Equation List for Sizing Wet Ponds

Calculating the Water Quality Volume (Water Quality TM Section 1.2)

The water quality protection volume is calculated by multiplying the 85th percentile annual rainfall event by the volumetric runoff coefficient (R_v) and the site area. R_v is defined as:

$$\mathbf{R_v = 0.05 + 0.009(I)} \qquad \mathbf{(1.1)}$$

where:

I = percent of impervious cover (%)

For North Central Texas, the average 85th percentile annual rainfall event is 1.5 inches. Therefore, WQ_v is calculated using the following formula:

$$\mathbf{WQ_v = \frac{1.5\ R_v\ A}{12}} \qquad \mathbf{(1.2)}$$

where:

WQ_v = water quality protection volume (acre-feet)

R_v = volumetric runoff coefficient

A = total drainage area (acres)

Calculating the Forebay Volume (Site Development Controls TM Section 22.5)

The forebay is sized to contain 0.1 inches per impervious acre of contributing drainage

Calculating the Permanent Pool Volume (Site Development Controls TM Section 22.6)

Wet Pond: Size permanent pool volume to 1.0 WQ_v

Extended Detention Wet Pond: Size permanent pool volume to 0.5 WQ_v. Size extended detention volume to 0.5 WQ_v.

Extended Detention Micropool Pond: Size permanent pool volume to 25 to 30% of WQ_v. Size extended detention volume to remainder of WQ_v.

Calculating the Streambank Protection Volume (Hydrology TM Section 3.0)

The Soil Conservation Service[1] (SCS) hydrologic method requires basic data similar to the Rational Method: drainage area, a runoff factor, time of concentration, and rainfall. The SCS approach, however, is more sophisticated in that it also considers the time distribution of the rainfall, the initial rainfall losses to interception and depression storage, and an infiltration rate that decreases during the course of a storm.

For SP_v estimation, using Figure 1.10, the unit peak discharge (q_U) can be determined based on I_a/P and time of concentration (t_C). Knowing q_U and T (extended detention time, typically 24 hours), the q_O/q_I ratio (peak outflow discharge/peak inflow discharge) can be estimated from Figure 3.1.

$$\mathbf{I_a = 200/CN - 2}$$

where:

I_a = initial abstraction

CN = curve number

Equation List for Sizing Wet Ponds

I_a/P

where:

I_a = initial abstraction

P = accumulated rainfall obtained from rainfall tables by county in the Hydrology TM Section 5.0 (inches)

Using the following equation from TR-55 for a Type II rainfall distribution, V_S/V_r can be calculated.

$$\mathbf{V_S/V_r = 0.682 - 1.43\,(q_O/q_I) + 1.64\,(q_O/q_I)^2 - 0.804\,(q_O/q_I)^3} \qquad \mathbf{(3.1)}$$

where:

V_S = required storage volume (acre-feet)

V_r = runoff volume (acre-feet)

q_O = peak outflow discharge (cfs)

q_I = peak inflow discharge (cfs)

The required storage volume can then be calculated by:

$$\mathbf{V_S = \frac{(V_S/V_r)(Q_d)(A)}{12}} \qquad \mathbf{(3.2)}$$

where:

V_S and V_r are defined above

Q_d = the developed runoff for the design storm (inches)

A = total drainage area (acres)

Equation List for Sizing Wet Ponds

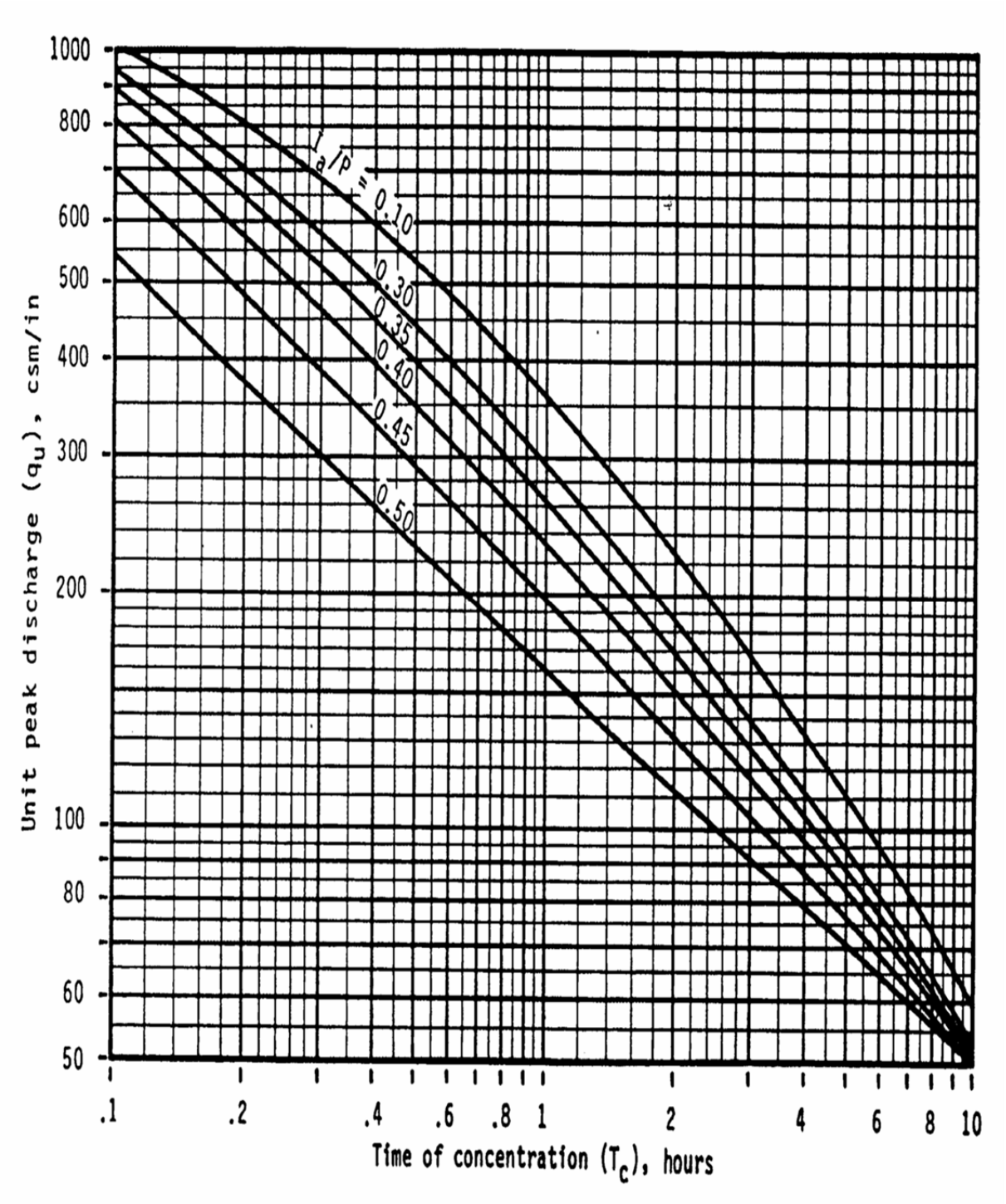

Figure 1.10 SCS Type II Unit Peak Discharge Graph

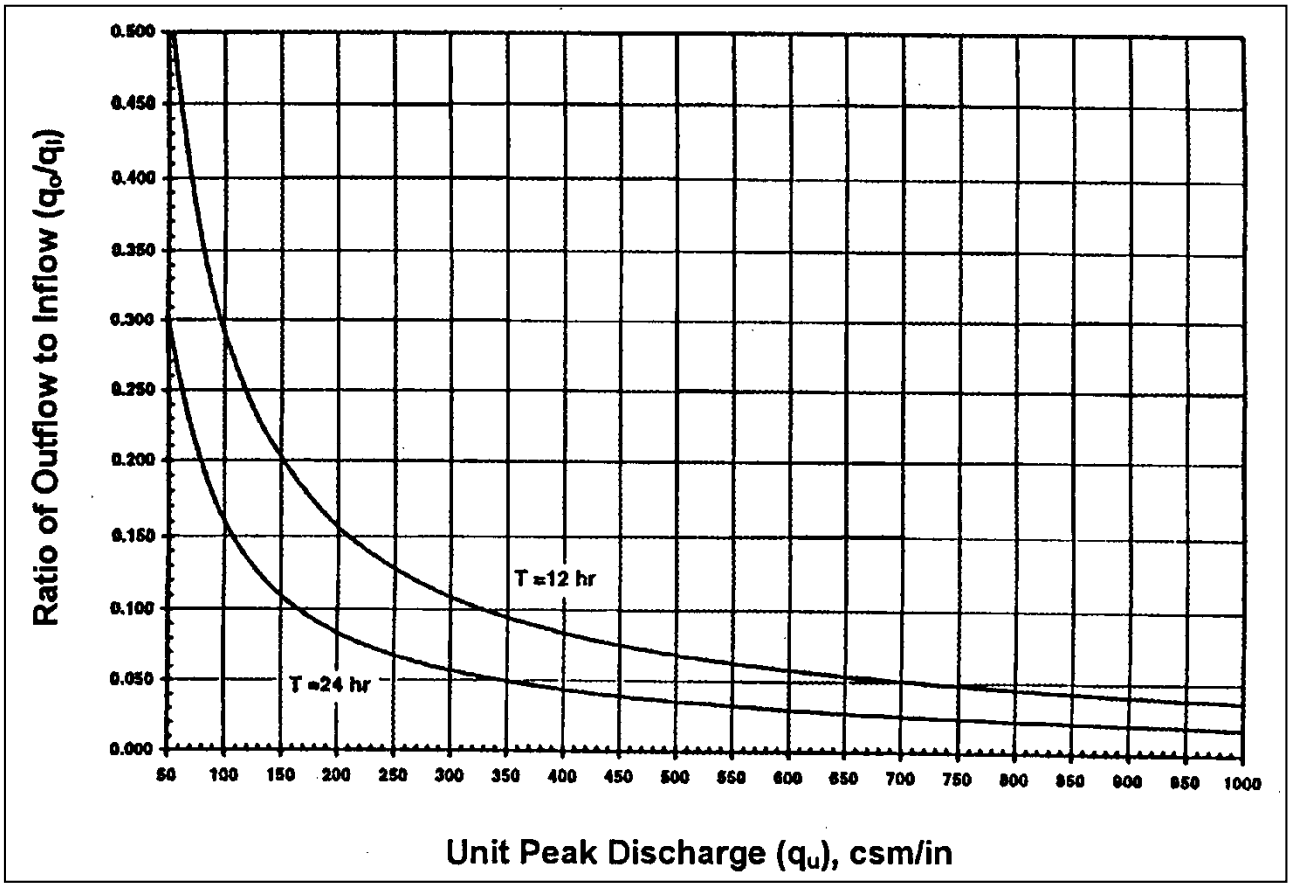

Figure 3.1 Detention Time vs. Discharge Ratios

Calculating the Flood Control Volume (Hydrology TM Section 1.5)

For drainage areas of *less than 200 acres*, a modification of the Rational Method can be used for the estimation of storage volumes for detention calculations.

The Modified Rational Method uses the peak flow calculating capability of the Rational Method paired with assumptions about the inflow and outflow hydrographs to compute an approximation of storage volumes for simple detention calculations.

The allowable release rate can be determined from:

$$Q_a = C_a\, i\, A \qquad (1.26)$$

where:

- Q_a = allowable release rate (cfs)
- C_a = predevelopment Rational Method runoff coefficient
- i = rainfall intensity for the corresponding time of concentration (in/hr)
- A = area (acres)

The critical duration of storm, the time value to determine rainfall intensity, at which the storage volume is maximized, is:

$$T_d = \sqrt{\frac{2CAab}{Q_a}} - b \qquad (1.27)$$

Equation List for Sizing Wet Ponds

where:

T_d = critical storm duration (min)
Q_a = allowable release rate (cfs)
C = developed condition Rational Method runoff coefficient
A = area (acres)
a, b = rainfall factors dependent on location and return period taken from Table 1.18

The required storage volume, in cubic feet can be obtained from the equations below:

$$\mathbf{V_{preliminary} = 60\,[CAa - (2CabAQ_a)^{1/2} + (Q_a/2)\,(b\text{-}t_c)]} \qquad \mathbf{(1.28a)}$$

$$\mathbf{V_{max} = V_{preliminary} * P_{180}/P_{td}} \qquad \mathbf{(1.28b)}$$

where:

$V_{preliminary}$ = preliminary required storage (ft^3)
V_{max} = required storage (ft^3)
t_c = time of concentration for the developed condition (min)
P_{180} = 3-hour (180-minute) storm depth (in)
P_{td} = storm depth for the critical duration (in)
all other variables are as defined above

The equations above include the use of an adjustment factor to the calculated storage volume to account for under sizing. The factor (P_{180}/P_{td}) is the ratio of the 3-hour storm depth for the return frequency divided by the rainfall depth for the critical duration calculated in Equation 1.27.

The Modified Rational Method also often under sizes storage facilities in flat and more sandy areas where the target discharge may be set too large, resulting in an oversized orifice. In these locations modifications to the C factor or time of concentration should be considered in the design of the orifice.

Equation List for Sizing Wet Ponds

Table 1.18 Rainfall Factors "a" and "b" for the Modified Rational Method (1-year through 100-year return periods)

County		Return Interval						
		1	2	5	10	25	50	100
Collin	a	101.14	129.51	177.49	209.08	250.52	283.13	320.81
	b	14.214	16.634	20.174	21.668	22.821	23.455	24.502
Dallas	a	99.8	128.85	178.58	210.73	253.77	288.56	327.75
	b	14.114	16.624	20.352	21.785	23.03	23.866	24.893
Denton	a	97.258	124.47	173.1	205.74	248.54	283.99	325.18
	b	13.788	16.121	19.754	21.358	22.615	23.508	24.822
Ellis	a	101.94	129.3	181.43	214.61	259.34	295.76	336.3
	b	14.511	16.697	20.792	22.384	23.744	24.681	25.818
Erath	a	90.53	113.9	159.31	189.97	228.79	260.81	298.07
	b	13.32	14.99	18.439	19.981	20.955	21.65	22.712
Grayson	a	100.87	128.89	175.74	208.17	250.17	285.35	325.63
	b	14.086	16.567	20.006	21.751	22.993	24.027	25.322
Hood	a	93.351	117.38	163	194.75	235.56	269.71	309.25
	b	13.654	15.308	18.65	20.281	21.438	22.299	23.508
Hunt	a	107.65	131.48	178.92	209.36	249.71	282.05	318.9
	b	15.348	16.855	20.456	21.855	22.995	23.713	24.744
Johnson	a	94.751	120.21	168.39	198.98	240.45	275.19	313.38
	b	13.414	15.543	19.272	20.676	21.847	22.804	23.875
Kaufman	a	104.54	132.07	183.2	216.62	260.03	295.03	334.63
	b	14.637	16.912	20.837	22.424	23.65	24.42	25.496
Navarro	a	108.66	132.42	185.55	221.63	268.93	306.83	350.06
	b	15.326	16.758	20.945	22.903	24.437	25.402	26.665
Palo Pinto	a	91.031	115.97	164.22	196.59	242.51	281.03	326.0
	b	13.127	15.264	19.05	20.714	22.468	23.769	25.388
Parker	a	95.164	118.64	166.17	198.53	242.46	279.34	321.89
	b	13.848	15.396	18.999	20.608	22.048	23.123	24.527
Rockwall	a	107.9	131.23	179.89	212.63	254.36	287.68	325.96
	b	15.671	16.882	20.467	22.064	23.178	23.891	24.906
Somervell	a	92.245	116.25	162.12	193.36	232.22	265.8	303.15
	b	13.091	14.967	18.503	20.102	21.066	22.001	23.039
Tarrant	a	95.835	121.96	170.81	203.93	247.1	282.6	322.07
	b	13.425	15.704	19.435	21.09	22.366	23.302	24.388
Wise	a	93.326	118.05	165.95	200.22	247.21	287.89	334.11
	b	13.491	15.315	18.974	20.889	22.662	24.112	25.784

1.5 Specific Landscaping Criteria for Structural Stormwater Controls

1.5.1 Stormwater Ponds and Wetlands

Stormwater ponds and wetlands are engineered basins and wetland areas designed to control and treat stormwater runoff. Aquatic vegetation plays an important role in pollutant removal in both stormwater ponds and wetlands. In addition, vegetation can enhance the appearance of a pond or wetland, stabilize side slopes, serve as wildlife habitat, and can temporarily conceal unsightly trash and debris.

Within a stormwater pond or wetland, there are various hydrologic zones as shown in Table 1.1 that must be considered in plant selection. These hydrologic zones designate the degree of tolerance a plant must have to differing degrees of inundation by water. Hydrologic conditions in an area may fluctuate in unpredictable ways; thus the use of plants capable of tolerating wide varieties of hydrologic conditions greatly increases the successful establishment of a planting. Plants suited for specific hydrologic conditions may perish when those conditions change, exposing the soil, and therefore, increasing the chance for erosion. Each of the hydrologic zones is described in more detail below along with examples of appropriate plant species.

Table 1.1 Hydrologic Zones

Zone #	Zone Description	Hydrologic Conditions
Zone 1	Deep Water Pool	1-6 feet depth (permanent pool)
Zone 2	Shallow Water Bench	Normal pool elevation to 1 foot depth
Zone 3	Shoreline Fringe	Regularly inundated
Zone 4	Riparian Fringe	Periodically inundated
Zone 5	Floodplain Terrace	Infrequently inundated
Zone 6	Upland Slopes	Seldom or never inundated

Zone 1: Deep Water Area (*1- 6 Feet)*

Ponds and wetlands both have deep pool areas that comprise Zone 1. These pools range from one to six feet in depth, and are best colonized by submergent plants, if at all.

This pondscaping zone is *not* routinely planted for several reasons. First, the availability of plant materials that can survive and grow in this zone is limited, and it is also feared that plants could clog the stormwater facility outlet structure. In many cases, these plants will gradually become established through natural recolonization (e.g., transport of plant fragments from other ponds via the feet and legs of waterfowl). If submerged plant material is commercially available and clogging concerns are addressed, this area can be planted. The function of the planting is to reduce resedimentation and improve oxidation while creating a greater aquatic habitat.

- Plant material must be able to withstand constant inundation of water of one foot or greater in depth.
- Plants may be submerged partially or entirely.
- Plants should be able to enhance pollutant uptake.

- Plants may provide food and cover for waterfowl, desirable insects, and other aquatic life.

Some suggested emergent or submergent species include, but are not limited to: Water Lily, Deepwater Duck Potato, Spatterdock, Wild Celery and Redhead Grass.

Zone 2: Shallow Water Bench (***Normal Pool To 1 Foot)***

Zone 2 includes all areas that are inundated below the normal pool to a depth of one foot, and is the primary area where emergent plants will grow in stormwater wetlands. Zone 2 also coincides with the aquatic bench found in stormwater ponds. This zone offers ideal conditions for the growth of many emergent wetland species. These areas may be located at the edge of the pond or on low mounds of earth located below the surface of the water within the pond. When planted, Zone 2 can be an important habitat for many aquatic and nonaquatic animals, creating a diverse food chain. This food chain includes predators, allowing a natural regulation of mosquito populations, thereby reducing the need for insecticidal applications.

- Plant material must be able to withstand constant inundation of water to depths between six inches and one foot deep.
- Plants will be partially submerged.
- Plants should be able to enhance pollutant uptake.
- Plants may provide food and cover for waterfowl, desirable insects and other aquatic life.

Common emergent wetland plant species used for stormwater wetlands and on the aquatic benches of stormwater ponds include, but are not limited to: Arrowhead/Duck Potato, Soft Rush, various Sedges, Softstem Bulrush, Switchgrass, Pickerelweed, Pond Cypress and various Asters.

Zone 3: Shoreline Fringe (***Regularly Inundated)***

Zone 3 encompasses the shoreline of a pond or wetland, and extends vertically about one foot in elevation from the normal pool. This zone includes the safety bench of a pond, and may also be periodically inundated if storm events are subject to extended detention. This zone occurs in a wet pond or shallow marsh and can be the most difficult to establish since plants must be able to withstand inundation of water during storms, when wind might blow water into the area, or the occasional drought during the summer. In order to stabilize the soil in this zone, Zone 3 must have a vigorous cover.

- Plants should stabilize the shoreline to minimize erosion caused by wave and wind action or water fluctuation.
- Plant material must be able to withstand occasional inundation of water. Plants will be partially submerged partially at this time.
- Plant material should, whenever possible, shade the shoreline, especially the southern exposure. This will help to reduce the water temperature.
- Plants should be able to enhance pollutant uptake.
- Plants may provide food and cover for waterfowl, songbirds, and wildlife. Plants could also be selected and located to control overpopulation of waterfowl.
- Plants should be located to reduce human access, where there are potential hazards, but should not block the maintenance access.
- Plants should have very low maintenance requirements, since they may be difficult or impossible to reach.
- Plants should be resistant to disease and other problems which require chemical applications (since chemical application is not advised in stormwater ponds).

Many of the emergent wetland plants that perform well in Zone 2 also thrive in Zone 3. Some other species that do well include Broom Grass, Upland Sea-Oats, Dwarf Tickseed, various Ferns, Hawthorns. If shading is needed along the shoreline, the following tree species are suggested: Boxelder, Ash, Willow, Red Maples and Willow Oak.

Zone 4: Riparian Fringe *(Periodically Inundated)*

Zone 4 extends from one to four feet in elevation above the normal pool. Plants in this zone are subject to periodic inundation after storms, and may experience saturated or partly saturated soil inundation. Nearly all of the temporary extended detention (ED) storage area is included within this zone.

- Plants must be able to withstand periodic inundation of water after storms, as well as occasional drought during the warm summer months.
- Plants should stabilize the ground from erosion caused by run-off.
- Plants should shade the low flow channel to reduce the pool warming whenever possible.
- Plants should be able to enhance pollutant uptake.
- Plant material should have very low maintenance, since they may be difficult or impossible to access.
- Plants may provide food and cover for waterfowl, songbirds and wildlife. Plants may also be selected and located to control overpopulation of waterfowl.
- Plants should be located to reduce pedestrian access to the deeper pools.

Some frequently used plant species in Zone 4 include Broom Grass, Yellow Indian Grass, Joe Pye Weed, Lilies, Flatsedge, Hollies, Forsythia, Lovegrass, Hawthorn and Sugar Maples.

Zone 5: Floodplain Terrace (***Infrequently Inundated)***

Zone 5 is periodically inundated by flood waters that quickly recede in a day or less. Operationally, Zone 5 extends from the maximum two year or SP_v water surface elevation up to the 25 or 100 year maximum water surface elevation. Key landscaping objectives for Zone 5 are to stabilize the steep slopes characteristic of this zone, and establish a low maintenance, natural vegetation.

- Plant material should be able to withstand occasional but brief inundation during storms, although typical moisture conditions may be moist, slightly wet, or even swing entirely to drought conditions during the dry weather periods.
- Plants should stabilize the basin slopes from erosion.
- Ground cover should be very low maintenance, since they may be difficult to access on steep slopes or if the frequency of mowing is limited. A dense tree cover may help reduce maintenance and discourage resident geese.
- Plants may provide food and cover for waterfowl, songbirds, and wildlife.
- Placement of plant material in Zone 5 is often critical, as it often creates a visual focal point and provides structure and shade for a greater variety of plants.

Some commonly planted species in Zone 5 include many wildflowers or native grasses, many Fescues, many Viburnums, Witch Hazel, Blueberry, American Holly, American Elderberry and Red Oak.

Zone 6: Upland Slopes *(Seldom or Never Inundated)*

The last zone extends above the maximum 100 year water surface elevation, and often includes the outer buffer of a pond or wetland. Unlike other zones, this upland area may have sidewalks, bike paths, retaining walls, and maintenance access roads. Care should be taken to locate plants so they will not overgrow these routes or create hiding places that might make the area unsafe.

- Plant material is capable of surviving the particular conditions of the site. Thus, it is not necessary to select plant material that will tolerate any inundation. Rather, plant selections should be made based on soil condition, light, and function within the landscape.
- Ground covers should emphasize infrequent mowing to reduce the cost of maintaining this landscape.

Placement of plants in Zone 6 is important since they are often used to create a visual focal point, frame a desirable view, screen undesirable views, or serve as a buffer.

Some frequently used plant species in Zone 6 include most ornamentals (as long as soils drain well, many wildflowers or native grasses, Linden, False Cypress, Magnolia, most Spruce, Mountain Ash and most Pine.

- Table 1.2 provides a list of selected wetland plants for stormwater ponds and wetlands. For hydrologic zones 1-4, provide shade to allow a greater variety of plant materials. Particular attention should be paid to seasonal color and texture of these plantings.

Table 1.2 Wetland Plants (Herbaceous Species) for Stormwater Facilities

Scientific Name	Common Name	Hydrologic Zone
Acorus calumus	Sweetflag	2
Andropogon gerardii	Big Bluestem	6
Andropogon glomeratus	Bushy Broom Grass	3
Andropogon virginicus	Broom Grass	4
Asclepias tuberosa	Butterfly-weed	6
Bouteloua certipendula	Sideoats Grama	6
Buchloe dactyliodes	Buffalograss	6
Carex spp.	Caric Sedges	2
Chasmanthium latifolium	Upland Sea-Oats	3
Coreopsis tinctoria	Dwarf Tickseed	3
Cynodon dactylon	Bermuda Grass	5,6
Echinacea purpurea	Purple Coneflower	6
Elocharis quadrangulata	Square Stem Spikerush	2
Elymus Canadensis	Canada Wildrye	4,5
Elymus virginicus	Virginia Wildrye	4,5
Eupatorium fistolosum	Joe Pye Weed	4
Euptorium serotinum	Late Boneset	3,4
Eustoma grandiflora	Texas Bluebells	4
Helianthus angustifolius	Swamp Sunflower	2
Helianthus maximiliani	Maximilian Sunflower	3,4,5,6
Hibiscus laevis	Halberdleaf Hibiscus	2,3

Table 1.2 Wetland Plants (Herbaceous Species) for Stormwater Facilities		
Scientific Name	**Common Name**	**Hydrologic Zone**
Juncus effuses	Soft Rush	2
Leersia oryzoides	Rice Cut Grass	2
Leptochola dubia	Green Spangletop	6
Liatris mucronata	Gayfeather	6
Liatris punctata	Gayfeather	6
Liatris pycnostachya	Gayfeather	5,6
Liatris spicata	Spiked Gayfeather	3
Lobelia cardinalis	Cardinal Flower	3
Malvaviscus drummondii	Turk's Cap	4,5,6
Nuphar luteum	Spatterdock	1
Nymphaea mexicana	Yellow Water Lily	1
Nymphaea odorata	Fragrant Water Lily	1
Osmunda cinnamomea	Cinnamon Fern	3
Osmunda regalis	Royal Fern	3
Panicum capillare	Witchgrass	3,4,5,6
Panicum virgatum	Switchgrass	2
Peltandra virginica	Green Arum	2
Pennisetum alopecuroides	Fountaingrass	6
Poa arachnifera	Texas Bluegrass	6
Polygonum hydropiperoides	Smartweed	2
Pontederia cordata	Pickerelweed	2,3
Pontederia lanceolata	Pickerelweed	2
Rudbeckia hirta	Black-eyed Susan	4
Sagittaria lancifolia	Lance-leaf Arrowhead	2
Sagittaria latifolia	Duck Potato	2
Salvia farinacea	Mealy Blue Sage	6
Salvia greggii	Autumn Sage	6
Saururus cernuus	Lizard's Tail	2
Schizachyrium scoparium	Little Bluestem	6
Scirpus americanus	Three-square	2
Scirpus californicus	Giant Bulrush	2
Scirpus validus	Softstem Bulrush	2,3

Table 1.2 Wetland Plants (Herbaceous Species) for Stormwater Facilities		
Scientific Name	**Common Name**	**Hydrologic Zone**
Sorgham nutans	Yellow Indian Grass	4
Tripsacum dactyloides	Eastern Gammagrass	3,4,5,6
Valpia octoflora	Common Sixweeksgrass	6
Woodwardia virginica	Virginia Chain Fern	2

Source: Aquascape, Inc.
Texas Parks and Wildlife Department

Zone 1: 12 to 36 inch depth below normal pool elevation
Water Lily, Deep Water Duck Potato, Spatterdock, Wild Celery, Redhead Grass

Zone 2: 0 to 12 inch depth below normal pool elevation
Arrowhead/Duck Potato, Soft Rush, various Sedges, Softstem Bulrush, Switchgrass, Southern Blue Flag Iris, Swamp Hibiscus, Swamp Lily, Pickerelweed, Pond Cypress, various Asters

Zone 3: 0 to 12 inch elevation above normal pool elevation
Various species from above, Broom Grass, Upland Sea-Oats, Dwarf Tickseed, various Ferns, Hawthorns, Boxelder, Ash, Willow, Red Maple, Willow Oak

Zone 4: 1 to 4 foot elevation above normal pool elevation
Broom Grass, Yellow Indian Grass, Ironweed, Joe Pye Weed, various Lilies, Flatsedge, Hollies, Lovegrass, Hawthorn, Sugar Maple

Zone 5: SP_v to Q_p or Q_f water surface elevation
Many wildflowers or native grasses, many Fescues, many Viburnums, Witch Hazel, Blueberry, American Holly, American Elderberry, Red Oak

Zone 6: Q_f water surface elevation and above
Many ornamentals as long as soils drain well, many wildflowers or native grasses, Linden, False Cypress, Magnolia, most Spruce, Mountain Ash, most Pine

Figure 1.3 Legend of Hydrologic Zones Around Stormwater Facilities

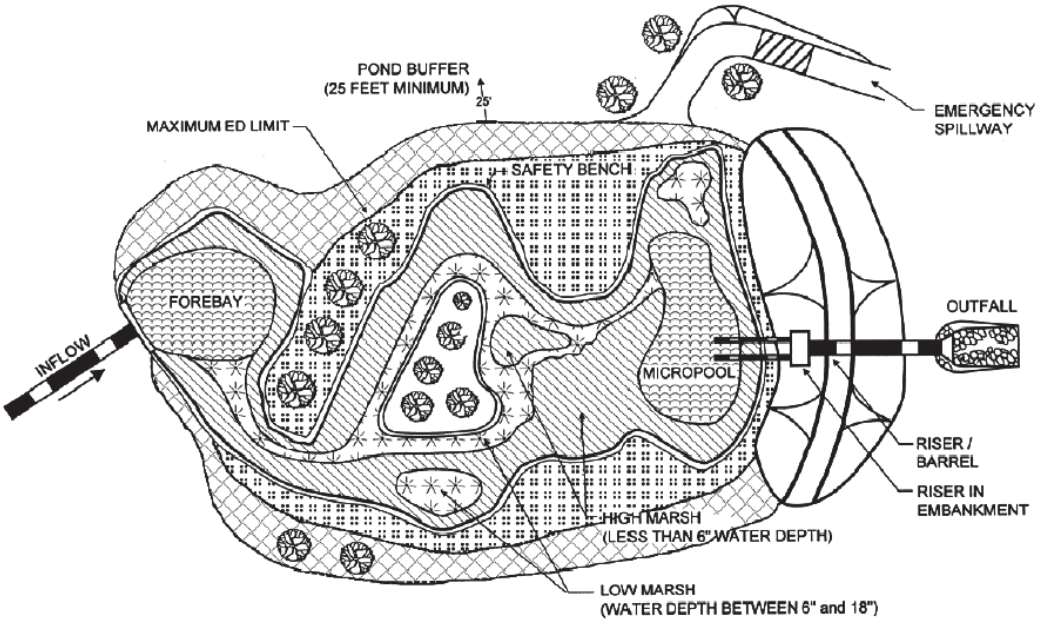

Figure 1.4 Plan View of Hydrologic Zones around Stormwater Wet ED Pond

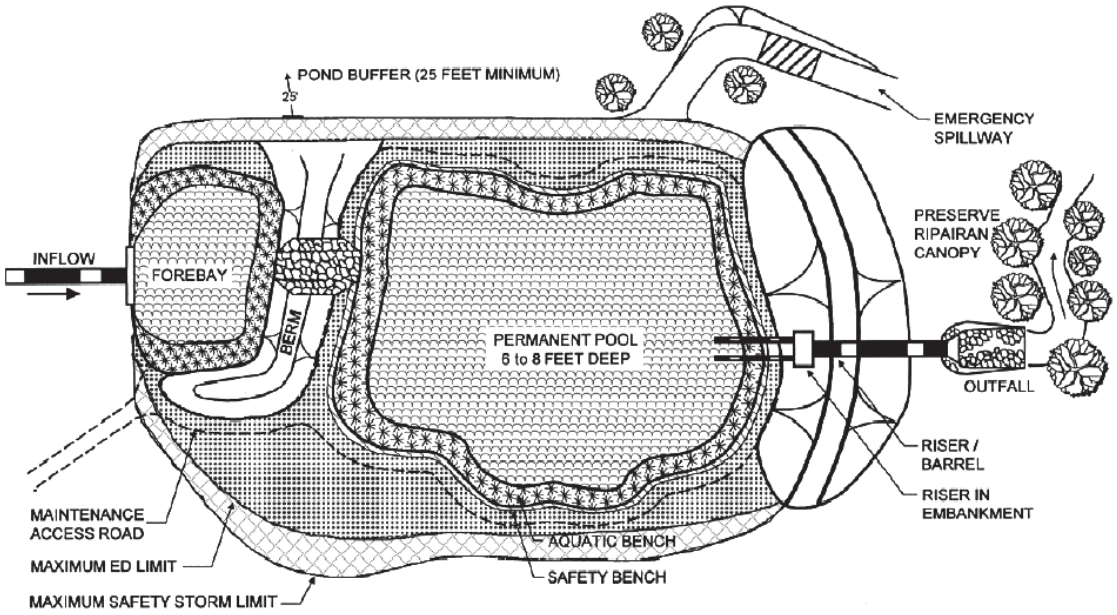

Figure 1.5 Plan View of Hydrologic Zones around Stormwater ED Shallow Wetland

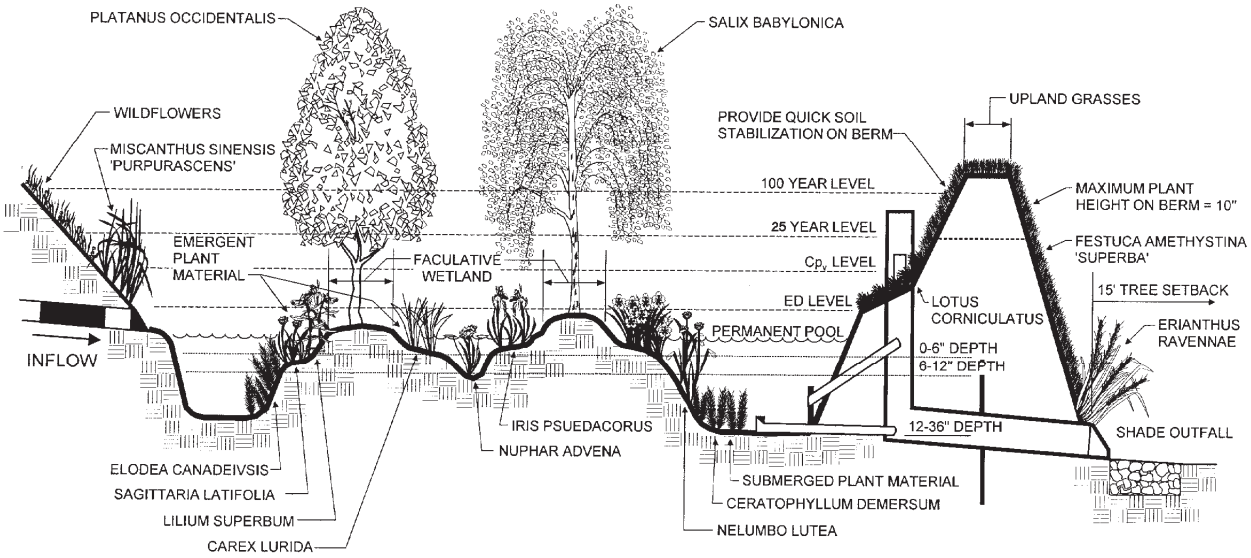

Figure 1.6 Section of Typical Shallow ED Wetland

Project Name: _____

Location: _____

File Number: _____

Date of Submittal: _____

Inspector(s): _____

Date: _____

Time: _____

Stormwater Pond and Wetland Construction Inspection Checklist

Development Status (Active, Inactive, Complete): _____

Stage of Construction (Pre-Construction, Installation, etc): _____

Key Questions			
Item	**X**		**Comments**
1. Type of stormwater pond or wetland (check all that apply)			
a. Permanent pool sized for full WQv			
OR			
Shallow wetland sized for full WQv			
OR			
Micropool			
b. Extended detention			
c. Ties into groundwater			
d. Pond with some wetland plantings			
e. Multiple pond system			
2. Type of wetland to be created			
a. Emergent			
b. Forested			
3. Type of pretreatment facility			Pretreatment must be provided
a. Sediment forebay			
b. Grass filter strip			
c. Other			Type:

A. Pre-Construction S = Satisfactory U = Unsatisfactory N/A = Not Applicable				
Item	**S**	**U**	**N/A**	**Comments**
1. Pre-construction meeting				
a. Review of facility details, landscaping and sequence of construction				
b. Review of required inspections and certificates				

B. Site Preparation S = Satisfactory U = Unsatisfactory N/A = Not Applicable				
Item	**S**	**U**	**N/A**	**Comments**
1. Erosion and sediment controls installed properly and according to approved plans				
2. Stormwater runoff diverted around facility or treated with proper erosion and sediment control practices				

3.	Tree save and non-compaction areas				
4.	Facility location staked out and cleared				
	a. Embankment/berm location stripped of all vegetation, topsoil and organic matter				
5.	Pipe and appurtenances delivered and inspected prior to construction				
	a. Materials				
	b. Diameters				
	c. Dimensions				

C. Excavation/Grading

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item		S	U	N/A	Comments
1.	Excavation and grading conform to plans				
	a. Embankment/berm core trench excavated and backfilled with suitable material				
	b. Suitable fill material used for construction of embankment/berm				
	c. Compaction completed in accordance with approved plans and specifications				
	d. Embankment/berm elevations, slopes and top widths are correct				
	e. Impounded area excavated/graded according to plans				
	f. Aquatic and safety benches provided in accordance with approved plans				

D. Installation

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item		S	U	N/A	Comments
1.	Pretreatment facility installed correctly				
	a. Location, size and depth of facility are correct				
2.	Inlet(s) and inlet protection installed according to plans				
3.	Liner installed correctly				
4.	Riser/outlet structure installed correctly				
	a. Location, dimensions and type of riser are correct				Type of riser:
	b. Riser located within embankment				
	c. Riser base excavated or formed on stable subgrade				
	d. Riser base set to design elevation				
	e. Riser equipped with removable trash rack				
	f. Location, dimensions and type of low flow orifice are correct				
	g. Low flow orifice installed correctly and adequately protected from clogging				
	h. Pond drain system installed correctly				

	i. Pond drain equipped with adjustable control valve				
5.	Outfall pipe (barrel) installed correctly				
	a. Invert at proper elevation and grade				
	b. Waterproof pipe connectors and gaskets properly installed				
	c. Anti-seep collars properly spaced and have watertight connections to pipe				
6.	Emergency overflow structure/spillway installed according to plans				
7.	Adequate buffer provided				

E. Vegetation

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. Vegetation complies with approved planting plan and specifications				
2. Embankment/berm and principal spillway kept free of woody vegetation				

F. Final Inspection

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. Contributing drainage area stabilized				
2. Construction sediment removed from stormwater pond/wetland and pretreatment facility				
3. Pretreatment facility installed and operational				
4. Inlet(s) installed and operational				
5. Configuration, size and depth of stormwater pond/wetland is correct				
6. Vegetation established				
7. Riser/outlet structure installed and operational				
8. Emergency overflow structure/spillway installed and operational				
9. Maintenance access routes provided				
10. Flow diversions removed; runoff reaches facility				

G. Permit Approval and Documentation

S = Satisfactory U = Unsatisfactory N/A = Not Applicable

Item	S	U	N/A	Comments
1. Facility constructed within drainage easement				
2. As-built plans submitted and approved				
3. Performance bond status				
a. Not released				
b. Partial release				
c. Full release				
4. Certificate of completion issued				

Additional Comments:

Actions to be Taken:	X	
1. No action necessary; continue routine inspections		
2. Correct noted deficiencies		Correct by:
a. 1st notice		
b. 2nd notice		
3. Submit modifications to project plans		Submit by:

Facility ID: _____

Location: _____

GPS Coordinates: _____

Inspector(s): _____

Date: _____

Time: _____

Stormwater Pond/Wetland Maintenance Inspection Checklist

Party Responsible for Maintenance:

Contact:

Phone Number:

E-mail:

Mailing Address:

Key Questions			
Item		**X**	**Comments**
1.	Type of stormwater pond or wetland (check all that apply)		
	a. Permanent pool sized for full WQv		
	OR		
	Shallow wetland sized for full WQv		
	OR		
	Micropool		
	b. Extended detention		
	c. Ties into groundwater		
	d. Pond with some wetland plantings		
	e. Multiple pond system		
2.	Type of wetland		
	a. Emergent		
	b. Forested		
3.	Type of pretreatment facility		
	a. Sediment forebay		
	b. Grass filter strip		
	c. Other		Type of pretreatment facility:

A. Contributing Drainage Area

0 = Good condition. Well maintained, no action required.

1 = Moderate condition. Adequately maintained, routine maintenance needed.

2 = Degraded condition. Poorly maintained, routine maintenance and repair needed.

3 = Serious condition. Immediate need for repair or replacement.

☐ Inspected

☐ Not Inspected

Item							**Comments**
1.	Excessive trash/debris	0	1	2	3	N/A	
2.	Bare/exposed soil	0	1	2	3	N/A	

3.	Evidence of erosion	0	1	2	3	N/A	
4.	Excessive landscape waste/yard clippings	0	1	2	3	N/A	

B. *Pretreatment*

0 = Good condition. Well maintained, no action required.
1 = Moderate condition. Adequately maintained, routine maintenance needed.
2 = Degraded condition. Poorly maintained, routine maintenance and repair needed.
3 = Serious condition. Immediate need for repair or replacement.

☐ Inspected
☐ Not Inspected

	Item						Comments
1.	Maintenance access to pretreatment facility	0	1	2	3	N/A	
2.	Excessive trash/debris accumulation	0	1	2	3	N/A	
3.	Excessive sediment accumulation	0	1	2	3	N/A	Sediment marker reading:
4.	Evidence of clogging	0	1	2	3	N/A	
5.	Dead vegetation/exposed soil	0	1	2	3	N/A	
6.	Evidence of erosion	0	1	2	3	N/A	

C. *Inlets*

0 = Good condition. Well maintained, no action required.
1 = Moderate condition. Adequately maintained, routine maintenance needed.
2 = Degraded condition. Poorly maintained, routine maintenance and repair needed.
3 = Serious condition. Immediate need for repair or replacement.

☐ Inspected
☐ Not Inspected

	Item						Comments
1.	Inlets provide stable conveyance into facility	0	1	2	3	N/A	
2.	Excessive trash/debris/sediment accumulation at inlet	0	1	2	3	N/A	
3.	Evidence of erosion at/around inlet	0	1	2	3	N/A	

D. *Facility*

0 = Good condition. Well maintained, no action required.
1 = Moderate condition. Adequately maintained, routine maintenance needed.
2 = Degraded condition. Poorly maintained, routine maintenance and repair needed.
3 = Serious condition. Immediate need for repair or replacement.

☐ Inspected
☐ Not Inspected

	Item						Comments
1.	Maintenance access to facility	0	1	2	3	N/A	
2.	Sediment accumulation	0	1	2	3	N/A	
	a. Bathymetric study recommended	☐					
3.	Abnormally high or low water levels	0	1	2	3	N/A	Cause:
4.	Evidence of pollution/hotspot runoff	0	1	2	3	N/A	Cause:

5.	Berm(s)/embankment(s)	0	1	2	3	N/A	
	a. Cracking, bulging or sloughing	0	1	2	3	N/A	
	b. Soft spots or sinkholes	0	1	2	3	N/A	
	c. Evidence of erosion	0	1	2	3	N/A	
	d. Evidence of animal burrows	0	1	2	3	N/A	
	e. Presence of woody vegetation	0	1	2	3	N/A	
6.	Riser/outlet	0	1	2	3	N/A	Type of riser:
	a. Maintenance access to riser	0	1	2	3	N/A	
	b. Structural condition of riser	0	1	2	3	N/A	
	c. Condition of joints	0	1	2	3	N/A	
	d. Trash/debris accumulation	0	1	2	3	N/A	
7.	Low flow orifice	0	1	2	3	N/A	
	a. Trash/debris accumulation	0	1	2	3	N/A	
	b. Adjustable control valve accessible and operational	0	1	2	3	N/A	
8.	Pond drain (underdrain) system	0	1	2	3	N/A	
	a. Broken	☐					
	b. Clogged	☐					
	c. Adjustable control valve accessible and operational	0	1	2	3	N/A	
9.	Vegetation	0	1	2	3	N/A	
	a. Plant composition consistent with approved plans	0	1	2	3	N/A	
	b. Presence of invasive species/weeds	0	1	2	3	N/A	
	c. Dead vegetation/exposed soil	0	1	2	3	N/A	
	d. Reinforcement planting recommended	☐					

E. Outlets

0 = Good condition. Well maintained, no action required.

1 = Moderate condition. Adequately maintained, routine maintenance needed.

2 = Degraded condition. Poorly maintained, routine maintenance and repair needed.

3 = Serious condition. Immediate need for repair or replacement.

☐ Inspected

☐ Not Inspected

	Item						Comments
1.	Outlets provide stable conveyance out of facility	0	1	2	3	N/A	
2.	Excessive trash/debris/sediment accumulation at outlet	0	1	2	3	N/A	
3.	Evidence of erosion at/around outlet	0	1	2	3	N/A	

F. Miscellaneous

0 = Good condition. Well maintained, no action required.

1 = Moderate condition. Adequately maintained, routine maintenance needed.

2 = Degraded condition. Poorly maintained, routine maintenance and repair needed.
3 = Serious condition. Immediate need for repair or replacement.

	Inspected
	Not Inspected

	Item						Comments
1.	Complaints from local residents	0	1	2	3	N/A	
2.	Mosquito proliferation	0	1	2	3	N/A	
3.	Encroachment on facility or easement by buildings or other structures	0	1	2	3	N/A	
4.	Adequate safety signage	0	1	2	3	N/A	

Inspector's Summary:

Photographs

Photo ID	Description
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Sketch of Facility

(note problem areas)