

LESSONS LEARNED IN PLAN DEVELOPMENT & IMPLEMENTATION

Roles & Responsibilities
Construction Verification & Inspection

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Waukesha County Land Resources Division

Spring 2013 Storm Water Workshop

Brief History of Problems

- ▣ Much time spent on plans, but they are not followed in the field
- ▣ Projects bid out before final plans are approved
- ▣ Leads to arguments/change orders
- ▣ Lack of contractor involvement in plan preparation
- ▣ Preconstruction meetings are too late to make plan changes
- ▣ Violations!

Why is Proper BMP Construction Important?

- ▣ If the BMPs do not work right, erode or fail:
 - Becomes a liability to new owners
 - Affects downstream water quality and property values
 - SW ordinance loses credibility, public confidence and support



Improve Accountability

- ▣ Detailed plans
 - Construction sequencing, site stabilization, contact lists, etc.
- ▣ As-built surveys
- ▣ PE construction verification
- ▣ Financial assurance
- ▣ Maintenance Agreements

Improve Accountability V2.0

- ▣ Construction Inspection Plan
 - ID when & what to inspect
- ▣ PE Construction Oversight required
 - BMP as-built verification



Improve Accountability V3.0

- ▣ Plan Implementation Meeting (PIM)
- ▣ Plan Implementation Sign-off

Plan Implementation Meeting

- ▣ All responsible parties must attend:
 - Owner
 - Engineer
 - Contractors
 - Erosion Control Contractor/Inspector
 - Construction Inspector
 - Landscaper

Plan Implementation Meeting

- ▣ The PIM should not be looked at as another meeting; it is a working session for the Owner, Contractor, and Engineer
 - Goal is to get everyone on the same page
 - Engineer and Owner know the ins and outs of proposed project from a design point of view, but there may be constructability issues with the project

Plan Implementation Meeting

- ▣ This is the Contractors chance to communicate their plan of attack to the Engineer, Owner, and Regulators
 - Up to this point the Engineer has had little or no contact with the Contractor
 - Eliminates costly change orders during construction

Plan Implementation

- ▣ Helps to ensure a smooth “hand-off” from the Engineer to the Contractor
 - Any changes to the plans should be made and approved prior to permit issuance. All parties should be on the same page
 - The stamped and numbered plans will have proposed PIM changes, eliminating multiple variations of plan sets
 - The Contractor will have taken more ownership of the project and should have a greater understanding of the Owner’s desires, Engineer’s designs, and Regulator’s do’s and don’ts

Plan Implementation Sign-off Form

Waukesha County Storm Water Management and Erosion Control Program

Waukesha County will not issue a Storm Water Permit until proof of *Plan Implementation Sign-off* has been submitted for all applicable contractors charged with implementing the approved version of the storm water management and erosion control construction plans. This is a signed statement from each of the key people charged with implementing the storm water management and erosion control plans for a proposed project. By signing below, the following people indicate that they:

- Have a copy of the approved plans
- Have read the plans and understand their role in implementation, and
- Understands that non-compliance subjects them to enforcement action.

PLAN DATE _____

Role in Project	Printed Name	Organization or Company	Mailing Address	Signature	Phone Number	Fax	Email
Owner / Permit Applicant							
Project Engineer							
Grading Contractor							
Erosion Control Inspector							
Erosion Control Contractor							
Landscaping Contractor							
Construction Inspector							

“Sign-off” of the final plans by each person noted above can be faxed to the LRD at 262-896-8298.

Plan Implementation Sign-off

- ▣ All parties agree on final plan
- ▣ Signed statement says:
 - I read the plans (final plan date)
 - I have a copy for my reference
 - I understand my role in implementation
 - I understand I am subject to enforcement

Benefits of PIM

- ▣ Forces ownership in the project for all parties involved
- ▣ Starts the lines of communication early on in the construction phase
- ▣ Expedites the construction process
- ▣ Reduces costly change orders during construction
- ▣ Reduces the chance of permit violations
- ▣ Disadvantage: **Another meeting?**

Storm Water Permit *

Permit # 1234

Permit Expiration Date: 4/10/13

This permit has been issued pursuant to Chapter NR 216 Wis. Admin. Code and the Waukesha County Storm Water Management and Erosion Control Ordinance (Chapter 14 Code of Ordinances).

Project Type & Name: Perry's Permit Shop

Permit Holders Name: Perry Lindquist

Project Location:

Survey Township of Pewaukee, Section 34, 1/4 Section SE

Address (if available): 515 W Moreland Blvd, AC260, Waukesha, WI 53188

Issued by (staff name): Jim Rose

Date Issued: 4/10/13

Waukesha County Department of Parks and Land Use
Land Resources Division
Administration Center
515 W. Moreland Blvd., Room AC 260
Waukesha, WI 53188
Phone: 262-896-8300

* This county permit also confers coverage under WPDES storm water discharge general permit WI-S067831-3, issued by the Wisconsin Department of Natural Resources under Chapter NR 216 Wisconsin Administrative Code.

- Post this permit on premises in clear view from road -

Construction Inspection Logs

- Engineer submits for approval
- Documents what needs to be inspected, when it was inspected and who conducted the inspection
- As-built survey schedule

Example Combined Construction Sequence and Construction Inspection Schedule

Date	Duration	Milestone or Task	Date of Inspection	Inspector Initials	Inspector Role
		Prior to grading activities			
		Surveyor stakes road, drainage ways, storm water BMPs. Mark wetlands			
		Plan implementation meeting			
		Hold pre-construction meeting with Town, County, DNR, contractors, utilities			
		Install tracking pad			EC Insp.
		Install silt fence or other perimeter BMPs, clearing and grubbing as minimally needed			EC Insp.
		Contact County LRD and other authorities at least 2 days prior to beginning construction			
		Construct Basins			
		Strip topsoil in basin and subsoil stockpile areas			
		Excavate temporary or permanent basins to be used for sediment control			
		The following steps apply to construction of wet detention basins			
		Before berm material is placed, verify that			
		Topsoil, stumps, and vegetation are stripped in basin berm footprint			Engineer
		A 2x6 ² <i>kayway</i> is excavated under berm (if permanent pool will pond =>3 ft against embankment)			Engineer
		The basin berm is constructed with the specified material			Engineer
		Before a liner is placed, verify that:			
		Basin interior slopes do not exceed maximum pitches (3:1 above water, 10:1 safety shelf, 2:1 below)			Engineer
		Basin bottom and shelf elevations are correct			Engineer
		The safety shelf is at least 5 ft wide			Engineer
		Before the berm is re-compacted around outlet pipes following installation, verify that			
		The correct pipe diameter, drain hole diameter, and materials are used			Engineer
		The outlet pipe and riser elevations are correct			Engineer
		Anti-seep devices are installed on specified outlet pipes			Engineer
		Before topsoil is re-applied, verify that:			
		A compacted 2-ft clay liner is installed up to the permanent pool elevation			Engineer
		The 90% standard Proctor compaction req't is met by sampling at five locations along embankment			Engineer
		The berm elevation is 5% above design height (above existing grade) to allow for settling			Engineer
		Verify that topsoil is re-applied to all surfaces above and including the safety shelf			Engineer
		Basin is dewatered to verify bottom elevation and remove sediment			Engineer
		As-built elevations are correct (see as-built survey punch list)			Engineer
		The following steps apply to construction of infiltration basins			
		Before engineered soil is installed in the infiltration area, verify that:			
		Basin was over-excavated to expose permeable soil			Soil Scientist
		Compost used to amend soil meets WCDNR specification S100. Submit sample to LRD			Engineer
		Correct mixture of engineered soil is used (40% sand, 30% topsoil, 30% compost)			Engineer
		Sand and soil samples tested for particle size distribution			Engineer
		Before berm material is placed, verify that			
		Topsoil, stumps, and vegetation are stripped in basin berm footprint			Engineer
		A 2x6 ² <i>kayway</i> is excavated under berm (if permanent pool will pond =>3 ft against embankment)			Engineer
		The basin berm is constructed with the specified material			Engineer
		Before a forbay liner is placed, verify that:			
		Basin interior slopes do not exceed maximum pitches (3:1 above water, 10:1 safety shelf, 2:1 below)			Engineer
		Basin bottom and shelf elevations are correct			Engineer
		The safety shelf is at least 8 ft wide			Engineer
		Before the berm is re-compacted around outlet pipes following installation, verify that			
		The correct pipe diameter, drain hole diameter, and materials are used			Engineer
		The outlet pipe and riser elevations are correct			Engineer
		Anti-seep devices are installed on specified outlet pipes			Engineer
		Before topsoil is re-applied, verify that:			
		A compacted 2-ft clay liner is installed up to the forbay permanent pool elevation			Engineer
		The 90% standard Proctor compaction req't is met by sampling at five locations along embankment			Engineer
		The berm elevation is 5% above design height (above existing grade) to allow for settling			Engineer
		Verify that compaction mitigation procedures were followed (deep tilling)			Engineer
		Verify that compost /loamy sand topsoil mixture is applied to surface of infiltration area			Engineer
		Verify that topsoil is re-applied to all surfaces above and including the safety shelf			Engineer
		Basin is dewatered to verify bottom elevation and remove sediment			Engineer
		As-built elevations are correct (see as-built survey punch list)			Engineer
		Begin Grading			
		Strip topsoil. Stockpile locations are shown on plan. Piles 1 and 2 for re-use on site. Pile 3 to be seeded and sold later.			
		Install silt fence around stockpiles within 7 days of lay-up			EC Insp.
		Seed stockpiles within 30 days of lay-up			EC Insp.
		Rough grading			
		Apply road base material			
		Stabilize disturbed areas that are inactive for 7 days or more with temporary seed mix.			
		Install gas			
		Install electric and communications lines			
		Pave roads			
		Finish shoulders			
		Remove ditch checks			EC Insp.
		Re-apply topsoil			EC Insp.
		Seed, apply matting and mulch per plans, within 7 days of end of grading			EC Insp.
		If permanent seeding is not completed by September 15, apply temporary seeding			Engineer
		If temporary seeding is not completed by October 15, apply soil stabilizers and dormant seed to all disturbed areas.			Engineer
		Site must be stabilized by November 1.			Engineer
		Refer to planting implementation plan for infiltration basins.			
		Project Wrap-Up			
		After grass is well-established, all silt fence and other temporary BMPs will be removed			EC Insp.
		Complete as-built survey of basins and conveyances			Engineer
		Complete planting verification of infiltration areas			Engineer
		Submit maintenance agreement addendum for approval			Planting Verifi.

3/5/09 LRD

Maintenance Agreement Exhibits:

A – Legal Description

B – BMP Locations

C – Maintenance Plan

D – Design Documentation

E – As-built Survey

F – Construction Verification

G – Permit Termination



Up-front
(plat/CSM)



Addendum

Watershed Data Summary (D)

Example Data Summary Sheet for Stormwater Management Plan

Project Name: Rolling Acres Project Size: 110 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 (30 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 (in acres) (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 5 ac. 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 7800/120 ac. RCN = 65	RCN = 68 (state standard)	RCN = 70	RCN = 30	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 notes)	15' (w) top 1' (d) parabolic 2% grade	2' deep standard road ditch 2% grade	15' top (w) 1' (d) parabolic 1% grade	2' deep standard road ditch 1% grade

Watershed Map (D)

Exhibit D (continued)

Watershed Map. The watershed map shown below was used to determine the post-development data contained in this exhibit. The post-developed watershed areas are the same as the pre-development watershed areas for this project.



BMP Design Summary (D)

Future reference
for repairs or
proposed
modifications

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" curbed 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 m otting
	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	1.6 acres (13% pool size) / 5 feet
Sediment storage depth & design maintenance	2 ft. depth for forebay & pool 15 year maintenance schedule

Design Basin Inflow, Outflow & Storage Data

(see attached hydrographs and detail drawings)

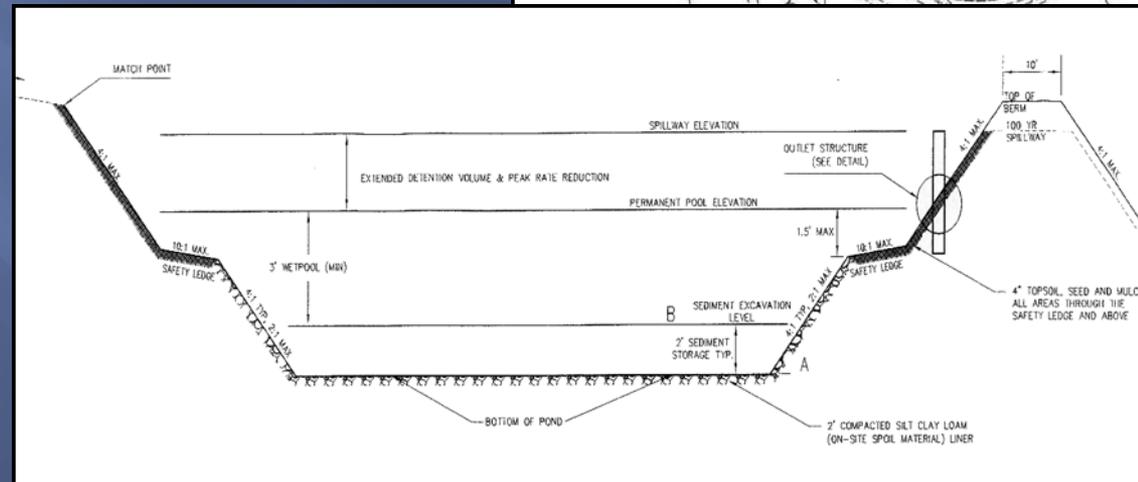
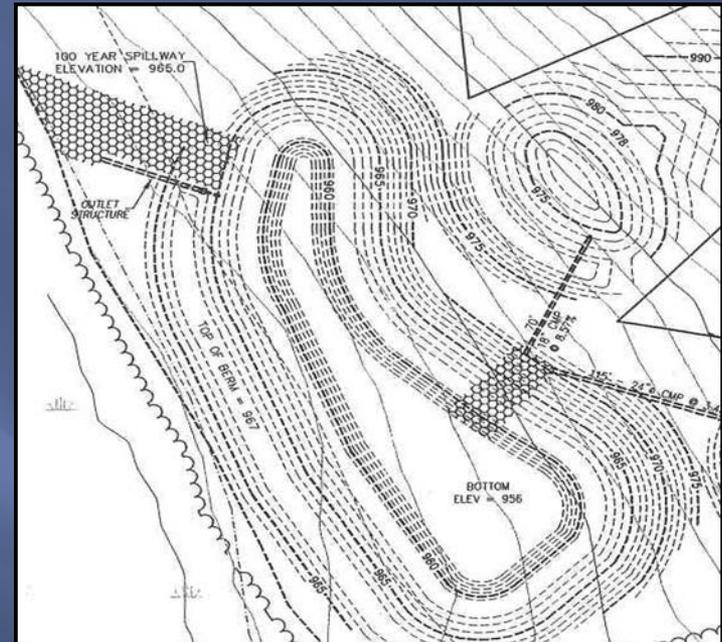
Inflow Peak/Volume	Maximum Outflow Rate	Max. Water Elevation	Storage Volume at Max. Elev. (above perm. pool)	Outflow Control Structures*
1-yr./24 hr. (volume) 24.3 cfs	.7 cfs (34 hr. drawdown)	901.3 ft.	2 acre feet	#1
(Post 2-yr./24 hr. peak) 72 cfs	11 cfs	902.0 ft.	3.1 acre feet	#1 and #2
(Post 10-yr./24 hr. peak) 171 cfs	35 cfs	903.0 ft.	4.5 acre feet	#3
(Post 100-yr./24 hr. peak) 171 cfs	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 embankment/soil/straw – flow line elev. @ 903.0 (1.0 ft. max. depth)

As-built Survey (E)

- ▣ Shows final construction details, elevations, etc.
- ▣ Referenced in construction verification



Construction Verification (F)

- ▣ Shows compliance with approved plans
- ▣ Documents any changes made

Exhibit "F"
Engineering/Construction Verification

DATE: _____

TO: Land Resources Division
Waukesha County Department of Parks and Land Use

FROM: _____ [Project Engineer's Name/Company]

RE: Engineering/Construction Verification for the following project:
Project Name: _____
Section _____, Town of _____
Storm Water Permit # _____
Storm Water Management Practices: _____

For the above-referenced project and storm water management practices, this correspondence shall serve as verification that: 1) all site inspections outlined in approved inspection plans have been successfully completed; and 2) the storm water management practice design data presented in Exhibit D, and the "as-built" construction documentation presented in Exhibit E comply with all applicable state and local technical standards, in accordance with the Waukesha County Storm Water Management and Erosion Control Ordinance.

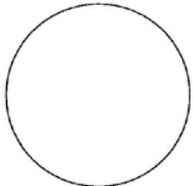
[Must include one of the following two statements:]

1. Any variations from the originally approved construction plans are noted in Exhibit E. These variations are considered to be within the tolerances of standard construction techniques and do not affect the original design as presented in Exhibit D in any way.
[Note: The County may request additional documentation to support this statement depending on the extent of deviations from the approved plans.]

Or

2. Any design or construction changes from the originally approved construction plans are documented in Exhibits D and E and have been approved by Waukesha County.

[Note: If warm season and wetland planting verification is required, it may be included in this exhibit.]



(Signed P.E. stamp must be included)

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Permit Termination (G)

- ▣ Demonstrates compliance/closure to storm water permit
- ▣ Transfers BMP maintenance responsibility to the party identified in the agreement
- ▣ Final step to record maintenance agreement addendum & return financial assurance

Questions?

