APPENDIX IV
BASIN EFFICIENCY

BASIN DESIGN

Basins should be designed according to the percentage reduction required to meet the Dane County Erosion Control and Stormwater Management Ordinance. Basin design takes into account the physical characteristics of the site such as: water table, permeable layers, proximity to cold water streams and wetlands. In addition, basins often serve a dual purpose of controlling peak flow rates leaving the site to pre-constructed conditions.

If the basin is located in the watershed of a cold-water stream, the design must consider thermal impacts. Possible ways to prevent stream warming from the basin include eliminating permanent pool storage and providing extended draw down by use of tile drainage.

Basins must have the volume of storage necessary to settle the particle size necessary to meet either the soil loss standard during the construction phase or the 80% reduction in TSS for post-development.

VOLUME OF STORAGE REQUIRED

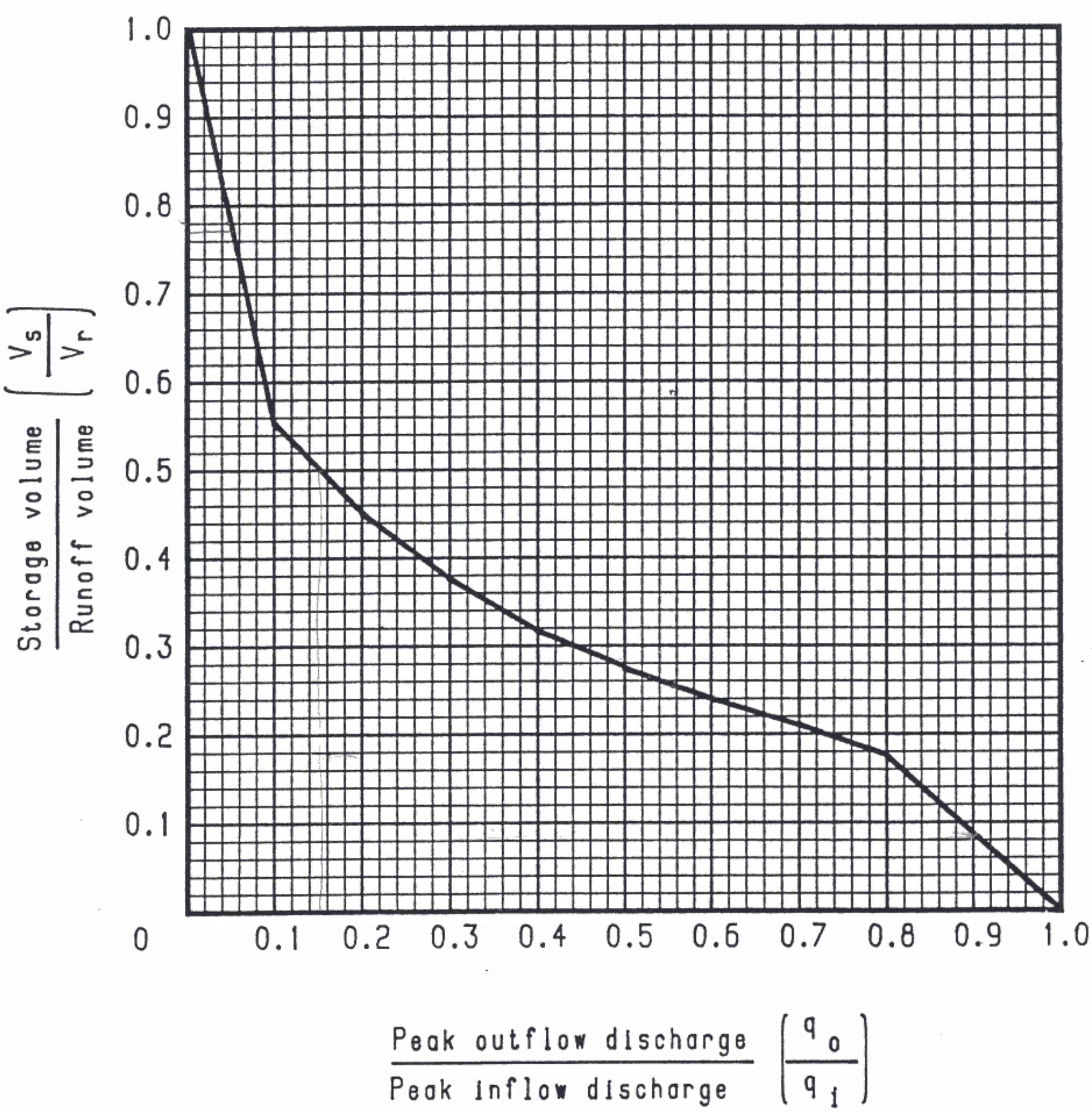
1. From TR-55 find the pre-construction and post construction peak flow for the 1-year, 24-hour storm event.
2. Calculate the ratio of peak inflow to peak outflow. The inflow rate will be the post construction condition and the outflow rate will be the pre-development conditions.

$$\frac{\text{outflow}}{\text{inflow}} = \frac{Q_o}{Qi} < 1.0$$

3. With the peak ratio, use the chart on the next page to find the ratio of storage volume to runoff volume.
4. The volume of storage necessary can now be calculated by multiplying the ratio from the table by the post-development runoff.

$$\left(\frac{V_s}{V_{ro}}\right) \times \text{Volume of post-construction runoff} = \text{required basin volume}$$

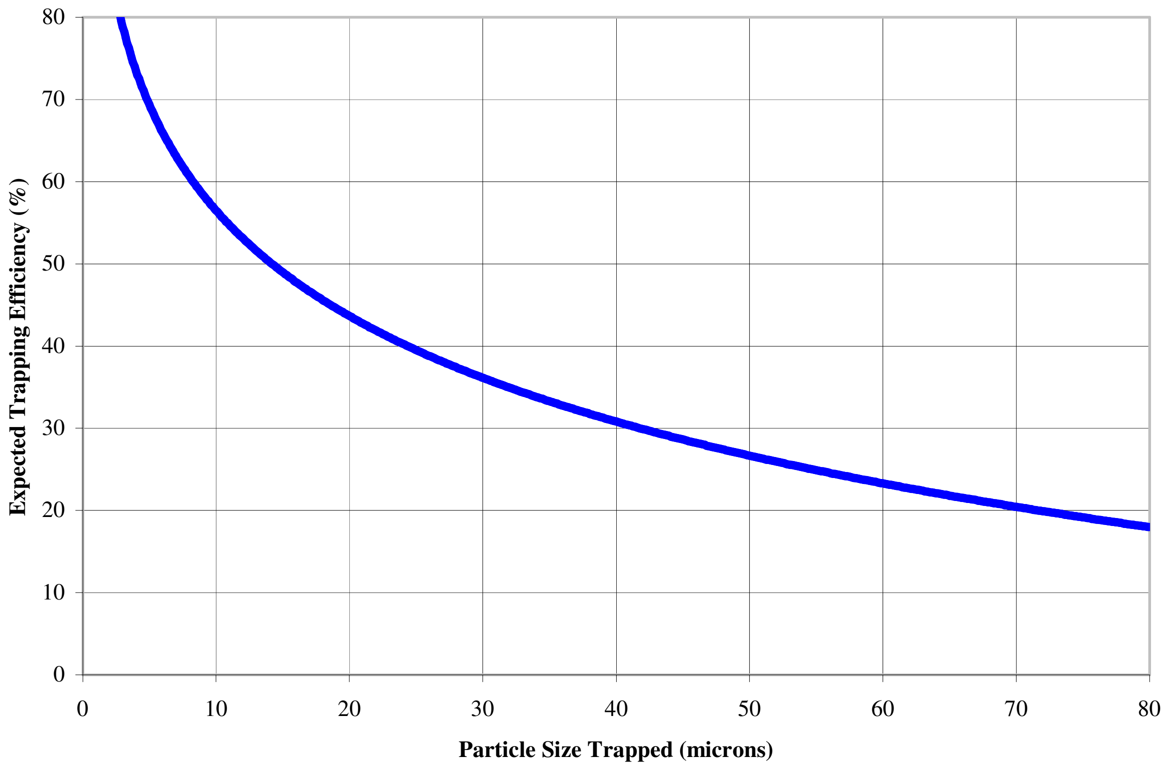
APPROXIMATE DETENTION BASIN ROUTING FOR TYPE II STORMS



Source: Technical Release 55. United States Department of Agriculture, Natural Resources Conservation Service. Washington, D.C. 1988.

CALCULATING TRAPPING EFFICIENCY

The sediment reduction is selected from the particle size versus expected efficiency for a Plano silt loam during construction. The expected efficiency is given by the USLE in the column named "Percent reduction required to meet Ordinance." With this expected efficiency, use the chart below to obtain the particle size required to be retained in the pond. The particle size has a settling velocity that may be calculated using Stokes Law (see Appendix III).



Convert the storage volume from the 1-year, 24-hour storm event into cubic feet. This volume of storage is then divided by the time required to settle the particle obtained by Stokes Law.

$$Q_{\max imum}(cfs) = \frac{V_{Storage}(ft^3)}{Time(\sec)}$$

Q $_{maximum}$ is the rate at which the basin must be released in order to obtain the expected efficiency.

See table on following page for particle settling velocities to calculate Time (sec)*

Settling Velocities for Spherical Particles - Stokes Law

Diameter (micron)		Velocity (ft/s)	Example Settling Time (hours for 2 foot depth)
CLAY	1	0.000003	185
	1.5	0.000007	76
	2	0.000012	46
SILT	3	0.000026	21
	4	0.000045	12
	5	0.000073	8
	6	0.000106	5
	7	0.000138	4
	8	0.00019	3
	9	0.00023	2.4
	10	0.00029	2
	12	0.00042	1.3
	15	0.00066	0.8
	20	0.0012	0.5
	25	0.0018	0.3
	30	0.0027	0.2
	40	0.0047	0.1
SAND	50	0.0074	0.07
	60	0.011	0.05
	80	0.019	0.03
	100	0.029	0.02

Note: Assumes specific gravity of 2.65 for soil particles and 20 degrees C water temperature.