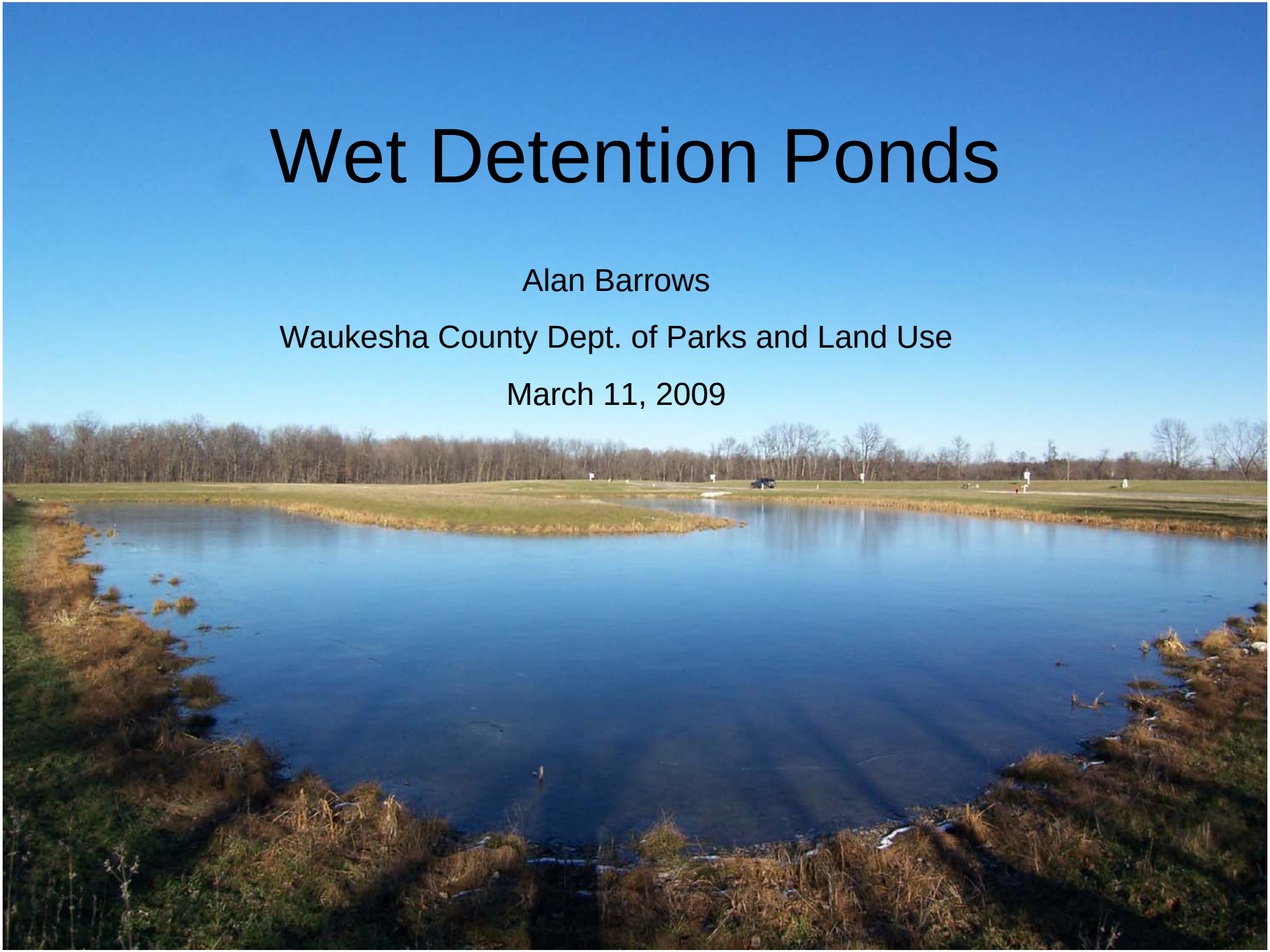
Wet Detention Ponds

Alan Barrows

Waukesha County Dept. of Parks and Land Use

March 11, 2009



Presentation Overview

Objective: Provide technical information regarding the design and installation of wet detention ponds to meet some post-construction performance standards and the guiding principals of storm water management.

Topics Covered Include:

WDNR Technical Standard 1001

Components of a Wet Pond

Pond Plan View and Cross-Section Drawings

Design Calculations

Pond Siting

As-Built Surveying

Pond Maintenance

Good & Bad Examples

WDNR Technical Standard

Wet Detention Pond
(1001)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A permanent pool of water with designed dimensions, inlets, outlets and storage capacity, constructed to collect, detain, treat and release stormwater runoff.

II. Purposes

The primary purposes of this practice are to improve water quality and reduce peak flow.

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This practice applies to urban sites where stormwater runoff pollution due to particulate solids loading and attached pollutants is a concern. It also applies where increased runoff from urbanization or land use change is a concern. Site conditions must allow for runoff to be directed into the pond and a permanent pool of water to be maintained.

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This practice provides a method to demonstrate that a wet detention pond achieves the total suspended solids (TSS) reduction and peak flow control required by NR 151.12, Wis. Adm. Code, for post-construction sites. Pollutant loading models such as SLAMM, P8, DETPOND or equivalent methodology may also be used to evaluate the efficiency of the design in reducing TSS.

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The following minimum criteria apply to all wet detention pond designs used for the purposes stated in Section II of this standard. Use more restrictive criteria as needed to fit the conditions found in the site assessment.

A. Site Assessment – Conduct and document a site assessment to determine the site characteristics that will affect the placement, design, construction and maintenance of the pond. Document the pond design. Items to assess include:

1. At the pond site, on a site map:

   a. Identify buildings and other structures, parking lots, property lines, wells, wetlands, 100-year floodplains, surface

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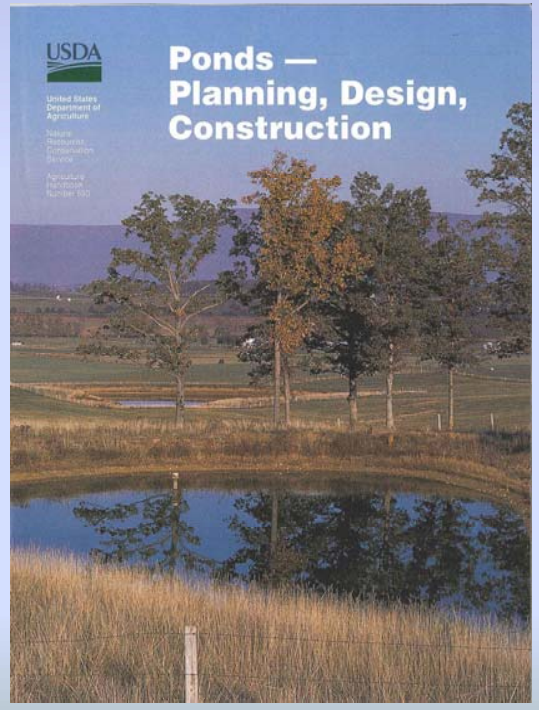
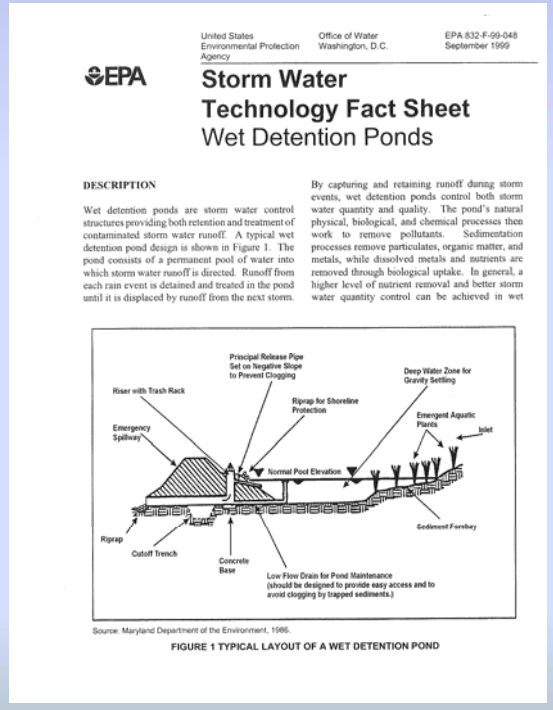
Two Functions of a Wet Detention Pond

1. Improve the quality of surface water runoff
   - Settling of particles and attached pollutants

2. Reduce the peak flow rate of discharged runoff
   - Reduce stream bank erosion
   - Reduce potential for downstream flooding

Other Design Resources





United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-99-048 September 1999

EPA

Storm Water Technology Fact Sheet
Wet Detention Ponds

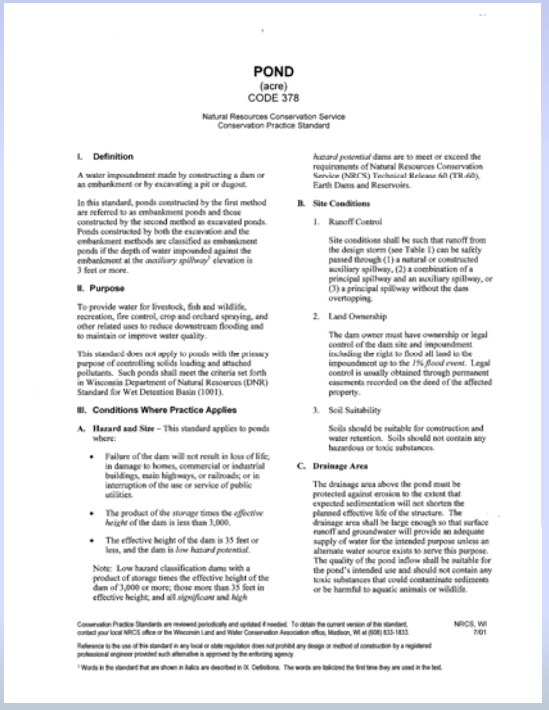
DESCRIPTION

Wet detention ponds are storm water control structures providing both retention and treatment of contaminated storm water runoff. A typical wet detention pond design is shown in Figure 1. The pond consists of a permanent pool of water into which storm water runoff is directed. Runoff from each rain event is detained and treated in the pond until it is displaced by runoff from the next storm.

By capturing and retaining runoff during storm events, wet detention ponds control both storm water quantity and quality. The pond's natural physical, biological, and chemical processes then work to remove pollutants. Sedimentation processes remove particulates, organic matter, and metals, while dissolved metals and nutrients are removed through biological uptake. In general, a higher level of nutrient removal and better storm water quantity control can be achieved in wet

Source: Maryland Department of the Environment, 1986.

FIGURE 1 TYPICAL LAYOUT OF A WET DETENTION POND



POND
(acre)
CODE 378

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout.

In this standard, ponds constructed by the first method are referred to as embankment ponds and those constructed by the second method as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the *auxiliary spillway*[1] elevation is 3 feet or more.

II. Purpose

To provide water for livestock, fish and wildlife, recreation, fire control, crop and orchard spraying, and other related uses to reduce downstream flooding and to maintain or improve water quality.

This standard does not apply to ponds with the primary purpose of controlling solids loading and attached pollutants. Such ponds shall meet the criteria set forth in Wisconsin Department of Natural Resources (DNR) Standard for Wet Detention Basin (1001).

III. Conditions Where Practice Applies

A. Hazard and Size – This standard applies to ponds where:

- Failure of the dam will not result in loss of life; in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities.
- The product of the *storage* times the *effective height* of the dam is less than 3,000.
- The effective height of the dam is 35 feet or less, and the dam is *low hazard potential*.

Note: Low hazard classification dams with a product of storage times the effective height of the dam of 3,000 or more; those more than 35 feet in effective height; and all *significant* and *high hazard potential* dams are to meet or exceed the requirements of Natural Resources Conservation Service (NRCS) Technical Release 60 (TR-60), Earth Dams and Reservoirs.

B. Site Conditions

1. Runoff Control

   Site conditions shall be such that runoff from the design storm (see Table 1) can be safely passed through (1) a natural or constructed auxiliary spillway, (2) a combination of a principal spillway and an auxiliary spillway, or (3) a principal spillway without the dam overtopping.

2. Land Ownership

   The dam owner must have ownership or legal control of the dam site and impoundment including the right to flood all land in the impoundment up to the *1% flood event*. Legal control is usually obtained through permanent easements recorded on the deed of the affected property.

3. Soil Suitability

   Soils should be suitable for construction and water retention. Soils should not contain any hazardous or toxic substances.

C. Drainage Area

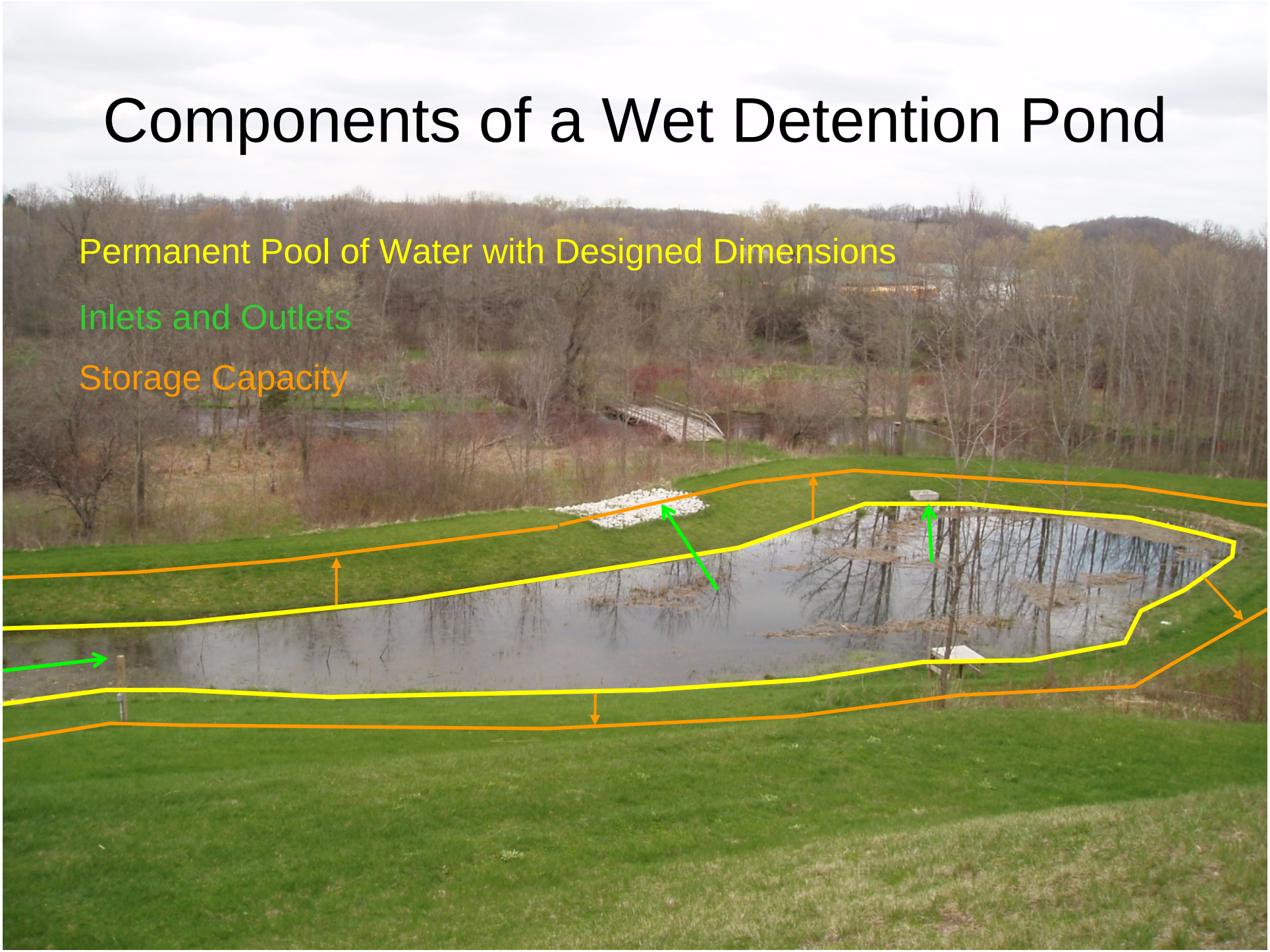
The drainage area above the pond must be protected against erosion to the extent that expected sedimentation will not shorten the planned effective life of the structure. The drainage area shall be large enough so that surface runoff and groundwater will provide an adequate supply of water for the intended purpose unless an alternate water source exists to serve this purpose. The quality of the pond inflow shall be suitable for the pond's intended use and should not contain any toxic substances that could contaminate sediments or be harmful to aquatic animals or wildlife.

Conservation Practice Standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your local NRCS office or the Wisconsin Land and Water Conservation Association office, Madison, WI at (608) 833-1833. NRCS, WI 7/01

Reference to the use of this standard in any local or state regulation does not prohibit any design or method of construction by a registered professional engineer provided such alternative is approved by the enforcing agency.

[1] Words in the standard that are shown in italics are described in IX. Definitions. The words are italicized the first time they are used in the text.

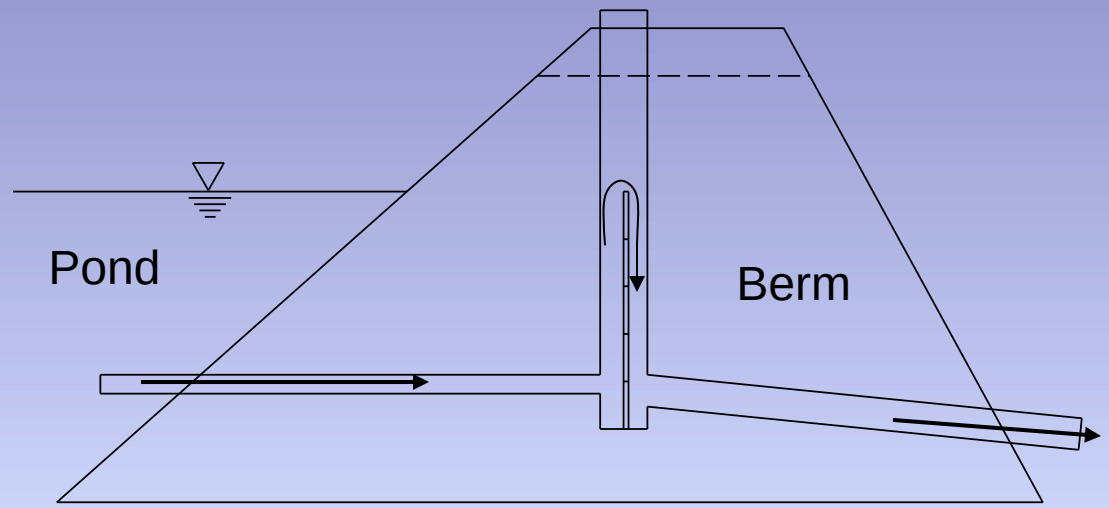
Components of a Wet Detention Pond



Pond Inlets

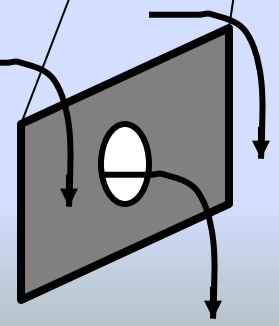
Pond Outlets

In-line Water Level Control



- No trash/ice/kids
- Future drawdown/sediment
- Multiple discharges
- Inexpensive

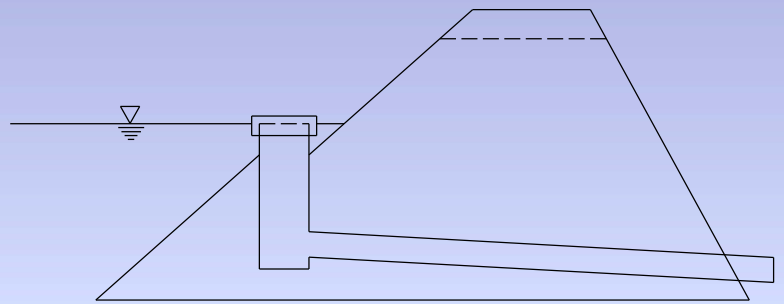
<u>Weir</u>: 2-10 Yr. Peak Flow Control



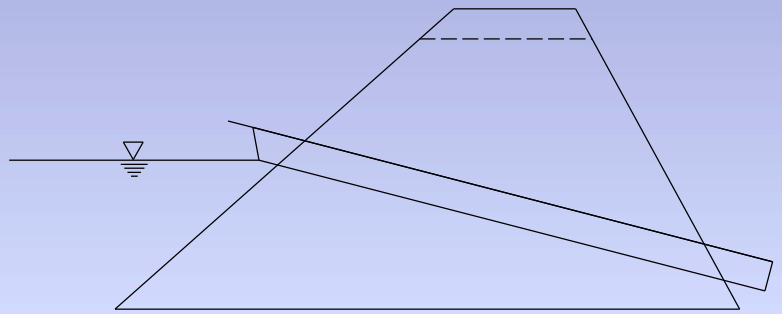
<u>Orifice</u>: Active Storage Volume

Example Basin Outlet Types

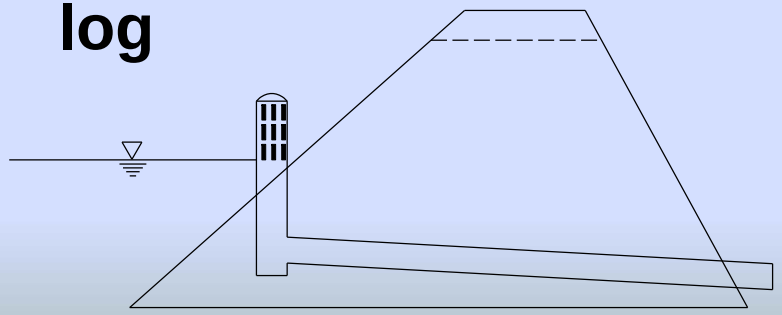
Pipe Drop



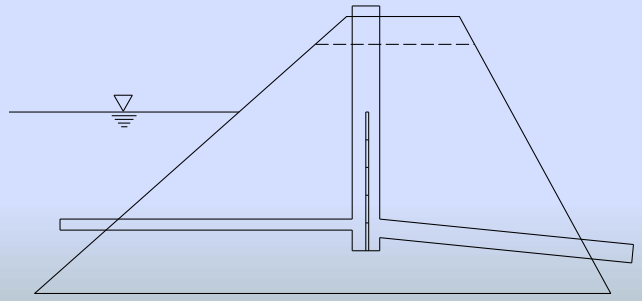
Grade Pipe



Perforated Riser or Stop-log

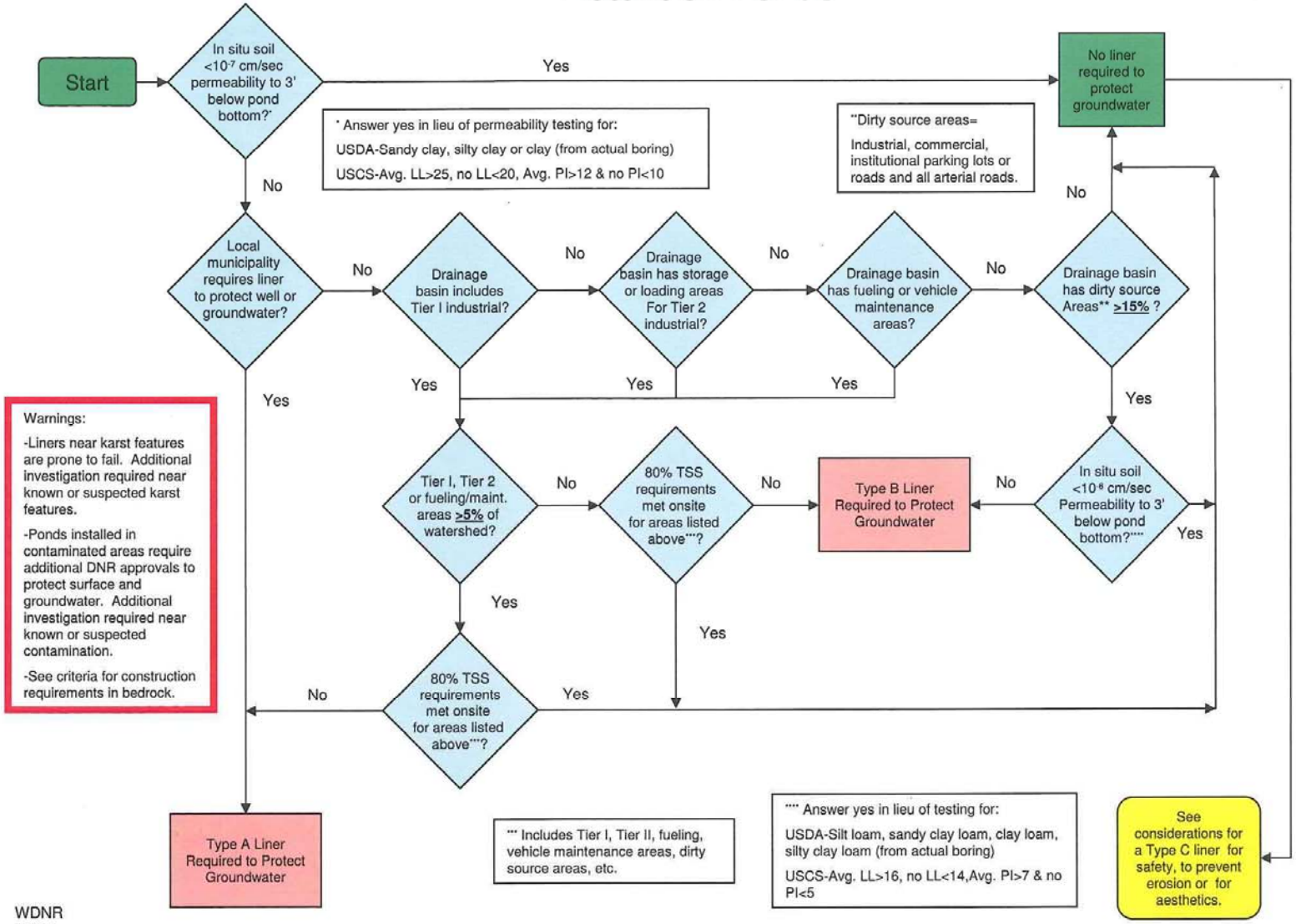


In-line Water Control



Emergency Spillway

Appendix D - Liner Flow Chart for Wet Detention Ponds



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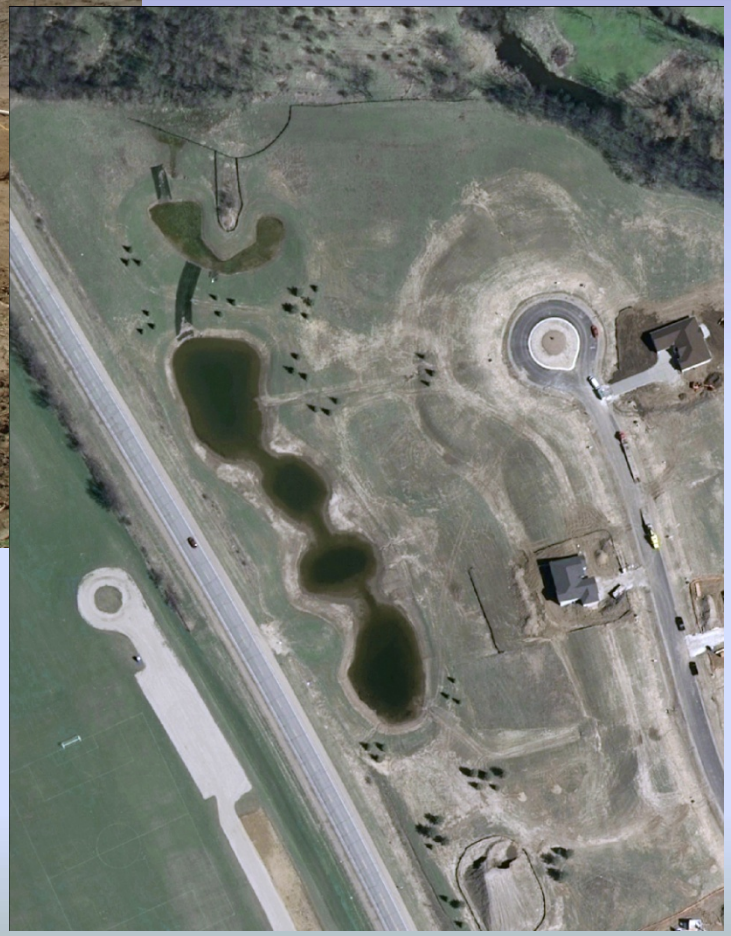
Clay Liner Placement



Safety Shelf

Minimum of 8 feet from the edge of the permanent pool

Slope of 10:1 or flatter

Maximum depth of the permanent pool over the safety shelf is 1.5 feet

Sediment Storage

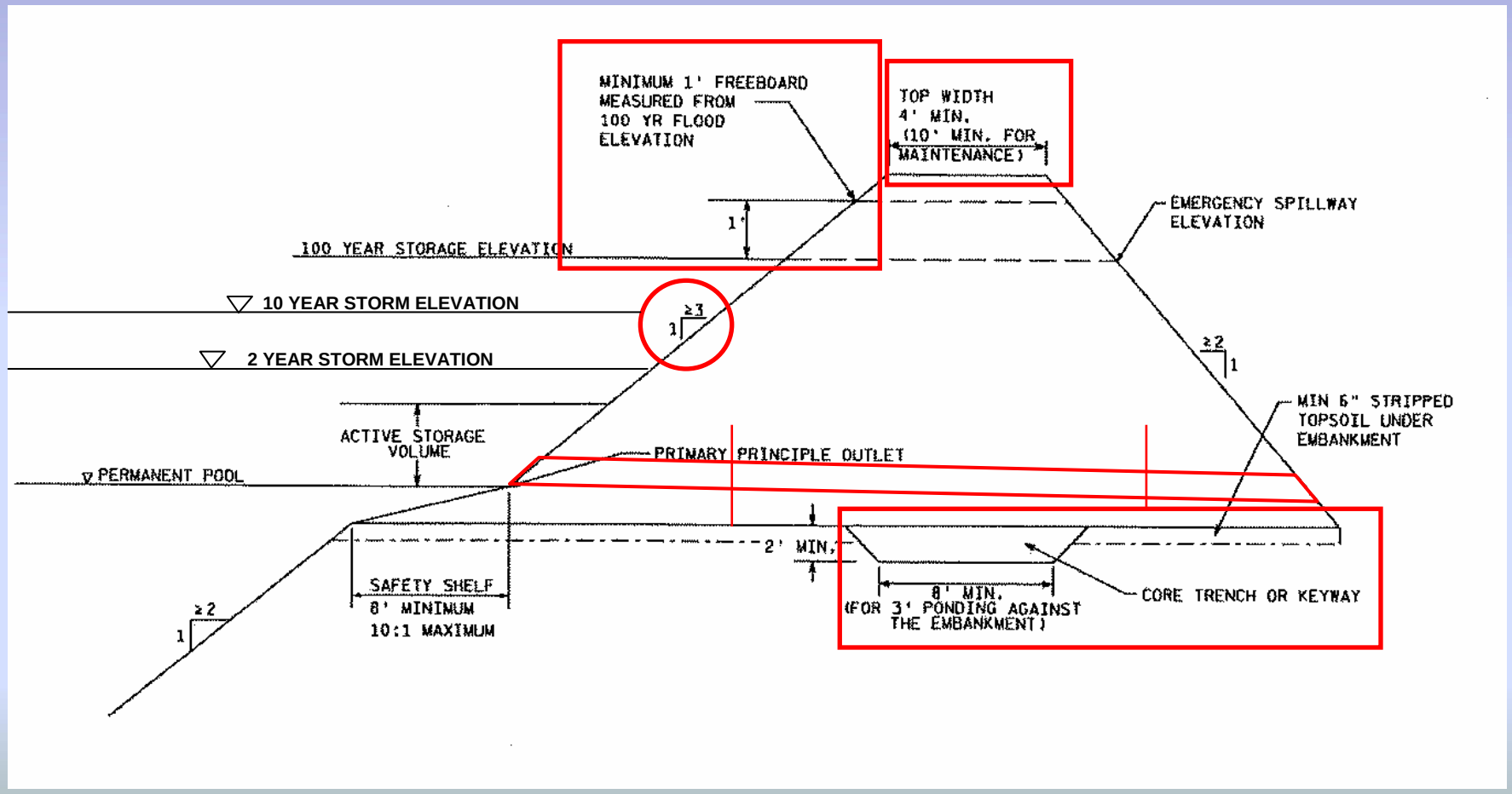
At least 2 feet for sediment storage for a total of 5 feet average depth.

For ponds > ½ acre, 50% of the total surface area of the permanent pool must be 5 feet deep.

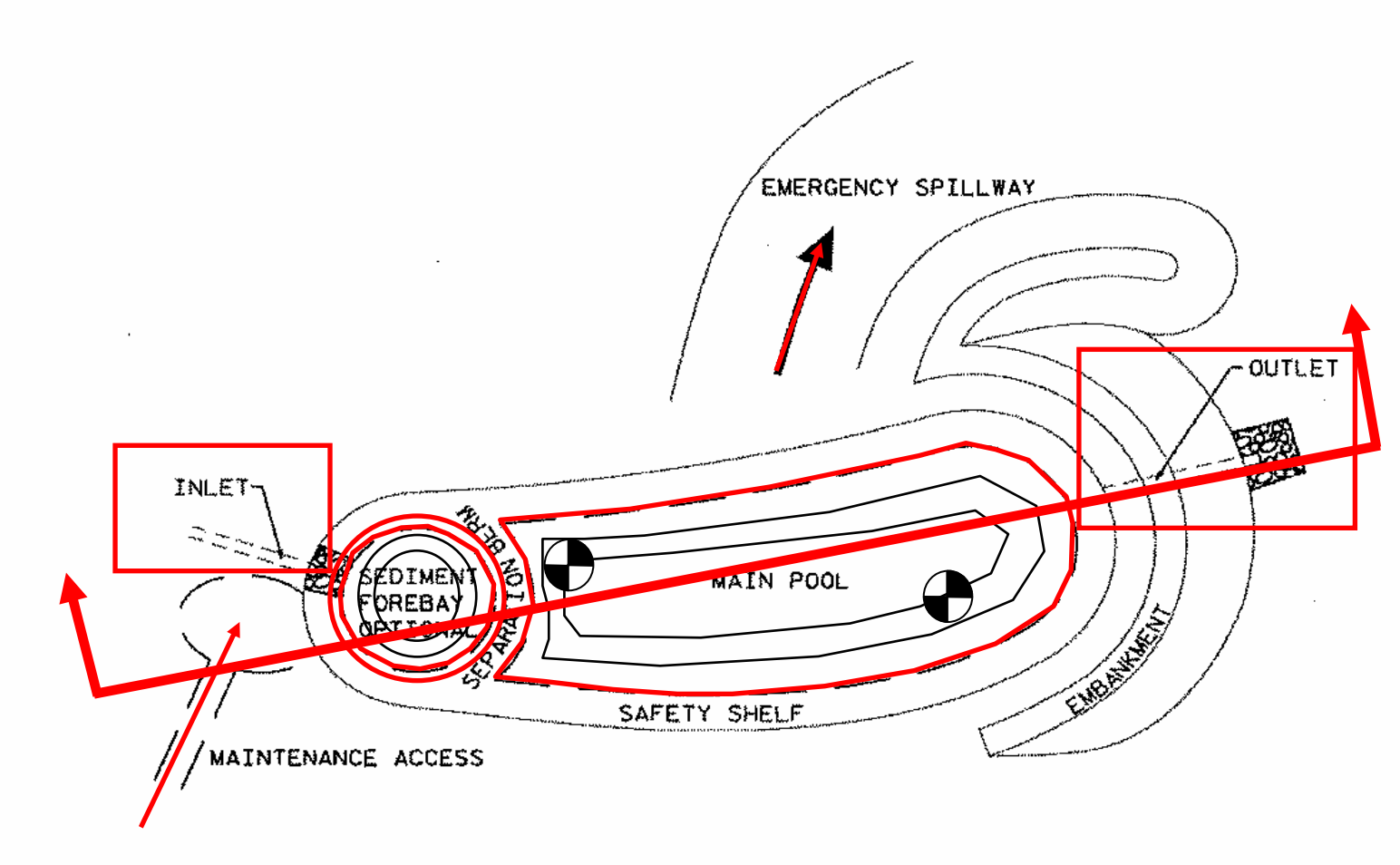
For ponds < ½ acre, maximize area of 5 ft. depth.

At least 4 feet of sediment storage for contributing areas that include cropland not stabilized by any other soil conservation practice such as strip cropping, terraces and conservation tillage

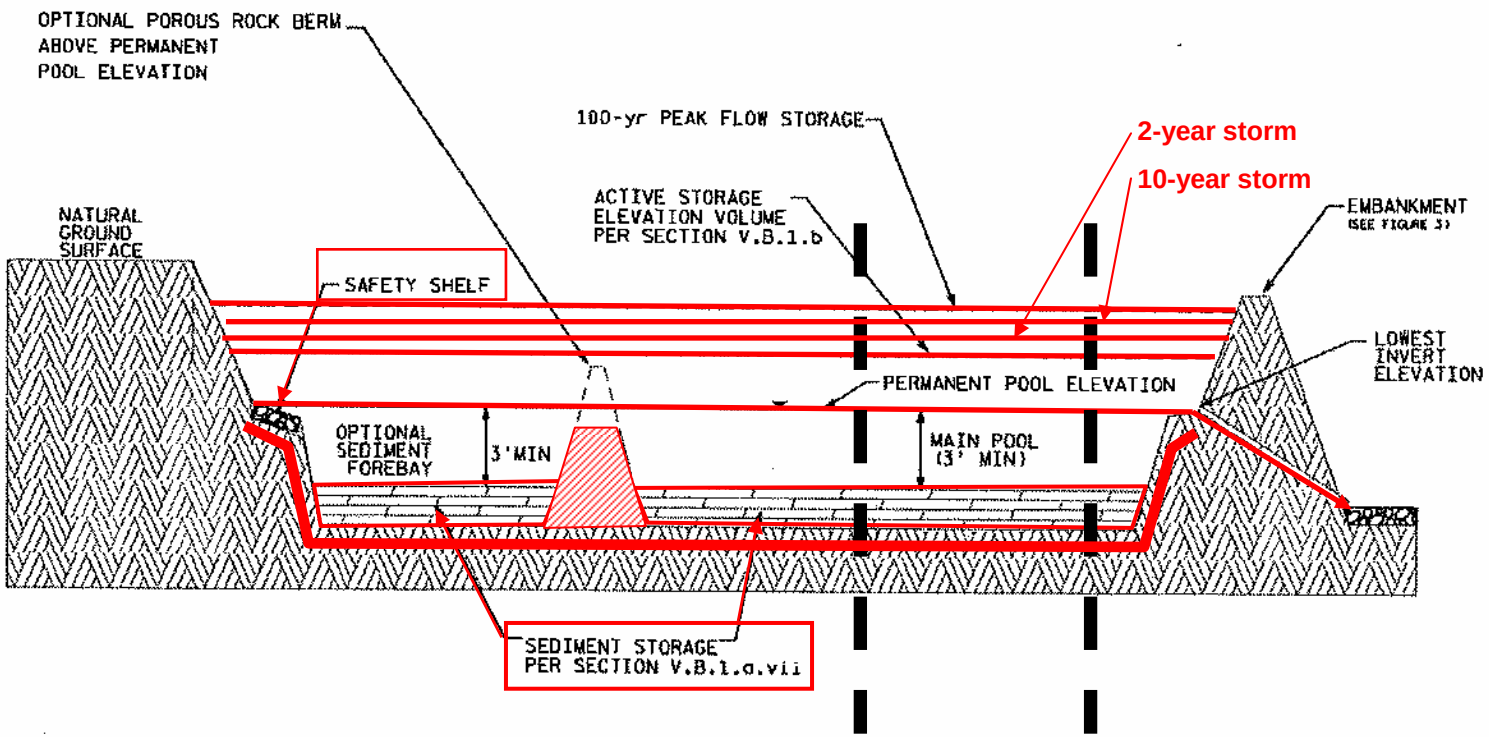
Berm Construction



Pond Plan View



Pond Cross-Section



Design Calculations

The size of a pond's permanent pool (S_a) is determined by:

$$1.2 \times (q_o / V_s)$$

q_o = Post Construction Peak Outflow Rate for the 1-yr/24-hr Storm

V_s = Particle Settling Velocity for the Desired Total Suspended Solid Removal

Use Appendix for the initial estimate of the Permanent pool area based on drainage area

For 80% TSS removal with a .5 cfs release rate a 31,000+ square foot permanent pool is necessary

Appendix A—Calculation of Preliminary Permanent Pool Surface Area for TSS Reduction [1]

Land Use/Description/Management[2]	Total Impervious (%)[3]	80% Minimum Surface Area of the Permanent Pool (% of Watershed Area)	60% Minimum Surface Area of the Permanent Pool (% of Watershed Area)
Residential • < 2.0 units/acre (>1/2 acre lots) (low density • 2.0 - 6.0 units/acre (medium density) • > 6.0 units/acre (high density)	8 - 28 >28 -41 >41 - 68	0.7 0.8 1.0	0.3
Commercial/Office Park/Institutional/Warehouse/Industrial/Manufacturing/Storage[4] (Non-retail related business, multi-storied buildings, large heavily used outdoor parking areas, material storage, or manufacturing operations	<60 60-80 80-90 >90	1.8 2.1 2.4 2.8	0.6
Parks/Open Space/Woodland/Cemeteries	0-12	0.6	0.2
Highways/Freeways (Includes right-of-way area) • Typically grass banks/conveyance • Mixture of grass and curb/gutter • Typically curb/gutter conveyance	<60 60-90 >90	1.4 2.1 2.8	1.0

[1] Multiply the value listed by the watershed area within the category to determine the minimum pond surface area. Prorate for drainage areas with multiple categories due to different land use, management, percent impervious, soil texture, or erosion rates. For example, to achieve an 80% TSS reduction, a 50 acre (residential, 50% imperviousness) x 0.01 (1% of watershed from table) = 0.5 acre + 50 acres (office park, 85% imperviousness) x 0.024 (2.4% of watershed) = 1.2 acre. Therefore 0.5 acre + 1.2 acre = 1.7 acres for the minimum surface area of the permanent pool.

[2] For offsite areas draining to the proposed land use, refer to local municipalities for planned land use and possible institutional arrangements as a regional stormwater plan.

[3] Impervious surfaces include rooftops, parking lots, roads, and similar hard surfaces, including gravel driveways/parking areas.

[4] Category includes insurance offices, government buildings, company headquarters, schools, hospitals, churches, shopping centers, strip malls, power plants, steel mills, cement plants, lumber yards, auto salvage yards, grain elevators, oil tank farms, coal and salt storage areas, slaughter houses, and other outdoor storage or parking areas.

Source: This table was modified from information in "The Design and Use of Detention Facilities for Stormwater Management Using DETPOND" by R. Pitt and J. Voorhees (2000).

Design Calculations

- Active Storage = The volume above the permanent pool that is released slowly to settle particles.

Volume (V_s) is determined by:
q_o = Peak Outflow Rate During the 1-yr/24-hr Storm
q_i = Peak Inflow Rate During the 1-yr/24-hr Storm
V_R = Volume of Runoff from the 1-yr/24-hr Storm
Appendix B of 1001 Technical Standard

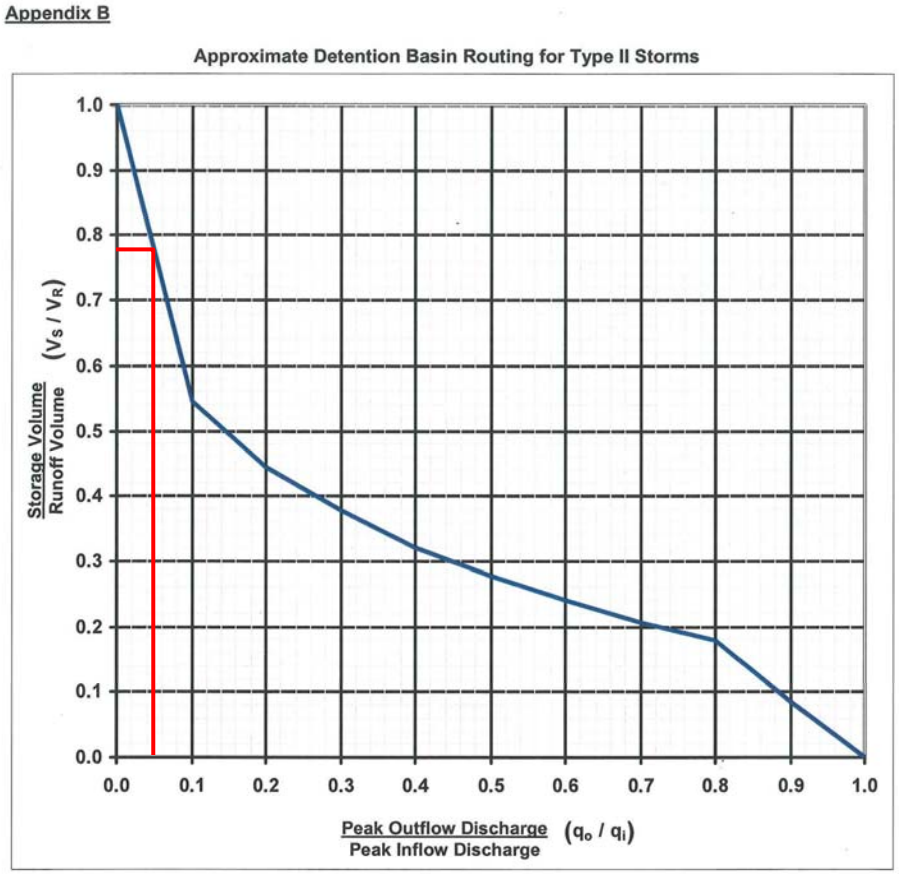
Example:

q_o = .5 cfs, q_i = 10 cfs, V_R = 5000 cf

$q_o / q_i = .5 / 10 = .05$

$V_s / V_R = .78 = V_s / 5000 = .78$

V_s = 3900 cf



Example Pond Summary Table

Example Data Summary Sheet for Wet Detention Basin Design

(Note: Example only – see minimum design criteria in DNR technical standard 1001)

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 3 ft. below proposed bottom?	Yes (see map)
Average soil texture at pond bottom elevation (USDA)	Clay loam
Distance from pond bottom to bedrock	> 5 feet
Distance from pond bottom to seasonal water table	Pond bottom 2 below mottling No water observed in test holes
General basin design data (see attached detailed drawings):	
Permanent pool surface area	1.5 acres
Design permanent pool water surface elevation	elev. 900.0
Top of berm elevation (after settling) and width	elev. 905.0 / 10 feet wide
Length/width (dimensions/ratio)	445 ft. (L) x 145 ft. (W) = 3:1
Safety shelf design (length, grade, max. depth)	10 ft. @ 10% slope/1.5' deepest
Ave. water depth (minus safety shelf/sediment)	5 ft. (in center)
Sediment forebay size & depth	.16 acres (13% pool size)/5 feet
Sediment storage depth & design maintenance	2 ft. depth for forebay & pool 15 year maintenance schedule

Include volume of post-developed 1-yr/24-hr storm

Include inflow/outflow rate of post-developed 1-yr/24-hr storm

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. (above perm. pool)	Outflow Control Structures*
1-yr./24 hr. (volume)	.7 cfs (34 hr. drawdown)	901.3 ft.	2 acre feet	#1
24.3 cfs (Post 2-yr./24 hr. peak)	11 cfs	902.0 ft.	3.1 acre feet	#1 and #2
72 cfs (Post 10-yr./24 hr. peak)	35 cfs	903.0 ft.	4.5 acre feet	#3
171 cfs (Post 100-yr./24 hr. peak)	143 cfs	904.0 ft.	6.0 acre feet	#3 and #4

* **The controlling elements are summarized below (See attached detail drawing of outlet structure):**

#1 = 6 inch orifice in water level control weir plate – flow line elev. @ 900.0 (1.3 ft. max. head)
#2 = 2 foot wide rectangular weir – flow line elev. @ 901.3 (.7 ft. hydraulic head)
#3 = 30 inch diameter smooth wall pvc pipe – flow line elev. @ 900.0 (3.0 ft. max. hydraulic head)
#4 = 30 foot wide earthen/grass emergency spillway – flow line elev. @ 903.0 (1.0 ft. max. depth)

Aesthetics

A wet pond can be an asset to the site if done right

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(1001)

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Stabilize according to permanent seeding criteria in the WDNR Conservation Practice Standard 1059 (Seeding for Construction Site Erosion Control)

- USDA-NRCS 342, Critical Area Planting
- UWEX A3434 Lawn Establishment
- WisDOT Section 630, Seeding

Consider aesthetics

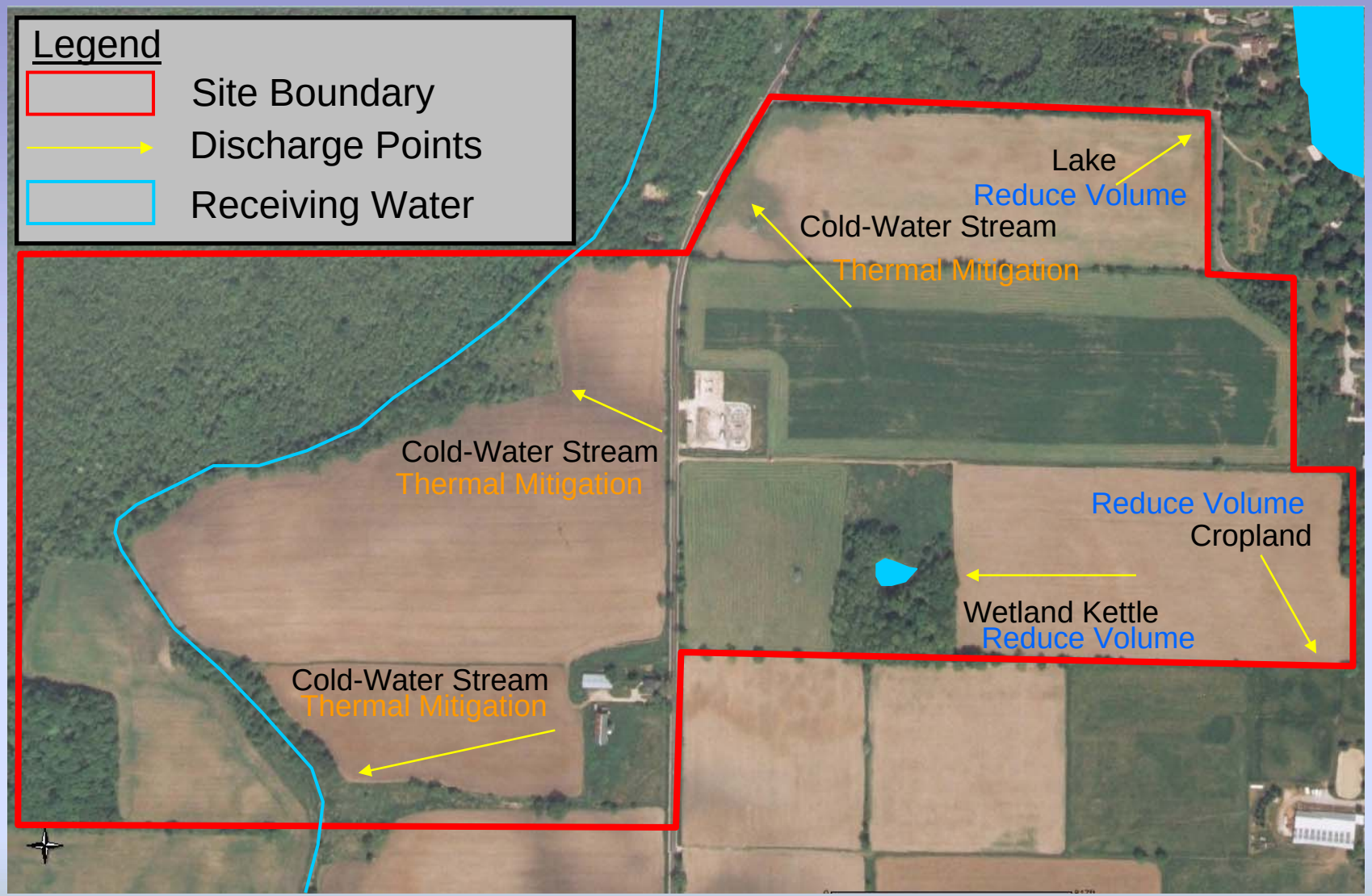
Consider providing a terrestrial buffer of 10 – 15 feet

Consider vegetative buffer strips

Soil Testing

- One test pit per every 2 acres of permanent pool with a minimum of 2 investigations.
- Characterize soils using both the USDA and USCS classification systems.
- Document soil texture, color, groundwater indicators & bedrock.

Siting a Wet Pond



Each Discharge Point Must Meet the Water Quality and Peak Flow Requirements
Give Consideration to the Potential for Increased Runoff Volumes

Waters that require thermal mitigation in Waukesha County

- Brandy Brook
- Coco Creek
- Genesee Creek**
- Jericho Creek
- Mason Creek
- McKeawn Spring Creek
- Mill Brook
- Mukwonago River**
- Oconomowoc River (between North Lake and Okauchee Lake)**
- Paradise Springs Creek
- Pebble Creek
- Rosenow Creek
- Scuppernong River
- South Branch Scuppernong River
- Spring Brook
- Spring Lake*

Minimum Requirements for As-Built Documentation for Storm Water Management BMPs

1. **Basin Plan View**: Collect survey data and show the following:
    a. Sufficient spot elevations on the berm, safety shelves, forebay bottom, and basin bottom to outline the shape of basin (a minimum of one shot per 50 feet). The lowest points of the berm must be represented. Dewatering may be required to shoot bottom and permit construction sediment removal.
    b. Spot elevations of the top and bottom of each shoulder of the spillway.
    c. A minimum of two survey points documenting the elevation of any berm separating the basin forebay from the main pool.
    d. Outlines of riprap aprons, spillways, and stone trenches.
    e. Topographic contours generated from the above data.
    f. Invert elevations of the basin outlet and inlet(s) (culvert inlet, culvert outlet, dewatering holes in risers, in-line weirs, etc.).
    g. The top elevation of all risers, surface drains, and monitoring sumps for stone trenches.
    h. Measured internal diameters of culverts, risers, orifices, catch basins, and other flow-control devices.
2. **Basin Cross-Sections**: A minimum of two per basin, locations shown on plan, oriented in opposing directions, with the following spot elevations:
    a. The bottom of the berm backslope.
    b. The inside and outside edges of the top of the berm.
    c. The edge of the water.
    d. The inside and outside edges of the safety shelf.
    e. The bottom of the slope into the basin bottom.
    f. The top and sides of any berm dividing the basin.
    g. The same locations as above going out the other side of the basin.
    h. For clay liners, either show bottom elevations before and after liner is installed, or document liner thickness through soil core sampling (resealing sample holes).
    i. Synthetic liner material used, if any, with placement.
    j. Type of engineered fill material used if any, and top and bottom elevations of fill.
    k. Bottom and top elevations of stone trenches, risers, if applicable.
    l. Invert elevations and measured internal diameters of any buried pipes or tile lines.
3. **Conveyance Systems**: Collect survey data and show the following:
    a. One set of cross-sectional survey points per 100 feet of conveyance system (emergency spillways, rock chutes, grass swales, etc.). Includes a minimum of 3-4 survey points per cross-section: the tops of both banks and each side of channel bottom (flat) or center of channel ("v-bottom"), as per design.
    b. The invert elevations and pipe diameter for all road culverts/channel crossings.

The as-built documentation shall be stamped and signed by a registered land surveyor or an engineer licensed in the State of Wisconsin and must contain the following statement: **"I hereby certify that, to the best of my knowledge and in accordance with applicable standards, the surveying data presented in this document reflects as-built locations and elevations for the storm water management facilities shown."**

Basin Maintenance

Who

Where
What
How

Why
&
When

Document Number

(Sample) Storm Water Management Practice Maintenance Agreement

[Owners Name], as "Owner" of the property described below, in accordance with Chapter 14 Waukesha County Code of Ordinances [or other applicable code], agrees to install and maintain storm water management practice(s) on the subject property in accordance with approved plans and Storm Water Permit conditions. The owner further agrees to the terms stated in this document to ensure that the storm water management practice(s) continues serving the intended functions in perpetuity. This Agreement includes the following exhibits:

Exhibit A: Legal Description of the real estate for which this Agreement applies ("Property").
Exhibit B: Location Map(s) – shows an accurate location of each storm water management practice affected by this Agreement.
Exhibit C: Maintenance Plan – prescribes those activities that must be carried out to maintain compliance with this Agreement.

Name and Return Address

Note: After construction verification has been accepted by Waukesha County, for all planned storm water management practices, an addendum(s) to this agreement shall be recorded by the Owner showing design and construction details. The addendum(s) may contain several additional exhibits, including certification by Waukesha County of Storm Water Permit termination, as described below.

Through this Agreement, the Owner hereby subjects the Property to the following covenants, conditions and restrictions:

1. The Owner shall be responsible for the routine and extraordinary maintenance and repair of the storm water management practice(s) and drainage easements identified in Exhibit B until Storm Water Permit termination by Waukesha County in accordance with Chapter 14 of the County Code of Ordinances.
2. After Storm Water Permit termination under 1., the current Titleholder(s) shall be solely responsible for maintenance and repair of the storm water management practices and drainage easements in accordance with the maintenance plan contained in Exhibit C.
3. Upon written notification by Town of _____ or their designee, the Titleholder(s) shall, at their own cost and within a reasonable time period determined by the Town of _____, have an inspection of the storm water management practice conducted by a qualified professional, file a report with the Town of _____ and complete any maintenance or repair work recommended in the report. The Titleholder(s) shall be liable for the failure to undertake any maintenance or repairs.
4. In addition, and independent of the requirements under paragraph 3 above, the Town of _____, or its designee, is authorized to access the property as necessary to conduct inspections of the storm water management practices or drainage easements to ascertain compliance with the intent of this Agreement and the activities prescribed in Exhibit C. The Town of _____ may require work to be done which differs from the report described in paragraph 3 above, if the Town of _____ reasonably concludes that such work is necessary and consistent with the intent of this agreement. Upon notification by the Town of _____ of required maintenance or repairs, the Titleholder(s) shall complete the specified maintenance or repairs within a reasonable time frame determined by the Town of _____.
5. If the Titleholder(s) do not complete an inspection under 3. above or required maintenance or repairs under 4. above within the specified time period, the Town of _____ is authorized, but not required, to perform the specified inspections, maintenance or repairs. In the case of an emergency situation, as determined by the Town of _____, no notice shall be required prior to the Town of _____ performing emergency maintenance or repairs. The Town of _____ may levy the costs and expenses of such inspections, maintenance or repair related actions as a special charge against the Property and collected as such in accordance with the procedures under s. 66.0627 Wis. Stats. or subch. VII of ch. 66 Wis. Stats.
6. This Agreement shall run with the Property and be binding upon all heirs, successors and assigns. After the Owner records the addendum noted above, the Town of _____ shall have the sole authority to modify this agreement upon a 30-day notice to the current Titleholder(s).

How – In Detail

(Sample)
Exhibit C
Storm Water Practice Maintenance Plan

This exhibit explains the basic function of each of the storm water practices listed in Exhibit B and prescribes the minimum maintenance requirements to remain compliant with this Agreement. The maintenance activities listed below are aimed to ensure these practices continue serving their intended functions in perpetuity. The list of activities is not all inclusive, but rather indicates the minimum type of maintenance that can be expected for this particular site. Access to the stormwater practices for maintenance vehicles is shown in Exhibit B. Any failure of a storm water practice that is caused by a lack of maintenance will subject the Titleholder(s) to enforcement of the provisions listed on page 1 of this Agreement by the Town of _____.

[Sample maintenance language is listed below. This exhibit must be customized for each site. The minimum elements of this exhibit include: a description of the drainage area and the installed storm water management system & best management practices, a list of BMP maintenance requirements and a reference to future as-built drawings and design summaries to be recorded as an addendum(s) to this agreement.]

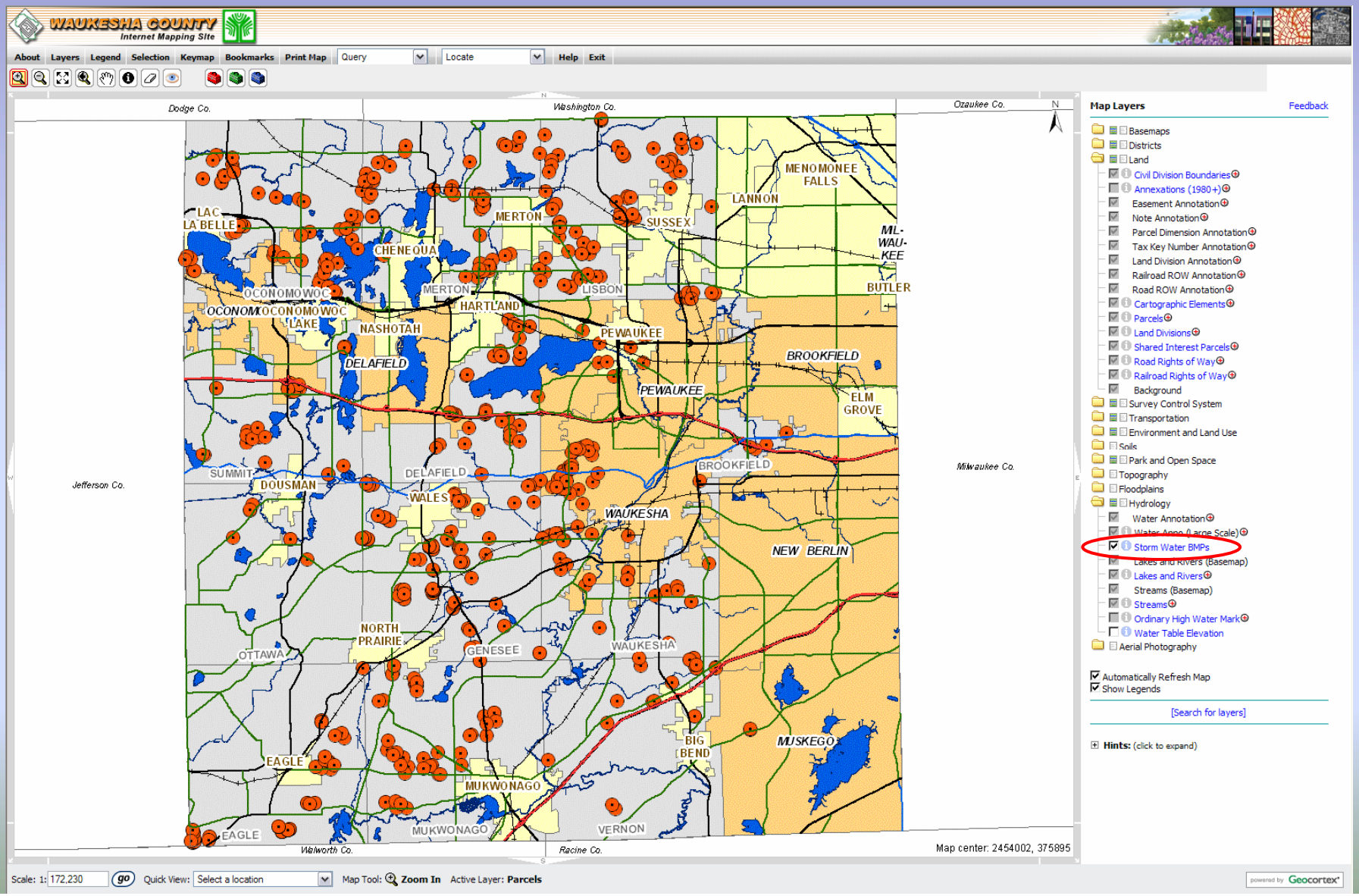
System Description:
The wet detention basin is designed to trap 80% of sediment in runoff and maintain pre-development downstream peak flows. The basin has two forebays (smaller ponds) located at the low end of two grass swales. In addition to runoff conveyance, the grass swales also allow infiltration and filtering of pollutants, especially from smaller storms. The forebays are each 4 feet deep. They are connected to the main pool by 18 and 24-inch metal pipes that outlet onto a rock chute. The forebays will trap coarse sediments in runoff, such as road sands, thus reducing maintenance of the main basin. The main pool will trap the finer suspended sediment. To do this, the pond size, water level and outlet structures must be maintained as specified in this Agreement (see Figures 1, 2 and 3).

The main basin receives runoff from a 67.1 acre drainage area (41.2 acres within the subdivision and 25.9 acres off-site drainage coming from the east). During high rainfall or snow melt events, the water level will temporarily rise and slowly drain down to the elevation of the control structure. The water level is controlled by a 12-inch concrete pipe extending through the berm in the northwest corner of the basin (see Figures 1 and 3). On the face of the 12-inch pipe, there is metal plate with a 3-inch drilled hole (orifice) with stone in front of it. This orifice controls the water level and causes the pond to temporarily rise during runoff events. Washed stone (1-2" diameter) is placed in front of the orifice to prevent clogging. High flows may enter the grated concrete riser or flow over the rock lined emergency spillway. "As-built" construction drawings of the basin, showing actual dimensions, elevations, outlet structures, etc. will be recorded as an addendum(s) to this agreement within 60 days after Waukesha County accepts verification of construction from the project engineer.

Minimum Maintenance Requirements:
To ensure the proper long-term function of the storm water management practices described above, the following activities must be completed:

1. All outlet pipes must be checked monthly to ensure there is no blockage from floating debris or ice, especially the washed stone in front of the 3-inch orifice and the trash rack on the riser in the main basin. Any blockage must be removed immediately. The washed stone must be replaced when it becomes clogged.
2. Grass swales shall be preserved to allow free flowing of surface runoff in accordance with approved grading plans. No buildings or other structures are allowed in these areas. No grading or filling is allowed that may interrupt flows in any way.
3. Grass swales, inlets and outlets must be checked after heavy rains (minimum of annually) for signs of erosion. Any eroding areas must be repaired immediately to prevent premature sediment build-up in the downstream forebays or basin. Erosion matting is recommended for repairing grassed areas.
4. NO trees are to be planted or allowed to grow on the earthen berms. Tree root systems can reduce soil compaction and cause berm failure. The berms must be inspected annually and any woody vegetation removed.
5. If floating algae or weed growth becomes a nuisance (decay odors, etc.), it must be removed from the basin or the forebay and deposited where it cannot drain back into the basin. Removal of the vegetation from the water reduces regrowth the following season (by harvesting the nutrients). Wetland vegetation must be maintained along the waters edge for safety and pollutant removal purposes.

http://www.waukeshacounty.gov/

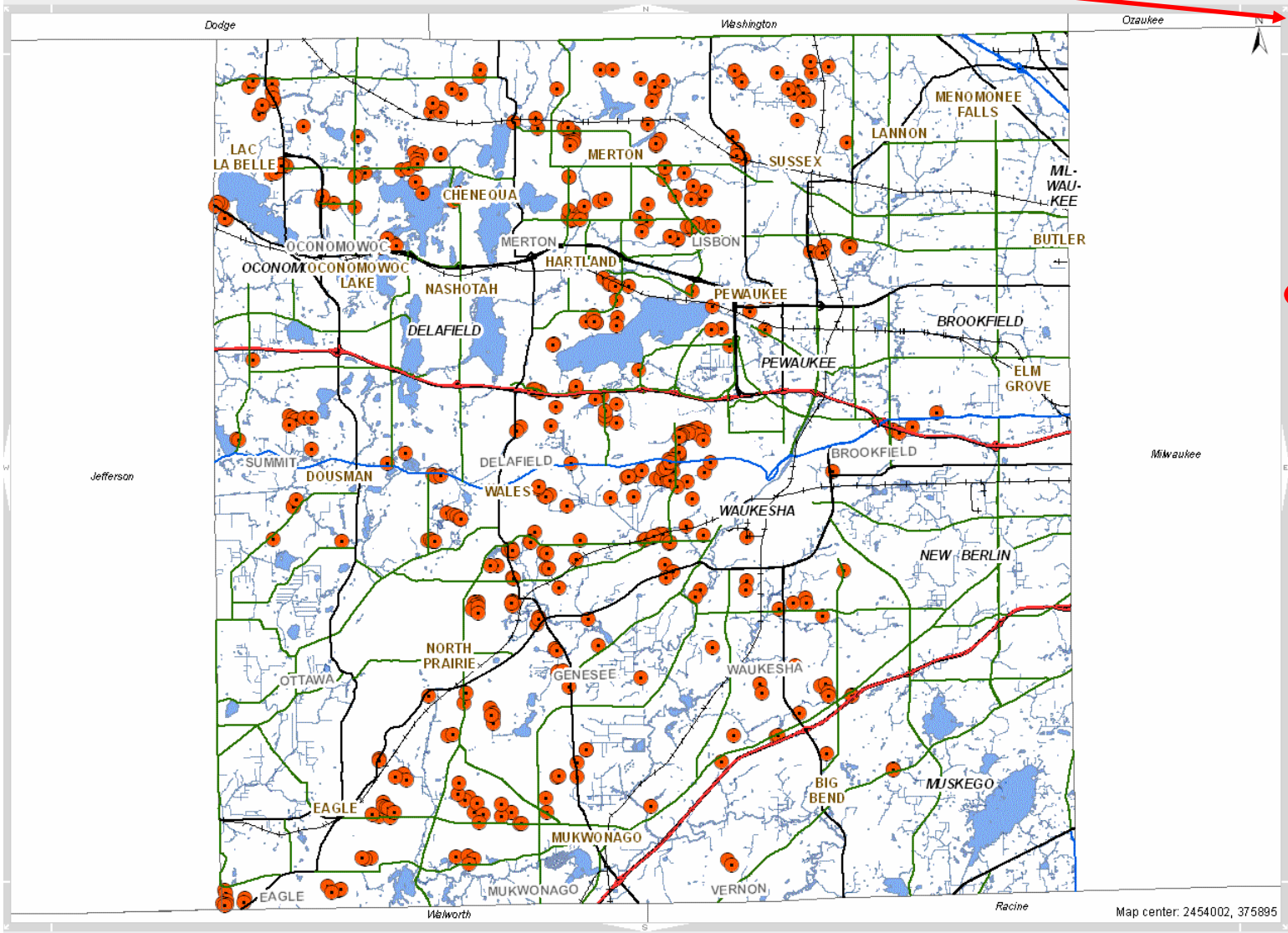


Waukesha County Internet Mapping Site - Microsoft Internet Explorer provided by Waukesha County

http://devgis-int.waukeshacounty.gov/imf/imf.jsp?site=waukesha

WAUKESHA COUNTY Internet Mapping Site

About | Layers | Legend | Selection | Keymap | Bookmarks | Print Map | Query | Locate | Help | Exit



Find By Attribute

Select the layer and a field from the layer, type in a value to search for, then press the Submit button. If the value is found in the layer's attribute table, the map will zoom to the extent of the feature(s) with that attribute value.

Layer Name

Storm Water BMPs

Field

BMP TYPE

Search Operator

equals

Attribute Value

Wet Detention Basin

Find within visible extent

Submit

Examples:

```
Bioretention Area
Compensatory Flood Storage
Constructed Wetland
Dry Detention Basin
Filter Strip
Grassed Swale
In-ground Water Quality Device
Infiltration Basin
Infiltration Trench/Structure
Native Prairie
Permanent Sediment Trap
Rain Garden
Wet Detention Basin
```

Scale: 1: 172,230 go Quick View: Select a location Map Tool: Zoom In Active Layer: Parcels

powered by Geocortex

Cursor Location: NAD27 SPCS WI South: 2545873.3259176775, 434426.7096774192

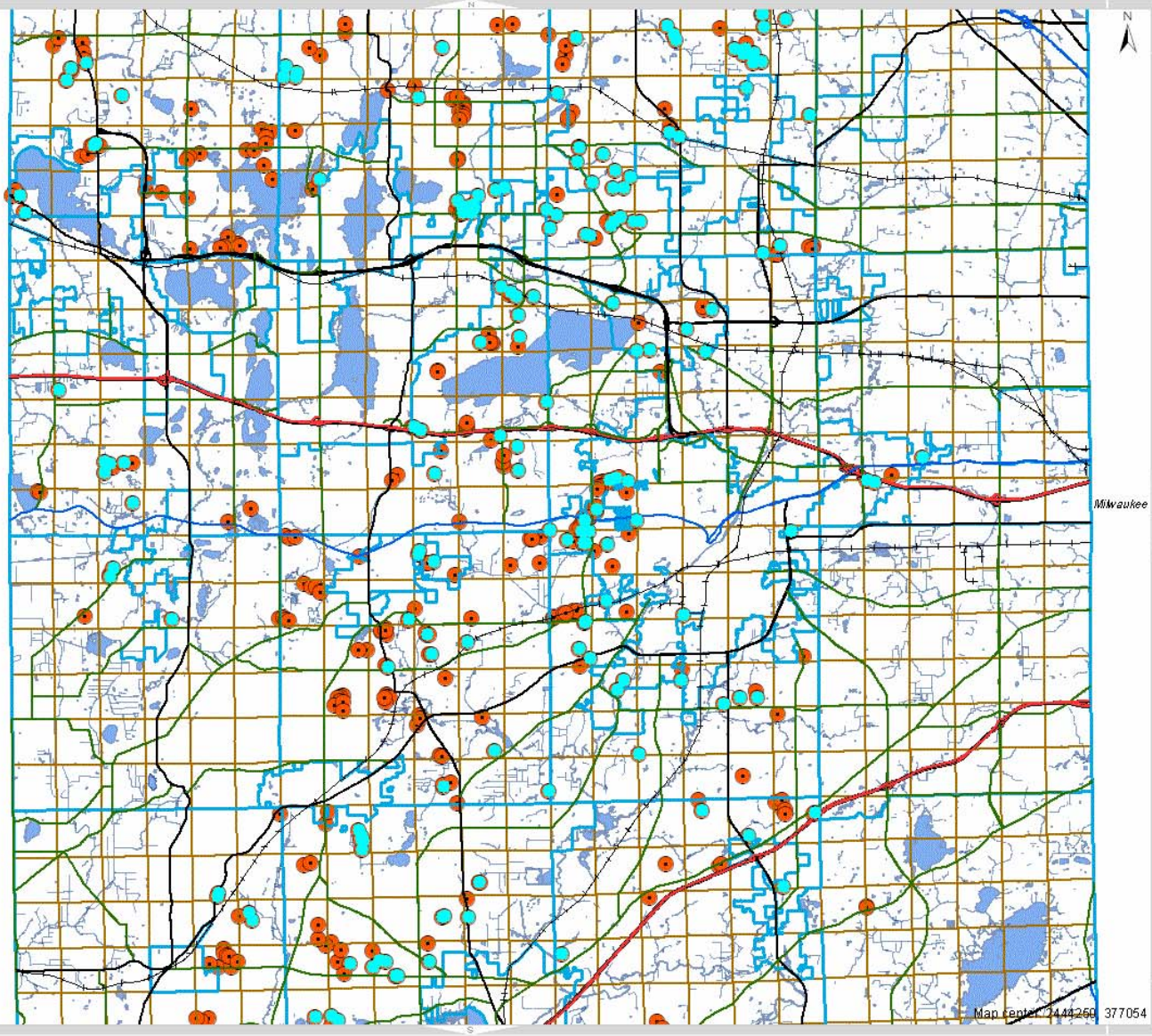
Trusted sites 100%

Waukesha County Internet Mapping Site - Microsoft Internet Explorer provided by Waukesha County

http://devgis-int.waukeshacounty.gov/imf/imf.jsp?site=waukesha

WAUKESHA COUNTY
Internet Mapping Site

About | Layers | Legend | Selection | Keymap | Bookmarks | Print Map | Query | Locate | Help | Exit



Zoom To Attribute

Map zoomed to extent of features matching attribute.

Scale: 1: 146,769 | GO | Quick View: Select a location | Map Tool: Zoom In | Active Layer: **Parcels**

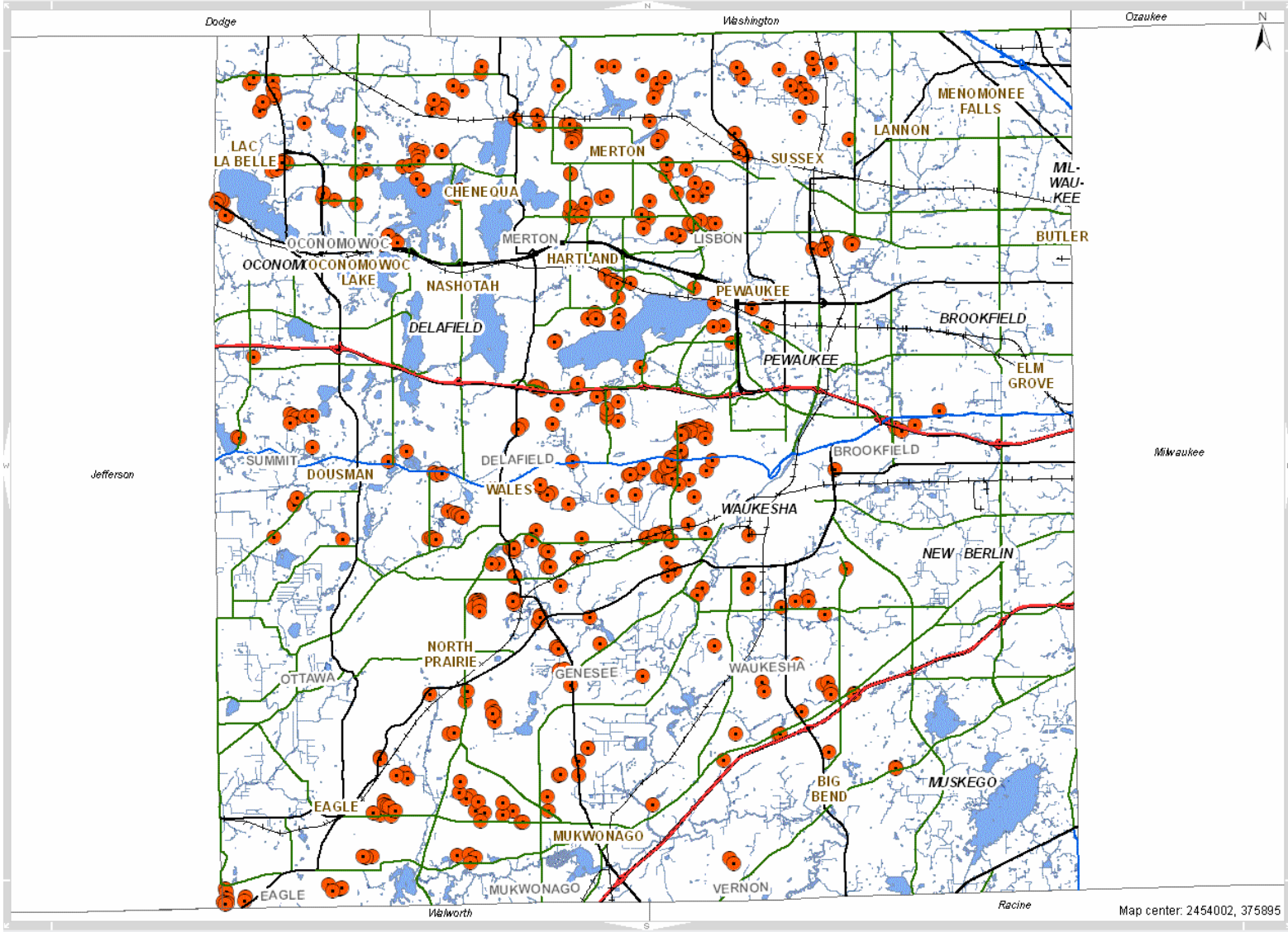
powered by Geocortex

Waukesha County Internet Mapping Site - Microsoft Internet Explorer provided by Waukesha County

http://devgis-int.waukeshacounty.gov/imf/imf.jsp?site=waukesha

WAUKESHA COUNTY
Internet Mapping Site

About | Layers | Legend | Selection | Keymap | Bookmarks | Print Map | Query | Locate | Help | Exit



Map center: 2454002, 375895

Find By Attribute

Select the layer and a field from the layer, type in a value t search for, then press the Submit button. If the value is fo in the layer's attribute table, the map will zoom to the exte of the feature(s) with that attribute value.

Layer Name

Storm Water BMPs

Field

BMP TYPE
- BMP REFERENCE NUMBER
- BMP TYPE
- MUNICIPALITY
- PROJECT
- SUBWATERSHED
- TOWNSHIP_RANGE
- WATERSHED

☐ Find within visible extent

Submit

Examples:

```
Bioretention Area
Compensatory Flood Storage
Constructed Wetland
Dry Detention Basin
Filter Strip
Grassed Swale
In-ground Water Quality Device
Infiltration Basin
Infiltration Trench/Structure
Native Prairie
Permanent Sediment Trap
Rain Garden
Wet Detention Basin
```

Scale: 1: 172,230 go | Quick View: Select a location | Map Tool: Zoom In | Active Layer: **Parcels**

powered by Geocortex

Cursor Location: NAD27 SPCS WI South: 2547517.8809788567, 318111.8153503875

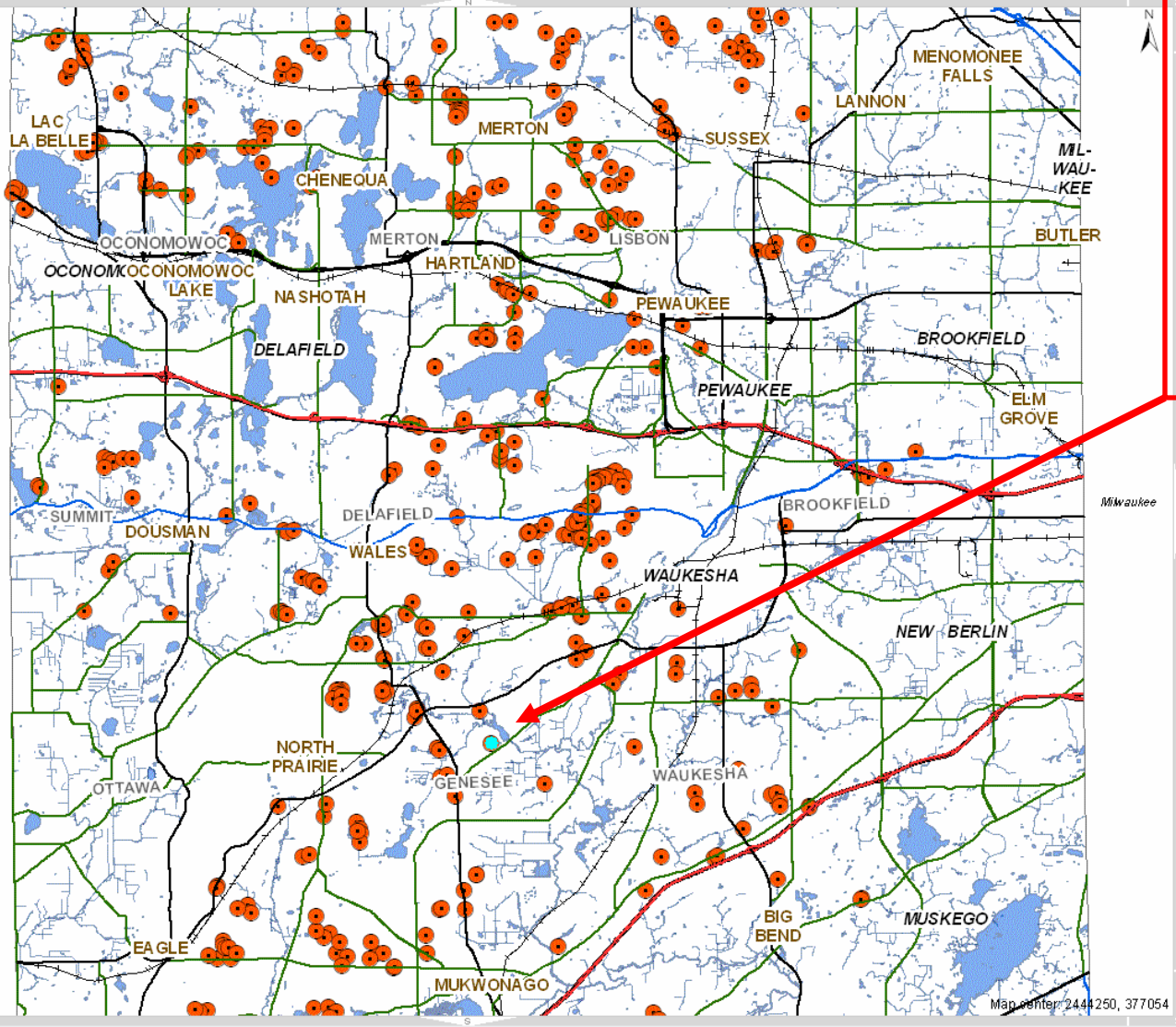
Trusted sites | 100%

Waukesha County Internet Mapping Site - Microsoft Internet Explorer provided by Waukesha County

http://devgis-int.waukeshacounty.gov/imf/imf.jsp?site=waukesha

WAUKESHA COUNTY Internet Mapping Site

About | Layers | Legend | Selection | Keymap | Bookmarks | Print Map | Query | Locate | Help | Exit



Identify Results

Coordinate Position

NAD27 SPCS WI South: 2446963, 349985
Latitude Longitude: 42°56' N, 88°19' W

Storm Water BMPs

Link to Images

BMP TYPE:	Wet Detention Basin
PROJECT:	Red Fox Run
BMP DESCRIPTION:	Wet Detention Basin in Outlot 1
CONTRIB. WATERSHED (AC):	24.7
MAINTAINED BY:	Red Fox Run Lot Owners
MUNICIPALITY:	Town of Genesee
TOWNSHIP_RANGE:	0618
SECTION:	26
QUARTER SECTION:	SE
WATERSHED:	Fox River Watershed
SUBWATERSHED:	Genesee Creek
VERIFICATION DATE:	Jan 22, 2006
VERIFYING ENGINEER:	David Vivian, PE
VERIFYING COMPANY:	RSV Engineering, Inc.
BMP REFERENCE NUMBER:	100
AS BUILT SURVEY DATE:	Feb 7, 2006
DOC. NUMBERS:	1000014, 3323575

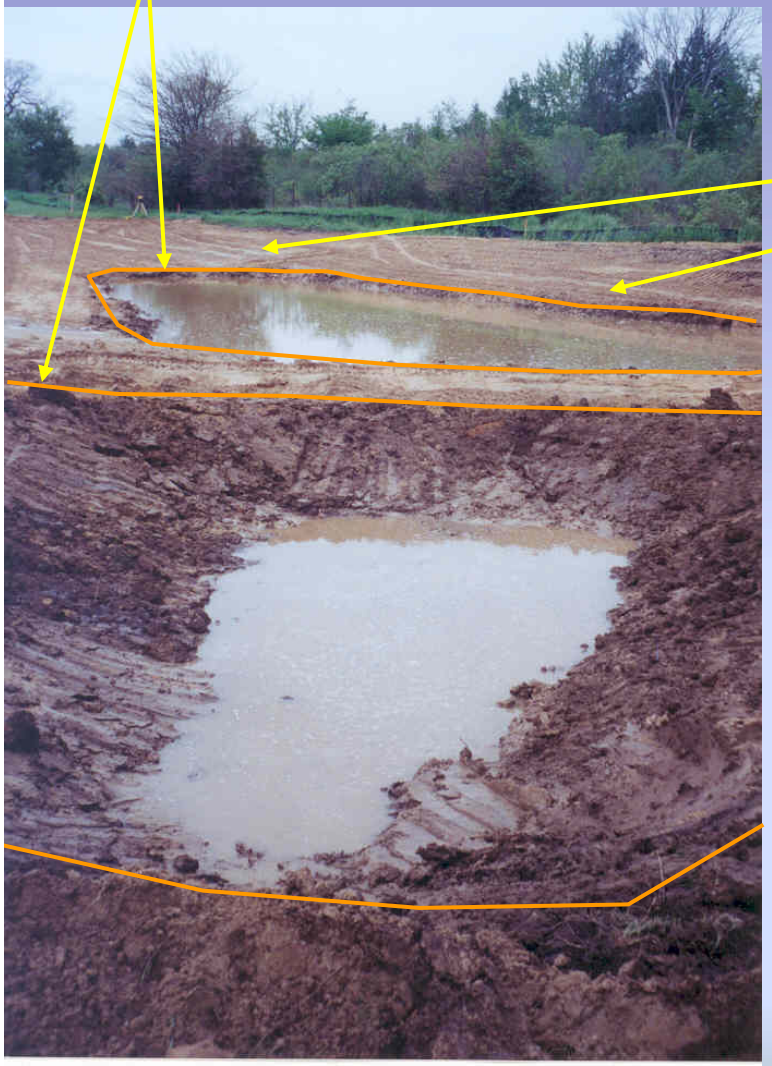
Scale: 1: 152,483 go Quick View: Select a location Map Tool: Identify Active Layer: Storm Water BMPs

powered by Geocortex

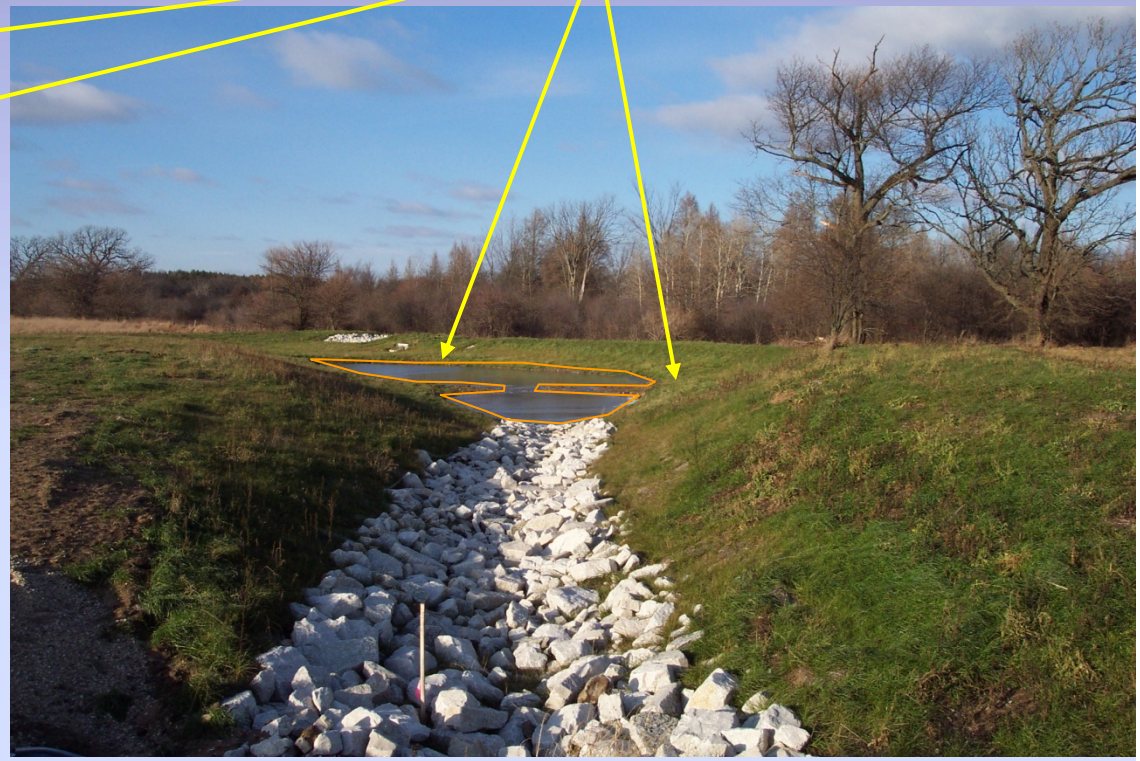
Cursor Location: NAD27 SPCS WI South: 2446963.648003327, 349985.5119910997

Trusted sites 100%

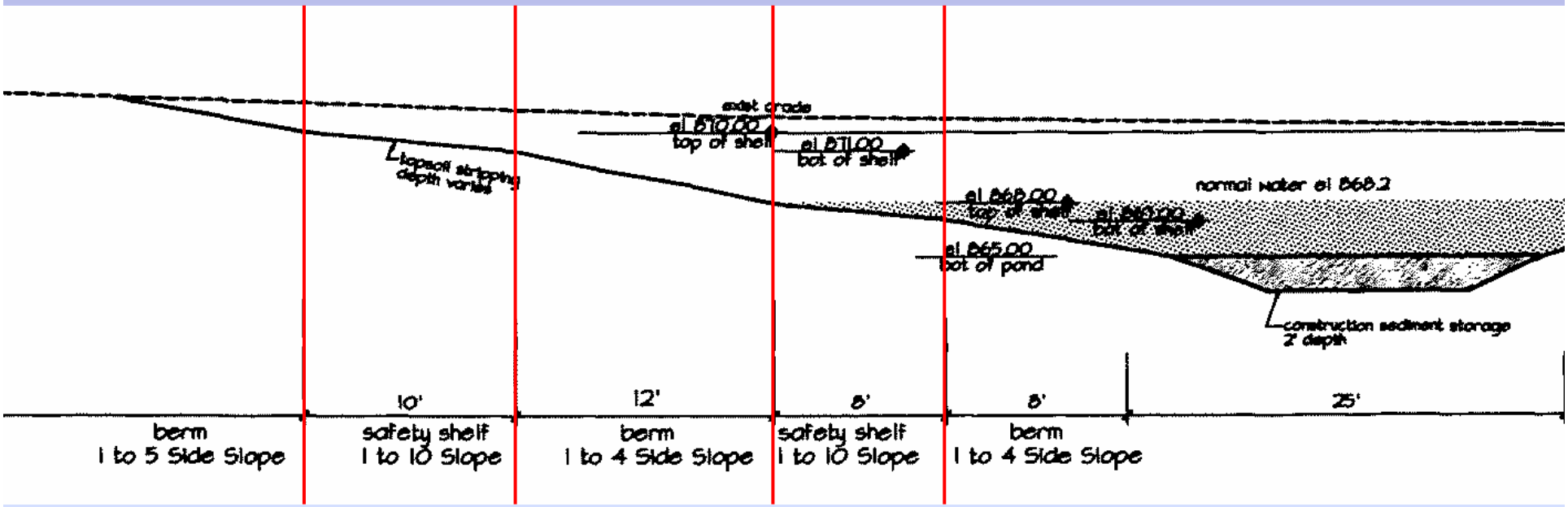
Limits of Clay Liner Installation



Safety Shelf Above Permanent Pool



Multiple Safety Shelves



What’s Wrong with this Picture?

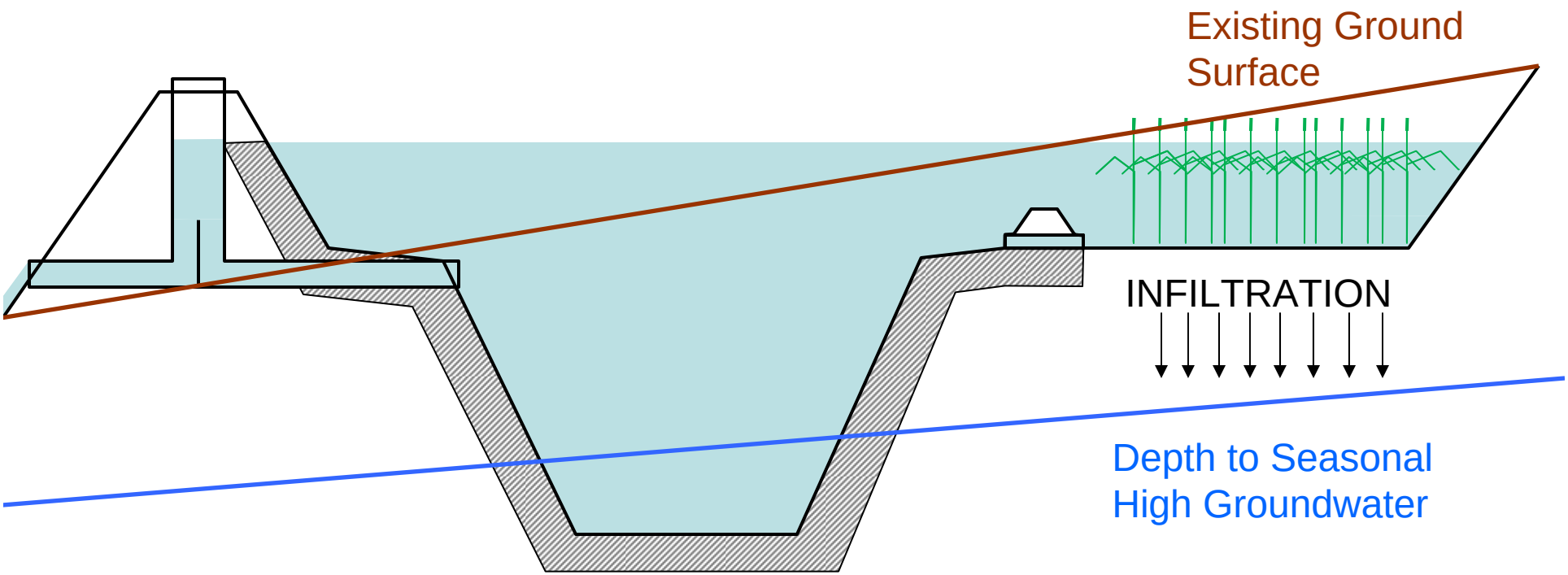
Soul Patch

Vegetated TRM Spillway

Emergent Vegetation on the Safety Shelf

Using Wet Detention in Conjunction with Infiltration

10-year & 100-year 24-hour storm events



Considerations

- VII, DD
  - Consider direct and indirect impacts to area wetland hydrology and wetland hydroperiod due to area hydrologic modifications that result from routing wetland source waters through a wet detention pond or releasing the discharge from a wet detention pond directly into a wetland.

Questions?