EXHIBIT X

BLEED DOWN TIME FOR RETENTION SYSTEMS
SAMPLE PROBLEM

SECTION 2.05: “**All retention areas (dry and wet) must be capable of percolating the design storage volume within 72 hours...”**

This criterion applies to all dry retention areas and wet retention areas with no discharge. The objective is to release the captured retention volume and free up retention storage to capture runoff from future storm events. An acceptable approach to estimate the time required to exfiltrate the design volume relies on a modified version of the following equation from the SFWMD Environmental Resource Permit Information Manual, Part III – References and Design Aids, Appendix G, Exfiltration Trenches :

$$L=V/[K(H_2W+2H_2D_u-D_u^2+2H_2D_s)+(1.39x10^{-4})WD_u] \qquad (1)$$

where $V = FS[(\%WQ)(V_{wq}) + V_{add}]$ as described in the SFWMD ERP Information Manual

This equation calculates the length of exfiltration trench required to exfiltrate a given runoff volume in one hour. The total runoff volume captured by the trench accounts for the following: (1) the volume of water exfiltrated out the trench bottom; (2) the volume of water exfiltrated out the trench sides; and (3) the trench storage capacity.

For its application to dry and wet retention areas, terms related to trench storage and bottom exfiltration were removed, since exfiltration occurs almost exclusively through the sides of the retention area. In addition, a factor of 0.5 is applied since retention areas exfiltrate along their perimeter (one side) as oppose to two sides. The resulting modified equation is as follows:

$$V=\frac{L*[K(2H_2D_u-D_u^2+2H_2D_s)]}{2}$$

For retention areas, H_2 and D_u take on the same value. The saturated depth (D_s) will vary depending on the nature of the reservoir. For dry retention areas, D_s will generally assume the value of one foot (the distance between the bottom of the retention area and the water control elevation). For wet detention areas, Ds will be equal to the depth of the lake/pond as measured from the water control elevation.

An example of the use of this formula is as follows:

Given

A. Required Retention Volume = 12 ac-in

B. Dry Retention Area = 0.5 acres

C. Dry Retention Perimeter = 600 ft

D. Design Volume Head = 2 ft

E. Hydraulic Conductivity = 1.75×10^{-4} cfs/ft^2 – ft

Using the revised formula,

$$V = \frac{L[K(2H_2D_u - Du^2 + 2H_2D_s)]}{2}$$

V = Volume of water treated in one hour (ac-in)

K = 1.75×10^{-4} cfs/ft^2 - ft

$H^2 = D_u = 2$ ft

$D_s = 1$ ft

L = 600 ft

Solving for V gives,

V = .42 Ac-in/hr, when the retention area is full

Average V = (0.0 +0.42)/2 = 0.21 acre-in

Time to drain retention volume,

$$T = \frac{12 \text{ ac-in}}{.21 \text{ ac-in/hr}} = 57.2 \text{ hrs}$$

57.2 hrs < 72 hrs; therefore, the design meets the 72-hour bleed down criterion