SHORT CUT FOR WETLAND DRAWDOWN ASSESSMENT

This appendix presents a simple method for calculating whether a storm water pond or wetland has an appropriate water balance to maintain a wet pool over a 30-day period without rainfall. When conducting this analysis, the following should be considered:

1. Calculate maximum drawdown during periods of high evaporation and during an extended period of no appreciable rainfall.

2. The change in storage within a pond (ΔV) = Inflows - Outflows

3. Potential inflows: runoff, base flows, and rainfall.

4. Potential outflows: infiltration, surface overflow, and evaporation (and evapotranspiration).

5. Assume no inflow from baseflow, no losses for infiltration and because only the permanent pool volume is being evaluated, no losses for surface overflows.

6. Therefore, (ΔV) = runoff - evaporation.

As an example, given the conditions in Tables 5.11.1 and 5.11.2, a wetland drawdown assessment may be determined as follows:

Table 5.11.1 - Site Data for Sample Water Balance Analysis

Drainage Area	38.0 acres
Post Developed Conditions, C [or CN for SCS Method]	0.60 [90]
DCIA	22.8 acres
2-yr, 24-hr Design Rainfall, P	2.27 inches
2-yr, 24-hr Design Runoff (PxC) [or QD from SCS formulas]	1.36 inches
Water Quality Volume (Vwq)	0.95 ac.ft
Surface Area of Wetland, A (minimum 1% of drainage area to BMP)	0.38 acres
$Q_D = \frac{(P - 0.2S_R)^2}{P + 0.8S_R}$	$S_R = \frac{1000}{CN} - 10$

A storm water wetland will be designed to treat the water quality volume (Vwq). Therefore, the permanent pool volume = 0.95 ac.ft, and the average depth = V/A = 0.38 acres/0.95 ac.ft =2.5 ft.

Table 5.11.2 - Mean Monthly Precipitation by State Climatic Divisions
(Michigan, Southwest Lower*)
Evaporation Rates for Maryland Ponds (1990)

	April	May	June	July	August	September
Precipitation (ft)	0.25	0.32	0.32	0.24	0.26	0.28
Evaporation (ft)	0.36	0.44	0.52	0.54	0.46	0.35
*Based on period 1931 through 1955.						

Calculate maximum drawdown during periods of high evaporation:

- Period of greatest evaporation occurs during the month of July (see Table 5.11.2)
- Runoff Volume = PxE
  where P = Precipitation
  E = Runoff Efficiency (ratio of 2-yr storm runoff to rainfall depths)
- For C = 0.60 [CN = 90 for SCS Method], Volume of Runoff (2-yr storm) = 1.36 inches
- 2-yr storm rainfall = 2.27 inches
- E = 1.36/2.27 = 0.60
- Inflow = PxExA
  0.24 ft x 0.6 = 0.14 ft
  over entire site area: (0.14 ft) (38 acres) = 4.31 ac.ft
- Outflow = surface area x evaporation losses
  = 0.38 ac x 0.54 ft (see Table 5.11.2)
  = 0.20 ac.ft
- Inflow (4.31 ac.ft) is greater than Outflow (0.20 ac.ft) therefore, drainage area is adequate to support wet pond during normal conditions

Check for drawdown over an extended period without rainfall:

- Use a 45-day interval using worst-case conditions
- Highest evaporation occurs during July - 0.54 ft per month (see Table 5.11.2)
- Calculate average evaporation per day = 0.54 ft/31 days = 0.017 ft/day
- Over 45-day interval, evaporation loss = 45 x 0.17 ft/day = 0.78 ft
- Assume surface of the permanent pool may drop up to 0.78 ft (9.4 inches) over this interval. Therefore, to be safe, specify vegetation for the aquatic shelves (to 10 inches) that can tolerate periods of drawdowns.

References

Ferguson, B. and T.N. Debo. 1990. *On-Site Stormwater Management - Applications for Landscaping and Engineering*, Van Nodstrandt, Reinhold, New York.

Maryland Department of the Environment, *2000 Maryland Stormwater Design Manual*, Water Management Administration, Baltimore, MD, 2000.