and from the demolition of the old bridge in 1939.

General Information

Restriction is an old two lane bridge whose reconstruction is planned by MHD

- Bridge condition - fair, needing repair
- Restriction width - 280 ft.
- Restriction length - 30 ft.
- Channel width - 250 feet
- Acres of wetlands affected - 226
- Acres of *Phragmites* - 113

Estimated Costs to Remediate Restriction

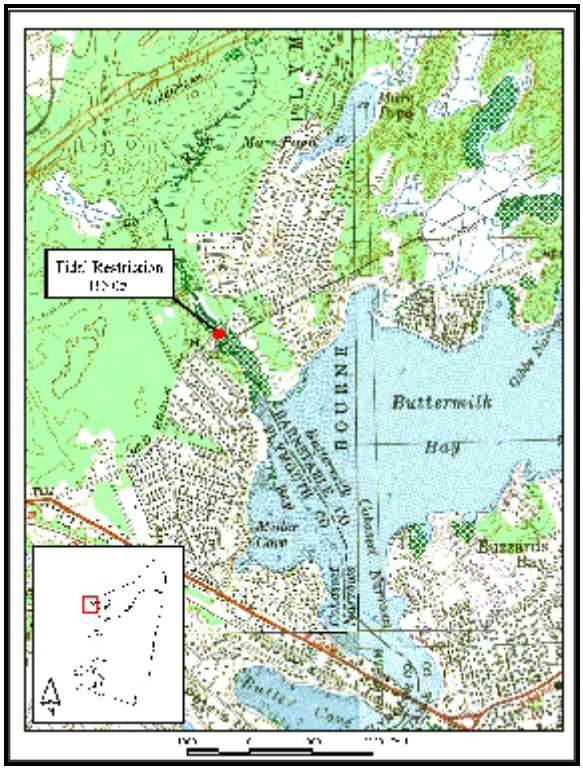
Remediation cost - $3,080,000 (depends upon many factors, assumes dredging and fill removal)
Cost per acre - $13,600

Comments

This BBP has requested that this site be reviewed by the US Army Corps of Engineers.

WAREHAM/BOURNE: Red Brook crossing at Head of The Bay Road

Tidal Restriction Site BN05
Score = 11, Ranking = Medium



Site Description
Tidal Restriction BN05 is caused by a small bridge that is part of Head of the Bay road. The bridge is at the Wareham-Bourne boundary.

General Information
Restriction BN05 consists of box culvert, old stone bridge under a well traveled paved road.

- Culvert condition - poor
- Restriction width - 35 feet
- Restriction length - 26.4 feet
- Channel width - 20 feet
- Acres of wetlands affected - 4.6
- Acres of *Phragmites* - 0.5

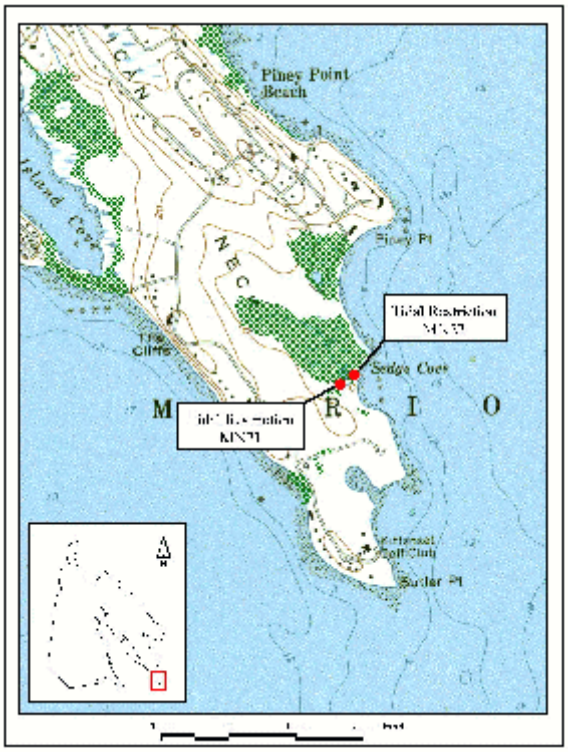
Estimated to Remediate Restriction
Remediation cost - $387,000
Cost per acre - $84,200

Comments
The stream above this bridge remains tidal. Widening or deepening of the bridge could improve habitat marginally. Because of costs and small wetlands areas affected, this work could only be justified during a future planned bridge replacement.

MARION: Kittansett Golf Club Salt Marsh

Tidal Restriction Sites MN21 and MN22

MN21: Score = 12, Ranking = High
MN22: Score = 14, Ranking = High



Site Description

Tidal Restriction MN21 is a 200 feet stone wall near shore. A pipe with a flapper gate was installed in the wall, and water flowed through a 3 foot wide collapsed area. MN22 is an aluminum culvert under a dirt road. A large Phragmites dominated salt marsh is found landward of these restrictions.

General Information

This property is own by the Kitansett Golf Course. The site has been remediated. Condition before remediation was as follows:

- Culvert condition - poor, nearly blocked
- Restriction width - 3 feet (MN21)
- Restriction length - 14.4 feet
- Channel width - 6 feet
- Acres of wetlands affected - 29.1
- Acres of *Phragmites* - 20.6

Estimated Remediation Costs

Remediation cost - $25,200
(Costs from BBP remediation model, actual costs unknown but believed close to this amount)
Cost per acre - $867

Removal of restriction MN22 (a stone wall across a salt marsh) during 1999.

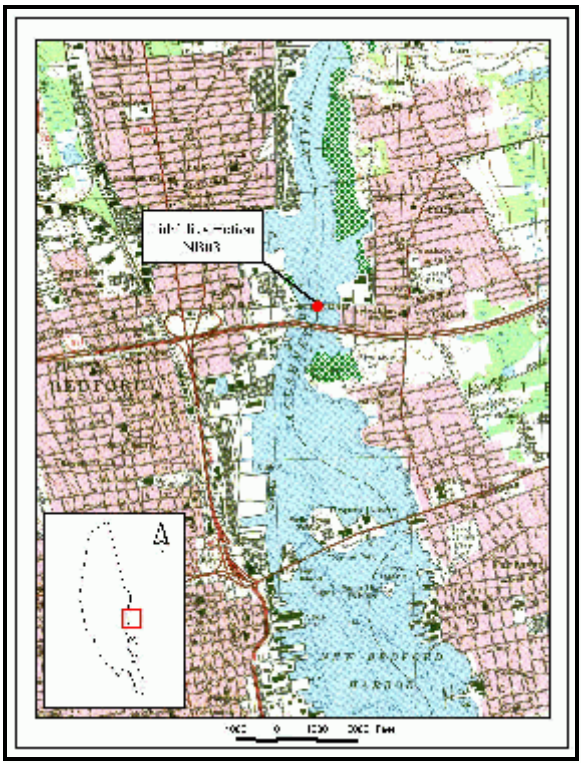
Comments:

This site was recently restored by the Kittansett Golf Club with technical assistance from the Buzzards Bay Project. At MN21, the culvert and a 50 foot length of stone wall was removed. AtMN22, the 6 inch aluminum culvert under a dirt was replaced with three 12 inch culverts. This site was kept in the Atlas for reference purposes and because two other unremediated restriction also affect this marsh

NEW BEDFORD: Coggeshall Street Bridge

Tidal Restriction Site NB03

Score = 11, Ranking = Medium



Site Description

Tidal Restriction NB03 is caused by the Coggeshall Street Bridge. Most of the area under the bridge is filled, leaving a 90 feet opening.

General Information

This site is an old bridge in an urban setting.

- Bridge condition - fair
- Restriction width - 100 feet
- Restriction length - 90 feet
- Channel width - 800 feet
- Acres of wetlands affected - 83.4
- Acres of *Phragmites* - 12.0

Estimated Remediation Costs

Remediation cost - $1,100,000
Cost per acre - $13,200

Comments

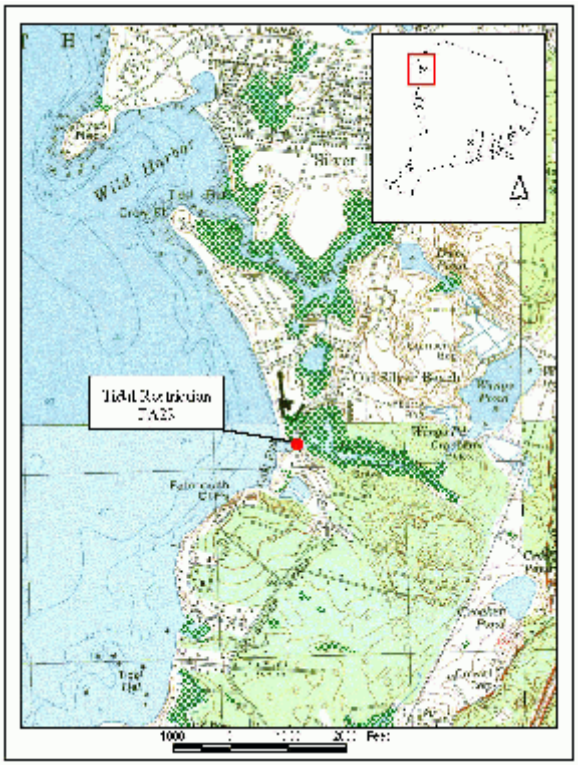
This site, like a number of bridge restrictions included in this report, became high priorities because of the large area of potential wetland habitat area affected. Whether expansion of the restriction, or dredging of the channel would be beneficial to salt marsh habitat will require further study.

Improved flushing at this site should be considered if the bridge is ever rebuilt. Improved flushing has relevance to water quality also because of upstream pollution sources and the PCB superfund site.

FALMOUTH: Bridge at Old Silver Beach

Tidal Restriction Site FA23

Score = 14, Ranking = High



Site Description

Tidal Restriction FA23 is a bridge, with a former footbridge adjoining. Massachusetts Highway Department recently upgraded and expanded the bridge with a sidewalk.

General Information

The recently upgraded bridge is in excellent condition. The Bridge crosses a long natural and altered channel connecting old silver beach to an extensive salt marsh area. The shallowness and shoaling of the channel may impede tidal flow.

- Bridge condition - Excellent
- Restriction width - 120 feet
- Restriction length - 250 feet
- Channel width - 40 feet
- Acres of wetlands affected - 25.5
- Acres of *Phragmites* - 1.57

Estimated Remediation Costs

Remediation cost - $1,190,000
(channel dredging)
Cost per acre benefitted - $46,000

New Bridge at Old Silver Beach (FA23).

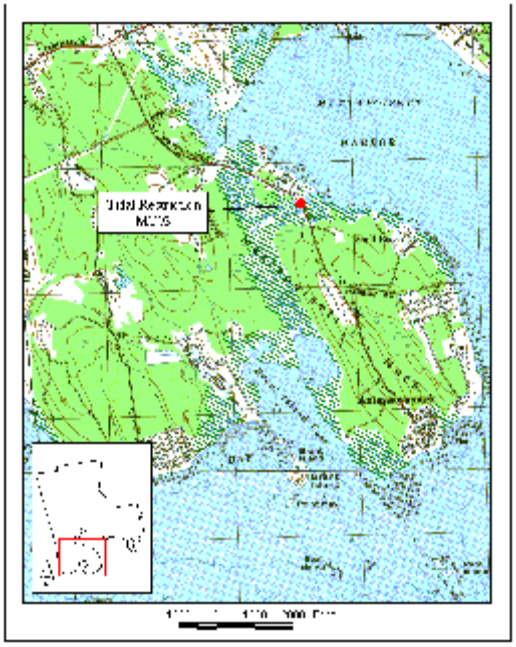
Comments

The bridge and foot bridge was recently reconstructed as a single bridge over the channel. Given this recent reconstruction, the only potential restoration at this site is channel dredging. The channel is very long and shallow, but it is unclear if dredging the channel under the road and to Old Silver Beach would result any benefit to this wetland system. This site is included in this report to acknowledge further study could be considered at this site.

MATTAPOISETT Mattapoisett Neck Road

Tidal Restriction Site MT03

Score = 12, Ranking = High



Site Description

Tidal Restriction MT03 is caused by an undersized 42" culvert under Mattapoisett Neck Road. This restriction impacts the same marsh system as does MT04, MT05, and MT06. Restriction MT03 is located on town property, while the restricted wetland is private.

General Information

Restriction MT03 consists of a circular, concrete, 42" diameter culvert. The culvert is located under Mattapoisett Neck Road , a 45 foot wide, paved road.

- Culvert condition - good
- Restriction width - 4 feet
- Restriction length - 54 feet
- Channel width - 30 feet
- Acres of wetlands affected - 32.7
- Acres of *Phragmites* - 6.8

Estimated Costs to Remediate Restriction

Remediation cost - $76,700

Cost per acre - $2,340

Comments

Replacement of the circular culvert with a large box culvert may be an effective cost effective solution for this site.

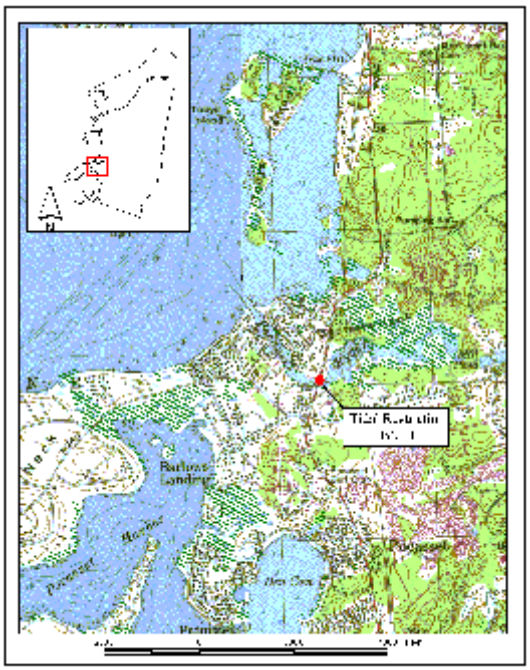
Upstream side of tidal restriction MT03

Downstream side of tidal restriction MT03

BOURNE: Pocassett River Bridge

Tidal Restriction Site BN14

Score = 9, Ranking = Low



Site Description

Restriction BN14 is the crossing of Shore Road across the Pocasset River. The restriction is town property, while the wetlands are private. The area surrounding the restriction is categorized as habitat for rare & endangered species as described by the Natural Heritage & Endangered Species Program.

General Description

The existing steel bridge was built in 1939 on a granite abutment. The road over the bridge is 22 feet wide and two lanes. There is no culvert. The upstream side of this restriction is clogged with debris.

- Bridge condition - Good
- Restriction width - 45 feet
- Restriction length - 26.4 feet
- Channel width -60 feet
- Acres of wetlands affected - 49.4
- Acres of *Phragmites* - 0.0

Estimated Remediation Costs

Remediation cost - $497,000 (dredging?)
Cost per acre - $10,100

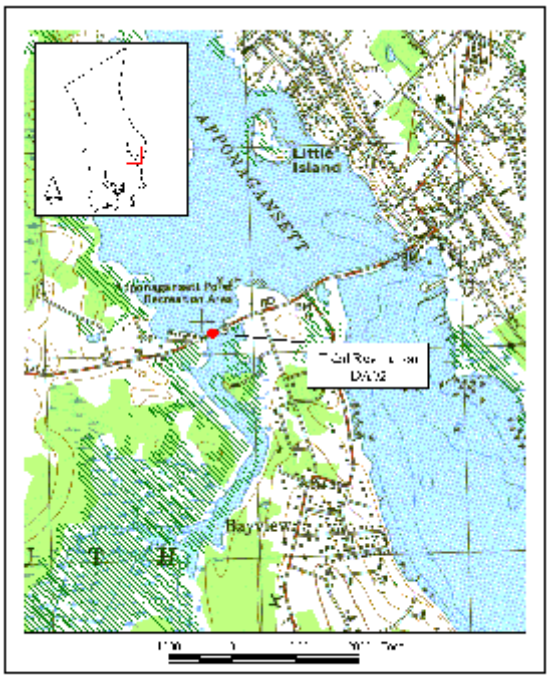
Comments

This site, like a number of bridge restrictions included in this report, became high priorities because of the large area of potential wetland habitat area affected. Whether expansion of the restriction, or dredging of the channel would be beneficial to salt marsh habitat will require further study.

DARTMOUTH: Saltmeadow, Apponagansett Bay Area

Tidal Restriction Site DA02

Score = 12, Ranking = High



Site Description

Tidal Restriction DA02 is the result of the Gulf Road bridge. This bridge was recently rebuilt. The restriction is town property and the affected wetlands are private property.

General Information

The bridge on Gulf Road consists of a 30 foot wide paved road with two lanes. There are no culverts.

- Bridge condition - Fair
- Restriction width - 50 feet
- Restriction length - 36 feet
- Channel width - unknown
- Acres of wetlands affected - 246.1
- Acres of *Phragmites* - 48.2

Close-up view of DA02

Estimated Remediation Cost

Total estimated cost - $552,000
Cost per acre - $2,240

Comments

This site, like a number of bridge restrictions included in this report, became high priorities because of the large area of potential wetland habitat area affected. Whether expansion of the restriction, or dredging of the channel would be beneficial to salt marsh habitat will require further study.

At this site, anecdotal information suggests the tidal circulation has diminished, and *Phragmites* cover has increased in recent years.

Restriction DA02

DARTMOUTH: Apponagansett Bay Area

Tidal Restriction Site DA15

Score = 13, Ranking = High

Site Description

This restriction is the result of an old stone culvert under a dirt road. The stone culvert is washed out on all sides allowing almost free flow at high tide. At low tide there is sufficient blockage from the old stones to justify remediation. The restriction and wetlands are on town property.

General Information

The restriction is an old 18" x 24" box culvert made out of stone. The culvert is located under a 20 foot wide dirt road.

- Culvert condition - poor
- Restriction width - 2 feet
- Restriction length - 24 feet
- Channel width - 10 feet
- Acres of wetlands affected - 6.3
- Acres of Phragmites - 1.9

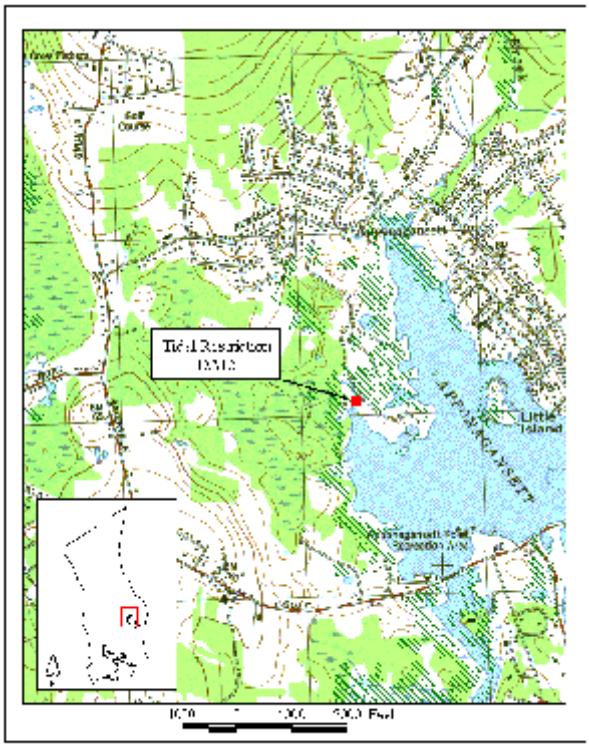
Estimated Remediation Costs

Remediation cost - $11,100

Cost per acre - $1,770

Comments

Simple removal of blocks and fill would be the solution for this site. Historic rights of way may need to be considered during the permitting process for any restoration options considered for this site.



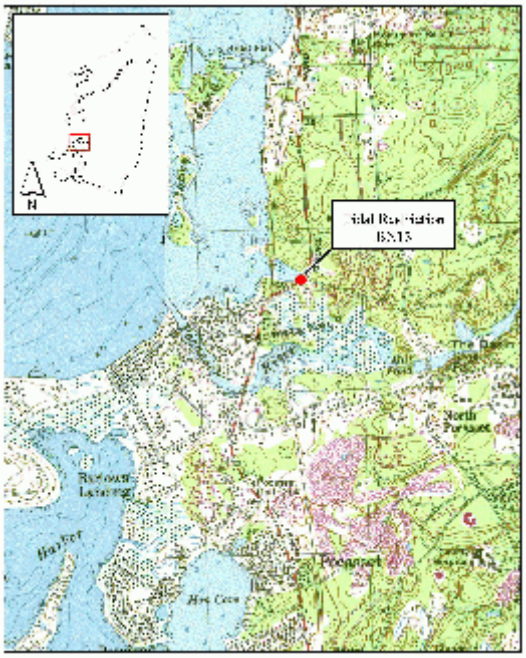
Old stone culvert at Restriction DA15

Tidal Restriction DA15

BOURNE: Shore Road Restriction and Pocasset River Head

Tidal Restriction Site BN13

Score = 10, Ranking = Medium



Site Description

Tidal Restriction BN13 is the result of an 18" culvert under Shore Road. The restricted area exhibits characteristics of many fresh water areas flooded by salt water during Hurricane Bob. Dead tress are throughout the restricted area. Salt water may have been trapped behind Shore Road for many days after the storm due to the small pipe leaving the area. The restriction and wetlands are on town property.

General Information

The restriction consists of an 18" circular, concrete culvert located under Shore Road, a paved, 2-lane road that is 22 feet wide.

- Culvert condition - poor
- Restriction width - 1.5 feet
- Restriction length - 26.4 feet
- Channel width - 2 feet
- Acres of wetlands affected - 0.9
- Acres of *Phragmites* - 0.9

Estimated Costs to Remediate Restriction

Remediation cost - $16,300
Cost per acre - $18,500

Comments

The elevation of the road above this culvert may be an important factor in the cost of replacing this culvert.

Tidal Restriction BN13

BOURNE: Old Dam Road on Back River

Tidal Restriction Site BN11

Score = 12, Ranking = High

Site Description

Tidal Restriction BN11 has a broken tide gate and damaged culvert under Old Dam Road. Upstream of the site is an abandoned cranberry bog that was once a salt marsh.

General Information

The restriction consists of an 18" circular, concrete culvert located under Shore Road, a paved, 2-lane road that is 22 feet wide.

- Culvert condition - poor
- Restriction width - 2.7 feet
- Restriction length - 26.4 feet
- Channel width - 2 feet
- Acres of wetlands affected - 31.8
- Acres of *Phragmites* - 0.0

Estimated Costs to Remediate Restriction

Remediation cost - $16,400

Cost per acre - $514

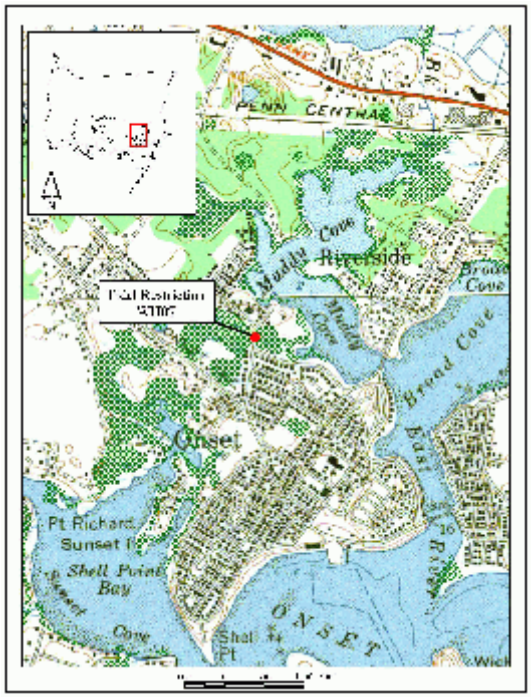
Comments

A policy decision needs to be made as to whether to allow the site to revert to a salt marsh..

Wareham: Muddy Cove Marsh at Camp Street

Tidal Restriction Site WH07

Score = 12, Ranking = High



Site Description

Tidal Restriction WH07 is two 1 ft diameter concete culverts that is blocked with large rocks located in the stream.

General Information

The restriction consists of an 12" circular, concrete culvert located under Camp St, a paved, 2-lane road that is 22 feet wide.

- Culvert condition - concrete culvert
- Restriction width - 2 feet
- Restriction length - 24 feet
- Channel width - 2 feet
- Acres of wetlands affected - 12.2
- Acres of *Phragmites* - 1.6

Estimated Remediation Costs

Remediation cost - $21,000
Cost per acre - $1,750

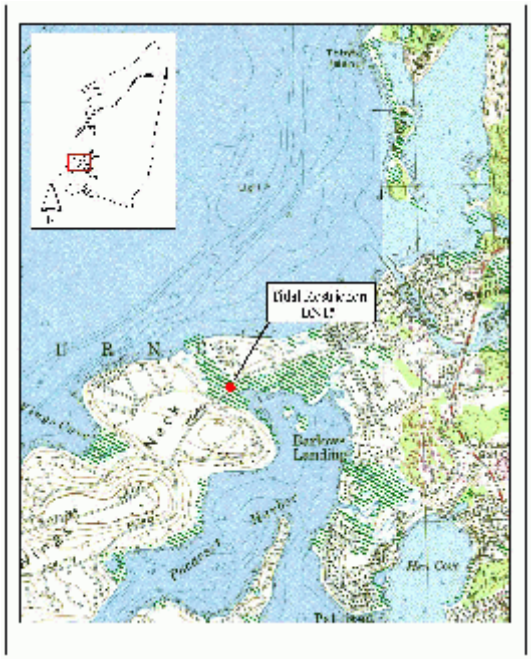
Comments

Removal of debris, and possibly installation of a box culvert may be the solution for this site.

Bourne: Wings Neck Road Restriction

Tidal Restriction Site BN15

Score = 12, Ranking = High



Site Description

Tidal Restriction BN15 is a 1 ft diameter concrete culvert that is blocked culvert with large rocks located in the stream.

General Information

The restriction consists of an 30" circular, concrete culvert located under Wings Neck Road, a paved, 2-lane road that is 22 feet wide.

- Culvert condition - concrete culvert
- Restriction width - 2.5 feet
- Restriction length - 26.4 feet
- Channel width - 4 feet
- Acres of wetlands affected - 8.2
- Acres of *Phragmites* - 1.3

Estimated Costs to Remediate Restriction

Remediation cost - $29,000

Cost per acre - $3,540

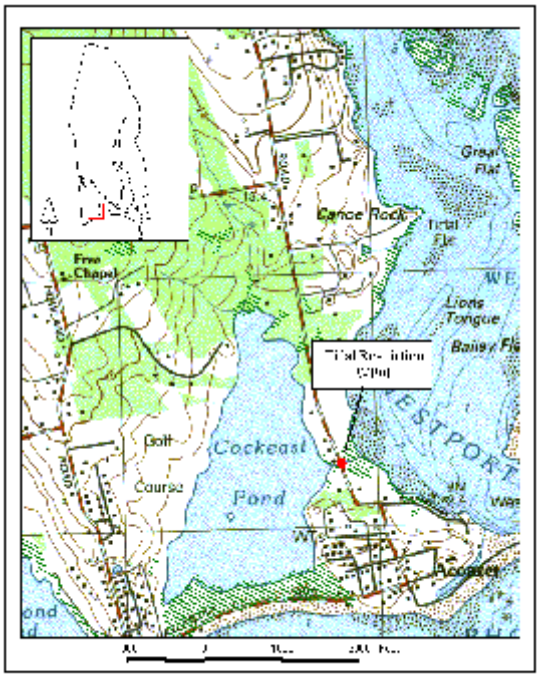
Comments

Several agencies have reviewed this site and it is under consideration as a remediation project. The town of Bourne has prepared grant applications for the remediation of this site.

WESTPORT: Cockeast Pond

Tidal Restriction Site WP01

Score = 7, Ranking = Low



Site Description

Restriction WP01 is a culvert under River Road at the edge of Cockeast Pond. The existing culvert has rusted through on bottom side. Historically this pond was fresh until the last culvert replacement after hurricane Carol in 1956. There is not sufficient salt water to establish *Spartina*. Species growing around the edge of the pond are *Phragmites* and narrow-leaved cattail, *Typha angustifolia*. The restriction is on town property. The restricted wetlands are privately owned and listed as habitat for rare & endangered species by the Natural Heritage & Endangered Species Program. The culvert is part of an anadromous fish run.

General Information

Restriction WP01 consists of a circular, 24 " corrugated metal culvert under River Road. The road is 30 feet wide and paved.

- Culvert condition - poor
- Restriction width - 2 feet
- Restriction length - 36 feet
- Channel width - 4 feet
- Acres of wetlands affected - 5.0
- Acres of Phragmites - 0.0

Estimated Remediation Cost

Remediation cost - $26,800
Cost per acre - $5,360

Cockeast Pond Restriction (WP01)

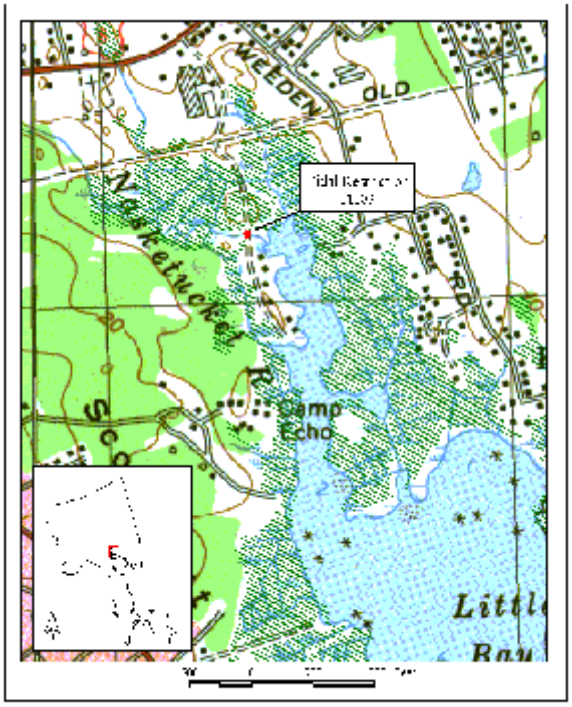
Comments

Increased salt water flows to the pond may eliminate it as a breeding area for alewives. For this reason points were lost in the scoring for adverse impacts, and this site became ranked low. Instead of increasing tidal flow, it may be appropriate to further restrict tidal flow by elevating the culvert. This option is now being considered by the town and the Massachusetts Highway Department. It is included in this report because this site is a worthy freshwater remediation project.

FAIRHAVEN: Nasketucket River, Pierce Point Area

Tidal Restriction Site FH03

Score = 10, Ranking = High



Site Description

Tidal Restriction FH03 is Pierces Point Bridge. This old bridge is passable for average daily use. The abutments are cut stone, the deck and framing are wood. The restriction is on town property. The wetlands are privately owned.

General Information

Restriction FH03 consists of the Pierces Point Bridge. There is no culvert.

- Bridge condition - fair
- Restriction width - 35 feet
- Restriction length - 12 feet
- Channel width - 20 feet
- Acres of wetlands affected - 19.3
- Acres of Phragmites - 4.2

Estimated Remediation Cost

Remediation cost - $387,000
Cost per acre - $20,000

Comments

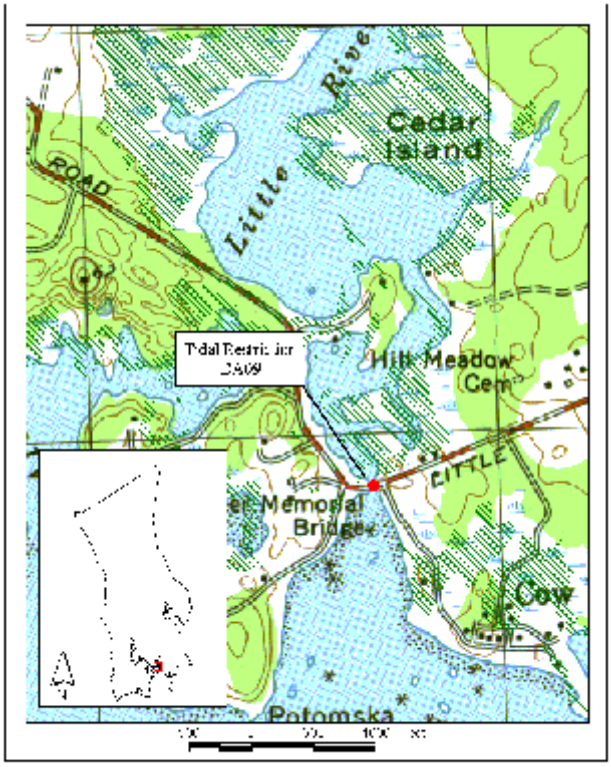
This site, like a number of bridge restrictions included in this report, became high priorities because of the large area of potential wetland habitat area affected. Whether expansion of the restriction, or dredging of the channel would be beneficial to salt marsh habitat will require further study. The cost of remediating this site is probably less than projected because this road receives little traffic.

Downstream view from site FH03.

DARTMOUTH: Little River Bridge

Tidal Restriction Site DA09

Score = 11, Ranking = High



Site Description

Tidal Restriction DA09 is the Little River Bridge. Located at the mouth of Little River, this bridge has cracks and spalling in many areas. The restriction is town property, while the restricted wetlands along Little River are privately owned. The wetland areas are categorized by the Natural Heritage & Endangered Species Program as rare & endangered species habitat.

General Information

This restriction consists of the Little River Bridge on Potomska Road in South Dartmouth. The road is 25 feet wide and paved. There is no culvert.

- Bridge condition - Poor
- Restriction width - 60 feet
- Restriction length - 30 feet
- Channel width - 120 feet
- Acres of wetlands affected - 164.7
- Acres of Phragmites - 0.0

Estimated Remediation Cost

Remediation cost - $662,000
Cost per acre - $4,020

Comments

This site, like a number of bridge restrictions included in this report, became high priorities because of the large area of potential wetland habitat area affected. Whether expansion of the restriction, or dredging of the channel would be beneficial to salt marsh habitat will require further study.

Selected Other Restrictions

Bourne: BN19

Falmouth: FA3

Westport: WP4

Mattapoisett MT8

Falmouth: FA4

Wareham WH3

Dartmouth: DA15

Westport: WP2

Falmouth FA2

Falmouth: FA1

Mattapoisett: MT12

Falmouth:FA6

Falmouth: FA5

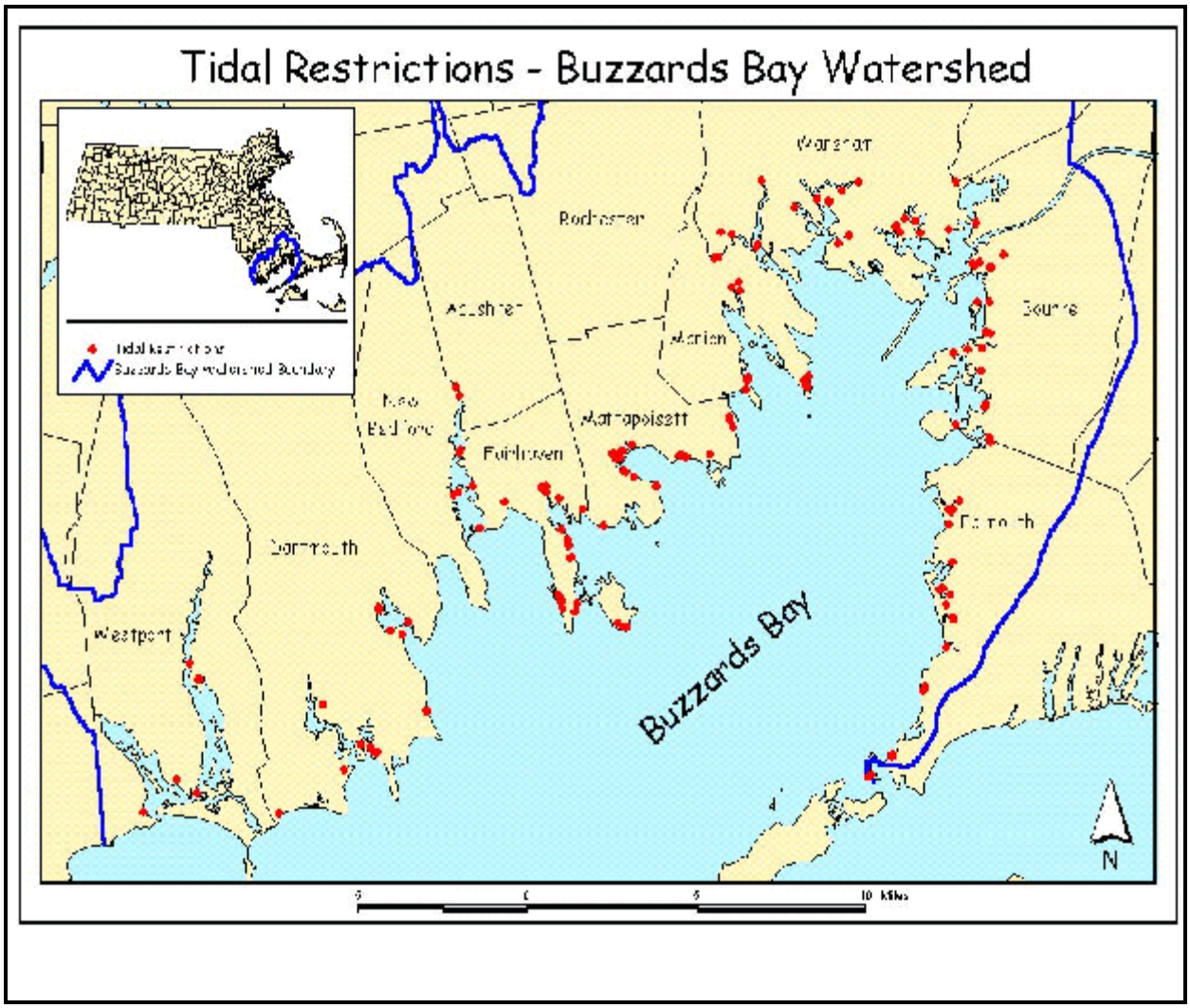
Mattapoisett: MT11

Dartmouth: DA11

Fairhaven: FH4

Explanation of Quad-based Maps of Buzzards Bay Tidal Restrictions

The location of the 145 potential tidal restriction sites identified in Buzzards Bay are shown in the figure below. Appendix C contains a series of detailed color GIS maps with the location of each of these potential tidal restrictions, along with the approximate location and size of Common Reed (*Phragmites australis)* stands at each site. The polygons were created from a field notes and aerial photographs, so the boundaries are approximate. A detailed summary of data collected at these sites is contained in the Excel spreadsheet smatlas.xls at the Buzzards Bay website [www.buzzardsbay.org.](http://www.buzzardsbay.org)



References

Atlas of Tidally Restricted Marshes: North Shore of Massachusetts. Massachusetts Wetlands Program, Natural Resources Assessment Group. Executive Office of Environmental Affairs, December 1996. Report.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service, Washington, DC. FWS/OBS-79-31.

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APPENDIX A.

Data Sheet used in Study.

Buzzards Bay Project Tidally Restricted/Deep Water Habitat Preliminary Field Inspection Sheet

SITE LOCATION INFORMATION

Site #____ Town or City_____

County_____, State **MA**

USGS map_____ Aerial Photograph #_____ Slide Photograph #_____

Restriction Feature Name_____

Channel and/or Wetland Name (if any)_____ Channel Width ~____DATE, TIME,

AND TIDAL CONDITIONS

Date__/__/__ Time_____ Tide Elevation_____ Tide Direction_____

TYPE OF RESTRICTING STRUCTURE
Check one or More: ❑ Bridge ❑ Culvert ❑ Dike ❑ Tide Gate ❑ Road ❑ Other

Bridges Data Check All Applicable: ❑ Draw Bridge ❑ Piers Present Fill Out Following: Date Built (if visible)_____ # of Piers_____
~Length in Feet_____ # of Lanes_____

Condition of Structure (Circle One) : excellent good fair poor
explain:_____

Culvert Data Check One: ❑ Corrugated Metal ❑ Concrete ❑ Clay ❑ Pebble
❑ Conglomerate ❑ Other

explain_____

Report Culvert Dimensions:_____ ❑ measured ❑ estimated

Report Culvert Shape in Cross Section:_____

Report # of Culverts:_____

Condition of Culvert (Circle One) : excellent good fair poor

explain:_____

If Dike or Tide Gate, Give Details:_____

If Road: Road width_____ # of Lanes_____ Surface Material_____

EVIDENCE OF RESTRICTION

Check One or More:

❑ seaward scouring basin ❑ upstream scouring basin ❑ bank erosion

❑ low marsh ❑ slumping ❑ culvert broken ❑ culvert clogged

❑ culvert invert problem detected ❑ vegetation die back

❑ *Phragmites australis* ❑ *Lythrum salicornia*

❑ ponded water on seaward side of dike or road

❑ ponded water on upstream side of dike or road

❑ seaward culvert opening submerged at mean high tide

Comments:_____

PROXIMITY TO LOW-LYING DEVELOPED AREAS ❑ yes ❑ no

WETLAND PLANT COMMUNITY CHARACTERISTICS

Dominance type, **seaward** side of tidal restriction_____
Some common plant species observed_____

Dominance type, **upstream** side of tidal restriction_____
Some common plant species observed_____
WILDLIFE OBSERVATIONS_____

Table 3. Common tidal marsh plants in Massachusetts		
Common Name	**Scientific Name**	**Type of Tidal Wetland**
Smooth Cordgrass	*Spartina alterniflora*	Salt and Brackish Marshes
Salt Hay Grass	*Spartina patens*	Salt and Brackish Marshes
Salt Grass	*Distichlis spicata*	Salt and Brackish Marshes
Black Grass	*Juncus gerardii*	Salt and Brackish Marshes
Glassworts	*Salicornia spp*.	Salt marshes
Seaside Arrowgrass	*Triglochin maritima*	Salt marshes
Seaside Plantain	*Plantago maritima*	Salt marshes
High-tide Bush	*Iva frutescens*	Salt marshes
Groundsel Bush	*Baccharis halimifolia*	Salt and Brackish Marshes
salt marsh Bulrush	*Scirpus robustus*	Salt and Brackish Marshes
Seaside Goldenrod	*Solidago sempervirens*	Salt and Brackish Marshes
Salt marsh Aster	*Aster tenuifolius*	Salt and Brackish Marshes
Common Reed	*Phragmites australis*	Salt, Brackish, and Fresh Marshes
Switchgrass	*Panicum virgatum*	Salt, Brackish, and Fresh Marshes
Three-squares	*Scirpus pungens* and *S. americanus*	Salt marshes
Rose Mallow	*Hibiscus moscheutos*	Brackish Marshes
Creeping Bent Grass	*Agrostis stolonifera* var. *compacta*	Brackish and Fresh Marshes
Narrow-leaved Cat-tail	*Typha angustifolia*	Brackish Marshes

(For illustrations, see *A Field Guide to Coastal Wetland Plants of the Northeastern United States* by R.W. Tiner, 1986, University of Massachusetts Press)

Table 4. List of marine and estuarine fish and shellfish dependent on Massachusetts tidal wetlands.			
Species	**Adult Use**	**Spawn In/Near Tidal Wetlands**	**Nursery Use**
Striped Bass	x	x	x
Bluefish			x
Winter Flounder	x	x	x
Scup			x
Tautog			x
Black Sea Bass			x
Menhaden	x	x	x
Summer Flounder			x
Weakfish	x		x
Eel	x		x
White Perch	x	x	x
River Herring	x	x	x
Shad	x		x
Smelt	x	x	x
Blue Crab	x	x	x
Jonah Crab			x
Lobster			x
Quahog	x	x	x
Soft Shell Clam	x	x	x
Bay Scallop		x	x
Oyster	x	x	x
Conch			x

(Source: Paul Caruso, Division of Marine Fisheries)

APPENDIX B. GROWetlands Fact Sheet

THE WETLANDS RESTORATION Program
and the
PARTNERSHIP TO RESTORE MASSACHUSETTS WETLANDS

Invite you to.....GROWetlands*

You Can Help Reclaim Our Wetland Heritage...

Wetlands are important aquatic resources that provide habitat for fish, birds, and other wildlife; cleanse our waters; and provide storage for flood waters within our watersheds. Wetlands provide educational, open space, aesthetic, and recreational experiences. Before these values were understood, about 28% of the state's wetlands were filled. Since the 1960s, Massachusetts has had strong laws protecting its wetlands. Many of our remaining wetlands (about 600,000 acres) have been degraded, however. Now there is a program to restore wetlands that have been damaged or destroyed.

By Joining Others...

The Massachusetts Wetlands Restoration Program (WRP) has established GROWetlands to encourage and support a collective effort by the citizens of the Commonwealth to restore our precious wetland heritage. WRP supports inland and coastal wetlands restoration and especially seeks restoration sites that can help heal our degraded rivers and coastal waters.

A GROWetlands site becomes part of a statewide network of wetland restoration projects. GROWetlands projects can be sponsored by anyone - community groups, government agencies, youth groups, schools, land trusts, watershed associations, and landowners. Sponsors may propose a wetland to restore or work with WRP to identify a wetland restoration site suitable for their group.

In The Partnership To Restore Massachusetts Wetlands...

GROWetlands projects are supported by and are part of the Partnership To Restore Massachusetts Wetlands, an alliance of agencies, organizations, businesses, and individuals committed to wetlands restoration. GROWetlands projects contribute to the partnership by restoring wetlands and providing information about their sites so others can learn from their experience.

* Groups Restoring Our Wetlands

Getting Started Is Easy, And...

GROWetlands project sponsors submit a brief project nomination form to WRP, participate in a preliminary site visit and project assessment with a team of wetland experts, work with WRP to prepare a work plan for the site, and then sign an agreement with WRP to implement the work plan.

GROWetlands Sponsors can receive:

* technical information and support from wetland experts
* training sessions for sponsors, teachers, and others
* assistance identifying and obtaining funding
* access to WRP's wetlands restoration data base
* support of the Partnership To Restore Massachusetts Wetlands
* publication of project results in technical and other literature
* recognition for their contribution to improving the state's wetlands

The Payback Is Forever.

The commitment to GROWetlands sites is long-term. A GROWetlands project is supported by WRP and other partners from the time it is proposed through project organization and design, implementation, and post-implementation maintenance and monitoring. The payback is restored wetlands that will endure and enhance the lives of generations to come.

For More Information Contact...

GROWetlands
Wetlands Restoration Program
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202
617-727-9800 ext. 213
FAX: 727-2754
EMail: cfoote-smith@state.ma.us
MASSACHUSETTS WETLANDS RESTORATION Program

GROWetlands

Wetlands Restoration Project Nomination Form

Thank you for your interest in restoring Massachusetts wetlands. If you wish to sponsor a wetlands restoration project and would like to propose that it be considered part of the statewide wetlands restoration initiative called GROWetlands (Groups Restoring Our Wetlands) under the Massachusetts Wetlands Restoration Program, please fill out this form and return to the address below.

Project Name:_____

Project Location: City/Town_____Watershed_____

Please attach a U.S.G.S. quad sheet or other map on which the site location has been marked.

If available, please attach current and historic photos and aerial photos of the project site.

Project Sponsor:_____

Designated Representative:_____

Telephone:_____FAX_____EMail_____

Address:_____

Project Co-Sponsors:_____

Landowner:_____

Has landowner expressed support for wetlands restoration at the site? Yes__No__ Explain:

Is all or part of the wetland totally destroyed or does it exist in a degraded condition? Explain:

GROWetlands Nomination Form - Continued

Briefly describe the current condition of the wetland to be restored.

Is the wetland part of an agricultural facility or was it farmland in the past?
___Is in agricultural use now. ___Was never farmed.
___Was formerly agricultural land.
Explain:

What caused the impact to the wetland?

Is the wetland area under an outstanding enforcement order? Yes___ No___
If yes, explain:

What is the approximate size of the area proposed to be restored?

What is the approximate size of adjacent wetland areas, if any?

Please attach a sketch of the area showing the wetland to be restored, adjacent wetlands and water bodies, roads and buildings in the immediate vicinity, and other pertinent information to describe the site. If possible, indicate different wetland types that are present (*Phragmites* swamp, wet meadow, forested wetland, etc.).
If known, what was the wetland type(s) prior to impact?

If known, what restoration activity would be required to restore the wetland?

If known, what is the approximate cost of the restoration?

Has any funding been identified for this project? Yes___ No___
If yes, describe:

Would you like WRP to arrange a site visit and evaluation by a Wetlands Restoration Assistance Team, a group of volunteer wetlands scientists?
Yes___ No___
Signed:_____
Date:_____

Please send this form with attachments to: GROWetlands EOEA Wetlands Restoration Program 100 Cambridge Street - 20th Floor, Boston, MA 02202 tel. 617-727-9800 ext. 213 A representative of WRP will contact you as soon as possible. Please call us if you have any questions!

Appendix C

Quad maps of salt marsh restriction sites

Prepared by the
Buzzards Bay Project National Estuary Program
Massachusetts Coastal Zone Management
2870 Cranberry Highway
East Wareham, Massachusetts 02538