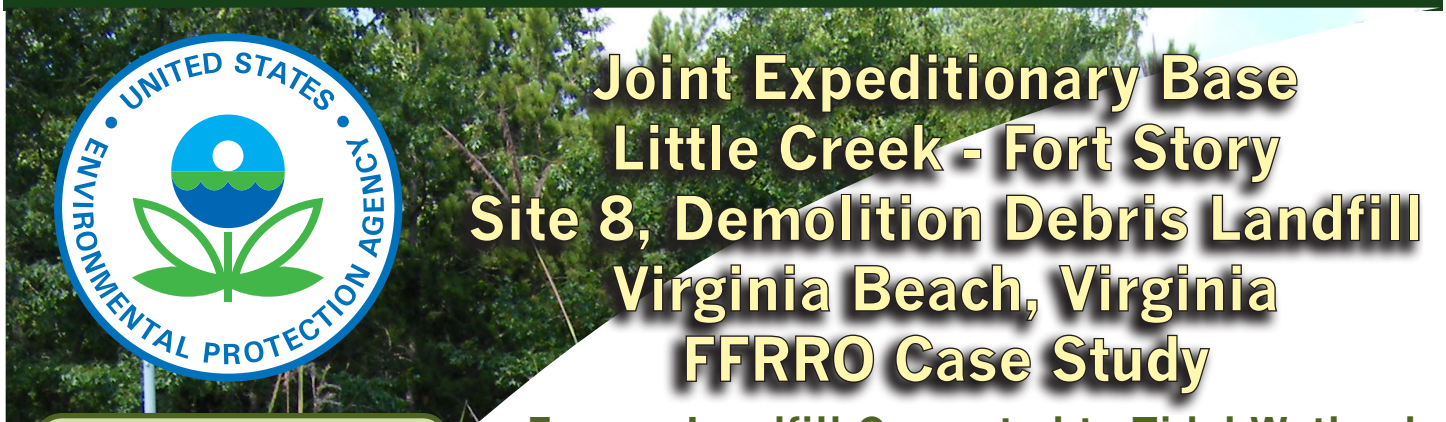

Joint Expeditionary Base Little Creek - Fort Story Site 8, Demolition Debris Landfill Virginia Beach, Virginia FFRRO Case Study

Former Landfill Converted to Tidal Wetlands In the Chesapeake Bay

This is the second in a series of case studies from EPA's Technology Innovation and Field Services Division (TIFSD) focused on ecological revitalization as part of contaminated site remediation and reuse. The purpose of these case studies is to provide site managers with ecological reuse information, including principles for implementation, recommendations based on personal experiences, a specific point of contact, and a network of sites with an ecological reuse component

Past disposal practices at the Joint Expeditionary Base (JEB) Little Creek - Fort Story site along the Chesapeake Bay area in Virginia Beach, Virginia, left a tidal wetlands area filled with debris, contaminated soil, and sediment. After waste materials were excavated, the landfill was converted to a tidal wetland. Two connecting channels were constructed to allow tidal inundation of the site from Little Creek Cove. Plants were selected and planted along designated elevations to establish native tidal wetland vegetation for habitat, using the neighboring marsh as a reference wetland.

The Navy strengthened existing partnerships with the U.S. Environmental Protection Agency (EPA) Biological Technical Assistance Group (BTAG) and National Oceanic and Atmospheric Administration (NOAA) restoration specialists by working together to design a tidal wetland with the highest chance of success. The site is currently a tidal wetland habitat with riparian forest to the south and east and tidal channels to Little Creek Cove to the north.

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

Background

- JEB Little Creek – Fort Story encompasses 2,215 acres in the northwestern corner of Virginia Beach, Virginia, adjacent to the Chesapeake Bay.

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

- The facility is primarily industrial. Personnel provide logistic facilities and support services for local commands, organizations, homeported ships, and other U.S. and allied units to meet the amphibious warfare training requirements of the U.S. Armed Forces. JEB Little Creek - Fort Story is also used for recreational, commercial, and residential purposes.
- Waste management activities, that were acceptable in the past, have contaminated areas of the installation and surrounding areas. In 1984, work was done at JEB Little Creek - Fort Story to identify, assess, characterize, and clean up or control contamination from these past activities.
- JEB Little Creek - Fort Story was placed on the National Priorities List (NPL) on May 10, 1999. An initial assessment study looked at 17 sites at JEB Little Creek - Fort Story to assess potential threats to human health and the environment. The 17 sites examined are in various stages of remediation.
- JEB Little Creek - Fort Story Site 8, the Demolition Debris Landfill (Site 8), is about

When appropriate, sites at JEB Little Creek - Fort Story that have been cleaned up have been converted to recreational space, including a driving range and baseball diamonds, as well as habitat incorporating tidal wetlands. This case study focuses on Site 8, which includes restoration of tidal wetlands.

1.2 acres that are adjacent to and within tidal wetlands of Little Creek Cove.

- Site 8 was used as an unlined landfill from 1971 to 1979. About 4,840 cubic yards of waste was reportedly disposed in the landfill. Landfill waste included mainly debris from construction and demolition and debris removed from the bar screens of base sewage pump stations.
- The following contaminants were identified at this site: semivolatile organic compounds, pesticides, polychlorinated biphenyls, volatile organic compounds, and metals.
- Three remedial action alternatives were evaluated for mitigation of (1) potential human health risk associated with exposure to landfill waste, and (2) potential ecological risk associated with sediment at Site 8. Based on a comparison of cost, long-term effectiveness, and implementability, complete excavation of waste materials and construction of a tidal wetland were recommended.

The landfill area was over-excavated to meet the required elevations for wetland construction. The remediation included excavating an adjacent marsh dominated by the invasive plant *Phragmites* (common reed) in and around additional debris.

- Beginning in September 2005, approximately 28,000 tons of waste, soil, and sediment were removed from the site. Debris, soil, and sediment were separated and disposed offsite at an approved landfill or disposal facility or recycled, as appropriate. Remediation activities at Site 8 were completed in 2007, and a No Further Action Record of Decision was signed in 2008.

Ecological Revitalization

While determining how best to clean up the site, the Navy considered the long-term use of the site. The location of Site 8 in the Chesapeake Bay area, an adjacent marsh surrounded by tidal wetlands, and a downstream wildlife watch area made this an ideal site for ecological revitalization. The first step was to partner with other agencies for technical support. The Navy routinely requests assistance from the EPA BTAG and NOAA restoration experts to help with ecological revitalization issues. In addition, the EPA site manager involved the Navy's liaison with the Chesapeake Bay Program, especially during the design phase of the created wetland. While these agency partnerships were already in place before the start of the project, Site 8 allowed the partnership to grow through working cooperatively and identifying creative ways to create the wetlands.

Involving the EPA BTAG, and other experts, helped the Navy create a design with the best chance of success. During the design process, there were some significant changes in the

The Chesapeake Bay Program

Site 8 is a part of the Chesapeake Bay Program, which is a unique regional partnership that has led and directed the restoration of the Chesapeake Bay since 1983. Chesapeake Bay Program partners include the states of Maryland, Pennsylvania and Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state legislative body; EPA (representing the federal government); and participating citizen advisory groups. Each of the Bay Program partners agrees to use its own resources to implement projects and activities that advance Bay restoration. For additional information on the Chesapeake Bay Program, please visit the following Website: *http://www.chesapeakebay.net/*.

layout of the wetland. For example, the design originally included an upland island in the middle of the wetland with a channel around the perimeter of the wetland. Residual soil would have been needed to create the island, but the agencies determined that all of the residual soil needed to be excavated. So, the design was revised to create only a low marsh without an island. Microtopography was also incorporated in the low marsh design, where rivelets and small channels formed through the marsh allowed various native plants to become established on their own. The wetland was seeded and planted in 2006, and geese exclusion fencing was installed to protect the plant plugs while they became established. During the summer 2010 growing season, most of the geese exclusion fencing was removed as it was no longer needed to keep out the destructive herbivores. However, a few stakes were left in the center low marsh "island" as perches for avian predators.

The revitalized area now includes low marsh, high marsh, and riparian areas. Surveyors made sure that elevations mimicked the neighboring marsh. The restoration steps included: (1) adding soil and seeding and/or planting with native species, (2) controlling invasive species, particularly Phragmites (common reed) present throughout the area, and (3) using performance standards and considering long-term maintenance to ensure success of the wetland.

Site 8 is located on the Navy base and is accessible only by people with access to the base. However, the Navy wanted to incorporate passive recreation on the site because of a campground located nearby on the base. Original designs attempted to include a bridge and footpath to connect Site 8 to the adjacent wetland, but maintenance and liability issues caused some concern. So, the design was revised to include a walking trail around the wetland areas, as well as two handicap accessible platforms with picnic tables and spotting scopes.

Seeding and Planting a New Habitat

Based on the expertise of the EPA BTAG and NOAA restoration experts that specialize in salt marsh restoration, the Navy decided to add clean sand after the excavation. Approximately 5,568 cubic yards of sand was added to the site to replace excavated materials. The low marsh, high marsh, and riparian habitats were then seeded and/or

Stakeholders Involvement

- **Navy** – The purpose of the Navy Assessment and Control of Installation Pollutants (NACIP) and Installation Restoration Programs (IRP) was to identify, assess, characterize, and clean up or control contamination from past waste management activities at Navy and Marine Corps facilities, including an assessment of Site 8.
- **Virginia Department of Environmental Quality (VDEQ)** – In the past, the VDEQ has primarily provided regulatory oversight at JEB Little Creek - Fort Story.
- **EPA** – Since JEB Little Creek - Fort Story was included on the NPL in 1999, the EPA has played a more active role in providing regulatory and technical oversight to support IRP and Comprehensive Environmental Response Control and Liability Act (CERCLA) activities at the base.
- **NOAA** – NOAA restoration specialists provided technical assistance during the design of the tidal wetland.
- **Restoration Advisory Board (RAB)** – The RAB included members of the community, local environment group members, and state and federal officials; the RAB met semi-annually to share information and obtain input on environmental issues at JEB Little Creek - Fort Story.

In the design of any restored habitat, the proximity of neighboring similar habitats needs to be considered. If there are similar habitats adjacent to, or in the immediate vicinity of, the created/restored habitat, it is likely that these native areas will act as a seed source for the new wetland. Since Site 8 was created four years ago, both invertebrate and plant species native to surrounding areas are readily observed in the new habitat. Numerous native species from the adjacent marsh, such as mud crabs, spiders and a variety of native plants have populated the low marsh, high marsh, and riparian habitat zones; these zones are most prone to erosion and invasive species pressures.

planted with native plants; the adjacent marsh was used as a seed bank for additional native species.

Seed and plants were purchased from a local vendor and consisted of grass plugs and 1-gallon potted shrubs. About 14,500 plants were installed, with appropriate species chosen based on elevation of the area. *Spartina alterniflora* (smooth cordgrass) was planted in the lowest areas, *Spartina patens* (saltmeadow cordgrass) was planted in the higher marsh areas, and shrubs (including *Iva frutescens* (marsh elder) and *Morella cerifera* (wax myrtle)) were planted in the upland riparian areas. In addition, the upland areas were seeded with *Panicum virgatum* (switchgrass).

An unforeseen issue with the groundwater caused a portion of the inland wetland slope to fail. Groundwater intrusion at the bottom of the slope created in the wetland area caused erosion that damaged the goose exclusion fencing installed around the plantings to fail. Geese were able to eat the grass plugs where exclusion fencing had fallen, and this area re-grew after the fencing was repaired. This shows that even in tidal-driven marshes, hydrology must be considered.

As shown in the figures of the northwest quadrant, native vegetation has thrived after only two years of growth. Site 8 currently consists of both low marsh and high marsh vegetation. Two observation platforms with binoculars allow viewing of the site. People able to access the site are drawn to the platforms to view the wildlife that uses the marsh habitat.

Northwest Quadrant just planted (Summer 2006)

Northwest Quadrant 2 years after planting (Sept. 2008)

Observation platform 1 year (left, Apr 2007) and 2 years (right, Sept 2008) after planting.

Observation platform 4 years after planting (July 2010).

Controlling Predators and Invasives

Potential issues were considered during the design process and actions were taken during the restoration to minimize any potential problems. For example, geese in the area would likely have eaten any new plantings in the marsh. The Navy incorporated goose exclusion fencing, which was highly effective (other than for the groundwater intrusion issue discussed above).

Phragmites (common reed), an invasive species, is widespread throughout the Chesapeake Bay area and is difficult to control. The Navy Natural Resources Department includes funding for invasive species control in its annual budget and conducts aerial spraying each fall for all sites in the area, including Site 8. This is an efficient and effective method for controlling *Phragmites* over a large area. In addition, spraying is conducted in the fall using an herbicide that targets actively photosynthesizing plants. While most other species are becoming dormant in the fall, *Phragmites* is still green, so the herbicide effectively inhibits this species.

Ensuring Success

After the wetland was created, the base was able to use it as a wetlands mitigation credit to offset a dredging project that impacted other wetlands on the base. Standard performance criteria were used to make sure the wetland was off to a good start and had the best chances of success. The performance criteria were as follows: in the fall after the first growing season (Year 1), vegetation is expected to be a minimum of 85 percent of the average percent cover in the Site 8 reference wetlands based on past experience in the tidewater area. Assuming the reference site has an average 59

Most nurseries have a 1 year warranty on all of their plants. During the first year after planting, some of the shrubs did not survive. The nursery provided new shrubs at no cost.

percent cover: 0.85 x 0.59 = 50 percent coverage at Year 1.

This metric was chosen to represent the expected percent cover in a young, healthy wetland system in the early stage of development in comparison to a well-established, vigorous system, as in the reference site. The careful matching of elevations and plant species based on the mix found in the reference wetland was designed to help meet this criterion.

During Year 1 monitoring, the performance criteria were not met, so additional action was taken to improve vegetation establishment. This included *Phragmites* control in specific locations of the marsh. Performance criteria were then met during Year 2 monitoring.

In addition, establishing steps and ensuring funding for long-term maintenance at project start-up greatly increase chances of success for a restored site. The Navy, in partnership with EPA and VDEQ, agree that no further action and no monitoring are required under CERCLA for Site 8. However, the Navy will continue to monitor the wetlands through JEB Little Creek - Fort Story's Regional Natural Resources Program. The site was restored and was monitored under the Navy's Environmental Restoration Program until it met the performance criteria. The site was then incorporated into the base's Integrated Natural Resources Management Plan and is managed under the Navy's Regional Natural Resources Program. The Regional Natural Resources Program also updated its wetlands map for the area to show the newly restored and created wetland.

Lessons Learned

1. **Consider ecological revitalization during cleanup:** While removing debris from the site, the invasive Phragmites-dominated marsh in and around the debris area was excavated to provide an opportunity to restore the area to a native Spartina (cordgrass) marsh.
2. **Measures to reduce erosion could be necessary while vegetation becomes established:** While vegetation was becoming established along the slope from wetland to upland, large rain events and groundwater intrusion were causing erosion of soil from the slope into the wetland. Riprap was placed along the slope to prevent erosion and support the establishment of vegetation.
3. **Selection of appropriate native plant species is critical to success of the ecological revitalization:** Some species planted in the tidal wetland did not survive because of erosion along the slope or normal transplanting shock; replacement species were then planted in those areas. Also, additional native species established themselves from the adjacent marsh and surrounding habitats.
4. **Make use of available experts:** Involving wetland restoration specialists beyond the design phase and using their assistance with adaptive management strategies was critical to project success.
5. **Plan ahead to mitigate any potential issues:** Geese were known inhabit the area and would likely eat all of the new grass plugs. Goose exclusion fencing was used and was highly effective. Only in areas where the fencing fell were the geese able to eat the new plants.
6. **Be flexible with the design:** The original design included an upland island instead of the low marsh island. Based on advice from the EPA BTAG and NOAA restoration experts, the design was revised to remove the upland area. The result provided more low marsh, which is high quality habitat, instead of creating more upland habitat that is already abundant in the surrounding area.

Additional Information

Websites to obtain additional information on the JEB Little Creek - Fort Story site and ecological revitalization include the following:

JEB Little Creek - Fort Story Installation Restoration Program
http://public.lantops-ir.org/sites/public/nablc/default.aspx

EPA Region 3 Mid-Atlantic Superfund Website for JEB Little Creek - Fort Story
http://www.epa.gov/reg3hwmd/npl/VA5170022482.htm

Final Record of Decision for Site 8 Former Demolition Debris Landfill
http://public.lantops-ir.org/sites/public/nablc/5%20Year%20Review/BaseWide/2008%20Site%208%20ROD.pdf

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 JEB Little Creek - Fort Story Site, contact the Navy or EPA Project Managers:

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