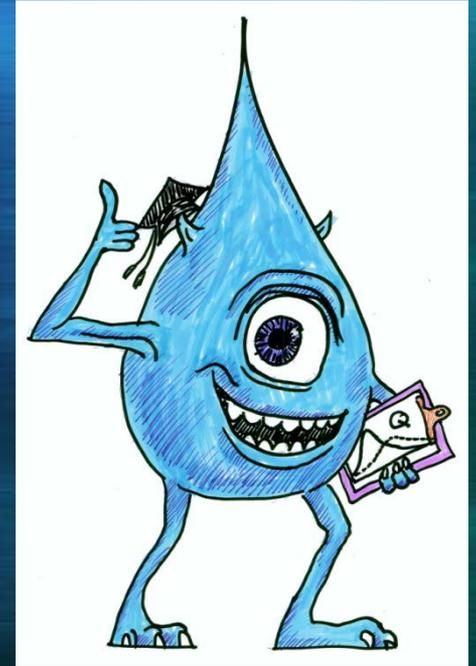


Storm Water Management Planning



Leif Hauge, PE, P. Hydrologist
Senior Civil Engineer
Waukesha County Land Resources Division

Site Plan Requirements

- Review Checklist 1
- Much in common with preliminary plat
- NAD 27 datum
- Soil test locations

Checklist #1

Site Plan Map Requirements

The following existing and proposed site features must be provided for all permit applications. Items listed below must be shown on the site and within 50 feet in each direction of the site boundaries. The county storm water ordinance requires a **Preliminary Review Letter** from the Land Resources Division (LRD) for projects that: a) Disturb a total land surface area of 1 acre or more; b) Involve the construction of a new public or private road of any length; c) Ultimately result in the addition of 0.5 acres or greater of impervious surfaces or; d) Other projects that may have significant negative impacts on adjacent properties or water resources due to soil erosion or storm water runoff.

All items on this list are required for the Preliminary Review Letter. Additional items must be shown on erosion control plans (see checklist #2) and storm water management plans (see checklist #3). A site plan map and supporting data of site conditions at a scale of 1 inch equals no more than 100 feet (unless otherwise noted) shall delineate or

Note: In addition to a paper copy, provide site map items in a digital format georeferenced to the State Plane Coordinate System, Wisconsin South Zone, NAD 27, NGSVD 20

- ___ 1. Development title, graphic scale and north arrow;
- ___ 2. Property location description by public land survey system (1/4 section, section, township, range, county);
- ___ 3. Location map (smaller scale) showing the site location within a public land survey section or subdivision, oriented the same as par. 4 below;
- ___ 4. Ownership boundaries, bearings, lengths and other survey references that will accurately identify the site location, in accordance with s. 236 Wisconsin Statutes and county mapping standards for all land divisions;
- ___ 5. Lot numbers and dimensions, including outlots for all land divisions;
- ___ 6. Name and complete **contact information** for the applicant, landowner, developer

Site Investigation

- Wetlands
- Infiltration potential
- Basement elevations
- Storm water BMP location and design



Wetlands

- Farming history doesn't preclude wetlands
- Air photos
- Review of maps not enough
- Walk the ground, hire delineator

1980, dry year



2008, wet year



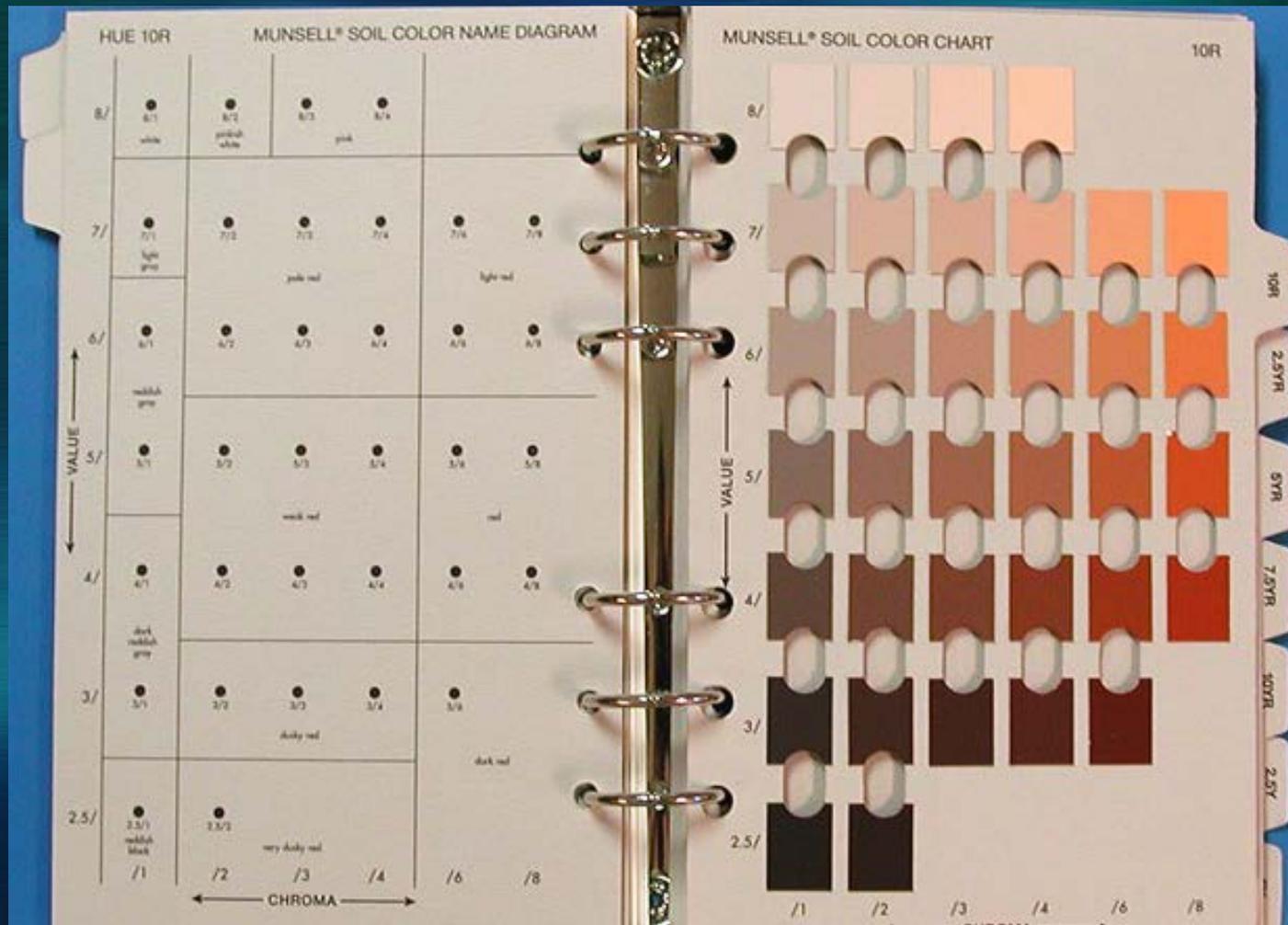
Soil Investigation Locations

- Basements – within 50 feet
- BMPs – 2+ in footprint, see 1002 standard
- Infiltration potential / rate / design / exemption



Soil Testing Requirements

- SPS 385
- USDA methodology



Plan Requirements

A plan shall describe how the permit holder... will meet the storm water management requirements...

Sample Storm Water Plan Narrative

(Sample Project: 40 lot rural subdivision on a county road)

Drainage Background:

The entire subdivision is located in the Pewaukee Lake watershed of the Fox River basin. There are no perennial or intermittent streams or any other water bodies within or adjacent to the site. Surface drainage from the site discharges into two ephemeral channels (which later join together) and travels approximately 900 lineal feet to the lake. No off-site runoff enters the site. Predevelopment drainage is shown on Map 1. Three acres of the site (Map 2) are requested to be exempted from meeting infiltration requirements as they have a measured infiltration rate of less than 0.6 in/hr (Attachment A). The exemption request fee (\$200) is attached.

Planning Goals:

The storm water planning goals include:

- Minimize sediment and other pollutants from entering the lake during and after construction; and
- Maintain predevelopment peak flows to avoid off-site channel erosion during post development storm water conveyance to the lake.
- Infiltrate runoff to recharge groundwater and maintain stream base flow.

Design Summary:

To accomplish the above goals, we propose to install a grass swale storm water conveyance system throughout the subdivision and two wet detention basins near the natural discharge points. (See the erosion control plan for site stabilization plans.) An infiltration basin will be installed at the outfall of each wet basin and the flows ultimately enter the existing ephemeral channels off site. Both wet detention basins are designed to comply with DNR's Wet Detention Basin Standard 1001, and the infiltration basins comply with the 1002 and 1003 standards. Specific design goals include the following:

- The wet basins will also serve as sediment basins during the road construction phase (extra 2' of

Guiding Principles

- Preserve natural watershed boundaries and drainage patterns
- Reserve adequately sized areas early in the site planning process
- Locate BMPs outside of wetlands, floodplains, or environmental corridors
- Minimize soil compaction
- Minimize impervious surfaces
- Use vegetation
- Separate cleaner runoff from more polluted runoff
- Provide for emergency overflow
- Distribute bioretention / infiltration BMPs throughout the site

Plan Requirements, Performance Standards

Peak discharge

- Pre-developed = Post-developed
- 1-, 2-, 10-, and 100-year 24-hour events

Total Suspended Solids

- 80%, vs no-controls, average annual basis
- 40% for redevelopment



Infiltration Standards (NR 151)

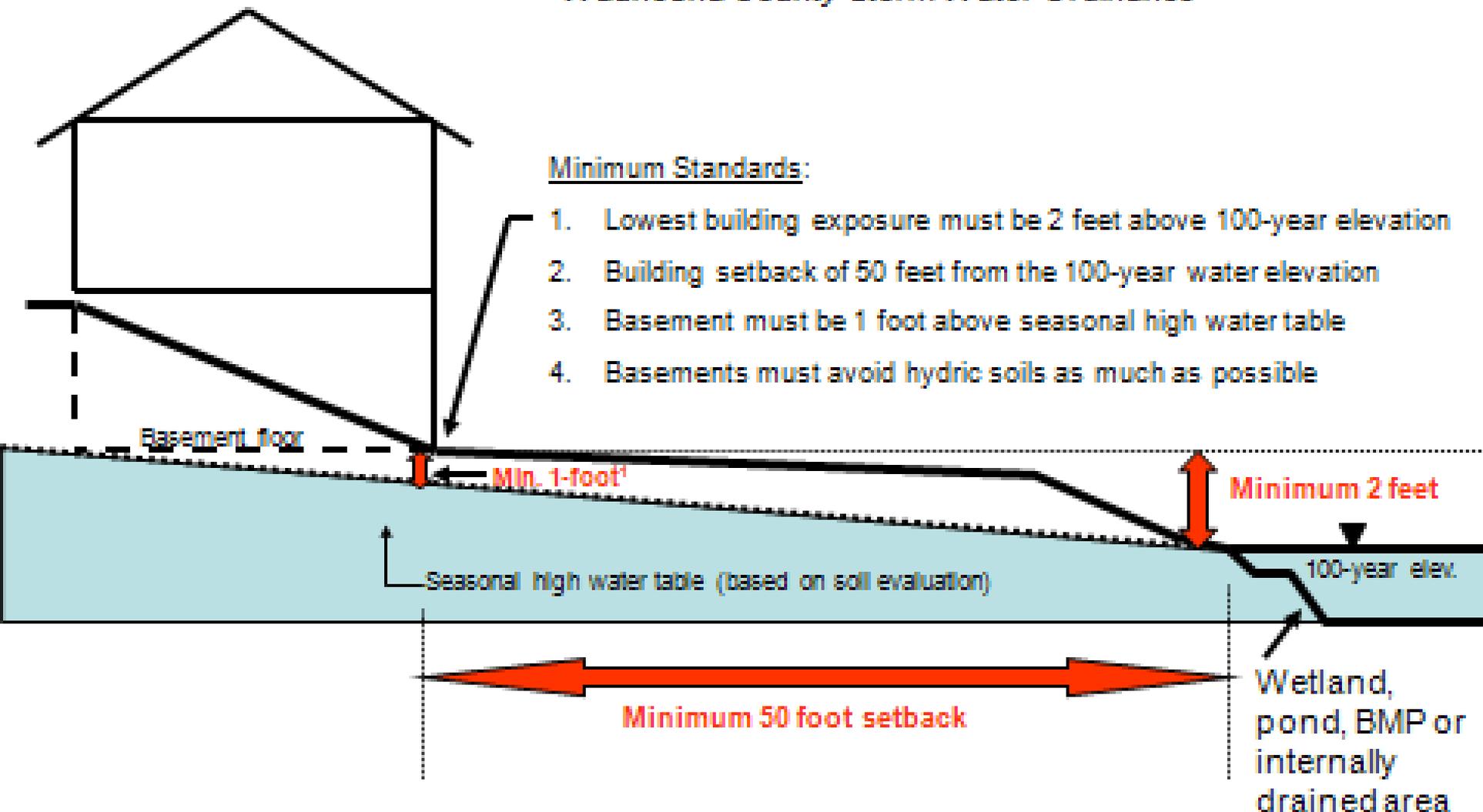
Impervious Category	Percent Connected Imperviousness	Post-Dev Infiltration Volume as Percent of Pre-Dev Volume
Low	Up to 40%	>90%
Medium	40-80%	>75%
High	>80%	>60%

Site Drainage Standards

- Drainage easements
- Grade so flows are away from buildings, infrastructure
- Street drainage, Flow depth at drainage crossings, <6 inches in 100-year storm
- Maintain storage areas
- Basement floors >1 foot above SHWT
- Open channels draining <130 acres sized for 10-year storm (>130 = 25 yr)
- Structure protection: 2-ft vertical 50-ft horizontal from 100-yr water surface
- Internally-drained areas assume 98 CN

Minimum Site Drainage Standards

Waukesha County Storm Water Ordinance



¹ The soil evaluation results must be interpolated through the building site. A gravity drain system may be required if a suitable outlet is available.

Review Checklist #3

- Separated into preliminary and final plans
- Must include soil data

Checklist #3

Storm Water Management Plan Requirements

Under county ordinance, additional impervious surfaces in a proposed development may trigger the need for a storm water management plan and permit. A storm water management plan is designed to protect downstream water resources and property owners from water pollution, flooding and other damage caused by urban runoff after a development is complete. Storm water management plans designed to meet the requirements of the county ordinance shall, to the maximum extent practicable, adhere to the following guiding principles:

- 1) Preserve natural watershed boundaries and drainage patterns;
- 2) Reserve adequately sized areas for storm water infiltration, detention and treatment early in the planning process;
- 3) Locate storm water BMPs upstream from where runoff leaves the site or enters waters of the state and outside of wetlands, floodplains, primary or secondary environmental corridors or isolated natural areas;
- 4) Minimize soil compaction and maintain pre-development groundwater recharge areas;
- 5) Minimize impervious surfaces and have them drain to vegetated areas for pollutant filtering and infiltration;
- 6) Emphasize vegetated swales, warm season and wetland plantings and low flow velocities for storm water conveyance, treatment and infiltration, especially for transportation related projects;
- 7) Allow for different storm water management strategies for cleaner runoff (i.e. roofs) versus more polluted runoff (i.e. streets and parking lots);

Preliminary Storm Water Management Plans must include (for Preliminary Review Letter):

- ___ 1. A **site map** in accordance with Checklist #1. Digital submittal required.
- ___ 2. **Drafting date and contact information** for the project engineer with all other mapping elements and scale consistent with the site plan map.
- ___ 3. Delineation of existing and proposed **watersheds**, subwatersheds and major flow paths within the site and draining into the site from adjacent properties.
- ___ 4. Location, type and **preliminary design** of proposed storm water BMPs needed to comply with the ordinance.
- ___ 5. Location and type of major storm water **conveyance systems** proposed for the site.
- ___ 6. Existing and proposed storm water **discharge points**.
- ___ 7. Locations and preliminary dimensions of proposed **drainage easements**.
- ___ 8. Location of soil borings and **soil profile evaluations** with surface elevations and unique references to supplemental data sheets, as needed to determine feasibility of any proposed storm water BMP and to comply with applicable BMP technical standards.
- ___ 9. Preliminary location of **access lanes** for maintenance of storm water BMPs.
- ___ 10. Support documentation including:
 - ___ a. Preliminary **plan narrative** describing site drainage, ultimate receiving water body for off-site discharge, impervious restrictions, and how the preliminary storm water management

Formatting

- Summary tables for watersheds

Example Data Summary Sheet for Stormwater Management Plan

Project Name: Rolling Acres **Project Size:** 120 Acres **Project type:** Residential Subdivision **No. of Lots:** 180
Number of Runoff Discharge Points: 3 **Watershed (ultimate discharge):** Pewaukee Lake (via unnamed tributary)
Watershed Area (including off-site runoff traveling through project area): 140 acres (20 acres off-site)
Public Land Survey Location: SE1/4, Section 32, T8N R19E (Pewaukee Township)

+

Summary Data Elements	Subwatershed A		Subwatershed B		Subwatershed C	
	Pre-develop	Post-develop	Pre-develop	Post-develop	Pre-develop	Post-develop
Watershed Areas (see attached map)	100 acres	120 acres	20	10	20	10
Average Watershed Slopes	2-8%	2-8%	3-6%	3-6%	6-8%	6-8%
Land Uses (% of each, see attached map)	75 ac. cropland 15 ac. brush 10 ac. woodland	110 ac. ½ ac. lots 5ac. brush 5 ac. woodlands	100% cropland	100% ½ ac. lots	100% Woodland	100% ½ acre lots
Runoff Curve Numbers	68 x 75 ac.= 5100 30 x 25 ac.= 750 Net 5850/100 ac. RCN = 59	70 x 110 ac.= 7700 10 x 10 ac.= 100 Net 7800/120ac RCN = 65	RCN = 68 (state standard)	RCN = 70	RCN = 55	RCN = 70
Conveyance Systems Types	Grass waterway	50% grass swale 50% storm sewer	100% bare channel	100% grass swale	100% natural channel	100% storm sewer
Summary of Average Conveyance System Data	8' bottom/4:1 ss 2' depth/3% grade	2' depth swale/3% 30" r/c sewer/2% (see calcs.)	15' (w) top 1' (d) parabolic 2% grade	2' deep standard road ditch 2% grade	15' top (w) 1' (d) parabolic 4% grade	2' deep standard road ditch 4% grade
Time of Concentration (Tc) (see attached map & worksheets)	1.1 hrs.	0.97 hrs.	0.74 hrs.	0.65 hrs.	0.45 hrs.	0.35 hrs.
Runoff volume: 25% of 2-yr 24-hr storm, post-developed	N/A	0.94 ac. ft.	N/A	0.18 ac. ft.	N/A	0.19 ac. ft.
Runoff volume: first half-inch	N/A	5.0 ac. ft.	N/A	0.41 ac. ft.	N/A	0.41 ac. ft.
Peak Flow: 1-year/24 hour (see attached hydrographs)	2.0 cfs	7.6 cfs	0.7 cfs	0.6 cfs	0.6 cfs	0.6 cfs
Peak Flow: 2-yr./24 hour	5.4 cfs	15.9 cfs	1.1 cfs	0.8 cfs	1.2 cfs	1.1 cfs
Peak Flow: 10-yr./24 hour	31.1 cfs	59.3 cfs	3.4 cfs	3.3 cfs	4.6 cfs	4.2 cfs

And BMPs

Example Data Summary Sheet for Infiltration Basin Design

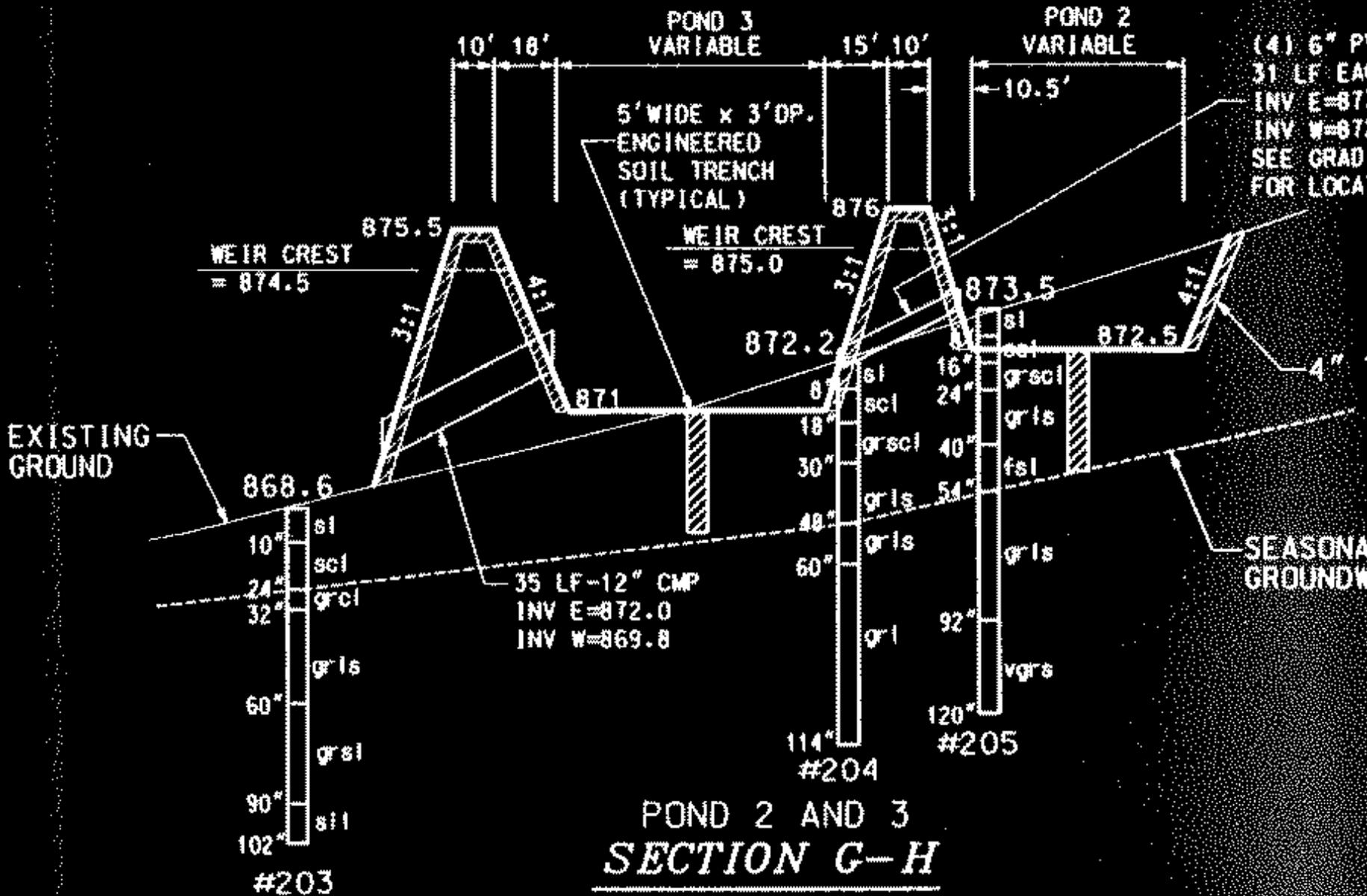
Design Element	Design Data
Site assessment data: (see attached maps)	
Contributing drainage area to basin (subwatershed A)	120 acres
Distance to nearest private well (including off-site wells)	> 100 feet
Distance to municipal well (including off-site wells)	> 1200 feet
Wellhead protection area involved?	No
Ground slope at site of proposed basin	average 3%
Any buried or overhead utilities in the area?	No
Proposed outfall conveyance system/discharge (w/ distances)	35 ft. to CTH "U" Road ditch 1000 ft. to wetland
Any downstream roads or other structures? (describe)	Yes - 36" cmp road culvert
Floodplain, shoreland or wetlands?	No
Soil investigation data (see attached map & soil logs):	
Number of soil investigations completed	3 (in basin area)
Do elevations of test holes extend 4 ft. below proposed bottom?	Yes (see map)
Average soil texture at pond bottom elevation (USDA)	Sandy loam
Design infiltration rate at basin bottom and method of analysis	2.0 in/hr, double-ring infiltrometer
Measured infiltration rate <i>following construction</i>	2.2 in/hr, double-ring infiltrometer
Distance from pond bottom to bedrock	> 5 feet
Distance from BMP bottom to seasonal water table	Trench bottom 3 ft above redox.
General basin design data (see attached detailed drawings):	
Basin bottom area	1.5 acres
Effective infiltration area	1.0 acres
1% of development area (120 acres)	1.2 acres
Basin bottom elevation	elev. 899.0
Top of berm elevation (after settling) and width	elev. 904.0 / 10 feet wide
Basin storage below outlet	1.0 ac-ft
25% of 2-yr 24-hr post-development runoff volume	0.94 ac-ft
Time to completely infiltrate stored water	6 hrs
Sediment forebay size & depth	0.16 acres (13% pool size)/5 feet
Additional design features	3' x 3' x 50' rock trench

Design Basin Inflow, Outflow & Storage Data

(see attached hydrographs and detail drawings)

Inflow Peak/Volume	Maximum Outflow Rate	Max. Water Elevation	Storage Volume at Max. Elev.	Outflow Control Structures*

BMP Cross-Section Details



Other Notes

- Technical exemptions – Request per procedure outlined in 14-342, letter
- Technical standards – WDNR
Conservation Practice Standards
- Maintenance agreement required – submit and record up front, with addendum to follow

Questions?

