Dakota County Soil & Water Conservation District

IRON ENHANCED SAND FILTER PROJECTS

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Long Lake

Brief Site Overview

- 84 Acres Direct Drainage to EVR-p13
- 10,000 ft² Available

Seidls Lake

Brief Site Overview

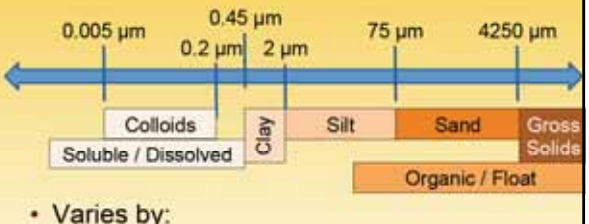
- 15.5 Acres Direct Drainage to Seidls Lake
- 5,000 ft² Available

Jensen Lake

Brief Site Overview

- .84 Acres Direct Drainage to Jensen Lake
- 2,000 ft² Available

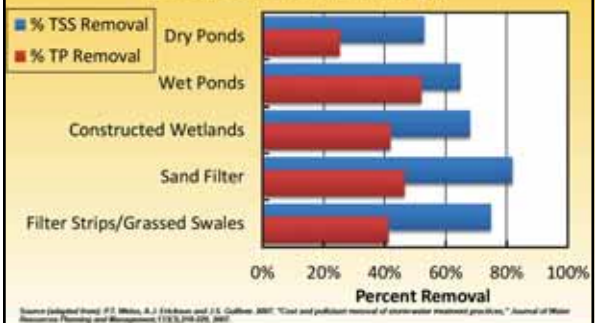
Pollutant Spectrum



- Varies by:
  - Pollutant
  - Location in management system

St. Anthony Falls Laboratory
University of Minnesota

Current Treatment Practices Are Not Good Enough

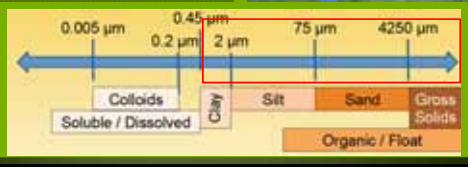


St. Anthony Falls Laboratory
University of Minnesota

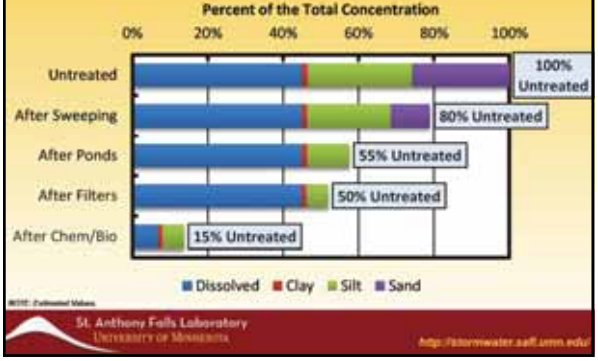
Stormwater Pollutants

Maximizing Cost/Benefit

Why Integrate Enhanced Filters Into Bioretention?



Treatment Train



Bio Pollutant Removal

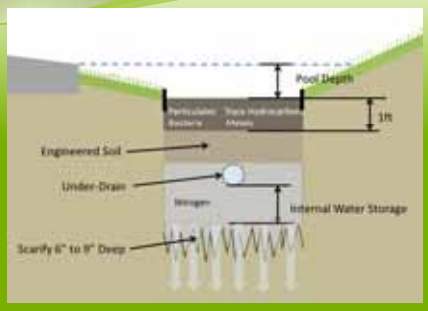
Processing of Pollutant in Bioretention Cells

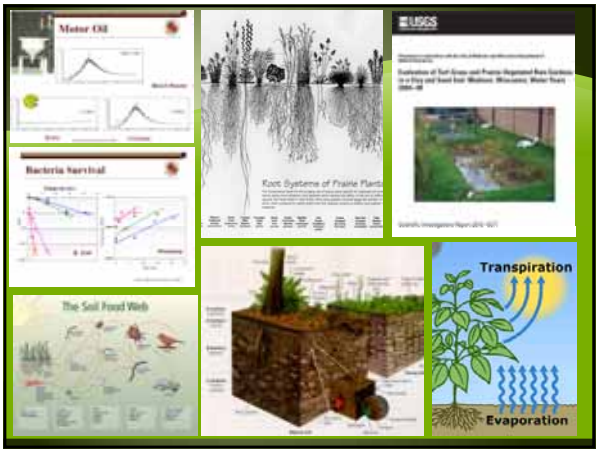
Treatment Priorties

1. Good House Keeping
2. Pretreatment
3. Infiltration
4. Bio Treatment
5. Enhanced Treatment

Bio Pollutant Removal

Processing of Pollutant in Bioretention Cells





Enhanced Reactive Filter

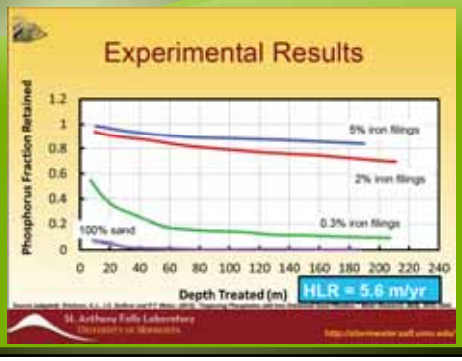
Iron Enhanced Sand Filter

1. Good House Keeping
2. Pretreatment
3. Infiltration
4. Bio Treatment
5. Enhanced Treatment

Potential 85% Total Concentration Reduction !

Enhanced Reactive Filter

Iron Enhanced Sand Filter



Enhanced Reactive Filter

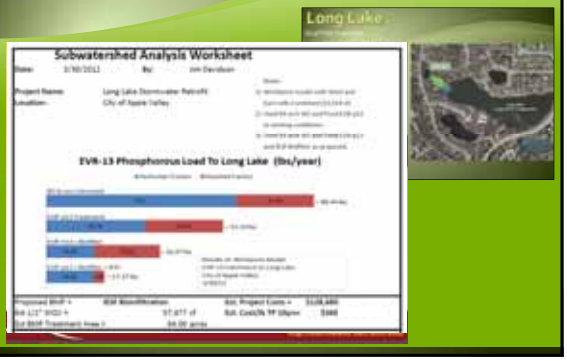
Iron Enhanced Sand Filter

Enhanced Reactive Filter

Iron Enhanced Sand Filter

Predesign Considerations

Long Lake

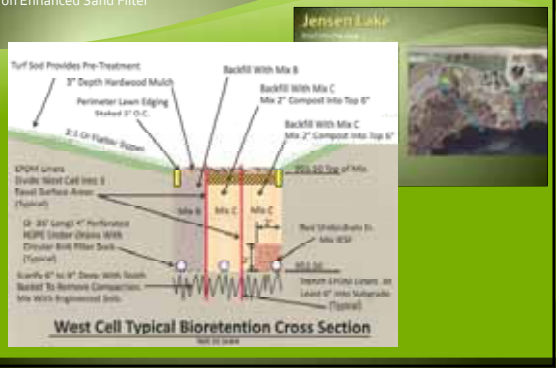


Predesign Considerations

Seidls Lake

Predesign Considerations

Iron Enhanced Sand Filter

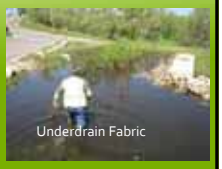


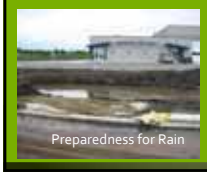
Lessons Learned from Failures

"*Failure* is simply an opportunity to begin again, this time more intelligently.- H. Ford


Engineered Soil Mix


Cowboy Contractors


Underdrain Fabric


Preparedness for Rain


Seeding and Compost


Construction Sequencing

Applying Lessons Learned

"*Failure* is simply an opportunity to begin again, this time more intelligently.- H. Ford

A Testament To The Sensitivity of Designing, Building and Maintaining Water Quality Systems with a Functional Life of 20+ Years

Dakota County LID Standards

www.dakotaswcd.org

Key Design Considerations

Pretreatment- Mechanical Removal of Large Particles

Long Lake Pretreatment

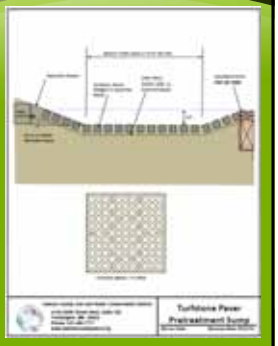
Existing Small Pond

Key Design Considerations

Pretreatment- Mechanical Removal of Large Particles

Siedls Lake

- Large Pretreatment Cell



Key Design Considerations for IESF

Avoiding Anoxic Conditions

Sizing

How Much IESF Do you Need for Your Catchment?

Andy Erickson, University of Minnesota, Saint Anthony Falls Laboratory


Not Actually Andy

Key Design Considerations for IESF

Mixture Ratios

- 5% Iron filings added to C-33 washed sand by weight
- Too much iron content forms a "brick" when it rusts

Key Design Considerations for IESF

Avoiding Anoxic Conditions

Iron Sand Mixture Needs to be aerobic: air needs to reach the filter media between rain events)

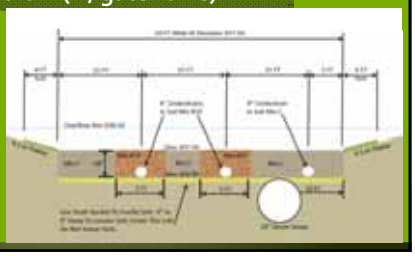
Perforated under-drains shall be slotted single wall HDPE with **circular knit polymeric filament filter sock per ASTM D6707-01.**

Perforated PVC and/or MnDot 3733 Type I sewn seam non-woven fabric has clogged

Key Design Considerations for IESF

Considerations Long Term Functionality

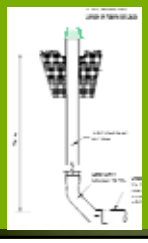
- Siedls Lake
- IESF is Exposed to the Air
- Extra Underdrain (w/ gate valve)



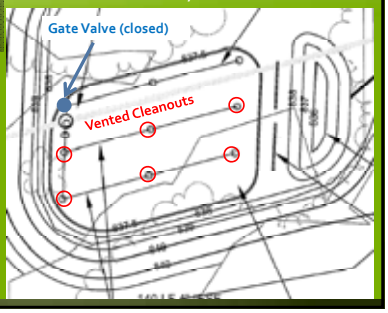
Key Design Considerations for IESF

Avoiding Anoxic Conditions

Incorporated Multiple Vents to All Systems



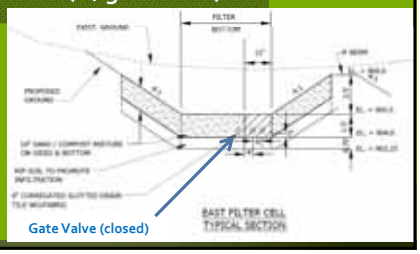
Thanks for the Advice Dwayne!



Key Design Considerations for IESF

Considerations Long Term Functionality

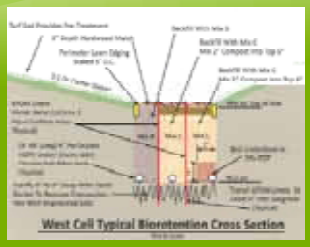
- Long Lake
- IESF is Exposed to Air
- Extra Underdrain (w/ gate valve)



Key Design Considerations for IESF

Key Considerations Long Term Functionality

- Jensen Lake
- Buried Filter to Test Resilience



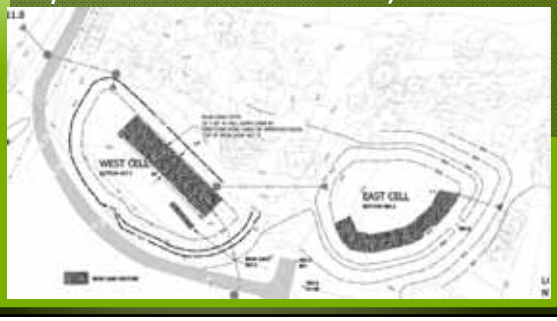
Key Design Considerations

Key Considerations Long Term Functionality and Maintenance

- Underdrain Gate Valves

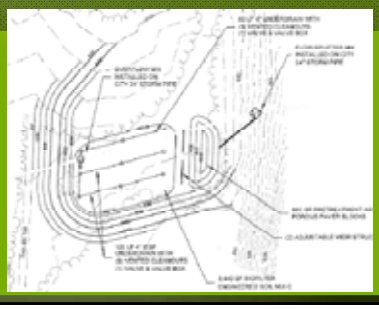
Long Lake

- 84 Acres Direct Drainage to EVR-p13
- 8,600 ft² Biofiltration Cells with 2700ft² IESF



Seidls Lake

- 15.5 Acres
- 3,400 ft² Biofiltration Cell with 480 ft² IESF



Cost

- Long Lake
  - Total Construction $124, 300
  - Iron 15 tons for $21,000
- Siedls
  - Total Construction $68, 700
  - Iron Sand Mixture 24 yd³ for $6,480

Construction Specifications

Key Components for Successful Installation

Sample and Field Control the Quality of Materials BEFORE Delivery

Is This Really Washed Sand and Compost ?

Which Sand is Washed?

Construction Considerations

Key Components for Successful Installation

- $21,000 of Iron Could Rust Into a Brick if Exposed to Moisture

Iron Enhanced Sand

Mixing

- DIY Mixing Process
  - 57,000 lbs of low moisture sand
  - 3,000 lb bag of iron
- Tools
  - Front End Loader With a Scale.
- Process
  - Loaded a Truck
  - Weighed the Loaded Truck
  - Dumped in the Mixing Pile

Iron Enhanced Sand

Mixing

- DIY Mixing Process
- Goal
  - Iron Evenly Mixed in the Sand. No Streaking
- Process
  - Mixed on a bituminous pad at the Fisher wash plant
  - Pad was swept and washed prior to mixing
- Trial and Error process.

Iron Enhanced Sand

Mixing

- Plaisted Mixes Using an AccuBlender

Construction Specifications

Excavation

Install in dry soil conditions

Use backhoe or excavator with a tooth bucket

Construction Specifications

Materials Handling

Use excavator bucket to place materials. Leveling and final grading within the cell must be completed by hand.

Installation

Long Lake

Clearing and Grubbing

Materials Delivery

Installation

Long Lake

Installation

Long Lake

Installation

Long Lake

Installation

Long Lake

Final Stabilization

Long Lake

Installation

Seidls Lake

Installation

Seidls Lake

Installation

Seidls Lake

Installation

Seidls Lake

Installation

Seidls Lake

Installation

Seidls Lake

Final Stabilization

Seidls Lake

Note: Vents are now cut off at 18" above the surface of the cell

Final Stabilization

Jensen Lake

Dakota County Soil & Water Conservation District

Thank You!

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