WHY THE CONCERNS WITH LEVEES? THEY'RE SAFE, RIGHT?

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There are two kinds of levees in Illinois: Those that have failed and those that will fail!

WHOA! That's a bold statement! But, engineers know this. Floodplain managers know this. The citizens of New Orleans certainly should know this. Unfortunately, the citizens of Illinois still haven't completely caught on! We are a population at risk. Most don't even realize it.

Less than 3% of the people living behind levees in Illinois carry flood insurance. Many residents of the state have no idea that they live in "levee failure zones'. Since the flood in New Orleans, more and more attention has been focused on "residual risk". Areas that are protected by a flood control structure, yet at risk of flooding, are called areas of "residual risk". In Illinois, some residual risk areas can extend up to 15 miles back from the river. At risk are entire communities, huge industrial complexes, refineries, chemical plants, and nearly half a million people across the state! In Illinois, residual risk needs to be taken seriously.

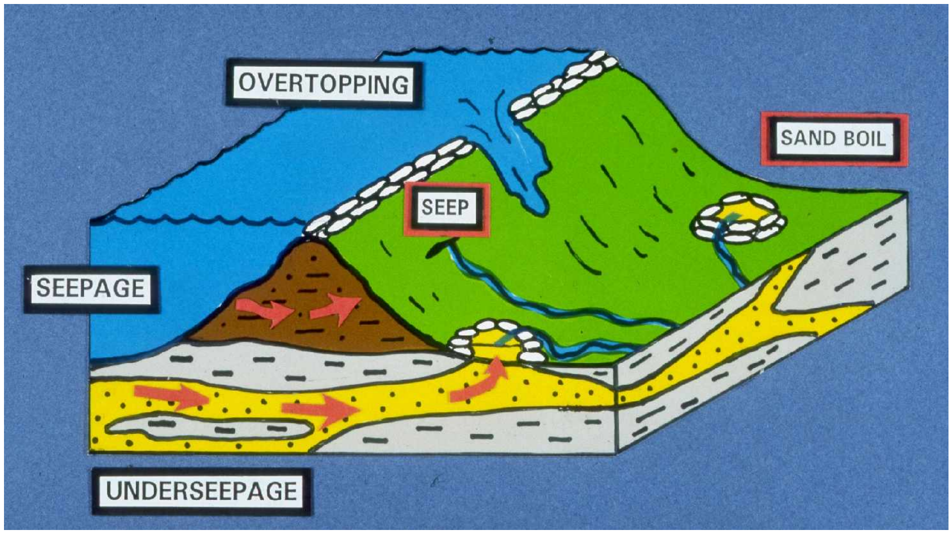
HOW OUR LEVEES FAIL

Levees are not "fail safe". They fail; plain and simple. Following the 1993 flood, the Illinois State Water Survey reported: "Despite significant improvements in levee construction, neither current knowledge about soil mechanics, hydraulics, hydrology, and hydrogeology, nor current construction technology are adequately considered in levee design and construction". We still don't know how to construct a fail safe levee.

Levees can fail in a variety of ways:

Overtopping - Most people that are involved with or protected by or perhaps just see a levee at some time in their life ponder the idea of a major flood sweeping over the top of the levee and the devastating impacts that would result. Levees are designed to provide a certain level of protection. When larger flood events happen, a levee will overtop. The overtopping failure of a levee is a relatively simple event to understand. It is akin to the overtopping of an earthfill dam. If water is allowed to flow over the top of an embankment constructed of soil for even a relatively short period of time, the shear stress exerted by the flowing water (velocity) can exceed the critical stress of the soils and the resulting impact is that soil particles will begin to be removed (erosion). Generally, the higher the velocity of flow over the levee, the more quickly that erosion will occur and cause a failure of the levee. Regardless of the standards used to design a levee, the levee can be overtopped by a storm event and therefore, is subject to failure.

Piping – In Illinois, levees are typically built on top of old alluvial materials and in many cases directly over old stream meander channels. Flood waters tend to travel thru these permeable materials and boil up on the back side of a levee. These ground water "conduits" can cause a levee to fail if sand or material is transported from underneath the levee foundation. Depending on the amount of material removed, the levee may settle unevenly, crack, or even completely fail.



Seepage and Saturation – In Illinois, flood waters on major streams tend to rise slowly and then recede slowly. When water is against a levee for a long period of time, they become saturated. As the levee becomes saturated, seepage through and sloughing of the soil can occur. The result is a loss of levee and foundation material stability and ultimately, failure. Seepage failures can be caused during a major storm event where the hydrostatic pressure imparted to the soils in and under the levee is sufficient enough to create unstable conditions in a portion of the levee or foundation material and the portion of the levee "collapses". It is standard design practice to construct relief wells along the interior toe of major levees to assist in reducing foundation seepage pressures.

Erosion – Most levees in Illinois are constructed of sand or alluvial materials. Both are among the easiest to erode. On larger streams and rivers, wave action caused by wind or boats can impact the river side slope of the levee. Levees can fail from gradual wearing down of the levee.

Structural Failures - Structural failures may occur at locations of gates, walls or closure structures. Many times, the lack of maintenance of these structures is a key component in the failure at these locations.

THE 1993 FLOOD AND "THE GALLOWAY REPORT"

Many of our levees along the Illinois and Mississippi Rivers were originally built over 100 years ago. In 1993, over 1,500 of these levees failed, many with disastrous consequences.

Following the 1993 flood, a Presidential Commission was established to determine the cause of the flooding and make recommendations to reduce the chances of future flooding. The report from this Commission is commonly called the "Galloway Report" named after the committee Chairman, General Gerald Galloway. This amazingly complete report is still considered among one of the best floodplain documents ever produced. Among the findings:

- Critical infrastructure should be protected
- Many levees are poorly sited and will fail again
- There is a need for better outreach to notify residents behind levees
- The purchase of Flood Insurance should be required behind levees
- Flood fighting and sandbagging of levees often worsens flooding for others
- Existing levees should be reconstructed at a set back distance from the river
- There should be no new levees to encourage development.

Unfortunately, many of the findings from this 1993 report, were ignored. In 2005, we saw the same concerns repeated after the flooding in New Orleans.

CERTIFIED LEVEES VS NON-CERTIFIED LEVEE

In Illinois, some levees are considered "Certified". Floodplain areas behind a certified levee are not shown on a Flood Insurance Rate Map. It is assumed that the flood risk has been removed due to the structural integrity of the levee. Mandatory flood Insurance is not required behind a certified levee. New development can be constructed below the flood protection elevation. Certified levees must meet the conditions of FEMA's levee certification criteria. Among the requirements are:

- At least three feet of freeboard above the 100 year protection level.
- Approved levee closure systems
- Embankment protection to prevent erosion
- Foundation stability to show that potential seepage has been addressed
- A plan to assess the potential of future settlement
- Pumps and drains to accommodate for interior drainage
- An approved operation and maintenance plan

In lieu of these detailed engineering analyses, a Federal agency with responsibility for levee design may certify that the levee had been adequately designed and constructed to provide 100-year protection.

Levees that do not meet FEMA's certification criteria, are considered "non-certified levees". Floodplain areas behind these levees are shown as if the levee simply does not exist. Flood Insurance and floodplain regulations are required.

As part of the Map Modernization effort, FEMA is no longer assuming that a previously certified levee still meets current certification criteria. FEMA has initiated a revised process to gain a better understanding of the actual flood risks for those citizens living behind levees. New levee certification must take place. This process is called the Provisionally Accredited Levees (PAL) procedure. For more information on levee certification and the mapping process, visit: http://www.fema.gov/plan/prevent/fhm/lv_intro.shtm

LEVEE DECERTIFICATION

Dozens of certified levees exist in Illinois. Most are located in urbanized areas. As part of the floodplain remapping and re-assessment, many certified levees in Illinois have recently been found to be in unacceptable condition. Once a certified levee no longer meets the FEMA certification criteria it MUST become de-certified.

The small town of Brookport sits entirely within the floodplain of the Ohio River. Much of the town is up to 15 feet below the flood protection elevation, but the floodplain maps don't show that risk. For nearly 10 years, the Brookport levee has had unacceptable inspections ratings. Despite these ratings, the FEMA floodplain maps have never shown any floodplain in Brookport. As a result, only one person in Brookport has a flood insurance policy. New maps have now been prepared for Brookport showing the true flood risk. Those maps will soon become the official floodplain map for Brookport.

The metro East St. Louis area is protected by a series of levee systems. These levees protect nearly 200,000 people located in 22 communities. In addition, the metro East St. Louis area is one the state's largest industrial areas. Chemical factories and oil refineries are common in the area. Last month, the Corps of Engineers reported that these levees were unacceptable. Despite these residual risks and the fact that without the levees, flood depths would be a staggering 24 feet deep in places, only 2.8% of the people in the Metro East have flood insurance. At the time of this article, the remapping of this region is still being debated. The results will be watched nationally.

The questions are complicated: Do we accurately portray the true residual risk or do we ignore the risk and place the population at risk.

RISK ASSESSMENT

Once it is acknowledged that a location is an "at risk" zone behind a levee, the next logical question is "how much risk"? Before the question of the risk that the levee imposes can be answered, it is important to state the basics of risk assessment. That being, the flood risk to a location or structure is equal to the product of the probability of the flood event and the consequences of the flood (probability_1 x damages). This definition also applies to a location or structure "protected" by a levee. The risk for this scenario is known as the residual risk and is defined as the portion of the risk that remains after a flood reduction structure (levee) has been built (probability_2 x damages). Usually, the probability of the flood event is greater than the probability for the residual risk event because the probability related to the residual risk event is related to an overtopping failure mode of the levee. It is important to note that because the failure of a levee can cause catastrophic impacts, the residual risks can often exceed the flood risk for a specific location or structure.

THE PARADOX OF LEVEE PROTECTION AND STANDARDS

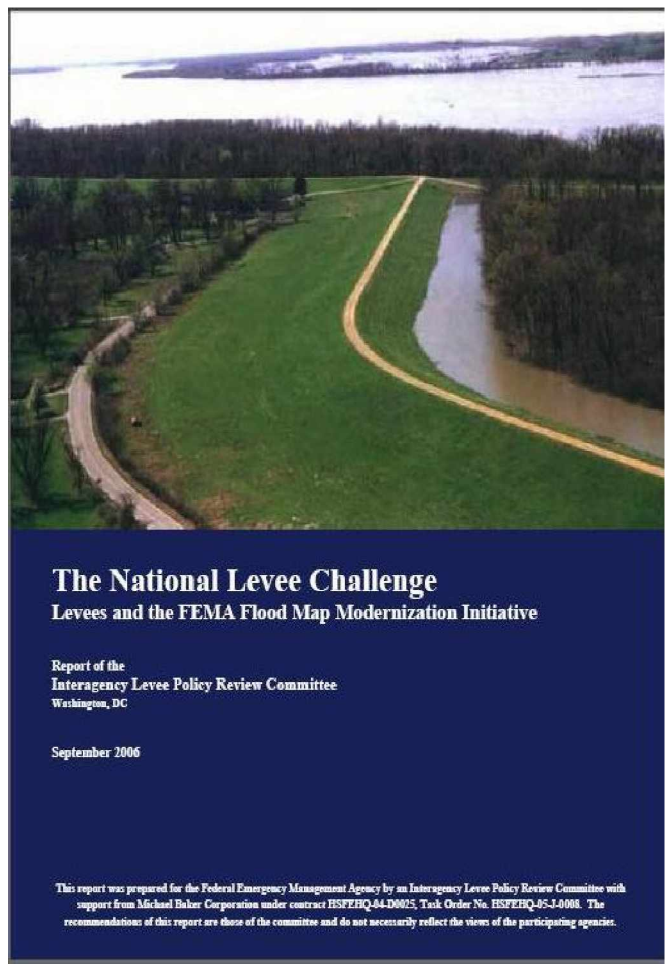
Most people living or thinking of living in a location where a levee provides a reduction in flood risk would agree that a 100-year levee would be a superior alternative to a 99-year levee. If the location under scrutiny follows the NFIP standards, “most people will be wrong”. Why? A structure located behind a 99-year levee will be required to be elevated to the 100-year flood elevation and flood insurance would be required. This significantly lowers the vulnerability of the structure. If the 99-year levee were to fail, much less damage would occur because the structure has already been elevated. Furthermore, damages that did occur would be covered by the insurance. Under the same failure scenario, a structure behind the 100-year levee is not required to be elevated nor carry insurance. Upon a failure of the 100-year levee the structure is likely to be heavily damaged and will likely have no insurance to cover the damages.

With the understanding of residual risk and the ongoing map modernization program areas prone to damage from a levee failure will be identified so that owners and local floodplain managers will understand that levees are flood risk reduction structures and not fall into the trap of believing that levees are flood protection structures.

NATIONAL LEVEE CHALLENGE RECOMMENDATIONS

Following Hurricane Katrina and the flooding of 2005, once again, a national committee was formed to seek answers on the levee issue. Their report, entitled “The National Levee Challenge” can be found on the FEMA website. Among the committee findings and recommendations:

- We don’t know what a levee is. We need a clear definition of “a levee”
- We don’t know where levees are located and how much population is at risk. We need to develop an inventory of all levees and identify location, ownership, age, and level of protection.
- We need to develop better levee design standards including a method to assess the subsurface foundation of a levee.
- We need better operation and maintenance of levees including scheduled inspections and renewed certification or decertification criteria.
- We need to manage residual risk including the identification of levee failure and dam failure zones, the preparation of emergency action plans, and outreach efforts to encourage residents to purchase flood insurance.



WHAT SHOULD YOU DO AS A LOCAL FLOODPLAIN MANAGER?
Local floodplain managers with levee risks should take immediate steps to protect your citizens. Placing the responsibility or blame on state and federal agencies will only continue to put your citizens at risk. Local officials can and should take these few simple steps:

- Identify the dams and levees in your community.
- Map the levee failure or dam breach zones in your community.
- Notify citizens who live in these areas of the potential risk.
- Encourage the purchase of flood insurance. There is an excellent flyer on the IAFSM website at: *illinoisfloods.org*. Pass this flyer on to citizens or insurance agents in your community.
- Prepare Emergency Action Plans to protect your citizens in the event of a levee or dam failure.
- Lastly….NO NEW LEVEES TO ENCOURAGE DEVELOPMENT…. The short term benefit of economic development is not worth the long term risk to property and lives.