

Remediation of a Former Wastewater Lagoon with a Forested Wetland

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" YOU SMELL AND I MEAN THIS IN A GOOD WAY...
... LIKE A SWAMP . "

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Wetlands Are More Than Just Swamps

Many of us know the true benefits that wetlands provide to both wildlife and human life...but they have the potential to go beyond natural wonders and become vital tools when it comes to environmental remediation efforts

The Superpowers of Plants



Stormwater
Treatment?



Green Contaminant Capping
Solution?

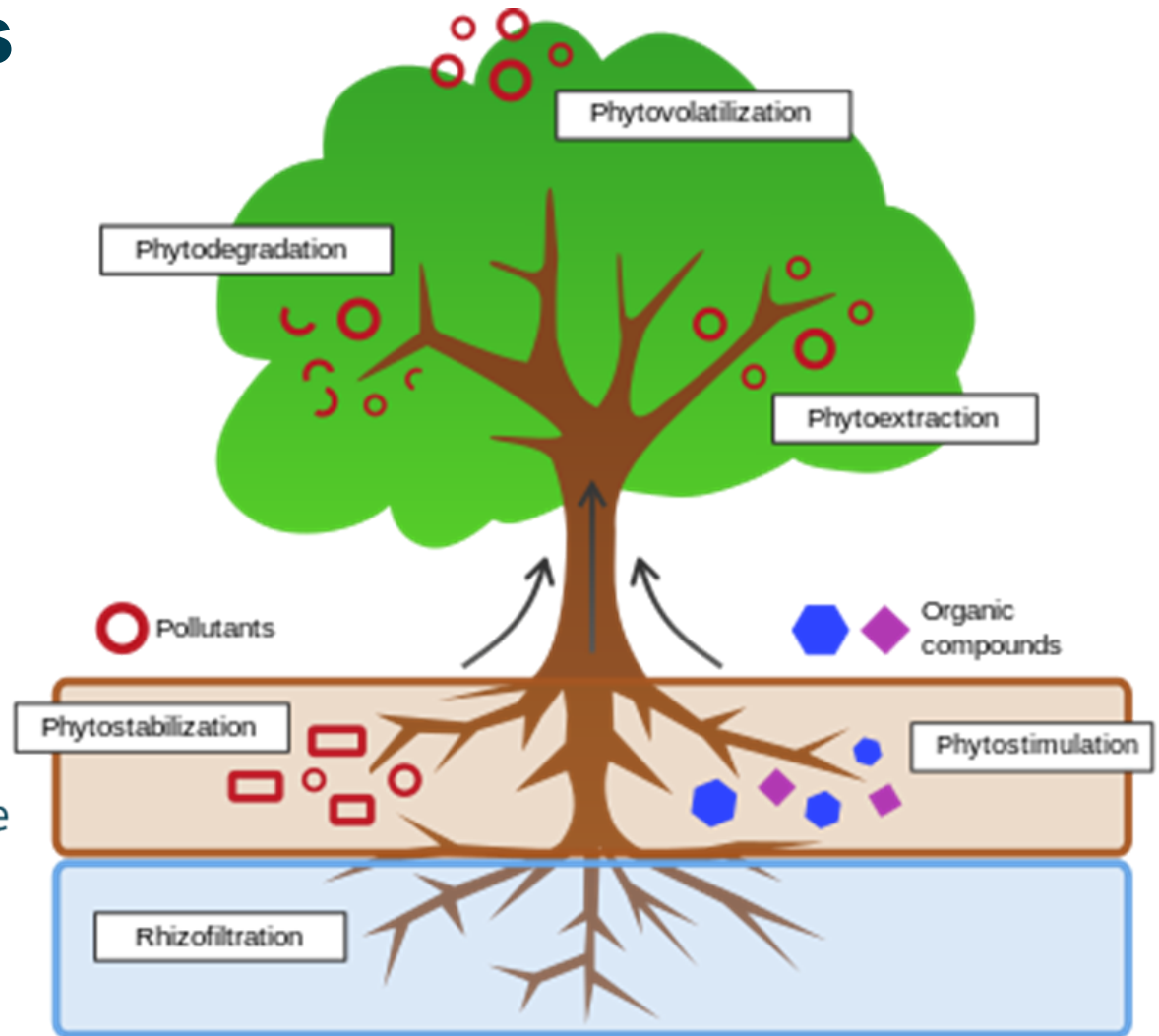


The Superpowers of Plants

We use a wide variety of plants that utilize various methods for dealing with contaminants in soil or stormwater:

Key approaches commonly used in industry are for:

- **Phytostabilization** – Low level soils with big level stormwater problems
- **Phytostimulation** – symbiotic relationship with microbes
- **Phytodegradation** – chemical conversion within the plant tissue
- **Phytoextraction** – grab it and hold on; common method for inorganics



The Regulatory Push For Green Alternatives

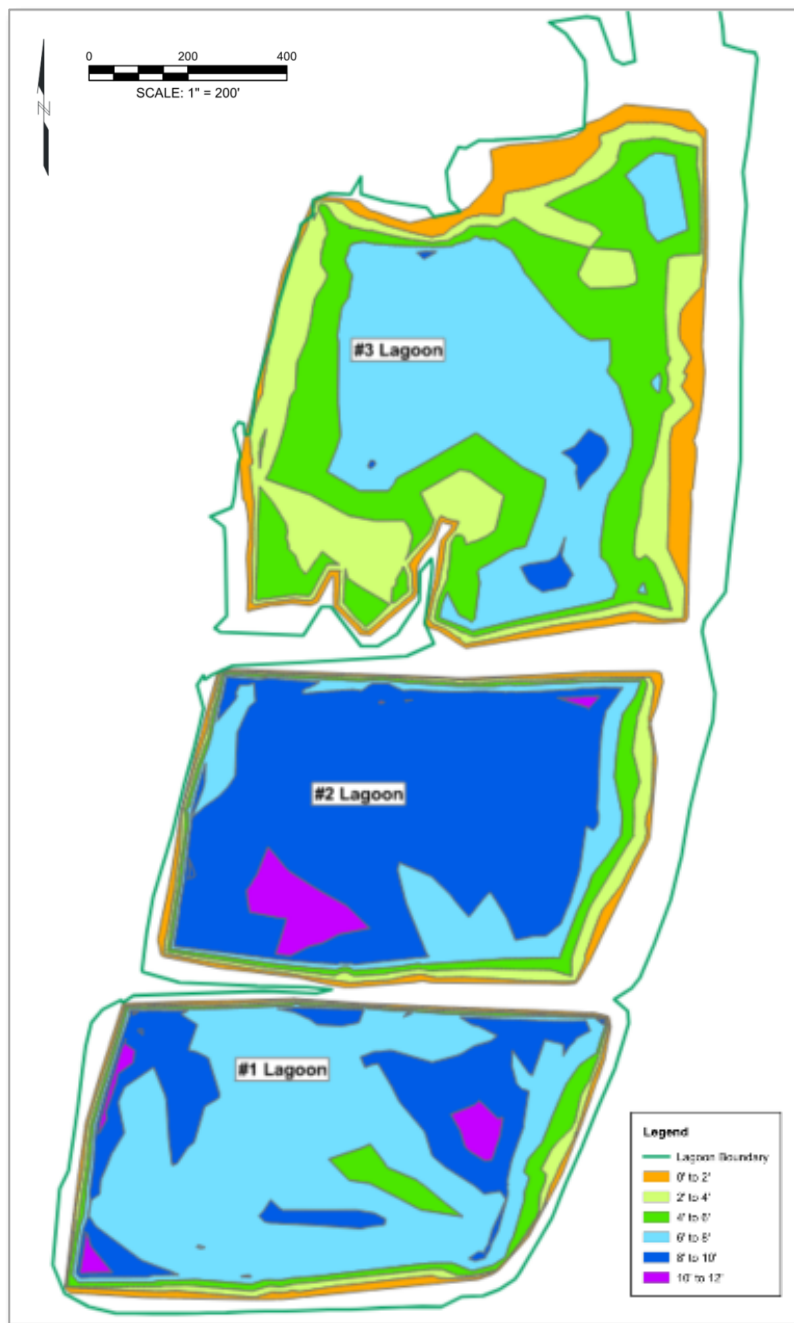
Green and sustainable remediation (GSR) is a regulatory approach that considers environmental, social, and economic factors when remediating a site.

- GSR aims to balance these factors while meeting regulatory objectives, protecting human health and the environment, and reducing the negative effects of cleanup.
- GSR can also aid in buffering the effect of climate volatility on both the site and surrounding areas.
- Provide community and wildlife enhancement





Case Study: Remediation of Historic Wastewater Treatment Lagoons



Some Background

- The three lagoons were investigated to characterize the extent, distribution, and potential for migration of LNAPL impacts
- The investigation concluded that the lagoons were constructed in a competent clay with no hydraulic connectivity to the groundwater.
- LNAPL was observed in sediment for the first two lagoons, but no LNAPL greater than a sheen was observed in the third lagoon.
- Similarly, ebullition-facilitated LNAPL flux (EFT) was consistently observed in the first two lagoons, but only one EFT event was observed in the third lagoon during the investigation.

And the Winner is.....



The characteristics exhibited at #3 Lagoon has made it the perfect candidate for a forested wetland cap

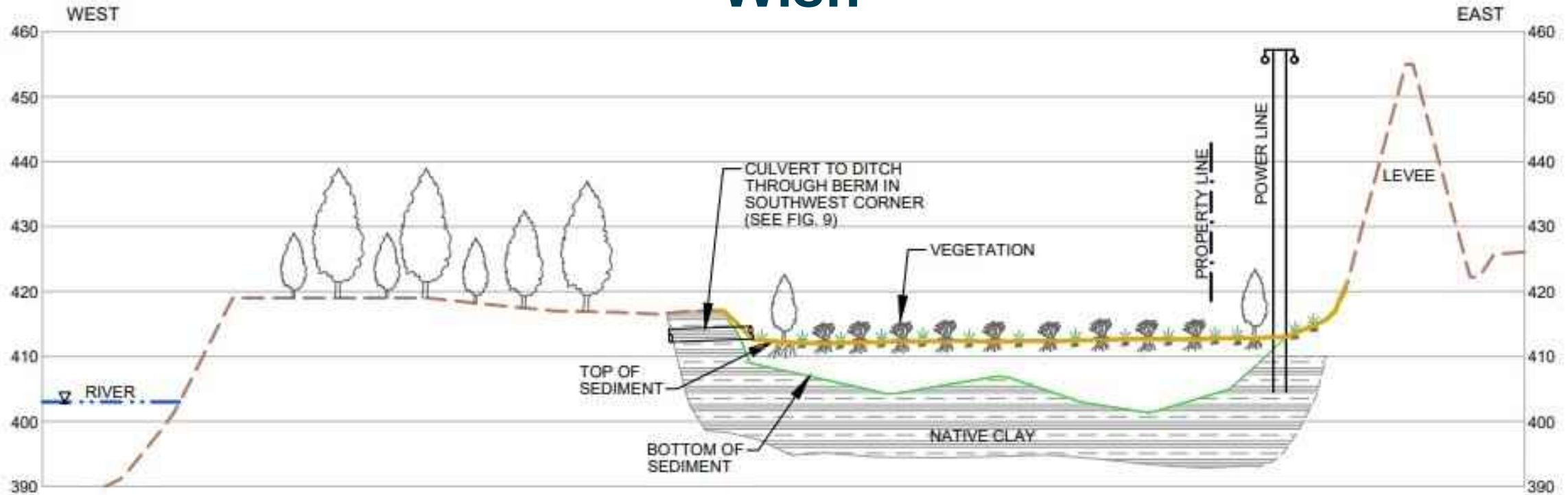
- Limited NAPL is present at only sheen amounts (i.e., not capable of flow)
- The observation of NAPL occurred at a depth (7 to 9 ft bgs) in only one of three boring locations.
- The ebullition rate in the #3 Lagoon was about half of the rate observed in the #1 and #2 Lagoons per June 2020 UAV survey.
- Draining the water would limit methanogenic gas generation and reduce sheen transport.

Why Here?...Why Now?

- The forested wetland remedy will control all potential exposure routes to potential human or ecological receptors.
- More sustainable than alternate engineered remedies such as dredging or subaqueous capping.
- It will consume fewer resources, produce fewer wastes, and be less disruptive to the surrounding community.
- Prevention of erosion and lateral migration of the sediment during rainfall and flooding events.



A Goal Without A Plan Is Just A Wish



The proposed conceptual remedy for the #3 Lagoon is to contain any LNAPL or COPCs by grading the sediment and vegetating the resulting soil.

Drying Out the Lagoon

This approach will allow #3 Lagoon to “dry out” with the installation of a flow-controlled discharge system and managing as a wetland.

During each future flood event, it is anticipated that the lagoon will further be filled in with new depositional sediments. Over time, the vegetation will transition from wetland plants and shrubs to trees.



Existing
Conditions



Proposed Design

Time to Showoff the Green Thumb



Following drying/grading, the following planting plan would be implemented:

- Greenhouse study in 2021 showed soil preference for graminoids (grasses) over forbs (flowering plants).
- Apply a forested wetland seed mix (31 species) favoring graminoids with a minor forb component.
- Planting of bare root trees (400 trees per acre) and native plugs (300 plugs per acre)
- Tree species to include (but not limited to) sycamore, red maple, silver maple, river birch and black willow

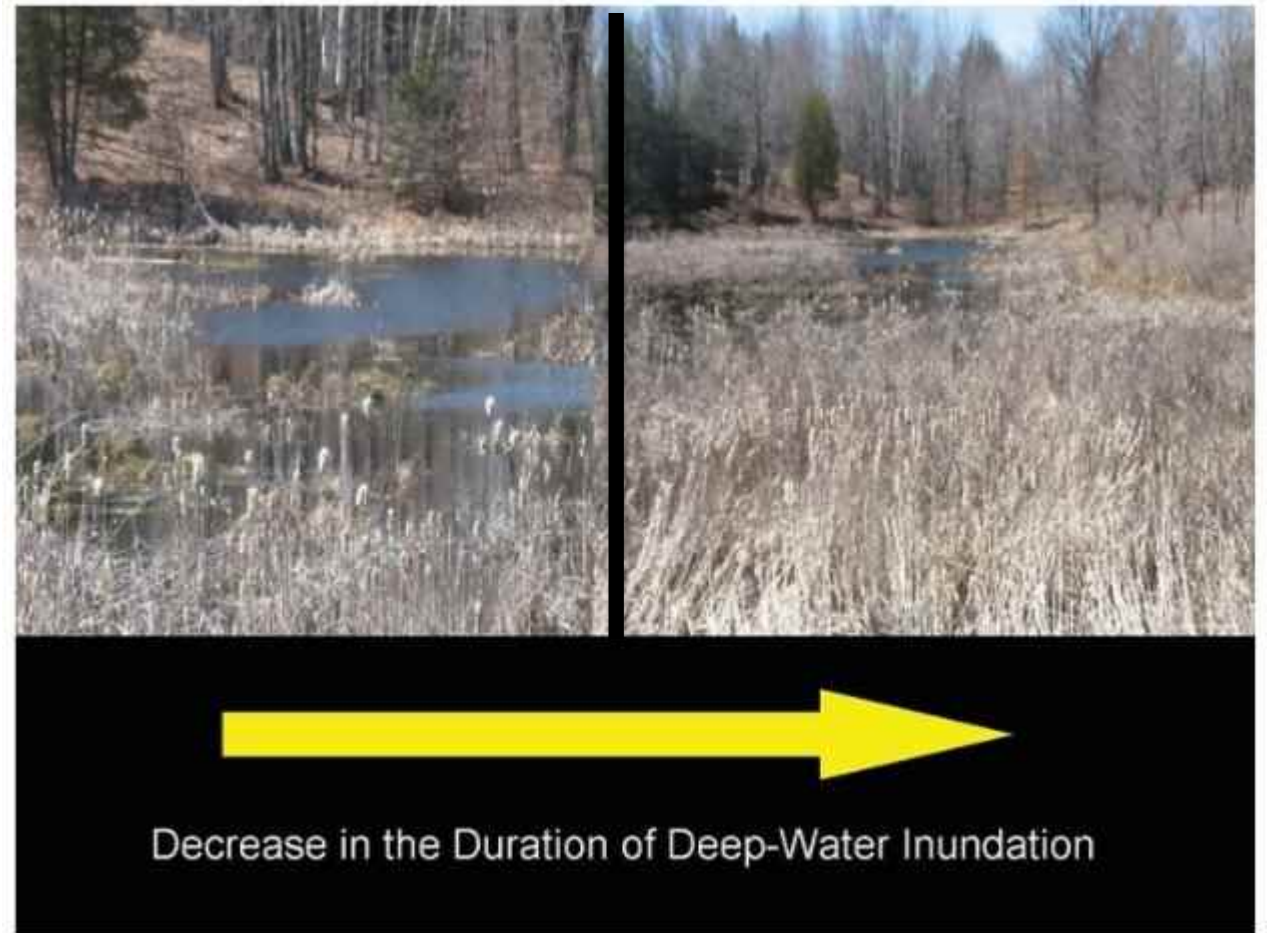


Let Nature Do the Work

Over time a floodplain forest will be established

The benefits of this design:

- Consolidates and maintains the upper layer of clean sediment
- Reduces or eliminates standing water.
- Enhances natural processes that degrade and eliminate impacts in the deeper sediments.



Erosion Control



Avena sativa



Lagoon → Forested Wetland

- The following measures will be implemented to aid in the wetland transition:
- Following seeding, erosion control materials (including erosion control blankets where necessary) will be installed to protect and stabilize bare soil while vegetation is establishing.
- Two growing seasons of maintenance including: watering, trimming, replanting, and invasive species treatments
- A cover crop of annual seed oats (*Avena sativa*) and annual rye (*Lolium multiflorum*) will be applied to provide early coverage while the slower growing native species become established.

Caps with Benefits



Carolina wren



pileated
woodpecker



wood duck



yellow billed
cockoo



great crested
flycatcher



lesser swamp
warbler



prothonotary
warbler



American
goldfinch



red shouldered
night hawk



black-crowned
night heron



eastern
kingbird



great egret



common
yellowthroat



tree swallow

Approach

Convert all sediment to soil.

Intent

No exposed sediment or standing surface water.

Closure

Demonstrated via site-specific closure metrics

The ReCap



Lagoon 3: Forested Wetland

**“Being afraid of
things going wrong
isn’t the way to
make things go
right”**

So what could possibly go
wrong....

Avian Species and Habitat



Carolina wren



pileated
woodpecker



wood duck



yellow billed
cockoo



great crested
flycatcher



lesser swamp
warbler



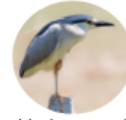
prothonotary
warbler



American
goldfinch



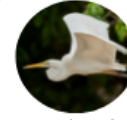
red shouldered
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black-crowned
night heron



eastern
kingbird



great egret



common
yellowthroat



tree swallow

QUESTIONS

Plant Species Diversity



sawtooth sunflower



rice cut grass



boneset



wild bergamont



golden Alexanders



mountain mint



blue vervain