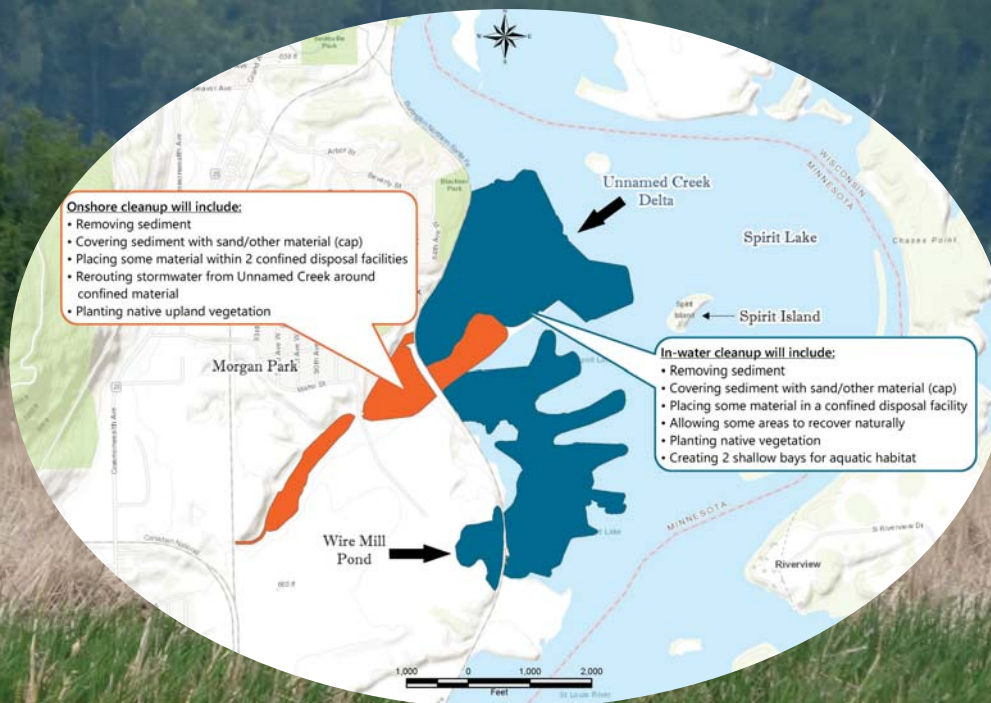


Spirit Lake Legacy Act Cleanup

a partnership to restore community and environmental health

About the Spirit Lake Site

A large environmental cleanup is tentatively set to begin in Spirit Lake near Morgan Park in late 2020. Decades ago, industrial pollution settled into the lake bottom sediment. The U. S. Environmental Protection Agency and U. S. Steel have formed a cleanup partnership, consulting with Minnesota Pollution Control Agency, the City of Duluth, the Fond du Lac Band, the Morgan Park Community Club, and other state and local agencies. The cleanup will dredge, cap, and monitor sediment to restore the St. Louis River.



Onshore cleanup will include:

- Removing sediment
- Covering sediment with sand/other material (cap)
- Placing some material within 2 confined disposal facilities
- Rerouting stormwater from Unnamed Creek around confined material
- Planting native upland vegetation

In-water cleanup will include:

- Removing sediment
- Covering sediment with sand/other material (cap)
- Placing some material in a confined disposal facility
- Allowing some areas to recover naturally
- Planting native vegetation
- Creating 2 shallow bays for aquatic habitat



Spirit Lake and Spirit Island

The Spirit Lake Community

- The cleanup will remove and contain pollution to benefit people, aquatic life, and the ecological system.
- The project will restore both in-water and shore habitat, including the creation of a protective, sheltered bay for fish, birds, frogs, plants, and more.
- The former steel site and the water around it will temporarily become a construction zone.
- EPA is resolving the project's adverse effects on the local railroad and Spirit Island in compliance with Section 106 of the National Historic Preservation Act.



Former steel works facility



Unnamed Creek Delta shoreline



Sediment coring



Shoreline survey



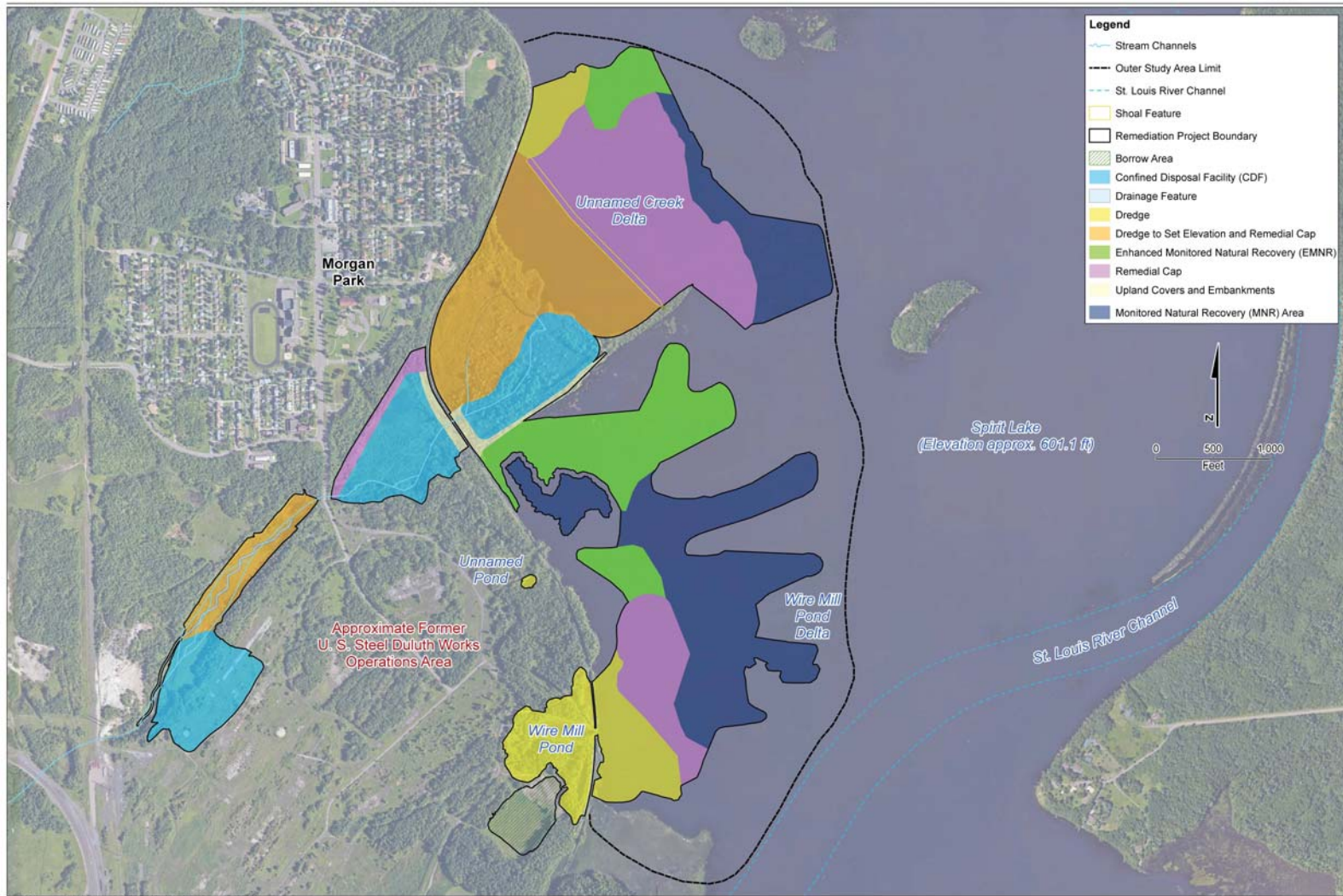
Wire Mill Pond Delta



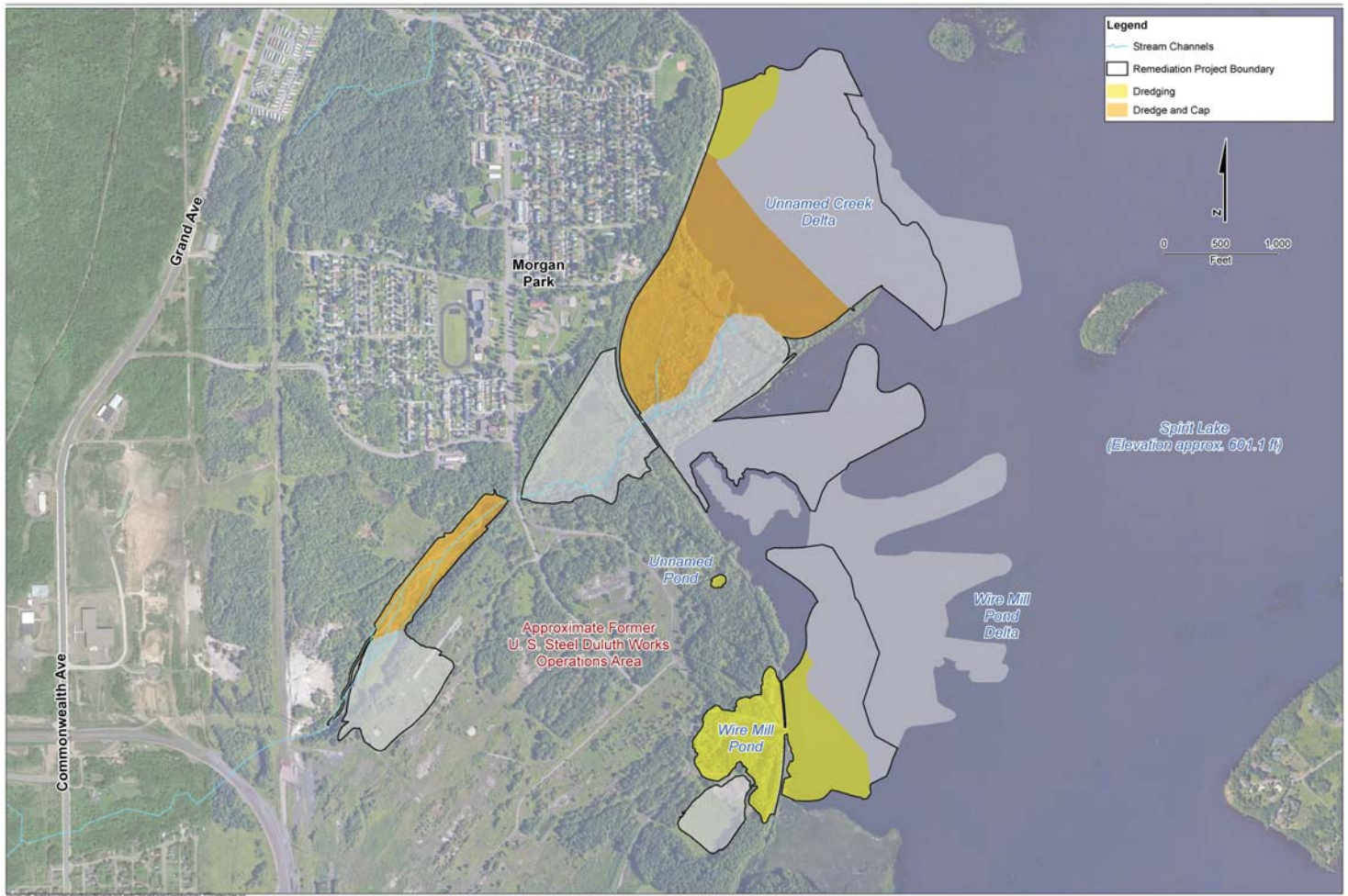
Questions? Contact Diana Mally at:
mally.diana@epa.gov

More information can also be found at:
www.greatlakesmud.org

Remedy Visualization



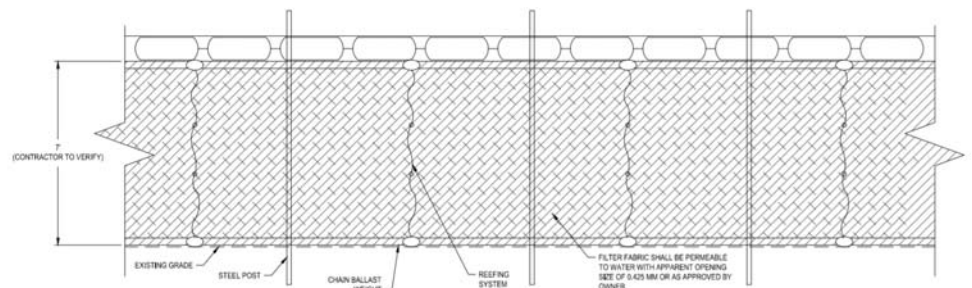
- 30 acres of new shallow sheltered bays
- Environmental dredging—removal of 780,000 cubic yards
- Underwater environmental capping—120 acres (estuary)
- Natural recovery areas—113 acres
- Confined disposal facilities—3 CDFs, all above high-water line
- Improved Unnamed Creek stormwater drainage
- Rehabilitation and/or enhancement of 168 acres of habitat
- Three years to construct



Dredging Areas—Spirit Lake, Duluth, Minnesota



Installation of silt curtain



Example Silt Curtain Drawing



Water quality monitoring

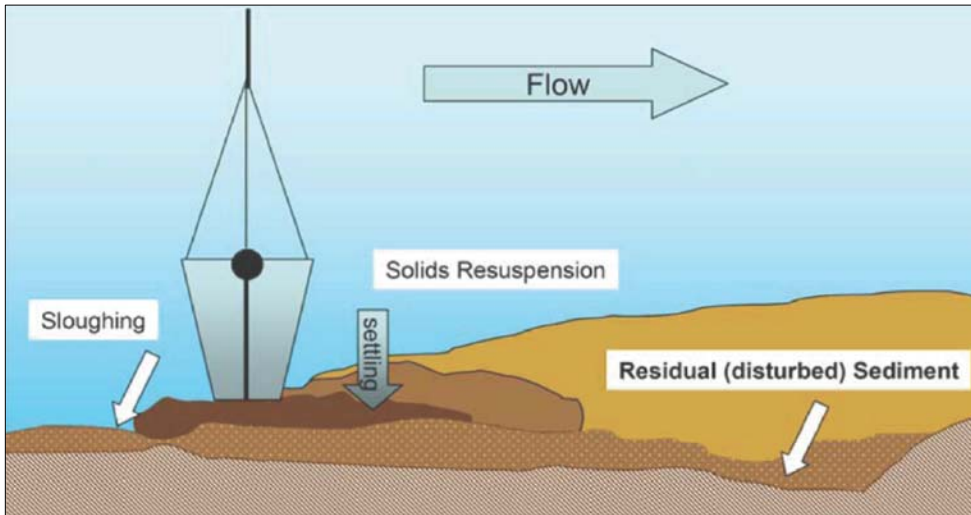


Example silt curtain



Example silt curtain

Mechanical dredging



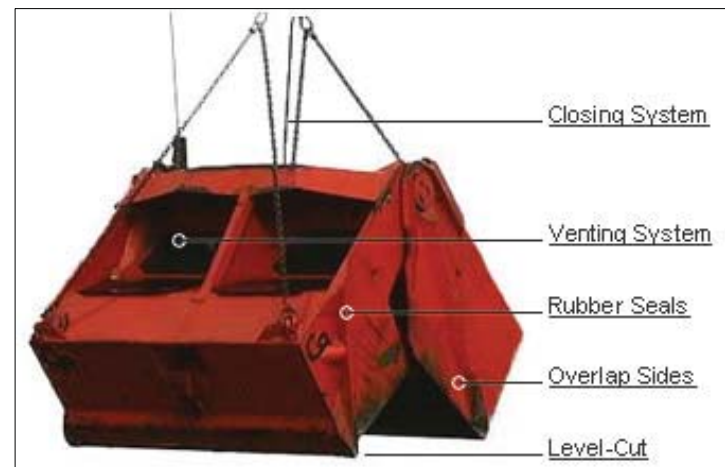
Environmental mechanical dredging process with key considerations.

Design must consider the "4 R's"

- Resuspension of sediment
- Release of chemicals to the environment
- Residual (leftover) impacted sediment
- Risks that must be mitigated or reduced

How dredging works

- Impacted sediment is removed from the environment using one of several methods
 - Mechanical dredging using environmental buckets and special curtains to keep sediments contained
 - Removal using standard construction equipment after diverting water using coffer dams
 - Clamshell buckets and grapples to remove debris
- Sediment is treated with drying agents or allowed to dry naturally for placement in CDFs



Typical features of an environmental bucket that minimize the "4 R's"
(Photo Source: CableArm)

What does dredging look like?



Crane with conventional bucket



Excavator with environmental bucket



Excavation behind coffer dam

Confined Disposal Facilities

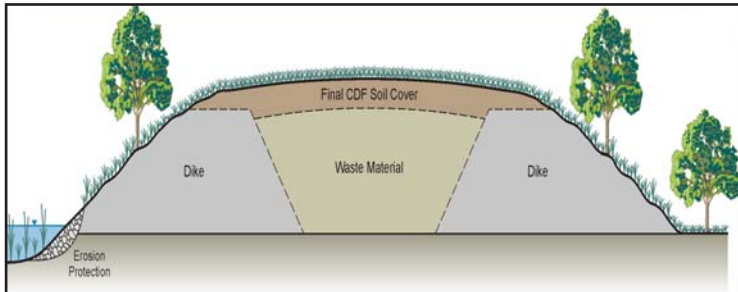


Great Lakes CDF locations

What is a Confined Disposal Facility?

A CDF is a structure designed to contain impacted sediments. CDFs can be constructed on land or adjacent to the water. The clean-up includes three CDFs. Two are adjacent to Unnamed Creek and one is located in the Unnamed Creek delta.

Design Perspective



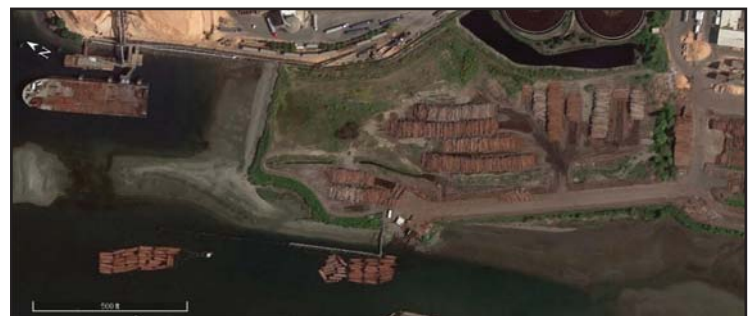
CDF integrating shoreline habitat features



Plantings to promote habitat restoration

Are CDFs Safe? Yes, CDFs are safe.

CDFs have been used throughout the Great Lakes region for over 50 years to manage and dispose of contaminated sediments from Great Lakes harbors. 45 CDFs have been constructed and safely operated in the Great Lakes Region since 1970. Monitoring studies conducted at operating CDFs have shown that CDFs are extremely effective at containing contaminated sediments with minimal risks of contaminant releases.

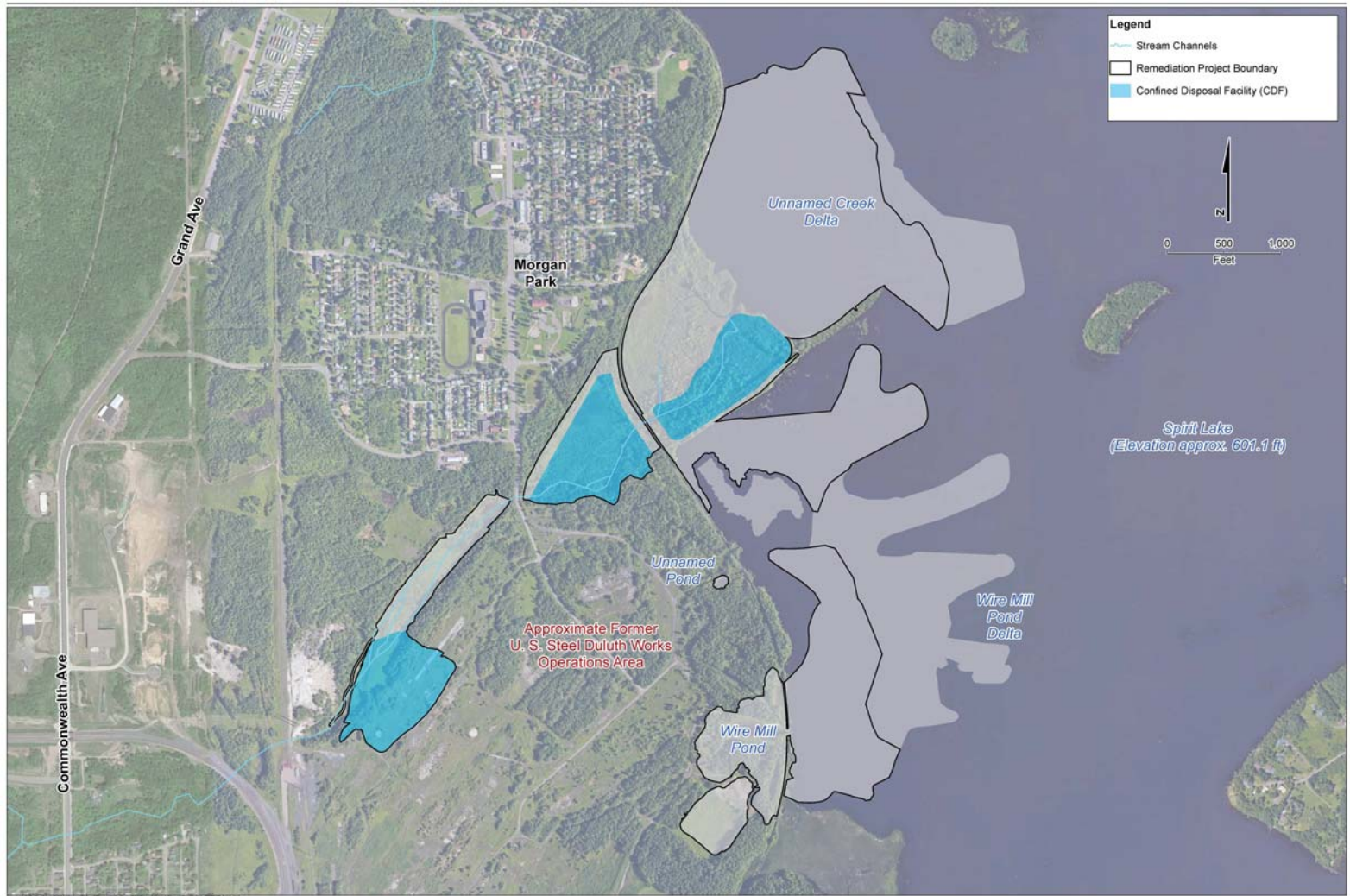


CDF with softened shoreline for habitat development



Berm construction

Confined Disposal Facilities



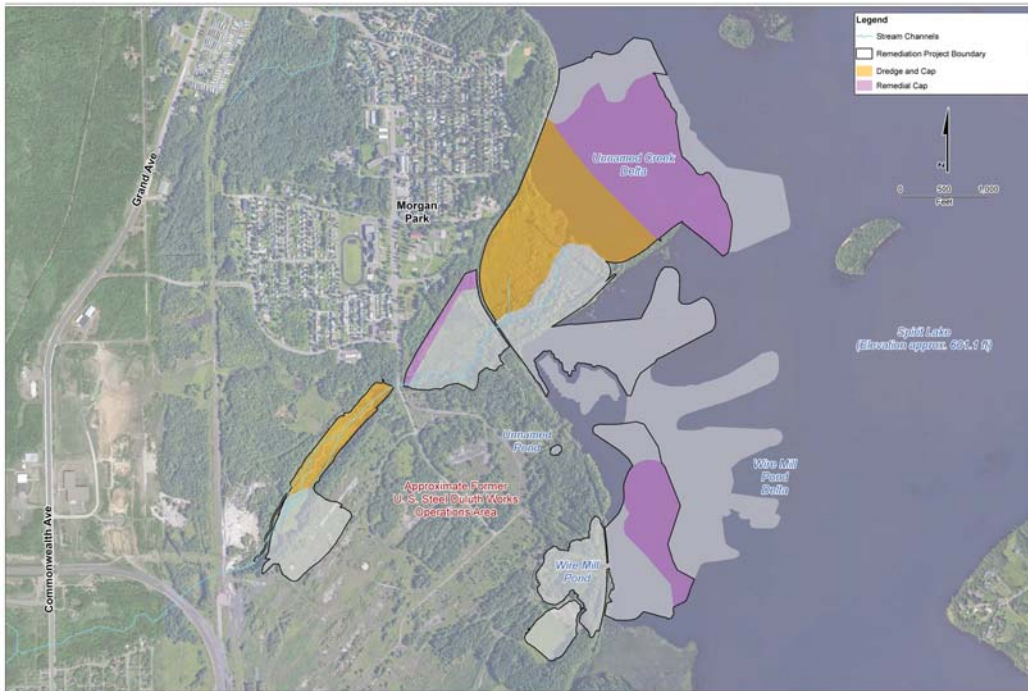
Examples of CDFs



Times Beach CDF in Buffalo, NY



Port of Cleveland CDF (Cleveland Lakefront Nature Preserve)



How do Caps Work?

Underwater caps provide a physical and a chemical barrier to prevent exposure of humans and wildlife to impacted sediment. Caps prevent direct contact with the sediments and reduce movement of chemicals.

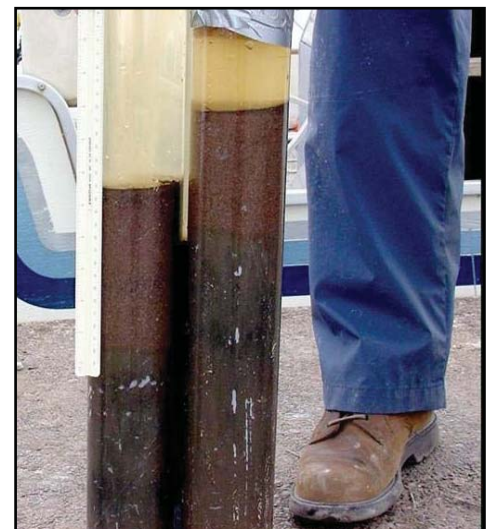
Have Caps Been Used at Other Sites?

Caps have been used throughout the Great Lakes and the U.S. to successfully remediate impacted sediments. They can be one of the most effective ways to immediately reduce exposures to impacted sediments. The Interlake/Duluth Tar site and Duluth Slip 2 project are local examples of successful capping remedies.

Installation Methods



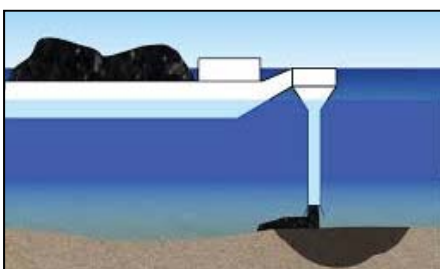
Cap armor along shoreline



Cap thickness verification sampling by coring



Sediment Cap Layers



Example of Cap Placement by Pipeline

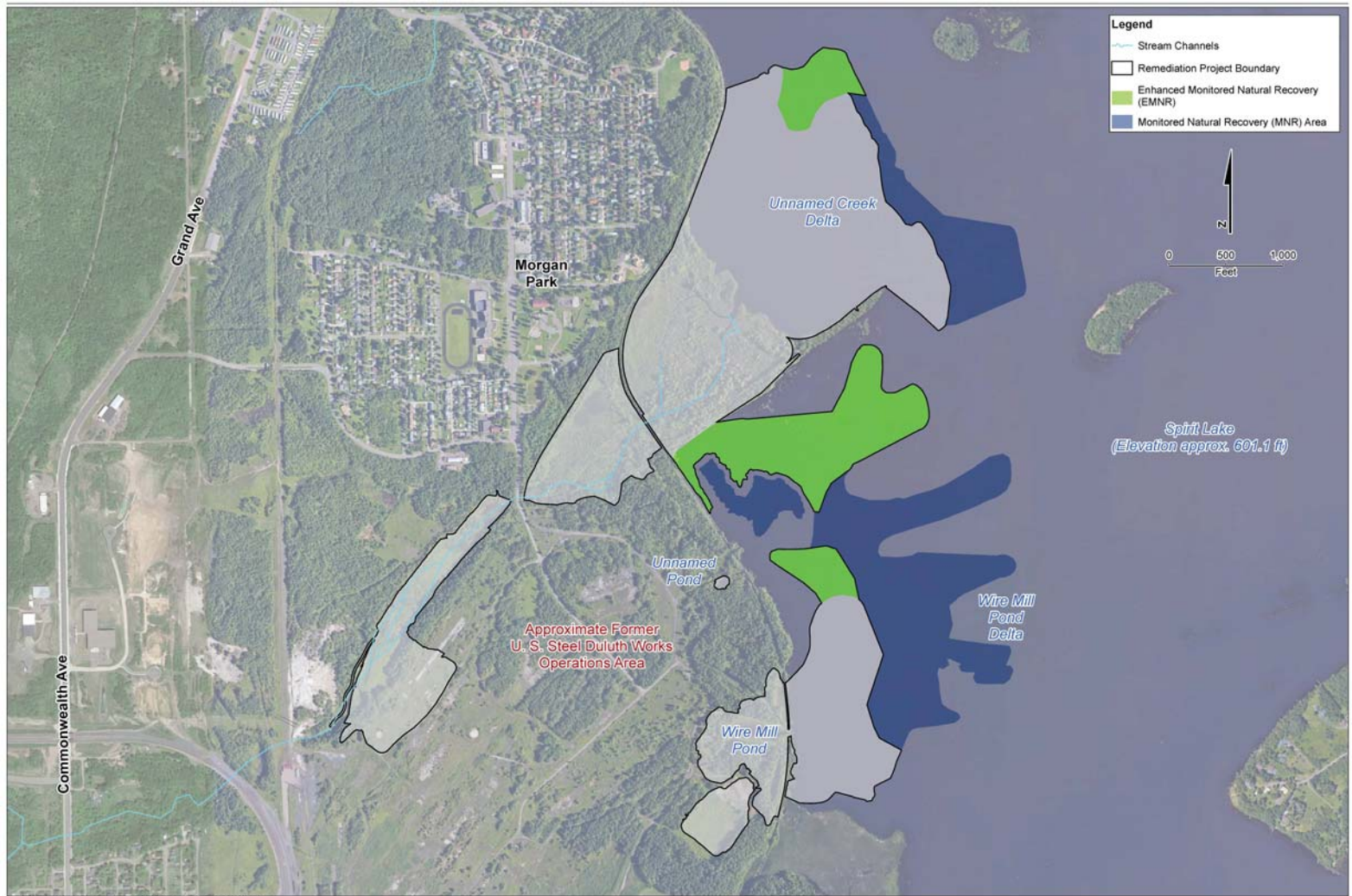


Installing root barrier in cap

How Long Do Caps Last?

Caps are usually designed to last at least 100 years, but modeling indicates they can be effective even longer. MPCA and EPA will require long-term monitoring of the site to verify the capping component of the remedy remains effective.

Natural Recovery



Monitored Natural Recovery (MNR)

Sampling at Spirit Lake shows that clean is naturally covering impacted sediment. Photographs of the sediment layers confirm that clean sediment has buried impacted sediment in many areas. Recovery will be monitored over time.



Spirit Lake sediment photograph

Water

Clean recently deposited sediment

Older impacted sediment

Enhanced Monitored Natural Recovery (EMNR)

Natural recovery can be enhanced by placing a thin layer of 6 inches of clean sand to speed up burial while preserving the plants and wildlife that are present already. EMNR areas will be monitored over time.



Example of EMNR sediment cover

Water

Clean sand cover and clean recently deposited sediment

Older impacted sediment

Habitat Enhancements

Habitat enhancements include potential elements in open-water areas, such as deep-to-shallow-water transitions, shoreline restoration through vegetation establishment, and shallow, sheltered bays. Some habitat enhancement may be part of the remedy construction, other elements may be implemented later. Conceptual examples are illustrated below.



Creating a shallow, sheltered bay allows for emergent vegetation and protected areas where such habitat is currently absent



Restoration of shoreline habitat



An example of a shallow, sheltered water area with emergent vegetation transitioning to a shoreline



An example of a restored shoreline with established vegetation



Shallow, sheltered water helps re-establish emergent vegetation types

Construction will include creation of trails and access to greenspaces along the river, including water access and viewing locations. Conceptual examples are shown below.



Trails with interpretive signs.



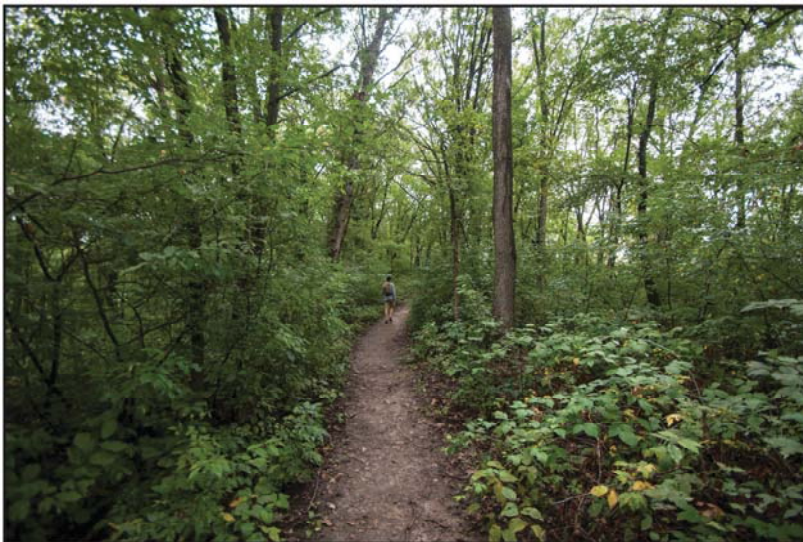
Shoreline access and canoe landing.



Formal Trails



Water viewing/fishing access.



Informal trails.

Remedy Visualization

The following visualizations show what the western shore of Spirit Lake will look like when viewed from Spirit Island once the sediment remediation project is complete.



View from Spirit Island west to the Unnamed Creek delta area



View from Spirit Island west to the Wire Mill delta area