

# Floodplain Development— Learning From the Great Flood of 1993

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NEARLY 14 YEARS AGO, THE NATIONAL NEWS WAS DOMINATED by stories of levee breaks and flooding along the Mississippi and Missouri rivers and their tributaries. In 2005, the story of the year was destruction on the Gulf Coast caused by hurricanes Katrina and Rita, compounded by the massive impact of two levee breaks that devastated neighborhoods in New Orleans. A year later, we saw serious flash flooding across the Northeast as a result of heavy local rains—up to 14 inches in places—with the entire state of Pennsylvania declared a disaster area.

Numerous other instances of flooding in areas along inland rivers impacted by flooding also have been documented, as has the continuing devastation of shorelands affected by hurricanes. Added to these traditional concerns is the fear of rising ocean levels from global warming that will affect not only coastal properties, but also inland riverfronts.

As quickly as these crises arise, they tend to fade from the public consciousness. More disturbing is the fact that we have seen few gains in terms of knowledge and commitment to changing land-use policies and practices to avoid repeat disasters. Instead, we remain destined to relive the past, perhaps with even worse consequences, as ongoing development occurs in flood-prone areas.

## CONSIDERING THE PHYSICS OF THE RIVER

Any assessment of the phenomenon of repeated flood-related catastrophes requires a brief review of the basics of floodplain development. A river system consists of two distinct components. The first and most obvious component is the water flowing within its banks. The area

between the riverbanks is technically termed the “flood way,” because it contains the runoff from the watershed—the area drained by the river—the vast majority of the time. When the volume of water coming downstream exceeds the capacity of the area between the riverbanks, floodwater overflows and spreads onto adjacent land.

Over the course of geologic time, hundreds and thousands of years, repeated flooding results in a build-up of alluvial soil—soil deposited by receding flood waters—on one or both sides of the normal river channel. This flat plain extends to the point where the land rises beyond the reach of the most severe flooding, often to a bluff where elevations increase steeply. This natural basin, the floodplain, is the second primary component of the river. However,



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because actual flooding occurs in this basin only periodically, there is a tendency to forget, or perhaps overlook, that this area is an integral part of the river system.

As long as there have been human settlements, people have sought to put floodplain land into productive use in support of human endeavors. This land is particularly attractive because it is flat, fertile and close to water. Perhaps most notable, in an urban context it also is less expensive than land outside of the floodplain. Conversion of floodplain land typically begins with the removal of bottomland forests to create crop or grazing land, followed by urban uses in many cases. The net effect of these changes is often that the volume and rate of runoff increase tremendously because there is a loss of natural land cover—forests, prairie grasses and brush lands—that has been replaced first by agricultural crops and grazing, and later by impermeable areas of pavement and buildings.

Once people invest in an otherwise flood-prone area, there is a natural desire to protect their investments. This leads to the building of levees, also referred to as dikes, to wall off rising floodwaters. When only one relatively small area of a floodplain is walled off from flooding by a levee, there is little impact on the river itself or on properties otherwise not so protected. The problem occurs when a system of levees is repeated along a much broader reach of the river. Then, when a dramatic increase in the volume of water is not allowed to spread out, the river rises higher and runs faster in the channel created by the levees. This effect is then intensified by higher volumes and rates of runoff from lands in the watershed.

### VICIOUS CYCLE

Once the first levees are built and the area is altered by the economics and politics of urban growth, a vicious cycle starts. The value of flood-protected land rises dramatically, causing other property owners to want to “get on the bandwagon.” More investment is made in the protected floodplain, so more people, businesses and governments have more at risk should the levee fail—and a growing stake in ensuring that it doesn’t fail. Eventually, steps are taken to raise the levee even higher to enhance the perceived level of protection.

As more and more areas along the river system are similarly treated, there is a dramatic and corresponding loss of capacity to store floodwaters. The result is a river channel much like a large ditch with high levees on both sides and

nowhere for the floodwater to go but up. At that point, the areas of protected floodplain also act as a bathtub, capturing and holding runoff from local streams that normally would flow into the river but cannot when the level of the river is above that of the floodplain.

### ONCE IN 100 YEARS

The current convention is that areas of a natural floodplain that have a 1 percent chance of being flooded in any one year are designated as being in the 100-year floodplain. To receive flood insurance, anything built in this area must either be raised above the level of the 100-year flood or protected by a levee that provides that level of protection.

Recalling the Great Flood of 1993, the Missouri River rose to breach levees and flood all but a few spots along its reach in central and eastern Missouri—the primary exceptions being the Riverport and Earth City business parks in suburban St. Louis County. The most dramatic levee failure was the Monarch levee, which provided nominal 100-year flood protection for an area on the Missouri River called Chesterfield Valley, located in the city of Chesterfield in west St. Louis County.

On July 30, an area of some 4,700 acres occupied by office and industrial parks, a large general aviation airport owned by St. Louis County government and a five-mile stretch of Interstate 64 disappeared under 10 feet of water. Because the levee break was in the upstream portion of the valley contained by the Monarch Levee, the floodwaters were very slow to drain out of that basin even as the level of the river dropped. Flood damage was estimated at more than \$320 million in 2006 dollars. Though no precise determination was possible because of limitations of historic records and continual changes in run-off characteristics throughout the river basins, the U.S. Army Corps of Engineers estimated that the 1993 flood was of lower frequency than a 100-year flood but not nearly as extreme as a 500-year flood—perhaps a 250-year flood.

The recovery of Chesterfield Valley since 1993 is a dramatic and inspiring story. Nearly a half billion dollars in public and private funds have been invested, with nearly 20 percent of that directed toward providing improved access and a 500-year flood protection system—a levee rated to withstand a flood level with a probability of occurring once in 500 years, or 0.2 percent probability in any one year. Business is booming, and the city of Chesterfield, along with the private interests that took the

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risk and invested in the recovery, are reaping handsome fiscal and economic rewards.

The new construction and economic activity in Chesterfield Valley, however, obscures the memory of that summer of 1993 when the Missouri River extended from bluff to bluff along its entire 250-mile length across Missouri. The river filled its floodplain—a distance some 10,000 to 12,000 feet wide, compared with the normal distance between the river banks of 1,000 to 1,200 feet. Simple math would suggest that, with a roughly 10-to-1 ratio of the normal river width to the width of its floodplain basin, and assuming an average depth of the 1993 flood across the plain of perhaps five feet, any attempt to protect large, extensive sections of this land from flooding is a practical impossibility.

### BUILDING AGAIN IN FLOODPLAINS

The recovery of Chesterfield Valley has certainly inspired major development activity in the other big floodplains that bracket the St. Louis region. A significant example is the emergence of a large planned residential community known as New Town in the city of St. Charles, which is across the Missouri River in St. Charles County.

Located in the heart of the vast alluvial plain near the confluence of the Missouri and Mississippi rivers, the project takes advantage of a unique geologic condition. It is located slightly higher than the rest of the floodplain—a matter of inches in some places and up to a few feet in others. Therefore, it has a lower probability of flooding than the rest of the bottomland area. Though this difference is not discernable to the naked eye, it was during the 1993 flood, when this area sat as a dry peninsula, albeit barely.

The developer of New Town, Whittaker Homes, engaged the new urbanist architect/planner Andres Duany of Duany Plater-Zyberg to prepare a development plan that provides housing products for a variety of incomes and lifestyles. Most important, the plan incorporates a storm-water collection and detention system that enables the ground floors of buildings to be raised several additional feet to a level at or above the 500-year flood elevation. The storm-water detention basins are treated as water features and community amenities. The planning concept of a pedestrian-friendly village with diverse housing types

in the manner of traditional neighborhood design has been eagerly accepted by the market, and additional phases are planned.

Despite its many positive attributes, there is good reason to be concerned that the New Town plan will become a catalyst for still more residential development in the St. Louis region's major protected floodplains. Similar areas planned and developed in the Missouri portion of the St. Louis region over the last 40 years have been reserved exclusively for nonresidential uses, thus avoiding placing residents and their homes and possessions at risk.

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For example, the city of Chesterfield's plan for its valley, completed in 1995, purposely excluded residential uses—even before the 1993 flood had excluded through zoning any new residential uses. (About a dozen original farm dwellings that predated zoning were inundated by the flood.) Likewise, the previously mentioned Earth City and Riverport business parks, which escaped damage from the 1993 flood in the Missouri River Valley, have excluded residential uses.

Now, however, the land-use plan for the area protected by the recently rebuilt Howard Bend Levee in the adjacent downriver city of Maryland Heights is being reconsidered. Chesterfield's market success with retail, office and service center uses in its floodplain district has yet to extend to Maryland Heights. Consequently, inspired by the success of New Town across the river in St. Charles County, the property owners who funded the construction of the new Howard Bend Levee in Maryland Heights have pressed the city to amend its land-use plan and development guidelines to enable residential uses within the flood-protected area.

### LESSONS LEARNED:

#### A GOOD NEWS, BAD NEWS STORY

The good news is that St. Louis developers and their host communities have clearly taken lemons and made lemonade with regard to floodplain developments since 1993.

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The Chesterfield Valley and New Town developments are economic successes that are inspiring other communities and developers to follow suit.

The net result is a rapid and accelerating pace of conversion of agricultural uses of floodplain lands to urban uses. From a real estate development perspective, the clear lesson is that out of catastrophe can come highly rewarding development opportunities along with dramatic gains in land value. By investing public and private funds to create a level of protection that sounds almost perpetual to the average person—500 years, or six to seven times the lifetime of most people—the perceived risks of levee failure and the kinds of losses experienced in 1993 wane and are discounted to zero.

The bad news, however, is that the lessons of past river events appear to have been lost as perceptions of risk and potential inundation continue to fade with each year that has passed since the flood. Private developers and investors continue to anticipate windfall profits from developments in the floodplains as the perceptions of danger continue to decline. Yet no one is realistically accounting for the collective impacts of the continued walling off of vast areas of floodplain with higher and higher levees, thereby increasing the height and speed of floodwaters in future floods and eventually eroding or even negating the increased levels of protection made possible by those very same levees.

Neither the U. S. Army Corps of Engineers nor the regional planners with the East West Gateway Council of Governments, the region's Metropolitan Planning Organization, appear to have much, if any, influence on local land use policies and practices. Floodplain land is being provided additional protection and converted from agricultural to urban uses, including residential.

The inevitable result is significant further reduction in the capacity of the region's big river floodplains to detain and slow the floodwaters of the Mississippi and Missouri rivers at the point they converge and are most powerful. It even appears that the stage is being set for the development of hundreds, if not thousands, of new residential

units in these nominally protected floodplain areas. Should this occur, the unwritten rules accepted by most local governments and developers in precursor developments over the past 40 years, which excluded new residential uses from these areas, will have been swept aside. With this, the level of potential human suffering and economic loss will grow substantially.

The concluding note is that enlightened members of the real estate community should join with public and civic interests to seek to impose limitations, if not exclude, the building of additional urban levees that will remove more land from natural floodplain areas. What has been done is done, and it would be unrealistic to call for removal or reversal of past commitments to floodplain development. Rather, efforts should be directed at not repeating these mistakes.

Certainly public floodplain insurance programs and corresponding public policies should be amended. And it should be clearly communicated that future development of urban levees and the investment in urban patterns of development fostered thereby will not be secured by government underwriting of the insurance or by direct payments for damages when those means of protection ultimately fail. ■

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