

Line	Standard	Additional Notes
	Pond Geometry and Structural Design--follow NR 1001 AND	
1	Interior side slopes are 4H:1V or softer	
2	Core Trench or Key-way – For embankments where the permanent pool is ponded 3 ft or more against the embankment, include a core trench or key-way along the centerline of the embankment up to the permanent pool elevation to prevent seepage at the joint between the existing soil and the fill material. The core trench or key-way shall be a minimum of 2 ft. below the existing grade and 8 ft. wide with a side slope of 1:1 (horizontal:vertical) or flatter. --follows DNR Tech Standard 1001.	
3	Provide specifications for compaction of soils used in embankments	
4	Avoid short-circuiting the pond (outlet and inlet should be far apart)	
5	A minimum of a 6' wide berm is needed along wet pond for mowing unless maintenance access needed (if no structures/dredging)--if maintenance access needed, see below for requirements	
6	Plunge pools/stilling basin needed for pipes >30" that outlet at grade above NWSE. Minimum of 4' deep, use glacial field stone and riprap filter fabric. Use Chapter 10 of FHWA's HEC 14, Third Ed., Hydraulic Design of Energy Dissipaters for Culverts and Channels (2006) covers riprap stilling basins, plunge pools, etc.	
7	Safety Shelf at 10:1 Slope for 8' (minimum)	
8	Pond side slopes below WSE and safety shelf are 3:1 or flatter	Privately owned ponds can be 2:1
9	Geotechnical borings and report typically advisable to determine underlying soils and global stability. Review geotech report for critical stability issues.	
10	Forebays shall be constructed at discharge points to basins with a permanent pool when the discharge pipe exceeds 18" in diameter. Generally, the forebay shall be designed to provide access for maintenance equipment (backhoe, tri-axle truck) to reach the area and such that the majority of the maintenance can be completed from the shore with the above equipment.	
11	Pipes/Pipe grates	
12	Grates are provided for pond outlet and any pond inlet pipes greater than 12" diameter. Grates have 6" OC (on center) max spacing--(must pass "ball test")	
13	Anti-seepage collars provided on pipes through embankments ponding greater than 8' of water	https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046898.pdf
14	Submerge inlet pipe 1/2 pipe diameter below NWSE (Normal Water Surface Elevation). NWSE=top of safety bench elevation.	
15	Pipe gates needed on any pipes you can't view through to other end	

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16	Pipes smaller than 8" diameter not allowed (this excludes orifices and underdrains)	
17	Box culverts and HERCP should be double-wrapped on 3 sides (top and sides). Internal mastic - external Mac-Wrap per City Specification 505.3. HERCP isn't included in 2022 spec, but should be also be called out in specials to be double-wrapped.	
18	RCP aprons always required for pipes >12" diameter	
19	Pipes between cells in ponds shall not be PVC (not UV-stable). Can use HP Storm/CI/RCP	
20	Grates on standard pipes are covered by our SDD (Standard Detail Drawing). Grates on non-standard inlet/outlets should be designed with the vertical steel being 2x2 od with 6" clear on edge and #4 bars tack welded under the top bar on like 10" centers. This allows cleaning equipment to "ride" up the flat steel on the outside.	
21	RCP apron ends need cutoff wall per SDD when pipe outlets above NWSE-- must be called out on plans	
22	Last 3 sections of pipes should be tied per SDD--must be called out on plans	
23	Cut off walls guidance: <ul style="list-style-type: none"> • required for all pipes 36" and larger on downstream end unless submerged w/ pond • required for all pipes 27" and larger on upstream end unless within a pond • required per for all wingwalls / splash pads associated with box culverts • if deemed necessary by the designer--can add at your discretion. 	https://www.cityofmadison.com/business/pw/documents/StdSpecs/2022/Drawings/5_4_4.pdf
24	Consider pre-treatment of stormwater (catch basin sumps) before entering the pond to extend the life of the basin.	
25	Design Elements that need additional expertise (typically avoided when possible for in-house designs)	
26	Side slopes steeper than 3H:1V need a geotech review - City Standard is 4:1 (see Pond Geometry Section)	
27	Retaining walls --designed by PE	
28	Embankments that impound water that have slopes steeper than 3H:1V and greater than 6' tall (see DNR dam requirements--make sure you don't need permit)--geotech review	
29	Pond berm embankment constructed on fill soils--needs geotech review	

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30	Dam design and permitting if: Structure height greater than 6 feet and a max. storage capacity of 50 ac-ft or more. Structure height of 25 feet or more and a max storage capacity of greater than 15 ac-ft. Structure height of 6 feet or less or a maximum storage capacity of less than 50 ac-ft of water if the department determines that the dam is likely to endanger life, health or property if it is not designed, constructed or reconstructed in accordance with NR 333.	
31	Setbacks	
32	Max WSE (MWSE) for 100-year, 200-year, 500-year shown on drainage plan and shown in pond cross-sections	
33	There is a 0.5' vertical clearance from the MWSE to adjacent property line elevations	
34	Wetland Setbacks: 30' no grading offset for CARPC, 75' setback for impervious surface - 30' of 75' setback will be in public ownership	CARPC Offsets
35	Control Structure	
36	Orifice(s) and weir sizes/elevations match modeling	
37	Control structure detail provided in plans	
38	Minimum orifice diameter is 6" on publically owned/maintained ponds.	Privately owned ponds may have smaller orificies but the City has concerns about effectiveness and maintenance and this is not preferred.
39	If backwater affects are possible for outlet pipe, it must be included in modeling. Check for dynamic modeling in hydrocad.	
40	10-year storm must go thru pipe, not emergency spillway	
41	Any grates on outlet structure must be designed to allow enough water into structure to make modeling valid (Bar spacing 6" OC Max). We don't want grates bolted directly to the concrete--should be 4"-6" spacers on top and front side.	
42	Control struture internal orifices are located in control structure that's within the access berm so it can be esaily maintained.	
43	Emergency Spillway	
44	Emergency Spillway provided and designed to pass 100-year, 200-year developed peak flow. Freeboard elevation 0.5' for 100-year and contain 200-year	
45	Model 500-year inundation--new development no flooding structures, re-development make sure we aren't making it worse	
46	Discharge from spillway or overflow directly to downstream conveyance system or other acceptable discharge point. Need safe outflow downstream. For private development, if no channel easement or pipe, or if it's going to undersized system of other municipality, must match existing 10-year volume (via HydroCAD).	

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47	Armored to full width, beginning at point 2' below the 100yr-24hr water elevation inside the pond and extending it across the berm embankment to downstream where the emergency overflow re-enters the conveyance system. TRM preferred over riprap wherever possible.	
48	100 -yr can use overflow but check that velocities are below 3 fps	
49	Plantings & landscaping	
50	Bioretention uses live plants (plugs or Native Vegetated Mat (NVM)). Plant spacing to be specified on plan (generally 12" OC for most plugs, but can be larger for larger shrubs).	
51	Infiltration uses plugs or Native Vegetated Mat. Plant spacing to be specified on plan (generally 12" OC for most plugs but can be larger for larger shrubs). If infiltration is seeded, diversion plan needed during construction. A diversion plan should divert pipe flow around infiltration basin until vegetation is established, upstream area is stabilized, and system is ready to be put online. Bypass system may be a berm, channel, or pipe and needs to be sized accommodated the 10 yr storm. If a bypass pipe is used, pipe shall be abandoned with a removable plug on both the up and downstream ends. Underdrain shall be left open until basin is established. Close when basin is established.	
52	Maddie/Carissa/Emily provide appropriate seed mix for all areas: basin bottom, side slopes, and flat outlot areas.	
53	Pond matting consistent w/ city specifications using no plastic in its manufacture	
54	Site conditions taken into consideration when choosing plants (shade, salt-loading etc)	
55	Drought watering included for plant plugs or NVM for public projects	
56	No tree plantings allowed on pond berms	
57	Construction Drawings	
58	Show existing topo based on field survey	
59	Show proposed topo and extend proposed topo to catch points	
60	Show tract boundaries and easements widths and location of easement markers	
61	Planting plan shows seed mix, quantity, location, and any special planting requirements	
62	10-year, 100-year, 200-year WSE shown in plan view	
63	10-year, 100-year, 200-year WSE shown in cross-section	
64	Provide typical pond cross section that includes outlet structure	
65	Details of emergency spillway provided (elevations, sta/offset, shape, matting -- TRM or flexamat)	

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66	Details of control structure down (elevations of orifices, riser overflow, top of structure, etc.)	
67	Showing location of matting to be used & list City Standard types	Needs to be mapped so that it isn't burned
68	Maintenance	
69	12' Pond Access road to all structures and forebays for gate cleaning and dredging	https://www.cityofmadison.com/business/pw/documents/StdSpecs/2022/Drawings/5_1_5.pdf
70	Provide access ramp to bottom for dredging. If no ramp to bottom of pond for dredging, need to design in forebays at each major outlet, or access road should go around the entire pond. Access should follow SDD 5.1.5, have a slope of a max of 10:1, and be 12' minimum.	https://www.cityofmadison.com/business/pw/documents/StdSpecs/2022/Drawings/5_1_5.pdf
71	Pond Access road grade less than 15% and less than 12% to the control structure	
72	Berms 12' across to provide for maintenance access	
73	Access to pond parcel not provided via street ROW needs minimum 15' easement. Access provided via easement shall be per our SDD and not include topsoil so ownership is delineated. Easements between homes over pipes are no longer allowed.	
74	Paved apron or mountable curb provided where access road connects to paved public road	
75	Control structures in Manhole in berm, NOT in Pond	
76	Sanitary structure w/in pond provide Sanitary Access via SDD (no topsoil is preferred). Turnarounds or drivethroughs need to be accommodated on stretches longer than 75'. Access path shall accommodate 80,000lb loading from vector, and shall be graded to accommodate vector geometry, including an 80' turning radius where there will be frequent maintenance and cleaning. See details attached to this spreadsheet.	
77	Detention Basins	Tech Standard 1001
78	All wet ponds=Sediment storage 5ft.	
79	Clay liner spec'd if w/in wellhead protection zone (areas defined by WU) & uses updated clay liner spec. Clay liner also needed if required by SOC STD 1002 based on Geotech report.	
80	Include specification language and bid item for dewatering during construction. Include a bid item for flow management or bypass system for online ponds that have a large upstream drainage area.	\\Fps2\data2\Encommon\STORM\Ponds-Shorelines-Greenways Gen Coord\PSG Designer Resources\General Guidance\Standard Special Provisions
81	Work through sampling & dredge material issues well in advance, especially in retrofits. Janet and Greg have most up-to-date information and should be consulted in planning efforts.	View Janet's logistics email for more info: \\Fps2\data2\Encommon\STORM\Ponds-Shorelines-Greenways Gen Coord\PSG Designer Resources\Pond Dredging\Dredge and sediment sampling.msg
82	Infiltration Basins -- Tech Standard 1003	Tech Standard 1003

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83	Install temp bypass pipe (CMP) so vegetation can establish if vegetated via seed or plug plantings installed in the fall (spring planted plugs or native vegetated mat don't need bypass)	
84	Bypass pipe abandonment plan. Plugging pipe w/ removeable plug is preferred method but it isn't always an option if ADS or large diameer.	
85	Soil borings and pits follow 1002. Test pits required, 2 min per basin and 1 for every 10000 sqft.	Tech Standard 1002
86	Peak infiltration rate is 3.6 in/hr	
87	60% TSS pretreatment for infiltration basins	
88	Check draw down times match DNR tech standards	DNR SW Post-Construction Tech Stds
89	Follows ECSM Manual	Dane County ECSM Manual
90	Discussion and justification of infiltration exemption and/or prohibition if requested	
91	Infiltration basins can use native soils for side slopes and bottom	
92	In addition to the max ponded depth based on soil infiltration rate per DNR tech standard 1003, a continuous storm model that includes both the infiltration basin and any upstream detention shall be run and the maximum ponding time in the infiltration must be less than 72 hours.	
93	Infiltration basin should have emergency drain at bottom	
94	if soil amendments are required to meet vegetation establishment goals the soil amendment must have an infiltration rate equal or higher to design infiltration rate	
95	Bioretention (backfilled w/ eng soil and has underdrain) --Tech Standard 1004	Tech Standard 1004
96	Vertical stand pipes and orifices should all be > 6" for publically maintained bioretention	
97	No topsoil in engineered soil (70% sand, 30% compost)	City Standard Specs
98	# of underdrains determined by WinSLAMM model. Ideally use 2.	
99	Soil borings and pits follow 1002 (test pits only accepted)	Tech Standard 1002
100	Peak infiltration rate is 3.6 in/hr	
101	Check draw down times match DNR tech standards (surface drains in 24 hrs, base drains within 72 hrs)	DNR SW Post-Construction Tech Stds
102	Follows ECSM Manual	Dane County ECSM Manual
103	Side Slopes with new non-infiltration soil spec	
104	Marker balls on under drains at clean outs	
105	Flexible corrugated underdrain is not allowed--if you can bend it, it cannot be cleaned. Must be drilled PVC pipe, schedule 35.	https://www.cityofmadison.com/business/pw/documents/StdSpecs/2022/Drawings/5_7_47.pdf
106	Consider pre-treatment of stormwater (catch basin sumps, filter strips, swales) before entering the bioretention basin to extend the life of the basin.	
107	Terrace Rain Gardens	

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108	Plans call out flume location and elevations	https://www.cityofmadison.com/business/pw/documents/StdSpecs/2022/Drawings/2_09.pdf
109	Plans call out key elevations/location at top of slope and bottom of slope at corners	
110	3:1 to 4:1 side slopes	
111	Look at borings and if sand layer nearby, call out to dig to the sand	
112	Check for Common Mistakes	
113	Side infiltration included in calculations	
114	Void space above 27%	
115	Aspirational infiltration rate -- base on soil borings and DNR post construction stds	
116	Outlet structure does not match HydroCAD--make sure outlets match in all models	
117	Outlet pipe sizes do not match between models	
118	No emergency draw down	
119	Peak flows table don't match model	
120	Time of concentration short for existing	
121	Drop CN by soils class	
122	Under estimating impervious area	
123	Including offsite sediment removal in model	
124	Matching existing flows to same areas leaving plat	
125	Ignoring offsite flow onto site	
126	Unacceptable draw down times	
127	Including cut-off walls for apron ends	
128	Do not use riprap on embankments--use TRM or flexamat	
129	Pipe ties called out for on plans for any outfall pipe	
130	Common Construction Mistakes to look for on-site	
131	Proper matting used	
132	Bioret/RG's properly backfilled w/ Eng Soil	
133	Missing gates	
134	Insufficient sanitary sewer cover	
135	separation from storm and san	
136	Slopes beneath safety shelf-- 3:1 or softer	
137	No heavy equipment while constructing the infiltration/bioretention basin to avoid compaction and smearing of engineered soils.	
138	Appropriate riprap placed at inlet pipes	