ATLAS TACK CORPORATION FAIRHAVEN, MASSACHUSETTS SUPERFUND CASE STUDY

This case study is part of a series focused on ecological revitalization conducted during contaminated site remediation and reuse; these case studies are being compiled by the U.S. Environmental Protection Agency (EPA) Technology Innovation and Field Services Division (TIFSD). The purpose of these case studies is to provide site managers with information on ecological reuse, including principles for implementation, recommendations based on personal experiences, a specific point of contact, and a network of sites with an ecological reuse component.

Agencies Work Together to Preserve and Create Fresh and Saltwater Wetlands at Former Manufacturing Facility

In an effort to save as much of a functional but contaminated marsh as possible while still protecting human health and the environment, the U.S. Environmental Protection Agency (EPA) and its partners used a creative approach to identify the contaminated areas at the Atlas Tack Corporation (Atlas Tack) site in Fairhaven, Massachusetts, that needed to be excavated and removed from the site. Historical waste disposal practices left soils, surface water, groundwater, and surrounding wetlands contaminated with volatile organic compounds (VOC), cyanide, heavy metals, polychlorinated biphenyls (PCB), and polycyclic aromatic hydrocarbons (PAH). Contamination even threatened nearby Buzzards Bay, an Estuary of National Significance. Original cleanup goals would have required excavation of the entire wetland, but agencies conducted a bioavailability study and toxicity testing to more accurately determine exactly which sediments needed to be removed.

During the excavation of contaminated marsh sediment, the agencies noticed that an existing hurricane dike was not allowing enough salt water to pass through to an existing saltwater marsh to support native plants. As a result, invasive species were taking over. Instead of spending millions of dollars to reconstruct the dike, the agencies maximized available resources and designed an earthen berm to divide the existing saltwater marsh into

Topics Highlighted in this Case Study:

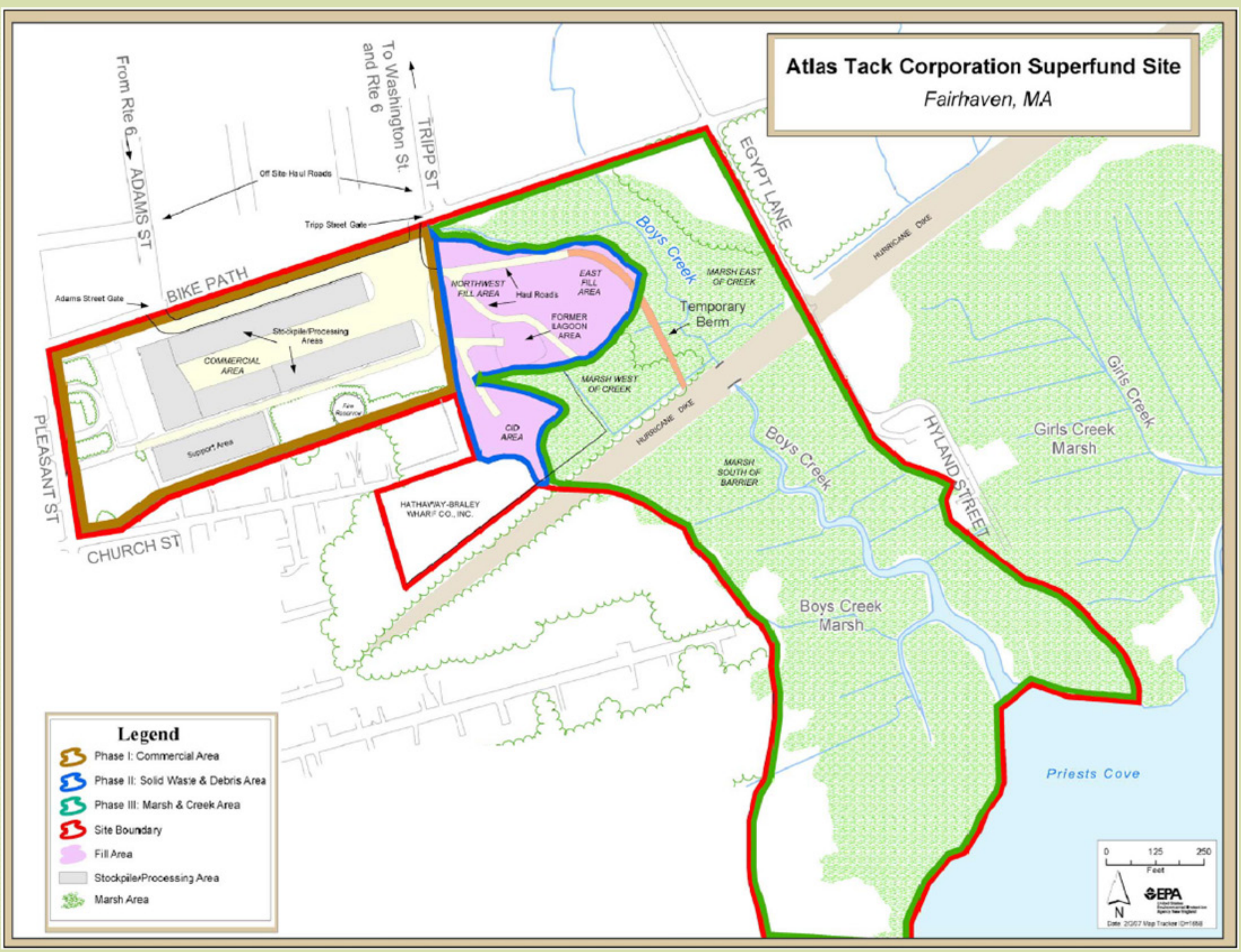
- • Attractive Nuisance
- ✓ Bioavailability
- ✓ Erosion
- ✓ Invasive Species
- ✓ Predator Control
- • Recreation
- • Soil Amendments
- ✓ Use of Native Plants
- • Use of Volunteers
- ✓ Water Management
- • Wildlife Habitat:
  - ✓ Freshwater Wetland
  - • Prairie
  - ✓ Saltwater Wetland
  - • Savannah
  - ✓ Stream
  - ✓ Woodland

Ecological Revitalization = the process of returning land from a contaminated state to one that supports functioning and sustainable habitat.

(1) a smaller saltwater marsh that could be supported with the existing dike, and (2) a new freshwater wetland. More than 14,000 native plants were planted throughout the preserved and newly created wetlands, and now the freshwater wetland and saltwater marsh are becoming thriving habitat for local wildlife and migrating birds.

Background

- The Atlas Tack site is located in Fairhaven, Massachusetts. The 48-acre site includes (1) the entire Atlas Tack facility property (about 13.6 acres of commercial area and 7.2 acres of wetland, some of which was filled during the manufacturing era), (2) property adjacent to the Atlas Tack facility (about 3.2 acres), and (3) portions of Boys Creek and adjacent saltwater tidal wetland (more than 20 acres) extending to Buzzards Bay, which is a designated Estuary of National Significance.
- The Atlas Tack facility operated at the site from 1901 through 1985 and manufactured wire tacks, steel nails, rivets, bolts, shoe eyelets, and similar items. The facility's operations included electroplating, acid-washing, enameling, and painting processes.
- Wastes containing cyanide and heavy metals were discharged into an unlined acid neutralizing lagoon adjacent to a saltwater tidal wetland in Buzzards Bay. Process wastes containing acids, metals (such as copper and nickel), and solvents were discharged into drains in the floor of the manufacturing building, an on-site lagoon, and Boys Creek. Some of these chemicals migrated to nearby soils and



Ecologically Based Cleanup Goals

Interim groundwater cleanup goals were ecologically based because the groundwater could carry contaminants to Boys Creek and Buzzards Bay. The groundwater at the site is not used for drinking water, so cleanup goals specific to drinking water did not need to be met.

groundwater. Other contaminated areas at the site include a filled wetland, a former dump, and other chemical spills.

- The facility's operations contaminated the surrounding soils, surface water, wetlands, and/or groundwater with VOCs (mainly toluene); cyanide; heavy metals including arsenic, chromium, cadmium, lead, copper, zinc, nickel, and antimony; pesticides; PCBs; and semivolatile organic compounds (SVOC) (mainly PAHs).
- The remediation included cleanup and ecological revitalization and was completed in three phases:
  - » Phase I included cleanup of the 13.6-acre commercial area and consisted of (1) demolishing the manufacturing facility, power plant, and 185-foot smoke stack; (2) excavating and removing the plating pit, pickling trench, and underground waste conveyance trenches; and (3) excavating approximately 5,500 cubic yards (cy) of contaminated soil and 775 cy of plating sludge. Some of the buildings contained asbestos, which was removed before demolition began. All material was disposed of off site at either nonhazardous landfills or hazardous waste facilities, as appropriate. This cleanup phase was completed in March 2006 and cost about $2.3 million.
  - » Phase II included remediation of a 9-acre solid waste disposal area. This area includes a portion of the original wetland that was filled during the manufacturing era, the former lagoon area, and the Commercial and Industrial Debris (CID) area. Before the remediation, there was essentially no vegetation in this area of the wetland. Remediation included excavation of approximately 36,600 cy of contaminated soil and debris, which was disposed of at nonhazardous waste landfills. This cleanup phase was completed in November 2006 and cost about $14 million.
  - » Phase III activities included excavating a total of 36,400 cy of contaminated marsh and creek bed sediment at Boys Creek and restoring these areas as well as the entire site. Based on analytical results, the contaminated sediment was disposed of at nonhazardous waste landfills. The marsh restoration began in May 2007, and construction was completed in September 2007. The cost of this cleanup phase was about $6.5 million. Monitored natural attenuation for the groundwater is under way.

Salt Marsh Excavation

Bioavailability Studies Can Preserve Habitat

A bioavailability study in the marsh was conducted to more accurately define areas to be excavated and avoid any unnecessary destruction of any floodplain, wetland, or riverfront area.

Ecological Revitalization

The 48-acre site originally consisted of a salt marsh below a hurricane dike and a creek running through the dike. Contaminants became concentrated to the area north of the dike when contaminated groundwater ran through the dike opening. Large stands of the invasive species *Phragmites* (common reed) grew south of the dike. EPA, the U.S. Army Corps of Engineers (USACE), and the National Oceanic and Atmospheric Administration (NOAA) used remediation of this site as an opportunity to create some much-needed freshwater and saltwater marsh habitat. Girls Creek Marsh, a pristine wetland that lies east of the marsh, was used as a reference wetland to compare in measuring success.

The remediation plan was designed to restore the existing marsh and create additional marsh areas as well as provide a means to eliminate storm water flooding. The revitalization included construction of a clay core earthen berm in the wetland north of an existing dike to create separate fresh and salt water wetlands. EPA, USACE, and NOAA jointly designed the new wetlands

Earthen Berm Installation

to minimize growth of the invasive species *Phragmites*, provide a means to allow storm water to discharge into the estuary, and create additional estuarine habitat. The restoration was completed in 2007 and includes the tidal saltwater marsh and a freshwater wetland fed mainly by groundwater and some storm water. The freshwater wetland was designed with steep slopes and a low elevation to encourage standing water at a depth that minimizes reintroduction of *Phragmites*. A lowered elevation in the saltwater marsh removed existing *Phragmites* during excavation and prevented it from coming back by allowing more salt water to enter.

Originally, the area was to be seeded with native species, but enough seeds were not available. Therefore, native plant plugs were planted, which increased the cost of the restoration. Both wetlands were planted with a variety of native species, and islands created in the freshwater wetland were planted with deciduous vegetation, including shrubs and trees.

Agency coordination has been an essential part of the Atlas Tack Superfund Site remediation. As part of planning for the ecological revitalization, EPA coordinated with USACE and made use of NOAA's Damage Assessment, Remediation, and Restoration Program (DARRP), which acts as a federal natural resource trustee. Through DARRP, NOAA contributed to development of cleanup values for the sediment, the wetland

Interagency Resources Benefit Restoration

The NOAA Restoration Center has an interagency agreement with EPA to provide technical assistance on feasibility, design, and construction details at no additional cost to EPA. NOAA can provide consulting for ecosystem restoration to help coordinate remediation and restoration at a remediation site. For example, NOAA can help select appropriate grass and seed mixes for restoration efforts at the site. In addition, NOAA can enhance or extend restoration above and beyond remediation with other funds through NOAA programs, such as the Community-based Restoration Program.

Stakeholders Involvement

- **EPA** – Conducted cleanup and revitalization activities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- **USACE** – Acted as construction manager for remedial activities and provided technical guidance during the design of the wetlands.
- **NOAA** – Restoration specialists provided guidance on selection of cleanup values, cleanup of the wetlands, and restoration through use of DARRP.
- **Massachusetts Department of Environmental Protection** – Responsible for operations and maintenance (O&M) of the site once the wetlands are functional or after one year.

removal plan, and the design of the mitigation that resulted in ecological enhancements at no additional cost to EPA. Using normal Superfund funding, these three federal agencies worked cooperatively to create an effective remedy for the site that was enhanced by ecological revitalization.

Preserving Existing Habitat

The original sediment cleanup goals from a 2000 Record of Decision (ROD) would have required excavation of the entire marsh. EPA and its partners were reluctant to completely excavate the marsh because it was a functional habitat. Therefore, EPA completed a bioavailability study in 2001 and 2002 to preserve as much of the existing marsh as possible, while still removing marsh sediment that posed a risk to human health and the environment. The study showed that some areas with sediment contamination above the original cleanup goals were not a threat to human health or the environment. Specifically, the study calculated the "effects range-median quotients" (ERMQ) for the main contaminants of concern (six metals) and compared the values with toxicity testing results. ERMQs of greater than 1.0 showed toxicity, while a value less than 1.0 showed little to no toxicity. The ERMQ was calculated for each sediment sample, and areas with sediment samples showing an ERMQ of greater than 1.0 indicated toxicity and were excavated; underlying soil was sampled to ensure that protective cleanup levels were achieved.

Removing Invasive Species during Soil Excavation

The entire area north of the dike (4.5 acres) was excavated, as well as 1.5 acres of the area south of the dike. Soil was removed in the winter, when the ground was frozen, and some of the invasive *Phragmites* was also removed while removing the soil.

Maximizing Water Resources

An existing culvert through the hurricane dike was under-designed and restricted tidal flow into the northern salt marsh. The amount of water coming through the dike could not sustain the original marsh and resulted in a large stand of *Phragmites* and a significantly lower value habitat. Cleanup funding could not be used to open the culvert through the dike, and it was estimated to cost several million dollars to replace the culvert. As a result, EPA, USACE, and NOAA designed (1) a freshwater wetland where the *Phragmites* once stood, and (2) a smaller saltwater marsh, which was separated by a clay core earthen berm and would be sustainable with water that could pass through the existing culvert, all of which could be completed using CERCLA funding. The earthen berm caused surface and groundwater to pond and create the freshwater emergent wetland. Spillways were also installed to allow excess fresh water to flow

Phytoremediation by planting trees was considered in the original cleanup plan to lower the groundwater table and prevent it from flowing through remaining contamination at the site. The agencies decided against this phytoremediation component because the newly created freshwater wetland needed as much groundwater as possible from the upland areas. Lowering the groundwater table would not allow enough groundwater to flow into the wetland, increasing the risk of *Phragmites* invasion. Plus, the risks from groundwater flowing beneath the site were determined to be minimal.

to Boys Creek during storms. The sides of the wetland were steeply sloped (2:1) to prevent re-invasion by *Phragmites*. The saltwater marsh was left at a lower elevation after contaminated soil was excavated to allow more salt water into the area and reduce *Phragmites* populations. Both wetlands were planted with native species.

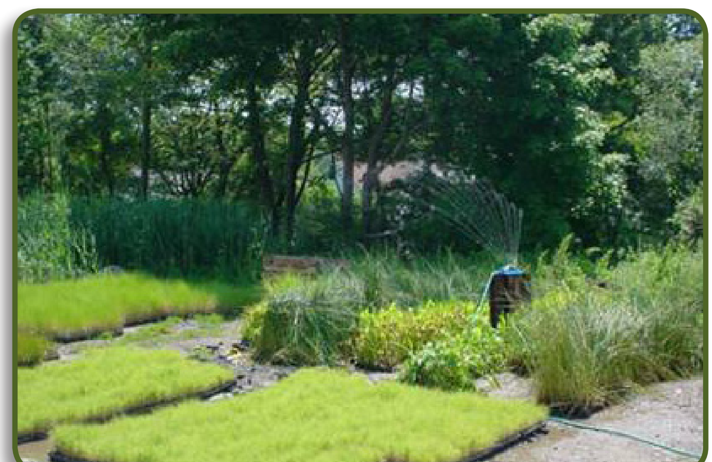
Creating New Habitat

Ten small upland islands were created in the freshwater wetland and planted with herbaceous freshwater plants, trees, and shrubs; these plants helped to maximize valuable habitat space. Woody debris and rock formations were also used as materials during construction of the islands to help provide a variety of habitats throughout the wetland. Native northeast New England wildflowers were also seeded to encourage the return of native birds and pollinators to the area.

More than 14,000 low and high marsh wetland plant plugs were planted, as well as shrubs and trees in the upland areas. Species such as seashore saltgrass (*Distichlis spicata*), saltmeadow rush (*Juncus geradi*), saltmarsh cordgrass (*Spartina alterniflora*), and salt hay (*Spartina patens*) were planted in the salt water marsh. The freshwater wetland was planted with a variety of species, including spatterdock (*Nuphar advena*), water smartweed (*polygonum*

Island Plant Plugs

High Marsh Plantings



Plant Plugs

amphibium), pickerelweed (*Pontedaria cordata*), and hardstem bulrush (*Scirpus acutus*). Islands were planted with sedges (*Carex spp.*), duck potato (*Sagittaria latifolia*), and giant bur-reed (*Sparganium eurycarpum*). Any remaining *Phragmites* stands were treated with herbicide.

Timing is Everything When It Comes to Planting

June or September are the best times to plant freshwater wetlands in the Northeast U.S. because the heat and lack of rain in mid-summer can stress newly planted plugs. However, all work needed to be completed by September, so planting was done in the summer. The plants were heavily watered to increase their chances of success since they were not planted during the optimal time.

Operation and Maintenance

Monitoring and maintenance of the restoration included (1) regular visits during the growing season to qualitatively assess the restoration, and (2) establishing wetland monitoring stations to quantitatively assess each habitat as well as the Girls Creek reference wetland.

This project has been remediated using CERCLA funding. Therefore, EPA was responsible for O&M of the site for 1 year, including the restoration area. In addition, EPA is responsible for groundwater monitoring activities for 10 years. The State of Massachusetts took over responsibility for O&M of the wetlands after 1 year and is exploring the opportunity of asking a local conservation group to take responsibility for long-term management of the wetlands.

Lessons Learned

a) **Consider timing when planting in wetlands.** The initial vegetation monitoring survey showed that many plugs did not survive the first winter because they were planted too late in the early fall. Since survival was guaranteed for 1 year, they were replanted in the spring to allow more time for the new plants to become established before the next winter.

b) **Soils are integral to the success of a restoration.** Loam with different amounts of organic material was used as topsoil for different areas of restoration. After the excavated areas had been backfilled with common fill, 6 inches of loam was placed before planting. The saltwater marsh needed an organic content of 0 to 2.33 percent, the uplands needed an organic content of greater than 3 percent, and the freshwater wetland needed an organic content of greater than 6 percent.

c) **Account for invasive species that are difficult to manage.** *Phragmites* is difficult to control. This project was able to remove existing stands of *Phragmites* during excavation and with the use of herbicides; steep bank slopes and deeper water were used to prevent additional growth. However, continued control of this invasive species will be a long-term effort.

d) **Reuse material during revitalization activities, when possible.** Boulders removed during soil excavation were cleaned and reused in the freshwater wetland. This reuse reduced disposal costs and enhanced the habitat. In addition, trees that had to be removed for access were chipped and used for erosion control and habitat enhancement.

e) **Be flexible with the design.** Soil in both the freshwater wetland and saltwater marsh consolidated and subsided because of the tide and the presence of standing water. Some areas that were originally high marsh consolidated and had to be replanted with low marsh species.

Atlas Tack Revitalization

Additional Information

Websites to obtain additional information on the Atlas Tack site and ecological revitalization include the following:

EPA Region 1 Atlas Tack Fact Sheet
http://yosemite.epa.gov/r1/npl_pad.nsf/f52fa5c31fa8f5c885256adc0050b631/7F21321A3A6F9C90852568FF005ADB0C?OpenDocument

U.S. Army Corps of Engineers Final Interim Remedial Action Report (O&F Completion Report) for Phases II and III Atlas Tack Corporation Superfund Site
http://www.epa.gov/region1/superfund/sites/atlas/295436.pdf

EPA Preliminary Closeout Report Atlas Tack Corporation Superfund Site
http://www.epa.gov/region1/superfund/sites/atlas/278812.pdf

EPA Ecological Revitalization Case Study Presentation on Atlas Tack
http://clu-in.org/conf/tio/ecocasestudies_080207/

EPA's Eco Tools Website
http://www.clu-in.org/ecotools/

Ecological Revitalization: Turning Contaminated Properties into Community Assets
http://www.clu-in.org/download/issues/ecotools/Ecological_Revitalization_Turning_Contaminated_Properties_into_Community_Assets.pdf

Frequently Asked Questions about Ecological Revitalization of Superfund Sites
http://www.clu-in.org/download/remed/542f06002.pdf

Revegetating Landfills and Waste Containment Areas Fact Sheet
http://www.clu-in.org/download/remed/revegetating_fact_sheet.pdf

Ecological Revitalization and Attractive Nuisance Issues
http://www.epa.gov/tio/download/remed/542f06003.pdf

For additional information on the Atlas Tack site, you can also contact the EPA/NOAA project manager:

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