

## **GIS Application Paper: Wisconsin DNR's Dam Safety and Floodplain Management Programs**

The Wisconsin Department of Natural Resources (WDNR) uses a Geographic Information System (GIS) to support its floodplain management and dam safety programs. The purpose of these programs is to protect public health and safety, mitigate the damage wrought by floods and dam failures, and minimize the expense associated with rebuilding after these events. In addition, the specific goals of the floodplain management program are to protect water quality, control erosion, increase groundwater recharge, reduce flood velocities, and provide habitat. One of the central activities of these two programs has been to collect data on delineated floodplains, flood insurance studies, historic flood elevations, flood photos, and dams around the state. These data have been assembled into a statewide GIS and have been made freely downloadable and accessible through a web interface.

To learn more about these programs, I interviewed Amanda Schwoegler, a GIS specialist at the WDNR office in Madison. She was involved in the creation of the datasets that make up the floodplain management and dam safety GIS and works on their ongoing maintenance and expansion.

The DNR began using GIS to support these programs because all of the data they maintain has a spatial component, making it logical to store it in a geospatial format. In addition, they felt it would be easier to share information both within the department and with the public through GIS software. Further impetus to use GIS in these programs came from the Federal Emergency Management Agency (FEMA), which has contracted with the DNR to modernize its statewide floodplain map inventory by converting all floodplain data into geospatial format.

The data maintained through the dam safety and floodplain management programs are used for a number of purposes. Local officials use them to enforce zoning regulations governing development in floodplains, and to inform the planning process. Insurance agencies and mortgage lenders use floodplain maps to determine where flood insurance is required. DNR staff use the GIS to maintain records of the locations of bridges and dams around the state. Because the data are freely accessible to the public, they may also be used by researchers, consultants, educators, nonprofit groups, and others.

The analytical functions performed using the dam safety and floodplain management data mainly include topological assessments and mathematical modeling. The topological assessments typically consist of determining whether specific parcels of land fall within or outside of a floodplain. The mathematical modeling is done to determine the extent of floodplains. Engineers within the department use GIS tools to run hydrologic and hydraulic models in order to delineate floodplains with specific flood recurrence probabilities.

Managing these databases using GIS has led to a number of efficiency gains for the dam safety and floodplain management programs. They are able to share data between offices much more easily than when it was maintained in non-geospatial formats. Because all staff in the programs have GIS software on their desktop computers, they are able to readily access data and perform analysis ways that were not possible

when it was maintained in paper format. The data are much more easily updated in digital form than they were in paper form. In addition, the use of a GIS web portal has increased the efficiency of public data access, saving both the public and the department time, as data no longer have to be requested and delivered.

The dam safety and floodplain management programs' use of GIS to manage their data has influenced policy in a number of ways. At the local level, the availability of data has informed the planning and municipal policy-making process. At a statewide level, upper management at the DNR and policymakers have begun to make reference to GIS data in internal strategic documents, indicating that the data are informing policy decisions. At the federal level, FEMA uses WDNR data in its disaster mitigation planning, and has paid to make these data available in geospatial form.

The biggest barrier to initiating the use of GIS to manage floodplain and dam data, according to Ms. Schwoegler, was bureaucracy. Upper management within the DNR were hesitant to commit the time and resources required to convert data into digital form. The fact that managers are beginning to reference GIS data in their internal reports, however, can be considered a measure of the success of the program. When asked for some ways in which the GIS database could be improved, Ms. Schwoegler suggested making all DNR GIS applications compliant with the Open Geospatial Consortium's standards. This would lead to easier data display, intra-departmental sharing, and public access. Currently, all state GIS servers are being consolidated under the state Department of Administration. This is presumably being done to improve efficiency and decrease costs for all state agencies, but the DNR has yet to determine how it will be influenced by the change.

Finally, I asked Ms. Schwoegler for what she feels are some of the most interesting ways in which her department's data are used. She is most interested in tools such as HEC-GeoRAS and HEC-GeoHMS, both of which were produced by the U.S. Army Corps of Engineers. HEC-RAS is a hydrologic modeling program used for such broad applications as dam removal studies, flow calculations, erosion predictions, and floodplain prediction. HEC-GeoRAS is an extension of that program that allows the use of geospatial data from ArcGIS software in the models, and outputs its results in geospatial format. HEC-GeoHMS performs similar functions as HEC-GeoRAS, but for rainfall and runoff modeling.

### **References:**

Email interview with Amanda Schwoegler, GIS Specialist, Wisconsin Department of Natural Resources. 2/26/2007.

Wisconsin Department of Natural Resources Floodplain Management Program Website: <http://www.dnr.state.wi.us/org/water/wm/dsfm/flood/>. Access date: 2/26/2007.

Wisconsin Department of Natural Resources Dam Safety Program Website: <http://www.dnr.state.wi.us/org/water/wm/dsfm/dams/index.html>. Access date 2/26/2007.