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## GIS

# GIS Guides Cleanup and Construction in Tornado Aftermath

21 Sep, 2011

By: [JoAnne Castagna](#)

In Joplin, Missouri, the U.S. Army Corps of Engineers creates maps to help field personnel remove debris and locate safe shelter sites.

On the evening of May 22, 2011, a multiple-vortex tornado plowed through the community of Joplin, Missouri. Powerful winds reaching 250 mph shattered the windows of St. John's Regional Medical Center, scattering broken glass on top of critically ill patients and sweeping up furniture, supplies, and medicine into a whirlwind within the violently shaking walls of the hospital.

Terri Edens, an emergency room nurse, was working at the hospital when the storm struck. "When things settled down, we evacuated patients and grabbed what medical supplies and water we could and continued their care in a parking lot outside of the hospital.

"When we got outside," she continued, "we saw how extensive the damage was to the hospital and surrounding area. We then started to receive the walking wounded. A nearby production theater was flattened, and its actors and attendees were streaming our way and people from area homes started flooding our ambulance bay doors."



Bob Hill, a heavy mobile equipment mechanic with the U.S. Army Corps of Engineers' Philadelphia District, surveys the tornado-stricken landscape of the city during a break in debris removal operations. St. John's Regional Medical Center is visible in the background. Image courtesy of U.S. Army Corps of Engineers and Mark Haviland.

St. John's was just one of the critical public facilities severely damaged during this tornado; schools and fire stations also fell within the funnel's path, which measured approximately one mile wide and six miles long. The deadliest and costliest tornado the United States has experienced in more than 50 years severely damaged or destroyed thousands of buildings, and killed more than 150 individuals.

### Managing a Major Mess

Soon after the tornado struck, the U.S. Army Corps of Engineers (USACE) and partnering agencies were on the scene, organizing a herculean debris removal effort. The tornado left behind approximately 2 million cubic yards of debris, which is equivalent to 400 football fields piled 3 feet high with rubble. USACE has been using GIS for years to coordinate the removal of massive amounts of debris, relying on the technology after

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Hurricane Katrina, 9/11 at the World Trade Center, and several California wildfires.



Trucks removing the estimated 3 million cubic yards of debris left by the tornado. Image courtesy of U.S. Army Corps of Engineers and John Daves.

"The GIS (geographic information system) takes data from various sources, including aerial photographs and electronic data, and combines these layers of information in various ways to create maps. These maps can be used to perform many different missions and solve complex problems," said Stephen McDevitt, GIS, USACE, New York District, who is one of four national action officers responsible for deploying and managing GIS teams throughout disaster regions.

McDevitt deployed Army Corps GIS specialists to Joplin right after the devastation. They were joined by collaborating agencies including the Federal Emergency Management Agency, the City of Joplin, and the U.S. National Guard. The team used Esri ArcGIS to create maps of the area.

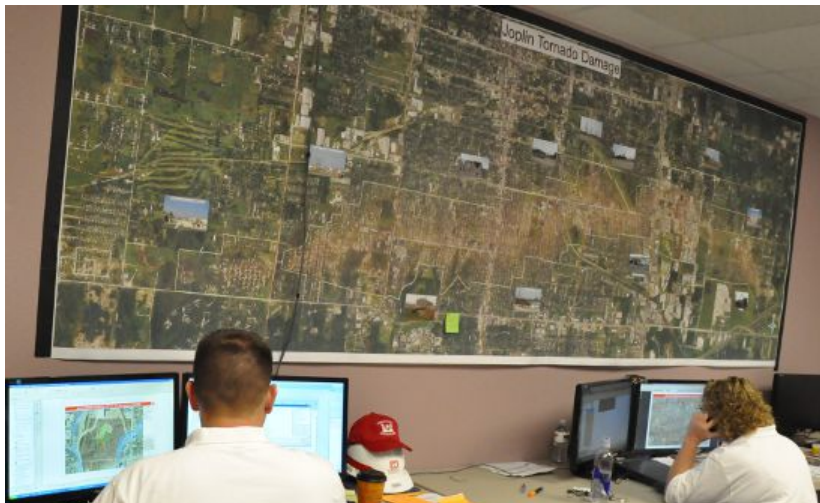
"From this team of agencies we collected a multitude of information that we layered to create maps, to assist with the many Army Corps missions," said Stephen Long, GIS specialist, Philadelphia District, USACE.

"We combined pre- and post-disaster aerial photography, parcel and property information from the city and county, sewer and water line information from utility companies, and electrical line data. In addition, Army Corps staff in the field collected data using GPS units, which we added to this mix," said Long, who has been an active member of the Army Corps GIS team for 10 years.

On a map that resembles a Google Earth image, the team overlaid street information and color-coded property outlines. A red outline meant the property owners had signed a Right-of-Entry form allowing USACE personnel to clear the property, a yellow outline meant a form wasn't signed yet, an orange outline indicated the cleanup was in progress, and green-outlined properties had already been cleared of debris.

These maps were updated daily and provided to the staff who were maneuvering five hundred debris-removal trucks around Joplin — no easy task since street signs had been blown away and landmarks destroyed. With the GIS maps, field workers knew not only where the streets were, but also which residential and commercial properties needed to be cleared next.

"One hour in the desk can probably save a whole day for one person out in the field," said Nicholas Laskowski, GIS specialist, Galveston, Texas District, USACE.



Army Corps GIS personnel working at the Corps' Recovery Field Office in Joplin, Missouri. To the left

is Nicholas Laskowski, GIS Specialist with USACE's Galveston, Texas District; at the right is Teresa Silence, GIS Specialist with USACE's Huntsville Center. Image courtesy of U.S. Army Corps of Engineers.

### Safe Sites for Shelter

Along with the debris mission, USACE was also called upon to manage the construction of emergency housing and temporary critical public facilities, such as schools and fire stations. Maps were created to determine that the land being considered for these uses was suitable and safe.

"The community selected several pieces of land to place temporary housing and to relocate critical public facilities, but before a piece of land could be selected, we had to make sure it met certain requirements," said Howard Ruben, NEPA compliance specialist, New York District, who volunteered to deploy to Joplin to make sure that all Army Corps construction locations complied with federal and state environmental regulations.

Ruben explained, "The land had to be away from the devastation and any flood zones and be near water, sewer, and electric lines, so that they could tap into these utilities."

Also, in some cases, it was desirable to find land close to where the original facilities stood. For example, many school personnel wanted to set up shop close to their original locations, so as not to make getting to school difficult for children. It was also important for the two temporary firehouses to be located near their original sites to retain full coverage of fire services in their communities.

"Not only did our maps show where there was safe land away from flood zones and near utilities, but specific property details," said Long. "In the background of the map, additional information could be pulled up by clicking on the property. This information included the owner of the property, tax ID numbers, and square footage, among other things."

If a property was in a suitable location, Army Corps real estate personnel could use this information to contact the property owner and find out if they were willing to rent or sell the property, so that the land could be used for temporary housing or to relocate a critical infrastructure.

Edens looks forward to the completion of the hospital's temporary facility, "It will be very nice to have more space and solid walls again, but mainly we look forward to continuing to do the job we love — which is serving our community."

### About the Author: JoAnne Castagna

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