Short Cut Method for Wetland Drawdown Assessment

Appendix D.3

This section presents a simple method for calculating whether a stormwater 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, baseflow 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

Using Design Example No. 1 - Reker Meadows (see Chapter 2.6) as an example and given the conditions in Table D.3.1 and table D.3.2, a wetland drawdown assessment may be determined as follows:

Table D.3.1 Site Data from Design Example 1 for Sample Water Balance Analysis

Drainage Area	38.0 ac
Post Developed Conditions CN	78
2-yr. Design Rainfall Event	3.1"
2-yr. Design Storm Runoff	1.2"
Water Quality Volume (WQ_v)	1.08 ac-ft
Groundwater Recharge Volume (Re_v)	0.25 ac-ft
Surface Area of Wetland (minimum 1.5% of drainage area to BMP)	0.58 acres

A shallow wetland (W-1) will be designed to treat the water quality volume (WQ_v) minus the groundwater recharge volume (Re_v). Therefore, the permanent pool volume = 0.83 ac-ft.

Table D.3.2 Evaporation Rates for Maryland Ponds
(from Ferguson and Debo, "On-Site Stormwater Management", 1990)

	April	May	June	July	August	September
Precipitation (ft.)	0.30	0.35	0.32	0.36	0.38	0.31
Evaporation (ft.)	0.36	0.44	0.52	0.54	0.46	0.35

Calculate maximum drawdown during periods of high evaporation:

- Period of greatest evaporation occurs during the month of July (see Table D.3.2)
- Runoff Volume = P x E

  where P = Precipitation
  E = Runoff Efficiency (ratio of NRCS 2 year storm runoff to rainfall depths)
- For CN = 78, Volume of Runoff (2 year storm) = 1.2"
- For Frederick County, 2 year storm rainfall = 3.1”
- E = 1.2”/3.1” = 0.39
- Inflow = $P \times E$
  = .36 ft ×.39 = 0.14 ft
  over entire site area: (0.14 ft) (38 acres) = 5.32 ac-ft
- Outflow = surface area × evaporation losses
  = 0.58 ac × 0.54 ft (see Table D.3.2)
  = 0.31 ac-ft
- Inflow (5.32 ac-ft) is greater than Outflow (0.31 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 D.3.2)
- Calculate average evaporation per day = 0.54 ft / 31 days = 0.017 ft/day
- Over 45 day interval, evaporation loss = 45 × .017 ft/day = 0.78 ft
- Assume surface of the permanent pool may drop up to 0.78 ft (9.4”) over this interval. Therefore, to be safe, specify vegetation for the aquatic shelves (to 10") that can tolerate periods of drawdowns.

Reference

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