



PROTECTING OUR RESOURCES:
St. Charles County's Strategy for Floodplain Management

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***Protecting Our Resources:
St. Charles County's Strategy
for Floodplain Management***

St. Charles County, Missouri

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Part I: The Assessment

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I. Introduction

The Flooding Experience

Situated between the Missouri and Mississippi rivers, the potential for great floods is ever present in St. Charles County. Most of the flooding suffered by the county is produced by these two rivers, however, floodplains are also found along the Cuivre River and the Dardenne, Peruque, Femme Osage and Belleau creeks. Approximately 242 square miles, or 43% of the total land surface area of the county is subject to flooding.

By and large, annual flooding along the two rivers and their tributaries is not front page news. Only when problems occur – the Great Flood of 1993, the flooding in the spring of 1995, the Flood of 2008 and the most recent flood of 2013- do people get a glimpse of the pervasive impact that the rivers have on their lives. The cumulative weight of flooding’s impact on St. Charles County is a result of the usual, not just the unusual, flood events that occur.

The damage of flooding to the county is economically devastating. There have been catastrophic damages to residential, commercial, industrial, agricultural, and public properties - all with hefty price tags. Federal, state and local agencies have spent millions of public dollars on flood mitigation projects. Every year, the National Flood Insurance Program (NFIP) pays out thousands of dollars in flood insurance claims. Out-of-pocket expenses for residents can also run into the thousands.

Often understated, the emotional expense of flooding is immeasurable. Lifestyles become recast as residents and business owners are forced to relocate. The ability to easily reach jobs, clinics and hospitals, child care, senior citizen centers, supermarkets, homes of friends and families - central to social and economic well-being - is temporarily thwarted.

Seen in this light, the quality of life in the county is critically dependent on good flood mitigation planning. The County is determined to reduce future economic and emotional flood losses and has responded by developing a comprehensive floodplain management plan.

Protecting Our Resources: St. Charles County’s Strategy for Floodplain Management

The *Strategy* for St. Charles County has been prepared with the assistance of a Flood Mitigation Assistance grant from the Federal Emergency Management Agency, administered by the State of Missouri, Emergency Management Agency. The Strategy, which is a collaborative effort of the County’s business, government, and farming industries, attempt to achieve objectives including:

- a. Identifying the flood risk;
- b. Reviewing and determining the adequacy of flood mitigation procedures and projects;
- c. Developing strategies and priorities for reducing the risk;
- d. Evaluating the financial capacity of implementing flood mitigation projects; and
- e. Establishing an implementation schedule and responsible entity.

The challenge of the Strategy is much more than making sure that things do not go wrong. It is making sure that things go right for the many residents affected by the rivers. Achieving this

end, however, is not a matter of a few new big-ticket projects. Rather, it is carrying out, on a consistent, coordinated, and continuous basis, small and large strategic actions. Ensuring that good flood mitigation decisions are made in such a framework is the fundamental test before the Strategy.

The Community Context

The development of the Strategy began in October 1997 when the then St. Charles County Planning and Zoning Department received a Flood Mitigation Assistance Planning Grant. In the seventeen months leading to adoption of the Strategy, more than 350 individuals throughout the county took advantage of opportunities to participate in the process. Some of these individuals were quite familiar with “planning”. To others, the planning language was very new. But each had an important perspective on how the county could better address flood issues.

The County attempted to provide a variety of opportunities for members of the public to participate. Comprised of residents of the floodplain and local community leaders, a Flood Risk Mitigation Plan Technical Advisory Committee (TAC) was formed in February 1998. The 24-member TAC provided technical support, expertise and guidance to the Planning and Zoning Department. Soon after convening, the TAC formed four subcommittees in order to more precisely plan for established focus areas. The subcommittees were: Critical Facilities and Infrastructure; Agriculture and Environment; Economic Impact of Flooding and Housing; and Regional Stormwater Management. Each subcommittee developed a “report” that has been incorporated into the Strategy.

Over 1,000 residents and business owners of the floodplain were provided with a Flood Assessment Questionnaire. The questionnaire sought information on flooding experience and recommendations for flood mitigation activities. The 364 returned questionnaires have been analyzed and incorporated into the Strategy.

The Strategy was also reviewed by the Floodplain Vision Board. These citizens from the incorporated and unincorporated portions of the County advise the County Council on floodplain management issues. In January 1999, the board offered formal endorsement of the Strategy. The Strategy is reviewed annually by the Floodplain Vision Board and recommendations are made.

Written comments on the Strategy were also solicited from schools located in the floodplain, the Town of West Alton, and the City of Portage Des Sioux. Additionally, the county held a central open house on February 10, 1999 to provide interested individuals an opportunity to review a summary draft of the Strategy.

In addition to providing direction and substance to the planning process, the individuals and organizations who participated in the planning process also helped to preserve an interest in flood mitigation and in the ongoing implementation of the Strategy. The County wishes to express appreciation to them. Their continued involvement will be a key element in the successful, dynamic implementation of the Strategy.

II. A View of the County

General Location

Located in the east-central part of the state of Missouri, St. Charles County neighbors the Illinois counties of Calhoun, Jersey, and Madison and the Missouri counties of Lincoln, Warren, Franklin and St. Louis. St. Charles County is approximately 18 miles northwest of the City of St. Louis and is in the St. Louis Standard Metropolitan Statistical Area. The County has a total land area of 586 square miles, of which over 22 square miles is water surface.

St. Charles County is located at the confluence of the Mississippi and Missouri rivers. Approximately 70 percent of the county drains into the Mississippi River, with the remaining southern 30 percent draining into the Missouri River.

Natural Features

Soils

St. Charles County contains five major soil groups. Over 35% of total land area in the county is covered by the Large River Floodplains group. As flooding occurs regularly, this soil group is the most prohibitive to development and sanitary facilities.

Small Stream Floodplain soils constitute 9% of the total land area in the county and are also very prone to flooding. Where drainage is managed, this soil group can be used for agricultural purposes.

Rough Stony Ozark Landmarks constitute approximately 14% of the St. Charles County land area. Characterized by moderately sloping to very steep topography, this soil group is generally located on the uplands in the southwest portion of the county.

Deep Loess Uplands are perhaps the most diverse soils in the county. This group is characterized by nearly level to steep topography, generally good drainage and encompasses most of the City of St. Charles. This soil group is prime land for agriculture, development, and sanitary facilities.

Prairie Uplands and Glacial Uplands constitute 21% of St. Charles County. The vast majority of this soil group (70%) has been cleared of its natural vegetation and is now characterized by gently to moderately sloping topography. The slow permeability of these soils makes central sewer systems almost mandatory in any type of development where sanitary facilities are required. The soil ranges from well to poorly drained and is generally found in the western portion of the county.

Topography

The topographical relief in St. Charles County can be quite dramatic. Slopes ranging from 0-5.9% are primarily found in the river bottom land around the major drainage easements. As a result of this, most of these gently sloping areas are in the 100-year floodplain as designated by the Federal Emergency Management Agency (FEMA). Limited development is permitted in these areas. Steeper slopes ranging from 6-13.9% can be found in the central and western sections of the county. These are the slopes most conducive to types of development that require

a high density of structures or an intense use (i.e., residential, commercial, industrial). The sharpest relief, 14% grade or higher, is found in the southwestern section of the county.

Waterways and Water Bodies

The Missouri River has an extensive reservoir system in the headwater area that serves to assist control of natural water flow. However, the Mississippi River is not significantly controlled at medium and high stages above the confluence with the Missouri, despite an extensive system of locks and dams that maintain navigation depth but do not significantly alter mean and high flows. As a result, water and flood management on the Mississippi River is a more serious issue than on the Missouri River.

There are six major drainage basins in St. Charles County. Two of these, the Femme Osage Creek Basin and the Missouri River Basin, drain into the Missouri River. The Cuivre River Basin, Perique Creek Basin, Dardenne Creek Basin, and the Mississippi River Basin drain into the Mississippi Drainage network. These watersheds are an integral component of the natural hydrologic cycle of the county.

Wetlands

While wetland soils make up approximately 22.7% of the entire county, St. Charles County wetlands contain only those conservation areas where the wetland soils retain their natural vegetation from agricultural or development uses. The Geographical Resource Center at the University of Missouri-Columbia in 1988 estimated the forested wetland areas in St. Charles County totals 36.5 square miles and the non-forested wetland area totals 8.3 square miles. These areas are integral to the natural hydrologic cycle through the recharge of aquifers, water purification, erosion and flood control, and provide recreational opportunities for area residents.

Floodplains

Approximately 43% of St. Charles County lies within the floodplain. The floodplain, as regulated by the County, is divided into three sections: the floodway, the density floodway and the floodway fringe.

The floodway is the existing water channel, including the adjacent portion of the floodplain, where FEMA restricts any fill or obstruction by any type of structure that could possibly increase the potential for flooding in the surrounding area or downstream.

Within the density floodway, the maximum surface area of each lot/parcel that can be developed is limited to not more than eighteen percent (18%). Development of each lot/parcel shall be located on one of the higher areas of the property, and situated so that location and orientation provide the greatest overall floodplain conveyance. All applicable development within the density floodway also must be elevated at least one foot above the base flood elevation.

The floodway fringe is the portion of the floodplain surrounding the floodway and reaching to the outer extent of the floodplain. Development can occur in this area, but County regulations require habitable structures to have their lowest floor, including the basement, built at least one foot above the base flood elevation.

Transportation System

The County has a system of roads and bridges which stretches across approximately 2,357 miles and is one of the most rapidly developing in the state. Major highways include Interstates 64 and 70, Missouri Routes 364 and 370, U. S. Highway 61 and 67, and State Highways 79 and 94.

There are 255 bridges located in the County. Five bridges span the Missouri River and physically connect the County with the St. Louis metropolitan region. Congestion relief and preservation needs on these five bridges are perennial problems, as traffic has increased significantly. To accommodate this problem, a significant number of new lanes have been built across or proposed for the Missouri River.

The public transit services include a public transit system, a city-operated bus system, private bus companies, and taxi services. The Bi-State Development Agency provides express bus service to St. Charles County along the I-70 corridor. Bi-State buses serve five paved and lighted Missouri Department of Transportation (MoDOT) commuter lots located at Mid-Rivers, Cave Springs, Zumbahl, Fairgrounds and Fairlane Road. All riders are transported to the Hanley Metrolink Station.

Two of the longest rivers in the United States, the Mississippi River and the Missouri River are located in the County and provide a variety of uses. Recreational craft are kept in numerous harbors, boat docks, and clubhouses located along the Mississippi River. The greater volume of recreational craft can be found on the waterways on summer weekends. Melvin Price Lock and Dam 26 has been among the most heavily used in the lock and dam system of the upper Mississippi River. Barge tonnage is considerably lower on the Missouri River.

Two railroads provide freight service to St. Charles County. The Norfolk and Southern Railroad essentially parallels Interstate 70 from St. Charles to Foristell, while the Burlington Northern Santa Fe Railroad is located in the 100-year floodplain and extends from Old Monroe to West Alton, where it branches south into St. Louis County.

There are two public use, general aviation airports in the County. St. Charles County Smartt Airport is a 320 acre, publicly-owned, public-use facility owned and operated by St. Charles County. Two runways serve the airport, with lengths of 3,800 feet and 2,000 feet. St. Charles Municipal Airport is a privately owned, public-use facility situated on 97 acres. The airport is served by one runway, 3,500 feet in length and two utility taxiways.

Economy

St. Charles County is located within the St. Louis Metropolitan Statistical Area (MSA). A study commissioned by the St. Charles County Economic Development Council illustrated that in 1995, 70% of county workers commuted out of the County compared to 56% in 1990. In 2010, an estimated 64.8% of employed residents worked within St. Charles County.

Large employers within the County include retail and service industries, manufacturing, and construction.

Population Trends

The population of St. Charles County has increased from 144,107 people in 1980 to 212,751 in 1990, an increase of 47% and further increased to 283,883 in 2000 with an estimated population of 338,719 in 2006. Population figures for the year 2010 are an estimated population of 360,485.

St. Charles County is the third most populated and one of the fastest growing counties in the state of Missouri. There are seventeen incorporated communities within St. Charles County. These communities vary in population from the City of O'Fallon with 79,329 to the Town of Weldon Spring Heights with 91.

III. The Flood Plain

Scope of Flooding

An estimated 43% of St. Charles County is defined by FEMA as vulnerable to flooding. The interior creeks and rivers constitute 13% of the vulnerable land area, while the Mississippi and Missouri rivers endanger the remaining 30% of flood prone land. Much of the flooding occurs in the northeastern part of the county.

The Mississippi and Missouri rivers are obvious flood problems in the County. Flooding has been attributed to a number of conditions, including locally constructed levees that offer varying degrees of protecting. All of these levee units were overtopped during the 1973 and 1993 floods. The large rivers also increase the flood potential of tributaries due to backwater. Backwater impedes the ability of the tributaries to carry runoff from their basins. This causes a relatively minor storm to create a severe flood situation.

Bluffs and levees along the rivers increase the flood risk in the County. The existence of bluffs on the northern bank of the Mississippi River forces the river southward into St. Charles County during periods of high water. By protecting the urban areas surrounding the St. Louis metropolitan area, large levees constructed along the Mississippi River and Missouri River created a bottleneck forcing floodwaters to back up into St. Charles County. These natural and manmade features combined with the size of the Mississippi and Missouri rivers make St. Charles County extremely flood prone.

The flood-producing characteristics of the streams are similar to other small watersheds in the Midwest. The streams generally have steep slopes, causing rainfall runoff to concentrate rapidly, making the streams susceptible to flooding from high-intensity, short-duration storms. Flood flows from this type of storm are characterized by high peaks, high velocities, short duration, and relatively small volumes of runoff. Most of the flood-producing storms in St. Charles County have occurred during the months from April to October, but flooding has occurred during all four seasons.

The Cuivre River drains over 1,200 square miles. Its major tributary is Big Creek, which drains 112 square miles before joining the Cuivre River approximately 18.5 miles from its mouth. Large floods on the Cuivre River have occurred during all seasons of the year. Mississippi River backwater can cause extensive damage upstream to Big Creek. Cuivre River flooding is usually limited to less than one week; whereas backwater flooding from the Mississippi River may remain above flood stage for a much longer period.

The Dardenne, Belleau, Peruque, and Femme Osage creeks are typical of creeks in Missouri. They generally have steep slopes that cause runoff to concentrate rapidly resulting in flash floods. The floods are usually caused by locally intense storms and are characterized by high peaks, high velocities, short duration and small volumes of runoff. Most floods on these creeks have occurred during the months from April through September, but flooding has been known to occur any time during the year.

The Dardenne Creek drains approximately 102 square miles before entering the Mississippi River floodplain. The stream joins the Mississippi River approximately 32 miles upstream of the mouth of the Missouri River.

The Belleau Creek drains an area of 10.5 square miles to the north of the Dardenne Creek and flows into Dardenne Creek four miles above its mouth. Many roads along both streams are subject to flooding. Floods have occurred on both creeks during all seasons of the year. Two floods of note occurred in April 1970 and December 1982.

The Peruque Creek drains approximately 72 square miles of hill land before entering the Mississippi River floodplain, joining the river approximately four miles below the Cuivre River. Lake St. Louis is located on the creek, between Interstate 70 and U.S. Highway 40. The upper reaches of the creek are characterized by steep slopes, resulting in over bank flooding lasting from two to four hours. The lower reaches have relatively gentle slopes, resulting in flood flows that stay out of the banks for as long as 20 hours. Flooding in the lower reaches is usually more severe than in the upper reaches because of backwater from the Mississippi River.

The Femme Osage Creek drains an area of 75 square miles. Near its confluence with the Missouri River, the creek flows through a manmade channel for approximately 2,000 feet. The basin is predominately rural, and past flood events have not affected large numbers of people. Some flooding occurs almost every year. In 1957, the basin experienced eight floods. Flooding was also recorded in 1935 and 1951.

Historical Flooding

St. Charles County has always been prone to flooding due to its proximity to the Mississippi and Missouri rivers. Both archeological and geologic evidence shows that the area has been flooded repeatedly. Early European explorers such as Hernando De Soto described experiencing immense floods on the Mississippi River. Consistent historic records did not begin until the 1800's.

Three floods exceeding the 100-year flood frequency have been recorded: 1844, 1903 and 1993 on the Mississippi and Missouri rivers. The 1993 flood that reached a flood stage of 49.58 feet had a flood discharge of 1,080,000 cubic feet per second (cfs) at St. Louis, Missouri. The ten highest flood stages known on the St. Louis gauge are listed in Table 1 and a comparison of flood discharges is shown in Table 2.

Table 1: St. Louis Gauge: Ten Highest Stages

Number	Stage	Date	Q (cfs)	Frequency (years)
1	49.58	8/01/1993	1,080,000	175
2	43.31	4/28/1973	852,000	30
3	41.32	4/27/1844	1,300,000*	>500
4	40.28	7/21/1951	782,000	20
5	40.26	7/01/1947	783,000	20
6	39.27	5/04/1983	708,000	10
7	39.14	4/30/1944	844,000	25
8	39.13	10/9/1986	728,000	15
9	38.94	5/24/1943	840,000	25
10	38.67	7/01/2008	780,000*	25*

*Based on data provided by the U.S. Army Corps of Engineer, St. Louis office.

Table 2: Comparison of Peak Discharge Rates

Station Name	Drainage Basin (sq. mi.)	1993		Previous	
		Peak Stage (ft)	Peak Discharge (cfs)	Peak Stage (ft)	Peak Discharge (cfs)
Keokuk, IA (Mississippi)	119,000	27.15	435,000	21.0	360,000 (1851)
Hermann, MO*	524,200	36.97	750,000	35.5	892,000 (1844)
St. Louis, MO† (Confluence)	697,000	49.58	1,080,000	43.23	1,300,000 (1844)

*1844 discharges occurred before regulation

†1844 data estimated Policies and Programs

Effects of Flooding

Flooding along the Mississippi and Missouri rivers and their tributaries causes substantial, and often repetitive, damages to transportation systems, critical facilities, residential, commercial/industrial, and agricultural properties, and environmental features. Following is a summary of the effects of flooding on those areas.

Transportation System

Transportation systems include roads, bridges, railroads, transit systems, ports and airports. They are critical to disaster response and recovery, as well as to facilitating ongoing commerce. Damage to the system can leave portions of the County isolated and at economic risk.

Most flood damage to public facilities involves roads and bridges. These damages range from blown culverts and washouts on rural roads and county streets to loss of bridges and damages to interstate highways inundated by floodwaters. In extreme cases, travelers throughout the county experience detours into adjoining communities. The repair of flood-damaged roads and bridges generally is funded through the FEMA Public Assistance Program of the Missouri Department of Transportation. However, flood events have also placed a financial burden on St. Charles County, as over \$1,260,633 was expended as a result of the 1986, 1993 and 1995 flood events.

Historically, railroads were built in floodplains and river valleys to minimize construction and fuel costs. St. Charles County has one railroad traversing the floodplain. The Burlington Northern Santa Fe Railroad extends from Old Monroe to West Alton, where it branches south into St. Louis County. Generally, although the tracks are elevated on embankments above the elevation of most floods or are located behind levees, they remain subject to major flood events. The existing railroad bed, running through the northern part of the County, acts as a levee holding back water in some areas while causing damage in other areas when it is breached. In 1993, several miles of track were flooded. According to a representative of Burlington Northern Santa Fe, the railroad had over \$3,500,000 in damage to tracks, signals and bridges as a result of the 1993 flood.

St. Charles County's Airport Smartt Field is located ten miles northeast of the City of St. Charles, in the Mississippi River floodplain. A reliever airport for Lambert St. Louis International Airport, Smartt has two paved runways. Smartt is at 430 feet above mean sea level (MSL) or above. The airport experiences flooding when floodwaters of the Mississippi River exceed 430 MSL or 8.21 feet above flood stage. Flooding occurred on the airport property in 1973, 1979, 1983, 1985, 1986, 1993, 2008, and 2013. However, airport operations were interrupted only in 1973, 1993, 2008, and only for a short time in 2013.

Critical Facilities

Critical facilities in the County include public utility facilities, public buildings and structures, transportation facilities, pipeline companies, schools, hospitals, hazardous material facilities, and emergency response facilities and services. Damage or loss to these facilities can create critical problems for emergency response, life support in hospitals, business operation and cause eminent danger. Two examples of critical facilities often impaired by flooding are the Ameren Sioux power plant and the Duckett Creek Sewage treatment plant.

The Sioux power plant is located near the City of West Alton on the Mississippi River. Several substations and transmission towers are also located in the floodplain. When flooding occurs, the power plant is isolated due to its location on an area of high ground. It is extremely difficult for emergency vehicles and equipment to reach the plant during large floods. During the Flood of 1993, the plant was without railroad shipments of coal and highway access for personnel, supplies and equipment. National Guard rafting operations were required to transport vital supplies to the plant.

The Duckett Creek Sewage lagoon and the Duckett Creek Sewage Treatment Plant are also located in the floodplain. The plant and lagoon are protected by a non-certified 100-year levee.

Agriculture

A rich agricultural producing region, St. Charles County has approximately 783 farmers. The floodplain farm acres are used mostly for crops with few livestock operations. More than half of the total damages from the Flood of 1993 were to the agricultural sector and include damages to crops, livestock, fields, farm buildings, and equipment. Much of the agricultural damage occurred in upland areas as the result of wet fields and a short growing season rather than inundation by floodwaters.

Millions of acres of farmland are impacted when flooding occurs on the Mississippi and Missouri rivers and their tributaries as only a few working family farms are protected by private levees. The majority is unprotected or is within one of the several levee districts. Construction of levees within these districts is funded and therefore controlled by the U.S. Army Corps of Engineers (USACE). The largest district, the Consolidated North County Levee District (CYCLED), is located in the eastern section of the county.

A number of farms designed strictly for water fowl habitat also exist. These farms or duck clubs are located along the Mississippi River and are owned by either individuals or groups to provide good duck and goose hunting. The land is planted in crops that will attract water fowl and are leveed to provide flooded areas where migrating birds might land.

Agricultural census data and the Missouri Department of Agricultural statistical data reveal the economic impact the 1993 flood had on the agricultural sector. In 1992 corn was harvested on sales value of \$15,005,000. Soybeans were harvested on 58,000 acres with an average yield of 41.3 bu/A (state average 38 bu/A) and a total sales value of \$13,292,000. By contrast, 1993 statistics look much different. Corn harvested totaled 16,300 acres with a sales value of \$4,446,000. Soybeans were harvested on 13,200 acres with a sales value of \$3,435,000. The differences in acres harvested due to the flood are 76,000, and the difference in sales is \$20,416,000.

Residential/Commercial

In the County, single-family and multi-family buildings are often needlessly exposed to damage because of location in a hazard zone or because of structural weaknesses that make them vulnerable to damage. For some residences, stormwater runoff has been the major source of flooding.

The County estimates that approximately 802 residential and agricultural structures remain in the floodplains of unincorporated St. Charles County. Many residences are located in rural subdivisions scattered along the river, many of which began as hunting and fishing camps in the late 1940s and 1950s and evolved into year-round communities. Inexpensive housing can be found in these subdivisions due in part to the hazardous location. Subject to the greatest damage of flood waters, these areas also represent a significant amount of the County's repetitive loss structures. There are approximately 245 unmitigated residential structures that remain in the 100 year floodplain.

The most severe flood damage to residences was experienced in 1993. Despite the use of 33,000 tons of sand and 2.2 million sandbags, 4,300 homes were damaged by flooding. Of that number, more than 2,000 homes were found to be either uninhabitable or condemned. More recently, in the Flood of 2008, over 200 homes were damaged by flooding, with approximately 100 of those homes sustaining substantial damage requiring elevation of the residences to one foot above base flood. Many of those homeowners sought either buyout through a county sponsored FEMA grant or elevated with Increased Cost of Compliance (ICC) funds from their flood insurance policies. Approximately 30 homes were demolished either using ICC funds or demolition by the county after non-repair of the structure over a two year period.

More recently, in 2013, the county experienced subsequent flooding of the Mississippi over a period of 4 months from April through July. Approximately 20 homes experienced substantial damage requiring elevation or demolition of their homes.

Several businesses are located in the floodplain and include laundry mats, printing establishments, recycling and manufacturing companies, golf courses, a casino and others. Some of these activities, such as harbors or bait and tackle shops, are economically dependent of the very body of water that often inflicts damage and destruction. Most of these marinas were closed for the duration of the summer of 2008. During the flooding of 2013 many marinas were able to reopen in July with the brunt of the flooding affecting the West Alton area near the confluence of the Mississippi and Missouri rivers.

Mississippi and Missouri River flooding has major impacts upon these businesses. Inadequate floodproofing, lost productions time, sales declines, and inaccessibility have cost business owners several millions of dollars for flood mitigation activities. Thirteen businesses responding to the 1995 questionnaire administered by the St. Charles County Emergency management Agency reported over ten million dollars in damage due to flooding in 1986, 1993 and 1995. And for the 1998 Flood Risk Assessment Questionnaire, three businesses reported over a two million dollars loss due to lost sales and cleanup costs also for 1986, 1993, and 1995 floods. These emergency response and recovery expenditures are eventually passed on to the consumer, in the form of higher prices.

Environmental Resources

Environmental damage caused by flooding has no dollar amounts attached to it, but environmentalists and scientists have pointed out some of the impacts. Over the course of a flood, raw sewage, agricultural and industrial chemicals, and other toxic substances spill into waterways and floodplain.

Thousands of acres of land can be covered with thick layers of sand or huge scour holes that pockmark the floodplain, lose vegetation due to lack of oxygen, and experience a reduction in wildlife due to loss of habitat and interrupted breeding cycles. The Mississippi River erodes in many reaches. Tributaries to the Mississippi and Missouri rivers also experience destruction caused by erosion and sedimentation, and the accelerated spread of zebra mussels, a foreign species that threatens native mussels in the Midwest. In addition to the erosion of the rivers and tributaries, erosion of valuable topsoil can be a major problem.

The Flood of 1993 caused substantial tree mortality in the Mississippi River Floodplain. A large percentage of canopy trees, saplings and smaller juvenile trees were killed or nearly wiped out. On the Missouri River, some levees reportedly lost considerable vegetative cover due to scour and prolonged inundations.

1993 Flood Events

In 1993, the Mississippi and Missouri river basins experienced some of the worst flooding in recorded history. A wet fall and winter combined with unprecedented rainfall in the upper basins during July resulted in floods exceeding the base flood of 100-year level. St. Charles County, extremely vulnerable to flood damage due to its location at the confluence of the two largest river systems in the United States, received unprecedented levels of flood damage. The County was placed under three separate Presidential Disaster Declarations between April and November 1993. At the height of the flooding in 1993, nearly 200 square miles of the County were under water. Some properties were under water from early spring until late fall. Boats became a primary transportation mode for some residents as their homes flooded in April could be reached by no other means.

The 1993 floods had their beginning the previous year. The fall of 1992 was rainy, saturating the ground and keeping the river levels high. Heavy winter snows all over the Midwest increased the amount of water present within the upper Mississippi River Basin. Although spring flooding along the Mississippi River is a common occurrence in the County, the 1993 floods were greater than average. Due to significant damage, a Presidential Disaster Declaration was issued on May 11, 1993 for Lincoln and St. Charles counties.

During the months of May and June, the Mississippi River receded slightly allowing some residents to begin repairing their homes. However, in late June, a stalled Bermuda High over the southeastern portion of the United States and an abnormally cool air mass over the northwestern and north-central United States resulted in a continual rainfall over the upper Mississippi and Missouri river basins.

Rainfall exceed all records with rainfall in July across the upper Mississippi River Basin exceeding 443% of normal and 462% of normal across the Missouri River Basin. A second Presidential Disaster Declaration was issued on July 10, 1993 for several counties throughout the Midwest. However, the flood crest did not occur in St. Charles County until August 1, 1993, nearly three weeks later.

At the crest of the flood in St. Charles County, nearly 30% of the land area was under water. Flood waters from the Mississippi and Missouri rivers covered their floodplains and caused backflooding on the Dardenne, Femme Osage and Peruque creeks and the Cuivre River. The

confluence of the Mississippi and Missouri rivers moved 24 miles upstream in St. Charles County, overtopping levees and completely inundating the communities of West Alton and portage Des Sioux.

By the time the water receded, the flood damaged over 4,300 structures and forced approximately 2,000 families from their homes and farms, including over 400 families in three mobile home parks. Any crops planted by farms in the areas flooded were ruined and due to the length of the flood, no further planting was possible for the year. The total losses in the County were estimated to exceed \$65 million. The extent and duration of the flooding and the resulting level of damage surpassed any reckoning of past county officials.

Disaster Response

St. Charles County responded to the flood disaster in several innovative ways. First, the County developed a damage assessment and permit review procedure that has been considered a model by the FEMA. Second, the County opened a centrally located office that included not only the County's buyout program, but also a number of social service organizations – a one stop shopping office for flood victims. Third, the County ended its policy of apparent non-intervention in the floodplain and created a citizen's committee to review floodplain management throughout St. Charles County. The County also applied for participation in the National Flood Insurance Program's Community Rating System.

St. Charles County's damage assessment and permit review procedure was a three-step process consisting of damage inspection and assessment, home owner review and negotiation. The Building Department sent out teams of inspectors to review each flood damaged structure in the county and determine the level of damage using fair market value. Each structure was tagged based on the damage level with a green (Safe 0% to 25%), white (Uninhabitable 26% to 49%) or orange (Condemned 50% or more) placard. The damage inspection reports were turned over the Planning Department which then notified the property owners of the level of damage. Owners of condemned properties were instructed to set up an appointment to review the damage reports and to discuss the available options.

The next step was negotiation. The owner of a condemned structure had four options: to demolish, to elevate, to prove damage was less than 50% of market value, or participate in the County Buyout Program. (After October 1993, replacement value had to be included in the calculations due to a directive from FEMA). Proof of the repair cost was determined by either submitting bids from contractors or a bid by the owner showing the cost of repair if done by himself/herself. The homeowner was allowed to charge only \$4.35/hour for labor which often greatly reduced costs. However, all materials whether donated or otherwise had to be given a value. All bids were reviewed by the Building Department for accuracy.

For many people, particularly the elderly and those with limited incomes, reconstruction was not a viable option. In order to meet the needs of these individuals and to reduce the number of vulnerable structures in the floodplain, St. Charles County decided to participate in the federal acquisition program. By the end of 1994, St. Charles County had received nearly \$20 million in FEMA 404 and Community Development Block Grant funds and had acquired three heavily damaged mobile home parks (430 structures) and over 400 single-family residences.

The St. Charles County Buyout Program was unique not only in its size, but also in its structure. The County invited other social service agencies to locate within the same office as the Buyout

Program with the overall name of Project Recovery. These groups included the Salvation Army, Flood Relief Services (a mental health organization), Disaster Relief Service (an umbrella group of local social services organizations), Mid-East Area Agency on Aging (social services for the elderly), and the Unmet Needs Committee. This grouping of related organizations in one location enabled St. Charles County to increase the assistance available to flood victims and to decrease the difficulty in accessing it.

Repetitive Loss Areas - 2013

The primary areas of repetitive losses are the subdivisions and other residential development along the Mississippi River and surrounding farmlands. These developments occurred in the 1950's and 1960's prior to the institution of the NFIP and zoning. Many of these residences have not been elevated or floodproofed sufficiently to protect them from even limited flooding.

There are few repetitive loss properties along the Missouri River. This is due primarily to the limited number of structures in the floodplain. Some of the area is protected by levees, but these are of an agricultural nature and provided limited protection.

Some repetitive losses occur along the interior creeks. However, much of the area is either relatively undeveloped, has had development occur outside the floodplain or is within incorporated communities and therefore outside the jurisdiction of the County.

Several properties have cumulative flood insurance payments exceeding the property value. A property located in the Mississippi River floodplain, valued at \$35,079, made eight claims totaling \$143, 275. In twenty-one years of ownership of a property located adjacent to the Mississippi River, one property owner made thirty NFIP claims. The property is valued at \$53,486; the claims totaled \$157,807.

Many repetitive loss properties have a history of four or more flood losses from 1978 to 2011. This number suggests that these properties will continue to flood if they remain in the floodplain and are not mitigated.

The record-setting and unprecedented flooding that lasted from the spring of 1993 into the early part of 1994 served as the catalyst for Missouri governments to look for solutions to the devastation and suffering caused by the massive floods. As a result, voluntary acquisitions or buyouts of flood-prone properties became the choice of action using Federal Emergency Management Agency, state and local government funds. The program has been widely successful and proved itself again during the floods of 2008 when 8 additional residences were acquired.

For the 2013 flood, it is estimated that more than 600 of the "bought-out" property sites were again flooded to a depth of 5 to 8 feet depending on location. This amounts to more than 600 flood insurance claims that could have multiplied into hundreds of thousands of dollars.

IV. The Flood Hazard Area

Floodprone Buildings

There are a number of buildings located within the floodplain, but most of the estimated 4,000 structures in the floodplain are residential or agricultural (barns and grain bins). The Dardenne Creek floodplain, upstream of the City of St. Peters, contains residences along with some commercial buildings, but the most northern part of the floodplain is used for farming. On Belleau Creek, residential development has occurred, a few commercial structures are scattered along the floodplain. Most of the buildings on the Peruque Creek floodplain are farm buildings. Part of the Cuivre River floodplain is used for recreational purposes, such as club houses. Big Creek and its tributaries are surrounding by agricultural land and park land with very little development in the floodplain. The floodplain areas of the Femme Osage Creek basin, except for a few roads and bridges, have been left relatively free of encroachment. Some recreational and residential development exists in the floodplain of the Mississippi River, but most of the land is used for agriculture. With the exception of a few primary residences, agriculture is the primary land use along the Missouri River floodplain.

Floodprone Infrastructure

There are many roadways, bridges, and culverts located in the floodplain. During flood events, several public roads are closed or inaccessible. According to the 1998 Flood Assessment Questionnaire, roadways that are repetitively flooded included:

Airport Road	Fox Hill Road	Orchard Farm School Rd.
Alice Avenue	Gutermuth Road (elevated)	Parr Road
Arrow Rock Drive	Hoff Road	Peruque Creek Road
Augusta Bottom Road	Huster Road	Portage Road
Barwise Road	Highway 79	Riverview Road
Blase Station Road	Highway 94	St. Peters Road (elevated)
Brown Road	Highway B	Salt River Road (elevated)
Church Road	Highway F	Silvers Road
Dalbaw Road	Highway H	South Main Street (elevated)
Defiance Road	Highway K (elevated)	Twin River Road
Dietrich Road	Highway N (elevated)	Upper Bottom Rd (elevated)
Dingledine Road (elevated)	Highway P	U.S. Highway 67
Ell Road	Highway V	Weston Woods Lane
Elm Point Road (elevated)	Koch Road	Wiess Road
Feltes Road	Lakeshore Drive	Willow Club Road
Femme Osage Road	Matson Hill Road	Wilmer Road
Firma Road	Mertz Road	Woodland Park Road
Flatwoods Road	Mette Road	Woodstream Drive

Highway 94 North is a major access road from the City of St. Charles to the Town of West Alton, the City of Portage Des Sioux, and other northern portions of the County. Flooding of Highway 94 North can result in the isolation of these communities and residents, in addition to impairing emergency vehicle access.

Critical Facilities

St. Charles County has a number of special hazards and critical facilities located in the floodplain. The primary special hazards are a series of pipeline and the Ameren power plant. Numerous underground pipelines cross and carry various petroleum products and chemicals across the country. The pipelines enter St. Charles County in the east at the confluence and continue westward following Interstate 70 into Warren County and northwest along the Burlington-Northern Railroad Santa Fe Railroad into Lincoln County. A list of the pipeline companies and the products carries can be found in Table 3.

Table 3: Hazardous Materials

Company	Type of Material
Explorer Pipeline Company (24" pipe)	Refined Petroleum, Aviation Fuel
Amoco Pipeline Company (12" pipe)	Refined Petroleum
Platte (Marathon) Pipeline Company (20" pipe)	Crude Oil
Missouri Pipeline Company (16" pipe)	Natural Gas
Shell Pipeline Company (22" pipe)	Crude Oil
Conoco Pipeline Company (10" pipe)	JP5 Jet Fuel, Refine Petroleum Products
Koch (Woodriver) Pipeline Company (20" pipe)	Crude Oil
Gulf Central Pipeline Company (6" - 8" pipe)	Anhydrous Ammonia
Arco Pipeline Company (Currently unused)	Kerosene
Burlington-Northern Railroad	Various
Norfolk-Western Railroad	Various
Commercial Barge Traffic (Missouri/Mississippi)	Various
Ameren Union Electric Sioux Plant	Various
Hasco International	Various
Boeing Radar Site	Various
Leonards Metal	Various
Lewis and Clark Sawmill	Various
Agricultural Facilities	Gasoline, Herbicides/Pesticides, Anhydrous Ammonia, Various
Smartt Field	Aviation Fuel

Other critical facilities in the floodplain include:

Schools

- Orchard Farm School District

Emergency Response Facilities and Services

- Rivers Pointe Fire District
- Augusta Fire Protection District
- Orchard Farm Fire Department
- St. Charles City Fire Department
- Portage Des Sioux Police Department
- O'Fallon Fire Protection District
- O'Fallon Police Department

Hazardous Materials Facilities

- Boeing Radar Site
- Leonard's Metal
- St. Charles City waste treatment plant
- Harbors (storage of marine fuel) along the Mississippi River
- Agricultural facilities (anhydrous ammonia, etc.)
- Gasoline service stations

Public Utilities

- AT&T
- Telecom telephone distribution
- St. Charles County well fields
- Cuivre River Electric facilities, substations and distribution
- Portage Des Sioux Water Treatment, Riverview Drive

Areas That Provide Natural and Beneficial Functions

A number of State and Federal agencies maintain open areas in the floodplains. The Army Corps of Engineers, the Missouri Department of Conservation, and the Missouri Department of Natural Resources are the primary holders of public lands. These areas provide recreational opportunities in the forms of hunting, fishing, nature outings, hiking and bicycling.

The Missouri Department of Conservation operates and maintains the August A. Busch Memorial Wildlife Area (6,986.58 acres) and the Weldon Spring Wildlife Area (7,355.95 acres). These adjacent parcels are located in southwestern St. Charles County, along Highway 40/61 and Highway 94 South. Both wildlife areas are maintained as open space and offer hunting, fishing, hiking and conservation education.

A wildlife refuge located on the south side of north Highway 94, Marais Temps Clair Wildlife Area is also maintained and operated by the Missouri Department of Conservation. The wildlife area is designed to create wetlands habitat replacement and open space. Limited duck hunting and public touring are permitted uses. This area is located within the Missouri River floodplain.

The Missouri River Trail (KATY Trail) is a 200-mile hiking and bicycling trail located on an abandoned railroad corridor along the Missouri River. The trail, developed by the Missouri Department of Natural Resources, stretches from Machens in northeast St. Charles County to Sedalia, Missouri. Approximately 32 miles of the trail are open for public use in St. Charles County, from the City of St. Charles to the Warren County line.

The Edward "Ted" and Pat Jones-Confluence Point State Park, at the confluence of the Mississippi and Missouri rivers, is comprised of approximately 1,121.43 acres and is managed by the Army Corps of Engineers. Serving as a reservoir for a number of endangered species, Riverland is a demonstration area for reversion to riverine/wetlands ecosystems. The area, managed by the U. S. Army Corps of Engineers and the Missouri Department of Natural Resources, provides an excellent area for conservation education and general use as open space.

The County owns approximately 2,613 acres of undeveloped land that has been converted to park land under the County park system. The County currently has twelve parks that include floodplain, intermittent draws or valleys, and second growth forests. After the 1993 flood, the County acquired three mobile home parks located in the Missouri River floodplain. These sites total 100 acres and have been deeded to the City of St. Charles. Adjacent to the Mississippi River, Hide-A-Way Harbor comprises approximately 48 acres. It is a former marina with boater and fisherman access.

Development Trends and Constraints

The primary region of development in St. Charles County has been a triangular area bounded by Interstate 70 on the north, KATY Trail on the east and U.S. Highway 40/61 on the west. This area is not located within the floodplains of the Mississippi and Missouri rivers. However, the Dardenne, Peruque and Belleau Creeks all flow through the area and drain into the Mississippi River. These streams experience flash floods and some backflooding from the Mississippi.

Development on properties along the interior creeks tends to avoid the areas delineated as floodplain. This is primarily due to the insurance requirements of the NFIP for federally backed loans and the development of storm water management regulations. Also, land designated as floodprone is less desirable and therefore less marketable than areas outside the floodplain.

In general, the main river floodplains have experienced little development pressure and remain primarily agricultural. The severity of the flooding and the regulations of the NFIP have discouraged development on a large scale. The few homes built in that area since 1978 have been elevated and/or placed on the few remaining areas of high ground.

Limitations on fill set by the Army Corps of Engineers have made construction costs higher for structures in the floodplain. An estimated \$40,000 to \$50,000 can be added to the construction cost of a typical residential structure if it is elevated to eight feet above ground level. This does not consider any of the costs for construction to meet the needs of the physically disabled or an individual with medical problems. Also, the length of time required for construction in the floodplain is longer due to more complex review requirements.

A significant constraint on development within the floodplain is the NFIP. St. Charles County joined the NFIP in 1978. Since then, the Unified Development Ordinance of St. Charles County (UDO) has required that all new construction in the county be built with the lowest level one foot above the base flood elevation. The UDO also establishes regulations for floodway, floodway fringe, and density floodway district. Appendix A is the Floodplain Regulations. Much of the area subject to flooding has been zoned A, Agricultural District with Floodway or Floodway Fringe Overlay Districts. In the Agricultural District the minimum lot size is five acres to ensure sufficient land for on-site septic and as a disincentive to development. Permitted uses in the A zones are agricultural uses such as farming, pasture, nurseries, and forestry; residential uses such as lawns, gardens, parking and play areas; non-residential uses such as loading areas, parking and airport landing strips; and public and private recreational uses such as golf courses, archery ranges, picnic grounds, parks, wildlife and nature preserves.

The St. Charles County Unified Development Ordinance requires all subdivisions platted in the unincorporated sections of the County to show the boundaries of the base flood on the recorded plat. In residential districts, special flood hazard areas must be located on common ground and not on individual lots. Through the UDO the County also requires that all new subdivisions with lots less than three acres in size have storm water systems to eliminate any increase in stormwater runoff.

V. Conclusions, Implications and Issues

Floodplain management in St. Charles County is a complex issue. The widely varying types of floodplain, the development pressures in the interior creeks and the many governmental jurisdictions combine to make decision making a slow and complicated process. It is apparent that there is a need to always seek to improve floodplain management and mitigation. There is considerable federal and state emphasis placed on proactive, preventative flood mitigation projects rather than the reactionary band-aid efforts that have been typical past responses to the flooding situation. The Federal governments will no longer help residents rebuild at the risk of the next deluge. Rather, a new vision for floodplain management looks beyond response to specific disasters and toward regional cooperation and planning, strategy and broad-based decision making, and efficient use of resources.

This section identifies some conclusions of the Technical Advisory Committee, the 1998 Flood Assessment Questionnaire, and previous planning efforts and identifies associated implications and issues. It is not intended to be a comprehensive listing of all deficiencies, but rather a concise summary of the most frequently cited problems. Categories are consistent with previous sections and are divided into transportation system, critical facilities, agriculture, residential/commercial, and environmental resources.

Table 4: Conclusions, Implications, and Issues

Category	Conclusion	Implications	Issues
Transportation	Many highways, arterials, Collectors and minor roads are damaged, closed or inaccessible during and after flooding	Lack of access to employment and for emergency services. Isolation of residential communities.	There is a lack of federal, state and local funding to rebuild many roadways, especially minor roads. Minor roads will not be funded through the Transportation Equity Act for the 21 st Century (TEA-21). Projects to address frequently flooded county roads have been developed and implemented.
	The Burlington Northern Railroad Santa Fe tracks, signals, etc., are damaged during and after flooding. Part of the Railroad bed acts as a levee ins some areas.	Railroad operations can be suspended; cargo will not reach clients at all or in a timely manner. The railroad bed “levee” causes damage when breached.	A source of funding to study free-flow water structures under the railroad has not been identified.
	The St. Charles County’s Airport Smartt Field can flood when floodwater of the Mississippi River exceed 430 MNL.	Lack of aviation access and service to patrons.	A flood protection levee would prevent future flooding, but is considered an “encroachment” by the Federal Aviation Administration. A flood study has not been performed.
Critical Facilities	Major flood risks to the Ameren power plant and telephone services.	Plant or service shutdown or isolation.	Lack of adequate levee protection. Relocation of some facilities is not probable, flooding will continue.
	Major flood risks to underground pipelines carrying various commodities.	Potential washout or leakage.	Relocation is not probable.
	Damage to fire and EMS services.	Threat to public health and safety.	Some facilities cannot be relocated due to a decrease in emergency response time.

Agriculture	Thousands of acres can be lost during major flooding due to location and levee failure.	The agricultural sector can lose several million dollars in destroyed crops, buildings and machinery.	Lack of adequate public funding for secondary levee repairs, clean-up fields, etc.
Residential/ Commercial	Several hundred residential and commercial properties are located in the floodplain and experience flooding.	Property owners experience personal and property losses and are displaced.	Efforts will continue to monitor residential and commercial structures for compliance with UDO floodplain requirements.
	The County has approximately 245 unmitigated repetitive loss structures.	These properties continue to deplete the NFIP.	Many homeowners will not accept buy-out and prefer to live along the river. Tracking of building permits allows for cumulative costs requiring elevation.
	Properties in the floodplain are safeguarded by many agricultural levees that provide limited protection.	These properties continue to flood.	Lack of federal support to increase height of some levees.
	Some properties are flooded by stormwater runoff, rather than by a river or creek.	As development in the County continues stormwater will be an increasing problem.	Lack of a regional authority.
Environmental Resources	River and stream banks erode in many reaches. Development and flooding cause erosion.	As development and flooding continues, erosion will be an increasing problem.	Unincorporated St. Charles County requires a Land Disturbance Permit and a minimum 25 foot setback from natural watercourses.

Several conclusions can be drawn from the County's past flooding experiences. First, developed floodplains tend to stay developed. Structural controls such as levees must stay to protect existing development in previously developed floodplains. However, future development must be controlled and directed to limit future losses. Also, the construction of new structural controls must be limited in order to avoid continued development in flood prone areas.

Second, funding needs to be made available to assist individuals and business owners in floodproofing structures. Floodproofing can be anything from raising utilities such as furnaces or meter boxes above the base flood level to raising houses. The benefit of such funding is a known reduction in flood insurance claims. Residents should take advantage of the Increased Cost of Compliance coverage in their flood policies.

Third, the County must continue to maintain its elevation ordinance when the development of properties is located within the designated special flood hazard area. By not allowing any variance to this ordinance, county residents continue to gain some relief in their flood policy premiums with significant reductions in price due to the County's continued participation in the Community Rating Service (CRS).

Part II: Action Plan

*Outcomes for the Future
Strategies to Confront Local Concerns
Initial Steps in Implementation
Protecting Our Resources Revisited*

VI. Outcomes for the Future: Goals and Objections

The many waterbodies that traverse the county are evolving and dynamic. Recognizing that fact, St. Charles County attempts to balance the every-changing nature of the floodplain with relatively static community needs. Toward that end, three key goals guide the County's strategy for floodplain management:

- modify human susceptibility to flood damage;
- modify the impact of flooding on individuals and the community; and
- preserve and restore the natural resources and functions of floodplains.

The following goals and objections focus on specific subject areas and what roles they play in achieving the larger key goals. They describe the optimal floodplain management situation from five perspectives: transportation system, critical facilities, agriculture, residential/commercial, and environmental resources.

Transportation

Goals:

- Improve existing County streets and culverts to acceptable levels of capacity and safety.
- Provide adequate protection for airports and railroads.
- Plan for the construction and financing of transportation facilities that are critical to emergency response and recovery.
- Reduce the limited accessibility of emergency vehicles during period of flooding.

Objectives:

- Explore and coordinate financing strategies and planning efforts for transportation facilities affected by flooding with the Missouri Department of Transportation and the St. Charles County Road Board. (ongoing)
- Raise, where appropriate, rail facilities located in the 100-year floodplain.

Critical Facilities

Goals:

- Provide adequate protection for all critical facilities.
- Coordinate emergency preparedness and decision-making with the County and critical facilities operators.
- Relocate emergency buildings out of the floodplain.

Objectives:

- Ensure adequate levee protection. Investigate the possibility of a universal levee height of 20 year. (completed)
- Improve upon the coordinated emergency preparedness and planning process. (ongoing)
- Remove threatened critical facilities and emergency buildings from the floodplain.

Agriculture

Goals:

- Provide protection for agricultural lands in the floodplain.
- Establish methods to manage and preserve agricultural lands in the floodplains.

Objectives:

- Ensure adequate levee protection. Investigate the possibility of a universal levee height of 20 years. (completed)
- Limit development within the floodplain to agricultural and recreational uses through the UDO. (completed)
- Improve emergency information to farmers such as additional river gauges, river stages reporting units, flood forecasting, and elevation markers. (ongoing)

Residential/Commercial

Goals:

- Reduce or eliminate flood damage to remaining structures located in the floodplain.
- Increase public awareness of risks of building in the floodplain.
- Improve housing conditions and maintenance of the existing housing stock.

Objectives:

- Emphasize removal and/or floodproofing of structures in the floodplain on a fair, voluntary basis.(ongoing)
- Establish dedicated sources of adequate state and local funding for buyout and floodproofing. (ongoing)
- Reduce storm water runoff and erosion. (ongoing)
- Develop an outreach strategy for floodplain residents and business owners. (ongoing)
- Review county code enforcement and inspection of floodplain structures. (ongoing)

Environmental Resources

Goals:

- Provide protection for environmentally sensitive areas, such as wetlands.
- Improve the environmental appeal of the County.

Objectives:

- Develop a land use system that will respect environmental concerns in the floodplain. (ongoing)
- Identify and preserve environmentally sensitive lands, scenic vistas, forested slopes, natural wildlife habitats and unique natural features as open space or recreational. (ongoing)
- Protect and enhance to the fullest extent possible wildlife habitats. (ongoing)

VII. Strategies to Confront Local Concerns

St. Charles County government leaders realized that the post-flood period in early 1994 was a time of change for the floodplain. To set a new course for floodplain management, they placed those most affected by flooding at the center of floodplain management decision-making. Individuals who live in the floodplain are most affected. Businesses located in the floodplain or whose employees reside in the floodplain area most affected. Communities linked by watersheds are most affected. And elected officials, county staff and service providers are most affected. Over the years leading to the adoption of this plan, representatives of these groups became stewards of floodplain management and helped to form a Floodplain Vision Policy Committee, a Floodplain Vision Board, and a Flood Risk Management Plan Technical Advisory Committee.

These groups assisted in providing information, ideas and suggestions relating to the future of floodplain. Input was provided with the assumption that the rivers and creeks in the County will continue to flood. Based on that assumption, hundreds of actions were evaluated, including the “do nothing” alternative which was eliminated. The overall intention of the recommendations was to make the most of the county’s natural resources and promote sound environmental policies; reduce losses and the impact on lives and property due to flooding; encourage individuals at risk to assume greater responsibility, thereby reducing disaster costs for all taxpayers; and improve flood preparedness and response, with greater coordination and efficiency among volunteer and public agencies.

Although the three distinct groups were created at different times, the messages presented in recommended activities are consistent. Those recommendations have been consolidated and shaped into six strategy areas that focus on the vision that drives the Strategy. The strategy areas are:

1. Preventative,
2. Property Protection,
3. Natural Resource Protection,
4. Emergency Services,
5. Structural Projects, and
6. Public Information.

These strategies seek to achieve the three goals that guide the strategy: modify human susceptibility to flood damage; modify the impact of flooding on individuals and the community; and preserve and restore the natural functions of floodplains.

1. Preventative

Activities that eliminate or reduce susceptibility to flooding are the focus areas for this strategy. These tools include regulations and policies that prohibit dangerous, uneconomical or unwise floodplain development. Flood damages can be greatly reduced if activities in the floodplain can be made more compatible with the natural flooding process.

Development Regulations

1.1 Update the Unified Development Ordinance (UDO). The Planning and Zoning Division will update the floodplain regulations to include the latest floodplain development standards and meet the minimum standards of the NFIP. For existing development, the standards will assure that additions and modifications to these structures are protected to current state and federal standards. It also limits the amount of additions and modifications over the life of the structure, thereby limiting future potential damages. (completed)

1.2 Through the Unified Development Ordinance (UDO), the County will develop a land use system that will respect environmental concerns. The County will encourage clustering under development regulations to allow more land to be preserved as open space and as natural drainage areas. Currently, the County has a Planned Unit Development overlay district that permits greater flexibility and more creative and imaginative design for the development of mixed land uses. The intent of the district is to promote a more economical and efficient use of land, to provide a harmonious variety of housing choices, to provide greater flexibility in the placement of buildings, to preserve the natural scenic qualities of open space, and to utilized the best potentials for site development relating to such features as topography, geography, and the size and shape of properties.

The Planning and Zoning Division has created the Floodway, Density Floodway, and Floodway Fringe Overlay Districts. These districts will ensure compliance with established floodplain regulations. The County will discourage rezoning that conflicts with the essential character of the surrounding area.

During the subdivision and commercial development review process, the Planning and Zoning Division and the Division of Development Review will include a review of environmental constraints such as soil conditions, floodplain and floodway area, and topography. The County will continue to promote the careful preservation of the banks of creek beds, streams and/or areas that carry storm water runoff. The Planning and Zoning Division will require floodway areas or wetlands to be depicted as common ground. Land unsuitable for subdivision development due to drainage, flood hazard area, jurisdictional wetland and other conditions constituting significant danger to health, life and/or property shall not be approved, unless satisfactory evidence is presented.

1.3 The County will update the Sediment and Erosion Control Regulations. In order to better control soil erosion on land that is undergoing development for non-agricultural uses and to preserve the natural terrain and waterways, the County has updated the Sediment and Erosion Control Regulations. The regulations promote the careful preservation of the banks of creek beds, streams and/or areas that carry storm water runoff and ensure that land development does not redirect storm water runoff to erode neighboring properties. For example, the regulations include a requirement that development along natural watercourses shall have residential lot lines, commercial or industrial improvement, parking areas, or driveway set back a minimum of twenty-five (25) feet from the top of the existing stream bank or the one hundred-year flood elevation, except residential lots having an area of one acre or greater. Land adjoining development sites will be provided with protection from accelerated and increased surface water, silt from erosion, and any other consequences or erosion. (completed)

The County will continue to review current enforcement procedures of sediment and erosion control plans and improve where necessary. The Division of Development Review is responsible for the review and approval of plans.

1.4 The County will improve the enforcement of floodplain regulations. The County will review current enforcement procedures and improve where necessary. Departments involved with the enforcement of floodplain regulations will ensure that the administrative procedures for floodplain regulations meet minimum NFIP standards. The review of enforcement procedures will include: continuous programs of information and education for local officials, aggressive pursuit of available sanctions for noncompliance, flexibility to address special flood hazard problems without relaxing minimum requirements. (ongoing)

Regional or “Watershed” Floodplain Management

1.5 Watershed Plans. The County will monitor, provide input, and support broader basin planning on the Mississippi and Missouri rivers, especially to those agencies with regulatory responsibilities.

The County will provide technical support to watershed management studies initiated by other agencies/jurisdictions, such as the Dardenne Creek Watershed Study.

The County will promote an updated hydrologic study of St. Charles County and surrounding counties. In order to establish a good basin for implementing storm water runoff control programs, such a study must be completed. Inclusion of the surrounding counties will insure that entire drainage basins are studied.

Transportation Improvements

1.6 The County will improve streets and culverts to acceptable levels of capacity and safety. Frequently flooded roads, especially those identified in this plan, will be studied and evaluated by the County and the Missouri Department of Transportation to determine the proper, if any, mitigation activity.

1.7 The County will recommend and support flood mitigation activities of the Burlington Northern Santa Fe Railroad. The County will participate in any studies performed by the Burlington Northern Santa Fe Railroad concerning raising rail facilities, flow through structures and other activities. Where appropriate, the County will make recommendations.

All Hazards Plan

1.8 Evaluate the feasibility of creating an All Hazards Plan. The County will review current emergency operations plans and other mitigation plans to determine if an all hazards plan should be developed. The All Hazards Plan should expand upon the Strategy to include other hazards applicable to St. Charles County such as earthquakes and hazardous materials. (completed)

2. Property Protection

This strategy area focuses on individual parcels or buildings. Activities seek to reduce the impact of flooding when it does occur will be promoted. Flood damages can be greatly reduced if activities in the floodplain can be made more compatible with the natural flooding process.

Inventory of Floodplain Structures

2.1 The County will inventory and develop a mitigation strategy for structures in the floodplain. Currently, the County does not maintain lot by lot flood data on structures in the Floodplain. The County estimates that approximately 817 residential structures remain in the floodplain. Of that number 582 are repetitive loss structures. To adequately determine which, if any, mitigation measure is appropriate for these structures, an inventory should be performed. Data should be maintained on each lot and include information about the building foundation, building walls, building condition, soil stability, lowest floor elevation, personal factors, and flood history. Once collected, this data can be stored and processed in database management system. The most appropriate non-structural measure to protect a building from surface flooding can then be selected based on a scoring system. (completed via GIS system)

The County will inventory the structures in the floodplain, utilizing the Geographic Information System to determine specific location. Other data needed will be obtained through tax assessor's records. (completed)

The County will coordinate with the Federal Insurance Agency to map repetitive loss properties. Mitigation for repetitive loss structures will receive the highest funding priority.

Acquisition

2.2 The County will develop an acquisition program. The County will pursue state and federal funds to acquire and relocate structures outside the floodplain, and explore the establishment of an ongoing buyout fund. The County will target remaining residents and businesses in the floodplain with repetitive claims and structures located in areas where approximately 90% of the properties have been bought out. A land reuse plan will be developed for the acquired areas on a property by property basis.

The County has targeted 129 properties to be evaluated for acquisition. The structures on these properties are in repetitive loss areas, dilapidated, abandoned or otherwise in bad condition, and contiguous to previously bought-out structures. Additionally, these structures are in riverine floodplain areas where federal investment to repair or replace structures and facilities should be avoided and the relocation of people and structures out of these areas encouraged. Further data collection is necessary to determine suitability for acquisition and includes:

- One-on-one meeting with the owner(s) of the structures to determine if he/she is a willing seller;
- A review of the NFIP claims on the structure;
- Determination that the structure is a primary structure;
- Cost-benefit ratio; and
- Neighborhood attitude.

Floodproofing/retrofitting

2.3 The County will develop a floodproofing/retrofitting program. The County will pursue state and federal funds to floodproof or retrofit existing structures in the floodplain. These measures include, but are not limited to: elevating structures or adding fill around them; sealing basement windows and other openings located below the flood protection elevation; installing subsurface drainage cut-off valves; or raising utilities above the flood protection elevation. Priority will be placed on target residents and businesses with repetitive claims.

Flood Insurance

2.4 The County will improve its participation in the National Flood Insurance Program (NFIP). As part of a Public Outreach Strategy, the County will encourage property owners in the Special Flood Hazard Area to participate in the national Flood Insurance (NFIP).

The County will continue to participate in good standing in the NFIP's Community Rating System for premium reduction for the County's NFIP policy holders.

The County will continue to encourage federal reform of the NFIP. Several improvements are necessary to the NFIP, especially with regard to repetitive claims. Many residents purchase flood insurance for structures that should not be located in the floodplain, due to continual flooding. These individuals collect multiple claims after disasters and minor flooding, and there is no incentive to relocate out of the floodplain. If the County is to have a successful voluntary acquisition program, repetitive NFIP claims must be discouraged or prohibited by the federal government.

Property Protection Assistance

2.5 The County will provide interested property owners with general information about flood protection assistance. This information may include, but is not limited to, providing site-specific flood data, names of contractors and consultants knowledgeable or experienced in retrofitting techniques and construction, floodproofing techniques and related topics. A brochure of available services will be developed as part of a Public Outreach Strategy.

Demolition of Unsafe Structures

2.6 The County and the Corps of Engineers (COE) will continue to identify unsafe structures in the floodplain and recommend appropriate actions. Through the Declaration of Nuisance and Order ordinance, the County will identify unsafe structures and recommend that these structures be demolished or repaired. At least eighteen structures have been removed from the floodplain through this ordinance.

The County will continue to cooperate with the Corps of Engineers (COE) to identify COE leased structures in the Sherwood Harbor subdivision that do not meet County regulations and codes. These structures must be repaired or demolished.

3. Natural Resource Protection

This focus area includes activities that preserve or restore natural areas or the natural functions of floodplain and watershed areas.

Open Space

3.1 The County will maintain buyout properties as open space/recreation. The County holds title to a significant acreage of undeveloped land scattered throughout the floodplain that was acquired after the Flood of 1993. Most of the small parcels have been leased to adjacent landowners. However, a significant tract in the floodplain has been developed into a park. The County Parks and Recreation Department has developed the recreational and natural potential of this site.

- Hide-A-Way Harbor is approximately 48 acres adjacent to the Mississippi River. It is a former marina with potential for boater and fisherman access to the river. (completed)

3.2 The County will explore the feasibility of acquiring additional vacant land, greenway access easements, and development setback easements along the Mississippi and Missouri rivers. This would prevent inappropriate development, preserve the open space appearance of the riverfront, and keep the areas in an natural state. Federal programs such as the Flood Mitigation Assistance Program, Emergency Wetlands Reserve Program and the Conservation Reserve Program should be researched, as well as donation of land.

3.3 The County will support the acquisition and development of the floodplain for recreational purposes. With the intent of protecting fragile riparian habitats and waters and increasing outdoor recreational opportunities, the County will encourage the acquisition of floodplain open space for recreation. The County will evaluate tracts between 100-300 acres for development as a County park. Efforts by organizations such as Greenway Network, inc., to develop bicycle/pedestrian trails in the floodplain continue to be encouraged.

4. Emergency Services

This focus area includes activities that are implemented during a flood to minimize its impact.

Flood Warning

4.1 The County will require and install the most accurate information of flood levels and flood predictions. The County will work with appropriate agencies to place river gauges along all river basins where needed, especially the smaller tributaries. The most current data collection and reporting system, such as IFLOWS, will be requested. (completed)

4.2 The County will request additional elevation markers or reference marks where needed. Additional elevation markers may be needed along the Missouri River, near areas such as Defiance. Markers will be placed in central, visible locations and will show ground elevations and the base flood elevations.

4.3 The County will continue and improve the emergency preparedness public outreach program. Emergency warning procedures will be updated periodically on the County web page site. Additionally, the public education program will be continued at schools and critical facilities and will be expanded to include civic groups, senior citizens groups, and other groups and organizations. The program will include education and information about a “family preparedness plan”. (ongoing)

4.4 The County will continue to improve flood response capabilities. Through constant assessment of resources, surveys, training and exercise, the County will continually evaluate and improve upon emergency response capabilities. Direct contact with property owners in the floodplain will be sustained to maintain community needs.

4.5 The County will develop a standard procedure for damage assessment. A damage assessment policy will detail the method that flood damage is calculated, the inspection procedure, and options for property owners once a structure has been targeted. Currently, the County uses FEMA’s Substantial Damage Estimator (SDE). (completed)

Critical Facilities Protection

4.6 The County will encourage critical facilities to develop and coordinate flood response plans. The County will provide guidance and organizational assistance to critical facilities in the development of flood response plans. Critical facilities will be encouraged to apprise the County of flood response/contingency plans.

5. Structural

This focus area includes activities that can affect changes in the volume of runoff, peak flood stage, time of rise and duration of floodwater, location of flooding, extent of area flooded, and velocity and depth of floodwater. These changes influence the amount of debris, sediment, and pollutants carried by floodwater.

Levees

5.1 The County shall monitor critical levees and inventory deficiencies. The County should work with the Army Corps of Engineers to identify primary levees in need of repair and develop recommendations. The County will assist farmers by facilitating repair of levees. The County, levee districts, and the Natural Resource Conservation Service should monitor deficiencies and develop recommendations.

6. Public Information

This focus area includes activities to advise property owners, potential property owner, and visitors about the hazards, way to protect people and property from the hazards, and natural and beneficial functions of local floodplains.

Public Outreach Strategy

6.1 The County will develop and maintain a broad public information program to keep residents informed about persistent and emerging floodplain management issues and developing trends and projects. Informing and educating the public about flood risk and appropriate responses and about the importance of preserving and restoring floodplain natural resources will be an ongoing effort. A communications plan that targets print, radio, and television outlets will be incorporated into the strategy. Activities to be evaluated for inclusion in the strategy are:

- Conducting seminars or open houses on a variety of subjects such as floodproofing and the benefits of the floodplain;
- Disseminating a newsletter and brochures and website updates on an “as needed” basis.
- Holding a flood hazard awareness month (March/April);
- A speakers bureau comprised of staff and Floodplain Vision Board members available to community groups on request;
- Timely press release and other appropriate forms of public notice in support of all County meetings at which floodplain issues are discussed; and
- An annual survey of floodplain management needs.

Map Information

6.2 The County will continue to provide residents with information from the County’s Flood Insurance Rate Maps (FIRM), including whether a property is in a Special Flood Hazard Area (SFHA), which zone, and its base flood elevation.

For convenience, accuracy and efficacy, the County has created a floodplain map in the Geographic Information System. The maps will be based on the latest FIRM, dated March 17, 2003, and will be on a parcel by parcel basis. Digital Flood Insurance Rate Maps (DFIRM) will be placed on the maps once they have been finalized and approved by FEMA. (The 2009-2010 DFIRM’s remain on hold while federal legislation and policy are developed for areas located behind a levee protection system.)

Library

6.3 The County will continue to provide the local libraries with documents about flood insurance, flood protection, floodplain management, and natural and beneficial functions of floodplains. Library branches to receive copies of the latest flood information publications are:

- Deer Run
- Kathryn Linnemann
- Kisker Road
- Middendorf-Kredell, and
- Spencer Road

Forming On-Going Planning Process

6.4 The County will maintain an on-going flood mitigation planning process. To ensure that the process can be dynamic and fully responsive, the County envisions a more substantive role in the planning process for those many public and private investors in the floodplain whose involvement in the past has not been as strong as it needed to be. This role must, and will, allow

for early involvement and varied opportunities in setting flood mitigation goals, defining options, selecting projects, and evaluating performance.

The County will continue to staff the Floodplain Vision Board through the Community Development and Emergency Management Departments. This organization will receive regular and timely information from County staff on floodplain management issues and decision. They will advise staff directly and make recommendations to the County Executive.

The County participates in educational opportunities, public education campaigns, and other information sharing activities involving floodplain management, such as the state Floodplain Managers Association. Information gleaned from this and other organizations will be shared with County counterparts, associations such as the St. Charles County Planning Association and other appropriate commissions and organizations.

VIII. Initial Steps in Implementation

The Strategy identifies a far-reaching approach, to be implemented over time, that will accomplish the goals and objectives of those most affected. The achievement of these goals and objectives will be driven by cooperation of appropriate County departments, as well as participation of all affected municipalities and public officials. If successful, these strategies will allow evacuation of the most vulnerable areas, restore areas of the floodplain to a more natural state, and protect the developed and developing areas.

Financing and Priorities

As its most immediate step in the implementation of the Strategy, the County must identify funding sources for the many strategies recommended. This Strategy, like previous plans, is an expression of floodplain management vision. Admittedly, this vision is not bridled by financial reality. Needs and proposed solutions were identified with the understanding that the solutions may not be financially attainable. Because the necessary funds may not be available, there is an impetus to look strategically at future floodplain needs and set priorities among competing needs for the use of limited resources.

Small but consistent steps toward protecting the land, citizens, and infrastructure from future flood problems are a visible and desirable accomplishment. The steps, as recognized by the Strategy, are numerous, ranging from better warning systems to producing educational pamphlets to inform citizens.

Implementation Schedule

There are four additional parts to the initial steps toward implementation. The first is the work element – planning activities and programs that the County and its partners will conduct. These activities are designed to both strengthen our ability to carry out the plan effectively and to implement its goals and objectives. Each of these activities was first introduced in Section VI *Strategies to Address Local Concerns*.

The second part is the responsible parties – identification of individuals who will carry out portions of the strategy. A responsible County department and partner has been identified for each proposed activity where appropriate, The Floodplain Manger will oversee the implementation of the recommendations.

The third part consists of a time frame – when the work elements will be carried out. Tentative dates for project completion have been proposed and will be reviewed annually as part of the Strategy evaluation and monitoring.

Lastly the fourth part is the project priorities – which projects are most needed and what is needed to clearly attain the goals of the Strategy.

Where possible, a funding source has been identified.

Table 5: Implementation Schedule

Work Element	Responsible Party	Time Frame	Priority	Funding Source/ Estimated Cost
1. Preventative				
1.1 Update the Unified Development Ordinance	Planning and Zoning Division	Ongoing	High	N/A Staff time
1.2 Develop a land use system that will respect environmental concerns	Planning and Zoning Division	Ongoing	High	N/A Staff time
1.3 Update and enforce the Sediment and Erosion Control Regulations	Division of Development Review	Ongoing	High	N/A Staff time
1.4 Improve enforcement of floodplain regulations	Planning and Zoning, and Neighborhood Preservation Divisions	Ongoing	High	N/A Staff time
1.5 Participate in watershed plans	Planning and Zoning Division	Ongoing	Medium	N/A Staff time
1.6 Improve streets and culverts	Highway Department and MoDOT	Ongoing	Medium	No estimate at this time
1.7 Support flood mitigation activities of Burlington Northern Santa Fe Railroad	Planning and Zoning Division	Ongoing	Low	N/A Staff time
1.8 Evaluate the feasibility of developing an All Hazards Plan	Planning and Zoning Division, Emergency Management Agency	Completed	Medium	N/A Staff time

Work Element	Responsible Party	Time Frame	Priority	Funding Source/ Estimated Cost
2. Property Protection				
2.1 Inventory the structures in the floodplain	Planning and Zoning, and Building Divisions	Completed	High	N/A Staff time
2.2 Improve flow of information to the public concerning flood insurance	Planning and Zoning Division	Ongoing	High	N/A Staff time
2.3 Provide property protection assistance	Community Development Department	Ongoing	Medium	N/A Staff time
2.4 Identify unsafe structures in the floodplain and recommend appropriate actions.	Building Division, Corps of Engineers	Ongoing	High	N/A Staff time/property owner
3. Natural Resource Protection				
3.1 Maintain buyout properties as open space/recreation	Parks and Recreation Department; Facilities Maintenance Department	Ongoing	Medium	N/A Staff time
3.2 Support development of riverfront creek greenway	Planning and Zoning Division; Parks and Recreation Department	Ongoing	Medium	N/A Staff time
3.3 Support the acquisition and development of the floodplain for recreational purposes	Planning and Zoning Division; Parks and Recreation Department	Ongoing	Low	N/A Staff time

Work Element	Responsible Party	Time Frame	Priority	Funding Source/ Estimated Cost
4. Emergency Services				
4.1 Require and install most accurate information on flood levels and predictions	Emergency Management Agency	Ongoing	High	No estimate at this time
4.2 Request additional elevation markers	Emergency Management Agency	Ongoing	Medium	No estimate at this time
4.3 Continue and improve emergency preparedness public outreach program	Emergency Management Agency	Ongoing	Medium	N/A Staff time
4.4 Continue to improve flood response capabilities	Emergency Management Agency	Ongoing	High	No estimate at this time
4.5 Develop a flood damage assessment procedure	Planning & Zoning and Building Divisions	Ongoing	Medium	N/A Staff time
4.6 Encourage critical facilities to develop and coordinate flood response plans	Emergency Management Agency	Ongoing	Medium	N/A Staff time

Work Element	Responsible Party	Time Frame	Priority	Funding Source/ Estimated Cost
5. Public Information				
5. Develop and maintain a public outreach strategy	Planning and Zoning Division; Floodplain Vision Board	Activities ongoing	High	Staff time; Cost will vary for activities – no estimates at this time.
5.1 Maintain an open, inclusive and ongoing floodplain management planning process	Planning and Zoning Division	Ongoing	Medium	N/A Staff time
5.2 Continue to provide FIRM/DFIRM information to the public	Planning and Zoning Division	Ongoing	Medium	N/A Staff time
5.3 Continue to provide flood-related information to the public libraries	Planning and Zoning Division	Ongoing	Medium	N/A Staff time
5.4 Encourage, support, and where necessary, establish information sharing forums	Planning and Zoning Division	As needed	Low	N/A Staff time

IX. Protecting Our Resources ***Revisited:*** ***Plan Evaluation, Monitoring and Updating***

In order to track and evaluate how recommendations of the Strategy are being implemented and to measure the effects of recommendations once they have been carried out, a plan monitoring and evaluation process has been established. This process has a two-fold purpose. The first is to monitor the progress of projects contained in the Strategy. Keeping track of the proposed projects is critical to ensure that recommendations are implemented. The second purpose is to evaluate the impact that projects have in relationship to regional goals and objectives. This information will enable the County to continually reevaluate needs and priorities.

To carry out this process, a progress report will be prepared annually by the Planning and Zoning Division and present to the Floodplain Vision Board. The report will include:

- A review of the goals and objectives of the Strategy;
- A review of any floods that occurred during the year;
- A review of each element or objective, including what was accomplished the previous year;
- A discussion of why any objectives were not reached or why implementation is behind schedule; and
- Recommendation for new projects or revised objectives.

APPENDIX A

ARTICLE XI. "FW", "FF" AND "DF", FLOODWAY, FLOODWAY
FRINGE AND DENSITY FLOODWAY OVERLAY DISTRICTS
of the Unified Development Ordinance of St. Charles County, Missouri