

Post Construction Best Management Practices (BMPs)

Presented By:
Ohio Department of Transportation
Central Office

Thursday, August 28, 2003

Speaker:

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Background Information:

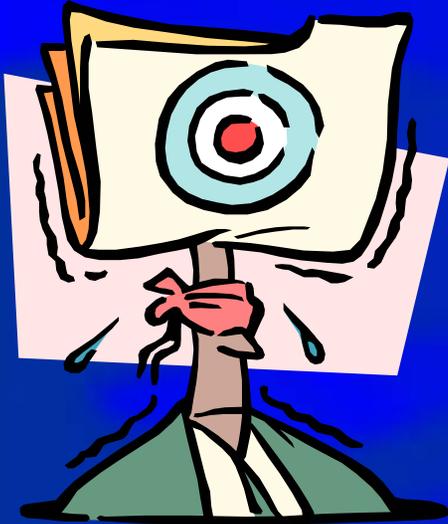
- The Ohio EPA dropped the bomb with the NPDES General Construction Permit.



Requirements from the Ohio EPA:

- Projects with earth disturbance between 1.0 to 5.0 acres require post construction water quality treatment.
- Projects with earth disturbance greater than 5.0 acres require post construction water quality and quantity treatment.
- Rehabilitation projects that disturb 5 acres or more shall be designed to provide treatment of 20% of the total Water Quality Volume (WQv).

Department Reactions



- We researched other State DOT's Storm Water Manuals.
 - California - *Caltrans Storm Water Quality Handbooks, Project Planning and Design Guide*, September 2002.
(<http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm>)
 - New York - *New York State Stormwater Management Design Manual*, October 2001.
(<http://www.dec.state.ny.us/website/dow/swma/wmanual/swmanual.html>)
 - Maryland – *Maryland Storm Water Design Manual*, October 2000
(http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.asp)

Department Reactions cont'

- We researched FHWA Ultra Urban BMP webpage.
(<http://www.fhwa.dot.gov/environment/ultraurb/index.htm>)
- We negotiated with the OEPA to grant us 3 years to be fully implemented.
- Got to work creating draft versions, getting comments, and revising!



WQv equation:

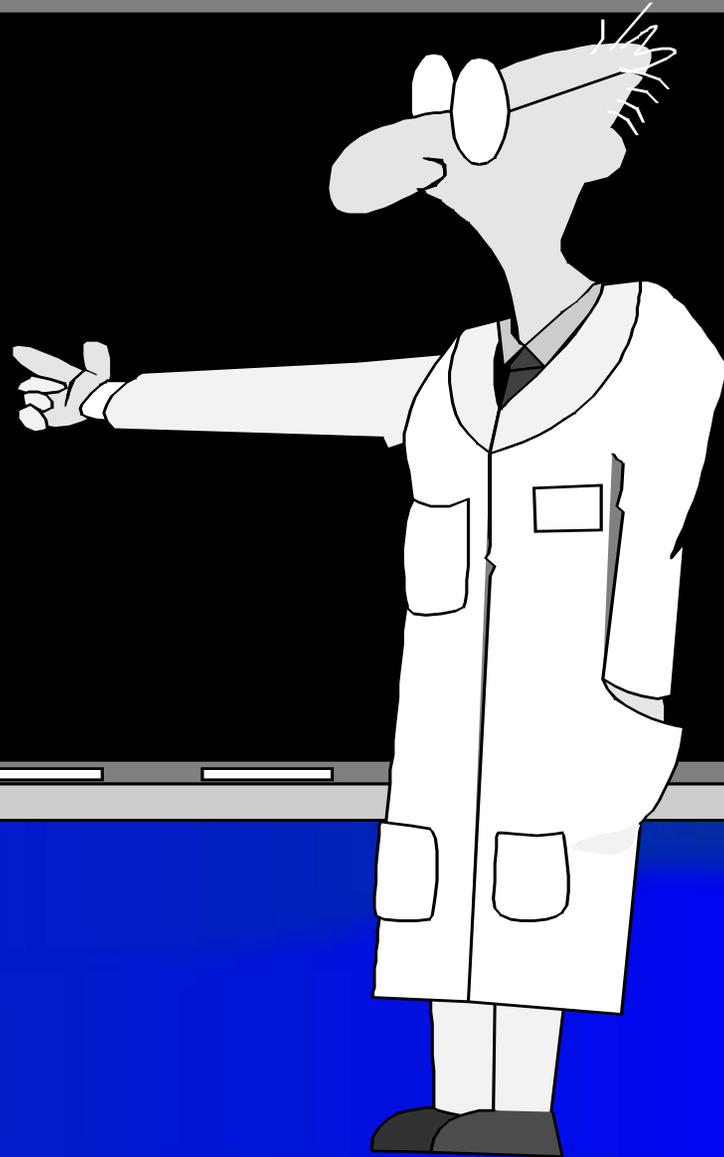
$$WQv = 1.2 * P * C * \frac{A}{12}$$

P=0.75 inch Precipitation depth
(regression constant x 90% of the
average annual precipitation depth=
1.5 x 0.5 inches)

$$C = 0.858i^3 - 0.781i^2 + 0.774i + 0.04$$

Where **i**= Impervious ratio (ODOT
pavement area / all other area)

A= Area in Acres

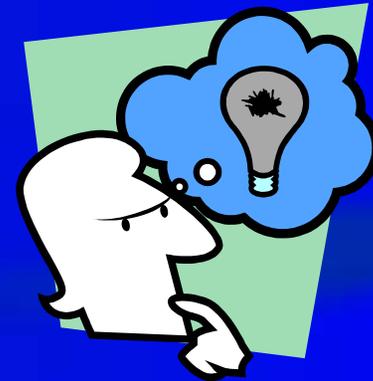


Water quality flow (WQf):

- Another term was defined by the Department to be used for filtration type BMPs that do not use WQv as a parameter: Water Quality Flow (WQf).
- Defined as the storm that creates an approximate precipitation of 0.5 inches (90% of the average annual storm water runoff depth).
- For Ohio, it was determined to be approximately the 2-year, 180 minute duration storm as calculated by the Rational Equation.

Structural BMPs Considered:

- To meet the criteria, we considered the following BMPs :
 - Vegetated Swales and Strips
 - Infiltration Basins
 - Infiltration Trenches
 - Extended Detention (dry ponds)
 - Above ground detention ponds
 - Below ground detention



Structural BMPs Cont':

- Retention Basins (wet ponds)
- Constructed Wetlands
- Biofilters
- Manufactured Systems
- Alternative Methods

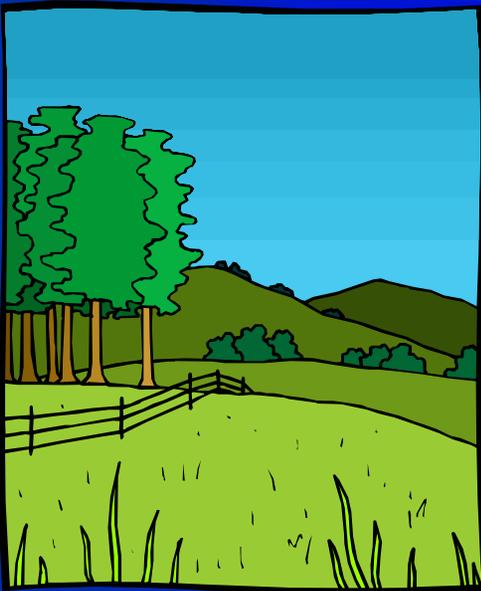
BMP Feasibility:

- Negotiated with the OEPA to agree on feasibility thresholds. Selected BMPs shall be:
 - Technically feasible.
 - Implemented within the highway right-of-way.
 - Safe for the travelling public and ODOT personnel.
 - Considered a drainage structure necessary for positive drainage.
 - Compliant with any Federal, State, or Local Laws.
 - Cost effective as compared to their benefit.

BMP Feasibility Cont':

- Presented threshold values for Post Construction Storm Water Management Controls to the OEPA.
- BMP's will be used for projects that meet any of the following:
 - Impervious surface width must be greater than 60 feet
 - More than 80 percent of the drained area is discharged through a storm sewer system.
 - Project is located within a MS4, Phase II regulated area.
 - ADT is 30,000 or greater and roadway is classified as Rural.

Vegetated Swales and Strips



Swale and Strip Overview:

- Treats storm water through the interaction of vegetation and suspended solids.
- Can be used exclusively or used as pretreatment to additional BMPs.
- Designed using WQf.



Polaris Parkway, Westerville, Ohio – Ohio Department of Transportation

Swale and Strip Design Criteria:

- Preferred slope of less than 2% with a maximum being 5%
- Flow velocity is limited to a maximum of 1.0 ft/sec.
- Healthy vegetation is mandatory (minimum of 6 inches of height).

Vegetated Swales:



Photo - Billingsly Road, Ohio - Courtesy of Ohio Department of Natural Resources



Photo- Courtesy of Ohio Department of Natural Resources

Vegetated Strips:



Photo – Courtesy of CALTRANS



Infiltration Techniques

Infiltration Overview:

- Treat storm water through a filtering substrate (sand, gravel, or soil).
- Discharges into the ground water.
- Requires the correct soils and geology to ensure success.
- Designed using the Water Quality Volume.
- Two primary techniques considered:
 - Infiltration Basin – Open surfaced pond with infiltration as an outlet. (Not considered feasible for WQv less than 0.1 Ac-ft)
 - Infiltration Trench – Excavated trench with a porous backfill such as gravel or sand.

Infiltration Design Criteria:

- Soil infiltration must be greater than 0.5 in/hr and less than 2.4 in/hr.
- Soils must have less than 30% clay or 40% of clay and silt combined.
- The invert of the structure must be 4 feet above the water table and any impervious or rock layer.
- Pretreatment (stilling basins, filter strips, etc.) should be used to remove large debris, trash, and sediment.

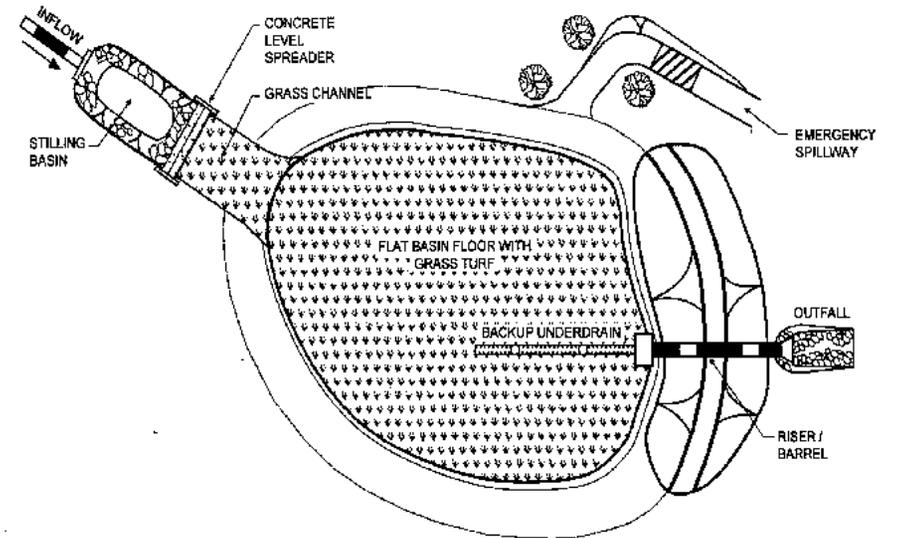
Infiltration Design Criteria Continued:

- Located at least 1,000 feet from any municipal water supply well and at least 100 feet from any private well, septic tank, or drain field.
- Do not locate where infiltrating ground water may adversely impact slope stability.

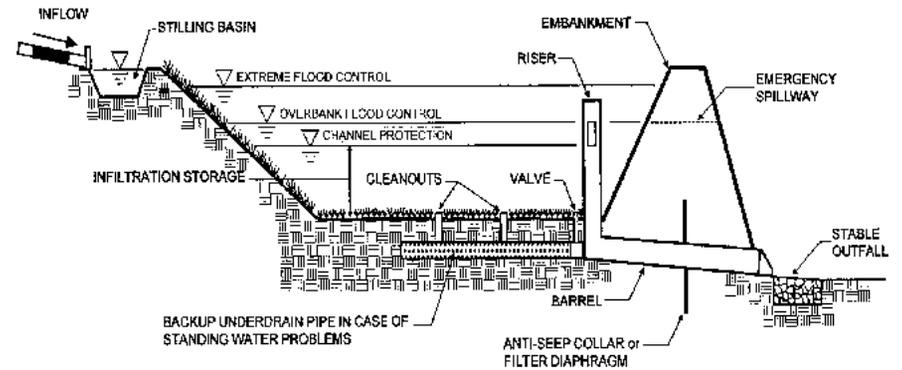
Infiltration Basin Example:



Photo- Courtesy of CALTRANS



PLAN VIEW



PROFILE

Figure 2. Infiltration Basin

Infiltration Trench Example:



Photo- Courtesy of Ohio Department of Natural Resources

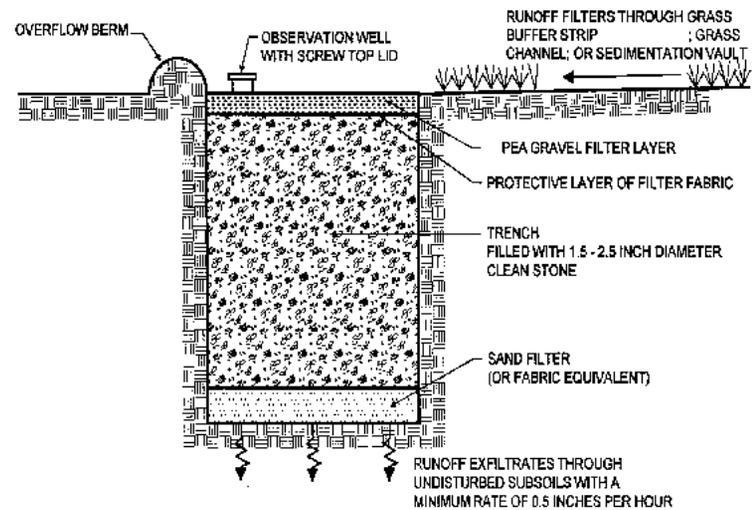
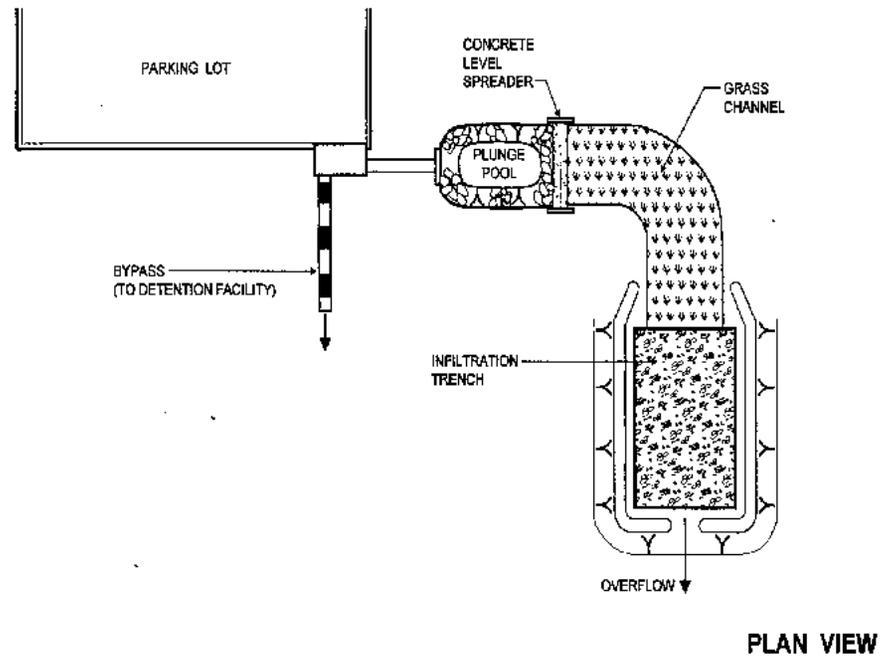


Figure 1. Infiltration Trench

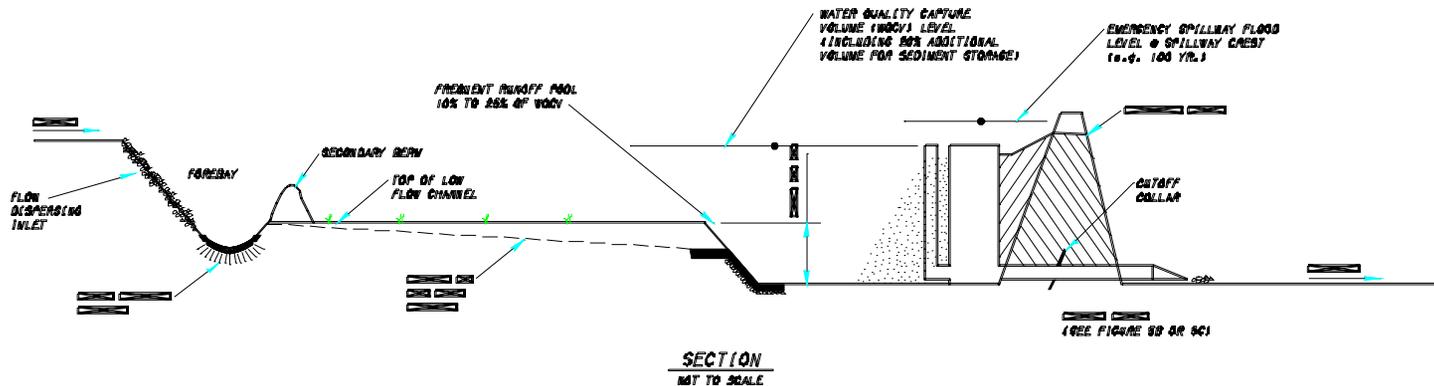
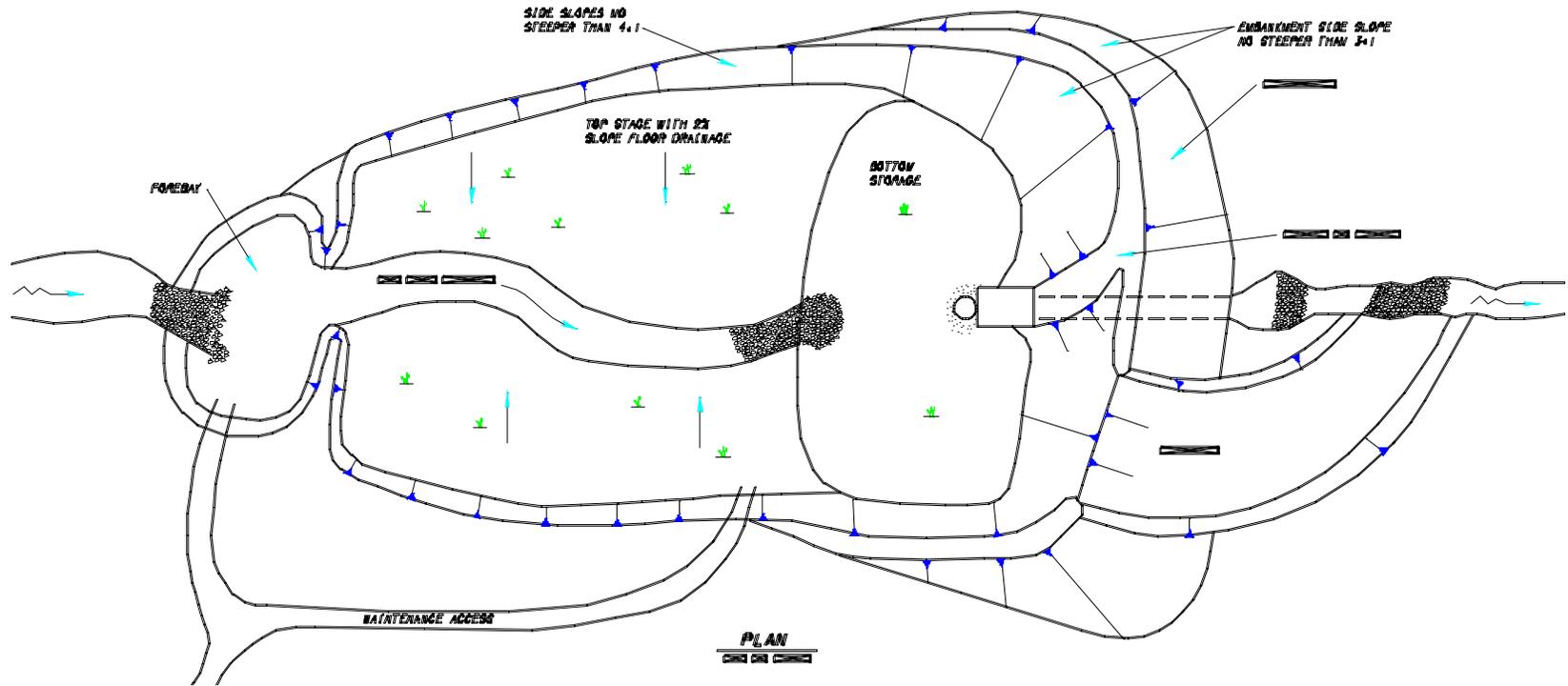
Extended Detention (dry basin)



Detention Overview:

- Treats the storm water by capturing and releasing the WQv slowly over 48 hours.
- Not considered feasible until the WQv is at least 0.1 Ac-ft.
- Two methods are available:
 - Above ground – Preferred method when feasible.
 - Below ground – Useful in urban situations.

Conceptual Above Ground Extended Detention Basin:



Example Above Ground Detention Basins:



Tuttle Crossing, Dublin, Ohio

Courtesy of Ohio Department of Natural Resources



Photo - Courtesy of Ohio Department of Natural Resources

Example Below Ground Detention:

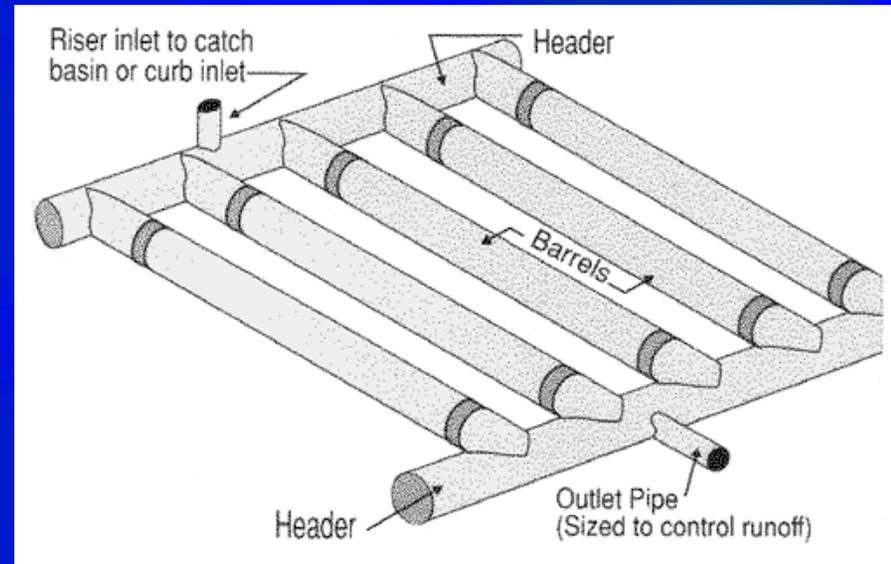
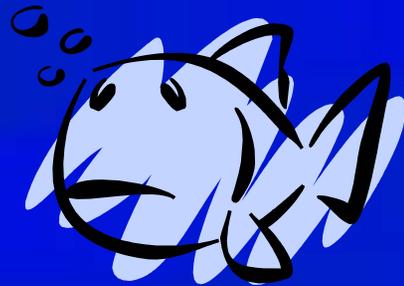


Photo & Diagram – Courtesy of Advanced Drainage Systems, Inc.

Retention (wet basin)



Retention Overview:

- Treats the storm water by capturing and releasing 75% of the WQv slowly over 24 hours.
- Provides permanent storage for 75% of the WQv.
- The full storage depth ranges from 3-9 feet.
- Ideal for large tributaries, but may require a large amount of space.
- Not considered feasible until the WQv is at least 0.1 Ac-ft.

Retention Basin Examples:



*Photos – Courtesy of Ohio Department of
Natural Resources*

Constructed Wetlands



Wetland Overview:

- Defined as a depressed heavily planted area that is designed to maintain a dry weather flow depth ranging from 0.5 to 2 feet.
- Treat storm water through bio-retention interaction.
- Surface Area required is usually quite large. Approximately 1% of the drained area.
- Not considered feasible until the WQv is at least 0.1 Ac-ft.
- Not considered feasible in dense, populated areas due to potential vector problems.

Constructed Wetland Examples:

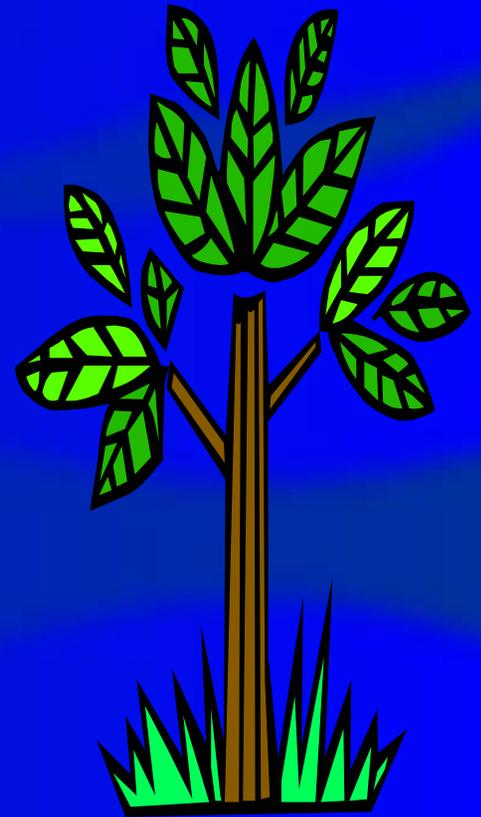


State Route 50, Athens County, Ohio- Ohio Department of Transportation



State Route 32, Pike County, Ohio – Ohio Department of Transportation

Bioretention



Bioretention Overview:

- Treats storm water via a special planting soil.
 - Soil must meet the following criteria:
 - pH range: 5.2-7.0
 - Organic matter: 1.5-4%
 - Magnesium: 35 lbs/ac
 - Phosphorus: 75 lbs/ac
 - Potassium: 85 lbs/ac
 - Sand: 30-55% 35-60%
 - Silt: 30-55%
 - Clay: 10-25%
- Uses an underlying perforated underdrain or storm sewer as an outlet.
- Native plant material such as trees, shrubs, and grasses give the appearance of normal landscaping.

Bioretention Examples:



Photo: Christine Pence

Photos – Courtesy of Ohio Department of Natural Resources

Manufactured Systems



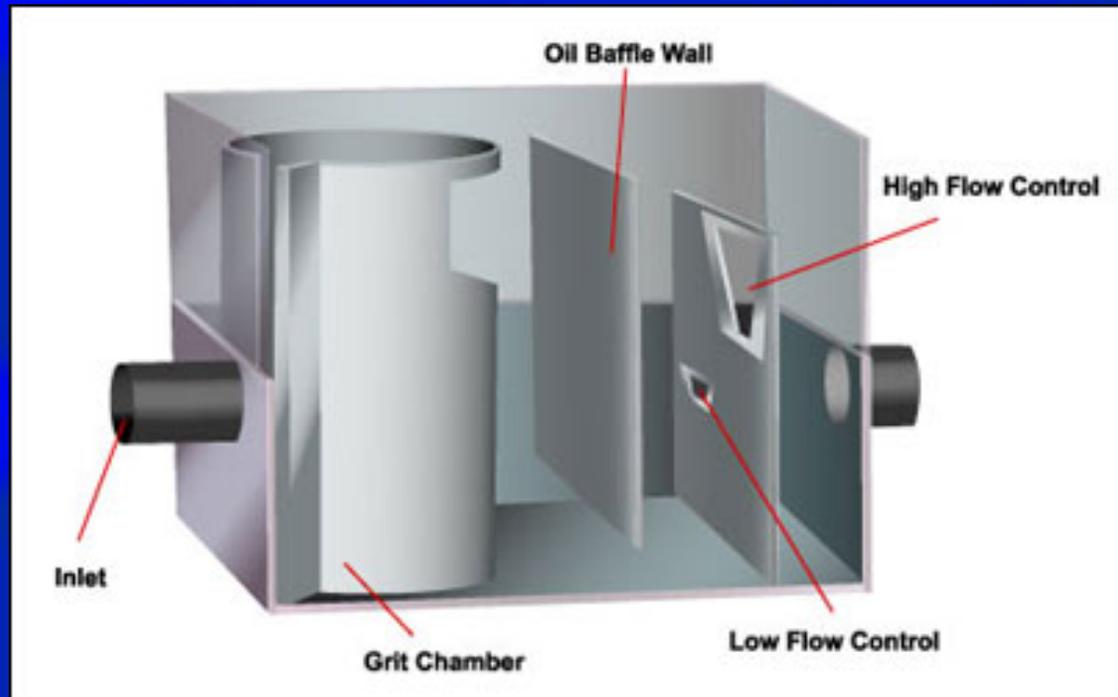
Manufactured Systems Overview:

- Manufactured systems consisting of an underground structure that treats the WQf.
- Placed within a storm sewer system (on-line, or off-line).
- Proprietary item, therefore we will be writing a performance specification.
- Useful in urban situations where other BMPs are not feasible due to R/W constraints.

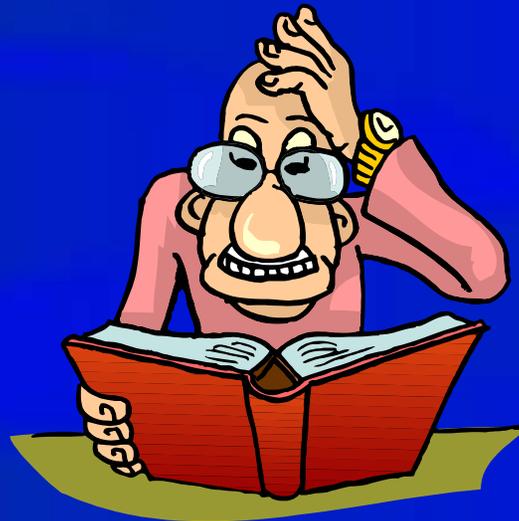
Manufactured Systems Design Criteria:

- Must meet performance specification (not written yet).
- Must be able to pass the hydraulic grade design discharges without damage to the system or surrounding properties.
- The hydraulic grade loss must be considered when designing within a storm sewer system.

Example Manufactured System:



Alternative Methods



Alternative Methods Overview:

- Alternative methods of storm water treatment may be used with approval from the Hydraulics Section.
- It must be demonstrated that the alternative BMP is equivalent in effectiveness as the selected BMPs.
- Will leave the opportunity for new creative ideas.

Conclusion



What does it all mean?

- With implementation of NPDES Phase II, changes in roadway hydraulic design will take place.
- Storm Water Post Construction Controls will have to be considered early in the design process.
- Additional Right-of-Way will be required for placement of BMPs.
- BMPs and the design process will be an evolving process into the future.

Where do we go from here?

- Will Provide our Districts and Consultants with an interim policy for Post Construction Storm Water Management.
- Will Construct BMP's as per our interim policy and monitor for effectiveness and constructability.
- Will Revise policy as necessary to provide adequate water quality effectiveness and feasibility.
- Will continue to work closely with the OEPA and negotiate when necessary.

Questions

