*University of Michigan* *Department of Civil and*

*Environmental Engineering*

**Semester Project** **– Part 3**

**CEE 546 – Slopes, Dams and Retaining Structures**

**Winter 2013**

Your stability analyses indicate that the factors of safety against deviatoric-type of instability are high for the assumptions made. The field investigation is currently ongoing and more refined soil stratigraphy data will become available soon.

The schedule from the time of field data availability to submission of the final report is expected to be tight and you need to be prepared. In preparation for the results of the soil stratigraphy data, you need to get a better estimate of the pore pressures throughout the embankment. Use Seep/W to perform seepage analyses assuming a uniform soil (as previously).

For soil 1 use the permeability measured in the laboratory. Obviously, make a comparison with the estimate using the Hazen equation. Assume that the lake is 4 ft deep and that the water table is at the surface in the vicinity of the toe. Both are reasonable assumptions based on the information collected (rainfall data, failure observations). For the model that you use, estimate:

1) The amount of flow at the toe of the embankment

2) The vertical pore pressure profile (i.e. x axis is pore pressure, y axis is elevation) estimated by

the model at:

a. the centerline of the lake;

b. the centerline of the crest of the embankment;

c. the location where the slope height of the embankment is 3.6 m (half way up the embankment slope);

Assume a relative elevation, i.e., use an elevation of 0 m at the toe of the embankment. Plot each location on a figure and compare the pore pressure profile from Seep/W (which considers flow), vs. the pore pressure profile from Slope/W (which uses hydrostatic increase from the assumed water table).

3) The exit gradient at the toe of the levee. What is the calculated Factor of Safety against piping?

Perform a parametric analysis to assess what happens to the estimates of flow, pore pressure profiles and exit gradient if (a) the permeability of the soil is actually one order of magnitude higher, and (b) one order of magnitude lower than the one used before. Use appropriate figures and tables to clearly make this comparison. For your model, consider only saturated flow (i.e., ignore flow above the saturation zone).

Use the results of the seepage analyses in Seep/W (i.e. the pore pressure at different locations of the model) as input in your Slope/W model (using the unit weight and strengths estimated previously). What is the new factor of safety against instability?

Prepare the results in a report for Dr. Athanasopoulos-Zekkos by Wednesday, April 3 2013. The conclusions of these analyses will help you to be ready for your final analyses once the ongoing field data comes in.