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MIDS Credits: Iron-Enhanced Sand Filters

MIDS Work Group

March 15, 2013

p-gen3-15a

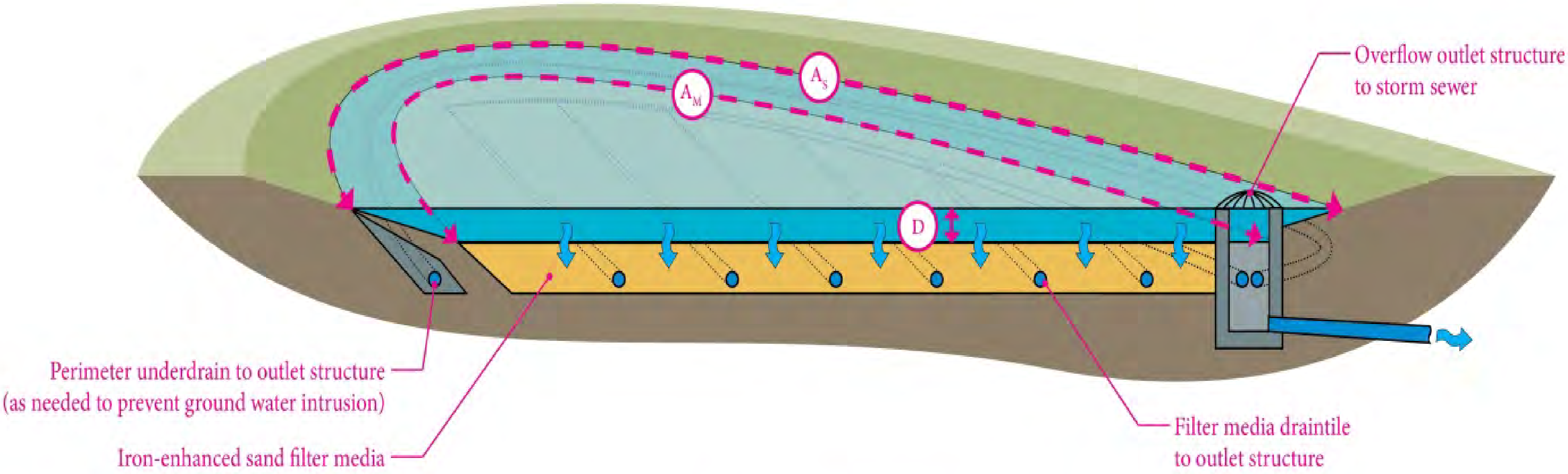
Draft Document

- Iron-enhanced sand filter basin
- Iron-enhanced sand filter bench in wet ponds
- ~~Iron-enhanced check dam in swales~~

Iron-Enhanced Sand Filter Basin

Iron-enhanced sand filter basin, Maplewood, MN.
Photo courtesy of Brian Huser.

Iron-Enhanced Sand Filter Basin



Iron Enhanced Sand Filter Basin

Iron-Enhanced Sand Filter Bench in Wet Pond

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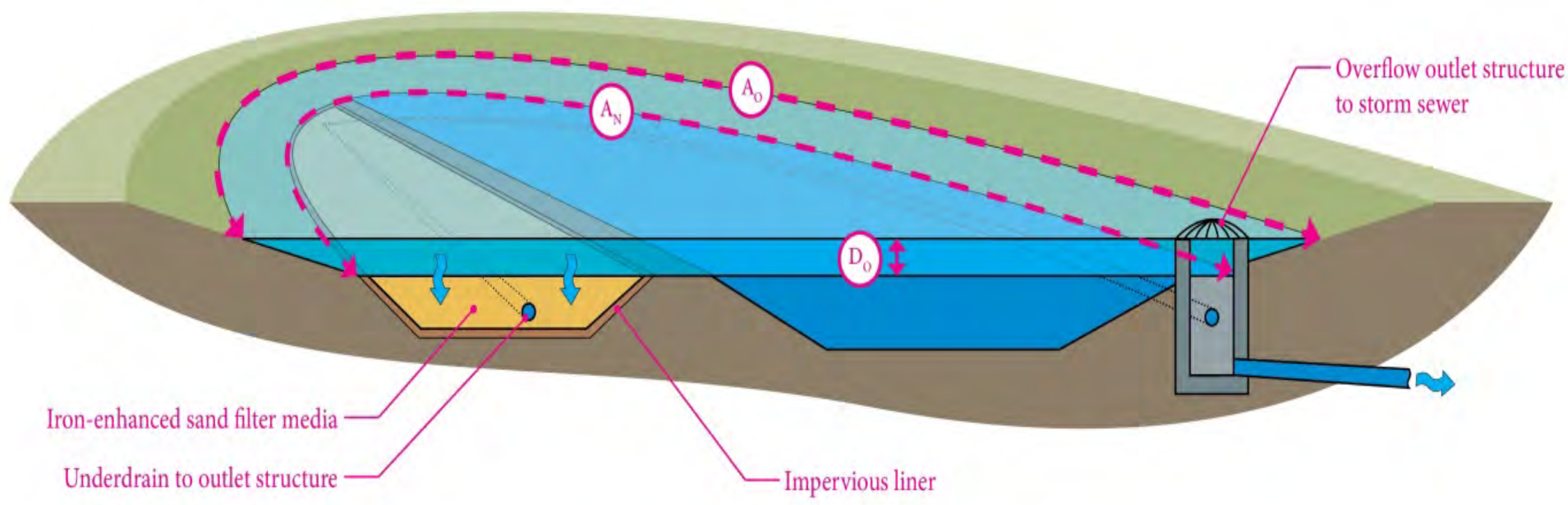
Iron-enhanced sand bench, Prior Lake, MN. Photo courtesy of Ross Bintner.

Iron-Enhanced Sand Filter Bench in Wet Pond



Iron Enhanced Sand Filter Bench in Wet Pond

General Design Criteria

- Iron must be elemental iron to enable it to gradually rust and convert to a form that can react with stormwater constituents.

General Design Criteria

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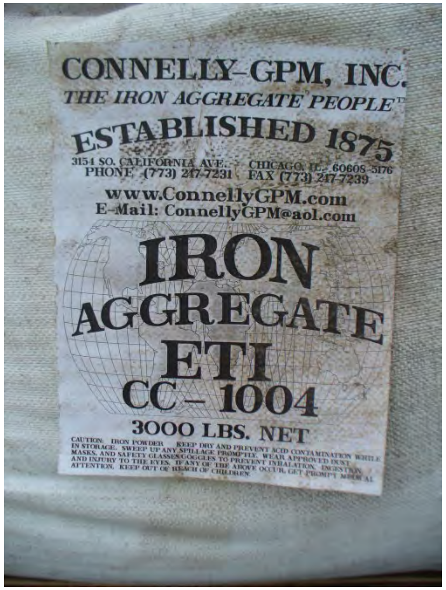
- Finely ground cast iron recycled from scrap iron is the source and form of iron typically used in full scale systems in MN



Photos: Barr Engineering Company

General Design Criteria

- Pre-treatment is required
- Water quality sizing for filtration applicable to iron-enhanced sand filters
- Iron[1] by weight 5-8% of iron-sand mixture
- Iron and sand need to be well mixed
- Filter draw down within 48 hours of storm completion to avoid filter fouling and to prepare the filter for next storm event

1 Several caveats in draft document

General Design Criteria

- Drains[1] needed to allow aeration of filter bed between storm events
- The outlet of these drains should be exposed to the atmosphere and above the downstream high water level to allow the filter to fully drain
- Head (top of filter to outlet invert) of 2-6 feet recommended depending upon application

1 Several caveats in draft document

Benefits

- Removal of some colloidal and dissolved constituents including color, metals, and phosphates
- High pollutant removal rates
- Use as a retrofit for existing ponds, swales, and other stormwater BMPs
- Good for nutrient-impaired waters
- Could be used at sites with certain types of restrictions where infiltration is not appropriate or feasible

Limitations/Concerns

- New technology with limited performance history
- Lifespan of iron-enhanced filtration practice potentially reduced by clogging or iron loss
  - Disposal of the iron-sand bed material will be required when the iron is consumed
- Iron-sand filtration offers limited water quantity control
- Head required for treatment and draw down of filter between storms
- Tailwater effects may restrict siting of filters

Credits
Annual percent reduction in dissolved phosphorus

3 Steps:

1. Calculate the amount of water that the BMP is capable of treating
2. Use P8 modeling results to convert the treatment volume into a percent annual runoff volume treated by the BMP
3. Calculate the percent reduction in dissolved phosphorus for all of the water routed to the BMP

Credits

- Currently, assuming 60% reduction in dissolved phosphorus
- Based on very limited data of 38% to >80% removal
  - Remember, “Big Question” from several presentations in late-2011and early-2012

Big Question:

Only non-infiltration, volume control BMPs and BMPs that manage dissolved phosphorus can achieve similar treatment results on sites with restrictions.

Is requiring these BMPs prudent and feasible?

Yes

- Performance goal for sites with restrictions: "provide equivalent TP removal"

No

- How much treatment is enough?

Flexible Treatment Options

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- **1.1-inch Volume Reduction**
- **Alternative #1**
  - Achieve at least 0.55” volume reduction goal, and
  - Remove 75% of the annual TP load, and…
- **Alternative #2**
  - Achieve volume reduction to the maximum extent practicable (as determined by the Local Authority), and
  - Remove 75% of the annual TP load, and….
- **Off-site Considerations**

Big Question Revisited

- Is 75% reduction of annual TP load prudent and feasible?
- 55% TP is particulate; 45% is dissolved

Only non-infiltration, volume control BMPs and BMPs that manage dissolved phosphorus can achieve similar treatment results on sites with restrictions.

- *Knowing there is limited data on iron-enhanced filter performance and operating life in real world situations, are we comfortable including it in the calculator?*