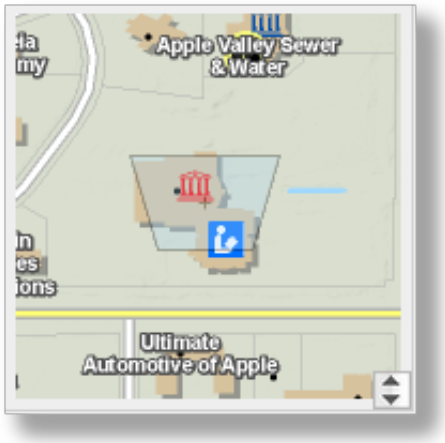
Winter 2011 - Desktop: Pictometry Online

By Joe Sapletal, GISP

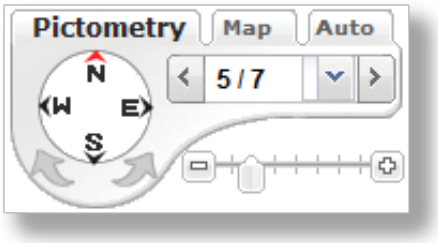
Pictometry Online (POL) has arrived and is being hosted by Dakota County. POL is a web-based oblique imagery viewer that replaces the desktop application Electronic Field Study (EFS). POL is available to county and city staff based on our cost-sharing partnership for purchasing aerial photography. POL can be accessed directly with a login and password, or by using the "Pictometry Viewer" tool in our web-mapping application, Dakota County GIS (DCGIS).

What can you do with POL? POL has all the measuring and annotation tools that EFS has, and more. For staff, we will still be able to search for current tax parcels, measure features (for all three years of imagery), extract portions of images (for all three years) or export whole images (for all three years). You can still draw or type annotation onto an image and save it, and now you can even import KML/KMZ files. For the public, you will be able to browse all the images (all three years) and search tax parcels. Did we mention you have access to all three years of oblique imagery that we have?



What's new or different? There is a navigation window in the lower right of the window that uses our own basemap. This basemap has streets, buildings, tax parcels, addresses and business names. The basemap is updated monthly. You can minimize or expand this map at any time. We are also planning on creating an ortho basemap with, of course, an ortho, and streets, tax parcels, addresses and business names. Basemaps are updated monthly.

POL has a Navigation Control. This toolbar has buttons that allow you to switch your view in the main image window between Pictometry imagery and the basemap. The oblique image you were viewing then appears in the Navigation Window. The Navigation Compass area allows you to switch the direction from which you are viewing a particular location, and by using the arrow buttons to the right of the compass, it allows you to view images from different years. The date of the image you are looking at is displayed in the status bar just below the Navigation Window.



Workspaces are available for city and county staff to share annotations you have drawn or typed on an image, or bookmarks for viewing particular sites that are saved in the POL system. You set the permissions on each of your workspaces, and you decide who you want to share any of them with and who you want to collaborate with.

How do I login? City staff can contact their Information Technology or Information Systems departments for login information. County staff can contact the Office of GIS. Anyone can use the public access to Pictometry Online Public Access.

Winter 2011 - GIS 101: 2010 Orthophotography - The Best Ever!

By Randy Knippel

In April, 2010, aerial photography of Dakota County was captured. This imagery has subsequently been processed and mosaiced together to form a seamless image of the entire county, and is currently undergoing final quality control checking. When released, this will be the highest quality aerial photography that has ever been available for the entire county.

When using aerial photography, it is important to know and understand the resolution and accuracy. Both terms are important. Resolution alone does not necessarily define accuracy. The County's new photography is 6-inch resolution, 2.4-foot accuracy. This means that each pixel, the smallest element of the image, covers 6 inches by 6 inches of ground and is accurate to at least plus or minus 2.4 feet in any direction. It will fit other GIS data, such as property lines, much better than imagery has in the past (Figure 1).

Figure 1
2010 orthophoto accurate to +/- 2.4 ft

The 2010 imagery's accuracy conforms to national map accuracy standards, which state that 95% of well-defined locations must fall within the specified error. In other words, statistically, the imagery is accurate to that degree, but there may be isolated, occasional areas that can be less accurate. As a part of the final quality control checking the imagery will be tested using GPS control points, and the actual accuracy is expected to be even better than 2.4 feet.

Once the accuracy is calculated, it can then be compared to other aerial photography. Pictometry provided orthophotography along with oblique aerial photography in 2005, 2006, and 2008. Although it, too, was 6-inch resolution, when using GPS points the tested accuracy in 2008 was just over 7 feet, which is still much better than their guaranteed accuracy of 5 meters (Figure 2).

Figure 2
2008 orthophoto accurate to +/- 7 ft

Orthophotography originated with companies that were part of a community of mapping scientists and specialists that developed methods to maximize accuracy from highly specialized cameras, aircraft, and techniques. However, the rules are changing, as new companies apply a variety of technologies in new ways to create new products and lower cost alternatives, such as oblique photography.

Aerial photography is useful as a background for maps and interactive applications. Often, other GIS data is overlaid to show property lines or identify areas such as parks. This can lead to confusion when the overlaid information doesn't appear to match the photography. The immediate reaction may be a determination that buildings or fences visible on the photography are over the property line. However, great caution must be used in this kind of evaluation.

Understanding the accuracy of the photography, as well as the overlaid GIS layers, is critical in such cases. In our case, we know that most of the property lines in the GIS database are very accurate, but with a variety of aerial photography to pick from, the registration of property lines to the photography varies widely. Although the 2010 orthophotography with its high degree of accuracy should minimize such problems, ultimately the determination of where a property line lies on the ground and whether or not fences and buildings are on the property requires a surveyor and research of legal descriptions of the property.

Regardless, these questions will continue to arise, since most people don't realize the numerous variations in sources and accuracies related to the data that is integrated using GIS. With this information available on the web, the general public may make assumptions about what they see when various layers are combined with aerial photography.

A common assumption is that everything is perfect. That is hardly the case, but we shouldn't expect to achieve perfection, either. The issue is finding appropriate products for an appropriate price that meet an appropriate amount of the need. That is an on-going balancing act in GIS that will only get more complex as more data sources and options become available.

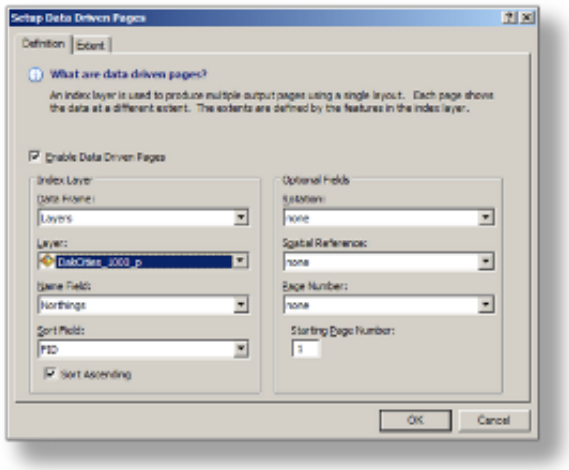
Winter 2011 - Tech Talk: Data Driven Pages

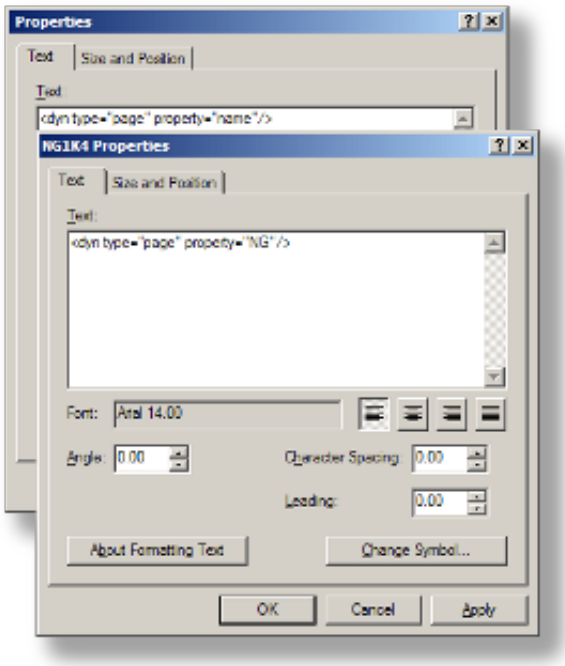
By Dan Castaneda

A popular ArcMap tool, DSMapBooks, that started as an ESRI developer's sample has finally been incorporated in ArcGIS 10 as Data Driven Pages. The tool allows you to create map books that have a consistent format and scale by using a single ArcMap document to export multiple layouts. Many of the tools found in the developer sample have been included in Data Driven Pages, and some new tools have been included by ESRI. At Dakota County, we have used this tool to create many different map products, including city atlases, and more recently, our Neighborhood Map Books which are based off of the National Grid.

Included in ArcGIS 10 are new tools to help get you started using Data Driven Pages: the Data Driven Pages toolset and the Data Driven Pages toolbar. The Data Driven Pages toolset will help you create an index layer if you do not already have one, and it will also help you create attribute fields used during the Data Driven Pages setup, and for use with dynamic text elements. The toolset can either help you create a gridded polygon feature class, or a feature class that follows a specific item on your map, such as a highway or river. ESRI refers to this as a Strip Map Index Feature.

The toolbar will help you set up Data Driven Pages in your current map document, based on the index feature and its attributes created using the toolset. You can also use existing feature classes, such as the USGS quads or National Grid polygons, for your index layer. In the Data Driven Pages setup dialog, there are several options you can specify, such as rotation, which will allow you to make sure that your map is always oriented to true north. The Extent Tab will allow you to control the map extents based on a percentage, page units, or map units. There are also options to maintain the current scale, or use attribute values from a specific field in the index layer for your map scale.

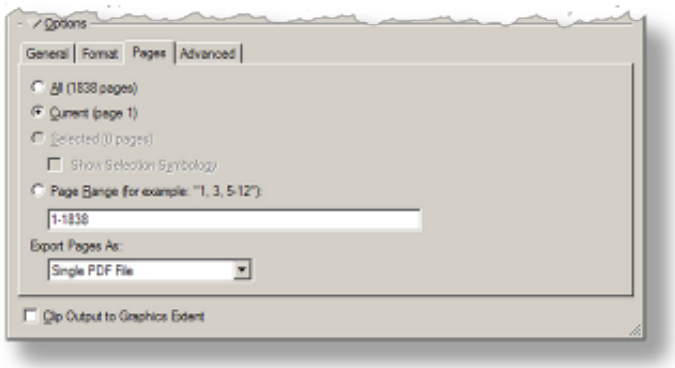




Another useful map book feature incorporated into Data Driven Pages from the map book developer sample is dynamic text. This feature has been enhanced in version 10 and includes more options for tagging text elements. This allows you to add text items to your layout such as a page title, or a page number that will change with each page of the map book. All of the elements are given a new format tag, <**dyn/**>. Formatting tags are not new, and have been included in previous versions of ArcMap, and were often used to make text bold or change the font style and color.

While it may not be evident in the Dynamic Text menu, you will still be able to tag text items by individual fields, and have the text update with the attribute values. This can be done by altering an existing dynamic text item, such as the Page Name. The format tag for Page Name currently appears like this: <dyn type="page" property="**name**"/>. By changing the “name” portion to a field name, making it appear as this: <dyn type="page" property="**NG**"/>, the text will now display the full USNG designation for that particular page. This can be done with any dynamic text item, for any field in the index layer.

After you have created your index layer, and properly tagged all of your text elements on your layout, you can begin to export your individual pages using the same export dialog in the file menu as in previous versions of ArcMap. A new tab will appear when you have enabled Data Driven Pages in your map document, and it will allow you to export all of your map book pages or a subset of the pages.



Many of the options that were available in the developer’s sample are included in Data Driven Pages. In addition, the functionality of Python scripting in ArcGIS 10 will allow you to customize your map book products beyond the default options available with the Data Driven Pages dialog. In the coming weeks, we will be updating all of our map book products to use the new Data Driven Pages in ArcGIS 10. For more information, consult the ESRI help documentation for creating map books.

Winter 2011 - Department Spotlight: The September 2010 Flood: How GIS Was (and Wasn't) Used

By Brian Welch, GIS Technician, City of Northfield

Introduction

On September 23, 2010 a large low pressure system moved across northern Iowa, crossed southern Minnesota and then passed into Wisconsin. During the 24 hours of its passage the storm dropped heavy rain over southern Minnesota, with some areas receiving almost 10 inches. In the Cannon River watershed the heaviest rainfall, almost 8 inches, was near Owatonna in the uppermost portion of the Straight River, a tributary that joins the Cannon River in Faribault. The Cannon River above Faribault received 3-4 inches of rain while the middle Cannon near Northfield received about 6 inches of rain (Fig. 1).

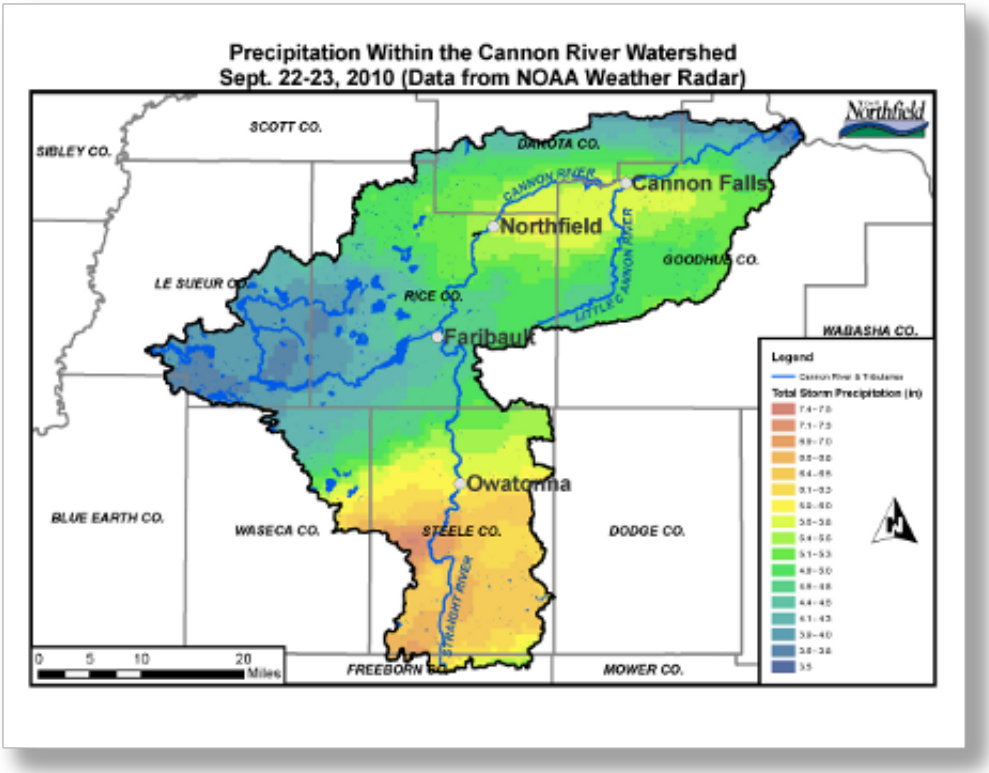


Figure 1. Map of total radar-derived precipitation in the Cannon River watershed. Precipitation grid interpolated from precipitation point data downloaded from NOAA. Archived precipitation data area available within 24 hours.

The heavy rain in Owatonna caused immediate area flooding and a rise in the level of the Straight River. The wastewater treatment plant in Owatonna was eventually forced to bypass its treatment and dump raw sewage directly into the river. In Faribault the river began to rise overnight and by midnight had topped its banks. Numerous local businesses and homes were flooded, a major sanitary sewer siphon was torn out by the strong river current and raw sewage began to flow into the river.

In Northfield the heavy rain caused an initial rise in the Cannon River similar to a spring flood - roughly three to four

feet – by the evening of the 23rd. While businesses along the river that are usually impacted by spring floods began to fill sandbags, the general feeling was that the city had dodged a bullet. By midnight, however, the picture had changed. Water from the Straight River began to raise the level of the Cannon River and the rise continued for the next 30 hours, despite clear skies and no additional precipitation. The river finally peaked in Northfield late in the morning of the 25th, nearly 14 hours after the Straight River crested in Faribault. Northfield was one of the only communities in the Cannon River watershed that was not forced to bypass its wastewater treatment plant.

The municipal response to the floods in Faribault and Northfield focused primarily on protection (sandbagging and wastewater treatment plant protection). Initially, GIS staff in both communities was tasked to assist with protection operations. Mapping and assessment operations did not start until after the rivers started to recede.

GIS Efforts

It is important to note that the upper Cannon River has not experienced a major (100+ year) flood in over a generation, and emergency response operations reflected the infrequency of such events. GIS staff in both communities noted that the lack of real-time mapping of protection operations - locations of resources, needs, etc. - may have reduced the effectiveness at times. However, given the scale of operations in the communities it is debatable whether a GIS solution was preferable over more traditional data management strategies. Simple maps of bridge closures and emergency shelter locations were posted to the city websites during the event (Fig. 2).

Figure 2. A simple map of road closures was posted to the city's website during the flood and updated as conditions changed. The basemap was quickly created with the city's GeoMoose intranet mapping system. The annotation was created and updated in Adobe Acrobat Professional.

At the county level, a server crash (not related to the flood) prevented a concerted mapping effort of the broader effects of the flood.

There were numerous mapping efforts related to the post-flood damage assessment. Surveys of businesses affected by river flooding (and therefore eligible for various forms of local, state, and federal aid) were mapped to provide guidance to local governing bodies and to establish the extent of the official disaster areas (Fig. 3).

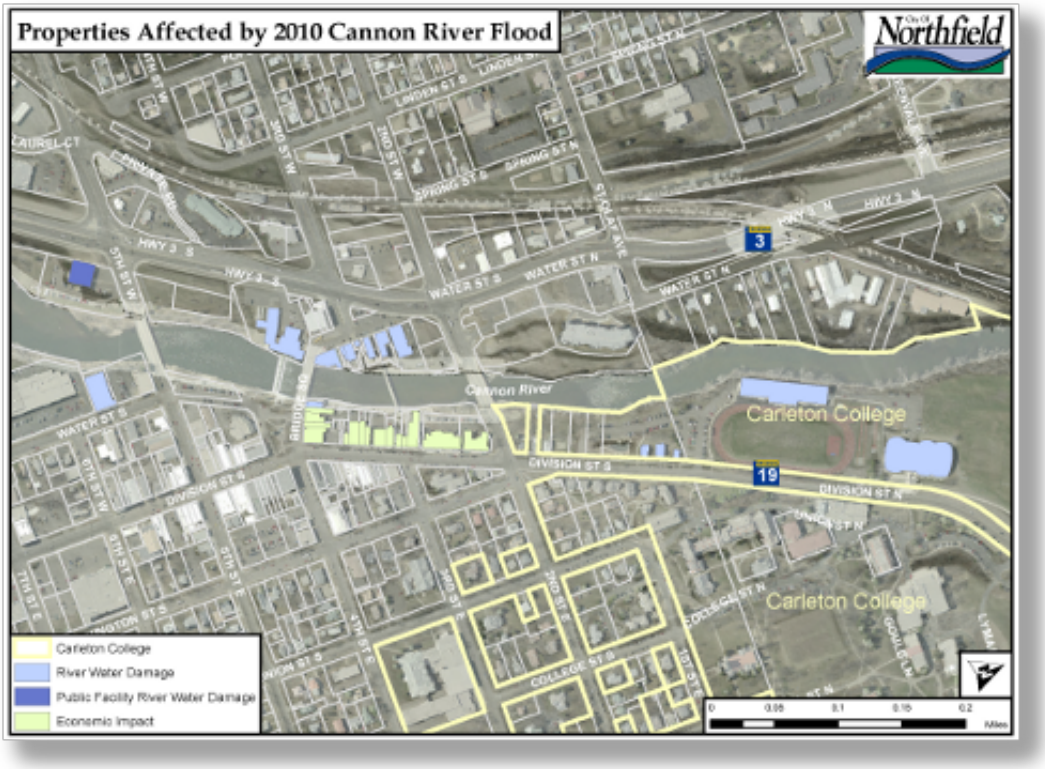


Figure 3. Map created for the City Council to illustrate the impact of the flood on local businesses and facilities.

Neither city owns a GPS-equipped camera.

Independently, both Northfield and Faribault developed preliminary assessments of the peak water level using a combination of digital photographs and GIS data. Photos of high water marks taken by city staff, news organizations, and the public were compared against 6”-resolution aerial photos to note the location of the high-water line with landmarks easily distinguished in the aerial photos (street lights, sign posts, driveway-sidewalk intersections, park benches, etc. – see photograph for example). Once the locations were established the elevation of the high-water line could be interpolated from LIDAR-based contours. Generally, the accuracy of this method was about ±1 foot or better. Staff from both cities noted that the observations showed general agreement with the new (preliminary) FEMA flood maps (Fig. 4).

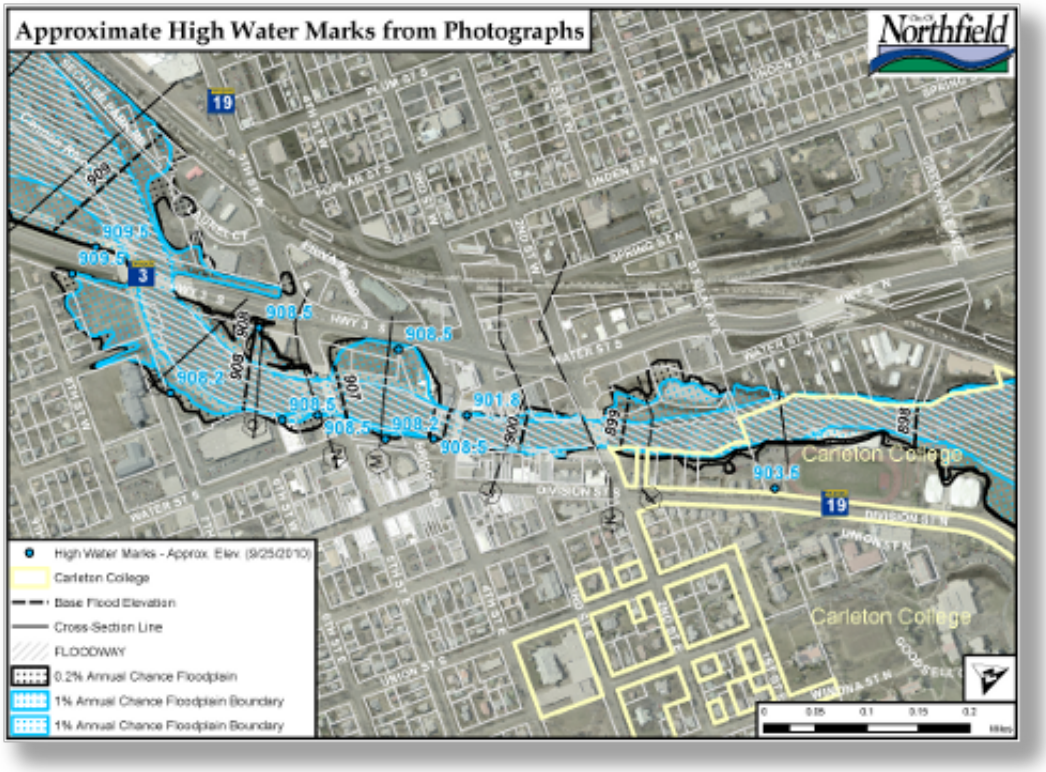


Figure 4. Map of high-water marks mapped from photographs taken at the crest of the flood, existing high-resolution aerial photos, and LIDAR-based contours. 2003 FEMA flood boundaries are shown for reference.

Suggestions for GIS in Local Emergencies

Ironically, the cities of Northfield and Faribault, along with Rice County, had been developing U.S. National Grid 10 km and 1 km maps and were close to releasing these maps to local emergency response personnel. Prior to the flood there was little interest in the USNG maps among emergency response personnel in Northfield. An emergency response drill earlier in September had raised the issue of the maps, but the general response was that local responders already knew the area well enough. During the flood itself, there was no time or interest among decision-makers to try a new and untested method. These issues raise the need to get local responders invested and trained in how maps may be helpful in making emergency management more efficient, as well as providing useful information to the public. Law enforcement and fire companies from neighboring jurisdictions were called in to assist during the flood. It would have been helpful to provide them with ready-made USNG maps of the community, especially since most of the assistance came from Dakota County jurisdictions that should be familiar with the maps.

GIS staff in Northfield is working with the city's emergency response coordinator to develop an emergency response drill for 2011 that utilizes USNG grids to provide quantitative information to the emergency command center as well as to the responders in the field. The goal is to help responders see how the maps can help to allocate resources more efficiently, as well as to identify those areas most in need of assistance. The primary goal is to help the responders to see the USNG maps and GIS capabilities in general as additional tools available to assist in effective emergency response.

While a number of staff members have been trained to use Northfield's Intranet GIS system (based on GeoMoose) for their specific department needs, it became apparent during the flood event that they were not comfortable using the system beyond its basic capacity. Annotating the PDF output of GeoMoose maps using standard tools available in Adobe Acrobat Professional is now part of the standard GeoMoose map-making training for city staff. Such overlapping skill sets are desirable as budget cuts reduce the number of staff, but also help to ensure that needed skills are available during an emergency.

For a relatively small community such as Northfield it is difficult to predict whether the GIS personnel are better utilized elsewhere during an emergency. However, pre-positioning map resources (online and/or paper-based) and training non-GIS staff to use simplified mapping tools should improve the efficiency and effectiveness of the emergency response.

Resources

City of Northfield 2010 Flood Response website:
http://www.ci.northfield.mn.us/assets/p/projects/Flood_2010/index.html

Radar-derived precipitation points from the National Weather Service Advanced Hydrologic Prediction Service:
http://water.weather.gov/precip/download.php

Real-time USGS stream gage data for Minnesota: http://waterdata.usgs.gov/mn/nwis/rt