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THE NATIONAL GEOSPATIAL CONFERENCE

Presented at the FIG Working Week 2025,  
6-10 April 2025 in Brisbane, Australia  
**FIG** **Geospatial**  
Council of Australia  
Brisbane, Australia 6-10 April

Collaboration, Innovation and Resilience: Championing a Digital Generation

# Emergency Bridge Surveys Responding to Flash Flooding Events Kentucky USA



Ben Shinabery, PLS  
Survey Director Qk4, Inc.  
[@theQk4Surveyor](#)  
Professor University of Kentucky



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Brisbane, Australia 6-10 April

## The Providential Preparation...



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# The Problem...

12/13/24, 1:36 PM

Historic July 26th-July 30th, 2022 Eastern Kentucky Flooding



**NATIONAL WEATHER SERVICE**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

**Historic July 26th-July 30th, 2022 Eastern Kentucky Flooding**

[Weather.gov - Jackson, KY](#) > Historic July 26th-July 30th, 2022 Eastern Kentucky Flooding

Jackson, KY  
Weather Forecast Office

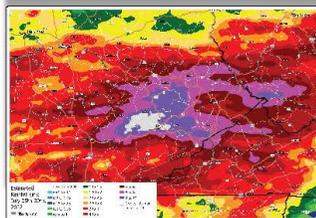
[Current Hazards](#) [Current Conditions](#) [Radar](#) [Forecasts](#) [Rivers and Lakes](#) [Climate and Past Weather](#) [Local Programs](#)

## Overview

Between July 25th and July 30th, 2022, several complexes of training thunderstorms developed south of I-64 and brought heavy rain, deadly flash flooding, and devastating river flooding to eastern Kentucky and central Appalachia. These thunderstorms, at times, caused rainfall rates in excess of 4"hr across complex terrain that led to widespread devastating impacts. While it did not rain continuously during this 4-day stretch, the overwhelming amounts of rain and resultant flooding led to 39 deaths and widespread catastrophic damage. Entire homes and parts of some communities were swept away by flood waters, leading to costly damage to infrastructure in the region. Over 600 helicopter rescues and countless swift water rescues by boat were needed to evacuate people who were trapped by the quickly-rising flood waters. In total, 24 Flash Flood Warnings were issued between July 26th and July 30th. Between the evening of July 27th and the mid-morning hours on July 28th (the peak of the event), 13 warnings were issued, 3 of which were upgraded to a Flash Flood Emergency.

Radar-based rainfall estimates suggest that upwards of 14-16" of rain fell during this 5-day period in a narrow swath, with many more locations receiving 6-10" of rain. Most of this rain fell during the night of July 27th into the morning of July 28th, which is when the most devastating impacts were felt. The highest totals occurred across an axis that stretches from northern Clay and southern Owsley counties, east through southern Breathitt and northern Leslie counties, into Perry, Knott and Letcher counties. The highest rainfall total report was from southern Knott County, where 14.00" fell between July 25th and July 29th. This site, a cooperative (COOP) observer at Carr Creek Lake, reported 6.71" from 7 am July 28th to 7 am July 29th, following a report of 6.50" at that site on the previous day. Another COOP site in Buckhorn reported 8.00" of rain for the 24-hour period ending 7 am on July 28th. The rainfall total in Buckhorn from July 25th to July 29th was 11.76". These rainfall values occurring in such a short period of time are incredibly rare; there is less than a 1 in 1000 chance for this much rainfall over five days in a given year.

The incredible rainfall also led to significant rises and flooding on many rivers in eastern Kentucky including on the main stem of the Kentucky River; North, Middle and South forks of the Kentucky River, Red River and Licking River. At Whitesburg, the North Fork of the Kentucky River swelled well above major flood stage, reaching close to 21' before gauge failure (the previous flood of record was 14.7' in 1957). The North Fork of the Kentucky River at Jackson also reached major flood, setting a new record crest of 43.47' (the previous record was 43.1' set in 1939). The river flooding caused a second round of destruction for communities in the region, and caused flooding in downstream areas that did not receive as much rainfall.



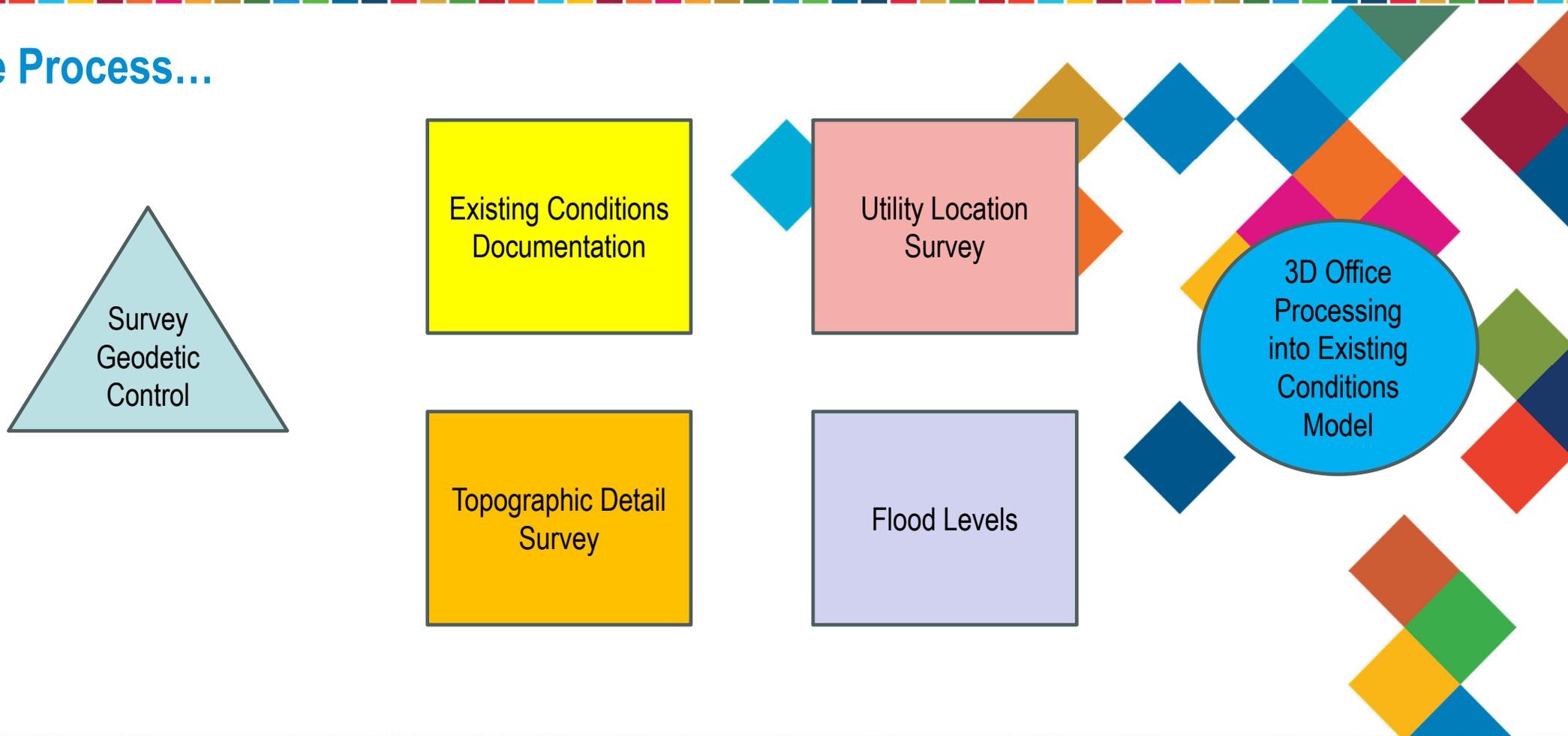
Estimated rainfall totals from July 25th through July 30th, 2022 via NCEP Stage IV precipitation data.



Flash Flood Warnings issued by NWS Jackson, KY from July 26th through July 30th, 2022. **Three of these warnings were "Flash Flood Emergencies."** This type of Flash Flood Warning is reserved for catastrophic flash flooding events.

- July 2022 Sudden **flash flood** – Eastern KY
- Exit routes along the creek bottoms **under water**
- **1 : 1000-year** flood event
- North Fork of the Kentucky River crested at **new records: 47.5 feet (14.5 meters)**
- Homes and bridges destroyed leaving **communities stranded**

## The Process...



The Process...  
... Perry County







The Proposal...

Be Open Minded

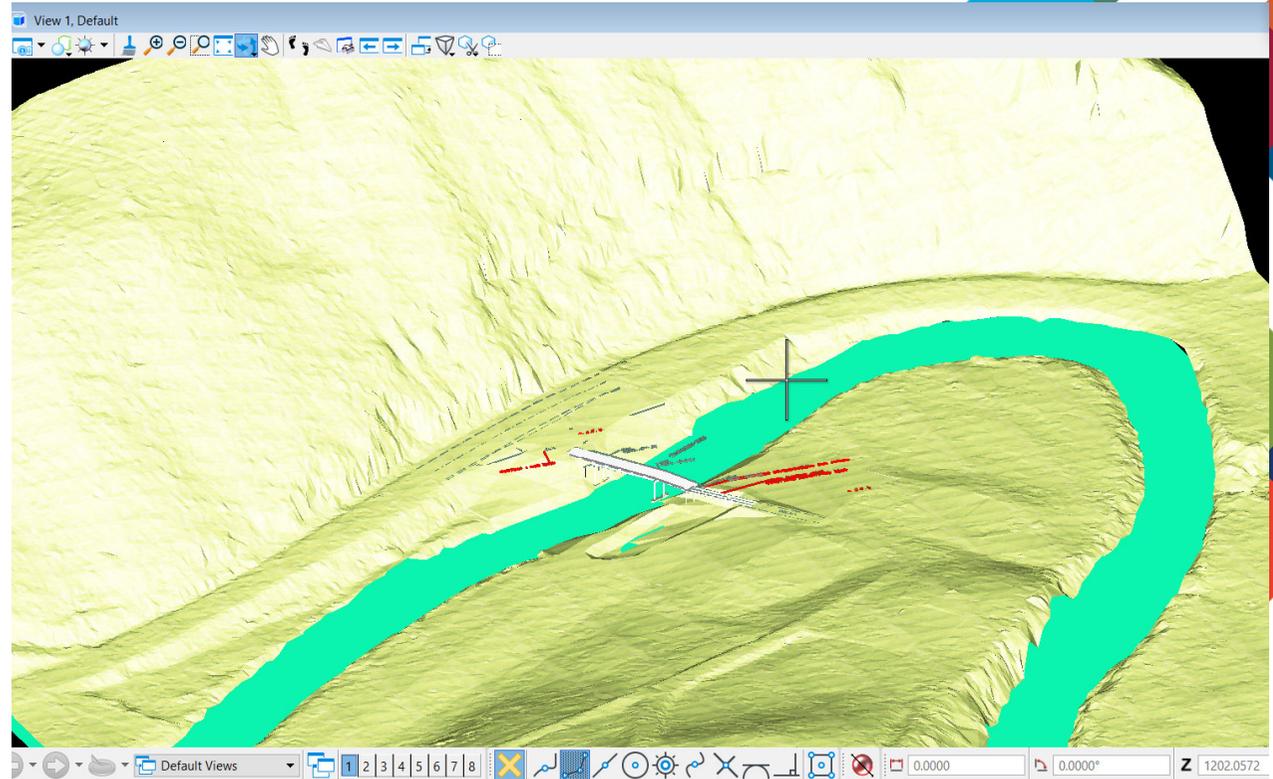
Be Prepared

Be Quick



## The Benefits of a Digital Twin...

- Parametric Modeling
- Finite Element Analysis
- Clash Detection
- Visualization Tools
- Complex Geometry
- Collaboration Tools





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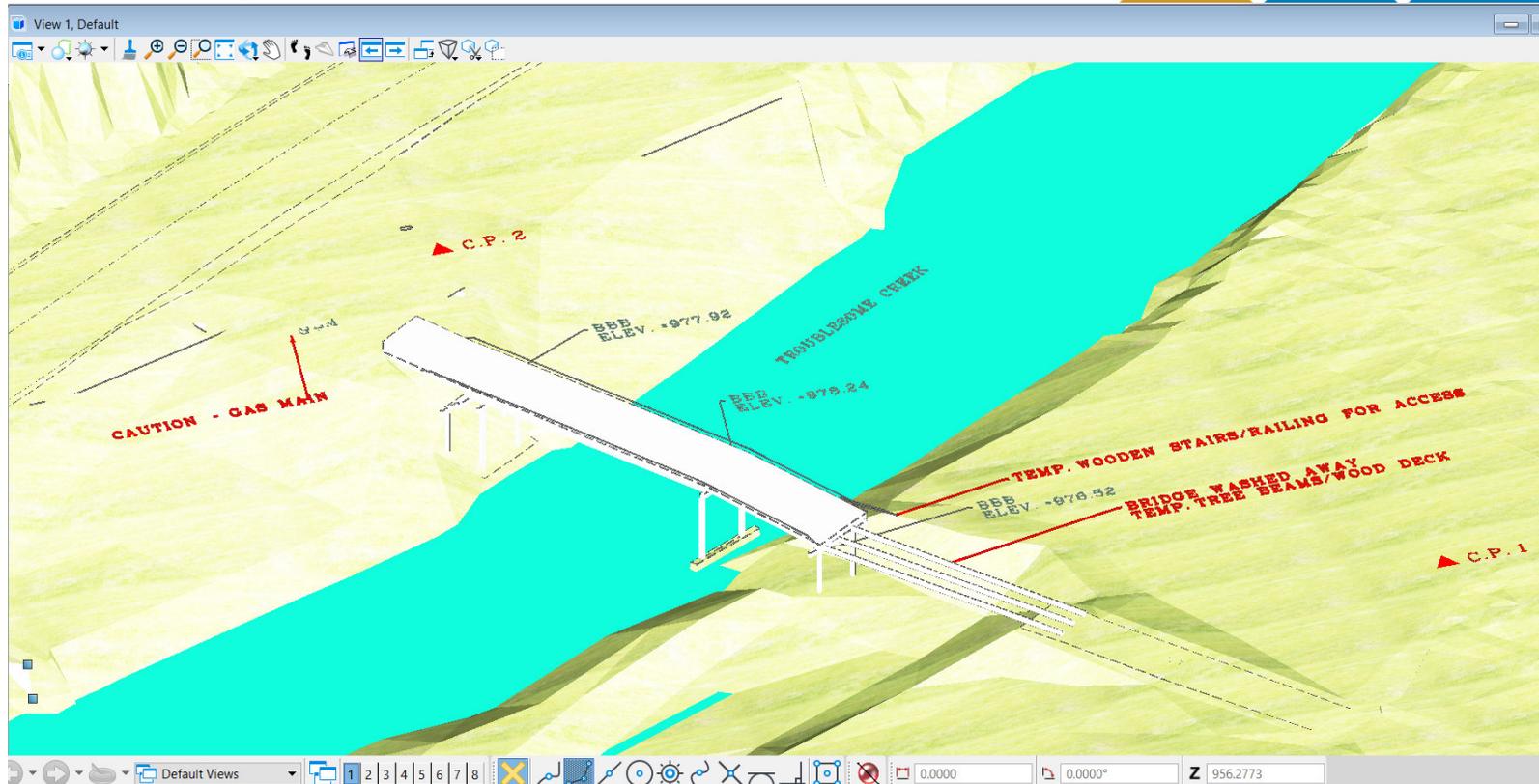
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# The Benefits of a Digital Twin...



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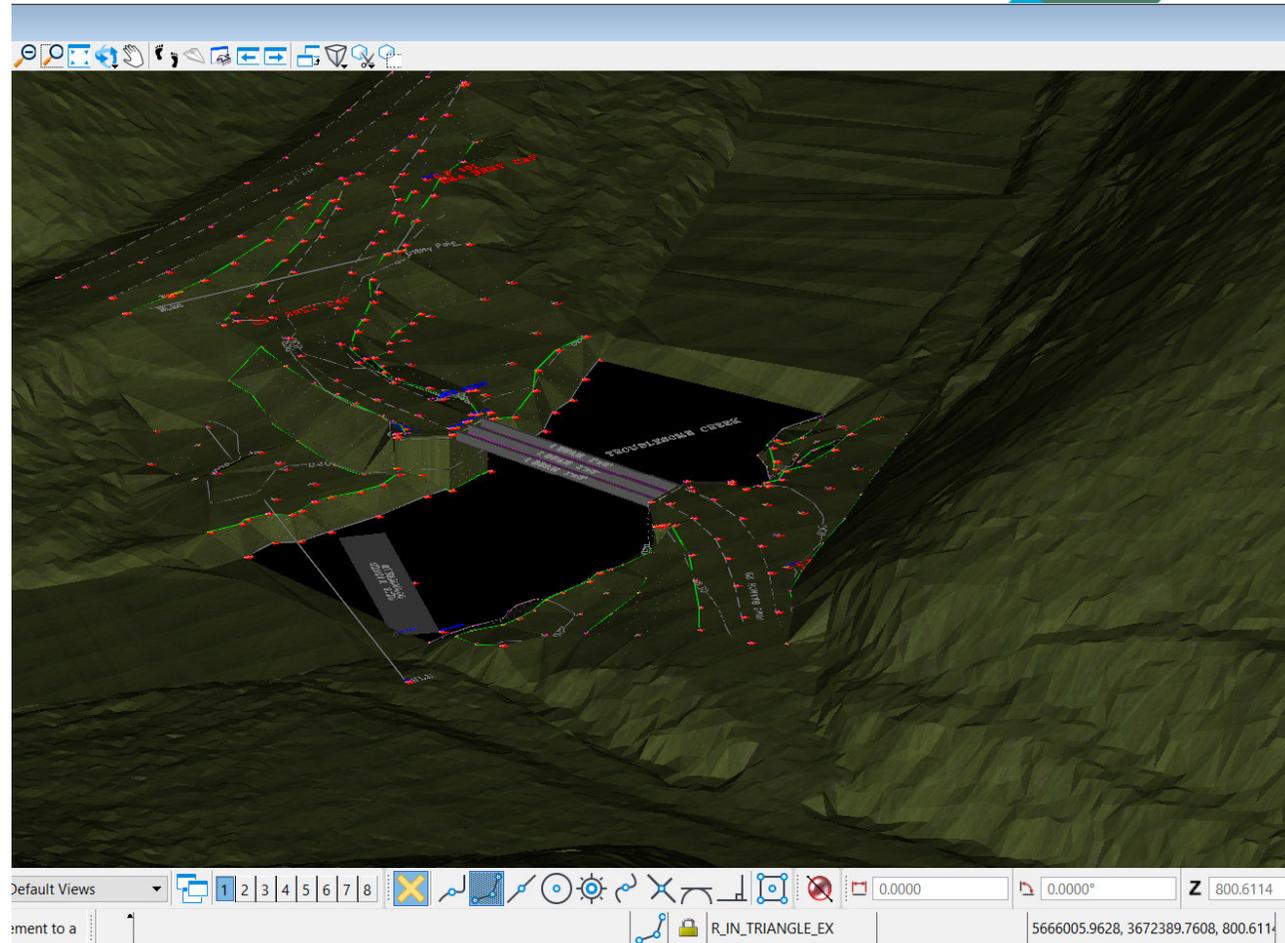


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# The most relevant SDGs related to the presentation and theme of this session

1st relevant SDG

**9** INDUSTRY, INNOVATION AND INFRASTRUCTURE



2nd relevant SDG

**11** SUSTAINABLE CITIES AND COMMUNITIES



3rd relevant SDG

**13** CLIMATE ACTION



SUSTAINABLE DEVELOPMENT GOALS

International Federation of Surveyors supports the Sustainable Development Goals

Predict the Future...

Bridge Security

Think Community

Learn Now to Respond

Be a Global Surveyor

