

6.0 SCALE OF RESTORATION

Sections 3 and 4 addressed the injuries to natural resources and services from Site contamination. The injuries are the interim losses that occur from 1981 into perpetuity. In Section 5, the compensatory restoration alternatives were identified and evaluated. The evaluation of restoration alternatives resulted in the Trustees selecting tidal marsh creation in the Swan Lake area as the preferred restoration alternative for compensatory restoration for natural resource damages caused by the Site.

The focus of the present section is the determination of the size or scale of the restoration action. The scale of the restoration action should be that which provides the value to just offset the value of the losses. The process of determining the size of restoration is called restoration scaling.

Restoration scaling requires a framework for quantifying the value of losses and for quantifying the benefits of restoration so the losses and benefits can be compared. The Trustees used habitat equivalency analysis (HEA) as the framework for quantifying losses and benefits. The process of scaling using HEA for this Site is summarized below.

6.1 Description of Habitat Equivalency Analysis

Habitat equivalency analysis (HEA) is an approach that has been used successfully for scaling restoration actions at a number of locations in Texas and around the country. Losses are quantified as lost habitat resources and services. The restoration projects are to provide comparable habitat resources and services. The scale of the restoration projects is that which provides equivalency between the lost and restored habitat resources and services. Restoration habitat of the same type, quality, and of comparable ecological value should be provided to compensate for the resource and service losses so that the value of the total losses equals the value of restoration benefits.

The HEA requires the development of injury parameters to quantify lost habitat resources and services. The parameters needed to estimate losses include the area of habitat injury, the degree of injury within that habitat, and how that degree of injury changes over time. The degree of injury is determined by the condition of key or representative resources or services in the habitat (for example, primary production or macrofaunal density). The losses are quantified by year as lost service acre-years, where a service acre-year is the loss of one acre of habitat and its services for a year.

Because the losses occur in different time periods, they are not directly comparable. People prefer to use or consume goods and services in the present rather than postponing their use or consumption to some future time. To make the losses that occur in different time periods comparable, a discount factor is applied to the losses to

determine discounted service acre-years (DSAYs). In general, HEA is a technique that balances “debits” (habitat or other injuries) that have occurred as a result of releases of hazardous substances against compensatory “credits” (habitat restoration projects) and uses a discount factor to account for the difference in time that the restoration services are delivered.

Other parameters are necessary to quantify the benefits of restoration actions in a HEA. They include when the habitat restoration action begins, the time until the habitat provides full services, the level of services provided between the time when the restoration action begins and when it provides full services, and the relative services of the created or enhanced habitat compared to the injured habitat before the injury. These parameters, along with the size of a restoration action and the discount rate, define the DSAY benefits that result from a restoration action. The task is to determine the size of the restoration action such that the DSAY benefits just offset the losses. To simplify the assessment for the Site, the Trustees normalized all habitat injuries to a single habitat type, *i.e.*, tidal estuarine marsh and decided that, to the extent possible, a single habitat type would be created to provide compensation. All injured habitats were normalized to tidal marsh to convert from the original habitat injuries to “marsh equivalents” using the ratios developed in the Lavaca Bay Draft Eco-DARP (Jul. 14, 2000) (Table 6.1).

The Trustees worked with experts familiar with Texas marshes and estuaries to develop a habitat exchange rate between marsh services and open-bay bottom services in order to stay within the HEA framework, *i.e.*, provide habitat services of the same kind that were lost. This exchange rate accounts for differences in services and the quality of services provided by uninjured subtidal unvegetated soft-sediment benthic habitat relative to natural marsh habitat. After considering the opinions of the scientific experts, the Trustees developed an exchange rate of 4:1 (Texas NR Trustees, 2000). That is, the value of ecological service flows from five acres of subtidal unvegetated soft-sediment benthic habitat in Lavaca Bay is equivalent to the value of service flows provided by one acre of natural Lavaca Bay marsh. This analysis was for the habitats in the Lavaca Bay system and was based on the habitat services that the Trustees judged to be most important given the types of habitats affected.

Table 6.1 – Habitat “trade-off” ratios (adapted from Lavaca Bay Eco-DARP, 2001)

| Injured Habitat | Ratio (injured habitat : marsh) |
|------------------------------|---------------------------------|
| Marsh | 1:1 |
| Wah Chang Ditch (open water) | 4:1 |
| Wah Chang Delta (open water) | 4:1 |

6.2 Quantification of Habitat Losses

Typically, the HEA framework is used to quantify losses by habitat type. The Trustees’ claim identifies six areas of injury (Appendix 1, Table A-1) based upon the distribution

of contaminant concentration, toxicity to benthic organisms, and composition of the benthic community. HEA of these injury parameters calculates the marsh habitat services that must be created to compensate for all of the ecological services that have been and will continue to be lost over time as a result of hazardous substances released from the Site.

Injuries to these habitats occur as injuries resulting from the effects of contamination. The interim habitat service losses due to contamination are quantified by the degree of direct injury to benthos and the loss of that benthos as food for fish populations. As discussed above, injuries due to remedial actions at this Site are expected to be minimal and are not assessed in this RP/EA.

6.3 Interim Loss of Habitat Function

The Trustees assessed injuries resulting from hazardous substances released into the environment at the Site. Data from Site Inspections, the RI, and supplementary investigations were reviewed as sources of information.

The Trustees identified six areas of injury - the Wah Chang ditch habitat, the delta region of Swan Lake where the WCD discharges, and four subareas of the salt marsh north of the WCD delineated based upon the distribution of contaminant concentrations that exceed the mean ERM quotient (Figure 6). Habitat injury to the 4.7 acre WCD habitat represents a 20% loss of ecological services. The 7.3-acre Swan Lake delta habitat injury represents approximately a 20% loss of services. The four injured marsh habitat sub-areas measure 31.5, 8.4, 2.6, and 1.3 acres and have losses of 50%, 75%, 100%, and 100% of ecological services, respectively (see Section 4.4 above). The HEA of these injury parameters indicates that the equivalent of 93 acres of marsh habitat services must be created to compensate for all the ecological services that have been and will continue to be lost over time as a result of hazardous substances released into the Swan Lake ecosystem from the Site.

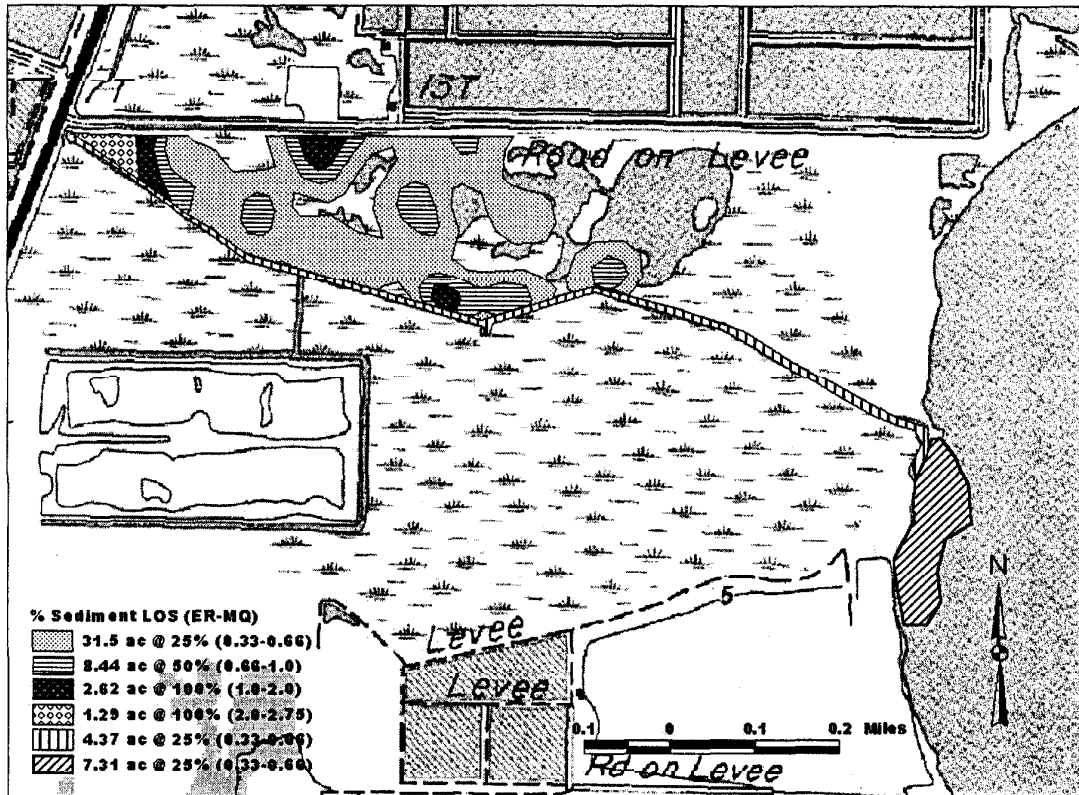


Figure 6. Sediment habitat injury zones, OU-4, Tex Tin Corporation Superfund, Galveston, County, Texas.

6.4 Habitat Restoration

The HEA was used to determine the scale of the tidal marsh restoration project. If tidal marsh creation/restoration is completed in 2001, the analysis indicates that 93 acres of created marsh are necessary to offset the losses associated with the Site (Table 6.2).

Table 6.2 - Summary of HEA results for OU-4, Tex Tin Corporation Superfund Site, Texas

| Injured Area | Debit (DSAY) | Credit / Acre (DSAY) | Total Acres to be created |
|---------------------------|--------------|----------------------|---------------------------|
| Wah Chang Ditch | 55.40 | | |
| Marsh (ER-MQ 0.33 – 0.66) | 563.55 | | |
| Marsh (ER-MQ 0.66 – 1.0) | 275.58 | | |
| Marsh (ER-MQ 1.0 – 2.0) | 123.43 | | |
| Marsh (ER-MQ 2.0 – 2.75) | 75.39 | | |
| Wah Chang Delta | 85.33 | | |
| | 1178.68 | 12.62 | 93.39 |

Using information from other marsh construction projects, the Trustees estimate \$30,000 per acre for costs necessary to create replacement marsh habitat, including a 10% contingency fund to cover mid-course corrections. This results in project construction costs of \$3,069,000. Based on past experience implementing and monitoring restoration projects, the Trustees estimate that another \$250,000 is needed to cover administrative expenses associated with the proposed marsh creation project. Finally, the Trustees' collective uncompensated assessment costs total approximately \$56,000. Therefore, restoration costs and uncompensated assessment costs total \$3,375,000.

7.0 EVALUATION OF RESTORATION PROJECT LOCATION

As described above, the overall objective of the restoration process is to make the environment and public whole for injuries to natural resources and/or service losses resulting from the releases at the Site. To meet that objective, the benefits of restoration actions must be related, or have an appropriate nexus, to the natural resource injuries and losses at the Site. The relationships that must be considered include the following:

- equivalency of created or enhanced resources or services to those affected or potentially affected by the hazardous substance releases, and;
- potential for restoration at or near the area where natural resource injuries/service losses occurred.

To achieve this fundamental objective, the Trustees determined that the preferred restoration alternatives must have an ecological and a geographical relationship to injured resources and lost services. The Trustees approached restoration planning with the view that the injured natural resources/lost services are part of an integrated ecological system and that the Galveston Bay system in the vicinity of Virginia Point (Swan Lake/Jones Bay/ West Bay) represents the relevant geographical area for siting restoration actions. Areas outside of this are considered less geographically relevant as restoration alternatives. Therefore, the Trustees' proposed location to construct marsh is the southwest portion of the Galveston Bay system in the vicinity of Virginia Point, i.e., Swan Lake. The preferred restoration action would build upon the remedial activities proposed for Swan Lake.

The state and federal natural resource trustees concur in EPA's determination that construction of a breakwater or wave energy barrier along the eastern border of Swan Lake is an essential element of any remedial action scenario for OU-4. Without a breakwater or wave energy barrier, complete loss of the existing shell islands and the resultant erosion and exposure of highly contaminated buried sediments would increase the extent and severity of natural resource injuries.

Creation of marsh on the leeward side of the breakwater/wave barrier would compensate for injuries to the ecosystem and would create marsh habitat that has been lost from erosion and subsidence. A proposal by TPWD and the National Marine Fisheries Service (NMFS) in 1995 outlines the creation of wave barriers and marsh habitat projects (Sipocz and Swafford, 1995).

8.0 NATIONAL ENVIRONMENTAL POLICY ACT: ANALYSIS OF SIGNIFICANCE OF IMPACTS

Pursuant to the National Environmental Policy Act (NEPA), 42 U.S.C. Section 4371 *et seq.*, and the implementing regulations at 40 C.F.R. Part 1500 (the NEPA regulations), federal agencies contemplating implementation of a major federal action must produce an environmental impact statement (EIS) if the action is expected to have significant impacts on the quality of the human environment. NEPA defines the human environment comprehensively to include the "natural and physical environment and the relationship of people with that environment." 40 C.F.R. Section 1508.14. All reasonably foreseeable direct and indirect effects of implementing a project, including beneficial effect, must be evaluated. 40 C.F.R. Section 1508.8. Federal agencies may

conduct an environmental assessment (EA) to evaluate the need for an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact (FONSI), which satisfies the requirements of NEPA, and no EIS is required.

Section 1508.27 of the NEPA regulations describes the minimum criteria that federal agencies should consider in evaluating the potential significance of proposed actions. The regulations explain that significance embodies considerations of both context and intensity. In the case of site-specific actions such as those proposed in this RP/EA, the appropriate context for considering significance of action is local, as opposed to national or worldwide.

With respect to intensity of the impacts of the proposed restoration action, the NEPA regulations suggest consideration of ten factors:

- (1) likely impacts of the proposed project;
- (2) likely effects of the project on public health and safety;
- (3) unique characteristics of the geographic area in which the project is to be implemented;
- (4) controversial aspects of the project or its likely effects;
- (5) degree to which possible effects of implementing the project are highly uncertain or involve unknown risks;
- (6) precedential effect of the project on future actions that may significantly affect the human environment;
- (7) possible significance of cumulative impacts from implementing this and other similar projects;
- (8) effects of the project on National Historic Places, or likely impacts to significant cultural, scientific or historic resources;
- (9) degree to which the project may adversely affect endangered or threatened species or their critical habitat;
- (10) likely violations of environmental protection laws.

40 C.F.R. Section 1508.27. These factors, along with the federal Trustees' preliminary conclusions concerning the likely significance of impacts of the proposed restoration action, are discussed in detail below.

8.1. Marsh Habitat Restoration

8.1.1 Nature of Likely Impacts

The proposed restoration action for injuries to marsh habitat and subtidal benthic habitat consists of marsh habitat restoration. Marsh habitat restoration will be effectuated by marsh creation. Marsh habitat restoration will provide an increased flow of organic material that will generally benefit the Swan Lake ecosystem by providing a source of organic carbon which provides an energy supply to support the estuarine food web. Created marsh would provide increased nursery, foraging, and cover habitat for critical species that inhabit the area. Increased habitat support for birds and other wildlife species would benefit recreational uses of the area.

Marsh creation results in some impacts to existing habitats, such as unvegetated subtidal sediments or terrestrial habitats on which the marsh is created. Unvegetated habitats are common in the Galveston Bay area due to heavy industrialization while many square miles of marsh habitat are lost each year due to subsidence and erosion. Marsh restoration provides most of the same services as unvegetated sub-tidal sediments, but marsh is a much more productive habitat and would provide additional services. Furthermore, created marshes will include 20% to 40% unvegetated open water bottoms.

In addition, marsh creation in the Swan Lake ecosystem will provide similar services to those lost in the Swan Lake area. Marsh construction in the area of contaminated sediments would cover those sediments and would benefit the ecosystem by preventing continued release of contaminants.

8.1.2 Effects on public health and safety

The Trustees do not expect marsh creation to have any impacts on public health and safety. The marsh would not present any unique physical hazards to humans. No pollution or toxic discharges would be associated with marsh creation.

8.1.3 Unique characteristics of the geographic area

Unvegetated subtidal benthic sediments and terrestrial habitats currently exist at proposed restoration sites and occur due to human intervention and industrialization that has displaced naturally occurring marsh. These existing unvegetated subtidal benthic sediments and terrestrial habitats consist of relatively uniform, soft bottom coastal habitat which is displacing naturally occurring marsh habitat, resulting in a net loss of habitat productivity. Therefore, no unique or rare habitat would be destroyed due to restoration of marsh to those areas that previously supported marshlands.

8.1.4 Controversial aspects of the project or its effects

The Trustees do not expect any controversy to arise in connection with marsh creation. Marsh creation has been implemented by these and other Trustees in connection with other injured sites, especially in Texas and Louisiana, with no adverse reaction from the public. Current governmental policy supports creating marshes along the Gulf Coast of Texas. The Trustees anticipate that the citizens of Texas will welcome the marsh restoration projects.

8.1.5 Uncertain effects or unknown risks

Given their past experience with marsh restoration, the Trustees do not believe there are uncertain effects or unknown risks to the environment associated with implementing the proposed restoration action. The Trustees will conduct a thorough site survey and engineering analysis to address any significant uncertainties before implementing the proposed restoration action.

8.1.6 Precedential effects of implementing the projects

The Trustees have pursued marsh construction restoration projects to compensate for other natural resource damages claims in Texas. Marsh restoration projects are regularly implemented to protect the Texas coast from erosion and sediment losses. The Trustees therefore do not foresee that this proposed restoration action sets any precedent for future actions of the type that would significantly affect the quality of the human environment.

8.1.7 Possible, significant cumulative impacts

The Trustees know of no impacts to the environment to which the proposed restoration action would contribute that, cumulatively, would constitute a significant impact on the quality of the human environment. The project will restore naturally occurring marsh to the area.

8.1.8 Effects on National Historic Sites or nationally significant cultural, scientific or historic resources

The proposed restoration action is located in a heavily industrialized area and will not affect any designated National Historic Site or any nationally significant cultural, scientific, or historic resources.

8.1.9 Effects on endangered or threatened species

The Trustees know of no direct or indirect impacts of the proposed restoration action on threatened or endangered species, or their designated critical habitats.

8.1.10 Violation of environmental protection laws

The proposed restoration action does not require nor do the Trustees anticipate incidental violation of federal, state or local laws designed to protect the environment. The restoration action can be implemented in compliance with all applicable environmental laws and regulations.

8.1.11 Preliminary conclusion

The Trustees conclude that implementation of the proposed restoration action will not have any significant impacts on the quality of the human environment.

8.2 Preliminary Finding of No Significant Impact on the Quality of the Human Environment

Based upon the analyses in this section and throughout this RP/EA, the federal Trustees have reached a preliminary conclusion that implementation of the preferred restoration action will not have any significant impacts on the quality of the human environment. Significant impacts were not revealed through the public review and comment process; thus no environmental impact statement will be prepared for the proposed restoration action.

A Finding of No Significant Impact (FONSI), based upon this Environmental Assessment with opportunity for public input on this analysis prior to project implementation, will fulfill and conclude all requirements for compliance with NEPA for both DOI and NOAA.

9.0 REFERENCES

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Appendix 1 - Habitat Equivalency Information Used in this Assessment

Table A-1. Summary of injury parameter values for the Tex Tin Corporation Superfund Site Habitat Equivalency Analysis. 1999 was chosen as the base year for injury calculation and a real annual discount rate of 3% was used.

| Location | Wah Chang Ditch | Marsh North of Wah Chang Ditch | | | | Mouth of Wah Chang Ditch |
|---|-----------------|--------------------------------|-----------------|-----------------|----------|--------------------------|
| | | | | | | |
| Injured Area (Acres) | 5.97 | 31.5 | 8.44 | 2.62 | 1.29 | 7.3 |
| Marsh Injury Indication (Mean ERM quotient) | 0.20-0.50 | 0.33-0.66 | 0.67-0.99 | 1.0-1.9 | 2.0-2.75 | 0.08-0.28* |
| Service Level in 1981 | 80% | 50% | 25% | 0% | 0% | 80% |
| Service level in 1999 | 80% | 75% | 50% | 25% | 0% | 80% |
| Services at maximum recovery | 80% | 75% | 50% | 25% | 0% | 80% |
| End of recovery (calendar year) | 2280 | 2280 | 2280 | 2280 | 2280 | 2280 |
| Shape of recovery curve | Linear | 2-spline linear | 2-spline linear | 2-spline linear | Linear | Linear |

Table A-2. Summary of injury parameter values for Tex-Tin Superfund site Habitat Equivalency Analysis. Base year for injury calculation was assumed to be 1999 and the real annual discount rate was assumed to be 3%.

| | | |
|---|-----------------------------|--------------------------|
| Restoration habitat type | Emergent estuarine wetlands | |
| Initial level of services | 0% | |
| Year construction/replacement Starts | 1999 | |
| Year maximum service level reached | 2014 | |
| Maximum Service level | 71.30% | |
| Shape of project maturation function | Multi-splined linear | |
| Maturation Function inputs (end of year values) | Year | Level of services |
| | 2000 | 22.60% |
| | 2001 | 40.10% |
| | 2002 | 52.70% |
| | 2003 | 60.80% |
| | 2004 | 67.60% |
| | 2005 | 68.10% |
| | 2006 | 68.60% |
| | 2007 | 69.10% |
| | 2008 | 69.60% |
| | 2009 | 70.00% |
| | 2010 | 70.30% |
| | 2011 | 70.60% |
| | 2012 | 70.90% |
| 2013 | 71.10% | |
| 2014 | 71.30% | |
| Expected length of service increases (years) | 30 | |
| Ratio of maximum services at restoration project to baseline service level for injured habitat | 1:0.71 | |

Appendix 2 - Compliance with Other Key Statutes, Regulations, and Policies

Clean Water Act (CWA), 33 U.S.C. Sections § 1251 *et seq.*

The CWA is the principal law governing pollution control and water quality of the nation's waterways. Section 404 of the law authorizes a permit program for the beneficial uses of dredged or fill material. The Army Corps of Engineers (Corps) administers the program. In general, restoration projects, which move significant amounts of material into or out of waters or wetlands, for example, hydrologic restoration of marshes, require 404 permits. Under Section 401 of the CWA, restoration projects that involve discharge or fill to wetlands or navigable waters must obtain certification of compliance with state water quality standards. Because OU4 is a Superfund Site, a Section 404 permit will not need to be obtained for this restoration project. However, the substantive requirements of the 404 permitting will need to be met.

Rivers and Harbors Act, 33 U.S.C. Sections § 401 *et seq.*

The Rivers and Harbors Act regulates development and use of the nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waters and vests the Corps with authority to regulate discharges of fill and other materials into such waters. Restoration actions that must comply with the substantive requirements of Section 404 must also comply with the substantive requirements of Section 10.

Coastal Zone Management Act (CZMA), 16 U.S.C. Sections § 1451 *et seq.*, 15 C.F.R. Section § 923

The goal of the CZMA is to preserve, protect, develop, and, where possible, restore and enhance the nation's coastal resources. The federal government provides grants to states with federally approved coastal management programs. Section 1456 of the CZMA requires that any federal action inside or outside the coastal zone shall be consistent, to the maximum extent practicable, with the enforceable policies of approved state management programs. It states that no federal license or permit may be granted without giving the state the opportunity to concur that the project is consistent with the state's coastal policies. The regulations outline the consistency procedures. The proposed restoration action is consistent with the Texas Coastal Management Plan.

Endangered Species Act (ESA), 16 U.S.C. Sections § 1531 *et seq.*, 50 C.F.R. Parts 17, 222, & 224

The ESA directs all federal agencies to conserve endangered and threatened species and their habitats and encourages such agencies to utilize their authorities to further

these purposes. Under the ESA, the Department of Commerce through NOAA and the Department of the Interior through USF&WS publish lists of endangered and threatened species. Section 7 of the Act requires federal agencies to consult with these departments to minimize the effects of federal actions on endangered and threatened species. The proposed restoration action should have no adverse impacts on threatened or endangered species and is expected to develop habitat enhancements beneficial to supporting ecosystems for threatened or endangered species.

Fish and Wildlife Conservation Act, 16 U.S.C. Sections § 2901 et seq.

The proposed restoration action will encourage the conservation of non-game fish and wildlife.

Fish and Wildlife Coordination Act (FWCA), 16 U.S.C. Sections § 661 et seq.

The FWCA requires that federal agencies consult with the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and state wildlife agencies for activities that affect, control, or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. This consultation is generally incorporated into the process of complying with Section 404 of the Clean Water Act, NEPA, or other federal permit, license, or review requirements. The proposed restoration action will have a positive effect on fish and wildlife resources. Coordination has taken place between the National Marine Fisheries Service and the U.S. Fish and Wildlife Service.

Magnuson Fishery Conservation and Management Act, 16 U.S.C. Sections § 1801 et seq.

The Magnuson Fishery Conservation and Management Act provides for the conservation and management of the nation's fishery resources within the Exclusive Economic Zone (from the seaward boundary of every state to 200 miles from that baseline). The management goal is to achieve and maintain the optimum yield from each fishery. The proposed restoration action will have no adverse effect on essential fish habitat (EFH) and will promote the protection of fish resources and EFH.

Marine Mammal Protection Act, 16 U.S.C. Sections § 1361 et seq.

The Marine Mammal Protection Act provides for the long-term management of and research programs for marine mammals. It places a moratorium on the taking and importing of marine mammals and marine mammal products, with limited section. The Department of Commerce is responsible for whales, porpoise, seals, and sea lions. The Department of the Interior is responsible for all other marine mammals. The proposed restoration action will have no adverse effect on marine mammals.

Migratory Bird Conservation Act, 126 U.S.C. § 715 et seq.

The proposed restoration action will have no adverse effect on migratory birds that are likely to benefit from the establishment of new marsh habitat.

Archeological Resources Protection Act, 16 U.S.C. § 470 et seq.

The Trustees know of no known cultural resources in the area and no known sites or properties listed on or eligible for listing on the National Register of Historic Places.

Executive Order 12898 (59 Fed. Reg. 7629) - Environmental Justice

This Executive Order requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. EPA and the Council on Environmental Quality (CEQ) have emphasized the importance of incorporating environmental justice review in the analyses conducted by federal agencies under NEPA and of developing mitigation measures that avoid disproportionate environmental effects on minority and low-income populations. The Trustees have concluded that there are no low income or ethnic minority communities that would be adversely affected by the selected restoration project.

Executive Order Number 11514 (34 Fed. Reg. 8,693) - Protection and Enhancement of Environmental Quality

This Restoration Plan is also an Environmental Assessment as required by NEPA.

Executive Order Number 11990 (42 Fed. Reg. 26,961) - Protection of Wetlands

This proposed restoration action will help ensure the protection of wetlands and the services they provide.

Executive Order Number 12962 (60 Fed. Reg. 30,769) - Recreational Fisheries

The proposed restoration action will help ensure the protection of recreational fisheries and the services they provide.

Executive Order Number 13112 (64 Fed. Reg. 6,183) – Invasive Species

The proposed restoration action will use only native vegetation and will not cause or promote the introduction or spread of invasive species.