Installing Bioretention Facilities

Waukesha County Dept. of Parks & Land Use
Storm Water BMP Design and Installation Workshop
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SYMBIONT

Topics

- Rain Gardens
- Bioretention
- Vegetated Swales

Definitions

Rain Garden

- A garden designed to pond water to a shallow depth, typically planted with native perennials
- An infiltration device
- Typically not engineered
- Typically no soil amendment or engineered base

Definitions

Bioretention System

- A garden designed to pond water to a shallow depth, typically planted with native perennials
- A pollution filtration and infiltration device
- Engineered
- Deep soil amendment and engineered base


TO
NORTH
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Definitions

Infiltration Swale

- A conveyance system designed to enhance infiltration
- An infiltration device with shallow flowing water
- Engineered
- Soil amendment to promote infiltration

nemo.uconn.edu/tools/stormwater/swales.htm

Beneficial Features of Devices

- Promote infiltration and evapotranspiration
- Filter storm water pollutants
- Reduce temperature of runoff from impervious surfaces

Applicability

Rain Garden

- Particularly suitable for residential retrofit applications
- Use for homes or businesses where no pretreatment is required
- Not applicable to accept runoff from busy streets, large parking lots, or heavily used impervious surfaces

Applicability

Bioretention System

- Particularly suitable for small developments and condominiums
- Good practice to protect cold water fisheries
- Use for up to 2 acre drainage basins, typically adjacent to source errors
- Use in areas where native vegetation is acceptable
- Not applicable for construction site erosion control

Applicability

Infiltration Swale

- Useful for satisfying infiltration requirements in low to medium density residential neighborhoods
- Use for up to 5 acre drainage basins
- Suitable for flat terrain

Planning Considerations

- Is there space available for the practice?
- Is the site suitable for native vegetation?
- Is the site relatively flat?
- Does the site have low groundwater?
- Is there an outlet for a drain tile at suitable depth?
- Who will maintain for the practice?

Location

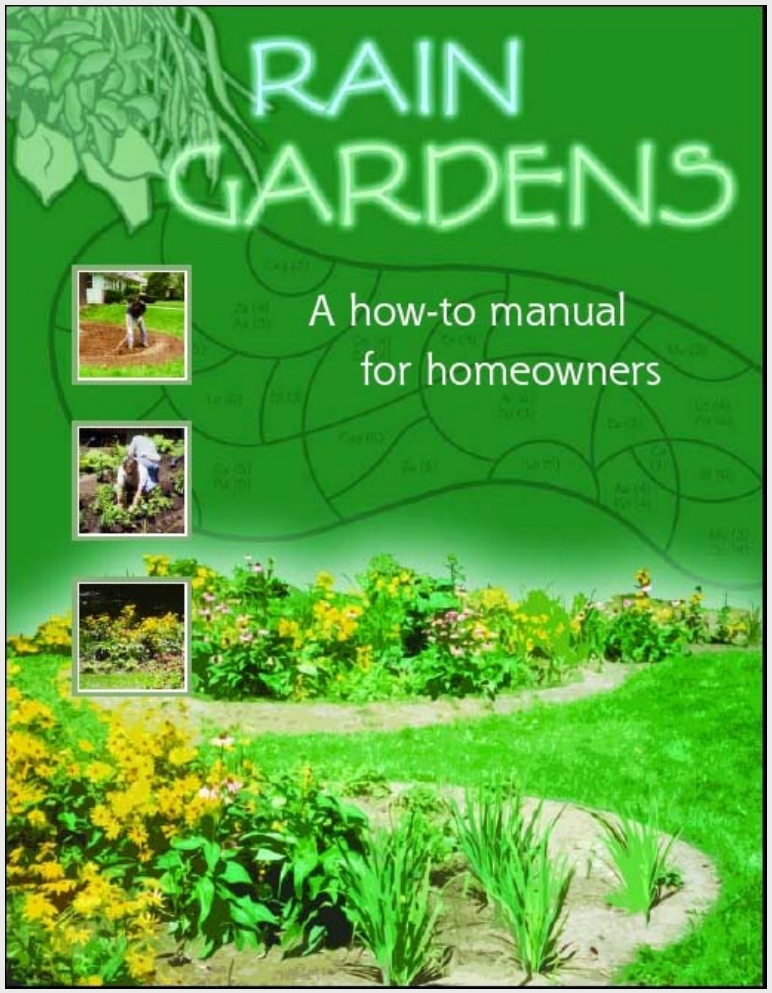
- Downgradient from source of water
- Sufficient source of water
- 10’ separation from foundation
- 50’ separation from POWTS
- Not above sanitary lateral

Planning Considerations

Infiltration Swale

- Useful for satisfying infiltration requirements in low to medium density residential neighborhoods
- Use for up to 5 acre drainage basins
- Suitable for flat terrain

Rain Garden Technical Standards



Rain Gardens

Typical Features

- Minimum infiltration rate of 0.25 inches/hour
- Excavation/berm combination 3” to 12” deep
- Size between 3% to 43% of tributary area
- Level bottom
- Full or partial sun
- Native plantings with heavy hardwood mulch
- Any shape

Bioretention Technical Standards

Bioretention For Infiltration
(1004)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A bioretention device is an *infiltration device*[1] consisting of an excavated area that is back-filled with an engineered soil, covered with a mulch layer and planted with a diversity of woody and herbaceous vegetation. Storm water directed to the device percolates through the mulch and engineered soil, where it is treated by a variety of physical, chemical and biological processes before infiltrating into the *native soil*.

II. Purpose

A bioretention device may be applied individually or

IV. Federal, State and Local Laws

Users of this standard shall be aware of applicable federal, state and local laws, rules, regulations or permit requirements governing bioretention devices. This standard does not contain the text of federal, state or local laws.

V. Criteria

A. Site Criteria

1. A site selected for construction of a bioretention device shall be evaluated in accordance with the WDNR Conservation Practice Standard 1002.

Bioretention

Site Investigation per DNR Standard 1002

- Initial Screening
- Field Verification
- Evaluation of Specific Infiltration Areas (1 pit/boring per 50 feet)
- Soils and site evaluation reporting

Bioretention

Typical Features (1 of 2)

- Overflow to regulate maximum ponding depth
- 6” underdrain with accessible orifice restrictor
- Ponding area maximum 12” deep and 24 hour drawdown
- Native plantings appropriate for expected inundation, established by plugs
- 2” to 3” hardwood mulch

Bioretention

Typical Features (2 of 2)

- 3’ deep engineered soil planting bed (40% fine aggregate concrete sand, 20-30% loamy soil, 30-40% S100 compost)
- 4” pea gravel lens to separate soil and storage layers
- Max 48” #2 coarse aggregate storage layer (max 72 hour drain down)
- 3” mixed sand/native soil interface

Bioretention

Required Pretreatment

- Sump or forebay sized to capture coarse sand
- Minimum 20’ long grass channel
- Filter strip 10’ to 25’ wide


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Figure 2. Example of **Bioretention Device** – cross-section across width of device

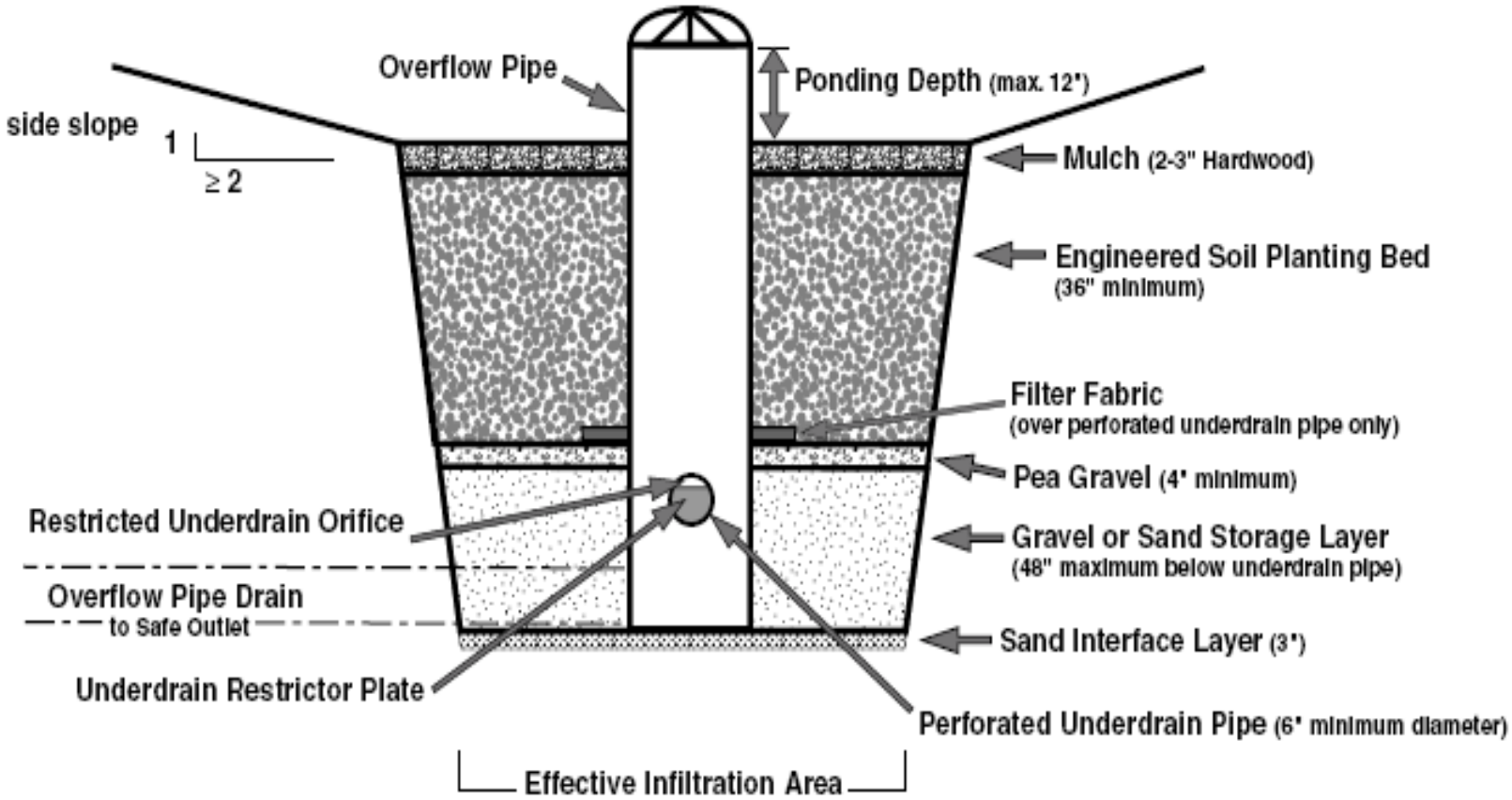
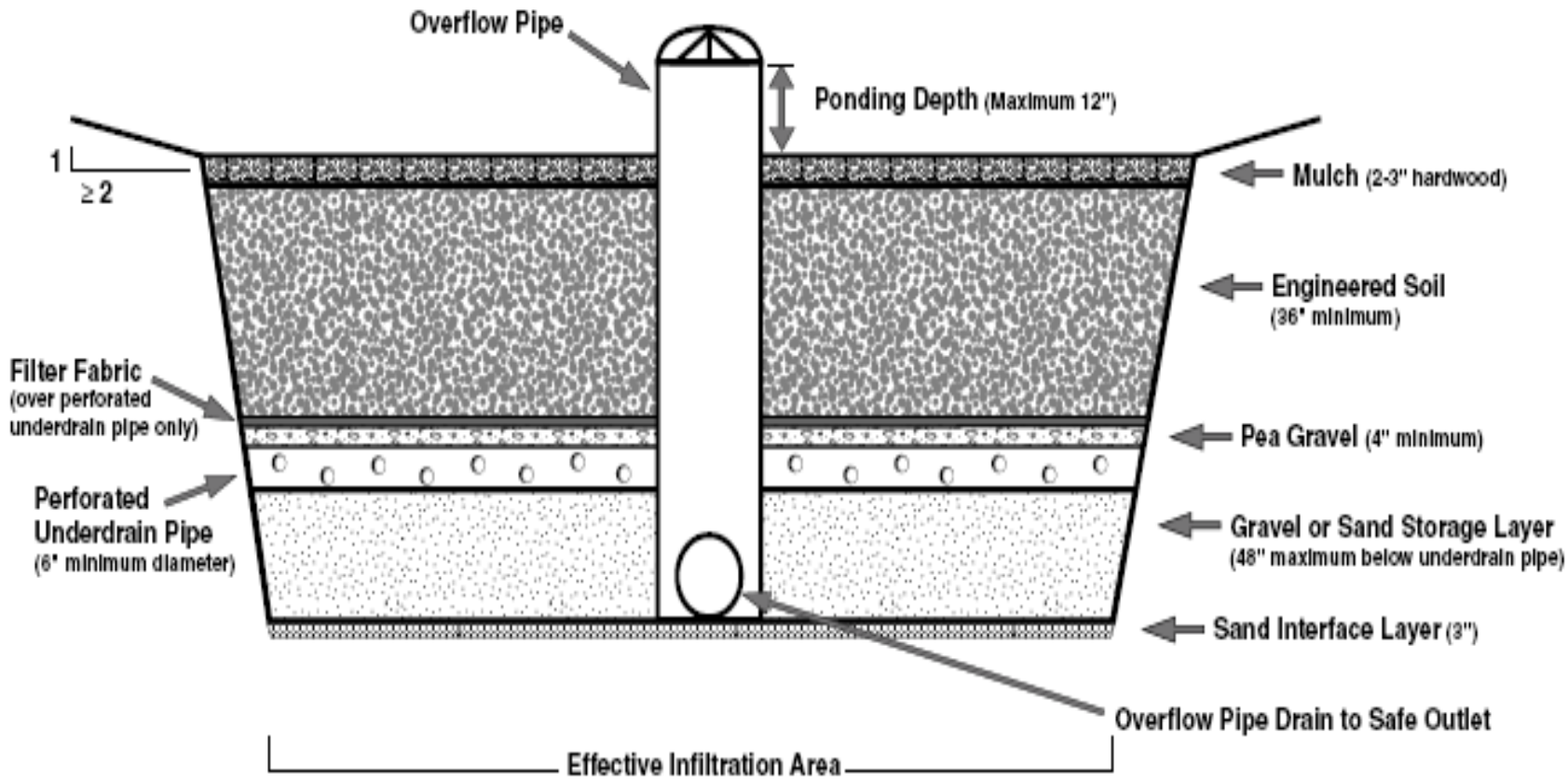


Figure 3. Example of **Bioretention Device – cross-section across length of device**



Infiltration Swale Technical Standard

Vegetated Infiltration Swale

(1005)

Interim Technical Standard

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

Vegetated infiltration swales are stormwater conveyance systems designed to enhance the infiltration runoff. A vegetated infiltration swale can be a natural elongated depression or a constructed channel. A vegetated infiltration swale differs from a conventional drainage channel or ditch in that it is constructed specifically to promote infiltration.

permit requirements governing vegetated infiltration swales. This standard does not contain the text of Federal, State, or local laws.

V. Criteria

Vegetated infiltration swales shall be designed to infiltrate runoff and can be a component of a system intended to meet the runoff infiltration requirements of Chapter NR 151. The swale may also be a component of the stormwater conveyance/storage system.

A. **Site Assessment** - A site assessment shall be conducted and documented meeting the

Infiltration Swale

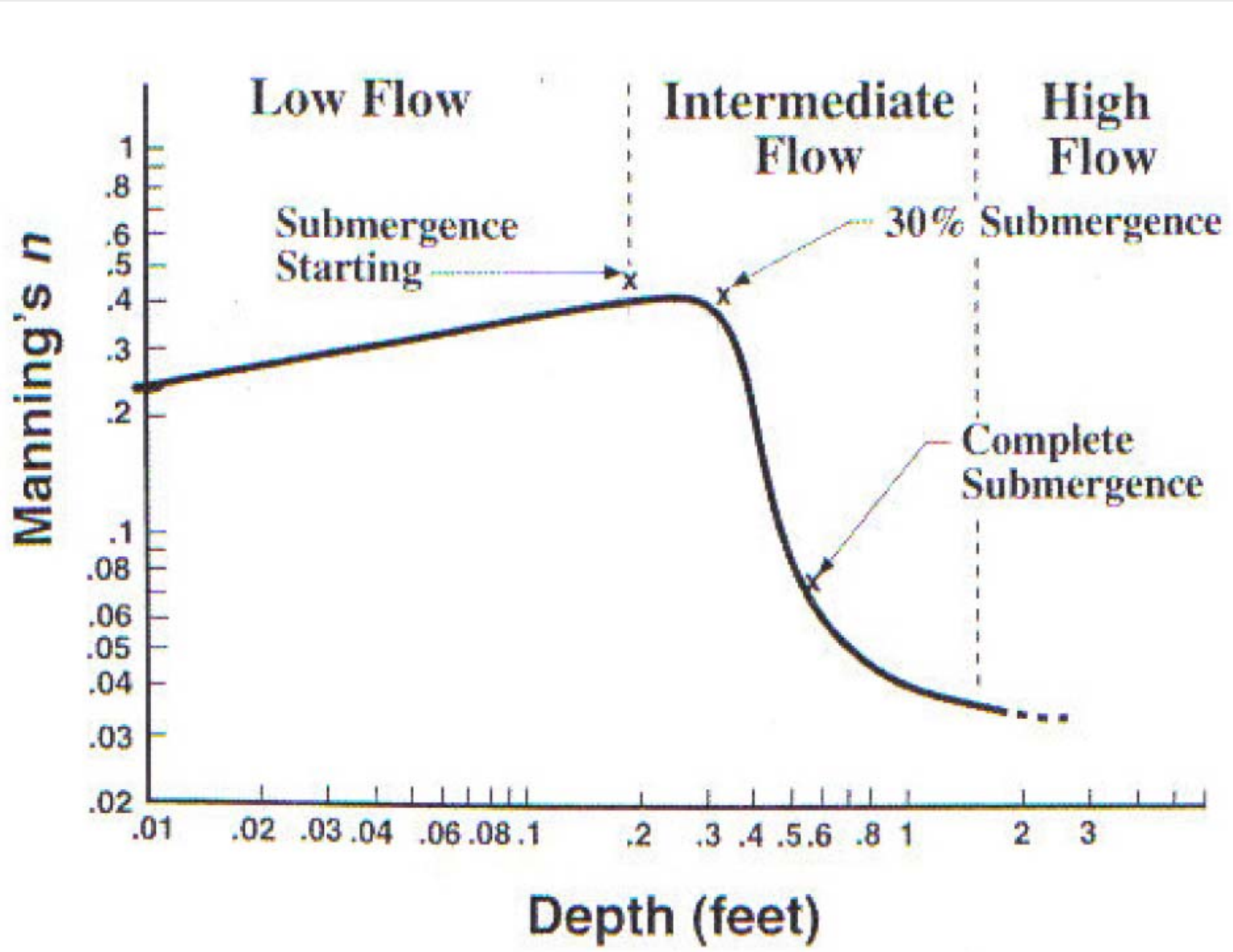
Site Investigation per DNR Standard 1002

- Initial Screening
- Field Verification
- Evaluation of Specific Infiltration Areas (1 pit/boring per 1000 feet)
- Soils and site evaluation reporting

Infiltration Swale

Typical Features

- Max 1.5 fps velocity, 12” depth in 2-year storm
- Can use ditch checks to slow veloctiy
- Flat bottom max 6’ width
- Longitudinal slope 1% to 4%
- Incorporate 2” compost and 2” topsoil into top 12” of infiltration bed
- Native vegetation or turf grass (not sod)



Source: Minton 2005

Infiltration Swale

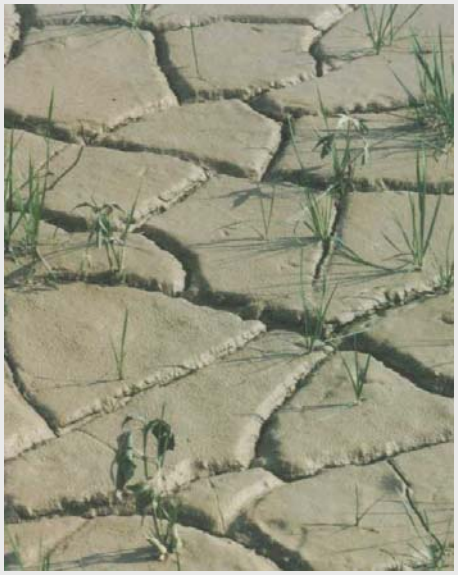
Required Pretreatment

- Detention basin, filter strip, or vegetated swale
- Vegetated swale must have 5 to 8 minutes of hydraulic residence time, minimum 200’ long

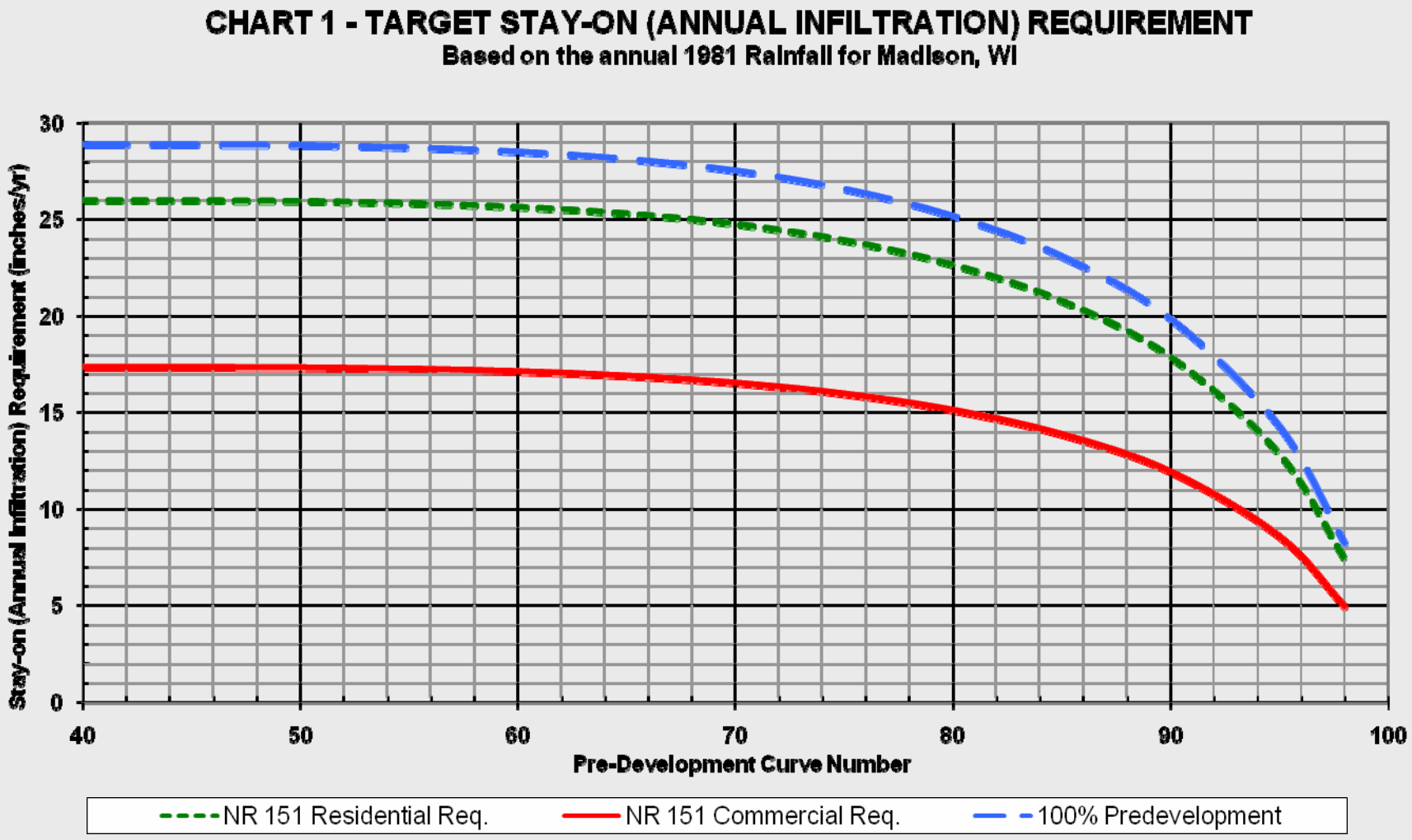
http://picasaweb.google.com/MaineNEMO/StJosephSCollege

Construction Sequencing

- Do not let construction runoff enter practice
- Suspend construction during rain or snowmelt
- Avoid compaction, remediate compacted or smeared native soil
- Place engineered soil in 12” lifts with minimal compaction
- Mulch soil bed prior to planting



Modeling/Sizing



RECARGA_2_3

Units: English

RECARGA Version 2.3

Bioretention/Raingarden Sizing Program

Planview Data

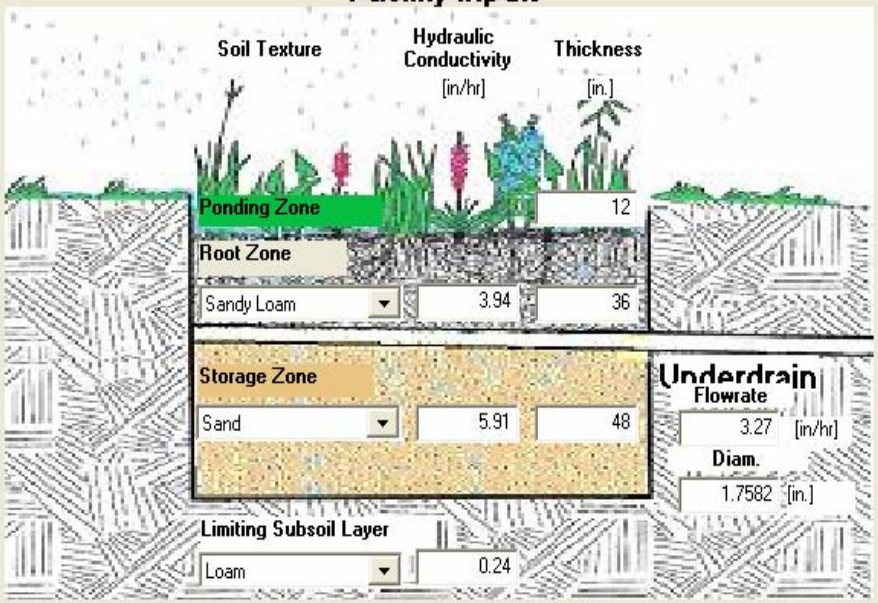
Facility Area	2000	[sf]
Tributary Area	1	[acre]
Percent Impervious	50	
Pervious CN	80	

Files

Regional Ave. ET	0.13	[in./day]
Simulation Type	Continuous	
Input File Length	266	days
Precip. File Name	Mad1981us	
Output File Name	test	

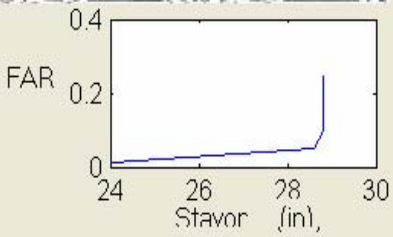
☑ Summary ☐ Record

Facility Inputs



Target	25	([in]
Facility Area Ratio	0.19213	

Run FAR



Results

Plant Survivability

(Less than 48 hours max. ponding is desirable)

	max.	Total
Hrs. Ponded	6.75	29.5
Number of overflows		2

Tributary Runoff [in]

Precipitation	28.81
Impervious Runoff	20.821
Pervious Runoff	4.7784

Raingarden Water Balance

	[in.]	%
Runon	13.1519	45.6506
Runoff	0.59231	2.0559
Recharge	8.1029	28.1253
Evaporation	1.6832	5.8423
Underdrain	2.9963	10.4002
Soil Moisture	-0.22275	-0.77316
Stay-on	25.2214	87.5439

RUN SIMULATION

CLEAR RESULTS

Developed by the University of Wisconsin-Madison
Civil & Environmental Engineering Water Resources Group
(D. Atchison, A. Dussailliant, L. Severson)