

# Soil Investigations

## “Why They Matter”

*Perry Lindquist, Waukesha County  
Land Resources Division Manager*



# Soils Agenda

- Perry Lindquist - 20 minutes
  - Soils overview, ordinance requirements & why
- Steve Hoelz – 20 minutes
  - USDA class., redox features, local soils
- Pete Wood – 10 minutes
  - WDNR Standard 1002

# Key Soils Issues

- Soil investigation standards
- Suitability for infiltration BMPs
- Suitability for wet detention
- Basement wetness/flooding
- Planning for construction dewatering and erosion control

# Soil Investigation Standards

- Comm 85 (WI Admin. Code)
  - Procedures, forms, state certification, etc.
  - USDA classification system
- DNR Technical Std. 1002
  - # of tests, depth, etc. by BMP type

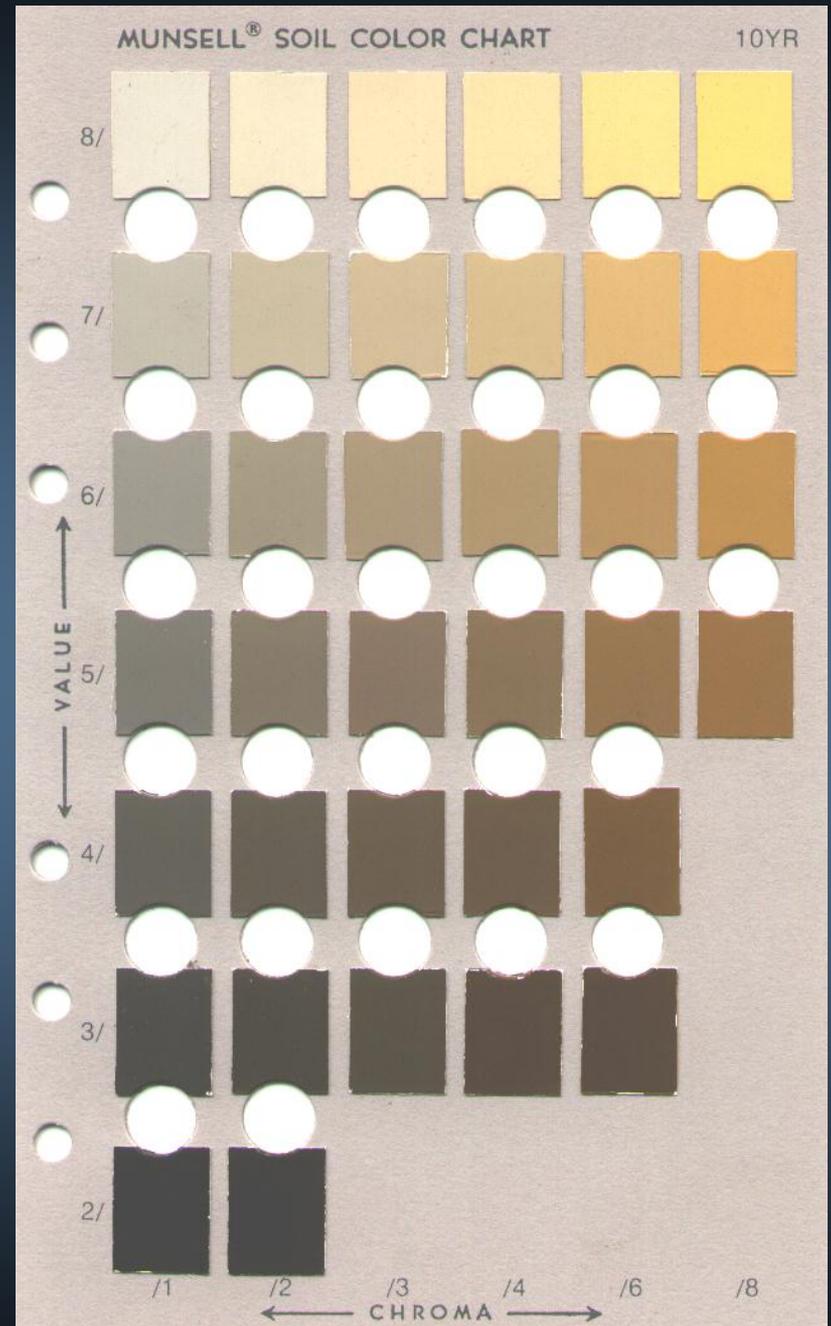


# Soil Mottling *(Redoximorphic Features)*



# Munsell Color Charts

- Hue
- Value
- Chroma



# Documentation

- Standardized form and process
- Seasonal high groundwater based on soils
  - Not saturation or “water fill” elevation

Wisconsin Department of Commerce  
Division of Safety and Buildings

**SOIL EVALUATION - STORM**  
In accordance with Comm 82.365 & 85, Wis. Admin. Code

Page \_\_\_\_ of \_\_\_\_

Attach complete site plan on paper not less than 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

*Please print all information.*

Personal information you provide may be used for secondary purposes (Privacy Law, s. 15.04 (1)(m)).

Property Owner		Property Location							
Property Owner's Mailing Address		Govt. Lot	1/4	1/4	S	T	N	R	E (or) W
City		Lot #	Block #	Subd. Name or CSM#					
State		Zip Code		Phone Number		<input type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Town    Nearest Road			

Drainage area _____ <input type="checkbox"/> sq. ft. <input type="checkbox"/> acres Optional: Test Site Suitable for (check all that apply) <input type="checkbox"/> Irrigation <input type="checkbox"/> Bioretention trench <input type="checkbox"/> Trench(es) <input type="checkbox"/> Rain garden <input type="checkbox"/> Grassed swale <input type="checkbox"/> Reuse <input type="checkbox"/> Infiltration trench <input type="checkbox"/> SDS (> 15' wide) <input type="checkbox"/> Other _____	Hydraulic Application Test Method: <input type="checkbox"/> Morphological Evaluation <input type="checkbox"/> Double-Ring Infiltrometer <input type="checkbox"/> Other (specify) _____
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<input type="checkbox"/> Obs. #	<input type="checkbox"/> Boring	<input type="checkbox"/> pit	Ground surface elev. _____ ft.	Depth to limiting factor _____ in.						Hydraulic App. Rate
Horizon	Depth In.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Inches/Hr	

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CST/PSS Name (Please Print)	Signature	CST/PSS Number
Address	Date Evaluation Conducted	Telephone Number

SBD-10793 (R.1/05)

# Infiltration Requirements

- Maintain predevelopment infiltration volumes:
  - Residential - 90% predevelopment
  - Non-residential - 60% predevelopment

# Suitability for Storm Water Infiltration

- Soil texture/infiltration rate (feasibility)
  - Can apply for exemption if infiltration rate is <0.6 inches/hour for all applicable areas
    - Using NRCS textures & book rates, or
    - Using on-site measured rates (double ring infilt.)
  - Evaluate whole site (not just the low spots)

**Infiltration rates  
<0.6 in./hour**

DNR Design Rates  
(Standard 1002)

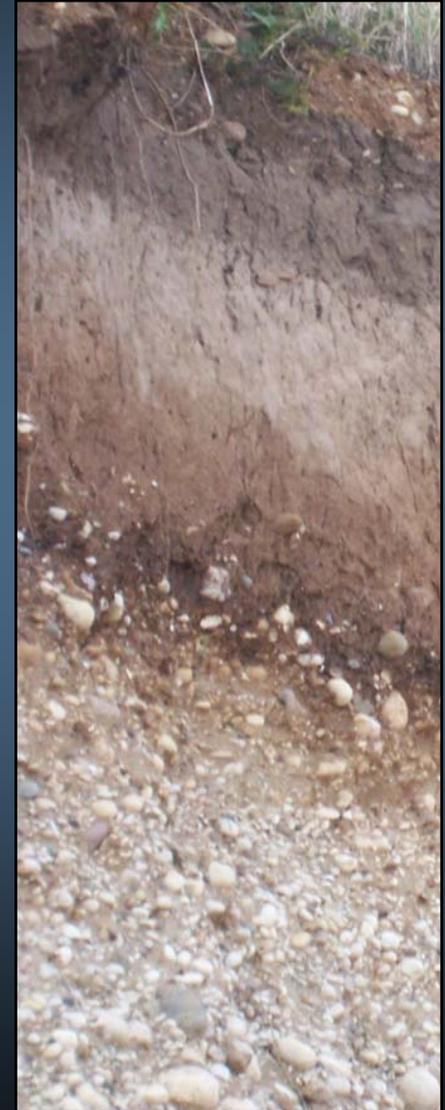
**Don't ask to exempt  
these soil textures!**

NRCS Book Rates  
(exempt below line)

- Coarse sand & gravel
- Loamy coarse sand
- Sand
- Loamy sand
- Sandy loam
- Loam
- Silt loam
- Sandy clay loam
- Clay loam
- Silty clay loam
- Sandy clay
- Silty clay
- Clay

# Suitability for Storm Water Infiltration

- Evaluate whole soil profile
  - Not just the limiting layer (B2t)
- May require removal of limiting soil layer

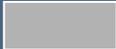
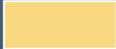


# Infiltration Potential

(4 foot depth)

Town of  
Genesee

## Legend

-  Low (exempt)
-  Moderate
-  High
-  Very high
-  Excessively high



# **“Filtering layer” (groundwater protection)**

- Minimum soil filtering & distance to bedrock/seasonal high groundwater:
  - 5 feet with 10% fines (#200 sieve)
    - Comm., industrial, parking lots, arterials, etc.
  - 3 feet with 20% fines (#200 sieve)
    - All other areas except roof runoff
  - Another medium with an equivalent level of protection, as determined by the LRD
- Does not apply to roof runoff (1 foot)

# Technical Exemption Process

- No self-proclaimed exemptions
- Must submit written exemption request
  - Explanation, soils data, maps, calculations, etc.
- Determination by LRD in accordance with ordinance criteria
  - “Impractical” due to site conditions...beyond the control of the applicant (site plan not an excuse)

2 inches compost (S 100) mixed by chisel/rotary device

**Compaction Mitigation  
(Infiltration Basin)**



**S 100 Compost**

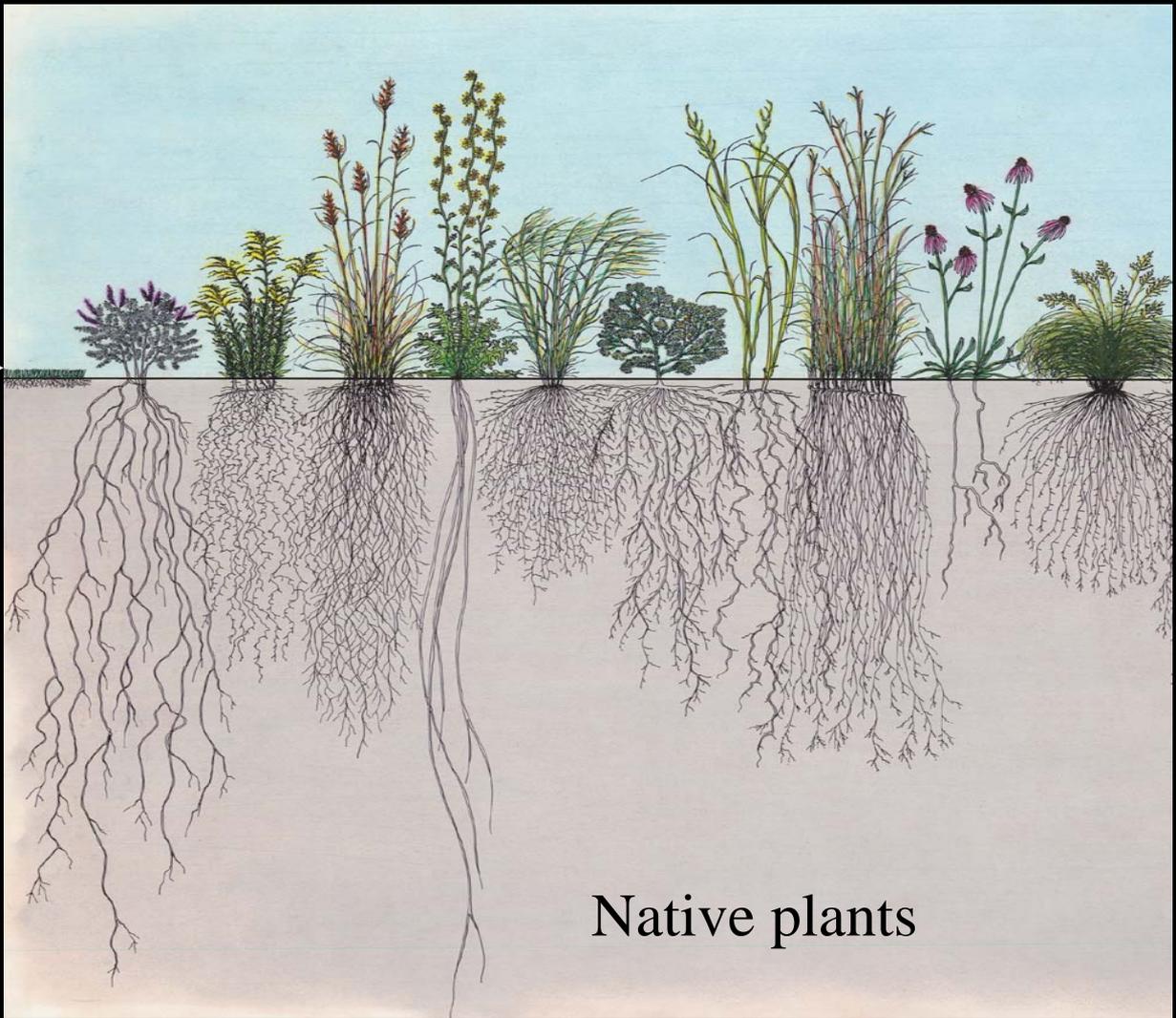


**Compost &  
soil/sand Mix**



# Just enough to get those roots growing!

Lawn grass: →  
3 inches



Natives: {  
5-15 feet

Native plants

# Suitability for Wet Detention

## *(DNR Technical standard 1001)*

- Pond liner requirements:
  - To protect groundwater, based on pollutant load in runoff (3 liner types)
  - Or needed to support permanent pool (rural)
    - Safety/erosion issue when safety shelf is exposed
    - Evaluate annual runoff volume and watershed size (water budget)
- For low density residential, may use high water table soils



Designed  
safety shelf



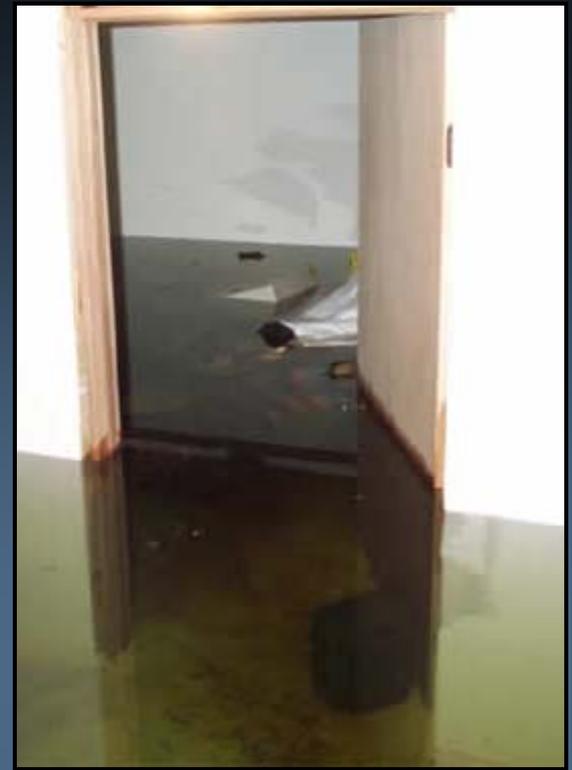
**Pond Not Holding Water**

# Basement Flooding



- Is preventable, but previous “warnings” did not work
- More of a problem as exposed basements have become more popular & expensive
  - Should not rely on a sump pump/electricity
  - Flooding can be from groundwater seepage or surface runoff – or both
  - Insurance exclusions

"Drainage Wars"





Municipal headaches



**Internally Drained Areas**

# Rain on Frozen Ground



Internally drained areas

# Flooding from Surface Runoff



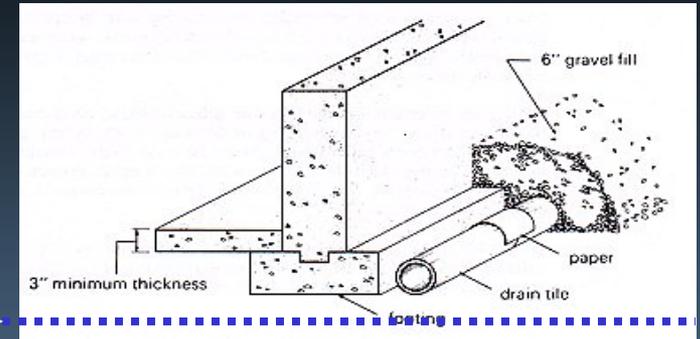
Internally drained areas

# Exposed Structure Restrictions (flooding from surface runoff)

- Lowest elevation of the exposed structure must be min. 2 feet above peak surface water elevation and setback min. 50 feet
  - Based on 100-year 24-hour rain event
  - Assume frozen ground (no infiltration in basin and watershed RCN of 98)
  - Limiting exposure elevation and building setback must be recorded on plat/CSM

# Basement Restrictions (flooding from groundwater)

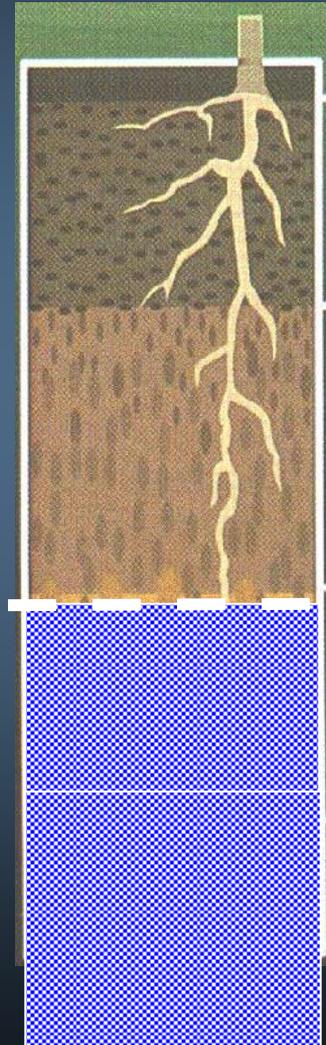
*Water table* →



- Basement floors must be a minimum of 1 foot above “seasonal high groundwater”
  - 8 foot deep soil profiles required
  - Test  $\leq 50$  feet of proposed basement in target areas
    - Within 8 vertical ft. of surface water, wet soils, etc.

# “Seasonal High Water Table”

“The upper limit of the zone of soil saturation caused by underlying groundwater at its highest level”



# Basement/Groundwater (cont.)

- Soil report by CST or PSS
- Any seasonal water table indicators requires Interpretative Report by CST, PSS, PE, PH
  - Form A to document basement/g.w. elevations
- Avoid all “hydric” soils (see list and GIS map)
  - Requires PSS to reclassify
- Limiting basement elevation must be recorded on plat/CSM



**Hydric Soil**  
(Sebewa silt loam)

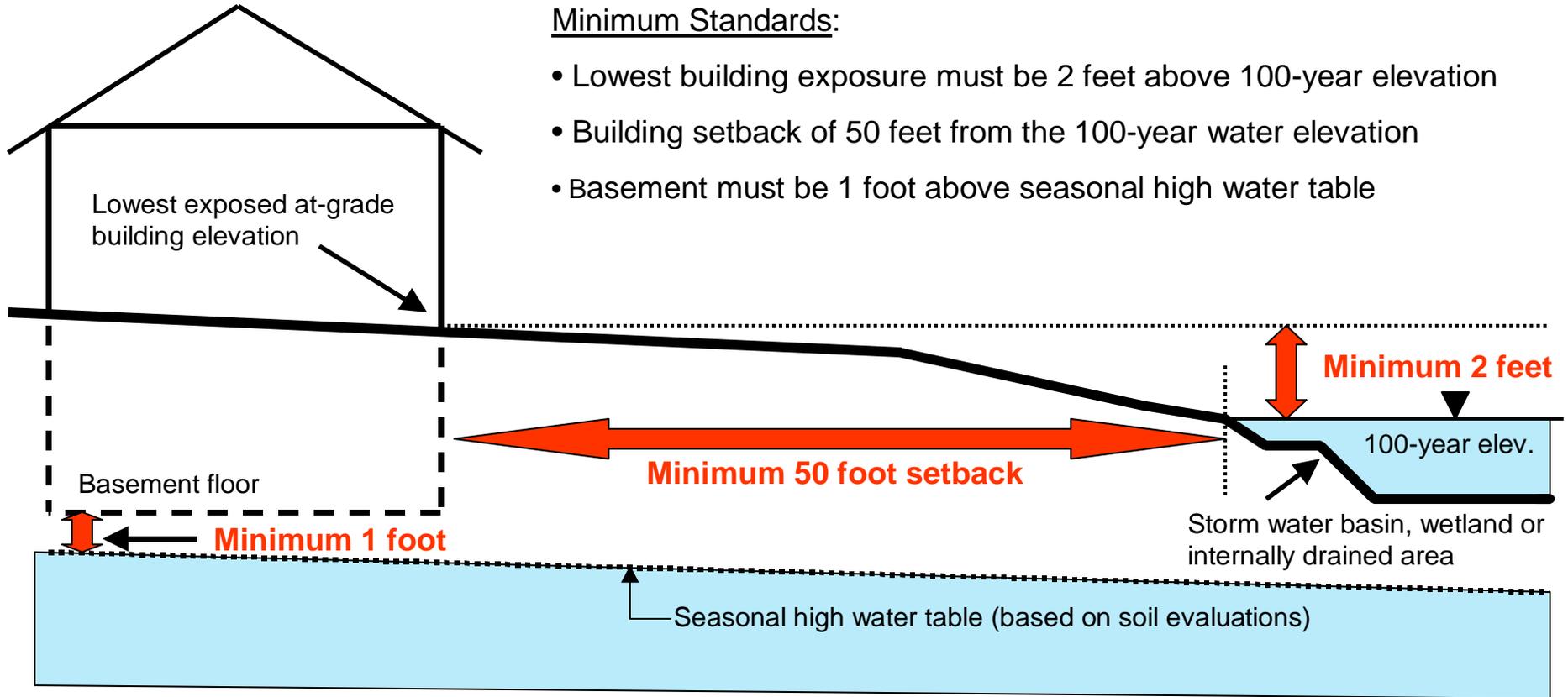
**Note: If its too wet for infiltration, it is no good for basements either!**

# Minimum Site Drainage Standards

*Waukesha County Storm Water Ordinance*

## Minimum Standards:

- Lowest building exposure must be 2 feet above 100-year elevation
- Building setback of 50 feet from the 100-year water elevation
- Basement must be 1 foot above seasonal high water table



# Site Screening Tools

NRCS – Web Soil Survey

## SOIL SURVEY OF MILWAUKEE AND WAUKESHA COUNTIES WISCONSIN

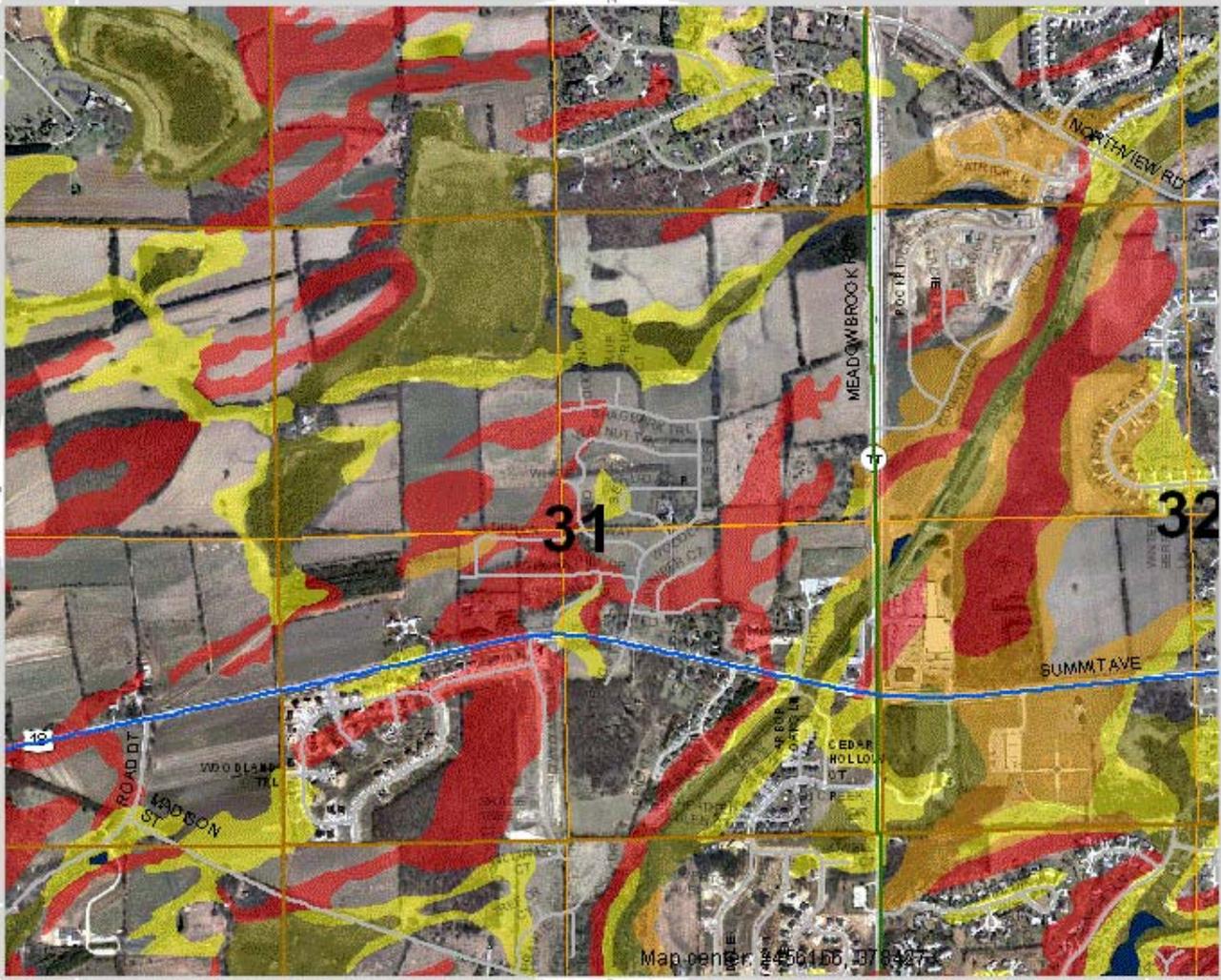


U. S. Department of Agriculture  
Soil Conservation Service  
In cooperation with  
University of Wisconsin  
Wisconsin Geological and Natural History Survey  
Soils Department and  
Wisconsin Agricultural Experiment Station

Issued July 1971

# Waukesha County GIS on the Web

About Layers Legend Selection Key Map Bookmarks Print Map Locate Parcel Query Points of Interest Query Land Division Query Help Exit



- Shared Interest Parcels
- Road Rights of Way
- Railroad Rights of Way
- Background
- Survey Control System
- Transportation
- Environment and Land Use
- Soils
  - Soil Thematic Maps
    - Building Limitations
      - <1 Foot to Watertable
      - <3 Feet to Watertable
      - 1-4 Feet to Bedrock
      - Slopes >12%
    - Depth to Seasonal High Water Table
    - Hydric Classification
    - Hydrologic Soil Group (Native Condi
    - Land Capability Class
    - Percent Slope
    - Stormwater Infiltration Potential
    - Surface Textures
  - Soils
- Park and Open Space
- Topography
- Hydrology
  - Water Annotation
  - Water Anno (Large Scale)
  - Best Mgmt Practices
  - Lakes and Rivers (Stream)

Scale: 1:17,499 Quick View: Select a location Map Tool: Zoom In Active Layer: Parcels

Powered by geocortex

Cursor Location: NAD27 SPCS WI South: 2458528, 374774

Trusted sites

# Other GIS Resources

- NRCS
- DNR

# Exhibit X

**Exhibit X**  
**Waukesha County Soil Series Designated as Hydric or**  
**Having Seasonal High Water Table Within 3 feet of the Surface\***

Soil Map Symbol**	NRCS Soil Series Name	Depth to Water Table (inches)	Hydric Soil (X)
Ac	Adrian muck	0	X
Am	Alluvial land	12-24	
As	Ashkum silty clay	0	X
Az	Aztalan loam	12-36	
Bl	Blount silt loam	12-36	
Bs	Brookston silt loam	0	X
Cv	Clayey land	12-72	
Cw	Colwood silt loam	0	X
Dt	Drummer silt loam, gravelly substratum	0	X
Es	Elliot silt loam	12-36	
Fa	Fabius loam	12-24	
Gd	Gilford loam	0	X
Gf	Granby fine sandy loam	0	X
Gw	Griswold silt loam, mottled subsoil variant	12-36	
Hm/Ho	Hochheim loam, Hochheim	***	
Ht	Houghton muck	0	X
Ke	Kane silt loam	12-36	
Kl	Kendall silt loam	12-36	
Lm	Lamartine silt loam	12-36	
Lo	Lawson silt loam	12-36	
Lu	Loamy land	12-72	
Me	Markham silt loam	24-42	
Mf	Marsh	0	X
Mg	Martinton silt loam	12-36	
Mh	Matherton sandy loam	12-24	
Mm	Matherton silt loam	12-24	
Mo	Mayville silt loam	24-72	
Mt	Mequon silt loam	12-36	
Mzb	Montgomery silty clay loam	0	X
Mzf	Mundelein silt loam	12-36	
Mzg	Muskego muck	0	X
Mzj	Muskego loam	0	X

# Planning is Key

- Do soil investigations early!
  - Need for preliminary reviews (feasibility)
- Plan ahead - soil investigations must be deep enough and in the right places
  - Or else extra trips (\$) later

# Use the Soils Data

- For the designer, not the regulator
- Use for:
  - Site planning/BMP & outlot locations
  - BMP design
  - Setting minimum basement elevations
  - Planning for dewatering/erosion control
  - Septic system location & design
- If plans aren't supported by the soils data, they will be rejected

The End

