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PONDS 3.2 TECHNICAL MEMO

Date: January 21, 2008
Re: **Calculating Effective Length and Width of a Pond**

In the PONDS 3.2 Refined Method, the effective length and width determine the length of the perimeter which is available for saturated horizontal infiltration. PONDS assumes that the pond is rectangular in shape (and the effective length and width are used to set up the finite difference grid used in Modflow for PONDS). However, real-world pond geometry is often irregular, or non-rectangular, so the actual pond must be approximated by an equivalent rectangular pond.

In selecting an equivalent pond length and width, two criteria must be satisfied:

① The pond stage height (h) at the overflow (i.e., discharge elevation minus pond bottom elevation) multiplied by the equivalent pond length (L) and equivalent pond width (W) must give the storage volume (V) from the stage-storage data. Mathematically, this may be stated as follows:

$$V = h \times L \times W \qquad (1)$$

Note that if we are dealing with a wet bottom pond, "h" is the discharge elevation minus the initial water table elevation. For dry bottom ponds, "h" is the discharge elevation minus the pond bottom elevation. The volume "V" is the volume between the discharge elevation and the discharge elevation minus "h".

② The effective perimeter of the pond "P" must be equal to the perimeter of the equivalent rectangle (i.e., 2L + 2W). In mathematical terms,

$$P = (2 \times L) + (2 \times W) \qquad (2)$$

Note that "P" is the effective perimeter of the pond which may or may not be equal to the actual perimeter of the pond. The user should review the shape of the pond and draw an imaginary line around the pond through which ground water will flow unencumbered away from the pond. The length of this line is the effective perimeter "P". See Exhibit 1 below for an example.

Since h, V, and P are known, equations (1) and (2) above may be solved simultaneously for L and W as follows:

$$L = \frac{\frac{P}{2} + \sqrt{\frac{P^2}{4} - \frac{4xV}{h}}}{2} \qquad (3)$$

and

$$W = \frac{\frac{P}{2} - \sqrt{\frac{P^2}{4} - \frac{4xV}{h}}}{2} \qquad (4)$$

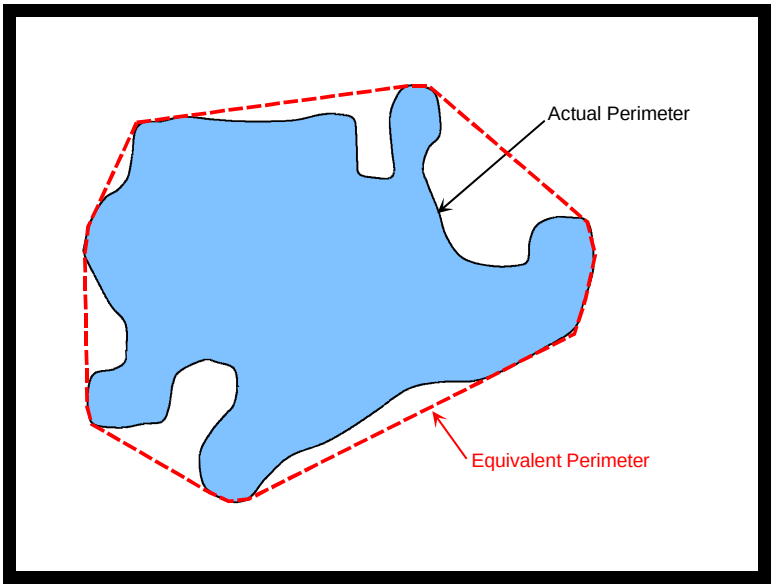

Exhibit 1. Actual vs Effective Perimeter