Hydrologic Engineering Applications of Geographic Information Systems

Objectives: The participant will acquire practical knowledge and skills in the application of GIS technologies for digital terrain modeling, watershed and stream network delineation, computation of watershed and stream characteristics, hydrologic parameter estimation and mapping of water depths, flood damage assessment, etc. Hands-on experience in applying ArcGIS to perform such analysis will be obtained. The participant will not gain broad-based skills in using ArcGIS, but sufficient knowledge and skills will be acquired to enable application of supplied scripts and procedures to perform specific hydrologic engineering analyses. While prior training in ArcGIS is desirable, it is not a prerequisite for this course.

HYDROLOGIC ENGINEERING APPLICATIONS OF GEOGRAPHIC INFORMATION SYSTEMS

Monday

8:00-9:00am	**Introduction** Welcome to HEC, class and staff introductions, and course overview.
9:00-9:45am	Lecture 1.1 **Hydrologic Engineering Applications of GIS** What is GIS? What does it offer to hydrologic analysis?
9:45-10:00am	**Break**
10:00-10:45am	Lecture 1.2 **Introduction to ArcGIS and GIS Concepts** Vector GIS and topology. GIS as a database.
10:45-11:45am	Workshop 1.3 **Introduction to ArcMap** The ArcGIS user interface, projects and map layouts.
11:45am-12:45pm	**Lunch**
12:45-1:30pm	Lecture 1.4 **An Introduction to ArcGIS Databases** How ArcGIS organizes and uses geospatial data. Basic editing. Coordinate systems and metadata.
1:30-2:30pm	Workshop 1.5 **Databases in ArcGIS** Organizing GIS data for viewing and analysis in ArcGIS.
2:30-2:45pm	**Break**
2:45-3:30pm	Lecture 1.6 **Introduction to Spatial Operations** GIS functions for spatial analysis. Buffering, clipping, editing.
3:30-4:45pm	Workshop 1.7 **Spatial Operations in ArcGIS** Using ArcGIS for spatial analysis.
4:45-5:00pm	**Review**

Tuesday

8:00-8:45am Lecture 2.1 **Introduction to HEC-HMS and HEC-GeoHMS**
Hydrologic modeling capabilities of HMS; data and parameter organization. How GeoHMS supports model development for HMS.

8:45-9:30am Lecture 2.2 **Raster GIS and ArcGIS Spatial Analyst**
Grid data structure. Continuous and categorical data layers. Grid operations. Introduction to digital elevation models (DEMs)

9:30-9:45am **Break**

9:45-11:00am Workshop 2.3 **Using Spatial Analyst**
Using grid data in ArcGIS. Vector/Raster conversion. Grid calculations.

11:00-12:00 pm Lecture 2.4 **GIS Data Setup and Terrain Preprocessing**
Discussion of DEMs from the USGS and steps required for preparing DEMs for HEC-GeoHMS. Processing terrain information for drainage paths and preliminary delineation of stream and subbasin will be discussed in context of the 8-point pour model.

12:00 -1:00 pm **Class Photo and Lunch**

1:00-2:15pm Workshop 2.5 **Terrain Preprocessing**
Using Arc Hydro Tools to preprocess the DEM and prepare GIS data for detailed subbasin delineation of the watershed.

2:15-2:30pm **Review**

2:30-2:45pm **Break**

2:45-3:30pm Lecture 2.6 **Building a Hydrologic Model**
Approaches to subdividing basin according to project specifications and extraction of characteristics of stream and basin will be presented.

3:30-4:45pm Workshop 2.7 **Building a Hydrologic Model**
Using GeoHMS to subdivide the basin and extract stream and sub-basin characteristics.

4:45-5:00pm **Review**

Wednesday

8:00-8:45am Lecture 3.1 **Assembling a Hydrologic Model**
Develop hydrologic inputs using GeoHMS that will be run in HMS. Estimate hydrologic parameters with the physical characteristics of stream and basin.

8:45-10am Workshop 3.2 **Assembling a Hydrologic Model**
Generate hydrologic inputs using GeoHMS and import them into HMS. Input additional hydrologic parameters and make a simulation run.

10:00-10:15am **Break**

10:15-10:45am Lecture 3.3 **Gridsets and Parameter Grids**
Radar rainfall data acquisition. Geographic referencing of the precipitation grid (HRAP and SHG).

10:45-12:00 pm Workshop 3.4 **Preparing Gridded Data**
Radar rainfall data acquisition and developing precipitation grids with GageInterp. Comparing both radar and precipitation gage inputs in an HEC-HMS model.

12:00am-1:00pm **Lunch**

3:00-3:15pm **Break**

3:15-4:00pm Lecture 3.7 **Triangulated Irregular Networks (TINs)**
Representing surfaces with TINs. The ArcGIS 3D Analyst Extension.

4:00-4:45pm Workshop 3.8 **Hands-On 3D Analyst**
Creating a TIN. Adding Breaklines. Recognizing and fixing problems.)

4:45-5:00pm **Review**

Thursday

8:00-8:30am Lecture 4.1 **Introduction to HEC-RAS**
An overview of the HEC-RAS program: data requirements, user interface, and capabilities.

8:30-9:30am Lecture 4.2 **Developing Geometric Data for HEC-RAS**
Using GIS to extract cross section data and other cross section properties from terrain models.

9:30-9:45am **Break**

9:45-11:15am Workshop 4.3 **Developing Geometric Data for HEC-RAS**
HEC-GeoRAS will be used to extract cross section data for import into HEC-RAS.

11:15-11:45am **Review**

11:45am-12:45pm **Lunch**

12:45-1:45pm Lecture 4.4 **Using Geospatial Data in HEC-RAS**
Importing cross section data from a GIS, completing the geometry data, performing the computations, and exporting the results to the GIS exchange file.

1:45-2:00pm **Break**

2:00–3:00pm Lecture 4.5 **Mapping of HEC-RAS Results**
Developing flood inundation maps and depth grids for display in the GIS.

3:00-4:30pm Workshop 4.6 **Mapping of HEC-RAS Results**
Flood inundation map will be developed with HEC-RAS results

4:30-5:00pm **Review**