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***Executive Summary Report***

# Development of a Flood-Warning System and Flood-Inundation Mapping in Licking County, Ohio

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| Research Agency: | U.S. Geological Survey |
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## Project Background

Licking County, Ohio, has experienced numerous floods with the majority of flood damages occurring in the central and south-central areas of the county along four streams: the Licking River, North Fork Licking River, South Fork Licking River, and Raccoon Creek. Flooding from these four streams affect communities including: Village of Granville, City of Newark, City of Heath, Village of Hebron, and the Village of Buckeye Lake. In addition, flooding has resulted in the closure of Interstate Route70 (I-70) in the vicinity of the Village of Buckeye Lake and the interchange of I-70 and State Route 79 (SR-79). The closure of I-70 results in traffic congestion, loss of commerce, and safety issues. The safety issues arise in part because commercial truck traffic is detoured into the nearby communities on State routes that lack the carrying capacity and intersection turning clearance to safely pass the increased traffic flow. Discussions between the United States Geological Survey (USGS), Ohio Department of Transportation (ODOT) and other interested parties identified the need for a comprehensive flood-warning system in central and south-central Licking County. ODOT will use the information from the flood-warning system in conjunction with their traffic alert systems to warn of the potential closure of I-70 and redirect traffic in advance.

## Study Objectives

The objectives of this study were to: (1) enhance the ability of National Weather Service (NWS) to develop flood forecasts by re-installing a discontinued stream gage, upgrading a lake-level gage, and installing three new stream gages, (2) develop steady state hydraulic models to produce a library of maps of flood-inundation areas for a range of stages along selected reach of the Licking River, South Fork Licking River, North Fork Licking River, and Raccoon Creek, (3)

develop a preliminary unsteady-flow hydraulic model for the South Fork Licking River in the Buckeye Lake region that will be given to the NWS for inclusion in their flood-forecasting system, and (4) publish a USGS Scientific Investigations Report detailing the methods used and results.

**Description of Work**

The USGS re-installed one streamgage on North Fork Licking River, added three new streamgages, one each on the North Fork Licking River, South Fork Licking River, and Raccoon Creek. In additional the USGS upgraded a lake-level gage on Buckeye Lake.

Steady-state hydraulic models were used to estimate water-surface-elevation profiles for up to 10 flood stages for each of the four stream reaches. The corresponding streamflows ranged from approximately 2 to 500 years in recurrence interval. The computed flood profiles were used in combination with digital elevation data to delineate flood-inundation boundaries. The flood-inundation boundaries were then overlain on digital orthophotographs to create a library of maps of the flooded areas.

A preliminary unsteady flow model was developed for a reach of the South Fork Licking River in the Buckeye Lake region and was approximately calibrated to recent flooding events.

**Research Findings & Conclusions**

The USGS re-installed a discontinued stream gage, upgraded a lake-level gage, and installed three new stream gages. The gages were located on North Fork Licking River, Raccoon Creek, South Fork Licking River, and Buckeye Lake.

Hydraulic models were used to determine water-surface profiles within Licking County for up to 10 stages for the Licking River, North Fork Licking River, Raccoon Creek, and South Fork Licking River. The water-surface profile data were subsequently used to determine flood-inundation boundaries and develop maps of flood-inundation areas.

The preliminary unsteady-flow hydraulic model was completed and delivered to the NWS. The NWS will further refine the model by including simulated streamflow contributions from unmeasured sources determined by means of NWS hydrologic forecast models.

The hydraulic models and flood-inundation-area map libraries were provided to the NWS. The flood-inundation data will be incorporated into the NWS Advanced Hydrologic Prediction Services (AHPS) to be used in conjunction with the NWS flood forecasts. AHPS are web based services providing flood warnings and water resource forecasts.

**Implementation**

Stream and lake-level gage information, flood-forecast predictions, and flood-inundation mapping corresponding to the flood forecasts can be accessed on Web sites hosted by the USGS and the NWS. Streamflow and stage data can be found at http://waterdata.usgs.gov/oh/nwis/current/?type=flow. Precipitation and lake-level data can be found at http://waterdata.usgs.gov/oh/nwis/current/?type=precip&group_key=county_cd and http://waterdata.usgs.gov/oh/nwis/current/?type=lake&group_key=basin_cd, respectively. NWS AHPS information can be found at http://www.nws.noaa.gov/oh/ahps/.

NWS advanced-flood warnings related to the unsteady-flow hydraulic model initially will be available only to ODOT. After the model is refined, it is the intent of the NWS and ODOT to make the advanced flood-warning information associated with the unsteady flow model available to the public.

The increased availability of streamflow data, the enhanced flood-prediction capability, and public access to the data will improve the ability of public and emergency-management officials to assess flood conditions, take appropriate steps to protect life and property, and reduce flood damages.