

GIS and Flooding – Understanding the Risk to Life

The challenge for GIS technology is in the display of large time varying data sets. The fourth dimension of time (x,y,x,t) requires special software.

The primary emergency strategy for reducing the risk to life in a flood is the evacuation of the community at risk. Evacuation planning and implementation requires a clear understanding of the spatial distribution of the population at risk, the evacuation routes available and their susceptibility to being cut by water during the early rising stages of a flood. It is essential to know where and when an evacuation route will be cut by the rising



floodwaters. Knowledge of how parts of a community could become isolated, and therefore placed at great risk, once the last evacuation routes are cut, can be crucial to saving lives.

The key element in evacuation planning is understanding how a flood rises over the land through time. Figure 1 to Figure 4 illustrate a typical flood evacuation scenario. Figure 1 shows a flood 1 hour after it breaches its banks. Figure 2 shows the same flood, 30

minutes later. At this stage, a resident may not feel compelled to evacuate, as to them, floodwaters are not yet threatening their property.



Figure 3 shows the same flood another 30 minutes later. At this stage, a person would be inclined to evacuate, as floodwaters are certainly threatening their property. However, it's too late because the site has been cut off, with the property left isolated. Figure 4 shows the peak of the flood, 2.5 hours after it breaks its banks, with flood levels well above the property.

Understanding the time varying flood surface comes by integrating topography, cadastre, air photos and predicted time varying flood extents and levels within a GIS environment. This involves disparate spatial and time varying data sets such as:

- Detailed topography via a digital elevation model (DEM)
- Cadastre, showing property locations, and possibly, floor levels
- Air photo to illustrate evacuation routes and improve communication and understanding of flood issues
- Predicted time-varying water surface generated by a mathematical model



Figure 3: 2.0hrs after bank full

The integration must be as accurate as possible because lives are at risk. The increasing availability of ALS (Aerial Laser Survey) data is allowing accurate DEM's to be developed (refer April/May 2006 issue of Public Works Engineering) and high resolution aerial photography is now common.

The most difficult task is to integrate the time varying model results in a live GIS and conventional GIS packages do not support time varying surfaces. waterRIDE™ was developed in Australia by Patterson Britton & Partners

expressly for this purpose. It integrates the time varying results of any hydraulic model (1D, 2D or 3D) within it's own full GIS environment, providing interaction between any GIS layer and the flood surface.

Gold Coast City Council recently opened its \$1.7 million Disaster Coordination Centre. GCCC is developing a Decision Support System (DSS) for flood emergency management based on waterRIDE™. waterRIDE™ is being used to integrate the time varying results of MIKE11 and MIKE21 modelling with their high resolution Aerial Laser Survey data.



Figure 4: 2.5hrs after bank full

Combining this information with Council's GIS datasets provides Council with vital intelligence such as:

- Flood Affected Properties – overfloor flooding associated with a predicted flood level
- Evacuation and Exit Routes – the predicted depth and relative timing along evacuation routes to and from evacuation zones and nearest evacuation centres
- Affected Road/Bridge Crossings – the predicted impact on road crossing and bridges
- Affected Demographics – display critical information on impacted population profiles eg population data with age distribution
- Flood Damage – post flood spatial assessment of the distribution of likely damage

The DSS is being used by GCCC to improve flood emergency management plans and assist emergency management personnel during actual flood emergencies.

To find out more about how you can reduce the risks to life by integrating your time varying flood model results with GIS, please contact Cameron Druery of Patterson Britton & Partners, on 02-9957-1619, or visit www.waterRIDE.net