WATERLINES

News affecting the management and use of Indiana's water resources

DIVISION OF WATER
INDIANA DEPARTMENT OF NATURAL RESOURCES
SUMMER 2008

MASSIVE AND HISTORIC FLOODING

It seems surreal. While Indiana is still trying to recover from the extensive damage rendered by the January and February 2008 flood events in central and northern Indiana, more flooding, with even greater damage, occurred in June. Who would think that in just a short six-month period two-thirds of Indiana's counties would be included in Presidential Disaster Declarations due to severe storms and flooding? The flooding was massive and historic.

Just before the onslaught of rain, nine tornadoes occurred in central Indiana from May 30 to June 4, 2008. From May 30 to June 9, storms also produced damaging straight-line winds, hail, and flood rains. Monthly rainfall totals ranged from 3 to more than 22 inches. A few isolated areas may have received 2 feet of rain in June.

Floodwaters affected more than 25,000 people in Indiana as flood damages exceeded $1 billion. The devastation left behind in the flood's wake was extensive and affected roads, railroads, homes, businesses, hospitals, dams, parks, flood protection works, and water and gas utilities. Mudslides occurred in Morgan, Owen, and Johnson counties. This was the largest agricultural disaster to strike Indiana, affecting about 9 percent of the state's farmland.

Levee breach near Newberry, Indiana
(Photo by Darren Pearson)

Among the hardest hit areas was the City of Columbus. Floodwaters flowed into locations identified as flood hazard areas and beyond. Not only were hundreds of homes damaged by floodwaters; the first floor of the Columbus Regional Hospital was also inundated, causing rescuers to evacuate

Also in this issue

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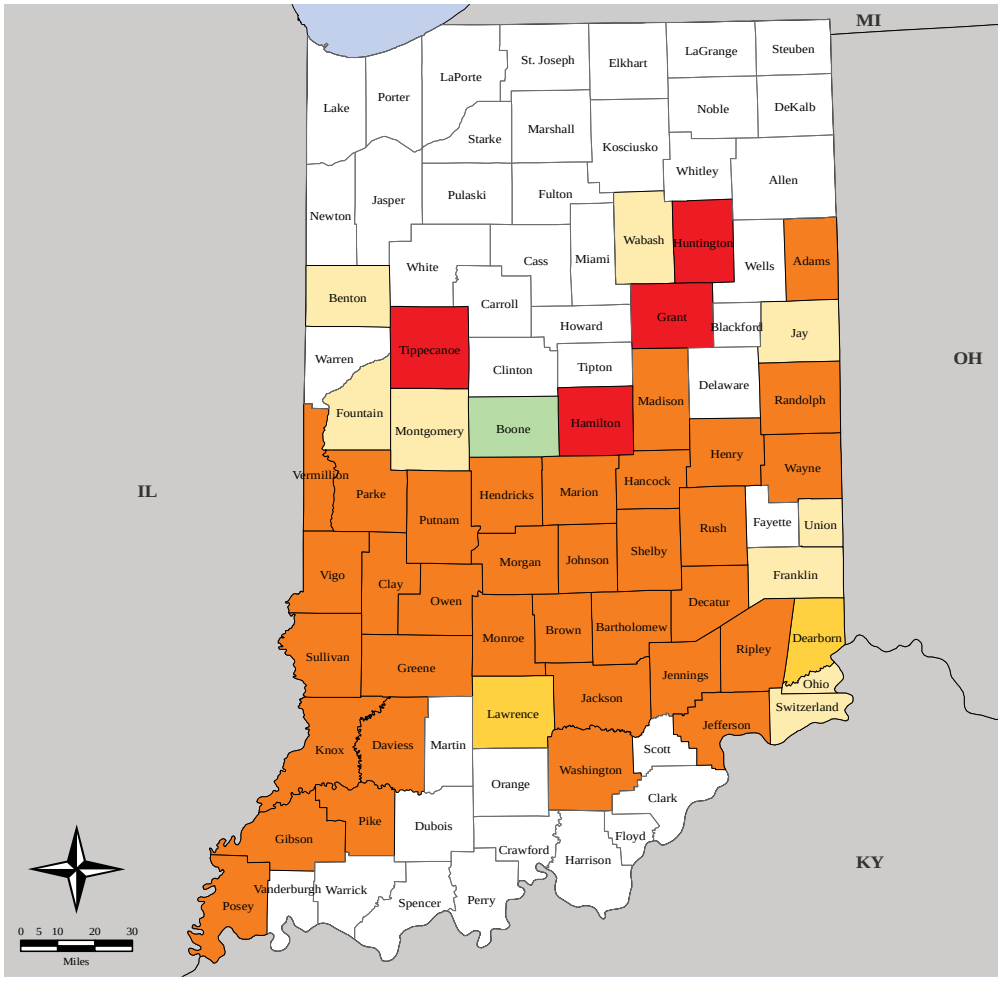
Floodwaters pouring into Columbus East High School Gymnasium (Submitted Photo)

patients. Schools and businesses were not spared either. Floodwaters poured into the gymnasium of Columbus East High School. At Columbus, the East Fork White River went from lowland to record flooding in six hours.

In Martinsville, many businesses and hundreds of homes were ravaged by floodwaters. The City of Franklin found some of its own city offices in the damaging floodwaters, leaving some city officials working out of their vehicles while trying to assist dozens of flood victims. The hospital in Franklin also sustained flood damage.

Hundreds of structures were flooded in Owen County as well, including the Town of Spencer, where memories are still fresh of the 2005 flood. This year floodwaters went higher, affecting even more homes in this area.

Those communities mentioned and so many others suffered damage, inconvenience, and loss. More than 40 counties were eventually included in the Presidential declaration for eligibility for various types of assistance (see map) due to the devastating June floods. More than two months later, some roads and bridges are still closed due to flood damage and many homeowners are out of their homes with decisions pending. Repairs, reconstruction and demolition are underway in many areas, while some owners will be navigating through buyout programs.



FEMA map for Disaster Declaration 1766 DR as of August 11, 2008
Disaster Declared June 8, 2008

The Great Flood of June 2008 was one of Indiana's costliest disasters. Indiana experienced a lion's share of damage and corresponding heartache. Four people perished during the floods of June. No one can adequately prepare an individual or community for this experience; but, the experience is one to learn from and demonstrates the importance of cooperation, good planning, and building developments that are reasonably safe from flooding.

Information includes excerpts from the Indianapolis NWS Monthly Report of River and Flood Conditions for June 2008

Flooded home in Franklin, Indiana
(Submitted Photo)

According to the NFIP's Flood Insurance Manual, the 1-percent-annual-chance flood is one that has a 1-percent chance of being equaled or exceeded in any given year. Formerly called the "100-year flood," the 1-percent-annual-chance flood is synonymous with "base flood."

A 1-percent-annual-chance of flooding may not seem like much of a gamble, but unpredictable weather conditions, recent upstream development, or deteriorating levees can dramatically increase the chances of flooding in areas that people thought were safe.

A MOVING EXPERIENCE

Hydrodynamic forces are among the five main causes of flood damage. The other four primary causes of flood damage are debris impact, hydrostatic forces, sediment and contaminants, and soaking.

Moving water creates a hydrodynamic force that can damage a building's walls in three ways (see below):

1. Frontal impact, as water strikes the structure.
2. Drag effect, as water runs along the sides of a structure.
3. Eddies or negative pressures, created as water passes the downstream side.

The speed of moving water is called velocity. The faster water moves, the more pressure it puts on a structure and the more it will erode stream banks and scour the earth around a building's foundation.

Floodwaters moving faster than 5 feet per second constitute a high-velocity flood, requiring special design considerations for buildings, roads, bridges and other man-made structures in its path.

While velocity is one factor in determining the potential harm of a flood, the total impact of moving water is also related to the depth of the flooding. Research demonstrates that deep water and low velocities can cause as much damage as shallow water and high velocities.

People are more susceptible to injury than buildings are to damage. Studies have shown that it doesn't take much depth or velocity to knock over a person. Thus, no areas with moving floodwater can be considered safe for walking.

A car will float in only 2 feet of moving water, which is one reason floods kill more people trapped in vehicles than anywhere else. Often victims put themselves in perilous situations by ignoring warnings about travel or mistakenly thinking that a washed-out bridge is still open.

This article is based on information from **" Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials,"** *a FEMA publication that is accessible online at* **www.fema.gov/library/viewRecord.do?id=1443.**

LEGISLATION PASSED REGARDING RECONSTRUCTION OF RESIDENCES IN THE FLOODWAY

On the heels of two major flood events affecting several northern Indiana counties, new legislation was passed and signed into law that revises the Indiana Flood Control Act and impacts reconstruction of homes in a *floodway* other than those in a boundary river floodway (the Ohio River).

The revised Act, IC 14-28-1-24 (B)(2) now authorizes reconstruction of a residence (abode) in the *floodway,* which has incurred substantial damage by any means, including flood. This reconstruction does not require a formal permit from the Department of Natural Resources (DNR) if specific conditions are met. It does, however, require that the property owner submit material facts to the DNR demonstrating how these conditions will be met.

Anyone wishing to reconstruct under this authority will need to have the base flood elevation (also known as the 100-year frequency flood elevation, regulatory flood elevation, and 1-percent-annual-chance flood elevation) to determine the required lowest floor elevation for the reconstructed residence. If there is a published base flood elevation for the site, or DNR has provided base flood elevations in the absence of a published elevation, local permitting officials can provide this information to the person wishing to reconstruct.

If this information is not available, the applicant or local permitting officials should contact DNR in writing requesting this information. Once DNR has provided the base flood elevation, the applicant may then submit his or her documentation regarding the proposed reconstruction.

In order to assist in this process, the DNR prepared a checklist for the submittal of material facts to reconstruct a substantially damaged residence (abode) in the *floodway.* The checklist was distributed to floodplain administrators of communities across Indiana for their reference/guidance and distribution to anyone seeking authorization to reconstruct a substantially damaged home in the *floodway.*

To date, more than 100 of these submittals have been received by DNR and processed. Reconstruction continues in several communities throughout the flood-ravaged areas.

The Flood Control Act is specific to the *floodways* in Indiana where the upstream drainage area from a given site is greater than one square mile. The *floodway* is the portion of the floodplain that carries the peak flow of floodwaters during a flood event – being more hazardous than the remaining portion of the floodplain located outside the floodway (called the flood fringe) because of higher velocities. For both State and Federal regulatory purposes, the frequency of flood adopted to determine the limits of the floodway, flood fringe, and overall floodplain, is the 100-year flood. The 100-year flood is more accurately described as the 1-percent-annual-chance flood, having a 1-percent chance of occurring in *any* given year. As shown in the beginning of 2008, this magnitude of flood can occur more than once in a year and can certainly be exceeded.

Indianapolis elevation project in process
(Photo provided by City of Indianapolis)

Completed elevation project in Spencer
(Photo by Anita Nance)

CHECKLIST FOR SUBMITTAL OF MATERIAL FACTS TO RECONSTRUCT A SUBSTANTIALLY DAMAGED ABODE IN THE FLOODWAY
SUBMITTED TO THE INDIANA DEPARTMENT OF NATURAL RESOURCES,
DIVISION OF WATER

(IC 14-28-1-24(B)(2)

- ❑ Submittal of a survey plot map of the parcel of land that contains documentation showing the dimensions of the original foundation for the abode or residence and existing ground elevations at the original foundation
- ❑ Documentation showing that the proposed reconstructed abode or residence does not extend beyond the original foundation of the abode or residence
- ❑ Documentation showing that the lowest floor elevation of the reconstructed abode will be at least two (2) feet above the one hundred (100) year flood elevation
- ❑ Documentation demonstrating that the abode or residence will be designed or modified and adequately anchored to prevent flotation, collapse, or lateral movement of the abode or residence resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy (Refer to FEMA 54 publication, page 71)
- ❑ Documentation demonstrating that the portions of the reconstructed abode or residence below the base flood elevation plus two (2) feet, will be constructed with materials resistant to flood damage (Refer to FEMA Technical Bulletin 2-93)
- ❑ Documentation demonstrating that the abode or residence will be reconstructed by methods and practices that minimize flood damages
- ❑ Documentation demonstrating that the abode or residence will be reconstructed with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and located to prevent water from entering or accumulating within the components during conditions of flooding (Refer to FEMA 54 publication, page 92)
- ❑ If the abode or residence will be reconstructed on solid foundation walls, documentation demonstrating that said foundation walls will have at least two (2) permanent openings (in addition to doors and windows) having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding and that the bottom of all openings shall be no higher than one foot above adjacent foundation interior grade **which must be equal to in elevation or higher than the exterior foundation grade** (Refer to FEMA Technical Bulletin 1-93)

If your proposed plans to reconstruct your residence do not meet the above criteria or if fill will be used to elevate the residence, your project will be required to be reviewed under the formal permit application process.

Submit documentation to:
Indiana Department of Natural Resources
Division of Water
402 W. Washington St., Room W264
Indianapolis, IN 46204

FEMA Website: **www.fema.gov** (Enter publication name and number in the Search Box at the upper right hand corner of the screen)

NGVD TO NAVD?

Regulatory floodplains are defined by the elevation of the base flood in relation to the elevation of the ground. Base flood elevations are used to determine the required elevation of new buildings in the floodplain. Floodplain management cannot succeed without accurate measurements of flood elevations, ground elevations and building elevations. Needless to say, if flood elevations are based on one system and ground or building elevations are based on another, things won't work.

NGVD 29 stands for National Geodetic Vertical Datum of 1929. It is the system of vertical measurement that has been used by surveyors and engineers for most of the 20th century and was the basis for relating ground and flood elevations. Now, however, it has been replaced by the more-accurate North American Vertical Datum of 1988 (NAVD 88). Because it has such an impact on floodplain management, it is important for local officials to understand what's happening.

First, what is "datum?" If we say that a flood will rise to 100 feet, one must ask "100 feet above what?" We need a consistent starting point so we can compare flood and ground elevations. The starting point for measuring elevations is our "datum plane," and the system and records we develop based on that plane are usually just called the "datum." In most cases, when we talk about elevations, we mean "above sea level." But some inland communities' elevation records were developed in relation to some other starting point. For example, the Chicago City Datum was developed with the level of Lake Michigan as its datum plane.

The National Geodetic Survey (NGS), the government people responsible for mapping, needed a common, consistent national datum plane from which to map the whole country. During the 1920s, the NGS established a network of 26 tidal gages in the United States and Canada. Maps were prepared with elevations based on "Mean Sea Level Datum of 1929." In the 1970s, the name was changed to National Geodetic Vertical Datum (NGVD) of 1929.

One reason for the name change was that it was found that the sea is actually not level. There are local variations caused by currents, wind, barometric pressure, temperature, sea bed topography, and salinity differences. The NGS ran more surveys around the country and had trouble making the numbers fit because mean sea level at one location was higher or lower than mean sea level elsewhere. This leveling work also found that ground elevations had risen or fallen due to earthquakes, subsidence, and rebounding of the earth that has continued since the glaciers receded. New satellite technology has discovered distortions in surveyed elevations caused by gravity.

Because of these shortcomings, the NGS established a new system on which to base elevation measurements. The North American Vertical Datum of 1988 (NAVD 88) corrects many of the problems with NGVD 29. It is also based on satellite systems that account for differences in gravitational forces in different areas. One can readily convert elevations in one datum to those based on another. For example, zero in the Chicago City Datum (CCD) is 579.48 feet above zero ("mean sea level") in NGVD 29. If one tries to compare ground elevation in CCD to a flood elevation in NGVD 29, the 579-foot difference will make it readily apparent that something is off. A simple formula can convert elevation from CCD to NGVD 29 , and vice versa.

Unfortunately, it's not so easy to convert to NAVD 88. The North American Vertical Datum is the product of thousands of corrections in elevation data. In the Rocky Mountains (where gravitational forces caused a lot of distortion to traditional surveys), the difference can be 3 feet or more. In other areas, the difference may be only a matter of inches. It takes a computer program called VERTCON to relate those two systems at any given point. (It should be noted that VERTCON 2.0 is not considered reliable beyond the boundaries of the lower 48 United States.)

Until recently, more FEMA Flood Insurance Rate Maps used NGVD 29. However, FEMA's new maps are using NAVD 88 as the basis for published flood elevations. If local surveyors or your community have not made the switch, errors will arise unless elevations in NGVD 29 or a local datum are converted to NAVD 88.

What is most import is that the same datum be used consistently. Since the base flood elevations used by the NFIP are on the Flood Insurance Rate Map (FIRM), the FIRM datum must be used for the FEMA Elevation Certificate, Letters of Map Amendment, Letters of Map Revision, and other insurance-related purposes.

A community and the surveyors in the community may normally use NAVD 88 for most purposes, but if the community's FIRM uses NGVD 29, then NGVD 29 must be used for all flood, ground, and building elevations on elevation certificates and other NFIP uses.

It is basically the responsibility of the professional surveyor, engineer or architect to use the appropriate datum on FEMA documents. However, the community must be aware of the potential for errors if more than one datum is used. You don't need to know the conversion factor between the two, but you do need to ensure that the same datum is used for all elevations on the same document. In time, that datum will be NAVD 88 for just about every community. Meanwhile, local officials should review their benchmarks and other elevation reference marks to ensure that they state which datum is referenced and that they are consistent with any code requirements.

For more information on datums and their use in FEMA mapping, see **www.fema.gov/pdf/fhm/frm_gsab.pdf.**

Reprinted from NFIP/CRS Update (Summer 2007 Edition)

NEW CFMS

CONGRATULATIONS to Indiana's newest Certified Floodplain Managers (CFMs)! Andrew Cochrane of Franklin, Anthony Kenning of Munster and Frank Stewart of West Lafayette passed the Certified Floodplain Manager (CFM) exam proctored by the Department of Natural Resources, Division of Water on March 27. With these latest additions, Indiana now has 64 CFMs.

The exam is offered each fall at the INAFSM conference and typically offered in the spring by the Department of Natural Resources, Division of Water. The next offering will be on Sept. 11, at the INASFM Annual Conference in Brown County, Ind. For more information on the CFM program or to register for the Sept. 11 offering of the CFM exam, visit the Association of State Floodplain Managers (ASFPM) Web site at **www.floods.org.**

CONFERENCE CORNER

INAFSM CONFERENCE

Indiana Association for Floodplain and Stormwater Management (INAFSM) Conference - Sept. 10-12, 2008, Nashville, Ind. The 12th annual INAFSM Conference will be held at the Abe Martin Lodge in Brown County State Park near Nashville. Visit **www.inafsm.net** to obtain the latest conference and registration information.

ASSOCIATION OF STATE DAM SAFETY OFFICIALS

Dam Safety '08 - Sept. 7-11, 2008, Indian Wells, Calif. The Association of State Dam Safety Officials (ASDSO) would like to welcome you to Dam Safety '08, one of the leading conferences in the United States dedicated to dam safety engineering and technology transfer. Dam Safety '08 will attract approximately 850 attendees from all 50 states plus Puerto Rico, and several nations. Go to **www.damsafety.org** for more information.

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The work that provides the basis for this publication was supported by funding under a cooperative agreement with the Federal Emergency Management Agency. The author and publisher are solely responsible for the accuracy of the statements, and interpretations contained in the publication. Such interpretations do not necessarily reflect the views of the Federal government.

THANK YOU

Darren Pearson, Greg Main, Debbie Smith, Bill Marsh, and Ed Reynolds.

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Waterlines is published biannually as a public service by the Division of Water, Indiana Department of Natural Resources. The cooperation and assistance of the National Weather Service is gratefully acknowledged.

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