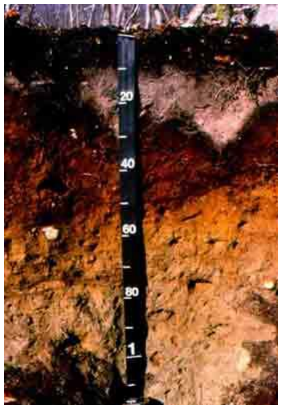
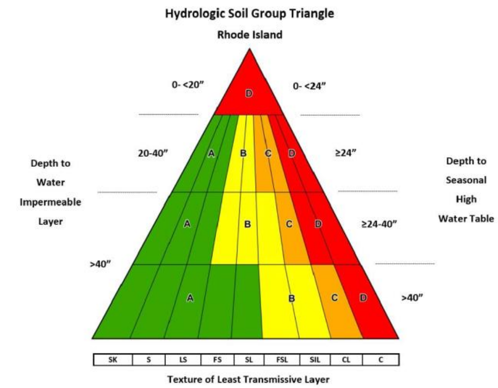
# Alternates to Redoximorphic Features for Determination of Seasonal High Water Tables for Use in Stormwater Management Designs






**Soil Matters**
**The 2018 NH Soils Conference**
**USDA Natural Resources Conservation Service**
**Society of Soil Scientists of Northern New England**
**April 4, 2018**
**Audubon Center, Concord, NH**

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WATERSTONE ENGINEERING
INNOVATIVE STORMWATER MANAGEMENT

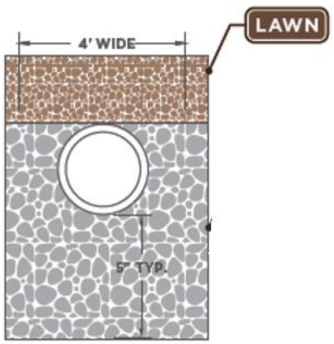
Society of Soil Scientists of Northern New England

# What is the purpose of ESHWT from a water quality protection standpoint?

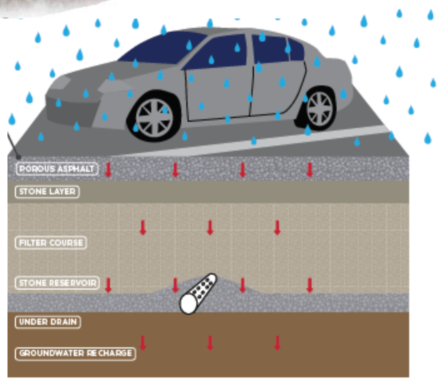
- **Goal:** Protection of people and the environment from harm—specifically groundwater contamination
- Could the restrictions be indirectly preventing greater good than harm?
- The use of redoximorphic features for SHWT determination is well documented
- Should we consider alternate approaches for the siting of septic systems than for infiltration systems?

# Hydraulic and Nutrient Loading Comparison

## Low Impact Development



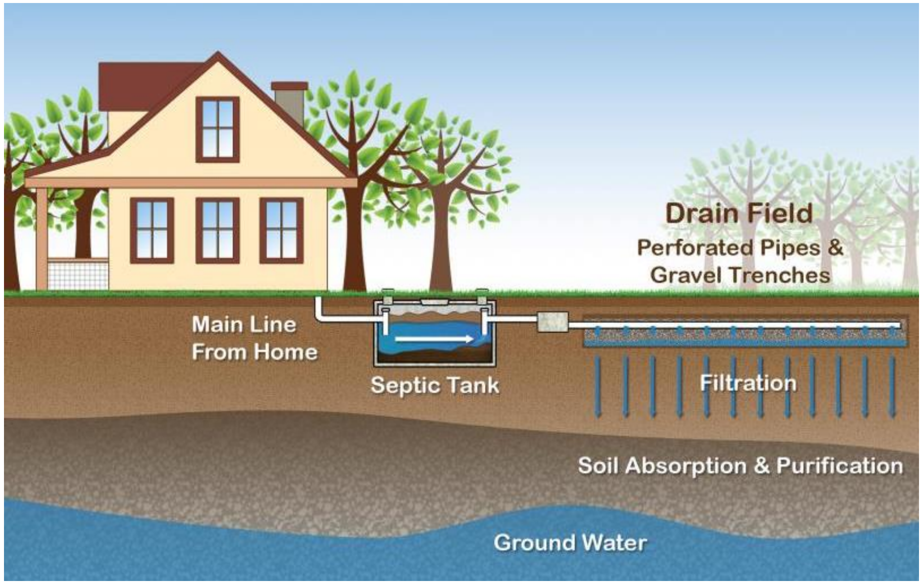

GROUNDWATER RECHARGE




POROUS ASPHALT DIAGRAM

- 46” rainfall per year on 2000 SF of impervious
- 53,000 gal/yr in a raingarden,
- ~2GPD/SF at 0.4 mg/L nitrogen
- 0.8 mg Nitrogen per day per square foot of infiltration

## Septic System




- 420 gallons per day septic system
- 153,000 gal/yr for leach field,
- ~1GPD/SF at 40 mg/L nitrogen
- 37 mg Nitrogen per day per square foot of leach field

# Frimpter Overview

- Study evaluated 83 observation wells
- 8 to 37 years
- Varied hydrogeologic materials and landform position
- till, sand and gravel on terraces, and sand and gravel in valleys
- determined the annual maximum water levels and annual variation with a 95% probability by broad soil type and landform position

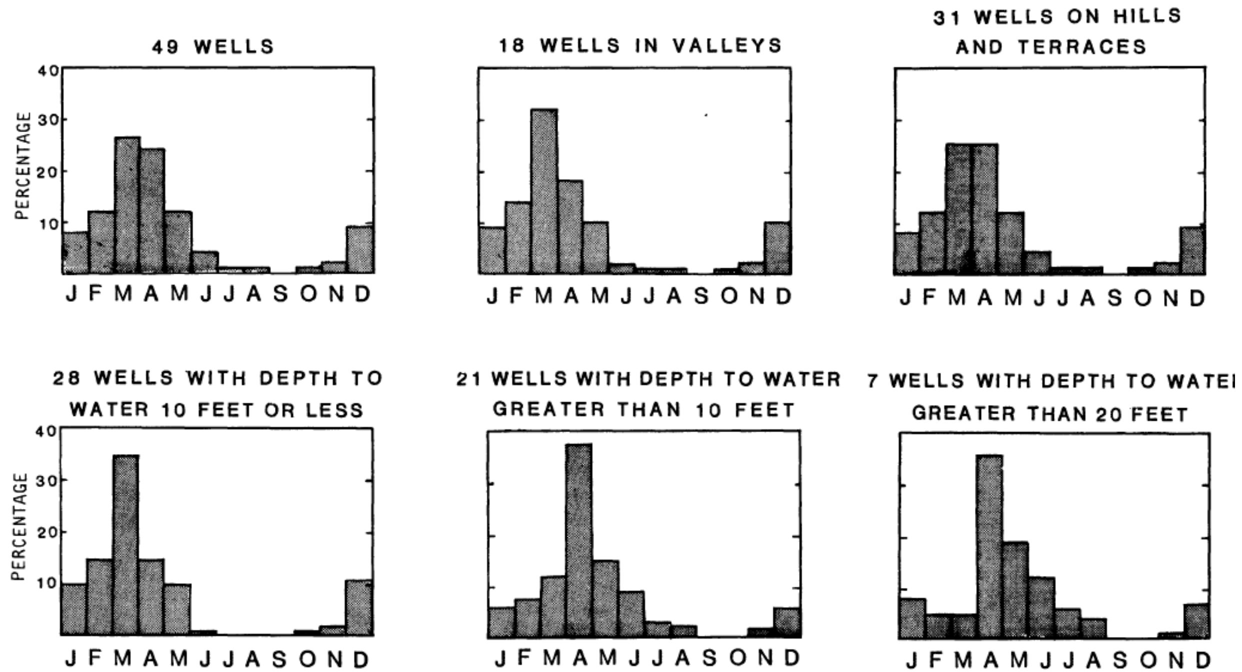
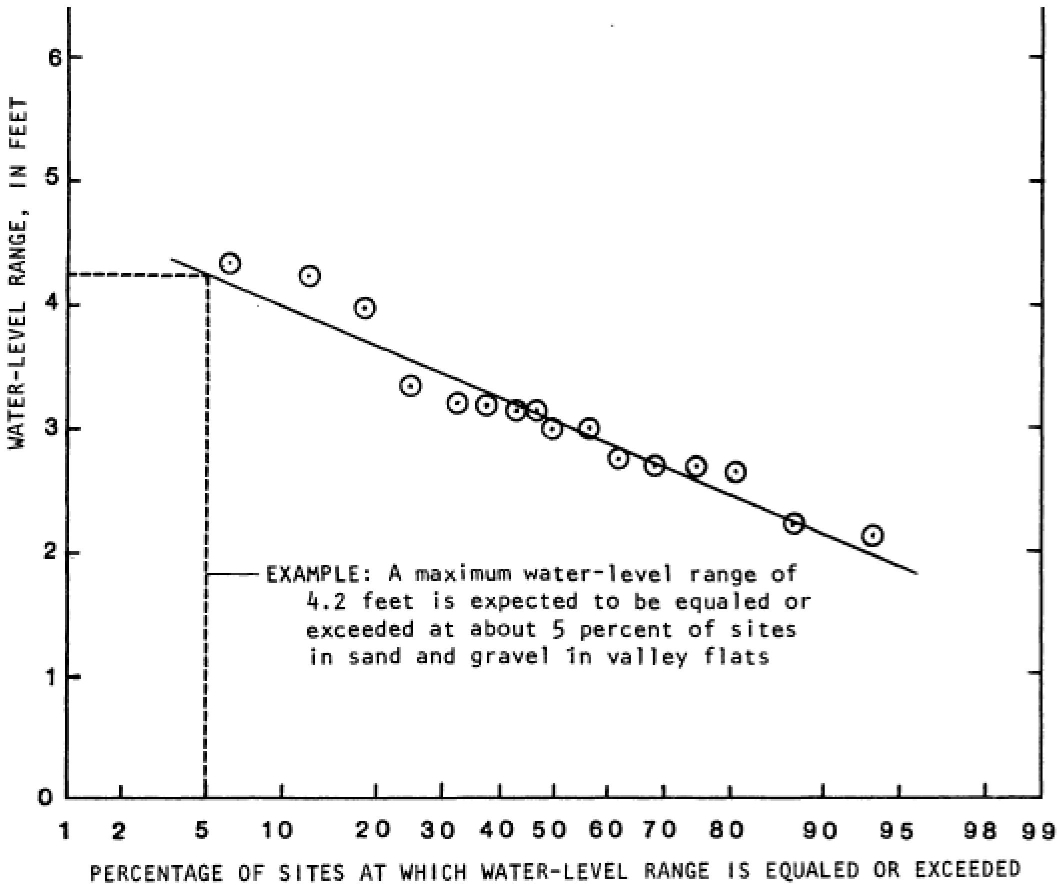



Figure 9.--Frequency of maximum annual water level in groups of wells in sand and gravel

**Annual SHWT occurs in March and April**

# Variations in Water Level




95% CONFIDENCE THAT THERE IS LESS THAN 4.2 FEET IN VARIATION IN SAND AND GRAVEL FROM ANNUAL MAXIMUM TO ANNUAL MINIMUM

**Frimpter, USGS, 1981**

# Frimpter Method

- Allowed in MA as an alternate method to RMF
- A simplified approach to estimation of seasonal high-water table by a single measurement of an existing water table taken <u>outside</u> the annual maximum period  and then adding the annual maximum difference by soil type.
- Depth to Water + Annual Maximum Difference = Frimpter Design SHWT
- Depth to water taken at a time outside of annual maximum

PROBABLE HIGH GROUND-WATER LEVELS IN MASSACHUSETTS

By Michael H. Frimpter

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U.S. GEOLOGICAL SURVEY

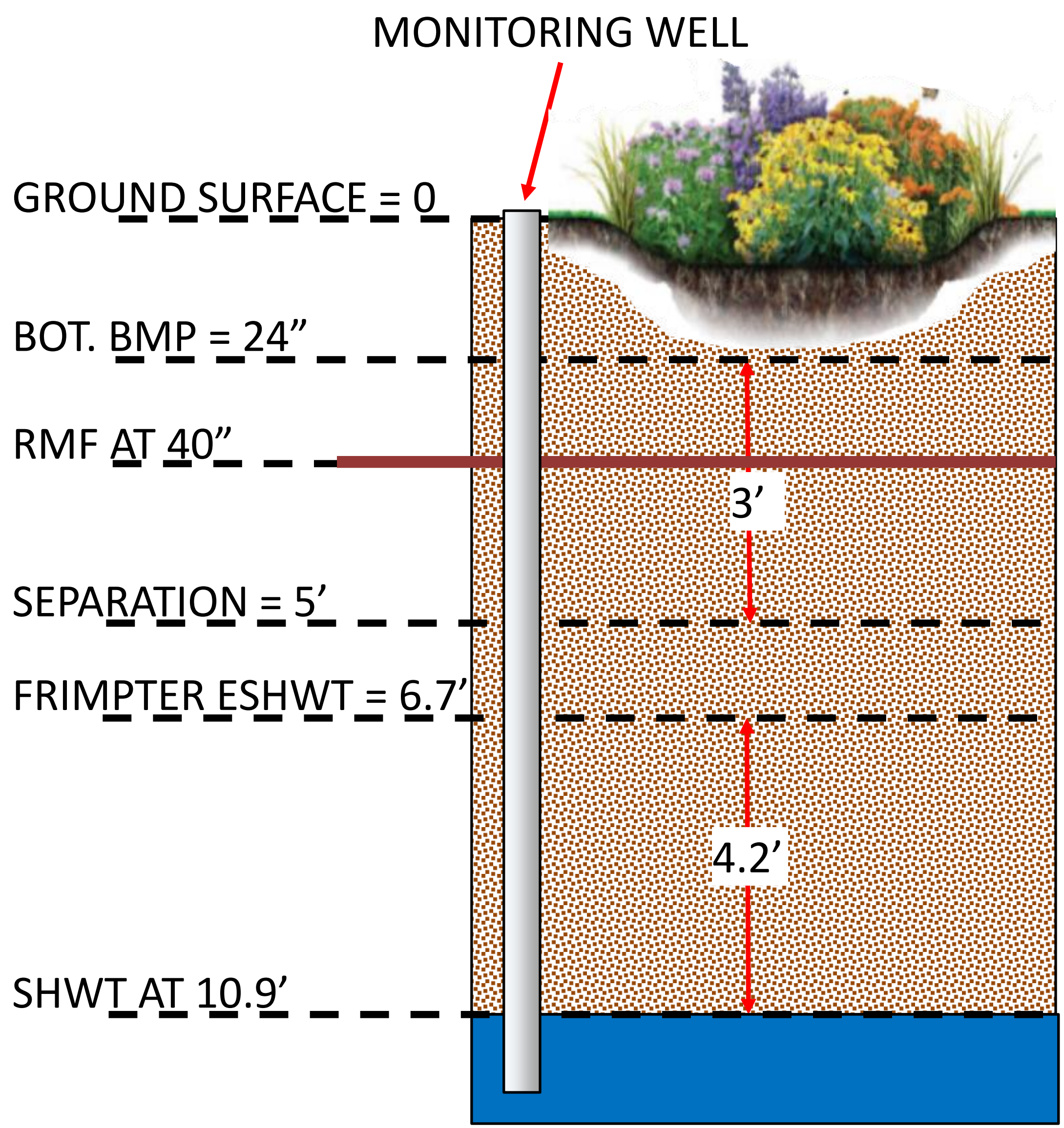
Water Resources Investigations 80-1205

Open-File Report 80-1205

**Frimpter, M. (1981). Probable high ground-water levels in Massachusetts. Boston, MA, US Geological Survey.**

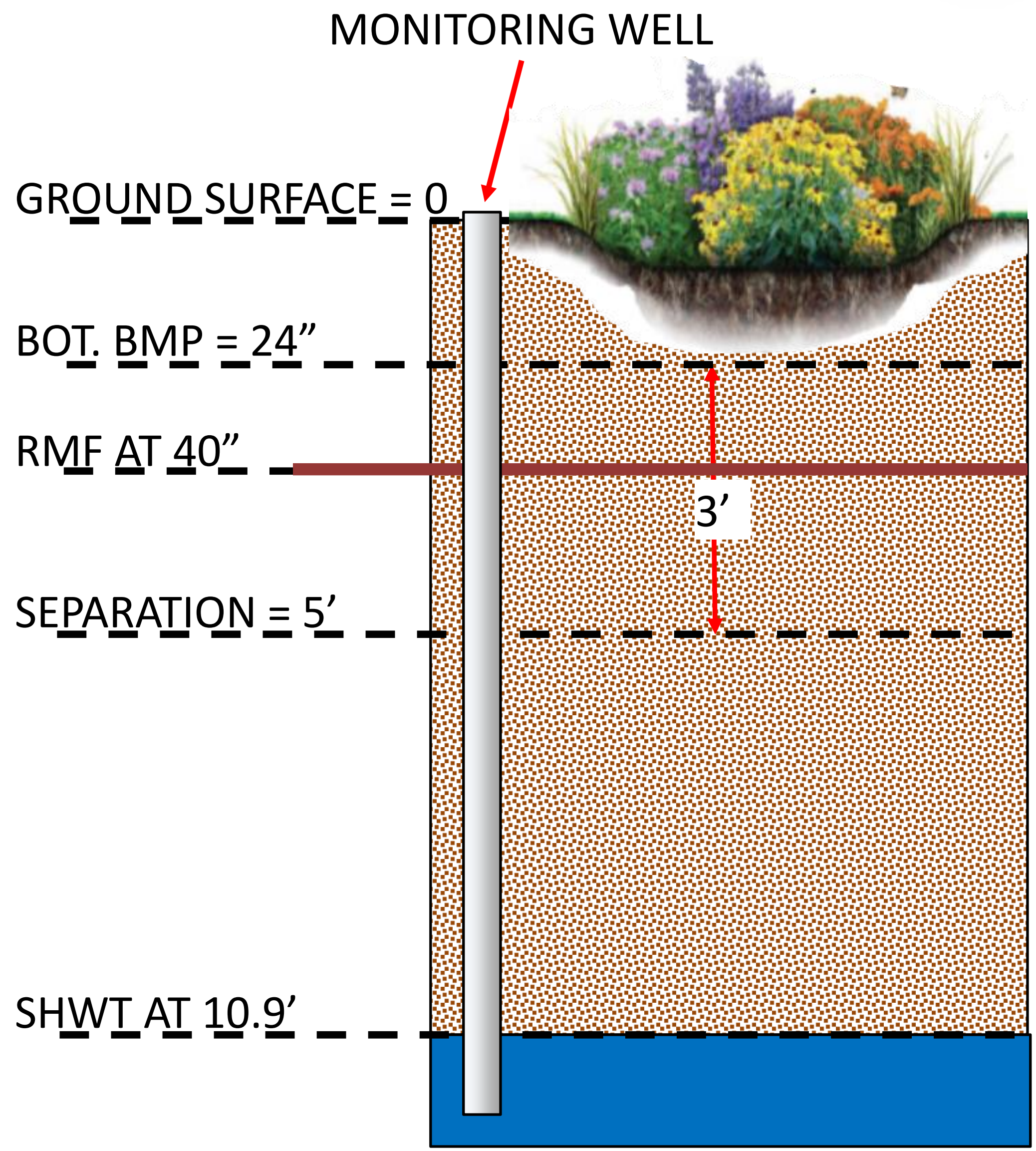
# Method Example 1: May-February

- A project site with a 2-foot-deep bioretention
- 3 foot separation from seasonal high water table
- plus 4.2 feet of maximum observed variation at the 95th percentile for a sand and gravel valley
- Depth to water = 10.9' outside of annual maximum (May to February)



# Method Example 2: March to April

- A project site with a 2-foot-deep bioretention
- 3 foot separation from seasonal high water table
- Depth to water = 10.9’ during annual maximum (March-April)
- No need to apply annual maximum separation

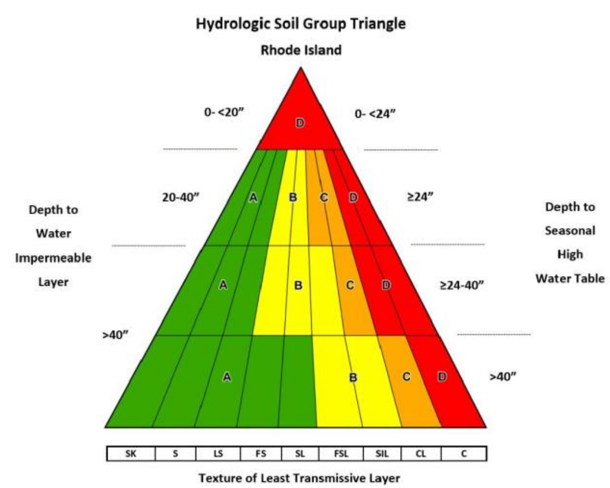


# Example Data from 4/3/18

| Test Pit | Depth to Water/ Well Depth | ESHWT by RMF | Frimpter ESHWT | DIFF | Infiltration Rate by RI Triangle | Field Infiltration Rate |
|---|---|---|---|---|---|---|
| # | FT, BGS | FT, BGS | FT, BGS | FT | | IN/HR |
| 1 | DRY/4.24 | 3.58 | 4.24 | **2.32** | 0.1 | 6.0 |
| 1.2 | DRY/9.83 | 3.58 | 9.83 | **2.32** | 0.1 | 6.0 |
| 7 | DRY/15.09 | 2.08 | 15.90 | **13.82** | 0.1 | 6.0 |

**IMPORTANT TO NOTE THAT THE CHANGE OF HSG FROM “A” TO “D” FOR SHWT HAS SIGNIFICANT IMPACT ON DESIGN INFILTRATION RATE IF CUT OCCURS BY SITE GRADING**

All soils with a depth to water impermeable layer <20” and/or a depth to the seasonal high water table of <24”will be in HSG D.



# Thank you for your time

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