

**LEVEE EROSION SIMULATION USING SMOOTHED
PARTICLE HYDRODYNAMICS**

By

Zhongxian Chen

An Abstract of a Thesis Submitted to the Graduate

Faculty of Rensselaer Polytechnic Institute

in Partial Fulfillment of the

Requirements for the Degree of

MASTER OF SCIENCE

Major Subject: **COMPUTER SCIENCE**

The original of the complete thesis is on file
in the Rensselaer Polytechnic Institute Library

Approved:

Barbara M. Cutler, Thesis Adviser

Rensselaer Polytechnic Institute
Troy, New York

October 2010
(For Graduation December 2010)

ABSTRACT

Levee erosion and failure from overtopping can cause catastrophic damage, especially to areas with a dense population. As a result, it is very important to have an accurate way of studying and investigating the details of how levees are eroded in storm conditions. We present a computer simulation of hydraulic erosion on levees, dams, and earth embankments, with emphasis on rill and gully initiation and propagation during overtopping. We have developed a 3-D fluid and hydraulic erosion simulation engine using Smoothed Particle Hydrodynamics (SPH). A series of computer simulations with different soil types were performed using this simulation engine. Furthermore, small-scale physical models of levees composed of different soils were constructed and tested experimentally in a laboratory by researchers in the Department of Civil Engineering. The computer simulations are compared to physical experimental results to validate the computer models. Careful study and quantitative analysis done by my colleagues and me on the simulation results allow us to evaluate the accuracy of computer simulations of hydraulic erosion and come to the conclusion that levee erosion can be studied and analyzed by using computer simulation. In the future, we will make the simulation engine more complete by implementing more features, such as sediment transportation and soil permeability.