Drainfield options after advanced treatment systems

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Funding Sources

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- RI Agricultural Experiment Station
- URI Cooperative Extension
- USEPA National Onsite Demonstration Project II
- RIDEM Nonpoint Source Program (Section 319)
- RIDEM Individual Sewage Disposal Section
- Community, industry, private sector partners

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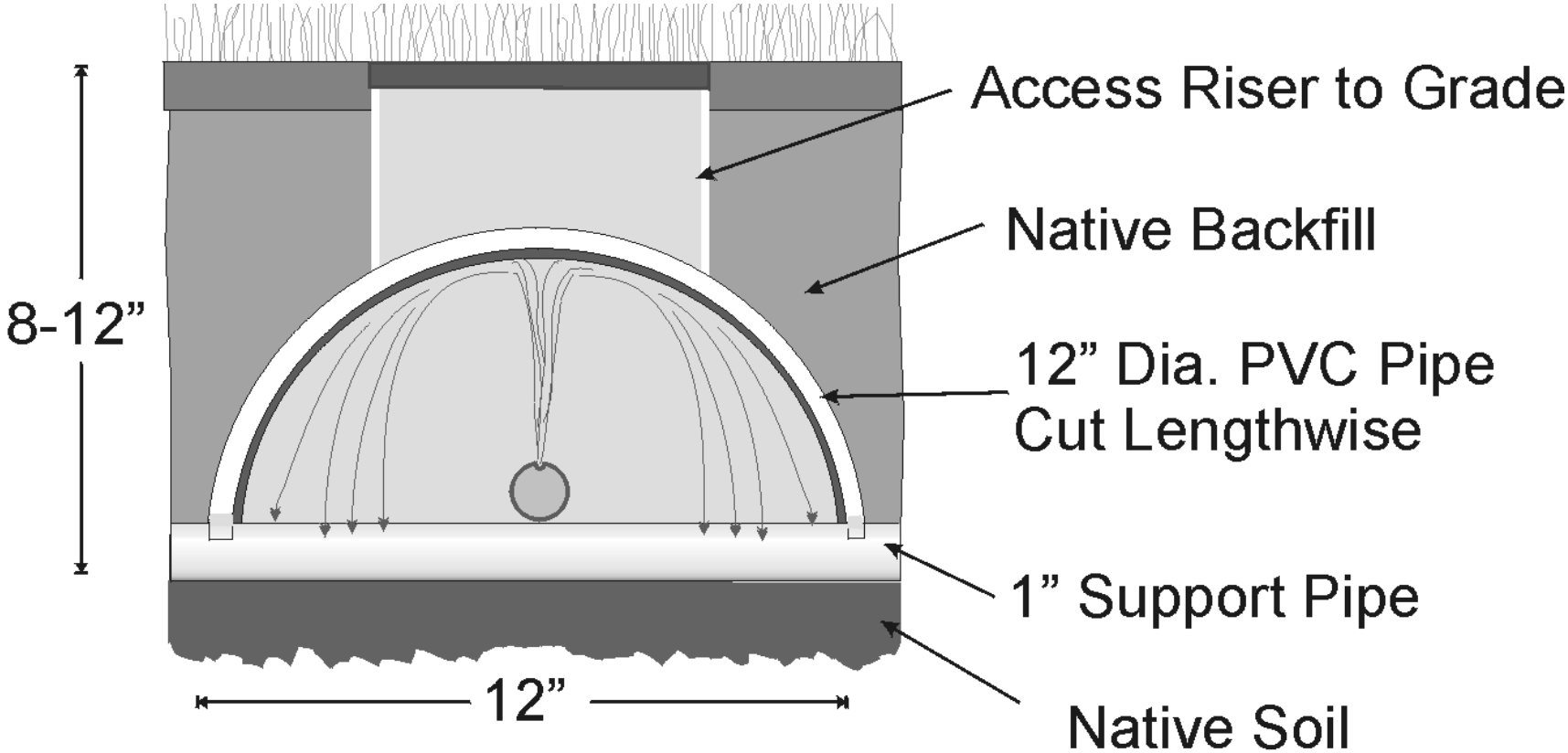
RIICA

Justin Jobin – Town of Jamestown, RI

Topics to be covered …

- Low pressure shallow narrow drainfields
- Bottomless sand filters

Both drainfield options used in Rhode Island only with advanced treatment technologies



(cross section)

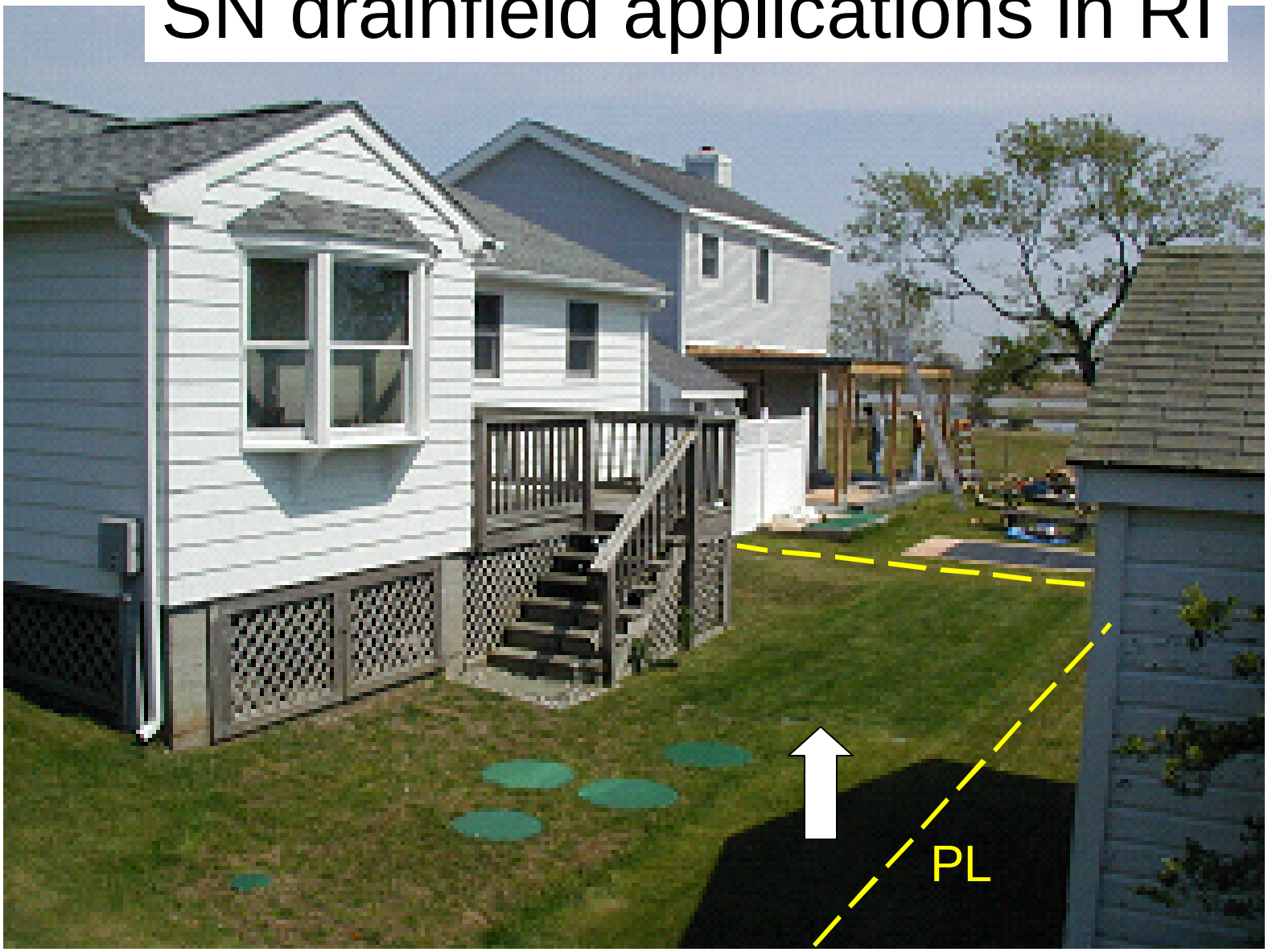
What is a pressurized shallow narrow drainfield ?

SNDF installation in Rhode Island –

- More biochemically reactive soil
- No biomat development
- Easy, cost effective
- Site friendly
- Increases vertical separation distance
- 1 foot reduction in req'd. vertical separation

50 installed on URI demonstration systems

SN drainfield applications in RI



3 - 25 ft. SNDF lines 2 bedroom home

5,000 sq. foot lot

Excerpts from RIDEM regulations Table 3. Range in SN DF hydraulic loading rates.

Soil Texture	Soil Structure	Soil Consistence	Loading rates g/sf/d
cos,vcos gravelly, v. gravelly soils	structureless single grain	loose	2.3
fsl, sl, l	granular to subangular blocky	friable	3.7
ls, sl, l	structureless – massive; dense till	firm to extremely firm	2.0

Goal - Maximize treatment and minimize disposal

Medium textured and structured surface soils get the highest loading rates, not the gravelly soils.

Visually – it looks like something is happening

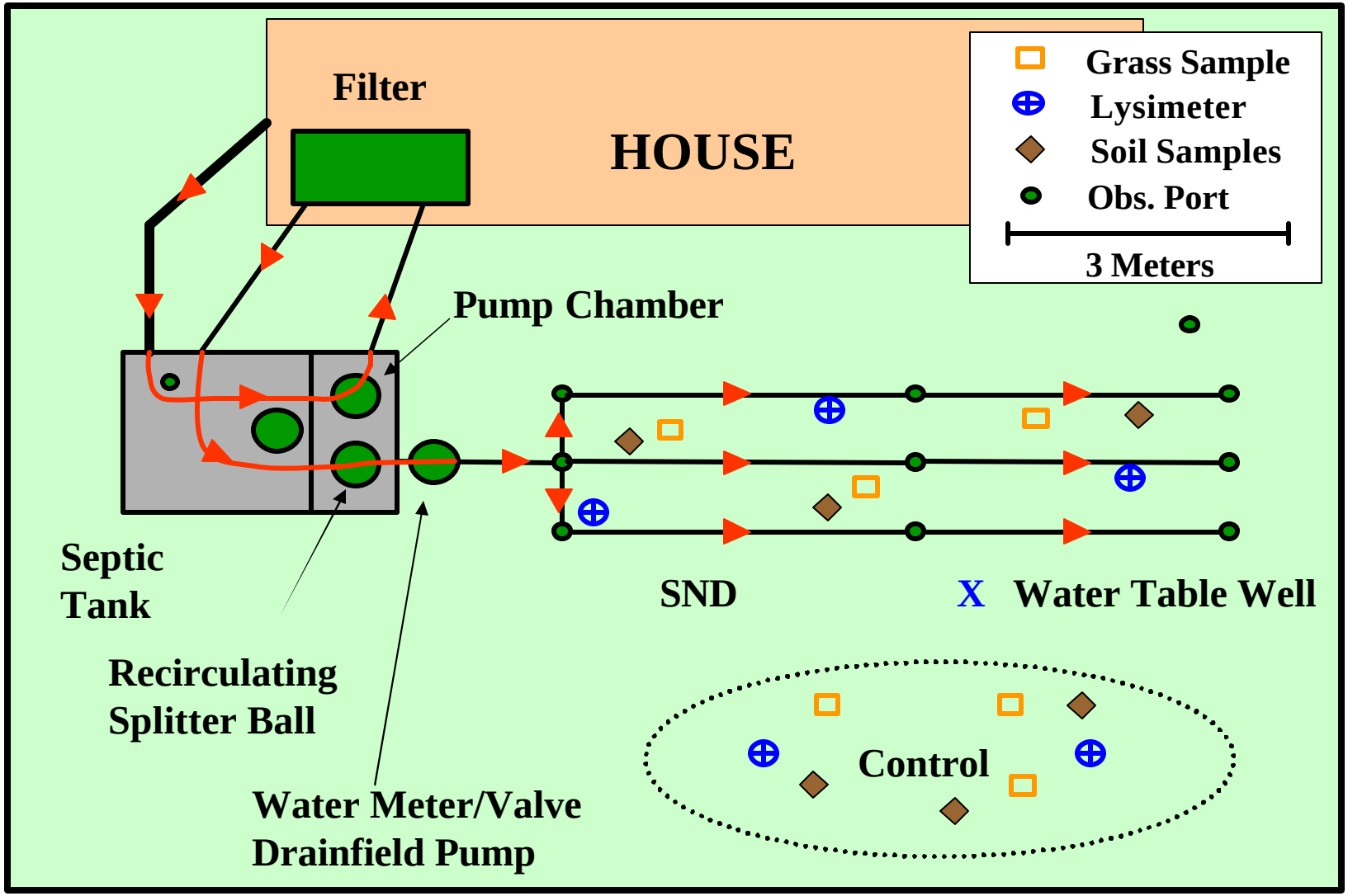
Treatment performance in shallow narrow drainfields

Holden et al., ASAE – 2004

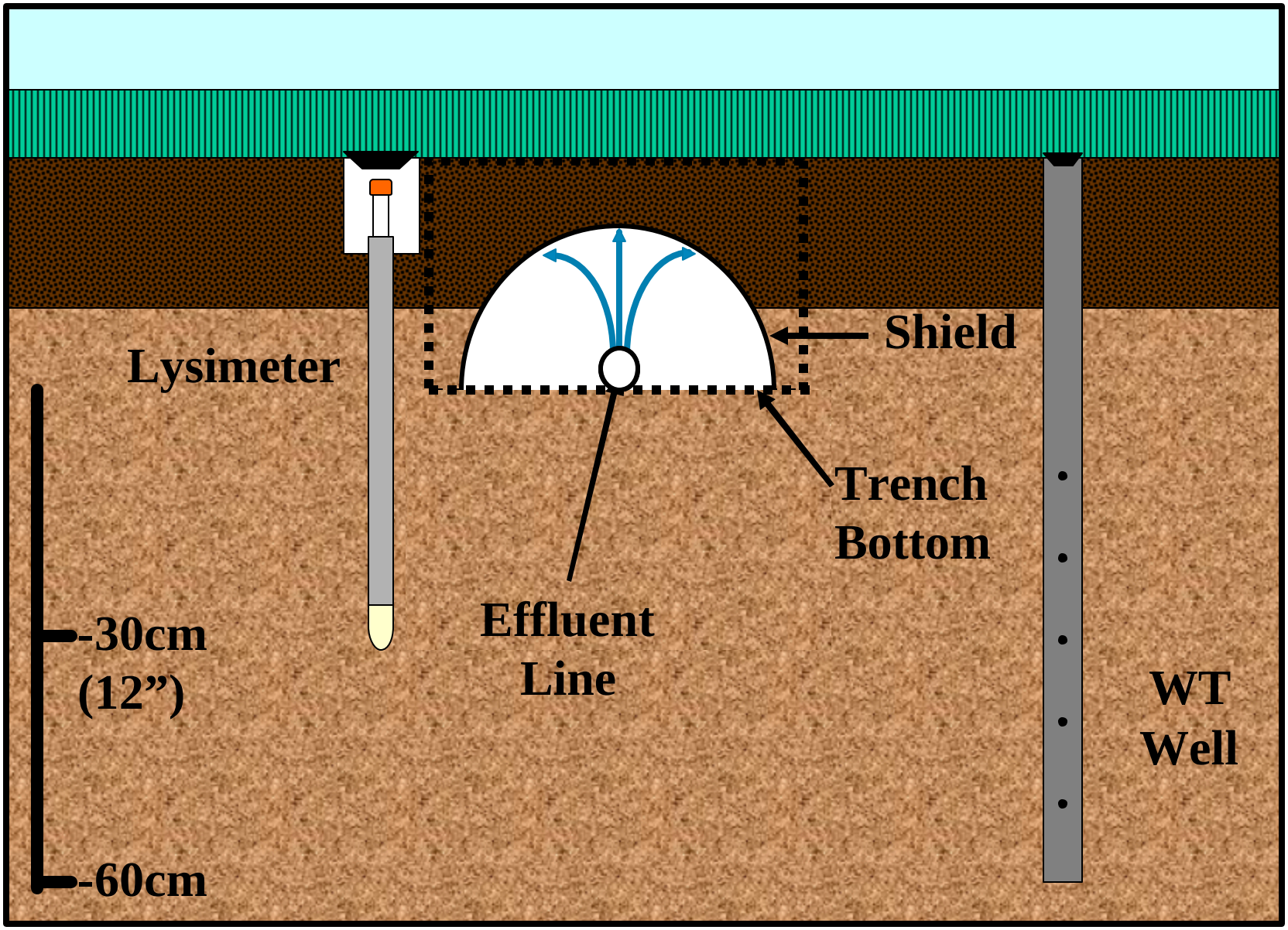
Steven Holden MS Thesis - 2004

Mark Stolt mstolt@uri.edu

Sampling Procedure



Lysimeter and well placement

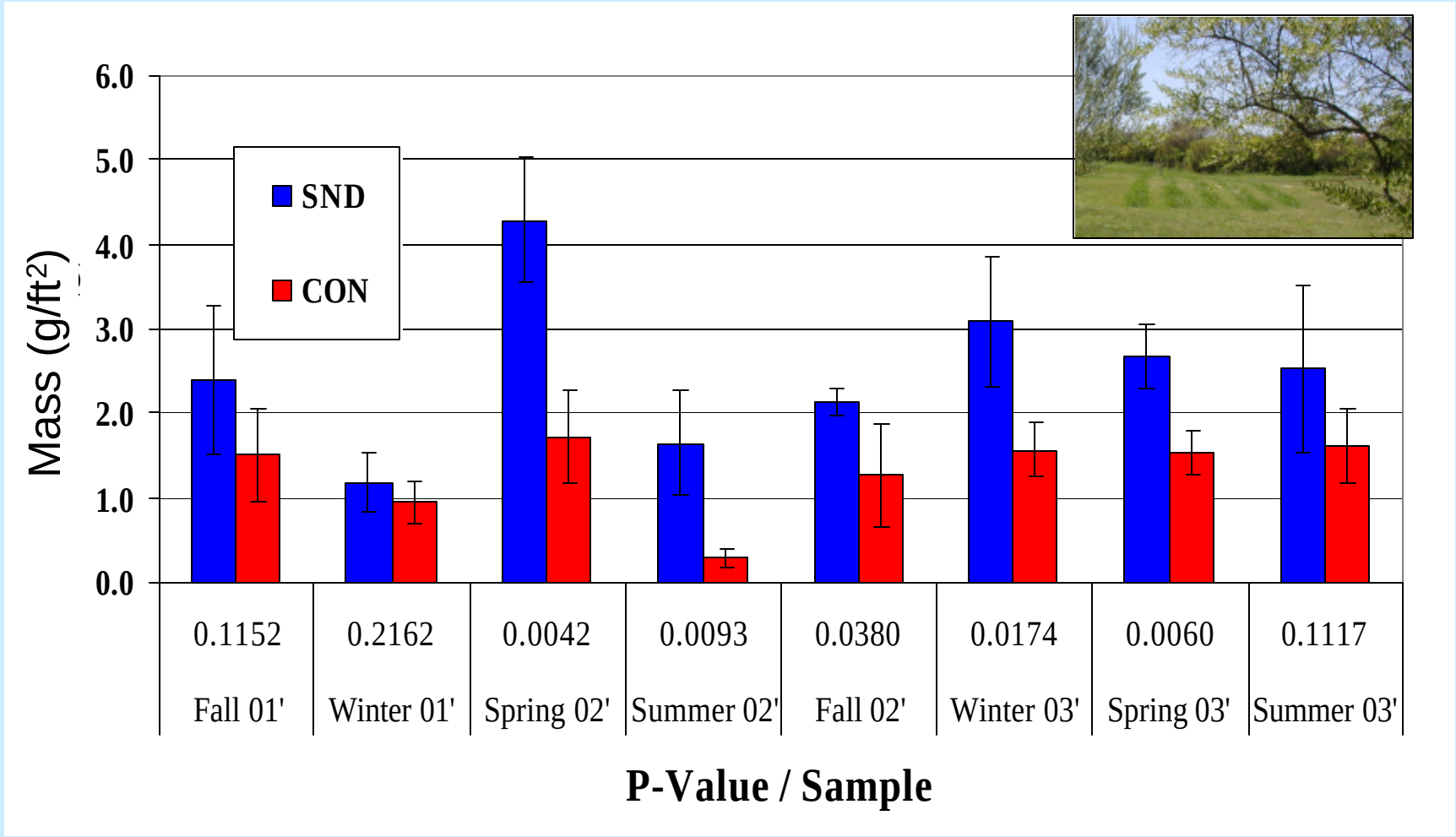


Sampling protocol

Soil-porewater (lysimeters)

- 14 total sampling events
- 2 events X 7 seasons
- winter 2001-02 through summer 2003

Example (SIS) - Biomass of Grass



5 out of 8 seasons biomass SND > biomass Control (0.05 level)

Mean nutrient concentrations and percent reductions in soil pore water at 30 cm below the SND

System	[TP] mg/L	TP Red. %	[TN] mg/L	TN Red. %
TWE	0	100	33	52
SIS	1.5	85	36	43
HAZ	0.03	99	28	55
TAR	2.6	55	10	33

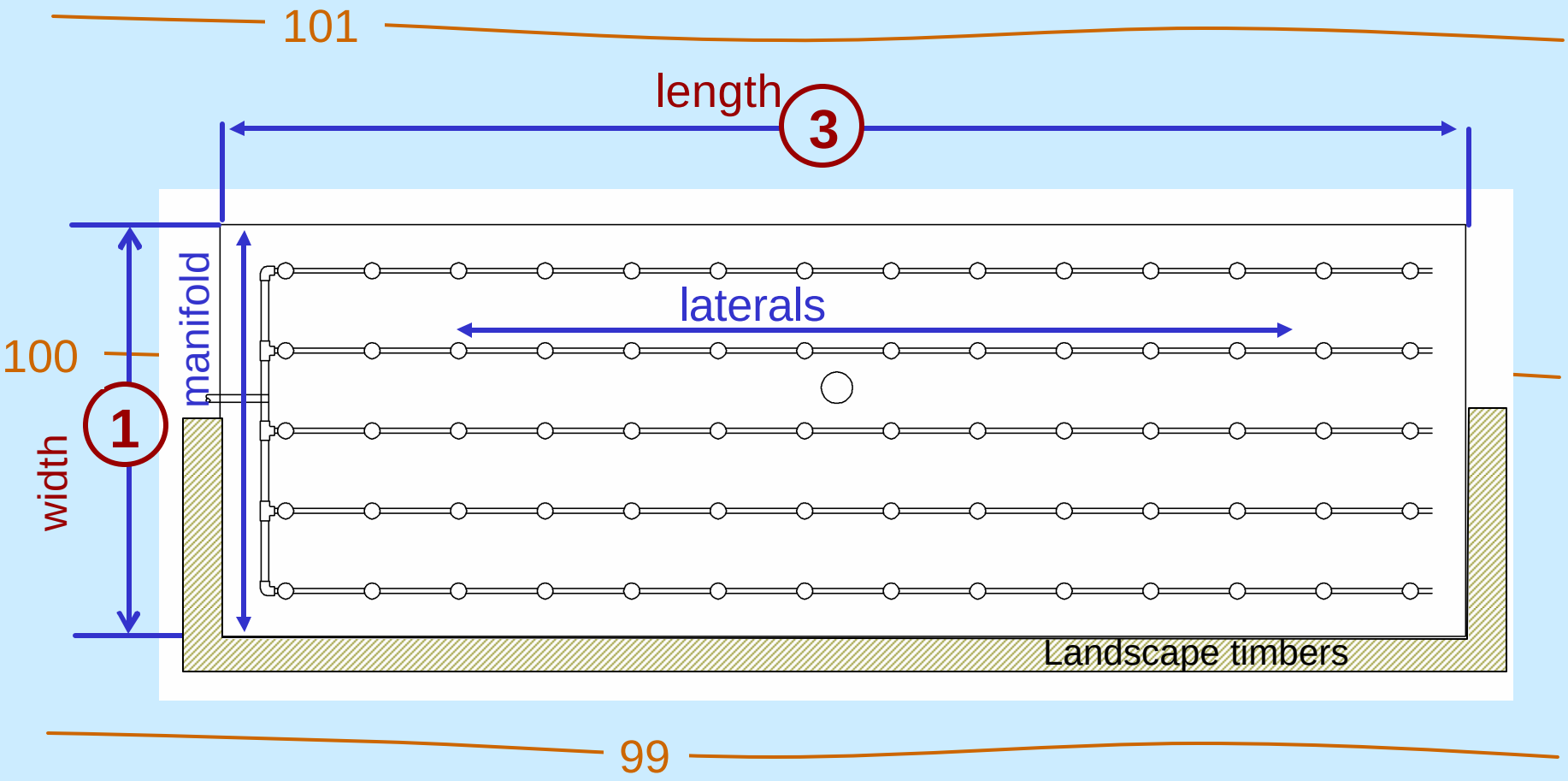
* There were no statistical differences between seasons.

Summary: Fertilized lawn sites

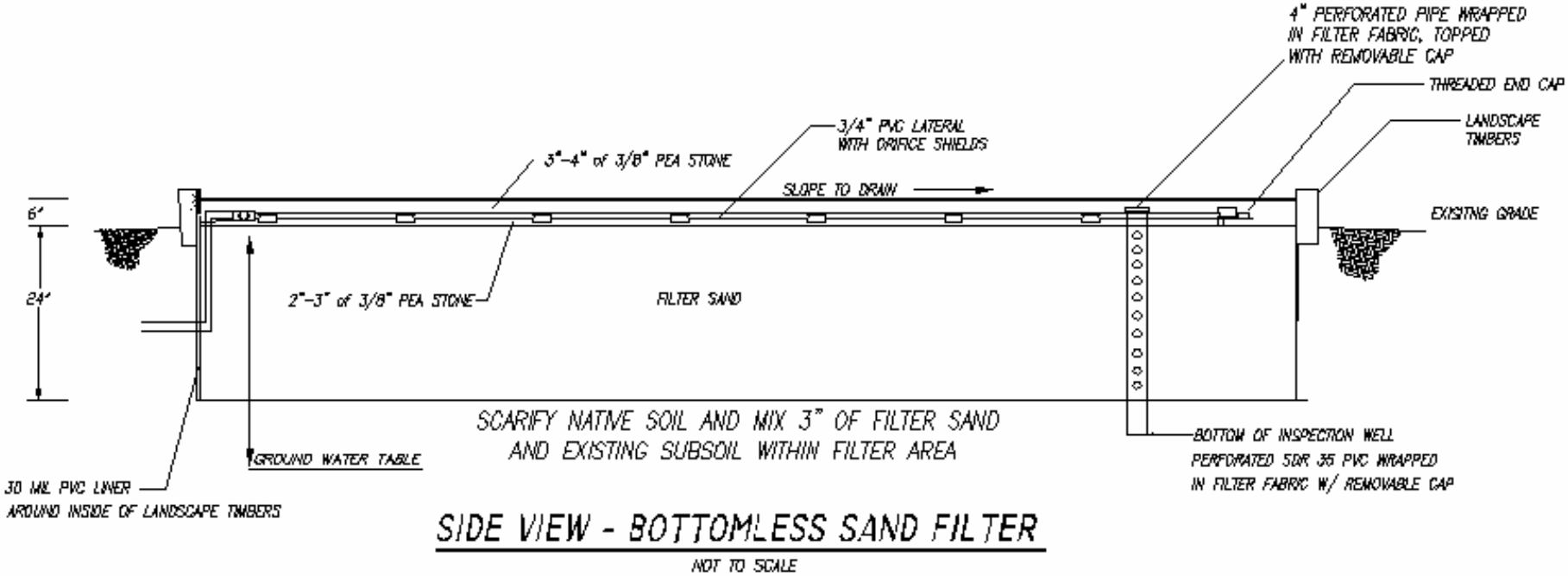
- Soil pore water [TN] in controls much higher than in SNDF area
- Exceeded drinking water standard 4 out of 7 seasons
- No seasonal effects on reductions
- Lawn fertilizer appears to satisfy all grass N needs
- Additional N from effluent is leached
- Excess fertilizer & watering potential problem
- Need to regulate all potential N inputs

What is a BSF ?

Top view - NTS

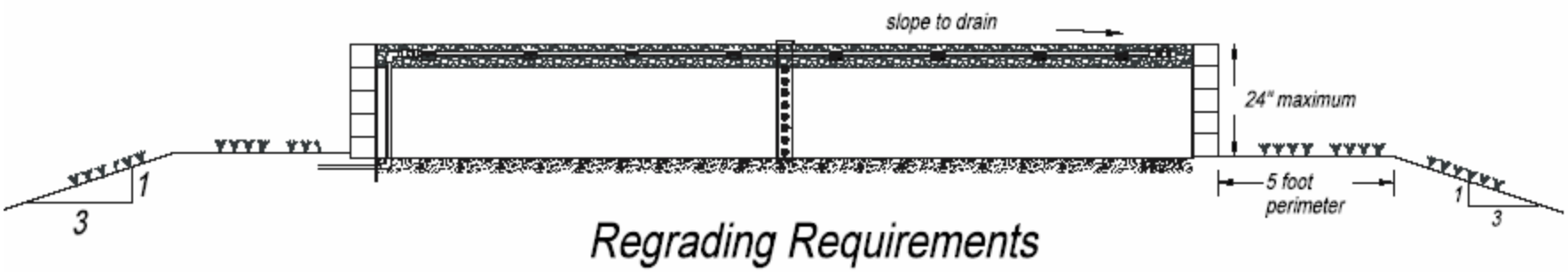


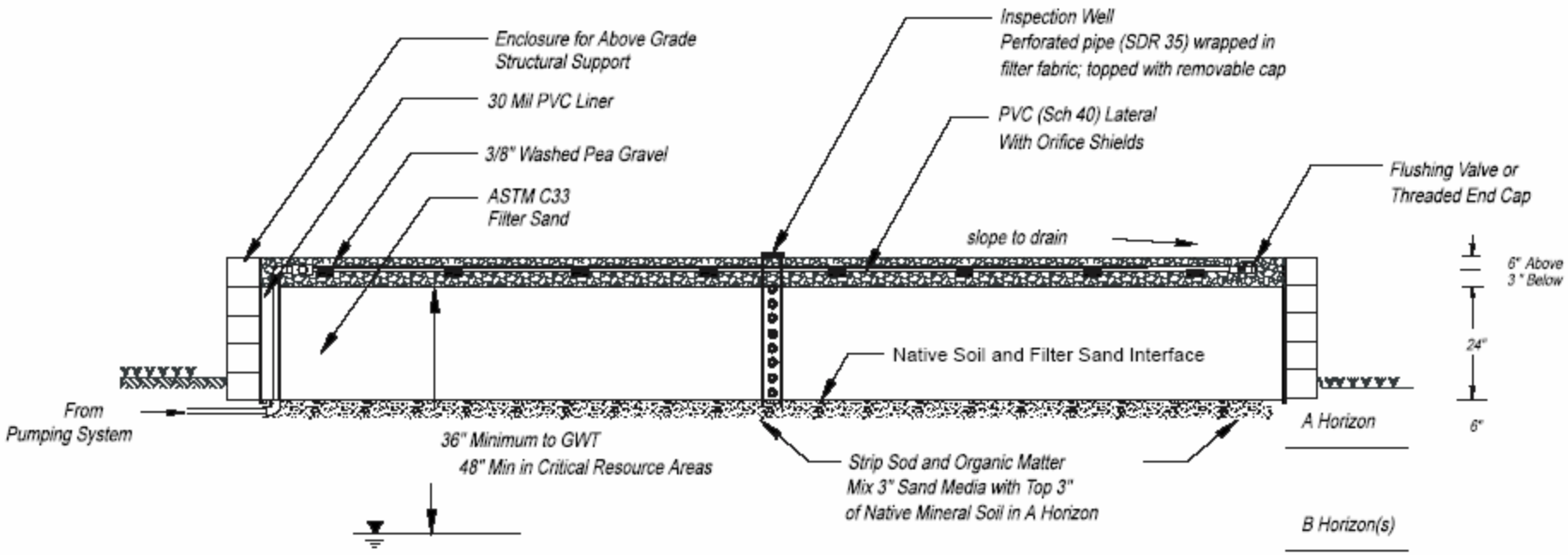
At-grade BSF



Separation distance datum point = *Top of sand*

Above-grade BSF





Where are BSFs used?

- Tight lots where PSND or conventional trenches require fill material
- Drainfield inverts would be above existing grade
- Shallow water table sites
- Restrictive layers are present

First R.I. BSF 1997

Portsmouth
Bluebill Cove

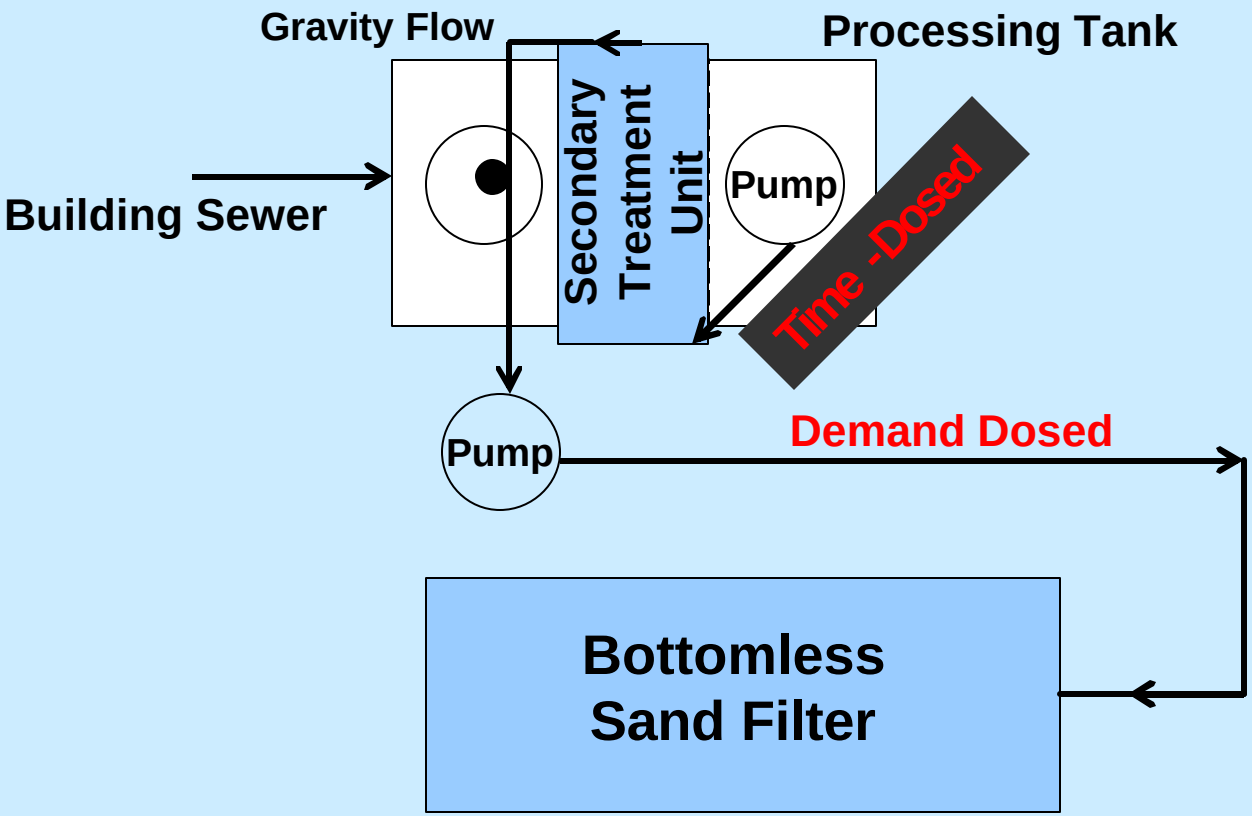
- Poorly flushed coastal pond
- Shell fishing area
- Pathogen sensitive critical resource area
- Recreational water contact

How are they used in Rhode Island?

- *Only* with pretreated effluent coming from a time dosed pump

- Hydraulic loading rates dependent on soil texture, structure, consistence <u>and type of advanced treatment technology</u>

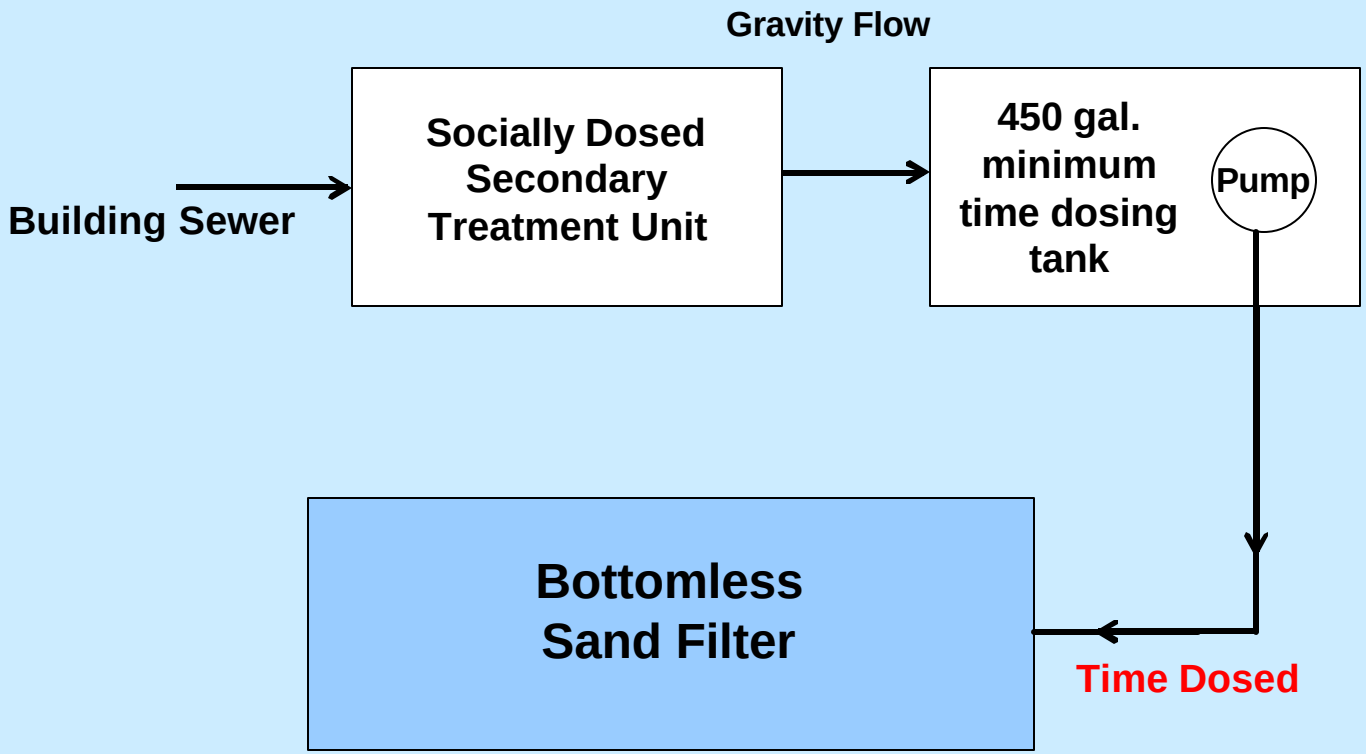
CAT 1 BSF treatment train



Includes - Time dosed media filters:

– peat, sand, textile, and trickling.

CAT 2 BSF treatment train



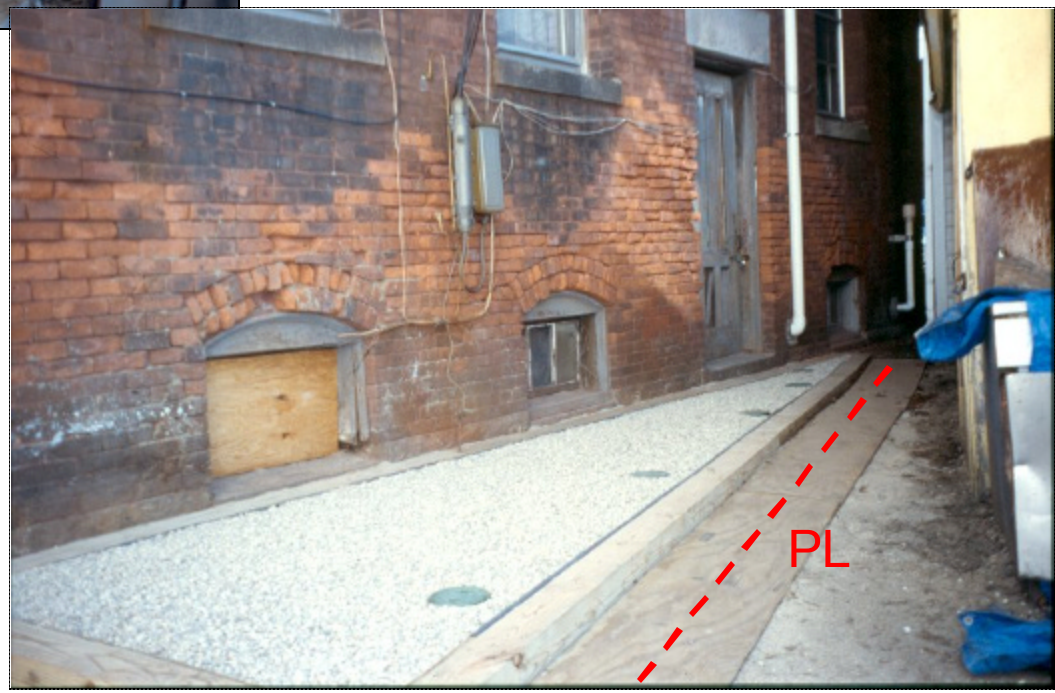
<u>Non-time dosed</u> technologies: extended aeration, fixed film, or fixed activated sludge system

(1 ½ ± x CAT 1)

Table 1. Hydraulic loading rates for bottomless sand filters.

Soil Category	Predominant USDA Soil Texture of Receiving Soils	Soil Structure	Soil Consistence	Category 1* Systems Loading Rate gal/ft^2/day	Category 2* Systems Loading Rate gal/ft^2/day
1	cos, s, lcos, ls, cosl, and gravelly soils	structureless- single grain	Loose	3.0	2.0
2	vfs, fs	structureless- single grain Structureless- massive	Loose Very friable	3.5	2.5
3	lfs, ls, fsl, sl	granular, subangular blocky	very friable to friable	4.5	3.0
4	lvfs, vfsl, sil	granular, subangular blocky	very friable to friable	4.0	2.6
5	lcos, ls, cosl	subangular blocky	friable	3.5	2.3
6	lfs, ls, fsl, sl	structureless- massive	friable	3.0	2.0
7	fsl, vfsl, sil, si	structureless- massive	very friable or friable	2.8	1.9
8	lcos, ls, cosl	structureless- massive	firm to very firm	2.5	1.7
9	fs, sl, l, fsl, vfsl, sil, sicl	platy, structureless- massive	firm to very firm	2.0	1.3
10	All textures	structureless- massive	extremely firm	Not allowed	Not Allowed

Bottomless Sand Filters



Can be configured in ways to work with site features.

BSF media specifications

ASTM C - 33 Sand ***plus***

- E.S. (D_{10}) = 0.33 mm
- U.C. (D_{60} / D_{10}) = 3.0 - 4.0
- 24 inches deep

Maximum allowable fines passing a # 200 sieve shall be $\leq$ 1%

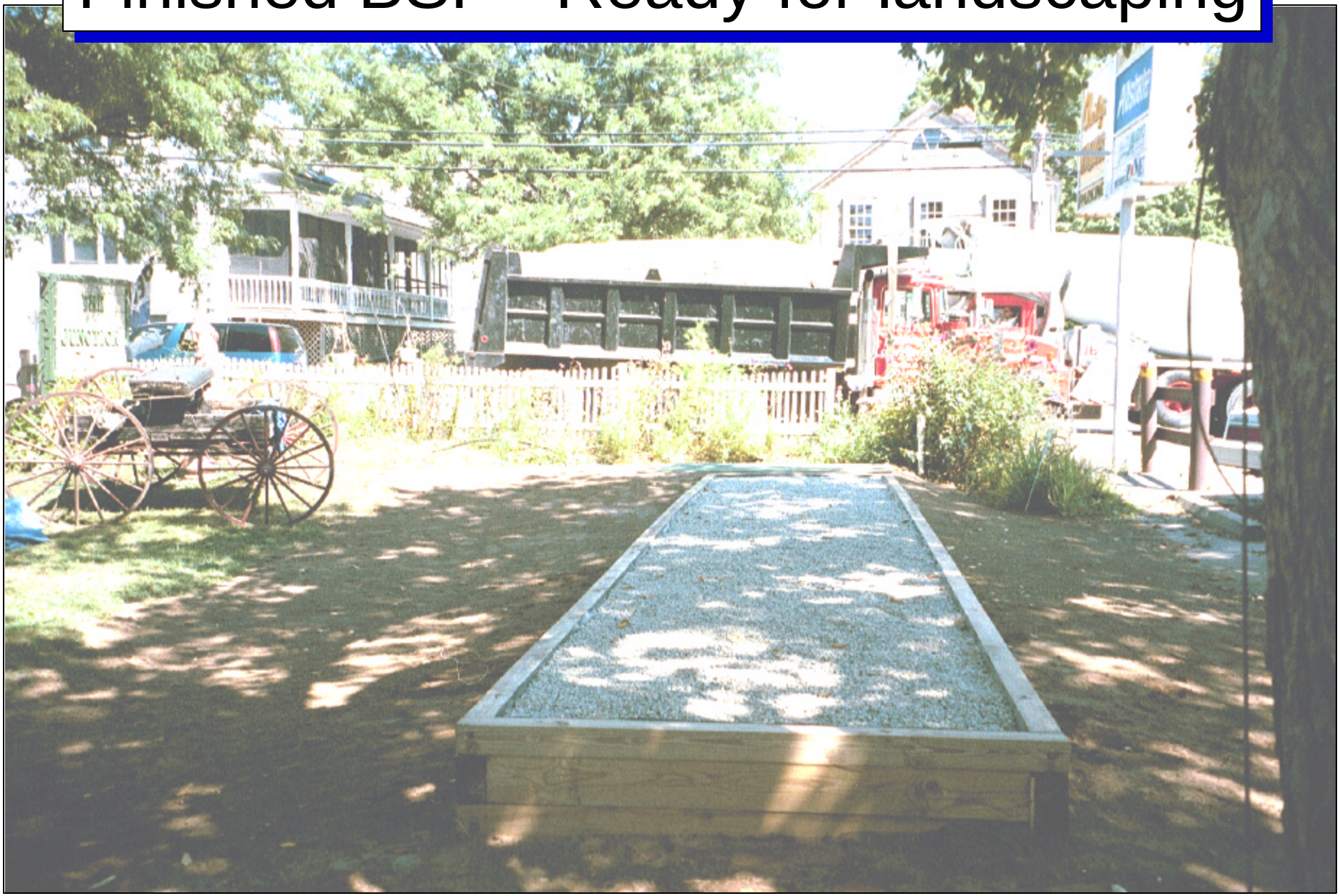
Build enclosure

Add sand media

Add pea stone

Install laterals

Finished BSF - Ready for landscaping



BSF approvals in RI

2001 and 2002	Mar. 2003	Mar. 2004	Mar. 2005	Feb. 2006	Total to date
121	277	330	335	263	1326

BSFs beginning to be used in Massachusetts

For more BSF information -

Guidelines for the Design and Use of Bottomless Sand Filters

November 2001

RI Department of Environmental Management - ISDS

www.dem.ri.gov

Thanks for your kind attention !

www.uri.edu/ce/wq/OWT

New England Onsite Wastewater Training Program

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College of the Environment and Life Sciences

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