

Draft
DAMAGE ASSESSMENT AND RESTORATION
PLAN/ENVIRONMENTAL
ASSESSMENT FOR THE
June 8, 2000
T/V POSAVINA OIL SPILL

Prepared by:

National Oceanic and Atmospheric Administration
U.S. Department of the Interior (US Fish and Wildlife Service)
Massachusetts Executive Office of Environmental Affairs

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EXECUTIVE SUMMARY

The *T/V Posavina* oil spill occurred on June 8, 2000 in East Boston, Massachusetts at the Tosco Marine Terminal located in the Chelsea River portion of Boston Harbor. The spill released 59,600 gallons of oil (IFO 380). Calm weather conditions, slow moving tidal currents, and a quick response time resulted in an approximately 89% recovery. Shoreline oiling occurred throughout the Chelsea River, coating areas of rip-rap walls, deteriorated bulkheads, and several relatively small areas of *Spartina sp.* salt marsh vegetation scattered along the shore. Field surveys and observations made during preassessment activities indicated that approximately five acres of shoreline were oiled, a third of which were estimated to be wetlands and the remainder was man-made structures and highly disturbed.

This Draft Damage Assessment and Restoration Plan/Environmental Assessment (Draft DARP/EA) has been prepared by state and federal natural resource Trustees¹ for the restoration of natural resources and public use services that were exposed and/or injured by the *T/V Posavina* oil spill. This Draft RP/EA is issued to inform the public concerning the Trustees' authorities and responsibilities under the Oil Pollution Act (OPA) (33 § 2701, *et seq.*) and the National Environmental Policy Act (NEPA), as amended, 42 U.S.C. § 4321 *et seq.*

The Trustees evaluated a range of restoration alternatives which would provide additional resource services to compensate the public for losses pending natural recovery of resources exposed/ or injured by the *T/V Posavina* oil spill. Potential restoration projects included wetland restoration, bank stabilization, fill removal and enhancement, and debris removal. Two salt marsh restoration projects were selected as the preferred alternatives to compensate for injured natural resources and lost services. The Mill Creek in Chelsea and the Belle Isle Fish Company project in East Boston will result in a total of approximately 2.5 acres of restored salt marsh. The impacts associated with these project are expected not to be significant.

The Draft DARP/EA briefly summarizes the natural resources found in the Chelsea River (section 2.0), provides a brief description of the nature and extent of the natural resources exposed and/or injured and the lost public uses resulting from the *T/V Posavina* oil spill (section 3.0), and provides a discussion of restoration options to enhance recovery of the resources affected by the spill (section 4.0).

¹ Massachusetts Executive Office of Environmental Affairs (“EOEA”); U.S. Department of Commerce/ National Oceanic and Atmospheric Administration (“NOAA”); and the U.S. Department of the Interior (“DOI”)/ U.S. Fish and Wildlife Service (“USFWS”)

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**DRAFT DAMAGE ASSESSMENT AND RESTORTION PLAN/
ENVIRONMENTAL ASSESSMENT FOR THE JUNE 8, 2000 *T/V POSAVINA* OIL
SPILL**

1.0 INTRODUCTION

1.1 Purpose and Need for Restoration

This Draft DARP/EA is intended to inform members of the public concerning the Trustees' OPA determination of the natural resource injuries caused by the *T/V Posavina* oil spill and proposed restoration projects to compensate for those injuries. This Draft RP/EA also serves as an Environmental Assessment under NEPA and addresses the potential impact of the preferred restoration actions on the quality of the physical, biological, and cultural environment. As described in detail below, this plan includes two salt marsh wetland restoration projects, one in the Mill Creek in Chelsea, Massachusetts and the other located in the Belle Isle Inlet in East Boston, Massachusetts.

The purpose of restoration, as outlined in this Draft DARP/EA, is to make the public whole for injuries to natural resources and natural resource services resulting from the *T/V Posavina* oil spill by returning the injured natural resources and natural resource services to their "baseline" condition (i.e., the condition that would have occurred but for the spill) and compensating for associated interim losses.

The regulations for conducting a sound natural resource damage assessment to achieve restoration are found at 15 C.F.R. Part 990. These regulations were promulgated pursuant to the Oil Pollution Act of 1990 (OPA) to determine the nature and extent of natural resource injuries, select appropriate restoration projects, and implement or oversee restoration. This Draft DARP/EA presents information about the affected environment (sec. 2.0), the Trustees' estimates of exposure and/or injury and service losses to natural resources caused by the *T/V Posavina* spill (sec 3.0) and the Trustees' preferred restoration alternatives (sec. 4.0). Implementation of the preferred restoration projects will be conducted in accordance with a proposed settlement that the Trustees have entered into with Sociedad Naviera Ultragas, Ltd., the Responsible Party under OPA for the *T/V Posavina* oil spill.

1.2 The *T/V Posavina* Oil Spill: Summary of the Incident

The oil spill occurred at approximately 0830 on June 8, 2000 when the tugboat, *Alex C* accidentally collided with the *T/V Posavina* while assisting its departure from the dock. The collision punctured a hole in the *T/V Posavina*'s hull resulting in the discharge of 59,600 gallons of oil (IFO 380). The spill occurred in East Boston, Massachusetts at the Tosco Marine Terminal located in the Chelsea River part of Boston Harbor (Figure 1). The majority of the oil was confined to Chelsea Creek and associated shorelines. Some sheening was observed in Boston Harbor, but it is not clear if this was due to this incident or another source.

On-scene oil recovery equipment included vacuum trucks, small boats, skimmers and fractionalization tanks, and more than 10,000 feet of containment boom. Approximately 100 personnel were on-scene from federal, state, and local agencies and contractors. The United States Coast Guard (USCG) reported that approximately 89% of the spilled oil was recovered. The high recovery rate was attributed to calm weather conditions, slow moving tidal currents, and a quick and effective response. Forty 20-yard containers of oiled shoreline debris were also removed (SCAT Report, July 12, 2000).

The Chelsea River is located within a highly industrialized area. Oil refineries, oil transporters, fuel storage facilities, warehouses, heavy equipment facilities, rental car facilities, and railroad tracks bound the waterway. The shoreline is predominantly comprised of rip-rap walls, deteriorated wooden bulkheads, and sheet metal pilings and bulkheads. However, there are several relatively small areas of marsh (*Spartina sp.*) vegetation scattered throughout the Chelsea Creek shoreline.

1.3 Authority and Legal Requirements

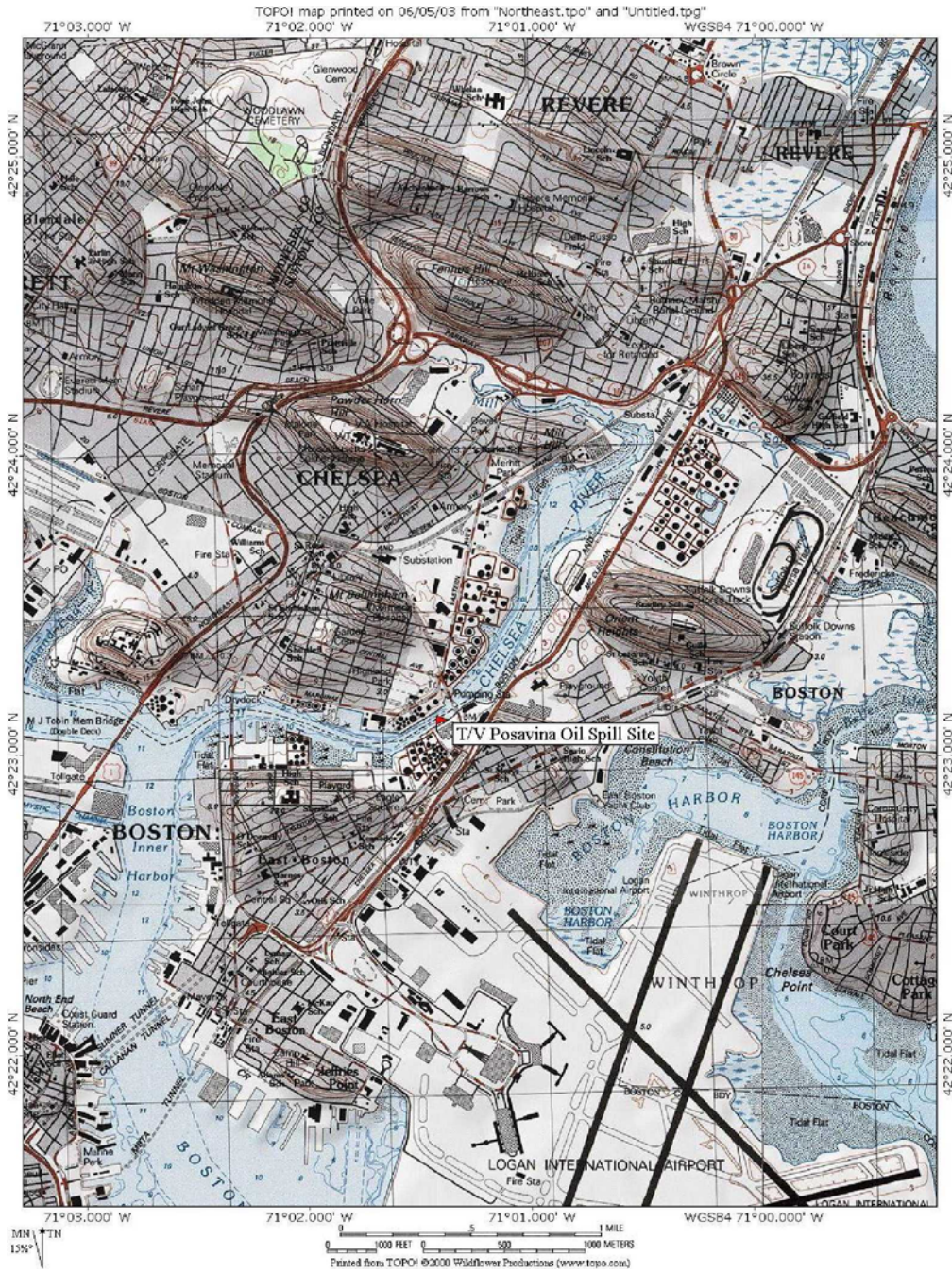
This Draft DARP/EA has been prepared jointly by the Massachusetts Executive Office of Environmental Affairs (EOEA), U.S. Department of Commerce / National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of the Interior (DOI) (represented by the U.S. Fish and Wildlife Service (USFWS) (collectively, “the Trustees”). Each of these agencies is a designated natural resource Trustee under Section 1006 (b) of OPA, 42 U.S.C. § 2706(b), and the National Contingency Plan, 40 CFR Section 300.600, for natural resources injured by the *T/V Posavina* oil spill. The Massachusetts Governor designated EOEA as the state trustee for oil spills. The state EOEA is also acting on the oil spill under the authority of the Massachusetts Oil and Hazardous Material Release Prevention and Response Act (MGL Chapter 21E). As a designated Trustee, each agency is authorized to act on behalf of the public to assess and recover natural resource damages, and to plan and implement actions to restore natural resources and resource services injured or lost as the result of a discharge of oil.

1.3.1 Overview of Legal Requirements

A natural resource damage assessment conducted pursuant to OPA and the regulations promulgated thereunder at 15 C.F.R. Part 990, consists of three phases: 1) Preassessment; 2) Restoration Planning; and 3) Restoration Implementation. OPA authorizes state and federal natural resource trustees to initiate a damage assessment, among other requirements, when natural resources may have been injured and/or natural resource services impaired as a result of the incident.

OPA regulations provide specific definitions for the following terms:

Figure 1
Locus Map of Showing Location of *T/V Posavina* Oil Spill



- "Injury" is "an observable or measurable adverse change in a natural resource or impairment of a natural resource service";
- "Natural resources" are "land, fish, wildlife, biota, air, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any state or local government or Indian tribe"; and
- "Natural resource services" are "functions performed by a natural resource for the benefit of another resource and/or the public".

During the Preassessment Phase, the Trustees determined that the provisions and determinations of OPA applied to this spill including: (1) an incident has occurred; (2) the incident is not from a public vessel; (3) the incident is not from a onshore facility subject to the Trans-Alaska Authority Act; (4) the incident is not permitted under federal, state, or local law; and (5) public trust natural resources and/or services may have been injured as a result of the incident. On the basis of those determinations, the Trustees began the Restoration Planning Phase. In this phase, the Trustees evaluated and quantified the nature and extent of injuries to natural resources and services, and determined the need for, type of, and scale of appropriate restoration actions. Using the information developed during the Restoration Planning Phase, the Trustees developed this Draft DARP/EA.

The first component of the Restoration Planning Phase was injury assessment. The Trustees evaluated injury to: (1) marine communities; (2) wetlands and birds; and (3) public uses. As provided at 15 C.F.R. § 990.14(c)(1), the Trustees invited the Responsible Party to participate in the injury assessment component of the natural resource damage assessment(sec. 1.3.3). The Responsible Party was involved in the design, performance, and funding of evaluations and conclusions reached through the cooperative assessment. The assessment produced relevant information that the Trustees considered in determining the nature and extent of injuries to natural resources

The second component of the Restoration Planning Phase was restoration selection. Considering the nature and extent of exposure and/or injuries to natural resources caused by the *T/V Posavina* oil spill, the Trustees developed a plan for restoring the injured resources and services, which is set forth in this Draft RP/EA. In it, the Trustees identify a reasonable range of restoration alternatives, evaluate those alternatives, and using the criteria at 15 C.F.R. § 990.54, select the preferred alternatives from among them.

In selecting their preferred restoration alternatives, the Trustees considered all of the criteria outlined in the regulations, including the cost of carrying out each alternative. The Trustees are proposing selection of the least expensive practicable alternatives that

are expected to provide the restoration benefits required by these criteria. In addition, the Trustees also considered whether the cost of a preferred alternative was commensurate with the value of the exposed and/or injured resource and service. The OPA Damage Assessment Regulations do not expressly require the Trustees to make this determination.

Consistent with the OPA regulations (15 C.F.R. § 990.54(a)(5)), the Trustees also considered the extent to which restoration alternatives provide benefits to more than one natural resource and/or service. As described in more detail in section 4.0 of this Draft DARP/EA, the preferred restoration alternatives selected by the Trustees benefit multiple resources and/or resource services.

Natural resource trustees may settle claims for natural resource damages under OPA at any time during the damage assessment process, provided that the settlement is: 1) adequate in the judgment of the trustees to satisfy the goals of OPA; and 2) fair, reasonable, and in the public interest, with particular consideration of the adequacy of the settlement to restore, replace, rehabilitate, or acquire the equivalent of the injured natural resources and services. Sums recovered in settlement of such claims, other than reimbursement of Trustee costs, may only be expended in accordance with a restoration plan.

1.3.2 NEPA Compliance

Any restoration of natural resources under OPA must comply with the National Environmental Policy Act (NEPA), as amended (42USC 4321 et seq.), and its implementing regulations (40 C.F.R. § 1500-1508). In compliance with NEPA and its regulations, this Draft DARP/EA summarizes the current environmental setting, describes the purpose and need for action, identifies alternative actions, assesses their applicability and environmental consequences, and summarizes opportunities for public participation in the decision-making process. Project-specific NEPA documents may need to be prepared under the separate regulatory processes for any selected projects (e.g., Clean Water Act §404 process)

1.3.3 Coordination with Responsible Party

The OPA regulations require the Trustees to invite the Responsible Party to participate in the damage assessment process. Accordingly, the Trustees worked with the Responsible Party to participate in the damage assessment process. A cooperative approach with the Responsible Party was undertaken that included the design, performance and funding of evaluations completed as part of this assessment. Coordination between the Trustees and the Responsible Party helped reduce duplication of studies, increase cost effectiveness of the assessment process, and increase sharing of information and experts. Input from the Responsible Party was sought and considered throughout the damage and restoration planning process. As required by the regulations at 15 C.F.R. § 990.14 (c) (4), the Trustees retain final authority to make determinations regarding injury and restoration.

1.3.4 Public Participation

Public review of the Draft RP/EA is an integral component of the restoration planning process. Through the public review process, the Trustees seek public comments on the analyses used to define and quantify natural resource injuries and the methods proposed to restore injured natural resources or replace lost resource services. The Draft RP/EA will provide the public with information about the nature and extent of the natural resource injuries and identify and evaluate restoration alternatives.

Public comments received during the public comment period for the Draft DARP/EA will be evaluated by the Trustees prior to selection of the final projects and issuance of a Finding of No Significant Impact (FONSI). The public comments and Trustee response will be incorporated into the Final DARP/EA.

Public review of the Draft RP/EA is consistent with all state and federal laws and regulations that apply to the natural resource damage assessment process, including Section 1006 of OPA regulations, 42 U.S.C. §2706; the OPA (15 CFR Part 990); NEPA, as amended (42 USC §4371, *et seq.*); and its regulations (40 CFR 1500-1508).

1.3.5 Administrative Record

The Trustees have maintained records to document the information considered by the Trustees as they planned and implemented this Draft DARP/EA. These records are compiled in an Administrative Record, which is available for public review at the address listed below. The Administrative Record facilitates public participation in the assessment process and will be available for use in future administrative or judicial review of Trustee actions to the extent provided by federal or state law. Additional information and documents, including public comments received on the Draft DARP/EA, the Final DARP/EA and other related restoration planning documents will become a part of the Administrative Record. A list of the current Administrative Record can be found in Section 8.0.

An Administrative Record containing a copy of the public documents in this matter is available for inspection by the public during normal business hours at:

NOAA-Fisheries

Northeast Regional Office

1 Blackburn Drive

Gloucester, Massachusetts

Contact: Eric Hutchins (978)281-9313

Eric.Hutchins@NOAA.GOV

Arrangements should be made in advance to review the record at National Marine Fisheries Service or to obtain copies of documents in the record by contacting Eric Hutchins (978) 281-9313.

1.4 Trustee Preferred Restoration Alternatives

In response to the *T/V Posavina* oil spill, the Trustees initiated natural resource damage assessment efforts pursuant to OPA. The Trustees and representatives for the Responsible Party cooperatively conducted and reviewed the results of preassessment studies to make a preliminary determination whether natural resources or natural resource services were injured and/or threatened by ongoing injury due to the *T/V Posavina* spill. An informal technical working group, consisting of representatives from the Trustees and the Responsible Party, was formed to address the following injury categories: marine communities, wetlands/birds, and lost public uses.

The Trustees have estimated the nature and extent of the natural resources exposed to and/or injured and the lost public uses resulting from the *T/V Posavina* oil spill. The Trustees believe that further injury assessment would result in the confirmation of such injuries to natural resources and natural resource services. However, in order to move more quickly toward the goal of restoration, the Trustees have proposed two restoration projects that they believe will adequately restore the injured natural resources and compensate the public for lost resources and uses resulting from the *T/V Posavina* spill.

The Trustees selected two salt marsh restoration projects after carefully considering a range of restoration alternatives. These projects, located in the vicinity of the spill, would enhance the marine environment's overall quality and simultaneously provide benefits to coastal wetlands, shellfish and birds. While the preassessment phase examined the specific injuries associated with marine communities, wetlands/birds, and lost public uses, the Trustees concluded that the two proposed restoration projects would satisfy their overall objectives in all three injury categories.

The Responsible Party has agreed to pay \$100,000.00 to the Trustees for the estimated costs of implementing these proposed projects, including the costs to the Trustees to include post-restoration monitoring. The title of the specific projects and the breakdown of the \$100,000 are shown in Table 1 below. Detailed descriptions of the restoration projects can be found in section 4.

Table 1		
SUMMARY OF PREFERRED <i>T/V Posavina</i> OIL SPILL RESTORATION PROJECTS AND COSTS		
Resource/Service	Preferred Restoration Project	Total Cost to RP
Marine Community and Wetlands	Mill Creek Salt Marsh Restoration	\$35,000
Marine Community and Wetlands	Belle Isle Fish Co. Salt Marsh Restoration	\$55,000
Total Estimated Cost of Restoration Projects		\$90,000
Total Estimated Post-Restoration Monitoring		\$ 10,000
Total Restoration and Oversight Costs Payment by RP to Trustees		\$100,000

2.0 AFFECTED ENVIRONMENT

2.1 Physical and Biological Environment

The area most heavily affected by the *T/V Posavina* oil spill was the middle portion of the Chelsea River extending from its outlet near the McCardle Bridge to where the commuter rail line crosses the river about two miles east (Figure 1). The Chelsea River is predominantly a tidal river system with a total length of only three miles, including the upper reach known as Mill Creek. Most fresh water input is stormwater runoff from the highly urbanized watershed. The Chelsea River enters Boston Harbor at the confluence of the much larger Mystic and Charles Rivers. Boston Harbor functions as an estuary where the freshwater from the Charles, Mystic, Chelsea and Neponset rivers mix with sea water from Massachusetts Bay.

Relative to other portions of Boston Harbor, natural resources are limited in the Chelsea River due to extensive development and industrialization. Much of the port development is devoted to unloading petroleum tankers and associated infrastructure.

The marine habitats, including tidal mud flats and the sloped walls of the federal navigation channel of the Chelsea River, support benthic species including polychaete worms, green crabs (*Carcinus maenus*), blue mussels (*Mytilus edulis*), periwinkles (*Littorina littorea*), and clams (*Mya arenaria*). American lobster (*Homarus americanus*) is commonly known to be commercially caught near the mouth of the river.

The Chelsea River does possess an array of intertidal vegetation, including cordgrass (*Spartina alterniflora*), salt hay (*s. patens*) and common reed (*Phragmites australis*) growing on soft, unconsolidated sediment substrate, and brown algae (*Fucus sp.* and *Ascophyllum sp.*), covering harder, rockier surfaces. Similarly, a limited

"vertical wall community", comprised of hydroids (*Obelia sp. and Tubularia sp.*), stalked sea squirts (*Botryllus sp.*) barnacles (*Balanus balanoides*), sea anemones (*Metridium sp.*) and blue mussels, exist on vertical walls in the river such as granite, concrete, steel and wood pilings and crib work. Relatively small patches of salt marsh habitat can be found in the area between the Chelsea Street Bridge and the commuter railroad bridge. Farther upstream in Mill Creek, salt marsh becomes the predominant shoreline type. The salt marsh provides important habitat for numerous sea bird, waterfowl, wading bird species, fin fish, shellfish, and crustaceans.

2.1.1 Endangered and Threatened Species

According to informal consultation under the Endangered Species Act (16 U.S.C. 1531 et seq.) with NOAA National Marine Fisheries Service and the U.S. Fish and Wildlife Service, the Chelsea River is not known to support any state- or Federally-listed endangered fish and wildlife species other than the potential for a transient endangered bird. Completion of endangered and threatened species coordination with Federal and state programs will be coordinated as part of the Clean Water Act Section 404 regulatory process for implementing the preferred restoration alternatives.

2.1.2 Essential Fish Habitat

Although the data are limited, the Trustees believe that the Chelsea River does provide Essential Fish Habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.) for a number of marine species including winter flounder (*Pleuronectes americanus*) pollock (*Pollachius virens*) and Atlantic cod (*Gadus morhua*).

2.1.3 Historic and Cultural Resources

There are a number of historic and cultural resources located throughout the Boston Harbor region including the USS Constitution located in adjacent community of Charlestown. However, due to the extensive wetland and waterway filling in the Chelsea River to facilitate large tanker vessels, the area of the oil spill in Chelsea River is not known to possess historic or Cultural Resources. Completion of state and Federal Historical and Cultural Resource assessment will be coordinated as part of the Clean Water Act Section 404 regulatory process for implementing the preferred restoration alternatives

2.1.4 Human Use Services

Boston Harbor is a major port in New England, and is the largest commercial port in Massachusetts. It is also used extensively by the public for recreational boating and fishing, and for ferry, tour and whale-watching trips. However, the Chelsea River portion of the Boston Harbor is almost exclusively utilized for petroleum, salt and other bulk material transportation and unloading, and almost no other human uses of the waterway and wetlands except for occasional bird watching and recreational vessel usage.

3.0 INJURY ASSESSMENT AND QUANTIFICATION

3.1 Introduction

The Trustees for the *T/V Posavina* oil spill initiated preassessment activities on June 8, 2000 immediately following notification of the spill. Preassessment activities, as defined by OPA, focused on collecting ephemeral data essential to determine whether: (1) injuries have resulted, or are likely to result, from the incident; (2) response actions have adequately addressed, or are expected to address, the injuries resulting from the incident; and (3) feasible restoration actions exist to address the potential injuries.

The Trustees conducted an expedited assessment to determine the nature and extent of natural resource injuries and lost services resulting from the spill. Principal investigators included state and federal scientists. Based on the expedited assessment, the Trustees believe that the spill caused injuries to natural resources in Chelsea Creek, including fringing wetlands and shoreline areas. The spill had a very limited and short-term impact on recreational use, involving the closure of Chelsea Creek recreational boating for approximately one week. Considering the limited recreational use of Chelsea Creek, these impacts were very minor.

Throughout the injury assessment and restoration planning process, the Trustees used available information, expert scientific judgment, information generated through response activities, shoreline assessments, and literature on the fate and effects of oil spills to arrive at the best estimate of the injuries caused by the spill. See the Administrative Record for documentation of these assessment activities. There is, however, some uncertainty inherent in the assessment of impacts from oil spills. While in certain instances collecting more information may increase the precision of the estimate of impacts, the Trustees believe that the type and scale of restoration actions would not substantially change as a result of more assessment studies. The Trustees sought to balance the desire for more information with the reality that further study would delay the implementation of the restoration projects, at the expense of the local environment and the public who use and enjoy the area's natural resources.

3.2 Impact Surveys

The following surveys are typically conducted by the Trustees and the USCG during the preassessment phase of an oil spill.

3.2.1 Shoreline Oiling Surveys

On-the-ground and aerial surveys of the Chelsea Creek and Boston Harbor were conducted by the Trustees to document the location, amount, and extent of oiling in Chelsea Creek. These surveys indicated that approximately five acres of fringing wetland, beach shoreline, and manmade shoreline were oiled.

3.2.2 Oiled Wildlife Surveys

Survey teams walked the Chelsea Creek shoreline from June 8 through June 11, 2000 with the purpose of recording the extent and degree of oiled wildlife, collecting dead wildlife, and capturing oiled birds (if possible) for rehabilitation. Other than a small number of live gulls being lightly oiled, the Trustees did not observe any oiled wildlife, dead or alive.

3.2.3 Marine Resource Surveys

There was some evidence of oiled live marine resources documented within the spill area, and limited reports of mortality. Soft-shelled clams, snails, and fiddler crabs were observed in the spill area. Heavy oiling was noted on gastropod shells (*Littorinid* spp. & *Nassarius* spp. snails), blue mussels, and ribbed mussels (*Modiolus modiolus*). However, based on field observations, exposure appears to have been minimal and short lived. There was a light sheen generally present throughout the intertidal area, but no evidence of oil penetrating any appreciable depth into intertidal sediments and/or oiling the vegetation roots. There was no evidence of other oiled live or dead marine resources documented within the spill area.

3.2.4 Recreational Lost Use

The USGG did implement a navigational closure following the spill. However, there is no evidence and the Trustees had no observations to indicate that recreational boating was affected by the spill. The only park in the immediate area is the USS Constitution, managed by the National Park Service, which did not report any adverse spill impacts.

3.3 Injury Assessment, Methods and Results

The following section describes the results of the Trustees injury assessment for the wetlands and shoreline areas.

Field surveys and observations made during preassessment activities indicate that approximately 5 acres of shoreline were oiled. Of this total, 1.1 acres were lightly oiled, 2.60 acres were moderately oiled, and 1.35 acres were heavily oiled.

- (1) Lightly oiled shorelines: Approximately 1.1 acres of shoreline were lightly oiled, defined as areas with less than 10 percent oil distribution and 0.01 cm oil thickness.
- (2) Moderately oiled shoreline: An estimated 2.60 acres of shoreline were moderately oiled, defined as areas with more than 10 percent oil distribution on the marsh surface and 0.01 cm oil thick.
- (3) Heavily oiled shorelines: Approximately 1.35 acres of shoreline were heavily oiled, defined as areas with more than 10 percent oil distribution and 0.1 cm oil thickness.

3.4 Injury Quantification

Only 0.38 acres of wetlands were oiled, whereas the total oiled (moderately and heavy) shoreline was 3.95 acres. Wetlands provide greater ecological services flows than the rest of the shoreline, which is mostly man-made and highly disturbed. The Trustees used Habitat Equivalency Analyses (HEA) using the following input parameters:

Initial service loss of all oiled habitats – 100%. This is very conservative since organisms were alive, feeding, and/or growing in many oiled areas following the spill. Ecological services provided by sheet-pile, cement bulkheads and other manmade structures is minimal.

Natural resource acres affected – 5.06. This is the total of all oiled surfaces, including very lightly oiled areas and man-made surfaces. Compensating for temporary seawall impacts with wetland creation or enhancement provides substantially more ecological benefit than service lost from man-made shoreline structures in the spill area. Furthermore, wetlands represent less than 10% of the affected habitats.

Recovery time – 5 years. This is an average estimate of moderately oiled wetland recovery time. The wetlands are sensitive environments and often require more time to recover than other habitats.

Relative productivity of a compensation site compared to the affected habitat – 80%. This is very conservative since even a created wetland is more productive than most or all of the man-made shorelines in the Chelsea River.

Years for a created site to attain full productivity of 80% - 10 years. A healthy growth of *Spartina sp.* marsh creation that provides substantial cover can occur in the first year post-construction.

Discounted value of created site – 3% per year following construction. This is standard for HEA.

Using these input parameters, the NOAA's HEA resulted in a compensation requirement of 0.7 acres.

The Responsible Party performed another iteration of an HEA using 3.28 acres of natural resources affected (wetlands and cobble, pebble, mud shorelines), 2 years to recover, and 10 years for a restoration project to provide a function equal to 80% of the function of affected sites. Using this set of HEA inputs, resulted in a compensation of closer to 0.25 acres.

Sublethal effects to the intertidal shoreline, water column, and benthic habitats were not quantified but are assumed to have occurred. These impacts were considered when calculating the relative productivity of the compensation sites to the affected habitat and why the larger compensation area was selected between the two HEA calculations.