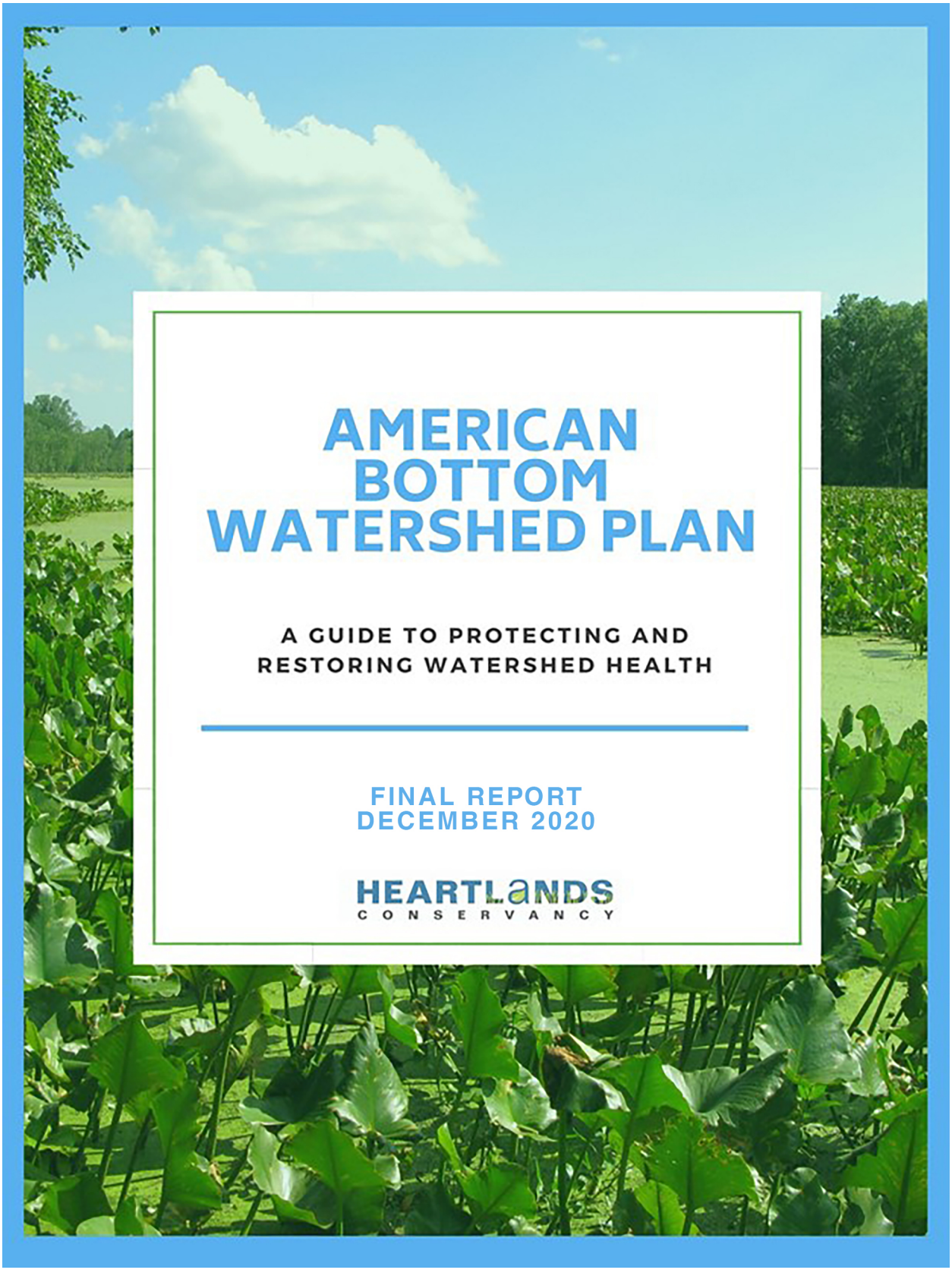

AMERICAN
BOTTOM
WATERSHED PLAN
A GUIDE TO PROTECTING AND
RESTORING WATERSHED HEALTH
FINAL REPORT
DECEMBER 2020
HEARTLANDS
CONSERVANCY

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American Bottom Watershed Plan

A Guide to Protecting and Restoring Watershed Health

December 2020

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for

MADISON COUNTY STORMWATER MANAGEMENT

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Key partners and stakeholders include, Madison County, HeartLands Conservancy, U.S. Army Corps of Engineers, Madison County Soil and Water Conservation District (SWCD), Madison County Stormwater Commission, Juneau Associates Inc., America's Central Port, Granite City, Hartford, Pontoon Beach, Edwardsville, Madison, Metro East Sanitary District, Madison County Highway Department, Collinsville Township, Nameoki Township, Chouteau Township, Venice Township, and Granite City Township. These stakeholders played an important role in providing input on watershed goals and objectives, water quality and flooding issues, Best Management Practices, and potential recommendations.

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EXECUTIVE SUMMARY

Introduction

Stormwater management for Madison County is guided by the policy framework established in the Madison County Stormwater Management Plan, a county-wide document that seeks to address the effects of urbanization on stormwater drainage. The plan sets broad policy for Madison County as a whole and sets policy and provides specific recommendations for each watershed's unique circumstances through individual watershed plans.

In 2013, Madison County and HeartLands Conservancy began to develop the first large-scale watershed plan in the county, for the Upper Silver Creek watershed. This plan was completed in 2016, was approved by the IEPA, and is pending adoption by the county. Following this success, HeartLands Conservancy and Madison County created watershed plans for other watersheds in the county including the Indian-Cahokia Creek watershed and the Canteen-Cahokia Creek watershed.

In 2016, the county began to move ahead with planning for an additional watershed, the American Bottom. The American Bottom is an area in Madison County that is part of a larger watershed known as Judy's Branch, which drains parts of both Illinois and Missouri along the Mississippi River. This plan is only concerned with the portion of the Judy's Branch watershed that is within Madison County (i.e., the American Bottom watershed).

This watershed plan offers guidance for managing watershed resources on public property, as well as providing a platform to encourage other watershed stakeholders (landowners, residents, businesses, developers, public agencies, and non-profits) to participate. The plan is not regulatory, meaning it does not become law. The intent is to encourage voluntary improvements to water quality and stormwater management in the watershed, for agricultural, urban, and natural areas and waters.

Executive Summary Contents

Introduction
Goals, Objectives, & Targets
Issues
Critical Areas
Management Measures Action Plan
Information & Education Plan
Implementation
Measuring Success

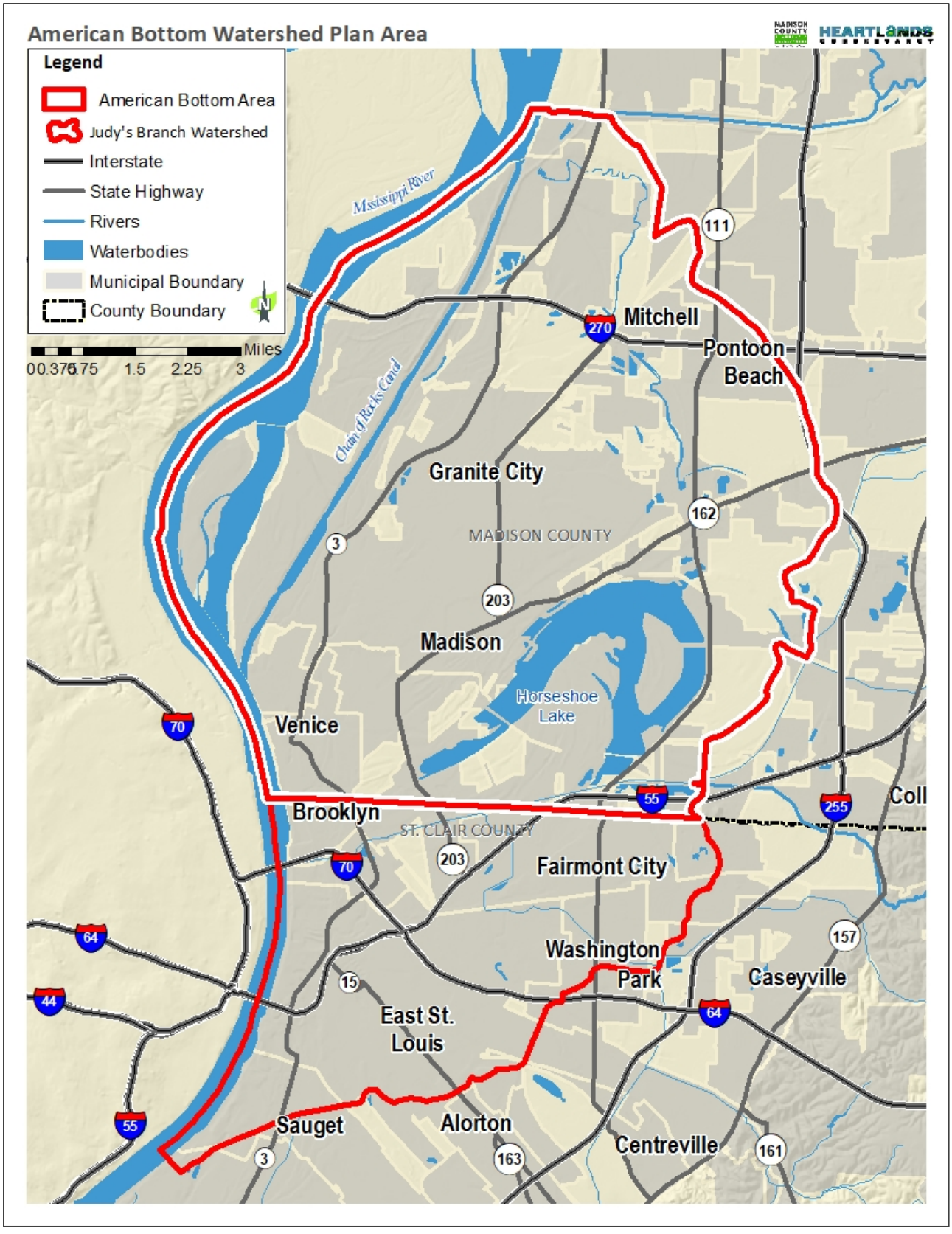


Figure 1. Watershed Location

The American Bottom Watershed

The American Bottom watershed is located directly northeast of St. Louis, Missouri. The watershed drains 9% of Madison County and also receives stormwater from the Canteen Creek – Cahokia Creek watershed which is located directly east of American Bottom. The watershed's 88.5 miles of streams drain roughly 43,245 acres of land and is a part of the larger Judy's Branch-Mississippi River watershed.

The American Bottom watershed project area contains numerous subwatersheds, called HUC12s and HUC14s. "HUC" stands for Hydrologic Unit Code, a number that identifies the general location and size of the watershed. Many of the issues identified in the watershed are assessed at these subwatershed levels.

As of 2010, the watershed is home to 42,825 residents. Much of the watershed's population lives in urban or suburban incorporated areas. Agricultural land makes up 27% of the watershed, with most of that land in row crop farming. Seven municipalities, five townships, and one county are located within the watershed.

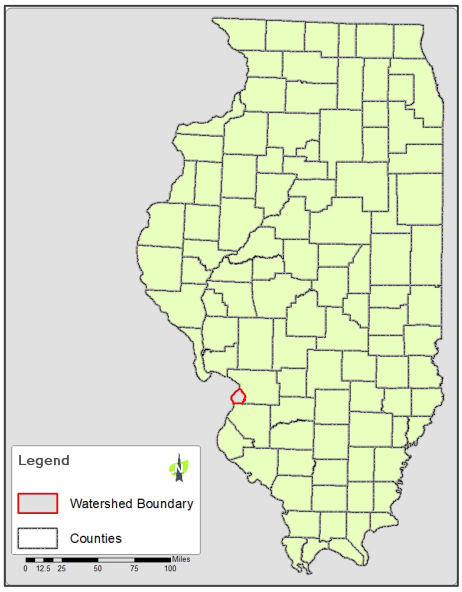


Figure 2. Location of American Bottom watershed in the State of Illinois.

Goals, Objectives, and Targets

The plan promotes a functioning, healthy watershed and guides the development, enhancement, and implementation of actions to achieve these goals:

GOALS [to be discussed with stakeholders]
GOAL 1: Reduce Flooding/Mitigate Flood Damage
GOAL 2: Improve Surface and Drinking Water Quality
GOAL 3: Promote Environmentally Sensitive Development
GOAL 4: Support Healthy Habitat and Recreation
GOAL 5: Develop Organizational Frameworks
GOAL 6: Conduct Education and Outreach

Objectives were developed to specify progress towards these goals. Targets in this plan were set at levels that can feasibly be reached by the implementation of a suite of Best Management Practices (BMPs), or Management Measures, over time. The targets include a 25% reduction in phosphorus loading and a 15% reduction in nitrogen loading by 2035 (based on Illinois Nutrient Loss Reduction Strategy), and a 20% reduction in sediment loading (based on estimated impacts of proposed BMPs) by 2035.

Key Watershed Issues

Analysis of the existing and predicted future conditions in the watershed (Appendix A: Watershed Resource Inventory) included collecting data from several government data sources, delineating HUC14 watershed boundaries, using the U.S. Environmental Protection Agency (USEPA) Spreadsheet Tool for Estimating Pollutant Loads (STEPL), conducting an aerial assessment of stream and riparian conditions, field checks, and stakeholder engagement. From this research, the following issues were identified:

Flooding issues

- **Prevalent flooding, within and outside floodplains**: All municipalities in the watershed have experienced flooding. Respondents to the Flood Survey reported 106 flood events per year outside the 100-year floodplain, while only 47 were within floodplains. (Note: these are the floodplains currently "in effect," identified in the 1970s to 1980s Federal Emergency Management Agency (FEMA) maps.)
- **Undersized stormwater infrastructure**: In many areas, stormwater infrastructure (e.g., culverts, ditches) is undersized for the amount of water it has to handle, leading to flooding. The infrastructure surrounding the Nameoki Ditch corridor in Granite City is too small to handle the increased rainfall and has been recommended for upgrades such as widening Nameoki Ditch.
- **High water table/groundwater**: When the soil is already saturated, stormwater cannot infiltrate and runs off on the surface. Granite City has a high water table throughout, particularly near the hospital, causing infiltration in elevator shafts and basements.
- **Hydrologic link to Mississippi River**: Groundwater levels in Pontoon Beach, located in the historic Mississippi River floodplain, are influenced by the river's water elevation. When the river is high, depth to the groundwater decreases.
- **Large areas of impervious cover**: New development and the creation of large areas of impervious surfaces have dramatically changed stormwater drainage in some areas, leading to flooding.
- **Backup issues from Horseshoe Lake and Long Lake**: If heavy rain falls for an extended period, water backs up from Horseshoe Lake into the farmland upstream, causing flooding. In Pontoon Beach, all water is routed through Long Lake. The outfall at Long Lake is undersized, causing backup issues and flooding portions of Pontoon Beach.
- **Logjams and beavers**: Beavers and logjams contribute to localized flooding issues.
- **Channelization**: When streams are straightened (channelized), such as the Nameoki Ditch in Granite City Township, water moves through them much more quickly and can exacerbate downstream flooding, erosion, and sediment problems.
- **Sediment deposition**: Dredging of lakes and detention basins is needed to maintain water storage capacity. Dredging can be very expensive.

Water quality issues

- **Pollutants in streams:**
    - **Phosphorus**: Phosphorus is carried into waterways along with soil particles, often from fertilizers. It can lead to harmful algae blooms. Phosphorus is one of the pollutants identified in Cahokia Creek (Cahokia Canal), Canteen Creek, and Horseshoe Lake on the 2018 IEPA 303(d) List.
    - **Manganese and Iron**: Iron is one of the pollutants identified in Cahokia Creek (Cahokia Canal) on the 2018 IEPA 303(d) List. Manganese is also one of the pollutants identified in

Cahokia Creek (Cahokia Canal), and Canteen Creek on the 2018 IEPA 303(d) List. These elements are found in naturally high levels in soil in the area. Both can be toxic to aquatic plants and animals.
    - **Barium**: Barium is one of the pollutants identified in Canteen Creek on the 2018 IEPA 303(d) List. The source of this pollutant is not known (possibly industrial or mining activity). Barium can be toxic to aquatic life and to human life if the level of exposure is too high.
    - **Polychlorinated Biphenyls (PCBs):** PCBs are one of the pollutants identified in the Chain of Rocks Canal and Horseshoe Lake on the 2018 IEPA 303(d) List. PCBs are a group of manmade chemicals that were used widely in electrical equipment like capacitors and transformers until they were banned in 1979 due to effects of exposure on human health, including cancer.
    - **Chloride**: Application and storage of road salt is a concern where water with high concentrations of chloride flows into groundwater or streams. Chlorides increase treatment costs for water supplies and are harmful to aquatic life in waterways.
- **Soil erosion:** Soil erosion contributes large amounts of sediments to streams and waterways.
    - **From streambanks, stream channels, and lake shorelines:** Stream and lake bank and channel erosion contributes a great deal of sediment to waterways. Logjams can exacerbate the problem, causing scouring and bank collapse.
    - **From farmland:** Valuable topsoil often erodes from the land when the soil is exposed.
    - **From construction sites:** Improperly stored earth at construction sites is highly prone to erosion.
- **Sediment**: Sediment is highly prevalent in streams and runoff throughout the watershed. When soil erodes from the landscape, it ends up as sediment and silt in streams. The soil carries other pollutants such as phosphorus, barium, manganese, and Polychlorinated Biphenyls (PCBs) with it. When sediment is deposited in streams and detention basins, it forces the water upwards, which can lead to flooding. **Total Suspended Solids (TSS)** is one of the pollutants identified in Cahokia Canal, Canteen Creek, and Horseshoe Lake on the 2018 Illinois EPA (IEPA) 303(d) List. Horseshoe Lake has lost capacity from increased sedimentation, leading to drainage issues in Mitchell, Pontoon Beach, and Granite City.
- **Drinking water source protection**: Edwardsville and Hartford get their water from wells. Contamination of these water sources is a life-safety issue and can be costly to remediate. Magnesium levels in groundwater surrounding the America's Central Port were at levels unsafe for drinking water.
- **Low Dissolved Oxygen**: Low levels of dissolved oxygen (DO) in water cannot support aquatic life. Low DO levels are often a result of algae using up oxygen in the water, which is caused by high levels of nutrients such as nitrogen and phosphorus. Low DO is listed as an impairment to Cahokia Creek (Cahokia Canal) on the 2018 IEPA 303(d) List.
- **Sewage contamination from private systems**: Poor maintenance of private sewage systems can lead to raw human waste in waterways and increased fecal coliform bacteria.
- **Combined sewers**: Granite City, especially west of Nameoki Road, and Madison, 90% of the city, have sewer pipes that carry both stormwater and sanitary waste (combined sewers). When large volumes of stormwater enter the system, overflows can carry untreated waste out onto the land and into streams.
- **Infiltration into/out of aging pipes**: Some pipes in Granite City and other municipalities are over 100 years old. Sewage can leak out of sewer pipes, and groundwater leak into water supply

pipes. Granite City reported more than $1 million a year in sewer breaks and Pontoon Beach receives an additional seven million gallons of water a day during precipitation events.

- **Litter and dumping:** Littering and unlawful dumping are widespread, particularly at streams. One location in the watershed accepted trash illegally for multiple years. The Horseshoe Lake "delta" accumulates a significant amount of trash.
- **Algae blooms and fish die-outs**: These are common in lakes and streams, resulting from an excess of fertilizer. Aquatic algae is listed as an impairment to Horseshoe Lake on the 2018 IEPA 303(d) List.
- **Point source discharges:** A point source is a single source of pollution that is discharged into waterways, such as from a sewage treatment plant. There are six facilities with National Pollution Discharge Elimination System (NPDES) permits.
- **Contact through boating, swimming, fishing**: People use the lakes in the watershed for recreation, often coming into direct contact with the water and becoming exposed to pollutants in it.
- **Superfund Sites**: Three Superfund Sites are located in the watershed; Jennison Wright site, TaraCorps Lead Smelter site, and Chemetco Site. These sites produced various products that have polluted the groundwater in the area.

Land cover and development issues

- **Poorly planned development.** Many older developments in the watersheds did not include adequate drainage infrastructure, which has exacerbated water quality and flooding issues. New development often increases the speed of stormwater runoff and does not provide for long-term maintenance of drainage infrastructure, even if it meets local building and stormwater requirements.

Habitat issues

- **Poor riparian condition**: The area either side of a stream is known as the riparian area. This area is considered to be in poor condition when there is not enough vegetation to support the streambanks and provide shade to the stream. These conditions are also important for wildlife, particularly migratory songbirds that use the Mississippi River flyway.
- **Fish die-outs**: Algae blooms can remove so much oxygen from water that fish suffocate.
- **Invasive species present:** Invasive species crowd out native species, such as plants that protect streambanks from erosion.
- **Unprotected habitat for endangered species:** Where their native habitat is not preserved, threatened and endangered species, such as the Northern long-eared bat, cannot be expected to thrive over the long-term.

Organizational needs/issues

- **Lack of levee/ditch maintenance**: Levee and drainage districts in the watershed have struggled to fund and maintain their levees and ditches. Pumps required for lowering water levels after flooding are often delayed due to cost to run the pumps.
- **Lack of detention basin maintenance**: Detention basins are often not being maintained/dredged to maintain their sediment storage and water storage capacities. Residents have reported multiple basins filled with sediment in Pontoon Beach.

- **Lack of code enforcement**: In some cases, municipal stormwater, development, subdivision, and floodplain codes have not been fully enforced or are out of alignment. Developers have added fill to wetlands in the floodplain and constructed non-compliant structures (e.g. house with walkout basements).
- **Lack of funding:** Funding is needed to maintain and expand stormwater infrastructure and improve water quality. The Metro East Sanitary District has a defined taxing boundary for funding stormwater infrastructure, however, drainage from outside this boundary flows into their systems and is currently unable to be taxed.
- **Need for strong partnerships:** A network of partner organizations/groups is needed to make large strides towards addressing flooding and other issues in the watersheds.

Information and outreach issues

- **Need for communication and collaboration:** Communication about funding and technical resources is sometimes lacking between potential partners; this information could help bring awareness, technical resources, and funding to address issues.
- **Need for outreach to key stakeholders:** A large group of landowners and other key stakeholders working together is needed to make progress towards addressing flooding and other issues.
- **Educating landowners on how to protect their watershed:** Many individual landowners are unaware of how their actions affect the watershed. By educating landowners about the importance of a healthy watershed and practices they can, such as rain gardens, the overall health of the watershed can be improved.

Critical Areas

"Critical Areas" were identified at locations in the watershed where existing and potential causes of pollutants or existing drainage functions are significantly worse than other areas of the watershed, OR there is significant potential for the area to make progress towards one or more of the plan's goals. The Critical Areas were identified using survey and stakeholder information, aerial and field assessments, U.S. Department of Agriculture (USDA) modeling, and a BMP Siting Analysis hosted by the EPA.

The following Critical Areas were identified:

1. Critical Stream Reaches: Highly or moderately degraded stream reaches with high channelization (12.0 miles)
2. Critical Logjam Areas: Stream reaches with high susceptibility to logjams (11.0 miles)
3. Critical Riparian Areas: Highly degraded riparian areas (6.9 miles)
4. Critical Wetland Areas: Areas suitable for wetland restoration (8,590 acres)
5. Critical Flooding Areas: Areas experience frequent significant flooding events (2,380 acres)

Implementation

The "Action Plan" is designed to provide partners with recommended actions, known as Management Measures, which address the plan's goals, objectives, and targets.

Recommended Management Measures

Programmatic Measures, including general remedial, preventive, and policy watershed-wide measures, and **Site-Specific Measures**, on-the-ground practices that can be implemented to improve surface and groundwater quality and flooding, are recommended. Management Measures identified for Critical Areas are prioritized for short-term implementation (e.g., wetland restoration projects in Critical Wetlands Areas). All recommendations in the plan are for guidance only and are not required by any federal, state, or local agency.

Together, these practices can make changes in the watershed that will meet and exceed the Impairment Reduction Targets. Significant participation from local landowners, farmers, residents, municipalities, and developers will be needed to achieve these targets.

Programmatic Measures

Protection and management of natural areas

- Conservation Development design, which protects natural features like streams and forests in new development (especially subdivisions).
- Open space and natural area protection from the design stage to the landownership stage.
- Green infrastructure incentives, which promote the protection of forests, wetlands, and other green infrastructure.
- Long-term management and maintenance of natural areas through management agreements with responsible entities.
- Monitoring water quality, flow, and stream health to help measure progress.

Restoration of natural areas

- In-lieu fee ecological mitigation, a type of program that funds the restoration of ecologically sensitive wetlands and streams to mitigate for the losses of those features to new development.
- Native landscaping, which encourages the use of native plants on public and private property.

- Stream Cleanup Team to remove litter and debris from streams and waterbodies.

Wastewater management

- Sewage Treatment Plant upgrades, which reduce the pollutant loading in wastewater discharge from wastewater facilities.
- Private sewage monitoring, a proactive program that samples private sewage systems to check for water quality problems and to encourage regular maintenance.

Natural resource policy

- Flood Damage Prevention Ordinance, which limits inappropriate development in floodplains, adopted by counties and municipalities.
- Riparian Buffer Ordinance, which limits development in riparian areas (areas adjacent to streams and waterbodies), encouraging forest and grassland that helps to filter and slow down runoff.
- Watershed plan integrated into community policies and programs.

Funding

- Federal and state programs such as the Conservation Reserve Enhancement Program (CREP) and the Environmental Quality Incentives Program (EQIP) are available to landowners in the watershed to finance practices that prevent soil erosion, among other benefits.
- Financial support for stormwater infrastructure, such as a Stormwater Utility, that is dedicated to upgrades and maintenance of detention basins, ditches, and other conveyance structures.

Site-Specific Measures

Urban areas

- Bioswales, also known as vegetated swales, which increase infiltration and delay stormwater surges during heavy rainfall.
- Detention basins (new and retrofitted), which store flows during and incrementally release stored water.
- Pervious pavement, which allows infiltration of stormwater into a below-ground storage area through porous ground.
- Rain gardens, which temporarily store and infiltrate rainwater, significantly slow water flow, improve water quality, and provide wildlife food and habitat.
- Rainwater collection and reuse, using rain barrels or cisterns.
- Single property flood reduction strategies, which differ from property to property, based on the sources of flooding and appropriate flood reduction strategies (e.g. home waterproofing, internal home drainage, raising homes, filling basements).
- Stormwater system maintenance and expansion, which is crucial for the efficient conveyance of stormwater.
- Tree planting (e.g., street trees), to filter stormwater, reduce air temperatures, and improve aesthetics.
- Urban filter strips, which remove sediment and pollutants, and enhance infiltration of surface water runoff.

Agricultural areas

- Bioreactors, also known as denitrifying bioreactors, which are ditches filled with woodchips that remove nitrogen from water leaving tile-drained fields.

- Comprehensive Nutrient Management Plans (CNMPs), which are farm-specific plans to eliminate unwanted runoff, incorporate manure nutrients into crop nutrient budgets, and efficiently apply manure to cropland, reducing water pollution and increasing soil health.
- Conservation tillage (reduced tillage/no-till), which leads to a reduction in soil erosion and the transport of associated nutrients, such as phosphorus, to the waterways.
- Cover crops, which prevent erosion, improve soil health, break pest cycles, and suppress weeds.
- Grassed waterways, which are vegetated channels designed to slow surface water to reduce soil erosion and flooding.
- Nutrient Management Plans (NMPs), which are farm-specific plans for determining nutrient needs for crops and obtaining the maximum return from fertilizers.
- Ponds, which store stormwater, settle out sediments, and allow nutrient uptake by aquatic organisms.
- Riparian buffers, which are vegetated zones immediately adjacent to streams that protect the stream channel.
- Wetlands, which function as one of the most effective pollution removal practices, store stormwater, settle out sediments, and allow nutrient uptake by aquatic organisms.

Streams and lakes

- Lake and stream dredging, which removes sediment from the waterbody and reduces the risk of flooding.
- Logjam removal, which removes debris from the stream channel, reducing scouring in the stream channel and the risk of floods overtopping the channel.
- Shoreline stabilization, which reduces bank erosion along lake shores.
- Streambank and channel stabilization and restoration, which includes stabilization and grade control structures, and re-meandering. These reduce erosion and provide flood storage.

Forest

- Forest stand improvement, which manages forest species composition (including removal of invasive species), can increase infiltration, reduce erosion, and provide long-term wildlife habitat.

Measuring Success

Water quality monitoring may be conducted, as funding allows, on a three to five-year cycle through the year 2035. This may be done by the by the National Great Rivers Research and Education Center (NGRREC). A set of Progress Report Cards is included in Appendix G, which includes milestones for short-term (one to 10 years; 2021 to 2031), medium-term (10 to 20 years; 2031 to 2041), and long-term (20+ years; 2041+) timeframes. The report card can be used to identify and track plan implementation and effectiveness. Checking in at appropriate milestones helps watershed partners make corrections and ensure that progress is being made towards achieving the plan's goals.

Information and Education Plan

Public outreach and educational activities are vital for supporting a healthier watershed. The Information and Education component of this plan supports the cumulative actions of partners, stakeholders, and the public across the watershed to accomplish its goals and objectives.

Recommended information and outreach activities include:

- Municipal outreach
- Watershed plan outreach
- An Urban BMP workshop
- A BMP Tour
- A public events booth
- Field days
- Educational signs
- School projects
- Watershed protection awareness

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SECTION 1: INTRODUCTION

Simply stated, a "watershed" is the area of land that drains into a common waterbody, such as a creek or river. It can be thought of as a large bathtub: when a drop of water hits anywhere in the tub, it eventually finds its way to the drain (the lowest point). The rim of the bathtub is like the watershed boundary—any drop falling outside it will not reach the drain. On land, a watershed boundary is determined by topography, and it includes surface water bodies (e.g., streams, rivers, lakes, reservoirs, and wetlands), groundwater (e.g., aquifers and groundwater basins), and the surrounding landscape.

The American Bottom watershed is an area in southwestern Illinois that drains to the Mississippi River (Figure 1). Rain falling on the watershed collects phosphorus and sediment on its way downhill. Excessively high concentrations of these and other pollutants in Cahokia Canal, Canteen Creek, Horseshoe Lake, and Chain of Rocks Canal earned these creeks a place on the 2018 IEPA 303(d) list of impaired waters for several successive years. Flooding is also a problem throughout the watershed, in instances when creeks rise up out of their banks, flash flooding in urban areas, and from high groundwater.

In 2012, Madison County began work on a county-wide Stormwater Management Plan to manage stormwater runoff. The plan is founded in four principles:

1. Acknowledging that multiple communities are connected by waterways and the actions of one jurisdiction will impact upstream and downstream jurisdictions. Stormwater management efforts should focus on a watershed-scale perspective.

2. Recognizing that a systems approach is needed in managing stormwater.

3. Recognizing that existing streams, creeks, bodies of water, and wetlands are infrastructure that needs to be protected and maintained.

4. Recognizing that future growth and a high quality of life are dependent on managing the effects of stormwater.

Based on these principles, the county is on track to incorporate watershed-level stormwater management plans for all of the major watersheds in the county. The Upper Silver Creek Watershed-Based Plan was completed in 2016. The Indian Creek-Cahokia Creek Watershed Plan and Canteen-Cahokia Creek Watershed Plan were completed in 2018. The Wood River and Piasa Creek watershed plans were completed in 2020.

A watershed plan is a strategy for managing watershed resources on public property, as well as providing a platform to encourage other watershed stakeholders (e.g., landowners, residents, businesses, developers, and non-profits) to participate. The plan is not regulatory, meaning it does not become law. The intent is to encourage voluntary improvements to stormwater management and water quality in the watershed.

American Bottom Watershed

Table 1. Jurisdictions in the American Bottom watershed.

Jurisdiction	Area within Watershed (acres)
Madison County (inclusive of municipalities)	43,320
Municipalities	30,184
Edwardsville	282
Fairmont City	619
Granite City	13,114
Hartford	627
Madison	8,681
Pontoon Beach	5,696
Venice	1,164
Unincorporated Areas	13,136
Townships	43,320
Chouteau	11,161
Collinsville	150
Granite City	9,333
Nameoki	13,439
Venice	9,236

The American Bottom watershed is located directly northeast of St. Louis, Missouri in southwestern Illinois. The watershed's 88.5 miles of streams drain roughly 72 square miles of Madison County. The watershed contains numerous subwatersheds, called HUC12s and HUC14s. "HUC" stands for Hydrologic Unit Code, a number that identifies the general location and size of the watershed. Many of the issues identified in the watershed are assessed at these smaller subwatershed levels.

Cahokia Creek (Cahokia Canal) and Canteen Creek are the major streams delivering water from the Canteen-Cahokia Creek watershed to the east of the American Bottom watershed. Horseshoe Lake is the largest waterbody in the watershed, at more than 1,600 acres. Long Lake, another large lake, drains to Horseshoe Lake. Part of the Mississippi River flows through the Chain of Rocks Canal within the watershed. Buried pipes carry water underground in several places in the watershed, including below America's Central Port. Pumps are installed to move water up and over levees into the Mississippi River when inland water levels are too high.

The watershed is home to 42,825 people. "Urban" land makes up 43% of land cover, agricultural land makes up 27%, with most of that land in row crop farming, open water covers 16%, and wetlands make up 14%. All or portions of seven municipalities, five townships, and one county are located within the watershed (Table 1 and Figure 3).

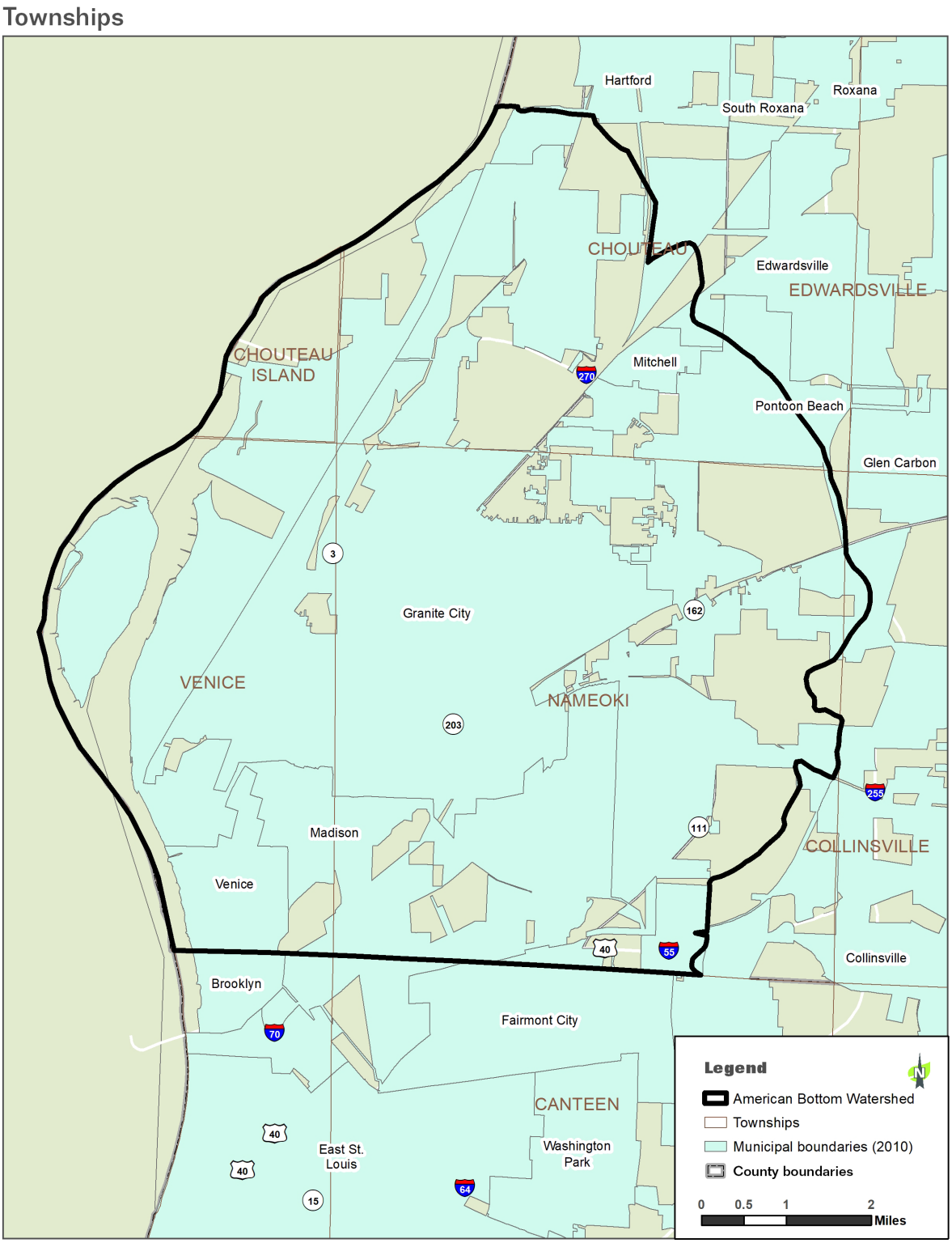


Figure 3. The American Bottom watershed, containing all or portions of three HUC12 subwatersheds, five townships, and seven municipalities.

Purpose

The purpose of the American Bottom Watershed Plan is to promote a healthy, functioning watershed that sensitively balances industry, farming, the built environment, and natural ecosystems, including restoring surface water quality to streams and lakes, improving ground water quality for drinking wells, and managing stormwater in floodplains and communities. The plan should enhance, manage, and protect the watershed's human, natural, cultural, and socio-economic resources by identifying strategies and resources that promote the health and safety of human inhabitants, improve surface and groundwater quality, prevent flood damage, protect wildlife, and increase environmental education.

United States Environmental Protection Agency Nine Elements

The USEPA outlines nine elements that are essential to a successful watershed plan. While these elements can be adapted as needed to support each individual plan, the watershed plan for American Bottom follows these nine elements as outlined below. Additionally, included in this document are locations of site-specific management projects that identify potential areas of BMP implementation, based on assessment by the Watershed Planning Committee (Section 5).

1) Identification of the causes/sources of pollution that need to be controlled to achieve the pollutant load reductions estimated in the watershed plan;
2) Estimate pollutant load reductions expected following implementation of the management measures under element 3 below;
3) Description of the BMPs (non-point source management measures) that are expected to be implemented to achieve the load reductions estimated under element 2 above and an identification of the critical areas in which those measures will be needed to implement;
4) Estimate of the amounts of technical and financial assistance needed, associated costs, and/or the source and authorities that will be relied upon, to implement the plan;
5) Public information/education component that will be implemented to enhance public understanding of the project and encourage early and continued participation in selecting, designing, and implementing/maintaining non-point source management measures that will be implemented;
6) Schedule for implementing the activities and non-point source management measures identified in this plan that is reasonably expeditious;
7) Description of interim, measurable milestones for determining whether non-point source management measures or other control actions are being implemented;
8) Set of environmental or administrative criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards;
9) Monitoring component to evaluate the effectiveness of the implementation efforts over time.

With these broader objectives in mind, the American Bottom Watershed Plan outlines a comprehensive way forward in improving the health of this watershed and subsequently maintaining any advances achieved.

Illinois Environmental Protection Agency Nonpoint Source Pollution Program

The Illinois Nonpoint Source Pollution (NPS) Management Program is a road map for Illinois' NPS pollution control activities and guides the implementation of the activities and projects supported by Section 319(h) grant funds and other NPS control activities in Illinois.

The Program includes a summary of Illinois' water resources, the sources and impacts of NPS pollution, and an outline of Illinois' approach to control NPS pollution to protect and improve those waters. The approach includes recommendations for state-wide and watershed-scale work.

Madison County Stormwater Plan

The Madison County Stormwater Plan is the overall framework for stormwater management in the county, which guides regulations, identifies flood and water quality problems, establishes BMPs, and prioritizes projects. The American Bottom watershed is one of 10 watersheds for which a watershed plan will be developed as part of the Stormwater Plan. Direction and approval for the Stormwater Plan comes from the Madison County Stormwater Commission, whose members include County Board members and municipal representatives.

The Madison County Stormwater Plan also references stormwater runoff, which is transported through Municipal Separate Storm Sewer Systems (MS4s). Madison County acts as the Coordinator for the MS4 Co-Permittee Group that consists of 26 communities including, Edwardsville, Granite City, Hartford, Madison, Pontoon Beach, Venice, Chouteau Township, Collinsville Township, Granite City Township, Nameoki Township, Venice Township, and Madison County. The group works together to help the individual communities and townships meet the six minimum control measures of their ILR40 permits.

The minimum requirements are: 1) public education and outreach, 2) public participation/involvement, 3) illicit discharge detection and elimination, 4) construction site runoff control, 5) post-construction runoff control, and 6) pollution prevention/good housekeeping. Madison County's MS4 activities in 2014 included technical training, outreach at public events, and hazardous waste collection.

Authority

The State of Illinois Counties Code (55 ILCS 5/) gives counties the authority to adopt and enforce floodplain regulations that apply to all buildings, structures, construction, excavation, and fill in the floodplain. The Counties Code also allows "management and mitigation of the effects of urbanization on stormwater drainage" in Madison County and eight other counties (55/ILCS 5/5-1062.2).

> *(55/ILCS 5/5-1062.2) Stormwater management. … The purpose of this Section shall be achieved by:*
>
> *(1) Consolidating the existing stormwater management framework into a united, countywide structure.*
> *(2) Setting minimum standards for floodplain and stormwater management.*
> (3) *Preparing a countywide plan for the management of natural and man-made drainageways. The countywide plan may incorporate watershed plans.*

The Section also allows the establishment of a stormwater management planning committee, whose principal duties "shall be to develop a stormwater management plan for presentation to and approval by the county board, and to direct the plan's implementation and revision." The Madison County Stormwater Commission fulfills this role. The stormwater plan it creates must be reviewed by the Illinois Department of Resources Office of Water Resources (IDNR-OWR), and can include elements such as rules for floodplain and stormwater management, fees or taxes from new development, and incentives for using green infrastructure and other approved drainage structures. Illinois municipalities also have the authority to adopt stormwater plans (65 ILCS/ Art 11 prec Div 110 – Flood Control and Drainage).

Methodology

Madison County and HeartLands Conservancy developed a watershed planning approach based on guidance from the Stormwater Master Plan, the county Stormwater Commission, IEPA's Nonpoint Source Program, and the USEPA's nine elements of watershed planning. The planning process included the following components:

1. Watershed area data collection and analysis
2. Delineation of subwatersheds
3. Technical Committee and Advisory Groups
4. Stakeholder engagement
5. Key issue identification and goal setting
6. Critical Areas identification
7. Management Measure and target development
8. Implementation plan
9. Stormwater Commission and County Board review
10. Integration into the county-wide Stormwater Master Plan

Watershed Data Collection and Analysis

A Watershed Resource Inventory (Appendix A) was developed by the U.S. Army Corps of Engineers (USACE), which reviews the existing conditions within the watershed. The inventory documents existing conditions in the streams and lakes in the watershed including channelization, erosion, riparian area condition, soil types, demographics, land use/land cover, and climate. Existing pollutant loads of nitrogen, phosphorus, and sediment are estimated from existing land uses using the Spreadsheet for Estimating Pollutant Loads (STEPL) from the USEPA. See planning inputs (right) for a list of data collected or generated for the Watershed Resources Inventory.

Aerial assessment of stream and riparian conditions

Little information existed about the condition of the streams in the watershed. To gather information about the stream reaches, geo-referenced video footage was taken by Fostaire Helicopter using Red Hen software on low-level helicopter flights over the larger streams in the watershed. USACE staff viewed the videotapes to assess three parameters for each stream: streambank erosion, degree of channelization, condition of the riparian area, and streambed erosion.

Detention basin survey

USACE looked at National Agriculture Imagery Program aerial photographs of the watershed, along with U.S. Geological Survey (USGS) topographic maps and the National Hydrography Dataset, to identify detention and retention basins in both Cahokia Creek watersheds. A point was created for each basin located in or very close to a group of five or more buildings, to avoid classifying natural ponds as detention basins. Eighty-two detention or retention basins were identified in the watershed. Site visits were made to 13 of the 82 accessible basins identified, in order to determine their condition.

Delineation of subwatersheds

The watershed contains three subwatersheds, or hydrologic units (HUCs), called HUC12s. To provide more detailed analysis and recommendations for the watershed, the HUC12s were further divided into five even smaller HUC14 subwatersheds. USACE used USGS methodology for defining watersheds in the Watershed Boundary Dataset (WBD), a component of the National Hydrography Dataset (NHD). Throughout this plan, the term "subwatershed" refers to the HUC14 subwatershed level.

Planning inputs

The following types or sources of data were used to shape the Plan:

Watershed Resources Inventory

- Watershed boundaries (incl. HUC14s)
- Streams and waterbodies
- Direction of flow
- Topography
- Climate (incl. temperature and precipitation)
- Geology
- Aquifers
- Wells
- Hydric and hydrologic soils
- Erodible soils
- Water table
- Jurisdictional roles (federal, state, and local)
- Demographics
- Land use/land cover
- Ecological significance
- Fish and wildlife populations
- Transportation infrastructure
- Cultural/historic resources
- Impervious cover
- Streambank & streambed erosion
- Channelization
- Logjams
- Detention and retention basins
- Floodplains
- Infrastructure in floodplains
- National Flood Insurance Program (NFIP) communities
- IEPA 303(d) impaired waters
- Other water quality data
- Spreadsheet for Estimating Pollutant Loads (STEPL) analysis

Watershed Plan

- Agricultural Conservation Planning Framework (ACPF) GIS tools
- Best Management Practice (BMP) pollutant reduction efficiencies
- Best Management Practice (BMP) siting GIS tool & analysis

Stakeholder engagement

- Technical Committee/Advisory Group
- Open House Events
- Stakeholder meetings
- Flood Survey

Stakeholder Engagement

Early on and throughout the planning process, the planning team engaged more than 300 individuals and more than 30 entities. Interviews were conducted with stakeholders including townships, municipalities, America's Central Port, and County Board members. Small group meetings allowed attendees to provide locations of floods and other issues on large paper maps, and give detailed input on stormwater issues in the watershed. Three Open House events were also used to gather input and get feedback from the general public.

Municipalities were asked about their drinking water source(s), wastewater treatment system(s), and flooding, as well as issues such as erosion, siltation, and water quality issues. Other stakeholders were asked about these issues in their jurisdiction or on their property. A table summarizing the input from municipalities can be found in Appendix A (Watershed Resource Inventory). Stakeholder input was particularly helpful in shaping the Critical Area locations and the Information and Outreach section of the plan, which identifies outreach gaps and opportunities with specific events and groups. Some of the issues identified during outreach include urban flooding, leaks in sanitary sewer infrastructure, private sewage, siltation, and surface water quality problems.

Flood Survey

As another component of stakeholder outreach, the Madison County Community Flood Survey for the American Bottom watershed was sent to 2,100 residents and business owners in the watershed—as well as posted online—following the initial stakeholder meetings. More than 380 responses were received. The results revealed trends in flooding locations, frequency, and impacts (Appendix B). The survey found that 45% of respondents experienced flooding in the last decade, and those respondents experience an average of 0.86 floods per year.

Key Issue Identification and Goal Setting

Using the results of the stakeholder outreach process, the project team and technical committee identified the key issues—such as urban flooding—in the watershed. As the key issues evolved, common themes emerged and the project team was able to develop overarching goals and objectives for the watershed.

Critical Areas Identification

In addition to identification of key issues, the project team used information gathered from municipalities, townships, the county, individual property owners, and a variety of technical and spatial data resources and modeling to determine the locations of Critical Areas in the watershed. A "Critical Area" is a location in the watershed where existing or potential future causes and sources of pollutants are significantly worse than other areas, or there is significant potential to make progress towards watershed plan goals.

Management Measures and Targets

Based on the Watershed Resource Inventory and input from stakeholders and the public, management measures and targets were identified. Management Measures include potential Best Management Practices (BMPs) for prevention, remediation, restoration, and maintenance to achieve water quality, natural resources, and flood control objectives. For each BMP, the plan identifies pollutant load reduction and other benefits, approximate costs, and a schedule for implementation. Sources of financial and technical support are also identified, and measures of success and milestones are established to monitor the ongoing progress of the plan.

Spreadsheet Tool for Estimating Pollutant Loads (STEPL)

USACE used the STEPL, which uses land cover, precipitation, and elevation data to estimate nitrogen, phosphorus, and sediment runoff from specific drainage areas. The tool created estimates for current land use conditions and future land cover scenarios incorporating Management Measures. These numbers were used to set targets for pollutant load reduction in the watershed.

BMP Siting Tool & Analysis

HeartLands Conservancy used the Best Management Practice (BMP) Siting Tool GIS framework developed by Tetra Tech and hosted by the EPA. This tool identifies appropriate areas for potential BMPs within an urban setting. The BMPs of interest for the American Bottom watershed are dry ponds, infiltration basins, grassed swales, vegetated filter strips, and porous pavement.

Agricultural Conservation Planning Framework (ACPF)

HeartLands Conservancy used the Agricultural Conservation Planning Framework (ACPF), a set of Geographic Information System (GIS) tools developed by the USDA to identify locations where certain BMPs (e.g., terraces, grassed waterways) would be well-suited. The ACPF uses topographic data (LiDAR) to create maps of drainage pathways across agricultural land. These drainage pathways are used alongside land cover, rainfall, and soils data to create usable maps within the watershed. HeartLands Conservancy worked closely with USDA to use the ACPF tools to get the most accurate and useful results for the agricultural portions of this watershed.

Implementation Plan

For each Management Measure, an implementation schedule was developed. Partners in the watershed plan can monitor progress and effectiveness using progress report cards (Appendix G).

Water quality monitoring

Water quality monitoring data was collected for the watershed (from Illinois State Geological Survey (ISGS), IEPA, and other sources), and a monitoring plan was created for the coming years (Appendix E).

Illinois Environmental Protection Agency Review

The final plan is submitted to and reviewed by the Illinois Environmental Protection Agency Bureau of Water Division. If the agency does not have any comments or recommendations to update the watershed based plan, the plan is approved and added to the IEPA website.

Stormwater Commission and County Board Review

The final plan will be reviewed by the Madison County Stormwater Commission. The Stormwater Commission will make a recommendation to the County Board on whether to adopt the plan as a part of the county-wide Stormwater Management Plan.

Integration into Madison County Stormwater Management Plan

Upon adoption by the County Board, the watershed plan will become a part of the county-wide Stormwater Management Plan.

SECTION 2: GOALS, OBJECTIVES, AND TARGETS

Goals and Objectives

A set of long-term goals and objectives were developed to address the challenges and issues associated with maintaining a healthy, functioning watershed (Table 2). These goals address the issues identified in the Watershed Resources Inventory, Community Flood Survey, and input from residents, landowners, businesses, and government officials. Each goal and objective align with a challenge/issue to be addressed, a set of recommended Best Management Practices (BMPs), organizations implementing those BMPs, specific and general projects using those BMPS, and ranking of the priority of the recommended BMPs.

Table 2. Goals and objectives of the Watershed Plan.

Goals	Objectives
Reduce Flooding/Mitigate Flood Damage	• Increase stormwater captured, stored, and infiltrated. • Limit development in the 100-year floodplain. • Restore the natural flow of streams and slow peak stream flow. • Promote ongoing maintenance and upgrade stormwater storage and conveyance infrastructure. • Improve outfalls of Horseshoe Lake and Long Lake. • Ensure safety of existing levees and plan for maintenance to minimize risk of flood damage. • Institute development standards to minimize impervious surfaces in development. • Provide information about flood damage prevention and insurance. • Provide information about development and waterproofing solutions in high water table areas. • Provide resources and create programs to assist property owners with on-site stormwater management. • Remove stream obstructions that impede water flow and cause flooding. • Develop and promote a “public watercourse” program, where property owners can have county assume responsibility of basins. • Ensure stormwater pumps are performing adequately through maintenance and/or replacement.
Improve Surface Water Quality	• Decrease pollutant loading to Mississippi River and its tributaries, and remove Cahokia Creek (Cahokia Canal), Canteen Creek, and Horseshoe Lake from the IEPA 303(d) List. • Protect drinking water sources from pollutants through groundwater protection, sanitary and storm sewer separation, stormwater infrastructure infiltration reduction, and infrastructure improvements. • Replace all combined sewer infrastructure with separate sewer and stormwater systems. • Reduce phosphorus by 25% by 2035. • Reduce sediment by 20% by 2035. • Reduce nitrogen by 15% by 2035. • Maintain dissolved oxygen (DO) levels above standard minimums. • Reduce manganese concentrations in Canteen Creek to 1,000 µg/L. • Create a private sewage assessment/maintenance/replacement strategy. • Monitor water quality and identify trends. • Reduce nutrient runoff into lakes and creeks to prevent algal blooms. • Monitor the six facilities with national Pollution Discharge Elimination System Permits.. • Promote the removal of contamination in three USEPA Superfund Sites. • Promote the removal of litter throughout the watershed, including where illegal dumping has occurred.
Promote Environmentally Sensitive Development	• Implement low-impact development strategies. • Develop programs to offset environmental impacts of new development and reinvest in neighborhoods developed prior to stormwater ordinances. • Conserve sensitive lands. • Use wetland mitigation banking or in-lieu fee programs to restore critical area wetlands. • Prioritize “green” stormwater management approaches.

	• Work with municipalities to amend policies and regulations to include conservation, native landscaping, stormwater management, green infrastructure, and to improve enforcement of existing codes.
Support Healthy Habitat and Recreation	• Promote healthy ecosystems within streams and riparian areas. • Increase the acreage of forest, native grassland, and wetlands. • Reconnect forest tracts along streams for habitat connectivity. • Monitor fish and aquatic macroinverterbrate communities. • Protect key natural features and wildlife corridors. • Create an invasive species removal strategy. • Create hiking and biking that interpret and help people experience natural areas.
Develop Organizational Frameworks	• Activate a network of partners to implement the plan. • Leverage funding from a variety of sources to implement the plan. • Develop county-wide and watershed-wide programs to address water issues. • Develop tools to improve guidance for sharing models, information, and systems that encourage the sharing of data to all partners.
Conduct Education and Outreach	• Identify opportunities to assist stakeholders with watershed management. • Connect watershed stakeholders to decision-makers and experts. • Offer opportunities for public education and participation in watershed matters. • Develop public recognition programs focused on the watershed plan's goals. • Increase awareness of the consequences of litter and illegal dumping. • Promote volunteer opportunities for monitoring and hands-on learning.

GOAL 1: REDUCE FLOODING AND MITIGATE FLOOD DAMAGE

Manage and mitigate floods to improve water quality, reduce property damage and health risk, and reduce infrastructure maintenance costs.

Within the watershed, there is a need for further outreach and dissemination of resources about flood damage prevention and flood insurance; a decrease in impervious surface area; preservation and slowing of natural stream flow; an increase in flood storage and infiltration features such as detention basins, wetlands, and no-till agriculture; assistance to homeowners to address issues on their properties, particularly in older neighborhoods; and changes in policy to discourage development in flood-prone areas.

Flood Management Objectives:

1.1 Increase the amount of stormwater captured, stored, and infiltrated in the watershed, particularly upstream of areas with periodic or regular property damage caused by flooding.

1.2 Limit development in the FEMA identified 100-year floodplain.

1.3 Restore the natural flow regime of streams in the watershed and identify opportunities to slow peak stream flow and recharge groundwater where increases in flood height are acceptable, to reduce pressure on waterways.

1.4 Promote ongoing improvement and maintenance of stormwater storage and conveyance infrastructure (e.g., infiltration basins, dry ponds, vegetated filter strips, and porous pavement) to maximize storage capacity.

1.5 Improve outfalls of Horseshoe Lake and Long Lake, through construction of larger stormwater infrastructure.

1.6 Ensure all existing levees are safe, and plan for maintenance and/or removal, where appropriate, to minimize risk of flood damage.

1.7 Institute development standards that seek to minimize the amount of impervious surfaces in new development and redevelopment projects, and provide more stormwater storage in the watershed.

1.8 Provide information and outreach about flood damage prevention and flood insurance.

1.9 Provide information about development and waterproofing solutions for existing development in high water table areas.

1.10 Provide resources or create programs to assist homeowners and businesses with on-site stormwater management (e.g. proper grading, rain gardens, downspout redirection, and interior drainage).

1.11 Remove stream obstructions that impede water flow and cause flooding outside of floodplains.

1.12 Develop and promote a "public watercourse" program where property owners can pay a fee to have county assume responsibility of basins.

1.13 Ensure stormwater pumps are performing adequately through maintenance and/or replacement to make sure they can prevent flooding during heavy rainfall events.

GOAL 2: IMPROVE SURFACE AND GROUND WATER QUALITY

This plan aims to improve surface and ground water quality in the watershed, so that the streams can be safely used by residents, groundwater can be safely used for a drinking water source, and to remove Cahokia Canal, Canteen Creek, Chain of Rocks Canal, and Horseshoe Lake from the IEPA 303(d) list of impaired waters.

Five streams have been listed on the 2018 IEPA 303(d) list of impaired waters. The causes of impairment for these creeks include total phosphorus, dissolved oxygen, iron, polychlorinated biphenyls (PCBs), manganese, barium, total suspended solids (TSS), bottom deposits, mercury, total ammonia, color, turbidity, sludge, odor, alteration in steam-side or littoral vegetative covers, changes in steam depth and velocity patterns, loss of instream cover, aquatic algae, aquatic plants, and sedimentation/siltation. There are also several areas in the watershed, particularly near the America's Central Port, where drinking water wells are not permitted due to high pollutant concentrations, mainly magnesium. For this plan, numerical reductions for impairments in the watershed are based on observed conditions and monitoring data, as well as Illinois water quality standards. The Watershed Impairment Reduction Targets table on page 37 (Table 3) provides details on the sources of these reduction targets.

Water Quality Objectives:

2.1 Decrease overall pollutant loading to lakes and streams in the watershed, including Cahokia Creek and its tributaries, and remove Cahokia Creek (Cahokia Canal), Canteen Creek, and Horseshoe Lake from the Illinois EPA 303(d) list of impaired waters.

2.2 Protect drinking water sources from pollutants that threaten human health or increase treatment costs through groundwater protection, sanitary and storm sewer separation, infrastructure infiltration reduction, inflow reduction, and infrastructure improvements.

2.3 Replace all combined sewer infrastructure with currently required separate sewer and stormwater systems.

2.4 Achieve a 25% reduction in phosphorus from the watershed by 2035. (i.e., a 25% reduction in the annual total phosphorus load by 2035, based on the Illinois Nutrient Loss Reduction Strategy.)

2.5 Achieve a 20% reduction in sediment from the watershed by 2035. (i.e., a 15% reduction in the annual sediment load by 2035, based on estimates from a suite of BMPs that also address the needed phosphorus reduction.)

2.6 Achieve a 15% reduction in nitrogen from the watershed by 2035. (i.e., a 15% reduction in the annual total nitrogen load by 2035, based on the Illinois Nutrient Loss Reduction Strategy.)

2.7 Maintain Dissolved Oxygen (DO) levels above standard minimums. (i.e., consistently maintain levels higher than the minimum concentrations set in 35 Ill. Adm. Code 302, set by the Illinois Pollution Control Board in 2011). These standards are different for March to July and August to February.)

2.8 Reduce manganese concentrations in Canteen Creek to 1,000 µg/L, per the Cahokia Canal Watershed TMDL Report.

2.9 Create a strategy to improve the assessment and maintenance of private sewage systems (i.e., septic tanks) for correct functioning.

2.10 Monitor the watershed's water quality and quantity to identify trends and evaluate the success of watershed management activities.

2.11 Reduce nutrient runoff into lakes and creeks to prevent harmful algal blooms.

2.12 Monitor the six facilities with National Pollution Discharge Elimination System Permits and encourage implementation of practices to further reduce pollutants from these outputs.

2.13 Promote the removal of contamination resulting in delisting of all three USEPA Superfund Sites.

2.14 Promote removal of litter throughout the watershed, including areas where illegal dumping has occurred.

GOAL 3: PROMOTE ENVIRONMENTALLY SENSITIVE DEVELOPMENT PRACTICES

Promote development practices that protect environmentally sensitive lands (e.g., wetlands and forests), conserve soil, limit new impervious surfaces, and increase the use of native vegetation.

Development Objectives:

3.1 Implement low-impact development (LID) and green infrastructure strategies so that important watershed processes and water resource functional values are protected. Development should allow high ground infiltration, use minimal impervious surface area, protect trees and native vegetation, and have adequate stormwater and sediment detention.

3.2 Develop programs to offset the environmental impacts of new development and encourage reinvestments in neighborhoods developed prior to stormwater ordinances.

3.3 Conserve sensitive lands by taking them out of crop production and/or protecting them from development. These lands include cropland that frequently floods, wetlands, highly erodible and hydric soils, and forested lands adjacent to waterways (riparian areas).

3.4 Use wetland mitigation banking or in-lieu fee programs to restore critical wetland areas.

3.5 Prioritize "green" stormwater management approaches that use native vegetation to naturally filter pollutants over conventional structural approaches, such as riprap and piped conveyance.

3.6 Work with municipalities to amend their comprehensive plans, zoning ordinances, and subdivision regulations to include sensitive land conservation, native landscaping, stormwater management, and low-impact development standards, and to enforce existing codes.

GOAL 4: SUPPORT HEALTHY FISH AND WILDLIFE HABITAT AND RECREATION

Improve and protect habitat in streams and water bodies to promote biodiversity.

Habitat Objectives:

4.1 Promote healthy ecosystems within streams and riparian areas to provide habitat for a wide variety of plant and animal species, as well as recreation opportunities.

4.2 Increase acreage of forests, native grasslands, and wetlands in the watershed while limiting the acreage of impervious surface area and turf grass.

4.3 Reconnect forest tracts along streams and improve interconnected landscape elements for habitat connectivity and greenway corridors.

4.4 Monitor fish and aquatic macroinvertebrate communities alongside water quality data to assess suitability of habitat.

4.5 Identify and protect key natural features and corridors for wildlife, including wetlands, forest, and grassland, to prevent the loss or degradation of fish and wildlife habitat and provide recreation opportunities such as fishing, hunting, and hiking.

4.6 Create a strategy to remove invasive species within the watershed and educate landowners about invasive species and how to safely remove them, particularly in riparian areas.

4.7 Create hiking and biking trails that interpret and help people experience natural areas.

GOAL 5: DEVELOP ORGANIZATIONAL FRAMEWORKS TO IMPLEMENT WATERSHED GOALS

Facilitate partnerships with stakeholders and leverage resources to implement the watershed plan.

Organizational Framework Objectives:

5.1 Activate a network of partners dedicated to implementing the watershed plan and other water quality and stormwater management issues throughout the county.

5.2 Leverage funding from a variety of sources to implement the watershed plan.

5.3 Develop county-wide or watershed-wide programs to effectively address water issues, such as basin maintenance and remediation, resources, and education.

5.4 Develop tools to improve guidance for sharing of models, improved regional information, and systems that allow and encourage the sharing of data to all watershed partners.

GOAL 6: CONDUCT EDUCATION AND OUTREACH

Promote public awareness, understanding, and stewardship of the watershed and the watershed plan.

Education and Outreach Objectives:

6.1 Identify opportunities to assist municipalities, counties, state and federal agencies, and other stakeholders with watershed management and conservation efforts.

6.2 Connect watershed residents, farmers, and business owners to decision-makers and experts with knowledge about water quality, flooding issues, and solutions.

6.3 Offer effective opportunities for public education, training, and participation in watershed matters, including information-based resources and demonstration projects.

6.4 Develop public recognition programs focused on the watershed plan's goals.

6.5 Increase awareness of consequences of littering and illegal dumping.

6.6 Promote volunteer opportunities for monitoring, service projects and other hands-on learning.

Watershed Impairment Reduction Targets

Establishing "Impairment Reduction Targets" is an important part of the watershed planning process. It enables calculations to be made about how implementation of a suite of Management Measures can be expected to reduce watershed impairments over time. The Implementation Reduction Targets for this watershed plan are based on the Illinois Nutrient Loss Reduction Strategy, published by IEPA in 2015. The strategy describes a comprehensive suite of BMPs for reducing nutrient loads from wastewater treatment plants and urban and agricultural runoff. Its targets are a 25% reduction in phosphorus and a 15% reduction in nitrogen by 2025, with an eventual target of 45% reduction for both nutrients. This watershed plan adds a target of a 20% reduction of sediment (Table 3). Because this plan was completed in 2020, a longer time horizon is needed to meet the targets. These targets should be achieved by 2035.

Additional watershed-wide impairment reduction targets were established for flood damage, habitat degradation, wetlands, surface water infiltration, and private sewage. A target for manganese in Canteen Creek and dissolved oxygen in Cahokia Canal identified in the Total Maximum Daily Load (TMDL) for the larger Cahokia Creek (Cahokia Canal) watershed is also included.

Table 3. Watershed-wide impairment reduction targets, their basis, and reductions from Critical Areas and other areas recommended.

Impairment: Cause of Impairment	**Basis for Impairment**	**Reduction Target**	**Reduction from Critical Areas and other areas**
Water Quality/Aquatic Life: Phosphorus	140,650 lbs/year of phosphorus loading, based on STEPL model	**25%** or **35,163** lbs/year reduction in phosphorus loading by 2035, based on the Illinois Nutrient Loss Reduction Strategy	539 lbs/year reduction from Critical Stream Reaches and other poor condition stream reaches 3,947 lbs/year reduction from Critical Riparian Areas and other riparian areas 6,552 lbs/year reduction from Critical Wetland Areas 20,722 lbs/year reduction from other agricultural areas 3,176 lbs/year reduction from urban and forested areas 2,151 lbs/year reduction from shoreline and logjam areas
TOTAL			37,087 **lbs/year or 26% total phosphorus reduction**
Water Quality/Aquatic Life: Sediment	25,081 tons/year of sediment loading, based on STEPL model	**20%** or **5,016** tons/year reduction in sediment loading by 2035, based on estimated impacts of proposed BMPs.	948 tons/year reduction from Critical Stream Reaches and other poor condition stream reaches 706 tons/year reduction from Critical Riparian Areas and other riparian areas 1,682 tons/year reduction from Critical Wetland Areas 2,7835 tons/year reduction from other agricultural areas 751 tons/year reduction from urban and forested areas 1,287 tons/year from shoreline and logjam areas
TOTAL			8,108 **tons/year or 32% total sediment reduction**
Water Quality/Aquatic Life: Nitrogen	809,193 lbs/year of nitrogen loading, based on STEPL model	**15%** or 121,379 lbs/year reduction in nitrogen loading by 2035, based on the Illinois Nutrient Loss Reduction Strategy	1,400 lbs/year reduction from Critical Stream Reaches and other poor condition stream reaches 15,520 lbs/year reduction from Critical Riparian Areas and other riparian areas 13,271 lbs/year reduction from Critical Wetland Areas 60,179 lbs/year reduction from other agricultural areas 20,663 lbs/year reduction from urban and forested areas 6,384 lbs/year reduction from shoreline and logjam areas
TOTAL			**117,417 lbs/year or 15% total nitrogen reduction**
Water Quality/Aquatic Life: Dissolved Oxygen	Cahokia Creek (Cahokia Canal) impaired for dissolved oxygen in 2018 and previous years	No samples lower than the minimum concentration in streams: March – July: 5.0 mg/L at any time, 6.0 mg/L daily mean averaged over 7 days August – February: 3.5 mg/L at any time, 4.0 mg/L daily mean averaged over 7 days, 5.5 mg/L daily mean averaged over 30 days Based on 35 Ill. Adm. Code 302 (Illinois Pollution Control Board (IPCB), 2011). No samples lower than the TMDL standards of 5.0 mg/L instantaneous minimum or 6.0 mg/L minimum during at least 16 hours of any 24-hour period (from Cahokia Canal Watershed TMDL).	91,344 feet streambank and channel stabilization and restoration, including riffle pools and other structures that increase re-aeration 242 acres (17.3 miles) of poor condition riparian areas ecologically restored, including 100% Critical Riparian Areas

Table 3, continued.

Impairment: Cause of Impairment	Basis for Impairment	Reduction Target	Reduction from Critical Areas and other areas
Water Quality/Aquatic Life: Manganese in Canteen Creek	423 µg/L average observed value on impaired segment of Canteen Creek, from 2009 Cahokia Canal Watershed TMDL Report	**No samples higher than the TMDL standards** of 1,000 µg/L.	Soil erosion control practices also reducing manganese: 7,112 acres cover crops 159 acres grassed waterways 7,112 acres reduced tillage (conservation tillage/no-till)
Water Quality/Fish Consumption: Polychlorinated Biphenyls (PCBs)	Horseshoe Lake and Chain of Rocks Canal impaired for PCBs in 2018 and previous years	**No samples higher than the general use standards** of 1 mg/kg.	300 acres dry detention basins installed 300 acres wet detention basins installed 3,709,134 square feet of urban filter strips 2,148 acres of Critical Wetland Areas 100 acres of pervious pavement
Water Quality/Fish Consumption: Barium	Canteen Creek impaired for barium in 2018 and previous years	**No samples higher than the general use standards** of 2 mg/L.	300 acres dry detention basins installed 300 acres wet detention basins installed 3,709,134 square feet of urban filter strips 2,148 acres of Critical Wetland Areas 100 acres of pervious pavement
Flood Damage: Flooding inside and outside floodplain	45% of Flood Survey respondents experienced flooding in the last 10 years. 20% of these reported monetary losses of >$5,000 over that time due to flooding.	300 **acres dry detention basins** installed 300 **acres wet detention basins** installed **Retrofits & maintenance** of existing detention basins	300 acres dry detention basins installed 300 acres wet detention basins installed Retrofits & maintenance on all 82 identified existing detention basins, plus regional retention basins added Single property flood reduction strategies, such as tile drainage, water proofing, and pumps.
Habitat Degradation: Invasive/non-native plant species in riparian areas; hydrologic changes due to loss of wetlands; logjams	The riparian areas along 42% of streams assessed (10 miles) are in poor condition. 105,600 ft of Critical Riparian Areas. 11 miles of Critical Logjam Areas.	**100% Critical Riparian Areas** restored **Majority of riparian areas in poor condition** restored **100% Critical Logjam Areas** assessed	105,600 feet of poor condition riparian areas ecologically restored, including 100% Critical Riparian Areas 100% Critical Logjam Areas assessed
Wetland Loss: Flood storage and filtration functions	Thousands of acres of wetlands lost since pre-settlement; loss of ecosystem functions	**25% Critical Wetlands Areas** restored	2,148 acres (25%) Critical Wetlands Areas restored
Reduced infiltration to groundwater	Current mean 13.4% impervious cover; current 4,567 acres developed open space (2011 NLCD) or 7,092 acres open space (EWG).	**Preservation of open space and infiltration measures** used in new and redevelopment **Increase in rain gardens** **Increase in pervious surfaces** in new and redevelopment **Increased connectivity** and green corridor.	Preservation of open space and infiltration measures in all new and redevelopment, e.g., designed for Conservation Development and green infrastructure 25,000 sq. ft of rain gardens installed 200 rain barrels/cisterns installed

Table 3, continued.

Impairment: Cause of Impairment	Basis for Impairment	Reduction Target	Reduction from Critical Areas and other areas
Fecal Coliform: Private sewage	Median 460 cfu/100mL fecal coliform concentrations based on samples collected from Cahokia Canal (1978-2005, Illinois Water Science Center). Also, average observed value (mean) of 3,111 cfu/100mL. Many private sewage systems located in watershed. Estimated 10% private sewage failure rate nationwide.	**57% or 260 cfu/100mL** reduction by 2035 to reach geometric mean of 200 cfu/100mL in a minimum of 5 samples taken over 30 days, based on 35 Ill. Adm. Code 302 (IPCB 2011). **Proactive inspection programs** for private sewage, not just complaint-based.	Reduction in in-stream measured fecal coliform in streams Proactive county/municipal inspection programs for private sewage, beyond complaint-based assessment Reductions following maintenance and replacement as a result of private sewage inspections Sanitary sewer system extension to non-service areas.
Reduction in natural stream flow	67% of streams assessed (16.2 miles) are highly channelized. 91,344 ft of Critical Stream Reach. 58,080 ft of Critical Logjams	**100% Critical Stream Reach Restored** **100% Critical Logjam Removed**	91,344 feet Critical Stream Reach Restored 58,080 feet Critical Logjam Removed

Table 4. Causes and sources of watershed impairments and the associated goals that address them.

IEPA or other impairment	Cause of impairment	Known or potential source of impairment	Goals
Structural Flood Damage	Encroachment in 100-year floodplain (known impairment)	Development in known 100-year floodplain Channelized streams Lakes and streams filling with sediment Agricultural drain tiles Wetland & riparian buffer loss Logjams and other obstructions in streams Existing and future urban impervious surfaces Undersized lake outfalls	1, 3, 5
Structural Flood Damage	Urban flooding / flash flooding (known impairment) and groundwater flooding	Existing and future urban impervious surfaces Inadequate stormwater infrastructure (e.g. too few detention basins) Poor stormwater infrastructure design & function Lack of funding for stormwater infrastructure Agricultural drain tiles Traditional development design Undersized lake outfalls	1, 3, 5
Water Quality - Aquatic Life	Nutrients: Phosphorus (known impairment) and Nitrogen (potential impairment)	Existing and future urban impervious surfaces Agricultural row crop runoff Streambank & channel erosion, lake shoreline erosion Wastewater treatment plants Failing private sewage systems Lawn fertilizer Level of landowner knowledge of watershed impairment causes	2, 3, 6
Water Quality - Aquatic Life	Sediment: Total Suspended Solids (known impairment)	Existing and future urban impervious surfaces Turf grasses, which decrease infiltration and increase erosion Agricultural row crop runoff Streambank & channel erosion, lake shoreline erosion Construction sites	2, 3
Water Quality - Aquatic Life	Low dissolved oxygen (known impairment)	Heated stormwater runoff from urban areas Lack of natural riffles and slopes in streams (incl. channelized streams) Poor riparian corridors Agricultural row crop runoff	2, 3
Water Quality	Manganese (known impairment)	Naturally high manganese levels in soil and rocks Atmospheric deposition from industry (e.g. from fossil fuel combustion, steel production) Discharges from industrial operations	2
Water Quality	PCBs and barium (known impairment)	Barium is used in oil and natural gas industries Older electrical systems with PCB transformers PCBs were used in various industrial facilities	2
Habitat Degradation	Invasive/non-native plant species & degradation in riparian and other natural areas (known impairment)	Existing and introduced invasive species populations Logjams, trash/debris, and other obstructions in streams and lakes Level of public awareness Removal of riparian corridor	3, 4, 6

Table 4 continued

IEPA or other impairment	Cause of impairment	Known or potential source of impairment	Goals
Habitat Degradation	Loss and fragmentation of open space/wetlands/natural habitat (known impairment)	Inadequate protection policy Lack of land acquisition funds Traditional development design and urban sprawl Streambank, channel, and riparian area modification Lack of restoration and maintenance funds Wetland and riparian area loss	3, 4, 5

SECTION 3: ISSUES AND CRITICAL AREAS

Key Issues Identified

The following issues were identified in the watershed planning process. Issues are organized by the primary goal to which they relate, such as flooding. For some issues, Critical Areas where the issue is most prevalent or impactful were identified (see p.54).

Flooding

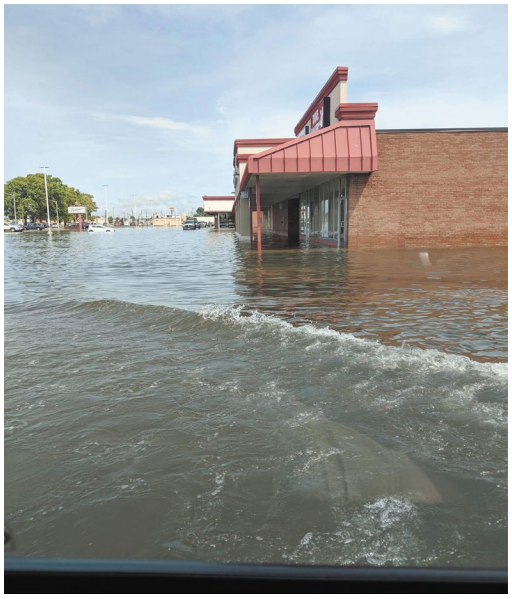
Issue: Prevalent Flooding, within and outside floodplains.
Flooding is highly prevalent in the watershed, both inside and outside of floodplains, and in rural and urban areas. Urban flooding was the most important to the municipalities interviewed; all of them had experienced at least some flooding in developed areas. Open House attendees and Flood Survey respondents reported flooding on their properties and on the roads around them. The Madison County Community Flood Survey, administered in 2017, revealed significant and widespread flooding problems affecting residents and property owners in the watershed (Appendix B). Frequent flooding damaged homes and businesses, causing health and safety impacts, as well as monetary loss. Several participants at the Open House events reported that homes which experienced the most frequent flooding were built in the 1960s before the floodplains had been delineated. See Table 4 for causes and sources associated with flooding.

Objectives addressing this issue:
♦ Increase stormwater captured, stored, and infiltrated.
♦ Remove stream obstructions
♦ Limit development in the 100-year floodplain
♦ Institute development standards that minimize impervious surfaces.
♦ Restore natural flow regime of streams
♦ Improve aging stormwater infrastructure
♦ Provide resources to assist with on-site stormwater management

There are several areas that experience repetitive flooding, including Nameoki Ditch corridor in Granite City, area surrounding America's Central Port, and upstream of Long Lake in Pontoon Beach. Neighborhoods on either side of Nameoki Ditch have been flooded with two to three feet of water. The America's Central Port area has also experienced flooding of two-foot depth, with Route 3 being overtopped near the entrance to the facility. The outfall at Long Lake is undersized and has resulted in back-ups and flooding upstream in Pontoon Beach with residents having to be rescued by boat in 2015.

Some areas of flatter, higher ground in the watershed that are not in the floodplain have still been flooded by flash floods/urban flooding from time to time. This flooding is a result of increased impervious surfaces (i.e., developed areas), changes in local hydrology (e.g., ditches installed or filled in), aging infrastructure, severe storm events with heavy rainfall, and a high water table. Ninety-six percent of the flooding reported in the Madison County Community Flood Survey did not occur in floodplains (Appendix B).





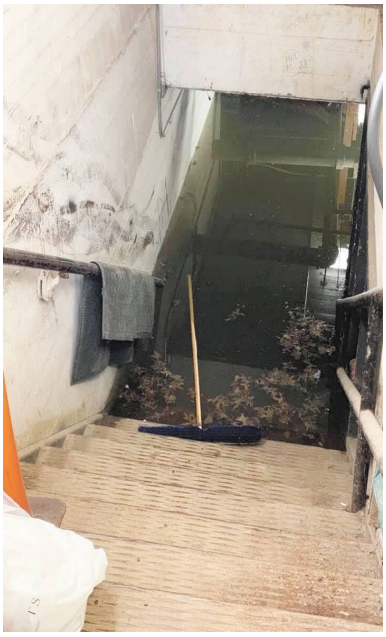
Left: Flooding in Granite City, 2018. Photo: Eric Pomeroy.
Right: Nameoki Rd flooding. Photo: Paul Kacera



Left: 25th and Missouri Ave. Photo: Thomas Jackson.
Bottom Left: Pontoon Rd. Photo: Rico Jefe.
Bottom Middle: Lydia Ln. Photo: Paul Yehling.
Bottom Right: Granite City HS. Photo: Amy Heath







Issue: Undersized and aging stormwater infrastructure: Throughout the watershed, stormwater infrastructure (e.g., culverts, ditches) is undersized for the amount of water it has to handle, leading to flooding, especially in Granite City. There are also water quality implications. In 2018, IEPA listed urban runoff/storm sewers as a source of impairment of water quality in Cahokia Creek (Cahokia Canal), Canteen Creek, and Horseshoe Lake. When water carries pollutants, debris, and sediment into storm drains and ditches, there is no filtration before the runoff reaches streams, lakes, and the Mississippi River. The outfalls for Horseshoe Lake and Long Lake are also undersized and filled with sediment reducing their efficiency and causing increased flooding upstream. Additionally, groundwater and stormwater can cause infiltration and inflow into aging sanitary sewer systems. This excess water can cause backups from sewers which flood yards and homes.

Objectives addressing this issue:
♦ Promote ongoing improvement and maintenance of stormwater storage and conveyance infrastructure.
♦ Improve outfalls of Horseshoe Lake and Long Lake.
♦ Develop program to have counties assume responsibilities of basins.
♦ Provide resources to assist with on-site stormwater management.
♦ Ensure stormwater pumps are performing adequately.

Issue: High water table/groundwater: The water table is less than 50 cm deep in 78% of the soils covering the watershed. Only 3% of the watershed has a water table depth of more than 100 cm (1 meter), mainly under elevated levees and highway interchanges. This is due to the location of the watershed being within the historic Mississippi River floodplain and the water table depth being influenced by the river elevation. Rainfall leads to saturation of soils with a high water table more quickly. When the soil is already saturated, stormwater cannot infiltrate and runs off on the surface, contributing to flooding.

Objectives addressing this issue:
♦ Provide information about development in high water table areas.
♦ Increase the amount of stormwater captured, stored, and infiltrated in the watershed.
♦ Institute development standards that minimize impervious surfaces.

Issue: **Large areas of impervious cover**: New development and the creation of large areas of impervious surfaces has dramatically changed stormwater drainage in some areas, leading to flooding. The mean imperviousness in the watershed is 13% as of 2011 but some subwatershed areas have 72% and 39% impervious surface. Imperviousness is set to increase as more low-density residential and industrial development is projected to be added to the watershed based on municipal Comprehensive Plans. Unless steps are taken to install green infrastructure that allows for infiltration and regional retention, this development will add large areas of impervious cover and exacerbate flash flooding.

Objectives addressing this issue:
♦ Institute development standards that minimize impervious surfaces.
♦ Increase amount of stormwater captured, stored, and infiltrated in the watershed.
♦ Provide resources to assist with on-site stormwater management.

Issue: Backup issues when the river is high: When the Mississippi River is high, the gates at the levee close and the river rises on its side of the levee. Cahokia Canal drains more slowly to the Mississippi River when this happens, or not at all, causing the inland waterways to back up. Pumps along the levees can only work so hard to move water from behind the levee to the Mississippi River. During heavy rain, the water moving towards the river eventually has nowhere to go and causes water to back up far inland of the river.

Objectives addressing this issue:
♦ Increase the amount of stormwater captured, stored, and infiltrated in the watershed.
♦ Provide resources to assist with on-site stormwater management.
♦ Ensure stormwater pumps are performing adequately

Issue: Horseshoe Lake and Long Lake backup issues: The current outlets for Horseshoe Lake and Long Lake are both undersized and partially filled with sediment, reducing the amount of water that can flow through the outlets. This flow reduction causes flooding of neighborhoods and agricultural land surrounding the lakes. The outlets need to be replaced with adequately size infrastructure to ensure stormwater can efficiently flow through the lakes.

Objectives addressing this issue:
♦ Improve outfalls of Horseshoe Lake and Long Lake.
♦ Increase the amount of stormwater captured, stored, and infiltrated in the watershed.
♦ Institute development standards that minimize impervious surfaces.

Issue: Logjams and beavers: Beavers and logjams contribute to localized flooding issues that can be significant in size. Along streams, a beaver-caused logjam can cause the stream to rise above its banks and flood adjacent lands. Some of these logjams are beneficial to areas downstream, as they slow the peak stream flow and can reduce flooding downstream. In other cases, the flooding and streambank scouring caused by the logjam do more harm than good.

Objectives addressing this issue:
♦ Restore natural flow regime of streams.
♦ Remove stream obstructions that impede flow.

Issue: Channelization: When streams are straightened (channelized), such as the Nameoki Ditch, water moves through them much more quickly and can cause flooding downstream by reaching the next choke point in large volumes. 67% of the assessed streams were classified as highly channelized. In 2018, IEPA listed channelization as a source of impairment of water quality in Canteen Creek, and Cahokia Creek.

Objectives addressing this issue:
♦ Restore natural flow regime of streams.
♦ Remove stream obstructions that impede flow.

Issue: Sediment deposition: Runoff causes an influx of sediment into ditches, detention basins, and lakes reducing the capacity of these stormwater systems. In the American Bottom watershed, 56% of sediment comes from urban areas, 23% from agricultural fields, and 20% from streambanks. Dredging in these systems is needed to maintain water storage capacity. These waterbodies and waterways are often not dredged as often as is necessary to maintain their sediment storage and water storage capacities. This can happen when ownership or management responsibilities associated with the area to be dredged are unclear, or simply because dredging and maintenance can be very expensive.

Objectives addressing this issue:
♦ Develop program to have counties assume responsibilities of basins.
♦ Increase the amount of stormwater captured, stored, and infiltrated in the watershed.
♦ Minimize impervious surfaces.
♦ Restore natural flow regime of streams
♦ Reduce sediment by 20% by 2035.

Surface and ground water quality

Table 4 lists the known water quality impairments in the watershed and their associated causes and sources. The following issues do not refer to point sources of pollution from the six facilities in the watershed that hold a National Pollution Discharge Elimination System (NPDES) permit for discharging wastewater into the watershed.

Issue: Pollutants

Pollutants in lakes and streams come from a variety of sources and impact human health and activity in many ways. Floodwaters bring all their contaminants onto the land. Also, boating, swimming, and fishing bring people into direct contact with the water. Several pollutants are found in streams and waterbodies in the watershed.

Objectives addressing this issue:
♦ Decrease overall pollutant loading to lakes and streams in the watershed.
♦ Reduce phosphorus by 25% and nitrogen by 15% by 2035.
♦ Reduce sediment by 20% by 2035.
♦ Monitor water quality and identify trends.
♦ Protect drinking water sources from pollutants.
♦ Reduce manganese concentrations in Canteen Creek.
♦ Promote the removal of Superfund Sites.

Phosphorus is carried into waterways along with soil particles. It often comes from fertilizers. An estimated 67% of phosphorus in the watershed comes from urban areas, with another 28% from agricultural land (see Appendix A, p.123). Phosphorus can lead to harmful algal blooms and is one of the pollutants identified in Cahokia Creek (Cahokia Canal), Canteen Creek, and Horseshoe Lake on the 2018 IEPA 303(d) List. Fertilizers and erosion on crop land contribute to significant nutrient loading (phosphorus and nitrogen). This issue is detailed in the 2015 Illinois Nutrient Loss Reduction Strategy.

Manganese and Iron are also carried with soil. Iron is one of the pollutants identified in Cahokia Creek (Cahokia Canal) on the 2018 IEPA 303(d) List. Manganese is listed as an impairment for Cahokia Canal and Canteen Creek on the 2018 IEPA 303(d) List. These elements are found in naturally high levels in soil in the area. Both can be toxic to aquatic plants and animals.

Barium: Barium is one of the pollutants identified in Canteen Creek on the 2018 IEPA 303(d) List. The source of this pollutant is not known (possibly industrial or prior mining activity). Barium can be toxic to aquatic life and to human life if the level of exposure is too high. The barium impairment may be related to historic mining activity upstream in the Canteen-Cahokia Creek watershed on the east side of Collinsville; however this has not been confirmed.

Polychlorinated Biphenyls (PCBs): PCBs are one of the pollutants identified in the Chain of Rocks Canal, Mississippi River, and Horseshoe Lake on the 2018 IEPA 303(d) List. PCBs are a group of manmade chemicals that were used widely in electrical equipment, such as capacitors and transformers, until they were banned in 1979 due to effects of exposure on human health.

Chloride: Application and storage of road salt is a concern where water with high concentrations of chloride flows into groundwater or streams. Chlorides increase treatment costs for water supplies and are harmful to aquatic life in waterways.

Issue: **Soil erosion:** Soil erosion contributes large amounts of sediment to streams and waterways. Soil that erodes from industrial areas can carry contaminants such as barium and PCBs into streams. In 2018, IEPA listed contaminated sediment as a source of impairment of water quality in Cahokia Creek (Cahokia Canal). Soil can also erode on farmland when it is exposed to the erosive action of the wind and precipitation and from streambanks, stream channels, and lake shorelines. Construction sites can also contribute significantly to soil erosion when erosion control practices are not properly planned or followed. In 2018, IEPA listed site clearance (clearing of vegetation and surface soil) as a source of impairment of water quality in Cahokia Creek and Canteen Creek.

Objectives addressing this issue:
♦ Reduce sediment by 20% by 2035.
♦ Increase amount of stormwater captured, stored, and infiltrated.
♦ Remove stream obstructions.
♦ Restore natural flow regime of streams.
♦ Conserve sensitive lands.
♦ Increase acreage of forests, native grasslands, and wetlands.
♦ Reconnect forest tracts for soil stabilization

Urban area makes up 43% of the land in the watershed but contributes slightly more than 56% of the sediment in the watershed. This sediment is a result of high impervious areas especially industrial areas, high runoff velocities, and turf grass ditches that are not as effective in retaining sediment as native deep-rooted grasses. In 2018, IEPA listed urban runoff as a source of water impairment for total suspended solids in Canteen Creek, and Horseshoe Lake.

Along with urban areas, an estimated 23% of sediment in the watershed comes from cropland (see Appendix A, p.120). In 2018, IEPA listed crop production as a source of impairment of water quality in Cahokia Creek (Cahokia Canal), Canteen Creek, and Horseshoe Lake. In Madison County, 75% of corn and 37% of soybeans are produced using conventional tillage practices, which contribute to high soil erosion. Conservation tillage (i.e., reduced tillage) and no-till practices contribute significantly less sediment and nutrients. Only 1% of corn and 7% of soybeans in Madison County are in no-till crop production.

In addition to soil erosion from urban and farmland, streambank and channel erosion contributes the remaining 20% of the sediment to waterways. Streambank erosion has the highest sediment delivery rate (100%) to the stream. Three miles, or 12% of the streams assessed in the watershed had "high" streambank erosion, and 60% of the streams assessed had "moderate" streambank erosion. Twelve miles of Critical Stream Reaches, which had high streambank erosion and high channelization, were identified (see p. 56). Streams in highly urbanized areas have increased bank erosion, due to the increased volume of water reaching streams in “flashy” surface flow during storm events.

Streambank erosion is exacerbated by logjams, which are woody vegetation or other debris that obstruct a stream channel and back up stream water. Over 11 miles of Critical Logjam Areas (identified at locations of concentrated logjams) were identified in the watershed (see p.56). Logjams can be both a cause and a result of streambank erosion. They can alter flow, which directs water outwards to the streambanks and increases scouring and bank erosion. Logjams result from streambank erosion when a stream is incising or meandering excessively, causing large woody vegetation on the banks to be undercut and fall into the stream. Several stakeholders also identified beavers as a cause of logjams along creeks in the watershed.

Issue: Sediment

Sediment deposition is the result of soil erosion. Sediment is highly prevalent in urban runoff, roadside ditches and gullies, and streams throughout the watershed. When soil erodes from the landscape, it ends up as sediment and silt in streams, lakes, and basins, carrying pollutants such as phosphorus, manganese, and PCBs with it. The deposited sediment reduces the storage capacity of lakes and basins, increasing flooding upstream. **Sedimentation/siltation** and **total suspended solids** (**TSS)** are two of the pollutants identified in Cahokia Creek (Cahokia Canal). TSS is also identified in Canteen Creek and Horseshoe lake on the 2018 IEPA 303(d) List.

Objectives addressing this issue:
♦ Reduce sediment by 20% by 2035.
♦ Decrease overall pollutant loading to lakes and streams in the watershed.
♦ Increase amount of stormwater captured, stored, and infiltrated.
♦ Minimize impervious surfaces.

Issue: Drinking water source protection: Communities such as Edwardsville and Hartford, and many people in unincorporated county, use well water as their drinking water supply. With the large industries and three superfund sites in the watershed, byproducts from these industries, such as barium and PCBs, can infiltrate into drinking water sources. Also, magnesium levels in groundwater surrounding the America's Central Port are at levels unsafe for drinking water. Contamination of these water sources is a life-safety issue and can be costly to remediate.

Objectives addressing this issue:
♦ Decrease overall pollutant loading to lakes and streams in the watershed.
♦ Protect drinking water sources from pollutants.
♦ Monitor water quality and identify trends.
♦ Reduce manganese concentrations in Canteen Creek.

Other municipalities in the watershed (Granite City, Madison, Pontoon Beach) purchase surface water from Illinois American Water, which is obtained from the Mississippi River.

Issue: Low Dissolved Oxygen (DO), algae blooms, fish die offs

When dissolved oxygen levels drop below 5.0 mg/L, aquatic life becomes stressed. As levels continue to decrease, stress on aquatic species increases, eventually leading to large fish kills at levels below 2 mg/L. Low DO levels are often a result of algae growth, during summer months, that uses up oxygen in the water, which is caused by high levels of nutrients such as nitrogen and phosphorus. Cahokia Creek (Cahokia Canal) has had a 303(d) List impairment for DO for several years, including 2018.

Objectives addressing this issue:
♦ Maintain DO levels above standard minimum levels.
♦ Monitor water quality and identify trends.
♦ Reduce phosphorus by 25% and nitrogen by 15% by 2035.
♦ Decrease overall pollutant loading to lakes and streams in the watershed.
♦ Conserve sensitive land.

Issue: Sewage contamination from private systems
Neglected maintenance of private sewage systems can lead to raw human waste in waterways. Private sewage systems are not common within municipal boundaries but nearly all properties outside of municipal boundaries have individual private systems. USEPA uses a figure from the U.S. Census Bureau that at least 10% of septic systems nationwide have stopped working. Municipalities and Open House attendees reported occasional bad smells from private sewage systems, which may indicate malfunctioning systems.

Objectives addressing this issue:
♦ Create a private sewage assessment strategy.
♦ Protect drinking water sources from pollutants.
♦ Decrease overall pollutant loading to lakes and streams in the watershed.
♦ Extend sanitary sewer lines.

Issue: Combined sewers
When large volumes of stormwater enter the system, overflows can carry untreated waste out onto the land and into streams. The untreated waste can damage the health of the streams and cause life-safety issues if contacted. Granite City has an extensive section of combined sewers west of Nameoki Road, and the Village of Madison has combined sewers in 90% of the city. In 2018, IEPA listed combined sewer overflows as a source of impairment of water quality in Cahokia Creek (Cahokia Canal).

Objectives addressing this issue:
♦ Replace all combined sewer infrastructure.
♦ Protect drinking water sources from pollutants.
♦ Decrease overall pollutant loading to lakes and streams in the watershed.
♦ Monitor water quality and identify trends.

Issue: Infiltration into/out of aging pipes
Several municipalities report that aging infrastructure has led to instances of infiltration of stormwater into the sanitary system, resulting in sewer backups, de facto combined sewers, and occurrences of combined sewer overflows (CSOs). Granite City reported more than a $1 million a year in sewer breaks and Pontoon Beach treatment system received 7 million more gallons per day after rain events. This situation results in property damage, raw sewage draining into surface water, and increased costs of cleanup and sewage treatment for municipalities.

Objectives addressing this issue:
♦ Replace all combined sewer infrastructure.
♦ Protect drinking water sources from pollutants.
♦ Promote ongoing improvement and maintenance of stormwater storage and conveyance infrastructure.
♦ Monitor water quality and identify trends.

Issue: Litter and dumping
Trash and debris is an issue throughout the watershed, but particularly in places where roads cross creeks and their tributaries. People throwing trash out of car windows or dumping unwanted or hazardous materials leads to debris deposits that are eyesores, harm to fish and wildlife, and obstructions in the creek. Illegal dumping of large objects into or next to creeks is also an issue, particularly in secluded areas around Horseshoe Lake. Open House attendees mentioned litter, trash, and debris on their property or on the creeks and streams they drive past. Additionally. One location in the watershed accepted trash illegally for multiple years.

Objectives addressing this issue:
♦ Promote the removal of litter throughout the watershed.
♦ Monitor water quality and identify trends.

Issue: Contact through boating, swimming, fishing

People use lakes in this watershed for recreation, often coming into direct contact with the water and becoming exposed to pollutants. Exposure to many pollutants, especially fecal coliform, ammonia, harmful algae, barium, manganese, among others can increase the chances of individuals becoming ill and can cause skin rashes. It is especially important to relay to the public which recreational waterbodies may have unacceptable levels of pollutants and bacteria.

Objectives addressing this issue:

♦ Maintain DO levels above standard minimum levels.
♦ Monitor water quality and identify trends.
♦ Reduce phosphorus by 25% and nitrogen by 15% by 2035.
♦ Decrease overall pollutant loading to lakes and streams in the watershed.

Issue: Point source discharges

In 2018, IEPA listed municipal point source discharges as a potential source of impairment of water quality in Cahokia Creek (Cahokia Canal), Canteen Creek, and industrial point source discharges in Horseshoe Lake. None of the six facilities with National Pollutant Discharge Elimination System (NPDES) permits in the watershed exceeded their pollutant limits in 2017 (based on available data through the Discharge Monitoring Report (DMR) online database.

Objectives addressing this issue:

♦ Monitor water quality and identify trends.
♦ Monitor all NPDES facilities and encourage pollution reduction.
♦ Promote ongoing improvement and maintenance of stormwater storage and conveyance infrastructure.

Issue: USEPA Superfund sites

Three Superfund Sites are located in this watershed: Jennison Wright site, TaraCorp Lead Smelter site, and Chemetco site. These sites produced various products that have polluted the groundwater in the area. These three superfund sites place residents at risk of exposure to cadmium, copper, lead, zinc oxide, benzene, and dioxins, among others. There has been documented risk to these communities from exposure to lead from these sites.

Objectives addressing this issue:

♦ Monitor water quality and identify trends.
♦ Monitor all NPDES facilities and encourage pollution reduction.
♦ Protect drinking water sources from pollutants that threaten health or increase treatment costs.
♦ Promote the removal of contaminant resulting in delisting Superfund Sites

Land Cover and Development

Issue: Poorly Planned Development. Flooding and water quality issues are exacerbated by development that does not include well-designed drainage and green infrastructure or is located in the 100-year floodplain. Additionally, some areas were built prior to standards requiring stormwater infrastructure onsite. There are 3,422 structures within municipal boundaries, the majority in Granite City and Pontoon Beach, which are located at least partially in the 100-year floodplain. These structures were likely built prior to the delineation of the floodplain boundaries. However, residents have reported that floodplain ordinances have not been enforced. There have also been instances of developers adding fill to wetlands and construction of non-compliant structures (e.g. houses with walk-out basements) in the floodplain. These development practices have exacerbated flooding, siltation, and streambank erosion, causing problems for roadways and adjacent property. Current development policy among most watershed communities does not actively promote green infrastructure to manage stormwater and allow infiltration.

Objectives addressing this issue:
♦ Conserve sensitive land.
♦ Implement low-impact development strategies.
♦ Use wetlands mitigation banking or in-lieu fee programs.
♦ Develop programs to offset impacts of development.
♦ Prioritize "green" stormwater management approaches.
♦ Work with municipalities to amend policies and regulations to include conservation, stormwater management, and to enforce existing codes.

Development in the Metro East has occurred rapidly with a population increase of more than 100,000 from 2000 to 2010. However, the American Bottom watershed development has been slower over the past decade. The population in the watershed is also projected to remain unchanged or decrease, with increases in populations in adjacent watersheds.

New development will likely still occur within and around municipalities and unincorporated areas in the watershed. New impervious surfaces will compound the problems of flooding, lack of infiltration, and poor water quality. Without changes in policy, local flash flooding will pose significant risks to both new and existing development. Furthermore, maintenance agreements are not always put in place for new development to ensure stormwater infrastructure continues to function. Municipalities in the watershed need stronger policies to maintain stormwater infrastructure and preserve natural areas to capture stormwater.

Habitat

Issue: Poor Riparian Conditions. The area to either side of a stream is known as the riparian area. This naturally vegetated area provides healthy habitat for a variety of wildlife including migratory birds that use the Mississippi River as navigation. It provides shade to the streams and rivers, which decreases water temperature and improves aquatic habitat. Riparian areas also stabilize the streambanks and reduce erosion. Approximately 40% of the riparian area along streams is in "poor" ecological condition and 42% as in "fair" condition (Appendix A, Table A.31). IEPA listed loss of riparian habitat ("alteration in stream-side or littoral vegetative covers") as a source of impairment of water quality in Canteen Creek and Cahokia Creek (Cahokia Canal) in 2018. "Loss of instream cover" (i.e. debris and vegetation), which provides habitat for aquatic organisms, was also listed as an impairment for these streams.

Objectives addressing this issue:
♦ Conserve sensitive land.
♦ Promote healthy ecosystems within riparian areas.
♦ Increase the acreage of forests, native grasslands, and wetlands.
♦ Reconnect forest tracts along streams.
♦ Identify and protect key natural corridors for wildlife
♦ Create an invasive species removal strategy
♦ Monitor fish and aquatic macroinvertebrate communities

Issue: Fish die-outs
Algae blooms can remove so much oxygen from the water that fish suffocate and die off. Aquatic algae is listed as a cause of impairment to Horseshoe Lake on the 2018 IEPA 303(d) List, where fish die-outs have occurred. Related to algal blooms, fish die-outs can occur when nutrient levels are high.

Objectives addressing this issue:
♦ Monitor fish and aquatic macroinvertebrate communities.
♦ Increase the acreage of forests, native grasslands, and wetlands.
♦ Promote healthy ecosystems within streams and riparian areas.

Issue: Invasive Species
Invasive species, such as bush honeysuckle, tree-of-heaven, garlic mustard, and climbing euonymous (wintercreeper), are threats to many natural areas because they crowd out native trees and shrubs that protect streambanks from erosion. Invasives also crowd out food sources of animals and insects, further degrading the ecosystem. See Table 4 for causes and sources associated with habitat degradation.

Objectives addressing this issue:
♦ Create an invasive species removal strategy.
♦ Identify and protect key natural corridors for wildlife.
♦ Increase the acreage of forests, native grasslands, and wetlands.
♦ Promote healthy ecosystems within riparian areas.

Issue: Unprotected Habitat for Endangered Species
Federally endangered species such as the Indiana Bat and Northern Long-eared Bat are likely to be present in the watershed. Where their native habitat is not preserved, these species cannot be expected to thrive over the long term. Removing invasive species and protecting native habitat around streams will provide locations for endangered species to thrive.

Objectives addressing this issue:
♦ Promote healthy ecosystems within riparian areas.
♦ Identify and protect key natural corridors for wildlife.
♦ Increase the acreage of forests, native grasslands, and wetlands.
♦ Create an invasive species removal strategy.

Organizational needs/issues

Issue: Lack of levee/ditch maintenance

There are three levee systems in the watershed: Chain of Rocks Levee, Chouteu Island Levee, and the Metro East Sanitary District (MESD) levee. These levee and drainage districts in the watershed have struggled to find funding to maintain the levees and ditches that they are responsible for. Pumps used to move stormwater when the Mississippi River is in flood stage are often not turned on due to the cost of starting up and running the systems. Several of the constructed ditches are also filling with sediment even with routine maintenance performed by MESD. Without routine maintenance, silt and sediment would fill ditches several feet deep.

Objectives addressing this issue:
♦ Develop programs to effectively address water issues.
♦ Activate a network of partners dedicated to implementing the watershed plan.
♦ Leverage funding from a variety of sources to implement the plan.

Issue: Lack of detention basin maintenance

Detention basins are often not being maintained/dredged to maintain their sediment storage and water storage capacities. Several communities have noticed a reduction in the capacity of their retention basins. This can happen when ownership or maintenance requirements associated with a detention basin are unclear, or simply because dredging can be very expensive. Older detention basins may no longer function properly and would benefit from adding extended detention outlet structures and vegetation, which would remove sediment and alter flow-regime patterns. Industrial waste has also been deposited along with the sediment in the basins and has to be treated and disposed per requirements for each chemical in the waste.

Objectives addressing this issue:
♦ Develop programs to effectively address water issues.
♦ Activate a network of partners dedicated to implementing the watershed plan.
♦ Leverage funding from a variety of sources to implement the plan.
♦ Develop a program to have counties assume control of basins.

There is also a lack of interest for more detention basins. Stakeholders throughout the watershed do not want additional permanent retention features because their current basins are consistently full of sediment which may attract negative attention.

Issue: Lack of code enforcement

In some cases, existing municipal stormwater, development, subdivision, and floodplain codes are not fully enforced. Some municipalities were not enforcing floodplain ordinances and developers have added fill to known wetland areas. There has also been instances of homes with basements constructed in the floodplain. Codes related to development in floodplains as well as sediment and erosion control during construction are particularly important when it comes to protecting water quality and preventing flood damage.

Objectives addressing this issue:
♦ Activate a network of partners to implement the plan.
♦ Develop programs to effectively address water issues.
♦ Activate a network of partners to implement the watershed plan.
♦ Develop tools to improve sharing of data with stakeholders.

Issue: Lack of funding

Funding from government entities and other groups is needed to maintain and expand stormwater infrastructure and improve water quality. MESD regulates and taxes an area of approximately 134 square miles but receives water from an additional 79 square miles for which MESD does not receive funding. A variety of funding sources and programs are available to implement goals and objectives of the watershed plan. Existing resources include IEPA Section 319, Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), State Revolving Fund, foundation grants, and various other programs.

Objectives addressing this issue:
♦ Activate a network of partners to implement the plan.
♦ Develop programs to effectively address water issues.
♦ Develop tools to improve sharing of data with stakeholders.

Issue: Need for strong partnerships

A network of partner organizations/groups is needed to make large strides towards addressing flooding and other issues in the watersheds. Many potential partners exist in the region dedicated to different aspects of water quality and stormwater management, including federal agencies, state agencies, universities, non-profits, land trusts, landowners, institutions, and local governments. To effectively implement the watershed plan and the county's stormwater program, a network of these partners should be established to help tackle certain issues and objectives.

Objectives addressing this issue:
♦ Activate a network of partners to implement the watershed plan.
♦ Develop tools to improve sharing of data with stakeholders.

Information and Outreach

Issue: Need for communication and collaboration

The public engagement process for the plan revealed a need for education on water quality and flooding for the general public. For example, the Flood Survey revealed a need for further education about flooding and flood insurance. In the American Bottom watershed, the majority of flooding reported in the survey (96%) was outside of FEMA-designated floodplains, and seven percent of property owners had flood insurance policies on structures outside of the floodplain. Over half of respondents who experienced flooding did not report it to anyone. Given that 45% of respondents experienced flooding over the last 10 years, there is a clear mandate to further educate residents on flood damage prevention and mitigation. Communication about funding and technical resources is also sometimes lacking between potential partners; this information could help bring awareness, technical resources, and funding to address issues.

Objectives addressing this issue:
♦ Identify opportunities to assist stakeholders with watershed management efforts.
♦ Connect stakeholders with experts.
♦ Offer opportunities for public education in watershed matters.
♦ Develop public recognition programs for watershed plan goals.

Issue: Need for outreach to key stakeholders

There are clear connections between activities happening upstream and impacts downstream in the American Bottom watershed. Education and outreach efforts to engage landowners and other key stakeholders are needed to increase environmental awareness and achieve the goals of this plan. A single regulatory agency or group cannot be as effective as a combined effort with other groups all working towards the same goal. Many people will work hard to help make the watershed better if they understand what to do and how it will help.

Objectives addressing this issue:

♦ Identify opportunities to assist stakeholders with watershed management efforts.
♦ Connect stakeholders with experts.
♦ Offer opportunities for public education in watershed matters.
♦ Develop public recognition programs for watershed plan goals.
♦ Promote volunteer opportunities for hands-on learning.

Issue: Need to educate landowners about protecting their watershed

Many individual landowners are unaware of how their actions affect the watershed in which they live. By educating residents about the importance of a healthy watershed, through community outreach and engagement, overall watershed health can be improved. Further outreach to property owners can supply communities with improved stormwater management practices, such as storm-drain stenciling, litter pick-ups, water quality monitoring, rain barrels, and rain garden installations. When taken together, multiple individual practices can reduce flooding, improve water quality, and provide healthy habitats and recreational areas for communities to enjoy.

Objectives addressing this issue:

♦ Identify opportunities to assist stakeholders with watershed management efforts.
♦ Connect stakeholders with experts.
♦ Offer opportunities for public education in watershed matters.
♦ Develop public recognition programs for watershed plan goals.
♦ Promote volunteer opportunities for hands-on learning.

Critical Areas

A "Critical Area" is best described as a location in the watershed where existing or potential future causes and sources of pollutants or issues are significantly worse than other areas of the watershed, OR there is significant potential for the area to make progress towards one or more of the watershed plan goals. The following Critical Areas were identified:

1. Highly or moderately degraded stream reaches with high channelization (Critical Stream Reaches);
2. Stream reaches with high susceptibility to logjams (Critical Logjam Areas);
3. Highly degraded riparian areas (Critical Riparian Areas);
4. Areas suitable for wetland restoration (Critical Wetland Areas); and
5. Areas of prevalent flooding (Critical Flooding Areas).

The Management Measures recommended (see section 5) are focused on these Critical Areas but are also recommended for application elsewhere in the watershed where conditions are suitable.

The location and extent of each Critical Area was informed by data collected in the Watershed Resource Inventory, including an aerial assessment of streambank condition, riparian area condition, and channelization. Information was also collected during stakeholder engagement. The Agricultural Conservation Planning Framework (ACPF), a GIS model developed by USDA, provided locations for Critical Areas on agricultural land. The following explains how the Critical Areas were delineated.

Critical Stream Reaches

Critical stream reaches exhibit highly eroded banks or stream beds, or degraded channel conditions, which are a major source of total suspended solids (sediment), phosphorus and nitrogen carried with it. **12.0 miles** of stream reaches have been identified as high priority "Critical Stream Reaches," using aerial assessment and field verification data on streambank erosion, streambed erosion, and channelization. The critical reaches have high or moderate streambank erosion AND high channelization. Streambank stabilization and channel restoration BMPs, including bioengineering, will greatly reduce sediment and nutrients transported downstream, increase dissolved oxygen levels, and improve habitat.

Critical Logjam Areas

Critical areas for logjams were delineated from known locations of logjams identified in the aerial stream assessment for this Watershed Plan. The Critical Logjam Areas are stream reaches where a logjam is within 0.25 mile of at least one other logjam. These areas represent current or likely locations of logjams, but not where they would cause the greatest flood impacts or damage. **11.0 miles** of streams have been identified as Critical Logjam Areas. Localized assessment is recommended for these reaches to determine whether logjam removal is appropriate and cost-effective at specific locations. The American Fisheries Society's 1983 "Stream Obstruction Removal Guidelines" is a reliable source for determining what types of logjams should be removed.

Critical Riparian Areas

Critical Riparian Areas are areas adjacent to stream reaches that:

1) Have limited or no vegetated buffer beside the stream (i.e., "poor" riparian condition as determined by aerial assessment), and/or
2) Receive significant surface runoff and groundwater and have high ecological significance.

Along the stream corridors, **6.9 miles** were identified as Critical Riparian Areas. Removal of invasive species and revegetation of these areas with appropriate native vegetation will increase surface water infiltration and reduce sediment and nutrient flows to the streams.

Critical Wetland Areas

Wetlands are highly effective at filtering pollutants from surface water, in addition to providing flood storage and wildlife habitat benefits. Critical wetland areas, which are highly suitable for restoration/construction of wetlands, were found by identifying:

1) Areas that have been identified in Missouri Resource Assessment Partnership (MoRAP) and East-West Gateway Council of Governments (EWG) mapped data on wetland importance and wetland restoration value. The areas were ranked from 0 to 18, with 18 being the highest ranking. The wetland areas with ranking values from 15 to 18 were chosen as Critical Wetland Areas.

There are **8,590 acres** of Critical Wetland Areas in the American Bottom watershed.

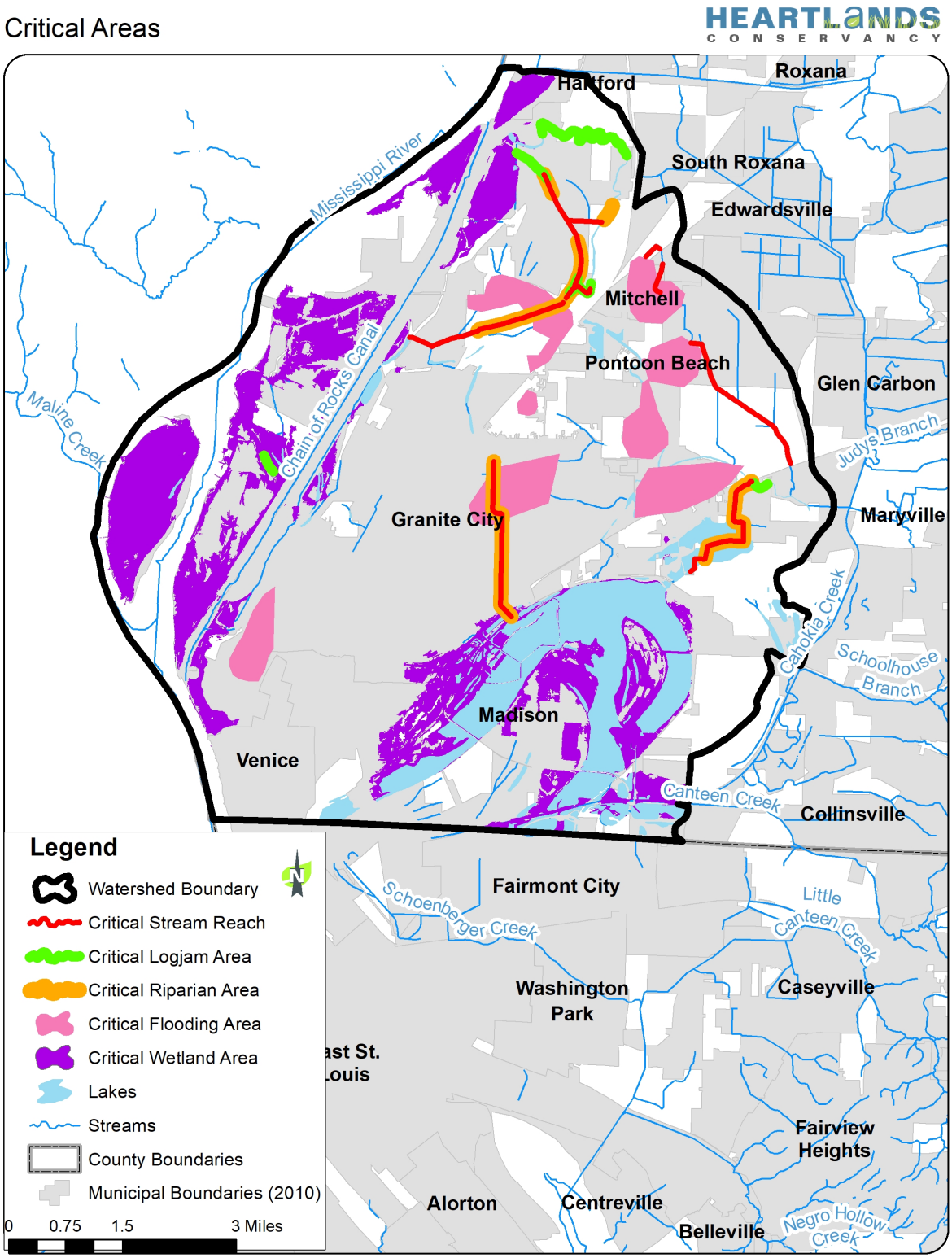
Critical Flooding Areas

Flooding occurs regularly throughout the American Bottom watershed. The Madison County Community Flood Survey provided mappable data to highlight areas that experienced flooding at an increased regularity than the rest of the watershed. In addition to the survey data, residents reported flooding events at Open House events and small group meetings. This information was combined and mapped and the areas with the highest density of known flooding events were deemed Critical Flooding Areas.

Seven locations have been identified as Critical Flooding Areas. These locations cover an area of approximately **2,840 acres**.

All of the Critical Areas identified in the watershed are shown in Figure 4. Appendix C shows the Critical Areas in more detail in each HUC14 subwatershed.

Figure 4. Critical Areas for logjams, riparian buffers, stream reaches, and wetlands. See Appendix C for maps of each HUC 14.



SECTION 4: OVERVIEW OF MANAGEMENT MEASURES

The term "Management Measures" or "Best Management Practices" generally describes acceptable practices that could be put into place to protect water quality and control stormwater. BMPs are typically designed to reduce stormwater volume, peak flows, and/or nonpoint source pollution. Two types of Management Measures are recommended to address the goals of this plan:

- **Programmatic Measures:** general remedial, preventive, and policy Management Measures that can be applied watershed-wide by various partners and stakeholders.
- **Site-Specific Measures:** locations where specific Management Measures can be implemented to improve surface and groundwater quality, green infrastructure, and flooding.

Programmatic Measures include policy changes, environmental monitoring, design processes, and other measures that can be applied by various partner and stakeholder organizations across the watershed. Information and education measures can be considered programmatic measures, and these are outlined separately in the Information and Education Plan section (Section 6).

Site-Specific Measures, which are often structural, can be implemented on the ground to improve surface and groundwater quality, green infrastructure, and flooding. The Site-Specific Management Measures are divided into four categories: **agricultural**, **urban/community, forest**, and **streams and lakes**.

This section provides an overview of many Management Measures that are recommended within the watershed.

Programmatic Management Measures

Financial support for stormwater infrastructure

Primary goal addressed: 1. Reduce Flooding/Mitigate Flood Damage

Maintenance of wastewater treatment systems imposes costs on communities that are usually recaptured through municipal property taxes and/or sewer fees. Stormwater infrastructure, however, does not often have such dedicated funding. Permitted municipal separate storm sewer systems (MS4s) are required to meet minimum control measures, but there are needs and issues beyond these measures, such as flood mitigation, that do not have dedicated funding. Green infrastructure is also not often funded through typical stormwater programs.

Several policy approaches can assign dedicated funding for stormwater infrastructure that prevents flooding and allows infiltration. As outlined in the 2015 Urban Flooding Awareness Act Report prepared by IDNR, USEPA recommendations for financing stormwater management include:

- Stormwater utility (or service fees),
- Property taxes/general funds,
- Sales tax,
- Special assessment districts,
- System development charges,

- Municipal bonds and state grants, and
- Low-interest or forgivable loans.

These funding options are explored in more detail in Appendix C.

Flood Damage Prevention Ordinance

Primary goal addressed: 1. Reduce Flooding/Mitigate Flood Damage

Madison County and most communities in the watershed are members of the National Flood Insurance Program (NFIP), and as such, have a Floodplain Ordinance in effect. These ordinances require specific development standards for structures and activities in the 100-year floodplain (as designated by FEMA). Due to increasing flood risk and flood insurance rates from climate changes and inadequate policies, strengthening these ordinances would help protect individuals and communities from flood loss and damage. One way of strengthening floodplain ordinances to reduce flood risk is to use text from the State of Illinois's Model Floodplain Ordinance, or the model ordinance published by the Association of State Floodplain Managers (ASFPM). In a 2014 report, HeartLands Conservancy reviewed flood prevention BMPs and recommended that Madison County adopt an updated, stand-alone Flood Damage Prevention Ordinance. Subsequently, HeartLands Conservancy created a draft ordinance based on state and regional best practices. The practices recommended include more stringent standards for development in floodplains so that flood damage becomes less likely and less severe. Ordinance effectiveness and implementation should be periodically reviewed.

Green infrastructure incentives

Primary goal addressed: 2. Improve Surface Water Quality

Green infrastructure can be defined as our region's natural resources, including open space, woodlands, wetlands, gardens, trees, and agricultural land. It can also be defined as the nodes and corridors of vegetation over the region, or the site-scale structures and landscaping that recreate natural processes (e.g., rainscaping). Green infrastructure results in a higher diversity of plants and animals, removal of nonpoint source pollution, infiltration of stormwater, and healthier ecosystems. Communities can offer incentives for developers that design for or implement green infrastructure, including flexible implementation of regulations, fee waivers, tax abatement, and streamlining the development review process. These incentives can be granted on a case-by-case basis.

Long-term management of natural areas

Primary goal addressed: 5. Develop Organizational Frameworks

Developers should be encouraged to protect sensitive natural areas/open space and create naturalized stormwater management systems (including green infrastructure). These practices are key components of Conservation Development design. Developers should be encouraged to donate natural areas and systems to a public agency or conservation organization for long-term management. This ensures that the natural areas have regular maintenance over time and remain aesthetically pleasing and functional spaces. Alternatively, HOAs can explicitly take on the management of the natural areas, writing rules about maintenance and fees into their bylaws.

In-lieu fee ecological mitigation

Primary goal addressed: 3. Promote Environmentally Sensitive Development

In-lieu fee mitigation is an opportunity to assist developers in meeting their mitigation needs while directing mitigation to high quality sites in the watershed. Under an in-lieu fee program, a developer can pay a fee in lieu of having to restore or protect wetlands on the development site, or to mitigate losses of those sites by protecting or restoring wetlands off-site. The fee goes to a

third-party organization which can direct the funds to high quality ecological sites for which restoration efforts will have the most environmental impact.

Native landscaping

Primary goal addressed: 4. Support Healthy Habitat

The use of native plants in landscaping on public and private property should be encouraged as a way to enhance stormwater management structures, slow down surface runoff, extend green infrastructure networks, and support wildlife. Changes to weed control ordinances (or other ordinances that specify plant species to be used in landscaping) may be needed to allow appropriate growth of native plants. Ordinance effectiveness and implementation should be periodically reviewed. Likewise, the removal of invasive species is important in promoting biodiversity. To ensure the native landscaping can maintain its designed function and aesthetic, an operation and maintenance program needs to be created and implemented by community leaders.

Open space and natural area protection

Primary goal addressed: 3. Promote Environmentally Sensitive Development

Several actions can be taken to encourage the protection of natural areas and open space in new development. These include establishing a dedicated source of funding for open space acquisition and management, creating agriculture zoning districts with very large minimum lot sizes, adopting an open space and parks plan, and implementing regulations to protect highly erodible soils, wetlands, and other sensitive natural areas. Comprehensive plans should be regularly updated to help protect valuable natural areas and open space from development and guide new development in ways that minimize negative water quality and flooding impacts.

Conservation Development

Primary goal addressed: 3. Promote Environmentally Sensitive Development

Conservation Development, also known as Cluster Design or Open Space Design, is a set of tools for designing development in a way that protects open space, aquatic habitat, and other natural resources. Conservation Development subdivisions are characterized by compact, clustered lots surrounding a common open space, which often includes a waterway, waterbody, or detention area. This facilitates development density needs while preserving the most valuable natural features and ecological functions of a site.

Open space designs have many benefits in comparison to conventional subdivisions: they can reduce impervious cover, stormwater pollutants, construction costs, grading, and the loss of natural areas. Despite these benefits, many communities' zoning ordinances do not permit Conservation Development designs because of code requirements for minimum lot sizes, setbacks, frontage distances, and more. These ordinances should be amended to allow for the implementation of Conservation Development design. Ordinance effectiveness and implementation should be periodically reviewed.

Developers should be encouraged to set up management procedures that protect sensitive natural areas/open space. Natural areas and systems can be donated to a public agency or conservation organization for long-term management to ensure that they have regular maintenance over time and remain aesthetically pleasing and functional spaces. Alternatively, Homeowners Associations (HOAs) can explicitly take on the management of the natural areas, writing rules about maintenance and fees into their bylaws.

As the area's population grows, the demand for recreational space also increases. Recreational features, such as multi-use trails, can be implemented alongside new or existing management measures to improve quality of life and provide educational opportunities for watershed residents. For example, hiking or biking trails can be established along levees, or portions of natural areas can be designated for picnicking or wildlife appreciation. Potential recreational opportunities should be explored when implementing the watershed plan BMPs.

Riparian Buffer Ordinance

Primary goal addressed: 3. Promote Environmentally Sensitive Development

A riparian buffer is an undisturbed naturally vegetated strip of land adjacent to a body of water. Among their many benefits, riparian buffers improve water quality, reduce erosion, store floodwater, and provide habitat for wildlife. In this region, oak-hickory forest or prairie grassland are appropriate vegetation types. A riparian buffer ordinance protects a riparian area of a certain width from new development and other disturbances and promotes revegetation/reforestation.

Federal and state programs

Primary goal addressed: 2. Improve Surface Water Quality

Federal and state agricultural easement and working lands programs such as CRP, CSP, EQIP, and the Agricultural Conservation Easement Program (ACEP) are designed to reimburse farmers and landowners for implementing practices that protect soil and water health.

Monitoring

Primary goal addressed: 2. Improve Surface Water Quality

Monitoring of water quality, flow, and stream health in the watershed will provide data that can be used to support future resource management decisions and assess the effectiveness of Management Measures that are implemented.

Continuous monitoring at USGS gage 05589490 located on Cahokia Canal will provide a broad assessment of the effect of land management practices in the watershed on surface water quality throughout the year. It will also allow trends to be identified by comparing new monitoring data to historical water quality data collected by USGS and the Illinois Water Sciences Center (IWSC) from this location.

In addition to continuous monitoring at the USGS gauge, secondary monitoring stations will be added in order to identify the relative contributions of HUC14 subwatersheds to overall water quality in the larger watershed. Sampling locations will be identified near the outflow of each subwatershed, and samples will be collected quarterly to determine seasonal variations in water quality. Additional sampling will be done during major storm events. See Appendix E for more detail on the recommended monitoring components. See Section 7 (Implementation) for the monitoring timeline.

The following parameters will be monitored:

- Flow
- Sediment (TSS)
- Total Phosphorus
- Total Nitrogen
- Barium
- Manganese

- Chloride
- Polychlorinated Biphenyls (PCBs)
- Ammonia
- Fecal Coliform

Private sewage monitoring

Primary goal addressed: 2. Improve Surface Water Quality

Private sewage inspections are required by Madison County during real estate transactions and are performed following complaints; however, the inspections can occur many years apart for a single property. More regular inspections (e.g., every three to five years) should be considered by watershed jurisdictions. An intensive inspection of private septic systems in areas with recurring problems should also be considered. Data on private sewage violations and water quality parameter exceedances should be collected and mapped. Connections to public sewer systems should be encouraged in new development. Counties and municipalities can create a Special Service Area (SSA) to fund improvements to localized private sewage problems.

Sewage Treatment Plant upgrades

Primary goal addressed: 2. Improve Surface Water Quality

Upgrades to wastewater treatment plants in the watershed should be installed to meet permit requirements, and to protect these critical facilities from flooding. Other improvements may include incorporating nutrient removal technologies. USEPA's draft "Case Studies on Implementing Low-Cost Modifications to Improve Nutrient Reduction at Wastewater Treatment Plants" document, published in August 2015, is a good source of information about optimizing nutrient removal in different types of treatment systems. As a further measure, a Nutrient Credit Trading system can be set up. In this system, municipalities can create agreements a land conservation organization and IEPA to provide payments on a conservation easement that reduces nutrient discharge from agricultural land in order to offset a Sewage Treatment Plant's discharge.

Stream Cleanup Team

Primary goal addressed: 4. Support Healthy Habitat

A Stream Cleanup Team with funding and resources dedicated to stream cleanup in the watershed would help to improve water quality, reduce flood risk (by removing litter and debris), and monitor stream health. Many Madison County residents were vocal in their support of the grant-funded Stream Cleanup Team that operated in 2008 to 2009. The program could be expanded from its previous scope to include an education component, roles for volunteers, and a stream inventory. The team could inform local sheriffs' departments about sites with the most litter/debris so that they can more effectively enforce laws on littering and dumping. In previous years (2013 to 2016), Streambank Cleanup and Lakeshore Enhancement (SCALE) grants from USEPA were made available to support cleanup efforts under Section 319 of the Clean Water Act. The funds were paid to groups that "have already established a recurring streambank or lakeshore cleanup," and used for dumpster rental, landfill fees, and safety attire. Local recipients such as Alton Marketplace/Main Street and the Village of Swansea received $500 (or more if more participants were involved). This program may be funded again in future.

Watershed plan supported and integrated into community plans

Primary goal addressed: 5. Develop Organizational Frameworks

Watershed partners, including communities, should adopt or support the watershed plan and incorporate its goals and

recommended actions into their policies (such as ordinances and comprehensive plans).

Street sweeping and de-icing education, training, and policies

Primary goal addressed: 4. Support healthy habitat

Pollution from roadways often enters streams through storm drains. These drains convey stormwater away from roads. However contaminants such as chloride, phosphorous, and litter can enter these drains and end up in streams. Street sweeping is an effective process for removing these contaminants. Additionally, education and training in road de-icing methods, such as quantity and timing of application as well as different types available, can reduce the amount of chloride entering waterways.

Site-Specific Management Measures

The following BMPs are recommended for agricultural, forest, and urban areas, and streams and lakes. See Appendix D for more detailed descriptions of these BMPs, including the amount, cost, and pollutant load reduction.

Urban Management Measures

Bioswales

Primary goal addressed: 1. Reduce Flooding/Mitigate Flood Damage
Pollution reduction: 77% sediment, 17% P, 47% N
Cost: $18/sq ft

Bioswales are swaled (sloped) drainage courses designed to remove debris and reduce pollution from surface water. The sides of the swale are less than 6% slope and the swale may be filled with vegetation, compost, and/or riprap. The design of the swale should maximize the time water spends there, which aids in infiltration (for groundwater recharge) and pollutant removal. Bioswales are often effective when sited adjacent to parking lots. They can capture and treat stormwater during the "first flush" of rain on the parking lot, which carries substantial automotive pollution.

Detention basins

Primary goal addressed: 1. Reduce Flooding/Mitigate Flood Damage
Pollution reduction: 58% (dry) or 60% (wet) sediment, 26% (dry) or 45% (wet) P, 30% (dry) or 35% (wet) N
Cost: $45,261/acre (dry), $49,722/acre (wet)

A detention basin is a constructed basin that receives, temporarily stores, and then gradually releases stormwater. They are designed to store flows during the most critical part of the flood and release the stored water as the flood subsides. While detention does not reduce the total volume of runoff from a flood event, it does reduce the peak flow rate. Many are also designed to treat stormwater by removing sediments, nutrients, and other pollutants.

Older detention basins may no longer function properly and would benefit from adding extended detention outlet structures and vegetation, which would remove sediment and alter flow-through patterns. Retrofitting existing detention basins can be cheaper than constructing new basins. New detention basins (dry and wet), retrofits to existing basins (e.g., addition of native vegetation, volume increases), and maintenance of existing basins (e.g., dredging to remove sediment) are recommended in this plan. Detention basins are recommended for municipalities in the 2014 Madison County EMA All-Hazard Mitigation Plan (Appendix D—Management Measures). Large, regional detention basins serving

several municipalities/entities may also be an effective option for reducing flood impacts to communities downstream.

Pervious pavement

Primary goal addressed: 1. Reduce Flooding/Mitigate Flood Damage
Pollution reduction: 90% sediment, 65% P, 85% N
Cost: $103,893/acre

Pervious pavement, also referred to as porous or permeable pavement, allows infiltration of stormwater into a below-ground storage area through holes in the pavement. It reduces the amount and rate of stormwater runoff over the ground surface and is a useful practice for areas requiring a smooth, paved surface that would normally be covered with impervious concrete or asphalt. Pervious pavement is suitable for parking lots, private roads, fire lanes, residential driveways, sidewalks, and bike paths, where the subsoil is of a suitable composition. Pervious pavement does require periodic cleaning with a vacuum to remain effective over time.

Rain gardens

Primary goal addressed: 2. Improve Surface Water Quality
Pollution reduction: 67% sediment, 27% P, 35% N
Cost: $10.00/sq ft

Rain gardens are vegetated basins that temporarily store and infiltrate rainwater. Situated near the lowest point of a small drainage area (such as a single residential lot), they significantly slow the flow of water, improve water quality, and provide food and shelter for birds, butterflies, and insects. Rain gardens can be used in combination with roof downspout disconnection and redirection, so that rainwater from a roof is channeled to the rain garden to infiltrate into the soil, reducing stormwater runoff.

Rainwater collection

Primary goal addressed: 1. Reduce Flooding/Mitigate Flood Damage
Pollution reduction: n/a
Cost: $245 per barrel/small cistern

Rainwater collection systems gather rainwater in structures such as rain barrels or cisterns, so that it can be used or released at a later time. They are often connected to roofs and gutters. Collecting rainwater in these systems decreases localized stormwater runoff during times of peak flow and reduces household water use and water bills.

Single property flood reduction strategies

Primary goal addressed: 1. Reduce Flooding/Mitigate Flood Damage
Addresses Critical Flood Areas
Pollution reduction: n/a
Cost: $1,088 per property

Property owners can use a number of practices to reduce flood damage, including many low-cost options. The key to successfully mitigating future damages is to identify the source(s) of flooding at the site scale. It is important to educate property owners about these sources of flooding and appropriate flood reduction strategies. The 2017 Madison County EMA All-Hazard Mitigation Plan recommends several actions to mitigate flood damage: 1) full or partial buyouts to relieve homeowners in frequently flooded areas, 2) elevating structures in frequently flooded areas, 3) making informational materials about the NFIP available, 4) participating in the Community Rating System, and 5) sanitary sewer line repairs to prevent stormwater infiltration and sewer backups in (Appendix D – Management Measures).

The Illinois Urban Flooding Awareness Act Final Report, published in June 2015, identified typical causes of basement flooding including overland flow, infiltration, and sewer backup. The report identified solutions available to address these causes, such as structural inspections, site grading, overhead sewer

installation, drain tile, downspout disconnection, rain gardens, and pervious pavement. Information from this Report is located in Appendix D. Additional mitigation activities include elevating structures in frequently flooded areas, sanitary sewer line repairs to prevent stormwater infiltration and sewer backups, water proofing, structure elevation, internal drainage systems, and basement modifications (Appendix D – Management Measures).

To aid homeowners in making decisions about flood risk to their homes, materials about the NFIP should be made available by communities. Additionally, communities could consider coordinating with FEMA and IDNR on a home buyout program to relieve homeowners in frequently flooded areas who do not wish to remain.

Stormwater and sanitary sewer system maintenance, improvement, and expansion

Primary goal addressed: 1. Reduce Flooding/Mitigate Flood Damage
Pollution reduction: n/a
Cost: $83/linear foot (storm drain cleaning)

Storm drain systems require regular maintenance to function as planned. Cleaning out culverts, ditches, clogged drains, and storm drain inlets reduces the amount of pollutants, trash, and debris entering receiving waters. In some cases, stormwater infrastructure is not appropriately sized to accommodate the flow it receives due to changes in the upstream drainage area or inappropriate sizing. In some areas, a stormwater pipe designed to convey the 10-year storm based on rainfall data through 1960 would only carry the 6.6-year rainfall estimated from a dataset extending to the 1980s.

Culverts, ditches, and detention basins that often overflow should be assessed for potential enlargement. Upgrades should be made in response to storm drain system inspections, citizen complaints, and/or updated modeling of the system. In addition, sanitary sewer systems should be maintained in order to prevent infiltration and combined sewer overflows. Expansion of sanitary sewers to new development and existing buildings (already a common practice among municipalities) should continue wherever feasible.

Tree planting (e.g., street trees)

Primary goal addressed: 4. Promote Environmentally Sensitive Development
Pollution reduction: 31% sediment, 31% P, 27% N
Cost: $2.85/sq. ft. tree canopy

Street trees are trees that are planted in the public right-of-way. They are an important component of municipal green infrastructure and provide benefits including reducing stormwater runoff, filtering pollutants in air and water, mitigating high “urban heat island” air temperatures, and providing pleasing aesthetics that increase property values.

Urban filter strips

Primary goal addressed: 2. Improve Surface Water Quality
Pollution reduction: 86% sediment, 33% P, 56% N
Cost: $2.08/sqft

Urban filter strips—also referred to as vegetative filter strips—are stable areas of vegetation on gently sloping land that reduce the impacts of overland flow by removing sediments and pollutants and increasing infiltration. They can be used to drain relatively small areas where surface water runoff is discharged as overland sheet flow, and are typically installed between impervious surfaces (e.g., parking lots, roads, sidewalks) and water bodies, swales, or storm sewers.

Selected Urban Management Measures (BMPs).





Left: Bioswale. Photo: Tip of the Mitt Watershed Council
Above: Storm drain cleaning. Photo: Ann Arundel



Above: Detention Basin with native plants.
Photo: Pennsylvania Environmental Council

Agricultural Measures

Conservation tillage (reduced tillage/no-till)

Reducing the extent of tillage is known as conservation tillage; when no tillage is used, it is called no-till. Reducing tillage leads to a reduction in soil erosion and the transport of associated nutrients, such as phosphorus, to the waterways. No-till allows natural soil structure to develop, which results in increased infiltration of rainwater, reduced surface runoff, and reduced overtopping of roads adjacent to farm fields.

Primary goal addressed: 2. Improve Surface Water Quality
Pollution reduction: 59% sediment, 52% P, 20% N
Cost: $60/acre

Cover crops

Cover crops can provide multiple benefits: preventing erosion, improving soil's physical and biological properties, supplying nutrients, improving the availability of soil water, breaking pest cycles, and suppressing weeds. Planted in the fall and/or spring, they take up unused fertilizer, build soil structure, and release nutrients for the following crop to use. The species of cover crop selected along with its timing and management determine the specific benefits.

Primary goal addressed: 2. Improve Surface Water Quality
Pollution reduction: 15% sediment, 30% P, 30% N
Cost: $31/acre

Grassed waterways

A grassed waterway is a vegetated channel designed to move stormwater at a non-erosive velocity to reduce soil erosion and flooding. Grassed waterways prevent gully erosion and protect water quality. They are most appropriate for areas where there is soil erosion from concentrated runoff.

Primary goal addressed: 2. Improve Surface Water Quality
ACPF areas identified: Yes
Pollution reduction: 80% sediment, 45% P, 55% N
Cost: $8,917/acre

Nutrient Management Plans (NMPs)

A NMP is a strategy for obtaining the maximum return from on- and off-farm fertilizer resources in a manner that protects the quality of nearby water resources. Creating an NMP involves reviewing soil maps, field boundaries, and nutrient uptake of crops to determine nutrient needs for each field and the types and amounts of fertilizers to meet those needs.

Primary goal addressed: 2. Improve Surface Water Quality
ACPF areas identified: Yes
Cost: $14/acre

Ponds

Ponds are popular features that also have significant pollutant removal benefits when well sited and designed. Also known as wet ponds, stormwater ponds, or wet retention ponds, they are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season). As stormwater runoff enters the pond, the sediment settles out and some nutrient uptake takes place. Nitrogen removal via denitrifying bacteria can also occur in ponds.

Primary goal addressed: 2. Improve Surface Water Quality
Pollution reduction: 58% sediment, 48% P, 31% N
Cost: $15,735/acre

Riparian buffers

Riparian buffers are vegetated zones immediately adjacent to a stream. They protect the stream channel and provide room for streams to move naturally, support habitat, reduce erosion, offer recreational space, and protect water quality. Buffers function as a vegetated filter strip and as overbank erosion protection during peak flows. The vegetation can be native forest, grasses, or shrubs.

Primary goal addressed: 2. Improve Surface Water Quality
Addresses Critical Riparian Areas
Pollution reduction: 53% sediment, 43% P, 38% N
Cost: $54/acre

Wetlands

Wetlands, also known as Nutrient Removal Wetlands, consist of a depression created in the landscape where hydric soils allow aquatic vegetation to become established. They are among the most effective stormwater practices in terms of pollutant removal. Wetlands can easily be designed for flood control by providing flood storage above the level of the permanent pool. The wetlands and surrounding buffers also offer environmental benefits such as increases in wildlife habitat and carbon sequestration. Wetlands can be natural or "constructed," meaning that they mimic naturally occurring wetlands. Wetland restoration is an important tool for bringing back the ecosystem services of nutrient removal and flood storage to a drainage area. Wetlands that have filled with sediment over time can be dredged to improve flood storage while retaining wildlife habitat.

Primary goal addressed: 2. Improve Surface Water Quality
Addresses Critical Wetland Areas
ACPF areas identified: Yes
Pollution reduction: 78% sediment, 44% P, 20% N
Cost: $13,563/acre

Selected Agricultural Management Measures (Best Management Practices, or BMPs).



Left: Grassed waterways in Highland Silver Lake watershed. Photo: HeartLands Conservancy.



Left: Wetland. Photo: HeartLands Conservancy



Left: Cover crops demonstration plot. Photo: HeartLands Conservancy, 2016.

Stream and Lake Measures

Lake and stream dredging

Several lakes and streams in the watershed have filled in with sediment, decreasing the volume of their storage capacity. This is a particular problem for the homes around Long Lake, which are flooded when lake levels rise too high.

Primary goal addressed: 2. Improve Surface Water Quality
Pollution reduction: n/a
Cost: $28/linear foot

Logjams—assessment and removal

A logjam is any woody vegetation, with or without other debris, which obstructs a stream channel and backs up stream water. Beaver populations can increase the number of logjams in an area. Reports of beavers along streams in the watershed were made by residents. Logjams occur naturally, providing beneficial stream structure and cover for fish and wildlife and allowing nutrient-rich sediments to be deposited on adjacent floodplain. Adding and maintaining logjams is sometimes a management improvement for fish habitat.

Primary goal addressed: 2. Improve Surface Water Quality
Pollution reduction: n/a
Cost: $32/linear foot

However, the benefits of logjams can sometimes be outweighed by the drawbacks. Logjams can impact water quality and impede the ability of streams in the watershed to drain and convey water from the land in a timely manner. They increase the impacts of flood events and contribute sediment when water scours the streambanks beside the logjam, taking soil and debris from the bank into the stream channel. Logjams can be beneficial or harmful depending on their size, location, the extent to which they stabilize streambanks, and the condition and land use of the riparian area. The decision to remove a logjam should be made following a thorough site inspection.

Localized assessment is recommended to determine whether logjam removal is appropriate and cost-effective at specific locations. The American Fisheries Society's 1983 "Stream Obstruction Removal Guidelines" are a reliable source for determining what types of logjams should be removed.

Shoreline stabilization

The shoreline provides habitat for fish and wildlife, supports recreation for humans, and cleans stormwater runoff before it enters the water. Shoreline erosion is a natural process that occurs on lakes and rivers and along the coast. It is the gradual, although sometimes rapid, removal of sediments from the shoreline. It is caused by a number of factors including storms, wave action, rain, ice, winds, runoff, and loss of trees and other vegetation. Stabilizing the shoreline of lakes in the watershed can reduce sediment erosion and support vegetation and wildlife habitat.

Primary goal addressed: 2. Improve Surface Water Quality
Pollution reduction: 58% sediment, 22% P, 15% N
Cost: $86/linear foot

Streambank and channel stabilization and restoration

Streambank and channel stabilization and restoration includes several practices. Streambed erosion (incision) is the first consideration for treatment. Treatment methods include installation of pool-riffle complexes, which consist of areas of rapid water movement over coarse substrate (riffles) and areas with slower stream movement and a smooth surface (pools).

Primary goal addressed: 2. Improve Surface Water Quality
Addresses Critical Stream Reaches
Pollution reduction: 98% sediment, 90% P, 90% N
Cost: $80/linear foot

Riffle-pool complexes help support healthy fish and wildlife habitat by increasing water depth and increasing DO.

Streambank stabilization methods use a combination of bioengineering with native vegetation and hard armoring. These practices are typically implemented together, often alongside riparian buffer improvements. They improve water quality by reducing sediment transport and increasing oxygen. Some practices, such as two-stage channels, help to store floodwater during periods of high flow.

Stream channel restoration includes re-meandering channelized streams to their original, more sinuous channels. This slows down flow and allows more aquatic wildlife habitat.



Logjam. Photo: Georgia DOT

SECTION 5: MANAGEMENT MEASURES ACTION PLAN

Management Measure Selection

BMPs for stormwater management and water quality were identified from several sources, including the Association of Illinois Soil and Water Conservation Districts (Illinois Urban Manual) and USEPA (e.g., the Water Quality Scorecard). Full descriptions of Management Measures selected are located in Appendix E.

The Management Measures were selected based on the following factors:

- Performance—Research-based pollutant reduction estimates for each BMP;
- Cost—The costs associated with installation and maintenance of each BMP;
- Public acceptance; and
- Ease of construction and maintenance.

Pollutant load reduction values associated with the Management Measures were identified from several sources, including the USEPA's Region 5 Load Estimation Model Users Manual and the International Stormwater BMPs Database (see Appendix E).

Cost estimates were assembled from several sources, including the Illinois Nutrient Loss Reduction Strategy (2015), experienced local contractors, and other watershed-based plans (see Appendix E).

Levels of public acceptance for various Management Measures were gauged during stakeholder engagement activities. Data on ease of construction and maintenance were collected from sources including NRCS's 2014 National Conservation Practice Standards.

Table 5 shows all Management Measures recommended, with the primary goal addressed by each measure. Secondary and/or tertiary goals addressed are also identified. Estimates of the pollutant load reduction efficiencies of each measure are listed for sediment, TSS, phosphorus, and nitrogen. If implemented, these Management Measures will achieve the goals, objectives, and targets of this plan.

Some BMPs are more effective at pollutant reduction when implemented in a treatment train (e.g., a terrace leading to a wetland). The STEPL can assess the efficiency of several BMP combinations.

Note: All recommendations in this section are voluntary and are not required by any federal, state, or local agency.

All Management Measures recommended

Table 5. All Management Measures recommended, goals addressed (see goal numbers in Section 2), and pollutant load reduction efficiencies.

	Goals addressed			Pollutant load reduction efficiency			
	Primary goal addressed	Secondary goal addressed	Tertiary goal addressed	% sediment removal*	% TSS removal*	% P removal	% N removal
Programmatic Measures							
Conservation Development	3						
Federal and state programs (CRP, CREP, etc.)	2	3	4				
Financial support for stormwater infrastructure	1	5					
Flood Damage Prevention Ordinance	1						
Green infrastructure incentives	3						
In-lieu fee mitigation	2	1	3				
Monitoring (water quality, flow, and stream health)	2	4	6				
Native landscaping	4	3	1				
Open space and natural area protection	3	5					
Private sewage monitoring	2						
Riparian Buffer Ordinance	3	2	5				
Sewage Treatment Plant upgrades	2						
Stream Cleanup Team	4	1					
Watershed plan integrated in community efforts	5						
Street sweeping and de-icing education, training	2	1					
Site-Specific Management Measures							
Agricultural Management Measures							
Conservation tillage	2			59%	59%	52%	20%
Cover crops	2			15%	15%	30%	30%
Grassed waterways	2			80%	80%	45%	55%
Nutrient Management Plan (NMP)	2	1		n/a	n/a	n/a	n/a
Water and Sediment Control Basin (WASCOB)	2	1		n/a	n/a	n/a	n/a
Ponds	2	1		58%	67%	48%	31%
Riparian buffers	2	4		53%	53%	43%	38%
Wetlands	2	1	4	78%	78%	44%	20%
Urban Management Measures							
Bioswales	1	4		77%	77%	17%	47%
Dry detention basins, new	1	1		58%	58%	26%	30%
Wet detention basins, new	1	1		60%	60%	45%	35%
Detention basin retrofits (vegetated buffers, etc.)	1	1	4	53%	73%	45%	40%
Detention basin maintenance (dredging, invasives, etc.)	1	1		n/a	n/a	n/a	n/a
Pervious pavement	1	1		90%	90%	65%	85%
Rain gardens	2	4	1	67%	67%	27%	35%
Rainwater collection	1	2		n/a	n/a	n/a	n/a
Single property flood reduction strategies	1			n/a	n/a	n/a	n/a
Stormwater & sanitary sewer maintenance & expansion	1	2		n/a	n/a	n/a	n/a
Tree planting (e.g. street trees)	1	2		31%	31%	31%	27%
Urban filter strips	1	2		86%	86%	33%	56%
Waterproofing	1						
Landscape regrading away from foundations	1						
Structure elevation	1	2					
Internal drainage systems/basement modifications	1	2					
Stream and Lake Management Measures							
Lake dredging	1			n/a	n/a	n/a	n/a
Logjam assessment and removal	2	1	4	98%	90%	90%	90%
Shoreline stabilization	2			58%	58%	22%	15%
Streambank & channel stabilization and restoration	2	4		98%	90%	90%	90%

*Independently calculated sediment and total suspended solids (TSS) values were used where available. Where only one sediment or TSS value was available, the known sediment and TSS reduction efficiency was used (purple cells).

Summary of Site-Specific Management Measures recommended

Table 6 shows the Site-Specific Management Measures recommended, along with associated costs and estimated pollutant reductions for sediment, TSS, phosphorus, and nitrogen. All recommendations are for implementation by 2035, or the long-term watershed-planning horizon.

Agricultural Management Measures

Conservation tillage is recommended for 7,122 acres of land, representing 60% of agricultural land in the watershed.

Cover crops are recommended for 7,122 acres of land. Cover crops are highly compatible with conservation tillage; a farmer planting cover crops will often find it more beneficial to till less or not at all.

Grassed waterways are recommended for 191 acres on agricultural land with Critical, Very High, or High runoff risk, as identified in the ACPF. This figure represents 30% of the grassed waterway locations identified in the ACPF, which are suited for drainage areas greater than six acres. Grassed waterways are a well-known practice among landowners and farmers in the watershed.

Nutrient Management Plans (NMPs) are recommended for 500 acres of agricultural land.

Ponds are recommended to cover 100 acres on agricultural land. Ponds are already a popular project for landowners in the watershed, who often use them for recreation and stock them with fish. Ponds are not eligible for funding by the major federal agricultural conservation programs such as CRP, but there appears to be high demand, and they function well as retention basins.

Riparian buffers are recommended for 242 acres along streams (assuming a 100-foot buffer width), or 20 miles, representing 100% of streams identified as having poor or moderate riparian condition. The recommended area includes 100% of the Critical Riparian Areas in the watershed (6.9 miles) which are composed of “poor condition” riparian areas identified in the aerial assessment and areas identified in the ACPF as Critical Zones (see Appendix D).

Wetlands are recommended to be installed or restored on 2,148 acres in the watershed. This represents 25% of the Critical Wetland Areas identified using the MoRAP Wetland Ratings.

Table 6. Summary of Site-Specific Management Measures recommended, including amount, cost (implementation cost), and pollutant load reduction.

					Cumulative pollutant load reduction			
BMP Name	**Amount**	**Unit**	**Cost per unit**	**Total Cost**	**Sediment (tons/yr)**	**Total Suspended Solids (lbs/yr)**	**Phosphorus (lbs/yr)**	**Nitrogen (lbs/yr)**
Agricultural management practices								
Bioreactors	508	Acres drained	$ 164.64	$ 83,555	-	-	-	3,136
Conservation tillage	7,112	Acres	$ 61.18	$ 435,150	2,094	4,187,610	12,860	21,977
Cover crops	7,112	acres	$ 31.47	$ 226,473	536	1,071,000	7,398	32,965
Grassed waterways	191	acres	$ 8,917	$ 1,722,352	64	127,694	248	1,351
Nutrient Management Plans (NMPs)	500	acres	$ 14.26	$ 7,216	-	-	-	-
Ponds	100	acres	$ 15,735	$ 1,593,000	87	201,780	499	1,417
Riparian buffers	242	acres	$ 54.25	$ 13,309	706	1,411,864	3,947	15,520
Wetlands	2,148	acres	$ 13,563	$ 17,389,575	992	1,984,190	3,866	7,830
Forest Related Practices								
Forest stand improvement	300	acres	$ 371.70	$ 111,510	-	87	1	3
Urban/Other Measures								
Bioswales	370,913	sq. ft.	$ 18.00	$ 6,676,441	5	10,366	8	138
Dry detention basins, new	300	acres	$ 45,136	$ 13,703,040	273	545,474	832	6,193
Wet detention basins, new	300	acres	$ 49,585	$ 15,053,580	285	569,190	1,441	7,225
Detention basin retrofits (native vegetation buffers, etc.)	20	acres	$ 15,700	$ 317,750	8	23,084	48	275
Detention basin maintenance (dredging, mowing, burning, invasives, etc.)	20	acres	$ 1,022	$ 20,689	-	-	-	-
Pervious pavement	175	acres	$103,675	$ 15,053,580	285	569,190	1,387	11,697
Rain gardens	25,000	sq. ft	$ 9.56	$ 241,800	-	608	1	7
Rainwater harvesting and reuse	200	rain barrels/ cisterns	$ 244.13	$ 49,410	-	-	-	-
Single property flood reduction strategies	2,920	properties	$ 1,085	$ 3,206,160	-	-	-	-
Storm drain system maintenance and expansion	100,000	feet	$ 83.00	$ 8,399,700	-	-	-	-
Tree planting (e.g., street trees)	2,280,000	sq. ft. canopy	$ 2.85	$ 7,821,080	13	25,654	87	486
Urban filter strips	3,709,134	sq. ft	$ 2.08	$ 39,105,400	121.8	243,565	323	2,441
Waterways								
Lake dredging	602,030	cubic yards	$ 27.62	$ 16,825,234	n/a	n/a	n/a	n/a
Logjam removal	58,080	feet	$ 32.16	$ 1,888,762	603	1,112,603	343	890
Shoreline stabilization	52,800	feet	$ 86.02	$ 4,598,035	684	1,368,500	1,808	5,494
Streambank & channel stabilization and restoration	91,344	feet	$ 80.40	$ 7,426,267	948	1,749,822	539	1,400
TOTAL				**$ 144,820,763**	**8,214**	**16,206,210**	**37,607**	**121,804**
% Reduction From Current Total:					**32.8%**		**26.7%**	**15.0%**

Urban Management Measures including 370,913 square feet of *bioswales.* If each bioswale treats an area of 10 acres or less, as is recommended, this represents minimum of swales implemented.

New dry detention basins (300 acres) and *wet detention (or retention) basins* (300 acres) are recommended. New detention and retention basins are anticipated to be constructed alongside new residential, suburban, commercial, and industrial development in the watershed.

Detention basin retrofits are recommended for 20 acres of existing detention/retention basins, which represents 24% of the 82 detention basins identified from aerial photographs in the watershed, assuming an average basin size of one acre. It is anticipated that all existing basins will benefit from upgrades by 2050. Several have already filled with sediment and fallen into disrepair, especially in older subdivisions. *Detention basin maintenance* for those 20 acres of detention/retention basins is also recommended to ensure that appropriate maintenance techniques and schedules are designed and adhered to in future.

Pervious pavement is recommended for 175 acres in the watershed, or 2% of the total current urban land cover in the watershed. Pervious pavement is an increasingly popular paving choice and has been installed at pilot sites in local municipalities.

Storm drain system maintenance and expansion is recommended for 100,000 feet of stormwater ditches and storm sewers in the watershed. This includes cleaning out culverts, ditches, drains, and storm inlets, and expanding stormwater infrastructure to new development and increasing culverts and other features that are not appropriately sized to accommodate the flow received.

Rain gardens are recommended to be installed on 25,000 square feet of urban land in the watershed. Rain gardens are gaining in popularity among homeowners because of their infiltration capacity and wildlife benefits, and they can be attractive community features as well.

Rainwater collection is recommended through the installation of 200 rain barrels or cisterns.

Single-property flood reduction projects are recommended for 2,920 properties. This number is a best estimate of properties with moderate to serious flooding/groundwater issues requiring upgrades by 2050, based on the Flood Survey results (Appendix B). Building owners may wish to update or elevate their properties to reduce flood damage or alter drainage on their properties by improving basement drainage, altering driveway grade, or other actions.

Tree planting of approximately 20,000 trees is recommended, especially along streets. With an estimated canopy area of 114 sq ft for a 10-year-old mature street tree, this amounts to 2,280,000 sq. ft. of recommended canopy cover.

Urban filter strips are recommended to be installed on 3,709,134 square feet of urban land in the watershed to increase infiltration and remove pollutants and sediments from surface water.

Stream and Lake Management Measures recommended include 602,030 cubic yards of lake dredging.

58,080 feet of *logjam removal*s, which represents 100% of the streams in the watershed. Some stream reaches with many trees and unstable streambanks may need to have multiple logjams removed.

Shoreline stabilization is recommended for 52,800 feet of lake shoreline. This represents 20% of the total perimeter of the shorelines of named, major lakes in the watershed.

Streambank and channel stabilization and restoration is recommended for 91,344 feet of streams. This number represents 100% of all streams with high streambank erosion, and includes 100% of Critical Stream Reaches. Streambank erosion is a major source of sediment and nutrient loading in the watershed.

Locations of Site-Specific Management Measures

Where data was available, Site-Specific Management Measures were recommended for implementation in certain locations. For example, Management Measures associated with Critical Areas are recommended for those areas.

Table 7. Area and length of eight Site-Specific Management Measures at known locations, divided by HUC14 subwatershed, alongside five Critical Areas with known locations (summary of Critical Areas information in Section 3). Greatest values in each category are shown in **bold red font**.

HUC14	Bioreactors (acres)	Drainage Management (Acres)	Grassed Waterways (feet)	Riparian buffers (feet)	*Critical Riparian Areas (feet)*	*Critical Wetland Areas (acres)*	*Critical Stream Reaches (miles)*	*Critical Logjam Areas (miles)*	*Critical Flooding Areas (acres)*	Dry Pond (acres)	Porous Pavement (acres)	Basins (acres)	Filter Strips (acres)
07140101040101	-	-	-		-	3,256	-	0.25	-	1,374	-	1,374	464
07140101040102	0.8	992	24,254	70,432	**2.4**	629	4.6	**3.0**	701	2,205	**538**	**1,616**	1,021
07140101040201	1.3	**2,849**	**87,615**	133,306	1.7	4.0	**4.9**	0.24	**1,110**	587	15	520	394
07140101040202	-	191	5,544	118,111	2.1	520	2.1	-	569	**2,213**	5	1,021	**1,101**
07140101040203	**4.1**	1,013	35,039	**230,037**	-	**3,582**	-	-	-	925	167	898	202
071401010403	2.4	209	13,351	54,840	-	599	-	-	-	968	161	636	203
TOTAL	**8.6**	**5,254**	**165,803**	**606,726**	**6.2**	**8,590**	**11.6**	**3.49**	**2,380**	**8,272**	**886**	**6,065**	**3,385**

Specific project locations

Eight specific project locations were identified by the watershed planning team. These projects address life safety issues and multiple goals of this plan by implementing a variety of Management Measures. A shortlist of these projects will help Madison County in its efforts to help communities and landowners in the watershed address the needs they identified in the stakeholder engagement process, and provide a near-term jumping off point for plan implementation by and for local government.

The locations were identified using the following information:

- Locations of issues identified by stakeholders on both public and private land;
- Critical Areas on public land, identified by cross-referencing the two map files;
- Parcels in which multiple types of Critical Areas are present, on both public and private land;
- Locations of agricultural and urban BMPs identified by the ACPF and EPA BMP Siting Tool;
- Road flooding locations identified by stakeholders, especially where floods threaten road access; and
- Madison County Community Flood Survey responses (which were returned with the promise of anonymity, so specific parcels from which a response was sent were not identified as project locations. However, flood issues reported nearby were included in the assessment criteria below).

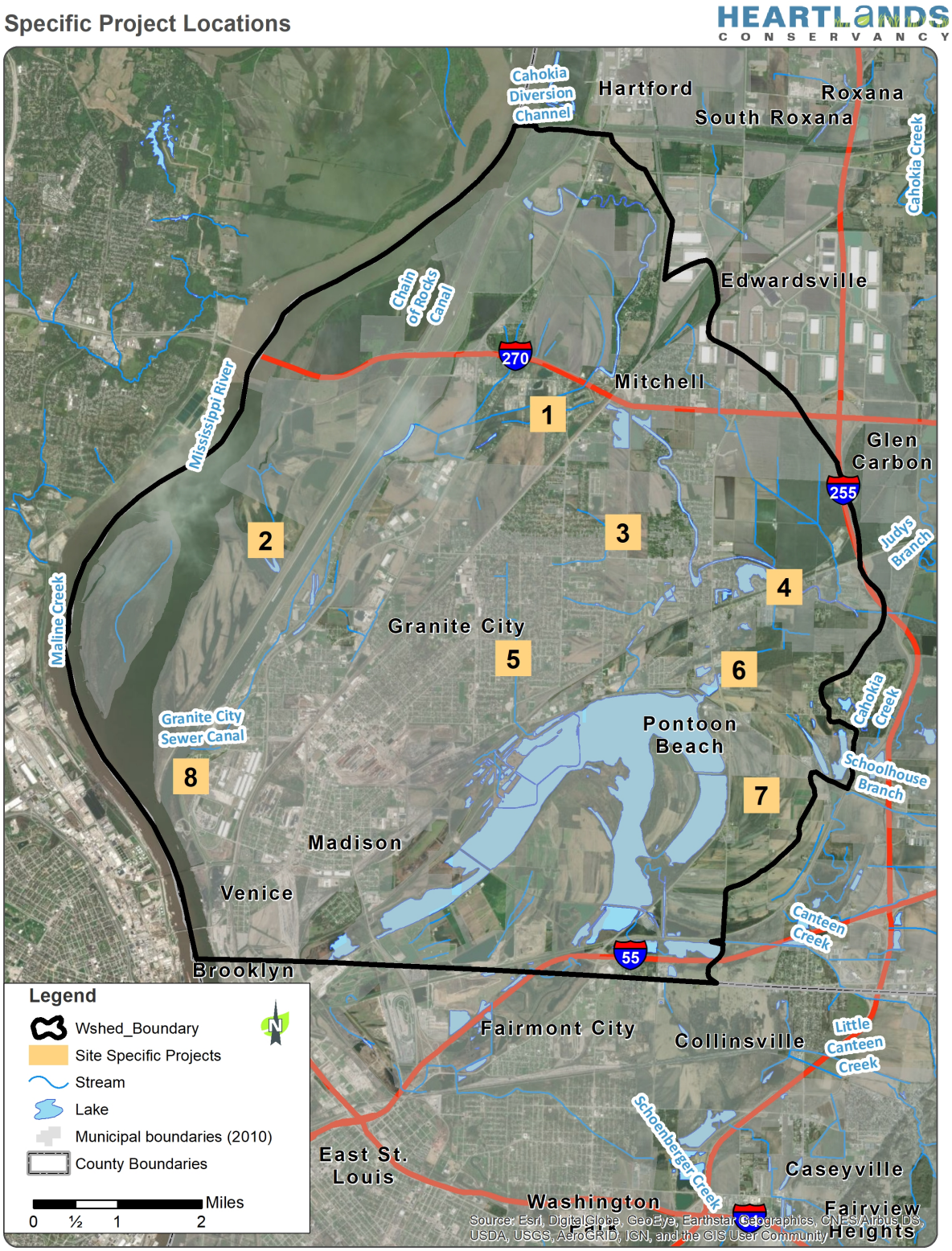
Once these locations were identified, the following criteria were used to select a shortlist of projects:

- Threats to critical facilities such as water treatment plants, wastewater treatment plants, fire stations, etc. (i.e., threats from flooding);
- Loss of road access to properties as a result of floods overtopping roads (which can harm health and wellbeing when access to hospitals, schools, and other services is curtailed);
- Frequency of flooding (if known);
- Proximity to flood issues identified in the Madison County Community Flood Survey;
- Representation of publicly and privately owned land;
- Estimated potential water quality benefits of the project (if known), based on area/length of project multiplied by the amount of pollution reduced);
- Number and type of Critical Areas the project would address, so that several types of issues are addressed; and
- Geographic distribution, with projects that are located throughout the watershed benefitting multiple municipalities, landowners, and other stakeholders.

For each project location, the problem/issue is explored, along with a description of the problem. Then, potential solutions that might be used to address the issue(s) are discussed. A map of each project location is provided for reference.

It is important to note that these specific project locations are only the sites of potential projects. The types of projects suggested are voluntary, not mandatory, and each one warrants further stakeholder engagement and site assessment to determine feasibility. Individual landowners with a stake in the projects may not have been consulted. These sites are identified here for outreach purposes only, so that the organizations and individuals implementing the Plan have places to begin planning for implementation.

Figure 5. Map of specific project locations. Numbered squares relate to project numbers in the following pages.



List of Specific Project Locations

The following specific project locations are listed and numbered from north to south (not in order of priority).

1. Mitchell Lake Subdivison Flooding
2. Chouteau Island Wetland Restoration
3. Dobrey Slough Restoration Area
4. Long Lake Outfall
5. Nameoki Ditch Flooding
6. Elm Slough Restoration Area
7. Horseshoe Lake Sediment Control
8. Madison Wetland Restoration & Flooding

Project #1: Mitchell Lake Subdivision Flooding

Description of Problem: During heavy rainfall events, stormwater from the creek, the surrounding impervious surfaces such as I-270 and from Long Lake, floods the Mitchell Creek Subdivision. These rainfall events cause Long Lake to reach its storage capacity, resulting in water backing up at the inlets of the lake near Mitchell Lake Subdivision. Several residents have reported flooding as much as five times per year in their yards and once per year in their basements

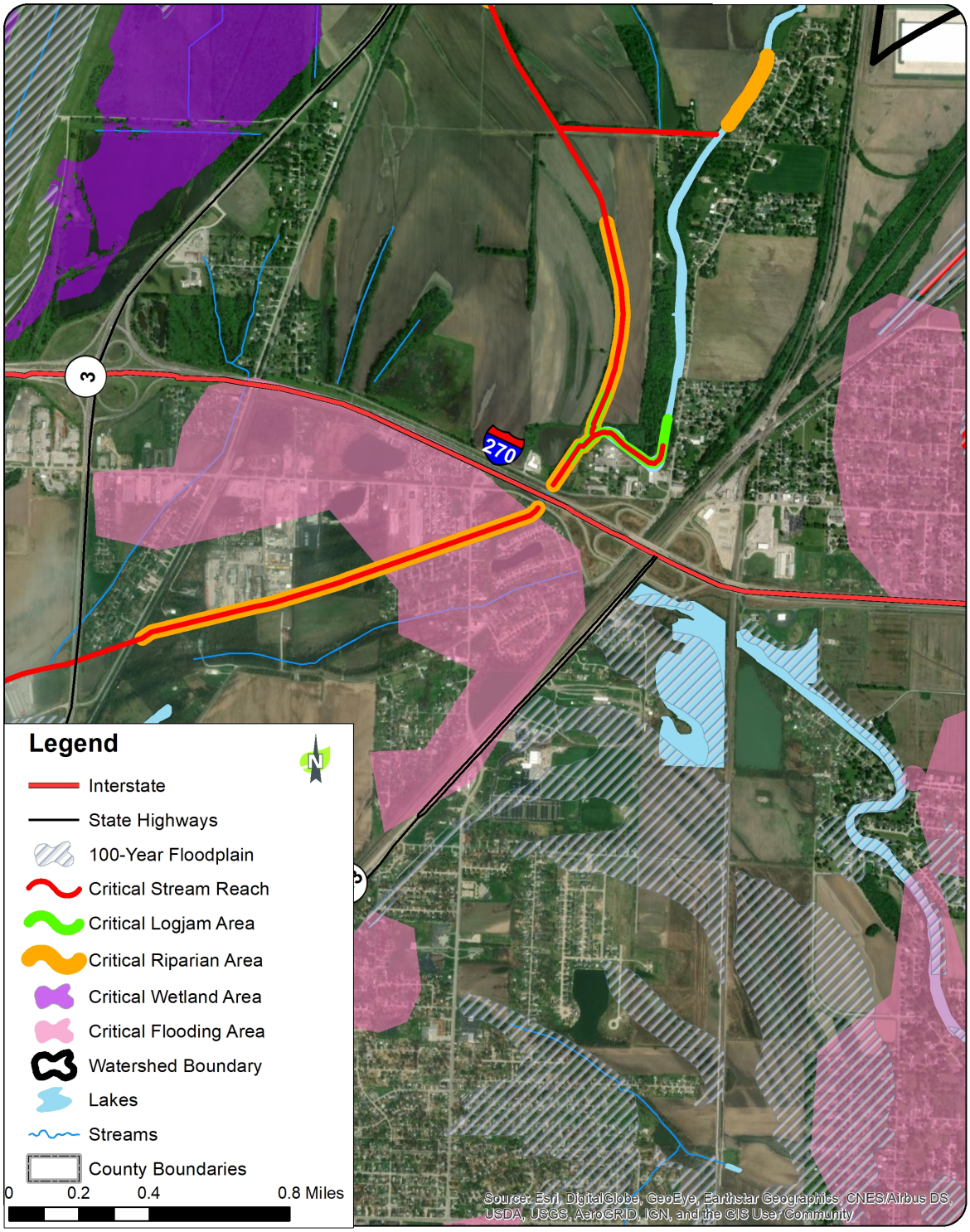
Floodplain: The subdivision is not in a 100-year floodplain.

Critical Areas: There are 4.5 miles of Critical Stream Reaches, 2.5 miles of Critical Riparian Areas, 1 mile of Critical Logjams, and 221 acres of Critical Wetland Areas in this project location. This subdivision is also located within a Critical Flooding Area.

Possible Solutions: Long Lake's outfall is severely undersized and filled with sediment. Installing a properly sized outfall that can manage flows from heavy rainfall events and keep the lake from flooding will help alleviate some backup issues. The Critical Stream Reaches that runs through the subdivision should have meanders created and reconnected to its natural floodplain north of the subdivision. This would allow increased water storage and ground infiltration. Also, the Critical Riparian Areas should be vegetated with native deep-rooted vegetation to slow water runoff. Bioswales could be implemented along the roads in the residential areas to improve drainage and convey stormwater away from private property.

Mitchell Lake Subdivision Flooding

HEARTLANDS CONSERVANCY



Project #2: Chouteau Island Wetland Restoration

Description of Problem: Chouteau Island is 5,500-acre island located between the Mississippi River and Chain of Rocks Canal and is one of the largest islands on the Mississippi River. The island does not have any residents and consists primarily of wetlands, woodlands, and prairies, but a former landfill covers a large area of the island. A master plan to restore Chouteau Island has been developed by the USACE and HeartLands Conservancy but has not been implemented.

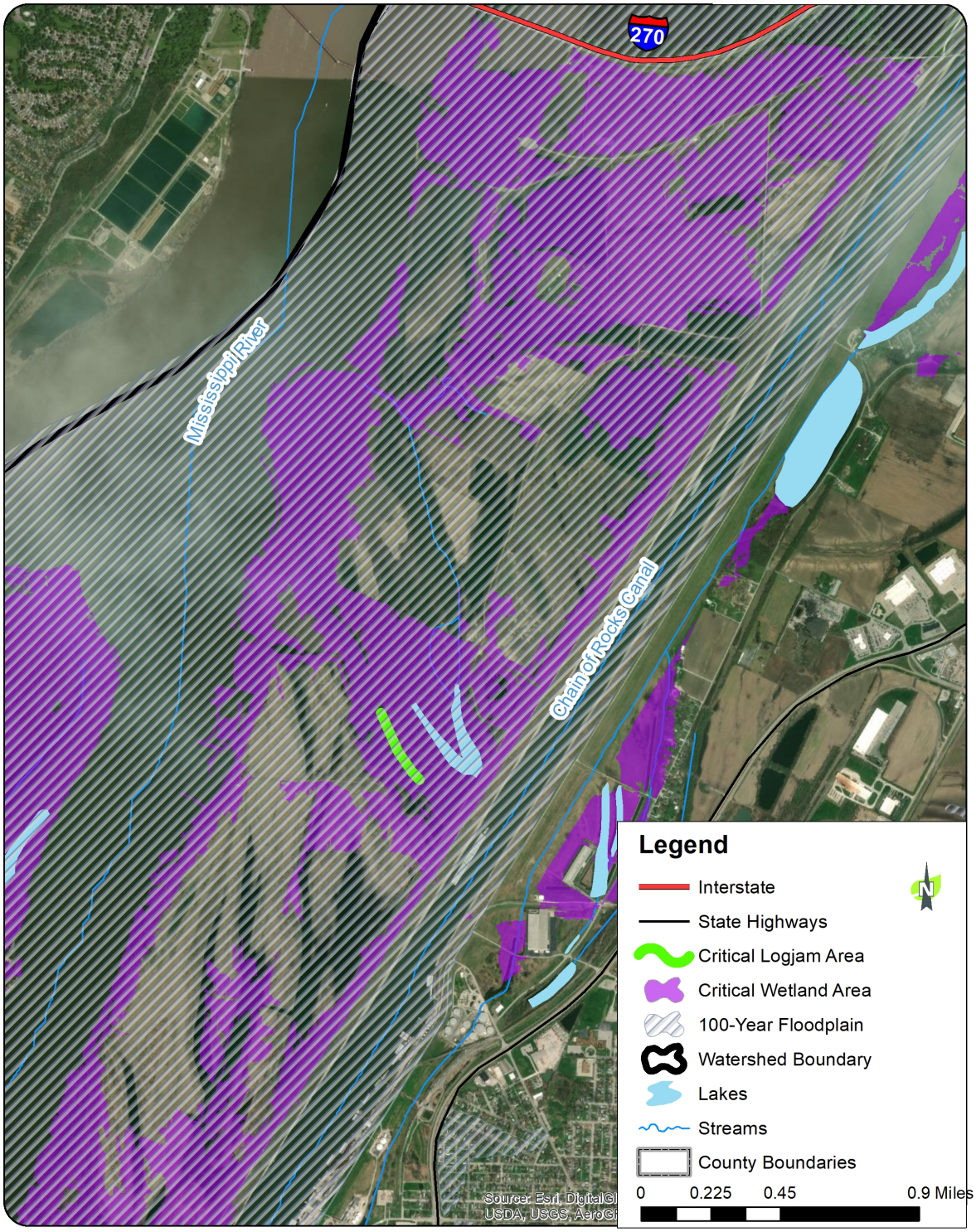
Floodplain: Chouteau Island is entirely located in the 100-year floodplain.

Critical Areas: The majority of Chouteau Island is Critical Wetland Areas and there is also 0.3 miles of Critical Logjam Areas.

Possible Solutions: The master plan created by USACE and HeartLands Conservancy outlines the restoration of wetlands, woodlands, and prairies as well as the including of a diverse mix of outdoor recreation and education opportunities. The Chouteau Island Master Plan includes 13 distinct restoration areas including an environment education area, slough restoration area, wetland & prairie mix area, recreation area, and habitat restoration area. The implementation will create and restore hundreds of acres of wetlands and conservation area to help reduce flooding and provide a valuable education and recreation for the watershed residents.

Chouteau Island Wetland Restoration

HEARTLANDS CONSERVANCY



Project #3: Dobrey Slough Restoration Area

Description of Problem: The Dobrey Slough is a historic remnant of a Mississippi River meander scar that was a depressional wetland in pre-settlement times. This area has since been developed into an urban area with residential housing, streets and railroads with stormwater water pumped under these structures through culverts and pipes an into Nameoki Ditch. During heavy rainfall events, Nameoki Ditch fills and the water is unable to be pumped away from Dobrey Slough, resulting in flooding. U.S. Army Corps of Engineers (USACE) expressed interest in rehabilitating this wetlands area as an Illinois Ecosystem Restoration and Flood Damage Reduction Project for East St. Louis & Vicinity.

Floodplain: Portions of this area are in the 100-year floodplain including residential areas to the west.

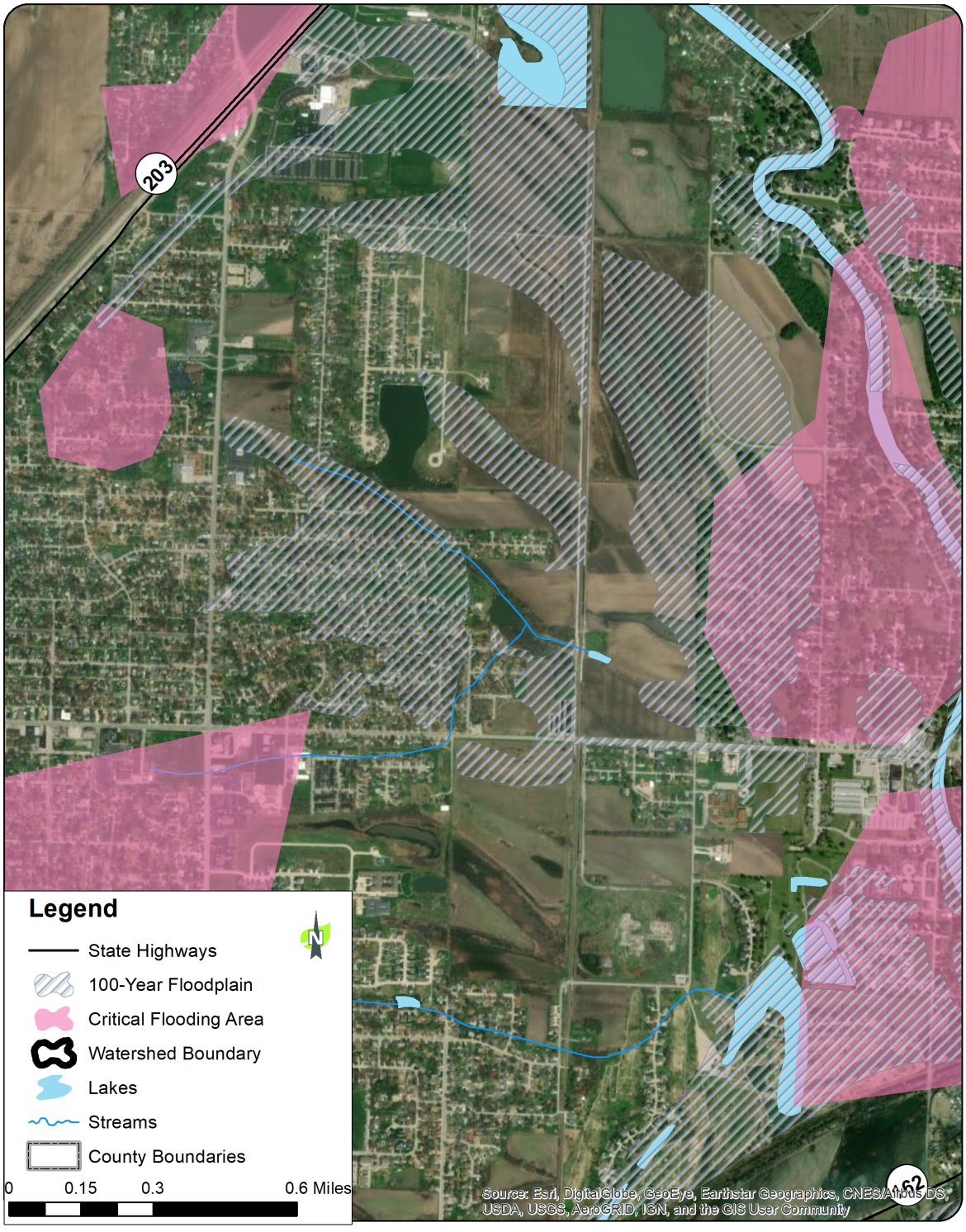
Critical Areas: There are six Critical Flooding Areas surrounding Dobrey Slough.

Possible Solutions: The USACE recommended creating approximately 59 acres of new marsh and forested corridors and restoring seven acres of existing marsh area surrounding the slough. This corridor would slow stormwater runoff and provide a natural flooding area for water to be diverted away from residential areas.

In addition to the USACE restoration areas, restoring the agricultural fields in the 100-year floodplain to native marsh or wetland areas should be promoted. The restoration of these areas would increase stormwater captured and reduce flooding.

The agricultural fields not within the 100-year floodplain should adopt best management practices include no-till planting and cover crops to improve groundwater infiltration and slow runoff. Development on these fields should be prohibited to prevent further increased stormwater runoff and flooding.

Dobrey Slough Restoration Area



Project #3: Long Lake Outfall

Description of Problem: Long Lake is a narrow lake that covers an area of approximately 62 acres. The outfall of the lake is severely undersized and cannot adequately handle the amount of stormwater that enters the lake during heavy rainfall events. This results in the flooding of residential areas surrounding the lake and causes backup issues further upstream.

Floodplain: The Long Lake outfall and surrounding residential areas are located within the 100-year floodplain.

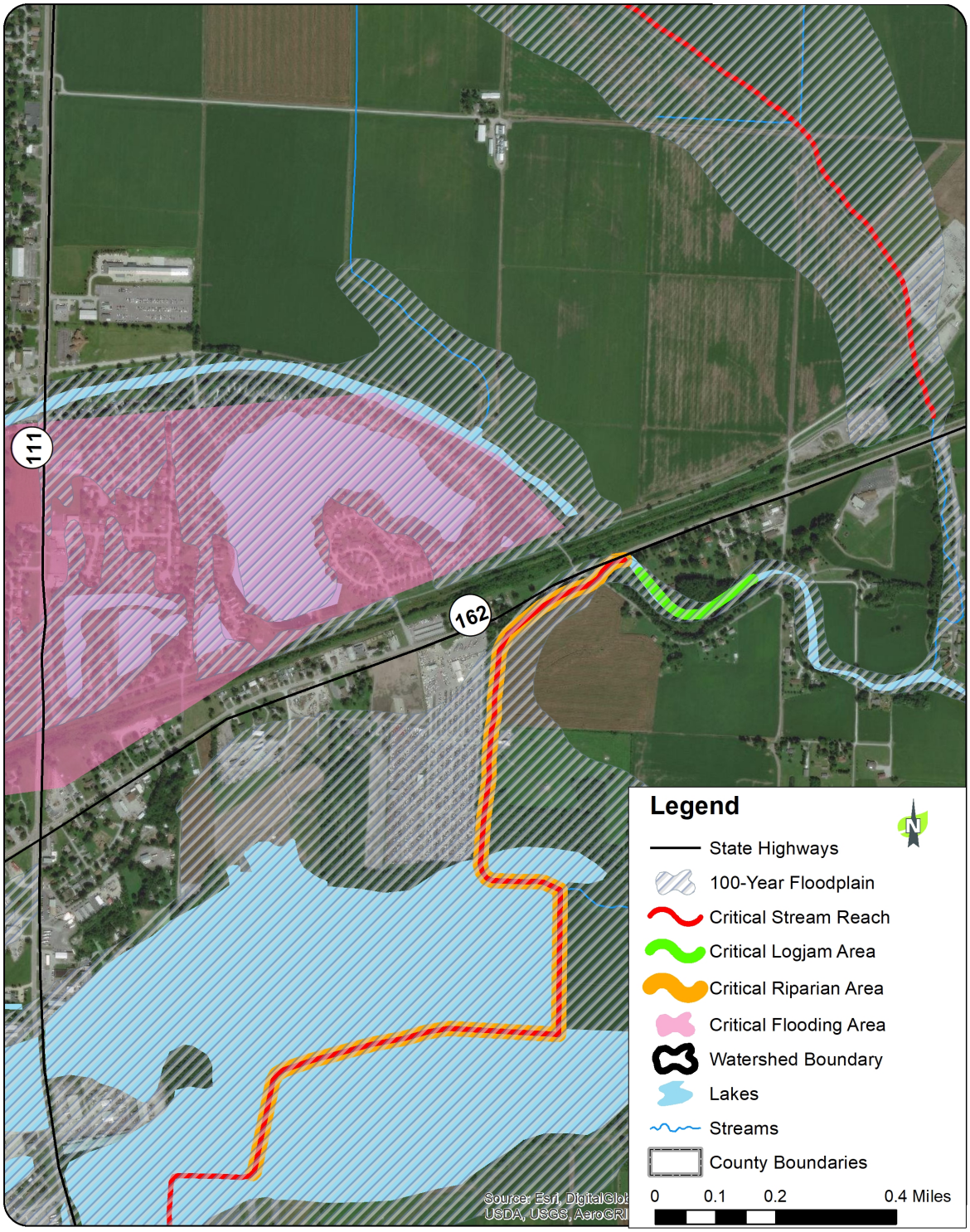
Critical Areas: There is 2.1 miles of Critical Stream Reach, 1.0 mile of Critical Riparian Area, and 0.3 miles of Critical Logjam Areas in this project location. There is also one Critical Flooding Area near the outfall however, three more Critical Flooding Areas surround the lake upstream.

Possible Solutions: Designs have been completed by an engineering firm and local stakeholders to improve the outfall of Long Lake. These designs should be adopted and constructed immediately.

To slow stormwater runoff into the lake to allow for the new outfall to perform as designed, the agricultural fields north of the lake should implement best management practices such as grassed waterways and cover crops. Also, the Critical Stream Reach meanders should be restored and Critical Riparian Areas should be vegetated to capture stormwater and allow for natural flooding areas.

Any future development in the surrounding agricultural fields should be required to detain 100% of its stormwater runoff using vegetated basins, pervious pavement, ponds and other urban best management practices.

Long Lake Outfall



Project #4: Nameoki Ditch Flooding

Description of Problem: Nameoki Ditch is a channelized drainage ditch that drains a portion of Granite City into Horseshoe Lake. The ditch is located in an urban area with residential homes surround its banks. When Horseshoe Lake's water level rises from consistent rainfall, Nameoki Ditch is unable to drain this urban area, resulting in flooding. Also during heavy rainfall events, stormwater infrastructure leading to the ditch become overwhelmed.

Floodplain: Portions of the Nameoki Ditch and surrounding neighborhoods are located in the 100-year floodplain but the majority of the area is not in the floodplain.

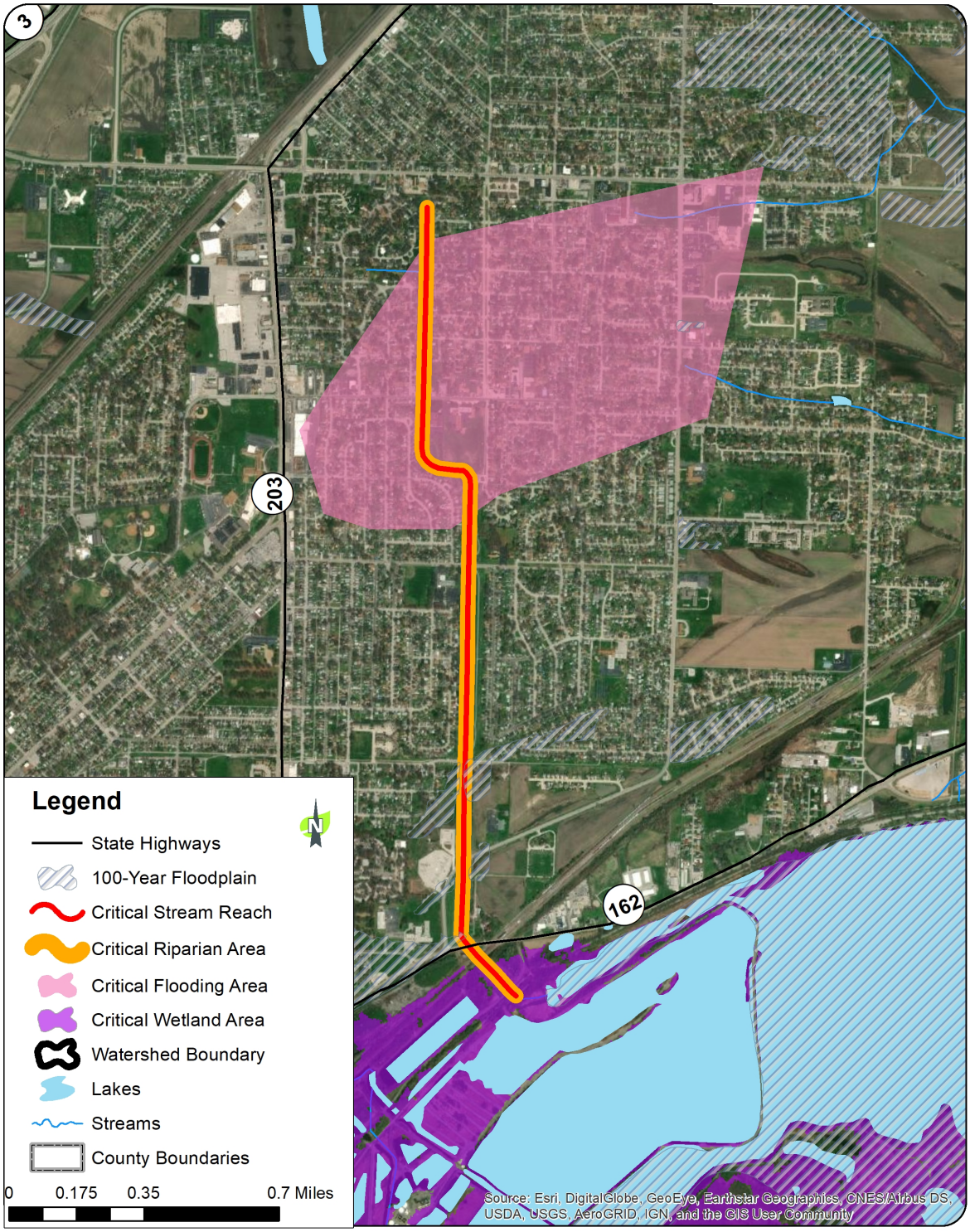
Critical Areas: There is 2.2 miles of Critical Stream Reach and 2.2 miles of Critical Riparian Area in this project location. There are also large amounts of Critical Wetland Areas surrounding Horseshoe Lake and one Critical Flooding Area.

Possible Solutions: Due to Nameoki Ditch being confined by urban areas, the ditch is unable to reconnected to its natural floodplain. However, the Critical Stream Reaches can be constructed into a two-stage ditch to provide a defined overflow area during flooding events. This overflow area can be vegetated with native deep-rooted vegetation to help slow the stormwater and reduce erosion.

To reduce the stormwater reaching Nameoki Ditch, vegetated filter strips, infiltration basins and pervious pavement can be installed to reduce runoff. Homeowner can also plant rain gardens in their yards and install rain barrels on their downspouts to capture rainfall where it falls. The surrounding municipalities should work with churches, schools, park districts, and citizen groups to install a networks of these practices to allow for increased storage.

The area surrounding Nameoki Ditch contains aging infrastructure and combined sewer systems. Replacement of all combined sewer systems with separated stormwater and sewer systems should be completed immediately and inspection and maintenance of the remaining systems should be performed regularly.

Nameoki Ditch Flooding



Project #5: Elm Slough Drainage Restoration

Description of Problem: Like Dobrey Slough, Elm Slough is a historic remnant of a Mississippi River meander scar that was a depressional wetland in pre-settlement times. Elm Slough is located at the main inlet of Horseshoe Lake and has experienced urban development and impervious surface encroachment. This encroachment has led to a loss of wetland area and an increase in sediment to Horseshoe Lake. U.S. Army Corps of Engineers (USACE) expressed interest in rehabilitating this wetlands area as an Illinois Ecosystem Restoration and Flood Damage Reduction Project for East St. Louis & Vicinity.

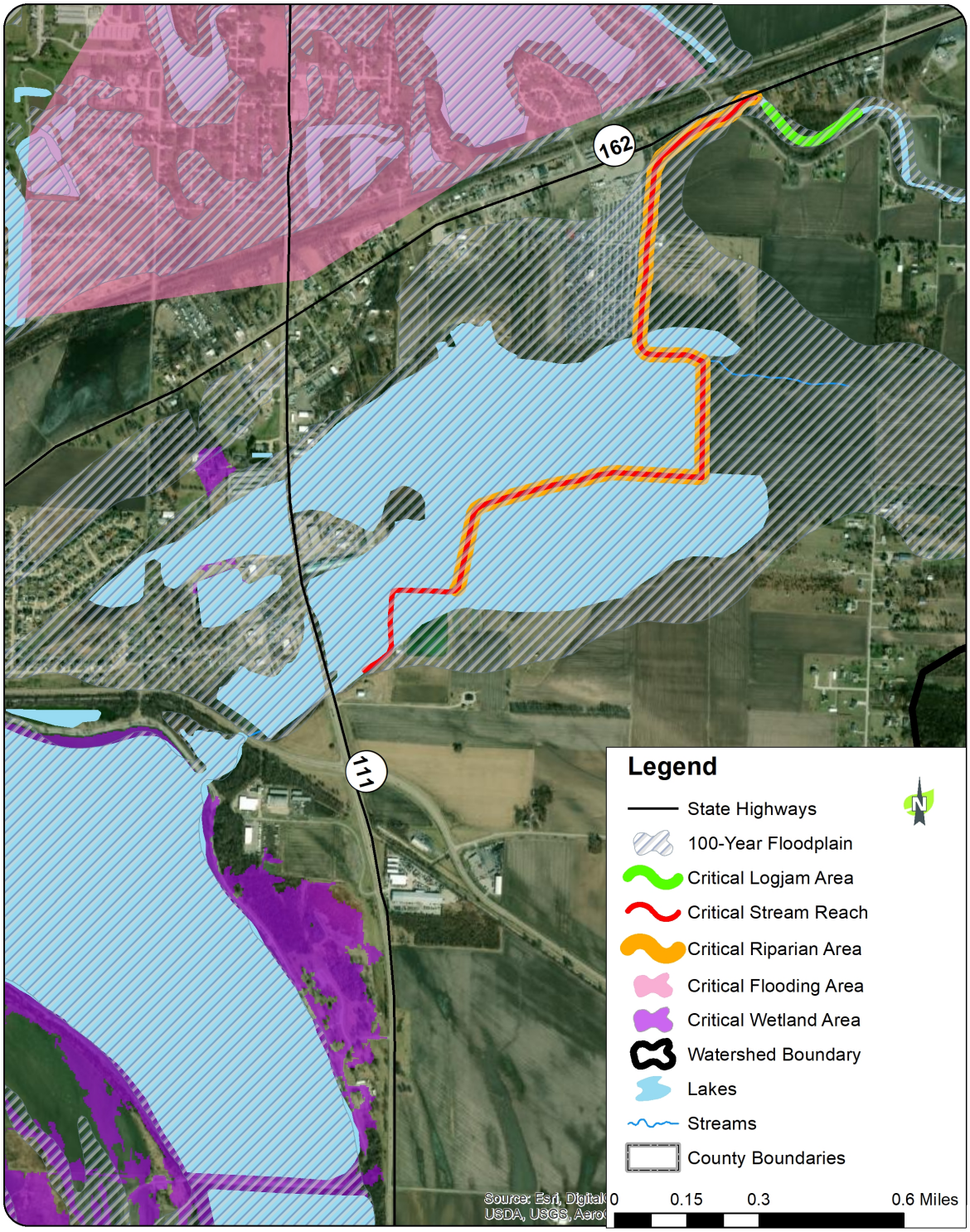
Floodplain: Elm Slough is located in the 100-year floodplain.

Critical Areas: There are 2 miles of Critical Stream Reach, 1.7 miles of Critical Riparian Area, and 0.3 miles of Critical Logjam Areas within this project location. There are also several Critical Wetland Areas surrounding Horseshoe Lake and a Critical Flooding Location just upstream.

Possible Solutions: Meanders should be established in Elm Slough for the Critical Stream Reaches to slow water flows, reducing sediment to Horseshoe Lake, and allowing flooding in natural areas. Native wetland vegetation should also be established throughout the slough and especially in the Critical Riparian Areas.

Elm Slough Restoration Area

HEARTLANDS CONSERVANCY



Project #6: Horseshoe Lake Sediment Control

Description of Problem: Horseshoe Lake is an oxbow lake formed by a meander scar of the Mississippi River that covers an area of approximately 2,400 acres. Sediment from the surrounding agricultural fields and the streams that flow in Horseshoe Lake, primarily Nameoki Ditch and the creek in Elm Slough, is causing the lake to lose water storage capacity. Areas of Horseshoe Lake have been reported to have five to six feet of sediment. The lake is naturally slow with depths averaging approximately three feet. These shallow depths and increased sediment cause significant harmful algal blooms from higher water temperatures and reduce water quality with pollutants trapped in the sediment.

Floodplain: Horseshoe Lake is within the 100-year floodplain but the surrounding agricultural fields are not.

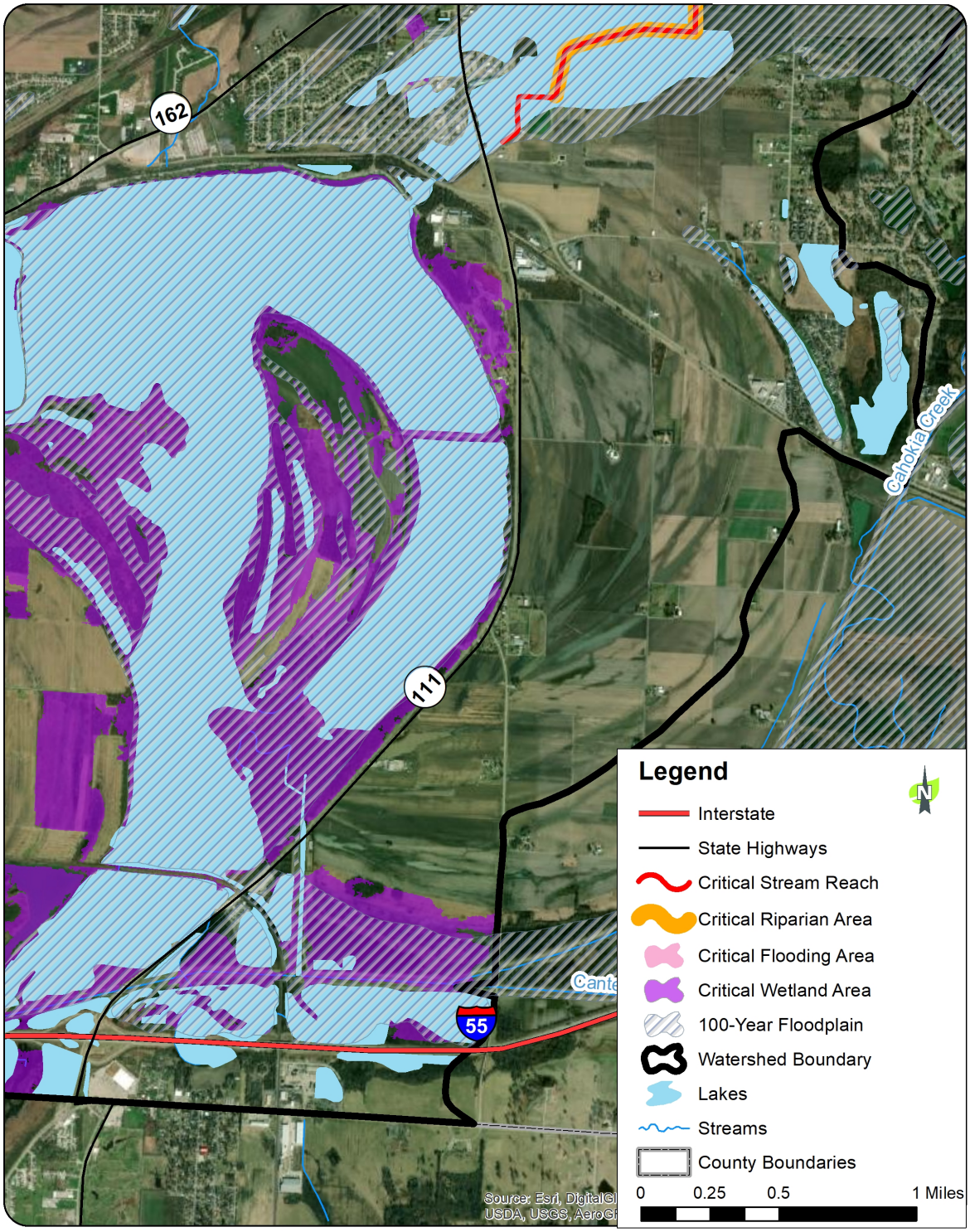
Critical Areas: There are Critical Wetland Areas surrounding the borders of Horseshoe Lake.

Possible Solutions: For the agricultural fields, several best management practices need to be installed. Some of the most important BMPs include cover crops which ensure the soil is never bare, no-till planting to limit the amount of soil disturbance, and grassed waterways to reduce gully erosion and slow stormwater runoff. Implementing all three of these BMPs would drastically reduce sediment runoff. Due to the small slopes on these fields, WASCOBs and terraces will not be viable options.

For the streams entering the lake, the streambanks need to be stabilized using native deep-rooted vegetation such as trees, grasses and bushes, and stone toe protection using riprap to reduce erosion. Nameoki Ditch should be constructed into a two-stage ditch to reduce stream channel erosion and the creek in Elm Slough should be reconnected to its natural floodplain by construction meanders. ASCOBs could be implemented to allow infiltration of stormwater which will reduce the amount of sediment transported to the lake.

The surrounding municipalities should adopt stormwater management practices for new developments to require 100% of stormwater to be retained on site and incentivize the use of porous pavements. Maintenance of ditches and basins should be performed regularly to remove any excess sediment.

Horseshoe Lake Sedimentation



Project #7: Madison Wetland Restoration & Flooding

Description of Problem: The western portion of the American Bottom watershed contains large amounts of Critical Wetland Areas that have been either neglected or destroyed. This reduction in wetland areas has caused increased flooding near Americas Central Port in Madison. In addition to wetland reduction, Madison has stormwater infrastructure consists primarily of combine sewer and stormwater systems.

Floodplain: Portions of this area is in the 100-year floodplain including west of Rte. 3 in the Critical Flooding Location.

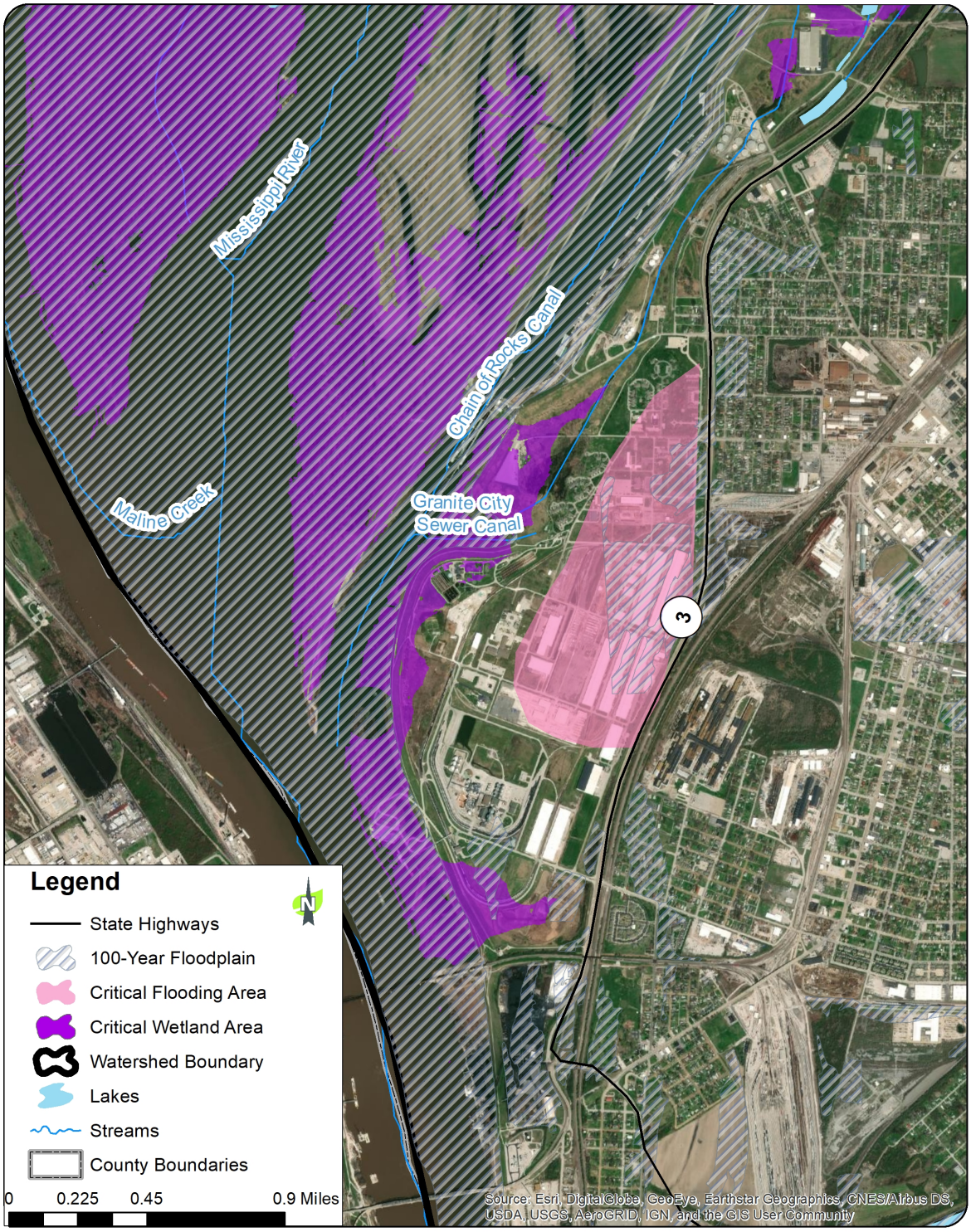
Critical Areas: There is one Critical Flooding Location and several Critical Wetland Areas.

Possible Solutions: These Critical Wetland Areas are among the highest ranked wetland areas in the Metro East. The restoration of these area will result in reduced flooding, increased groundwater infiltration, and improved water quality. A higher priority for restoration should be given to the wetlands on the eastern banks of the Mississippi River.

Madison should replace all combine sewer and stormwater systems with separate systems prevent any overflow issues. Development in known floodplain areas should be prevented and maintenance of all stormwater infrastructure including ditches and basins to ensure adequate storage capacity.

Madison Wetland Restoration & Flooding

HEARTLANDS CONSERVANCY



SECTION 6: INFORMATION & EDUCATION PLAN

The Information and Education component is designed to spark interest in and enhance public understanding of the watershed plan, and to encourage early and continued participation in selecting, designing, and implementing its recommendations. It further expands on Goal 6 of this plan, "Promote public awareness, understanding, and stewardship of the watershed and the watershed plan."

The watershed faces challenges and threats from widespread and serious flooding, numerous impairments, high nutrient and sediment loads, streambank erosion and channelization, increasing development and land use changes, deteriorating stormwater and sewer infrastructure, invasive species, and more. Some audiences lack the knowledge and resources to make informed decisions and adopt constructive behaviors to mitigate these challenges and threats.

Since a significant amount of the watershed is held as private property, education and outreach efforts to engage landowners and other key stakeholders are needed to improve water quality and achieve other goals of this plan. A single regulatory agency or group working alone cannot be as effective as a combined effort with other groups in the watershed all working towards the same goal. Many people will commit to protecting and improving the watershed if they understand what to do and how it will help.

This Information and Education Plan serves as an outline toward achievement of the long-term goals and objectives of the watershed plan. The cumulative actions of individuals and communities across the watershed can accomplish these goals and objectives. County, municipal and township staff, elected officials, and other key stakeholders have tools at their disposal to establish best practices in their activities and procedures. Residents can be actively involved in monitoring, protecting, and restoring the health of the watershed, and developers can follow guidelines that consider watershed health. As these stakeholders become aware of the lakes and creeks in the region and adopt specific behaviors to improve these waterbodies' health, the threats and challenges in the watershed will decrease. Public information and stakeholder education efforts will ultimately inspire watershed residents and community members to adopt recommended behaviors that improve the water quality and overall health of the watershed.

Information and Education Process

To develop the strategies for the Information and Education Plan, the following questions were asked:

- Who can affect this issue?
- What actions can people take to address it?
- What do people need to know before they can take action?

The list of activities has been divided into three broad timeline categories: short-term, medium-term, and long-term. The full list of objectives and activities can be found in Table 8. An estimate of the cost of the outreach activities outlined in this plan is $30,000, which does not include many unforeseeable component costs such as staff time and costs for rental and materials.

Target Audiences

Key stakeholder audiences that can effect significant changes in watershed health, and who should be reached by outreach and education, include:

- Madison County government departments and elected officials
- Metro East Sanitary District (MESD)
- Municipal staff, township staff, and elected officials (including Municipal Separate Storm Sewer System (MS4) Co-Permittee Group Members)
- State and federal agencies (including Illinois Department of Natural Resources, Illinois Environmental Protection Agency, USACE, and FEMA)
- HOAs
- Developers
- Residents with property adjacent to Horseshoe Lake, Long Lake, and Nameoki Ditch
- Residents throughout the watershed
- Farmers and farm groups
- Local engineering clubs and societies

Decision-makers are an important audience that can impact all the other audiences by controlling long-term regulatory actions and policy initiatives. Madison County staff, members of the Technical Committee, and watershed residents can be messengers to reach the decision-maker audience.

Jurisdictions with Phase II MS4s are required to educate their communities on the pollution potential of common activities such as littering, disposing of trash and recyclables, disposing of pet waste, applying lawn chemicals, washing cars, changing motor oil on impervious driveways, and household behaviors like disposing leftover paint and household chemicals.

Some of the HOAs for subdivisions in the area have a shared detention or retention basin. However, these basins are often not covered by a maintenance agreement and after some time will fill up with sediment and deteriorate in function. For new subdivisions, it is important for HOAs to designate funding and a maintenance schedule for management of detention and retention infrastructure. If possible, existing HOAs should adopt maintenance by-laws.

Residents of the watershed often feel a deep connection to their neighborhood and to the land on which they live. Several families in the watershed can trace their ancestry back for generations to European settlers who put down roots in the area in the 1800s. Outreach with messages that emphasize sustaining the rich soil and the landscape for the next generation is likely to resonate with this audience.

Residents with property adjacent to a creek will be more willing to make changes to the creek property if they understand how it can enhance their property and its value. They should also be made aware of landscaping BMPs along the creek, in terms of beneficial or harmful structures, vegetation, and management practices.

Activities and Tools

Before the plan is complete

Making this watershed plan available to stakeholders, and informing them of its location and contents, is a major component of the Information and Education Plan. To this end, the plan document is available for download on the watershed plan website hosted by HeartLands Conservancy, www.heartlandsconservancy.org/americanbottom.php. Printed copies of the Executive Summary and

the full plan will also be shared with key watershed stakeholders. Emails to stakeholders engaged in the planning process provided updates on the plan's progress and point to the website for all plan materials.

After the plan is complete

Table 8 outlines each objective followed by recommended strategies that can be implemented to achieve the goals/objectives. For each activity, a target audience, suggested strategies, schedule, lead and supporting agencies, the desired outcomes and issues addressed, and estimated costs to implement is provided. Periodic review of the watershed plan is recommended, with meetings of the plan partners held twice a year at six month intervals. Larger annual meetings may be held to include stakeholders and the public. Plan revision should be considered at five-year intervals.

Table 8. Information and Education Plan recommended strategies. Acronyms used: HLC: HeartLands Conservancy; MESD: Metro East Sanitary District; NGRREC: National Great Rivers Research and Education Center; SWCD: Soil & Water Conservation District; CREP: Conservation Reserve Enhancement Program.

Program	Target Audience(s)	Strategies	Schedule	Lead & Supporting Orgs	Desired Outcomes/Issues Addressed	Est. Cost
Objective 6.1: Identify opportunities to assist local, state, and federal agencies and stakeholders with watershed management and conservation efforts.						
Municipal Outreach	Municipalities	• Connect officials and staff to resources about water quality and flooding • Provide sample permitting language, ordinances, and lists of preferred practices • Discuss projects for shortlist of Management Measures on public land • Invite MESD to speak about their stormwater/flooding programs • Invite FEMA to present about floodplain management and flood insurance. • Share case studies of conservation development • Present at municipal council and committee meetings • Share sample funding structures for infrastructure changes • Share GIS data and maps from the watershed plan to aid municipal decision-making	Long-Term	Madison County	• Municipalities adopt green infrastructure practices as part of development plans, permits and ordinances. • Developers follow recommended practices in new and retrofitted developments. • More stormwater is infiltrated, water quality is improved, problematic flooding is reduced, and wildlife habitat is preserved.	Staff time
Watershed Plan Outreach	Watershed residents, developers, municipalities	• Mail or e-mail Executive Summary of the watershed plan to municipalities and key stakeholders • Final plan and recommendations on web page. Post progress updates. • Press release announcing completed plan. • Meetings of the watershed plan partners held twice a year. Plan revision considered at five-year intervals. • Translating language into Spanish for Hispanic population.	Short-Term	Madison County, HLC, other partners	• Majority of watershed residents have knowledge of watershed conditions, possible behavior improvements, and key contacts to get involved and implement projects. • The public begins to alter activities leading to watershed improvement.	Printing and Tanslation: $1000

Program	Target Audience(s)	Strategies	Schedule	Lead & Supporting Orgs	Desired Outcomes/Issues Addressed	Est. Cost
Objective 6.2: Connect watershed stakeholders to decision-makers and experts with knowledge about water quality, flooding issues, and solutions.						
Urban BMP Workshop	Homeowners, Municipalities	• Host workshop to inform about and demonstrate recommended BMPs. • Provide information about available funding for BMPs.	Medium-Term	Madison County, HLC	• Homeowners and municipalities learn about and implement BMPs, as well as funding/ program support.	$500 Materials + Staff time
BMP or Demonstration Project Tour	Watershed residents, developers, municipalities, farmers	• Take participants on a tour of BMPs in this area, such as NGRREC or a farm enrolled in the CRP. • Host a demonstration project event, such as a demonstration on cover crops.	Short-term	Madison County, Farm Bureau, SWCD	• Landowners/stakeholders learn about BMPs and can visualize them on their property. • Increase in landowners implementing BMPs. • Soil erosion is reduced and stormwater is infiltrated.	$1,000 per tour
Public Events Booth	Watershed residents	• Host a booth with materials about the plan, water quality, stormwater management, flooding, and BMPs at public events, such as county fairs, environmental fests, etc.	Ongoing	Madison County, HLC	• Residents understand importance of healthy watershed. • Property owners in flood-prone areas understand and monitor development upstream to prevent flood problems from increasing. • Residents understand the location of floodplains and why they should obtain flood insurance.	$150 per event

Program	Target Audience(s)	Strategies	Schedule	Lead & Supporting Orgs	Desired Outcomes/Issues Addressed	Est. Cost
Objective 6.3: Offer opportunities for education, training, and participation in watershed matters.						
Field Days	Residents, Students, Non Profits, Volunteer Groups	• Organize stream and lake cleanup volunteer opportunities (e.g. "trashtag"). • Promote volunteer field days through media, social media, and community groups. • "Adopt a Stream" program (similar to Adopt a Road) • HOA Basin/Pond Maintenance Field Days • Coordinate with local governments to host a Stream Awareness Day, to include activities like stream cleanup, water quality testing, or restoration activities.	Medium-Term	HLC, Madison County, volunteer groups	• Amount of debris is reduced in streams and lakes. • People develop an interest in watershed protection and conservation. • Invasive species are removed and participants learn how to manage invasives on their own. • Leverages in-kind donations for future grants. • Riparian area and habitat conditions improve. • Stormwater storage features are maintained/capacity is increased.	$500 per event
Educational Signs	Residents, Visitors	• Mark watershed boundaries with signs • Post warning signs about littering and illegal dumping • Encourage neighborhoods to create stream names for local streams	Medium-Term	Madison County	• People better understand the term "watershed." • Littering and illegal dumping is reduced. • Increased awareness of watershed boundaries and streams.	$2,500 (25 signs)
School Projects	Students, Parents, Teachers, Administrators	• Develop age-appropriate project opportunities for schools and colleges such as rain gauge maintenance, rainscaping, wildlife habitat restoration, and geocaching.	Long-term	Schools and colleges, Madison County	• Students and parents develop interest in watershed protection and conservation. • Teachers and administrators implement related coursework into curriculum.	Equip-ment costs and staff time
Professional Development	Engineers	• Coordinate with engineering organizations to host professional development opportunities.	Long-term	Engineering clubs or societies	• Engineers receive continuing education on green infrastructure and BMPs.	Staff time

Program	Target Audience(s)	Strategies	Schedule	Lead & Supporting Orgs	Desired Outcomes/Issues Addressed	Est. Cost
Objective 6.4: Develop public recognition programs focused on the watershed plan's goals.						
Watershed Protection Awareness	All stakeholders	• Develop messaging based on goals in the watershed plan and disseminate the message using media, social media, collateral (e.g. pencils, bumper stickers, temporary tattoos), and other materials.	Medium-term	Madison County, HLC	• Increased interest and understanding of watershed protection and the watershed plan's goals. • Water quality and habitat conditions are improved.	Cost of materials and ads

Additional resources

The following resources have been compiled either as other successful campaign examples, or as inspiration for ways to implement the activities identified in Table 9.

Table 9. Resources and tools for activities/campaigns.

Activity / Campaign Examples	**Activity / Campaign Tools and Resources**
"How's My Waterway?"	Quick information about waterways, presented in plain language, from USEPA. http://watersgeo.epa.gov/mywaterway/
Surf Your Watershed	Links and information on streamflow, water quality, and groups working on environmental protection in your watershed, from USEPA. http://cfpub.epa.gov/surf/locate/index.cfm
Storm drain stencilling	Free storm drain stencil kits with directions. http://prairierivers.org/articles/2008/09/stenciling/
Student and citizen monitoring	Illinois RiverWatch and the National Great Rivers Research and Education Center (NGRREC) (http://www.ngrrec.org/riverwatch/). Stream monitoring manual, kit supply lists, monitoring guidelines, identification keys, biotic index calculator, and volunteer training.
Native plants	List of Illinois native plant species: www.wildflower.org/collections
Flooding	How to prepare for and prevent flooding: www.ready.gov/floods
Green Infrastructure	Chicago Wilderness Green Infrastructure Vision and data: www.cmap.illinois.gov/green-infrastructure
River/stream cleanup	American Rivers: www.americanrivers.org/take-action/cleanup Living Lands and Waters: http://livinglandsandwaters.org/
Sustainable backyards	HeartLands Conservancy's *Conservation@Home* program: https://www.heartlandsconservancy.org/conservationhome.php The National Wildlife Federation's *Certified Wildlife Habitat* program: https://www.nwf.org/garden-for-wildlife/certify

SECTION 7: IMPLEMENTATION

Implementing the recommendations in this watershed plan will take time and commitment from partners and stakeholders. No single stakeholder has all of the financial or technical resources to implement the plan. Successful implementation will require stakeholders working together, using their individual strengths.

Implementation Schedule

The Implementation Schedule provides a timeline for when the recommended Management Measures should be implemented in relationship to each other, allowing reasonable amounts of time for preparing for and transitioning between projects.

The Management Measures are recommended for the short term (one to 10 years), medium term (10 to 20 years), long-term (20+ years), ongoing (for maintenance activities), or as needed. The "Information and Education Plan" also uses these schedule options. The schedule is arranged to accommodate practices based on practice type, available funds, technical assistance needs, and timeframe for each recommendation. Higher scheduling priority was given to Management Measures that address an issue in a Critical Area, are recommended in greater amounts, have greater eligibility for state and federal programs, and are more widely known among stakeholders (Table 10).

Table 10. Implementation schedule for Management Measures, watershed-wide. Acronyms used: NRCS: Natural Resources Conservation Service; SWCD: Soil and Water Conservation District; NGRREC: the National Great Rivers Research and Education Center; IEPA: Illinois Environmental Protection Agency; IDNR: Illinois Department of Natural Resources; USFWS: U.S. Fish and Wildlife Service; FEMA: Federal Emergency Management Agency; HOA: Homeowners Association; HLC: HeartLands Conservancy.

BMP/Management Measure Recommended	Responsible entity/ entities	Priority	Sources of Technical Assistance	Implementation Schedule
PROGRAMMATIC MANAGEMENT MEASURES				
Conservation Development	Counties, municipalities, developers	High	Urban planners, planning resources, HLC	Medium term
Federal and state programs (e.g. CRP)	Landowners/farmers, NRCS, SWCD	Medium	NRCS, SWCD, NGRREC	Medium term
Financial support for stormwater infrastructure	Counties, municipalities	High	Regional/statewide community examples	Long term
Flood Damage Prevention Ordinance	Counties, municipalities	Medium	IDNR, FEMA, HLC	Medium term
Green infrastructure incentives	Counties, municipalities, developers	Medium	IEPA, HLC, regional/statewide community examples	Long term
In-lieu fee mitigation	Developers, Counties, NGOs	Medium	USACE, IDNR	Ongoing (as development occurs)
Native landscaping ordinance	Counties, municipalities, developers, residents	Low	IDNR, regional/statewide community examples	Long term
Open space and natural area protection	Counties, municipalities, developers	Medium	IDNR, regional/statewide community examples	Medium term
Private sewage monitoring	Counties, residents, some HOAs	Medium	Counties, IEPA	Ongoing
Riparian Buffer Ordinance	Counties, municipalities	Medium	IDNR, HLC	Medium term
Sewage Treatment Plant upgrades	Municipalities, STP operators	Low	IEPA, contractors	Long term
Stream Cleanup Team	Counties, NGOs, residents	Medium	Madison County, NGOs	Long term
Watershed plan supported and integrated into community plans	Counties, municipalities	Low	Watershed plan partners	Short term
Information and Education Plan	Several entities	High	Counties, IEPA, HLC	Ongoing
Monitoring (water quality, flow, etc.)	USGS, IEPA, NGRREC	High	USGS, IEPA, NGRREC, SIUE, SIU-Carbondale	Ongoing

Table 10, continued.

BMP/Management Measure Recommended	Responsible entity / entities	Priority	Sources of Technical Assistance	Implementation Schedule
SITE-SPECIFIC MANAGEMENT MEASURES				
Agricultural Management Measures				
Riparian buffers	Landowners/ farmers	High: Critical Areas	NRCS, Ecological consultant/ contractor	Short term
Wetlands	Landowners/ farmers	High: Critical Areas	USACE, NRCS, Ecological consultant/ contractor	Short term
Conservation tillage	Landowners/ farmers	Medium	NRCS, SWCD, contractor	Ongoing
Cover crops	Landowners/ farmers	Medium	NRCS, SWCD, contractor	Ongoing
Grassed waterways	Landowners/ farmers	Medium	NRCS, SWCD, contractor	Medium term
Nutrient Management Plans	Landowners/ farmers	Medium	NRCS, SWCD, contractor	Medium term
Ponds	Landowners/ farmers	Medium	NRCS, SWCD, contractor	Medium term
Urban Management Measures				
Single property flood reduction strategies	Residents, industry/ commercial	High	FEMA, municipalities, contractors	Short term
Waterproofing	Residents, industry/commercial	High	FEMA, municipalities, contractors	
Landscape regrading away from foundations	Residents, developers	High	FEMA, municipalities, contractors	
Internal drainage systems	Residents	High	FEMA, municipalities, contractors	
Bioswales	Developers, municipalities, HOAs	Medium	SWCD, contractor	Medium term
Dry detention basins, new	Developers, residents, municipalities, HOAs, landowners/farmers	High	SWCD, contractor	Long term
Wet detention basins, new	Developers, residents, municipalities, HOAs, landowners/farmers	Medium	SWCD, contractor	Long term
Detention basin retrofits (native vegetation buffers, etc.)	Municipalities, residents, HOAs, landowners/farmers	High	SWCD, contractor	Medium term
Detention basin maintenance (dredging, mowing, burning, invasives, etc.)	Municipalities, residents, HOAs, landowners/farmers	Medium	SWCD, contractor	Ongoing/As needed
Pervious pavement	Developers, municipalities, residents	Medium	NGRREC, IEPA	Long term
Rain gardens	Residents, industry/ commercial	Medium	NGRREC, IEPA	Medium term

Table 10, continued.

BMP/Management Measure Recommended	Responsible entity / entities	Priority	Sources of Technical Assistance	Implementation Schedule
Urban Management Measures (continued)				
Rainwater collection	Residents, industry/ commercial	Low	NGRREC, IEPA	Long term
Stormwater and sanitary sewer system maintenance and expansion	Municipalities, HOAs	High	Municipalities, IEPA, contractors, MESD	Ongoing/As needed
Tree planting (e.g. street trees)	Municipalities, townships, HOAs	Medium	Municipalities, Tree City USA, arborist/contractor	Short term
Urban filter strips	Municipalities, townships, HOAs	Medium	Municipalities, NRCS, contractors	Medium term
Stream and Lake Management Measures				
Logjam removal	Landowners/ farmers, residents, municipalities	Medium	Ecological consultant/ contractor	Short term
Streambank and channel stabilization and restoration	Landowners/ farmers, residents, municipalities	High: Critical Areas	Ecological consultant/ contractor	Short term
Lake and stream dredging	Municipalities, HOAs, counties	Medium	Consultant/contractor	Medium term
Shoreline stabilization	Municipalities, landowners, developers	Medium	Ecological consultant/ contractor	Medium term

Funding Sources

Many opportunities are available to secure funding for the varied and diverse Management Measures recommended in this plan. Entities such as government agencies, non-profit organizations, and companies that provide funding for watershed improvement projects often require that partnerships be in place and funds are leveraged. Table 11 shows some of the potential funding sources for agricultural and stream and lake BMPs recommended in this plan. Table 12 provides a longer list of funding opportunities for management measures in this plan. More detail about these opportunities is included in Appendix G.

Funds may come from existing grant programs run by public agencies, from partner organizations, or through other avenues. Partners may wish to become involved if the project helps to achieve their objectives, is a priority, or provides networking opportunities. Partnerships are also critical for leveraging assets including political support; partners can leverage valuable goodwill and relationships that have the potential to lead to other assistance.

Identifying suitable partners to support a specific project involves assessing the organizations' jurisdictional, programmatic, and fiscal priorities and limitations. Different partners will be attracted to different projects. It is beneficial to all partners to maintain relationships and communication, with each organization denoting a specific staff member responsible for maintaining these connections. One or two enthusiastic individuals or "champions" who believe that engagement in this process is in the interests of all the partners can make a huge difference in the success of a partnership.

Table 11. Funding sources for agricultural and in-stream BMPs from state and federal programs. CRP: Conservation Reserve Program, from USDA. CPP: Conservation Practice Program, from USDA. EQIP: Environmental Quality Incentives Program, from USDA. CSP: Conservation Stewardship Program, from USDA. WRE: Wetland Reserve Easement program, from USDA. SSRP: Streambank Stabilization and Restoration Program, from the State of Illinois. 319: Illinois EPA funding under Section 319 of the Clean Water Act for addressing nonpoint source pollution.

BMP/Management Measure Recommended	Program(s) for which Practices are Eligible
Agricultural Management Measures	
Animal waste storage/treatment systems	EQIP, CPP, CSP, 319
Bioreactors	EQIP, CPP, CSP, 319
Comprehensive Nutrient Management Plans (NMPs)	EQIP, CPP, CSP, 319
Conservation tillage	EQIP (no-till only), CSP, 319
Cover crops	EQIP, CPP, CSP, 319
Grassed waterways	CRP, EQIP, CPP, 319
Nutrient Management Plans (NMPs)	EQIP, CPP, CSP, 319
Ponds	EQIP (if sole livestock drinking water source), 319
Riparian buffers	CRP, CREP, EQIP, 319, ALE
Waste storage structure	EQIP, 319
Wetlands	CRP, CREP, WRE, 319, GIGO, ALE, WRE
Forest Management Measures	
Forest stand improvement	EQIP, CRP, CPP, CSP, 319, ALE,
Stream and Lake Management Measures	
Shoreline restoration	EQIP, 319
Streambank & channel restoration	SSRP, 319, GIGO
Urban Management Measures	
Detention basin	319, GIGO
Pervious pavement	319, GIGO
Rain gardens	319, GIGO
Tree Planting	319, GIGO
Bioswales	319, GIGO
Single property flood reduction strategies	319, GIGO
Stormwater and sanitary sewer system improvements	319, GIGO

Table 12. Funding sources for management measures recommended. See Appendix F for more information.

Funding Sources	Programs
State/Federal Programs	
Illinois Environmental Protection Agency	Section 319(h) Nonpoint Source Pollution Control Financial Assistance Program
	State Revolving Fund Loan Program, including: ● Public Water Supply Loan Program ● Water Pollution Control Loan Program
	Streambank Cleanup and Lakeshore Enhancement Grants
	Green Infrastructure Grant Opportunities Program
Illinois Department of Agriculture	Streambank Stabilization and Restoration Program
	Conservation Practice Program
	Sustainable Agriculture Grant Program
	Cover Crop Premium Discount Program
Illinois Department of Natural Resources	Urban Flood Control Program
	Illinois Recreational Access Program
	Open Space Land Acquisition and Development
	Land and Water Conservation Fund
	Great American Outdoors Act
	Special Wildlife Funds
	Clean Vessel Act Grant
Illinois Emergency Management Agency/Federal Emergency Management Agency	Flood Mitigation Assistance Program
	Pre-Disaster Mitigation Program
	Hazard Mitigation Grant Program
	Severe Repetitive Loss Program
	Building Resilient Infrastructure & Communities
	National Dam Safety Program
Illinois Department of Commerce and Economic Opportunity	Illinois Development Assistance Program

The Conservation Fund	Community planning and environmental programs
Illinois Conservation Foundation (ICF)	Schoolyard Habitat Grants
	Disabled Outdoors Opportunities
Metro East Park and Recreation District (MEPRD)	Trail Grant Program
	Community Planning Grant Program
U.S. Army Corps of Engineers/Upper Mississippi River Basin Association	Continuing Authorities Program *(not a grant)*
	Flood Plain Management Services (FPMS) Program *(not a grant)*
	Planning Assistance to States (PAS) Program *(not a grant)*
	Water Resources Development Act
U.S. Department of Housing and Urban Development	National Disaster Resilience Competition
U.S. Environmental Protection Agency	USEPA Source Reduction Assistance Grant Program
	Environmental Education Grants Program
	Environmental Justice Small Grants Program
	Urban Waters Small Grants Program
	Technical assistance from EPA Regions for: ● Green stormwater management ● Protection of healthy watersheds
U.S. Department of Agriculture	Conservation Reserve Program
	Conservation Reserve Program (CRP0—Grasslands
	Conservation Reserve Enhancement Program (CREP)
	Agricultural Conservation Easement Program, including: Agricultural Land Easements and Wetland Reserve Easements
	Environmental Quality Incentive Program
	Conservation Stewardship Program
	Healthy Forests Reserve Program
	Regional Conservation Partnership Program
	Conservation Innovation Grants
	Water and Waste Water Disposal Loan and Grant Program

	Forest Legacy Program
U.S. Fish and Wildlife Service/ North American Wetlands Conservation Act	Partners for Fish and Wildlife Program and Grants

Table 12, continued. Funding sources for management measures recommended.

Funding Sources	Programs
Non-Government Organizations (non-profit organizations, private foundations/companies, other) that support watershed management efforts	
Ducks Unlimited	Living Lake Initiative
Pheasants/Quail Forever	Landowner Assistance
Trees Forever	Working Watersheds: Buffers and Beyond
The Nature Conservancy	N/A
The National Fish and Wildlife Foundation	Five Star and Urban Waters Program Resilient Communities Program
The National Wildlife Federation	N/A
Water Environment Federation	N/A
Coca-Cola Foundation	Community Support Program, Rain Barrel Demonstrations
Illinois American Water	2020 Environmental Grant Program
In-Lieu Fee Mitigation Program	N/A
McKnight Foundation	N/A
Walton Family Foundation	N/A
National Great Rivers Research and Education Center	Habitat Strike Team

Monitoring Timeline

Upon initiating implementation of the watershed management plan, the first set of discrete grab samples will be collected to combine with the continuous sample gages throughout the waters. . Subsequently, samples will be collected on a monthly interval for the duration of the project. Stormwater monitoring with the Isco 6712 sampler will begin once a suitable location has been identified where a BMP will be installed to reduce flooding. Sampling beyond year 1 may be adjusted based on monitoring results from the first year.

Opportunities for continuing or expanding the monitoring program should be evaluated in order to further assess water quality conditions throughout the watershed, the causes and sources of pollution, the impact of nonpoint source pollution, and changes in water quality related to implementation of the watershed plan as well as social indicator data related to the plan's goals and objectives. Monitoring can be conducted on a three- to five-year cycle through the year 2040 (Table 13). Quality Assurance Project Plans (QAPP) should be developed for those monitoring opportunities that are selected for implementation in support of the watershed plan.

Table 13. Water quality monitoring timeline. Monitoring activities likely to be conducted primarily by NGRREC and Illinois RiverWatch. Acronyms: TSS: Total Suspended Solids. TP: Total Phosphorus. TN: Total Nitrogen. SRP: soluble reactive phosphate.

	2022				2023				2024				2025-2030
Monitoring Activities	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	
Develop standard operating procedures for collection & analysis of samples													
Sampling at Gage Sites													
Install monitoring equipment													
Monitor TSS, TP, TN													
Evaluate & adjust monitoring plan													
Monitor TSS, TP, TN based on adjusted plan													
Discreet Sampling at HUC12 Level													
Identification of HUC12 discreet sampling sites													
Monitor TSS, TN, TP, barium,													
Evaluate & adjust monitoring plan													
Continue discreet monitoring based on adjusted plan													

MEASURING SUCCESS

The success of the watershed plan can be measured by tracking several indicators at several milestone points in time. Success can be documented in terms of:

- Plan effectiveness: the absolute improvements seen in water quality, flooding, habitat, and other plan goals; and
- Plan implementation: the number and extent of Management Measures implemented, understood as a proxy for absolute improvements.

For both of these dimensions, measurement indicators were identified that would establish the progress made towards each goal of the plan. Interim milestones were established for each indicator so that improvements in effectiveness and extent of implementation could be tracked. Rather than waiting several years to measure the effectiveness of the plan, measuring ongoing improvement allows for more dynamic, directed, and effective implementation.

Measurement indicators

Measurement indicators were established to determine whether and how much progress is being made towards achieving each of the goals of the plan (Table 14).

Interim milestones

Milestones represent time periods or deadlines for meeting watershed plan objectives. Tracking milestones allows for adaptive management; if milestones are not being met, the most current information can be used to implement a course correction or a plan update.

Meetings of the watershed plan partners should be held twice a year, at six-month intervals, in order to assess the progress of the plan and address deficiencies in its implementation. The partners may also hold a larger annual meeting to which stakeholders and the public will be invited. The need for a plan revision will be assessed at five-year intervals. When deficiencies in plan implementation are identified, the plan's timeline and focus should be revised to address the issues. The watershed planning process of issue identification, goal-setting, and management measure recommendation should be reiterated, paying special attention to current data and new data sources.

A set of Progress Report Cards was developed for the watershed with milestones for the short-term (one to 10 years; 2020-2030), medium-term (10 to 20 years; 2030 to 2040), and long-term (20+ years; 2040+) timeframes. The milestones and scorecard can be used to identify and track plan implementation and effectiveness. Checking in on the measurement indicators at the appropriate milestones helps watershed partners to make corrections as necessary and ensure that progress is being made towards achieving the plan's goals.

The Progress Report Cards provide for each goal:

1. Summaries of current conditions
2. Measures of progress (Measurement Indicators)
3. Milestones for short-, medium-, and long-term timeframes
4. Sources of data required to evaluate milestones
5. Notes section

Grades for each milestone term should be calculated using the following scale: [adapt/simplify based on short, medium, long term milestones?]

Grade	Percentage milestones met
A	80-100%
B	60-79%
C	40-59%
Fail	<40%

Lack of progress can be demonstrated where water quality monitoring results show no improvement, new environmental problems, lack of technical assistance, or lack of funds. These factors should be explained in the Notes section of the scorecard.

The Progress Report Cards should be used at every biannual meeting of the watershed plan partners, and should be fully filled out and evaluated every five years to determine if sufficient progress is being made and whether remedial actions are needed. The Progress Report Cards can be found in Appendix H.

Table 14. Measures of success and measurement indicators for each watershed plan goal. Specific interim milestones incorporating these measurement indicators can be found in the Progress Report Cards in Appendix H.

Goal(s) Addressed	Measure of Success	Measurement Indicators
All goals	Projects and Practices Implemented: BMPs to manage stormwater runoff, including those that encourage infiltration, clean water of pollutants, and replenish groundwater.	Number and extent of Management Measures (BMPs) implemented on public and private land, wherever such data is available.
	Financial and Technical Assistance Secured: Sources of funding and technical assistance committed towards plan implementation.	Number of funding sources secured for plan implementation. Number of partnerships developed that provide technical and/or financial assistance.
Flooding and Flood Damage	Stream Discharge: Moderate peak flows and adequate minimum stream flows.	Stream flow data from the USGS gauge on Judy's Branch, plus flow data collected from monitoring at other HUC14 locations. Data correlated with rainfall.
	Flood Protection Ordinances: Enaction of local ordinances to restrict construction in floodplains and floodprone areas.	Number and extent of flood damage prevention ordinances, riparian buffer ordinances, and other actions by local governments to restrict construction in floodplains and riparian areas.
Surface Water Quality	Use Impairments: The reduction of use impairments as defined by IEPA.	Removal of Cahokia Creek (Cahokia Canal), Canteen Creek, and Horseshoe Lake from the IEPA 303(d) list.
	Pollutant Loads: A decrease in pollutants observed through water quality monitoring.	Concentrations and loads of in-stream pollutants including phosphorus and sediment (assessed by monitoring), to measure against plan target reductions.
	Point-source Pollution Facility Upgrades: Upgrades to facilities such as sewage treatment plants and others that require a NPDES permit.	Nutrient removal technologies incorporated into upgrades of wastewater treatment plants in the watershed. Measured pollutant loads in effluent.
	Connecting to Public Sewers: Connection of new and existing properties to public sewers so that individual septic systems are no longer needed.	Percentage of new development projects with private sewer. Number of existing on-site treatment systems connected to public sewers.
	Inspection and Maintenance of On-Site Waste Systems: Local government codes and programs for on-site treatment systems.	Number and extent of local ordinances requiring regular inspection and maintenance of on-site sewage systems. Number of county/municipal programs inspecting more frequently than is complaint-driven.
Surface Water Quality / Flooding and Flood Damage	Wetlands: Restoring and creating wetlands, which are very effective at storing and filtering stormwater.	Number and acreage of wetland construction/restoration, enhancement, and protection.
Environmentally Sensitive Development Practices	Infiltration: Practices allowing stormwater to infiltrate to groundwater.	Area of impervious surfaces in new development (see NLCD Percent Developed Impervious Surface dataset) and number of detention basins or other stormwater infrastructure constructed and retrofitted to allow more infiltration.

Table 14, continued.

Goal(s) Addressed	Measure of Success	Measurement Indicators
Environmentally Sensitive Development Practices	Land Conservation: Preservation of sensitive lands.	Acreage of land enrolled in conservation easements including CRP, and number of new development proposals using Conservation Development design to protect natural features.
	Green Infrastructure Implementation: Encouragement of green infrastructure and native landscaping, including incentives for developers that design for or implement it.	Number of counties/municipalities implementing green infrastructure incentives (e.g., flexible regulation implementation) fee waivers, tax abatement, and streamlined development review process. Number of ordinance changes allowing/encouraging native landscaping.
	In-Lieu Fee Mitigation: Program that allows and incentivizes wetland and streambank restoration in impactful locations	Number of acres wetland restored and number of feet streambank restored under in-lieu fee mitigation program.
Flooding and Flood Damage/ Fish and Wildlife Habitat	Riparian Buffers: Vegetated, undeveloped buffers adjacent to waterways.	Area and length of restored riparian corridors. Number and area of conservation easements for riparian areas. Number and extent of riparian buffer ordinances adopted by local government.
Fish and Wildlife Habitat	Improvements to Fish and Wildlife Habitat: Protection and restoration of stream areas for fish and wildlife.	Macroinvertebrate sampling results (diversity and stream health indicators) from Illinois RiverWatch volunteers and fish sample data collected by the Illinois Natural History Survey.
	Stream Cleanup Efforts: Programs with funding and resources for stream cleanup.	Number of programs and participants for stream cleanup activities in the watershed.
Flooding and Flood Damage/ Organizational Frameworks	Financial Support for Stormwater Infrastructure: Funding sources directed to infrastructure maintenance and upgrades.	Number of counties/municipalities with dedicated funding for stormwater infrastructure, (e.g. a Stormwater Utility. Dollar amount of revenue.
Organizational Frameworks/ Environmentally Sensitive Development Practices	Protection through Policy: Several aspects of local policy can protect watershed resources, including ordinances and agreements.	Number of watershed partners adopt and/or support (via a resolution) this plan as a "guidance document." Number and extent of municipal ordinances that support: stormwater, flood management, green infrastructure, wetlands protection (e.g. in-lieu fee), and native landscaping.
	Open Space and Natural Area Protection and Management: protection of sensitive natural areas/open space, creation of naturalized stormwater management systems, and long-term management of those features.	Number of new and redevelopment projects protecting sensitive natural areas/open space and creating naturalized stormwater systems. Area of land donated to a public agency/conservation organization for long-term management. Number of HOAs with rules about management of the natural areas in their bylaws.
Education & Outreach	Public Involvement: Public awareness, understanding and action, which affect decisions in watersheds where individuals own most of the land.	Number of people reached by and involved in outreach efforts related to this watershed plan. Percent of county residents who know which watershed they live in (survey).
	Education: Effective materials to encourage behavior changes for a healthier watershed.	Percent of attendees at watershed-related presentations and other events, and percent who commit to action or follow-up with the county. Percent of schools that incorporate a watershed-based project or curriculum.

Glossary of Terms

Terms found in the watershed plan and appendices:

100-year floodplain: Land adjoining the channel of a river, stream, watercourse, lake, or wetland that has been or may be inundated by floodwater during periods of high water that exceed normal bank-full elevations. The 100-year floodplain has a probability of 1% chance per year of being flooded.

303(d) list of impaired waters: The federal Clean Water Act requires states to submit a list of impaired waters to the U.S. Environmental Protection Agency for review and approval every two years using water quality assessment data from the Section 305(b) Water Quality Report. These impaired waters are referred to as "303(d) impaired waters." States are then required to establish priorities for the development of Total Maximum Daily Load analyses for these waters and a long-term plan to meet them.

305(b): The Illinois 305(b) Water Quality Report is a water quality assessment of the state's surface and groundwater resources compiled by the Illinois Environmental Protection Agency and submitted as a report to the U.S. Environmental Protection Agency as required under Section 305(b) of the Clean Water Act.

Agricultural Conservation Easement Program (ACEP): Provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits.

Agricultural Land Easement (ALE): Provides financial and technical assistance to help conserve land surrounding agricultural lands.

Wetlands Reserve Easement (WRE): Provides financial and technical assistance to remove agricultural land from production and replace it with wetlands.

Agricultural Conservation Planning Framework (ACPF): A GIS model developed by USDA.

Aquifer: A layer of permeable rock, sand, or gravel through which groundwater flows, containing enough water to supply springs and wells.

Base flow: The flow to which a perennially flowing stream reduces during the dry season. It is commonly supported by groundwater seepage into the channel.

Bedrock: The solid rock that lays beneath loose material, such as soil, sand, clay, or gravel.

Best Management Practices (BMPs): See Management Measures.

Biodiversity: The variety of organisms (plants, animals and other life forms) that includes the totality of genes, species and ecosystems in a region.

Center for Watershed Protection (CWP): Non-profit 501(c)3 corporation founded in 1992 that provides government entities, watershed organizations, and others around the country with the tools to protect streams, lakes, rivers, and watersheds.

Channelization: The artificial straightening, deepening, or widening of a stream or river to accommodate increased stormwater flows, typically to increase the amount of adjacent developable land for urban development, agriculture, or navigation.

Comprehensive Nutrient Management Plans (CNMPs): A strategy for farmers to integrate livestock waste management into overall farm operations.

Conservation Development: A development designed to protect open space and natural resources for people and wildlife while at the same time allowing building to continue. See Appendix E for more detail.

Conservation easement: The transfer of land use rights without the transfer of land ownership. Conservation easements can be attractive to property owners who do not want to sell their land now, but would support perpetual protection from further development. Conservation easements can be donated or purchased.

Conservation Practice Program (CPP): Illinois Department of Agriculture program implemented by the Soil and Water Conservation Districts (SWCDs) in Illinois. Cost-share funds are available through the SWCDs for various conservation practices including Filter Strips, Grassed Waterways, No-Till, and Terraces. See Appendix E for more detail.

Conservation Reserve Enhancement Program (CREP): The country's largest private land conservation program, administered by the Farm Service Agency (FSA). An offshoot of the Conservation Reserve Program (CRP), CREP compensates farmers and landowners for removing environmentally sensitive land from production and implementing conservation practices. See Appendix E for more detail.

Conservation Reserve Program (CRP): A land conservation program administered by the FSA, which provides a yearly rental payment for farmers who remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality. See Appendix E for more detail.

Conservation Stewardship Program (CSP): U.S. Department of Agriculture program that helps producers maintain and improve existing conservation systems and implement additional activities to address priority resources concerns. See Appendix E for more detail.

Conservation tillage: Any method of soil cultivation that leaves the previous year's crop residue (such as corn stalks or wheat stubble) on fields before and after planting the next crop, to reduce soil erosion and runoff.

Contour Buffer Strip: Strips of perennial vegetation that alternate with strips of row crops on sloped fields. The strips of perennial vegetation, consisting of adapted species of grasses or a mixture of grasses and legumes, slow runoff and remove from it sediment, nutrients, pesticides, and other contaminants. See Appendix E for more detail.

Conveyance: The act or means of carrying or transporting water from place to place.

Cover crops: Crops that protect soil from erosion by covering the ground in the fall and sometimes in the spring. See Appendix E for more detail.

Designated use: Appropriate use of a waterbody as designated by states and tribes. Designated uses are identified by considering the use, suitability, and value of the water body for public water supply; protection of fish and wildlife; and recreational, agricultural, industrial, and navigational purposes. Determinations are based on its physical, chemical, and biological characteristics; geographical setting and scenic qualities; and economic considerations.

Detention basin: A man-made structure for the storage of stormwater runoff with controlled release during or immediately following a storm. Wet detention basins are also known as retention ponds. See Appendix E for more detail.

Digital Elevation Model (DEM): Grid of elevation points used to produce elevation maps.

Discharge (streamflow): The volume of water passing through a channel over a given time period, usually measured in cubic feet per second.

Dissolved oxygen (DO): The amount of oxygen in water, usually measured in milligrams/liter.

East-West Gateway Council of Governments (EWG): The metropolitan planning organization (MPO) for the 4,500 square miles encompassed by the City of St. Louis; Franklin, Jefferson, St. Charles, and St. Louis counties in Missouri; Madison, Monroe, and St. Clair counties in Illinois. EWG is a forum for local governments of the bi-state St. Louis area to work together to solve problems that cross jurisdictional boundaries.

Environmental Quality Incentives Program (EQIP): A program that provides financial and technical assistance to agricultural producers, helping them to plan and implement conservation practices that address natural resource concerns and improve natural resources on agricultural land and non-industrial private forestland. See Appendix E for more detail.

Erosion: The displacement of soil particles on land surfaces due to water or wind action.

Federal Emergency Management Agency (FEMA): Government agency within the Department of Homeland Security that responds to, plans for, coordinates recovery from, and mitigates against natural and man-made disasters and emergencies, including significant floods.

Flash flood: A rapid rise of water along a stream or low-lying area, usually produced when heavy localized precipitation falls over an area in a short amount of time. Flash floods are considered the most dangerous type of flood event because they offer little or no warning time and their capacity for damage, including the capability to induce mudslides.

Flood Damage Prevention Ordinance: Ordinance that imposes certain rules and limitations on development in floodplains in order to reduce the risk of flood damage. See Appendix E for more detail.

Geographic Information System (GIS): A computer-based approach to interpreting maps and images and applying them to problem-solving.

Geology: The scientific study of the structure of the Earth, focused primarily on the composition and origins of rocks, soil, and minerals.

Grassed waterways: Vegetated channels designed to prevent gully erosion by slowing the flow of surface water with vegetation. See Appendix D for more detail.

Green infrastructure: Green infrastructure can be defined as our region's natural resources, including open space, woodlands, wetlands, gardens, trees, and agricultural land. It can also be defined as the nodes and corridors of vegetation over the region, or the site-scale structures and landscaping that recreate natural processes. See Appendix D for more detail.

Green Infrastructure Grant Opportunities: A program that provides funding for the construction of a variety of green infrastructure stormwater management practices such as porous pavement and bioswales.

Groundwater recharge: Primary mechanism for aquifer replenishment which ensures future sources of groundwater for commercial and residential use.

Headwaters: Upper reaches of streams and tributaries in a watershed.

HUC or HUC Code: A Hydrologic Unit Code (HUC) that refers to the division and subdivision of U.S. watersheds. The hydrologic units are arranged or nested within each other, from the largest geographic area (regions) to the smallest geographic area (cataloging units). Where two digits follow "HUC," they refer to the length of the HUC code. For example, "HUC14" refers to the lowest-nested subwatershed level with a 14-digit long code, such as HUC 07140204050101.

Hydric soil: Soil units that are wet frequently enough to periodically produce anaerobic conditions, thereby influencing the species composition and/or growth of plants on those soils.

Hydrologic Soil Groups (HSG): Soil classifications from the Natural Resource Conservation Service based on the soil's runoff potential. The four Hydrologic Soils Groups are A, B, C and D. A's generally have the smallest runoff potential and D's the greatest.

Hydrology: The scientific study of the properties, distribution, and effects of water in relation to the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hydrophytic vegetation: Plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; one of the indicators of a wetland.

Illinois Department of Natural Resources (IDNR): State government agency established to manage, protect, and sustain Illinois' natural and cultural resources, provide resource-compatible recreational opportunities, and promote natural resource-related issues for the public's safety and education.

Illinois Environmental Protection Agency (IEPA): State government agency established to safeguard environmental quality so as to protect health, welfare, property, and quality of life in Illinois.

Illinois Nature Preserves Commission (INPC): Commission responsible for protecting Illinois Nature Preserves, state-protected areas that are provided the highest level of legal protection, and have management plans in place.

Illinois Pollution Control Board (IPCB): An independent agency created in 1970 by the Environmental Protection Act. The Board is responsible for adopting Illinois' environmental regulations and deciding contested environmental cases.

Impervious Cover Model: Simple urban stream classification model based on impervious cover and stream quality. The classification system contains three stream categories (sensitive, impacted, and non-supporting) based on the percentage of impervious cover.

Impervious cover/surface: An area covered with solid material or that is compacted to the point where water cannot infiltrate underlying soils (e.g., parking lots, roads, houses).

In-lieu fee: A payment made to a natural resource management entity for implementation of projects for wetland or other aquatic resource development, in lieu of (in place of) on-site restoration or site mitigation. See Appendix E for more detail.

Infiltration: Rainfall or surface runoff that moves downward from the surface into the subsurface soil.

Loess: An unstratified loamy deposit, usually buff to yellowish brown, chiefly deposited by the wind and thought to have formed by the grinding of glaciers.

Logjam: Any woody vegetation, with or without other debris, which obstructs a stream channel and backs up stream water like a natural dam.

Low Impact Development: Comprehensive land planning and engineering design approach with a goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds.

Macroinvertebrates (aquatic): Invertebrates that can be seen by the unaided eye (macro). Most benthic invertebrates in flowing water are aquatic insects or the aquatic stage of insects, such as mayfly nymphs and midge larvae. They also include organisms such as leeches, clams, and worms. The presence of benthic (bottom-dwelling) macroinvertebrates that are intolerant of pollutants is a good indicator of good water quality.

Management Measures: Also known as Best Management Practices (BMPs). Methods or techniques that are the most effective or practical means to achieving objectives including improving water quality, reducing flooding, and improving fish and wildlife habitat. These practices include non-structural practices such as site planning and design aimed to reduce stormwater runoff and avoid adverse development impacts, or structural practices that are designed to store or treat stormwater runoff to mitigate flood damage and reduce pollution.

Marsh: An area of soft, wet, low-lying land, characterized by grassy vegetation and often forming a transition zone between water and land.

Missouri Resource Assessment Partnership (MoRAP): Program at the University of Missouri which develops, analyzes, and delivers geospatial data for natural and cultural resource management. MoRAP partnered with the East-West Gateway Council of Governments to deliver mapped data on wetland importance and wetland restoration value.

Mitigation: Measures taken to eliminate or minimize damage from development activities such as construction in wetlands.

Municipal Separate Storm Sewer System (MS4): A system that transports or holds stormwater, such as catch basins, curbs, gutters, and ditches, before discharging into local waterbodies.

National Hydrography Dataset (NHD): Digital database of surface water features, such as lakes, ponds, streams, and rivers. The NHD is used to make hydrology and watershed boundary maps.

National Pollutant Discharge Elimination System (NPDES) Phase II: Permit program authorized by the Clean Water Act requiring smaller communities and public entities that own and operate a Municipal Separate Storm Sewer System (MS4) to apply and obtain a NPDES permit for stormwater discharges to surface water. Permittees must develop, implement, and enforce a stormwater program designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable. Individual homes that use a septic system, are connected to a municipal system, or do not have a surface discharge do not need an NPDES permit. The NPDES permit program is administered by authorized states. In Illinois, the Illinois EPA administers the program.

National Land Cover Database (NLCD): Database with mapped land cover categories produced by the Multi-Resolution Land Characteristics (MRLC) Consortium with land cover classifications based on Landsat satellite data and ancillary data sources such as topography, census and agricultural statistics, soil characteristics, wetlands, and other land cover maps.

Native landscaping: A landscape that contains native plants or plant communities that are indigenous to a particular region.

Natural Resources Conservation Service (NRCS): Government agency under the U.S. Department of Agriculture (USDA) that provides technical assistance to landowners and land managers.

Nitrogen: A colorless, odorless, unreactive gas that constitutes about 78% of the earth's atmosphere. The availability of nitrogen in soil is important for plant growth and ecosystem processes, and nitrogen is used in many fertilizers.

No-till: No-till farming (also called zero tillage) is a way of growing crops or pasture from year to year without disturbing the soil through tillage. It uses herbicides to control weeds and results in reduced soil erosion and the preservation of soil nutrients. See Appendix E for more detail.

Nonpoint source pollution (NPS pollution): Any source of water pollution that is not from a discrete outflow point. Instead, NPS pollution comes from diffuse sources and is carried into waterways with runoff from the land. Pollutants can include oil, grease, sediment, and nutrients in excess fertilizer.

Nutrients: Substances needed for the growth of plants and animals, such as phosphorous and nitrogen. The addition of too many nutrients to a waterway causes problems to the aquatic ecosystem by promoting nuisance vegetation including excess algae growth.

Nutrient Management Plans (NMPs): A strategy for obtaining the maximum return from on- and off-farm fertilizer resources in a manner that protects the quality of nearby water resources.

Overland flood: Flooding that occurs when rainfall collects on saturated or frozen ground. When surface runoff cannot find a channel, it may flow out over a large area at a somewhat uniform depth in sheet flow or collect in depressions as ponding.

Partners: Key watershed stakeholders who take an active role in the watershed management planning process and implementing the watershed plan.

Pervious pavement: Pavement type (also referred to as porous or permeable pavement) that allows water to infiltrate to the soil or a storage area below. See Appendix E for more detail.

Phosphorus: A nonmetallic element that occurs widely in many combined forms especially as inorganic phosphates in minerals, soils, natural waters, bones, and teeth and as organic phosphates in all living cells.

Point source pollution: Pollution that discharges in water from a single, discrete source, such as an outfall pipe from an industrial plant or wastewater treatment facility.

Pollutant load: The amount of any pollutant deposited into waterbodies from point source discharges, combined sewer overflows, and/or stormwater runoff.

Private sewage: Sewage systems that are the responsibility of the owners or occupiers of the properties connected to them. These systems can include septic tanks, lagoons, and leach fields.

Rain garden: Vegetated depression that cleans and infiltrates stormwater from rooftops and sump pump discharges, typically planted with deep-rooted native wetland vegetation. See Appendix E for more detail.

Rainwater Harvesting: The accumulation and storing of rainwater for reuse before it reaches an aquifer. See Appendix E for more detail.

Retention basin: A man-made structure with a permanent pool of water for the storage of stormwater runoff. Also known as a wet pond, or wet detention basin.

Retrofit: Modifications to improve problems with existing stormwater control structures such as detention basins and conveyance systems such as ditches and storm sewers. See Appendix E for more detail on detention basin retrofits.

Riparian: The riverside or riverine environment adjacent to the stream channel. For example, riparian, or streamside, vegetation grows next to (and over) a stream.

Riparian Buffer: An undisturbed naturally vegetated strip of land adjacent to a body of water, such as a stream or lake. Riparian buffers have water quality, flooding, and habitat benefits.

Riverine flood: The gradual rise of water in a river, stream, lake, reservoir, or other waterway that results in the waterway overflowing its banks. This type of flooding generally occurs when storm systems remain in the area for extended periods of time, when winter or spring rains combine with melting snow to create higher flows, or when obstructions, such as logjams, block normal water flow.

Runoff: The portion of precipitation that does not infiltrate into the ground and is discharged into streams by flowing over the ground.

Sediment: Soil particles that have been transported from their natural location by wind or water action.

Special Flood Hazard Area: The area inundated during the base flood is called the Special Flood Hazard Area or 100-year floodplain.

Special Service Area (SSA): Special taxing districts in counties and municipalities that are established by ordinance. Taxes from SSAs are used to pass on the costs of items such as streets, landscaping, water lines, and sewer systems in new development to homeowners who reside within it. See Appendix E for more detail.

Stakeholders: Individuals, organizations, or enterprises that have an interest or a share in a project.

Stream reach: A stream segment having fairly homogenous hydraulic, geomorphic, riparian cover, and land use characteristics.

Streambank stabilization: Techniques used for stabilizing eroding streambanks.

Streambank Stabilization and Restoration Program (SSRP): Illinois Department of Agriculture (IDOA) program designed to demonstrate effective streambank stabilization at demonstration sites using inexpensive vegetative and bio-engineering techniques. See Appendix E for more detail.

Subwatershed: Any drainage basin within a larger drainage basin or watershed.

Terrace: Ridges and channels constructed across the slope of a field to intercept runoff water, reducing soil erosion. See Appendix E for more detail.

Threatened and endangered species: A “threatened” species is one that is likely to become endangered in the foreseeable future. An “endangered” species is one that is in danger of extinction throughout all or a significant portion of its range.

Topography: The relative elevations of a landscape describing the configuration of its surface.

Total Maximum Daily Load (TMDL): The highest amount of discharge of a particular pollutant that a waterbody can handle safely per day.

Total Suspended Solids (TSS): The organic and inorganic material suspended in the water column greater than 0.45 micron in size.

U.S. Army Corps of Engineers (USACE): Federal group of civilian and military engineers and scientists that provide services for planning, designing, building, and operating water resources and other Civil Works projects. These include flood control and environmental protection projects.

U.S. Department of Agriculture (USDA): Federal government agency that provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues. The USDA administers several programs to encourage land conservation and agricultural best practices.

U.S. Environmental Protection Agency (USEPA): Federal agency whose mission is to protect human health and the environment. USEPA enforces the Clean Water Act, among other laws.

U.S. Fish and Wildlife Service (USFWS): Federal government agency within the U.S. Department of the Interior dedicated to the management of fish and wildlife and their habitats.

U.S. Geological Survey (USGS): Federal government agency established with the responsibility to provide reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect quality of life.

Urban runoff: Runoff that runs over urban developed surfaces such as streets, lawns, and parking lots, entering directly into storm sewers rather than infiltrating the land upon which it falls.

Wastewater Treatment: Process that treats wastewater to alter its characteristics such as its biological oxygen demand, chemical oxygen demand, pH, etc. in order to meet effluent or water discharge standards.

Water and Sediment Control Basin (WASCOB): Small earthen ridge-and-channel or embankment built across a small watercourse or area of concentrated flow in a field. See Appendix E for more detail.

Watershed: The area of land that contributes runoff to a single point on a waterbody (in this case, the outlet of Canteen Creek from Madison County to St. Clair County).

Watershed-Based Plan: A strategy and work plan for achieving water resource goals that provides assessment and management information for a geographically defined watershed, including the analysis, actions, participants, and resources related to development and implementation of the plan.

Wetland: Lands that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, under normal conditions, a prevalence of vegetation adapted for life in saturated soil conditions (known as hydrophytic vegetation). A wetland is identified based upon the three attributes: 1) hydrology, 2) hydric soils, and 3) hydrophytic vegetation. A wetland is considered a subset of the definition of the Waters of the United States.

Wetland Reserve Easement (WRE) program: Component of the Agricultural Conservation Easement Program (ACEP) that provides technical and financial assistance to restore, protect, and enhance wetlands. See Appendix E for more detail.

Appendix A : Watershed Resources Inventory

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Introduction

The Judy's Branch watershed is located at St. Louis, Missouri on both the Illinois side and Missouri side of the Mississippi River. The watershed drains parts of St. Louis, St. Louis City, Madison, and St. Clair counties.

This Watershed Resources Inventory is only concerned with the Illinois portion of the watershed, also known as the American Bottom. The American Bottom watershed project area is that portion of the Judy's Branch watershed within Madison County.

Within the American Bottom watershed there are 147 stream miles draining 43,247 acres of land. This watershed flows into the Mississippi River from the east.

As of the 2010 census, there were 42,825 residents within the American Bottom watershed. The majority of the population resides within Granite City.

The Illinois Environmental Protection Agency (IEPA) has designated six streams/waterbodies in the American Bottom watershed as impaired (Canteen Creek, Cahokia Diversion Channel, Chain of Rocks Canal, Mississippi River, Schoenberger Creek, and Horseshoe Lake). These waterways have been classified as impaired as a result of stream alterations of various types, loss of in-stream cover, and high concentrations of substances including phosphorous, barium, polychlorinated biphenyls, total suspended solids, mercury, dissolved oxygen, manganese, and fecal coliforms. In addition to water quality issues, this watershed experiences water quantity issues. Properties in this watershed have experienced recurring flooding, both within and outside the 100-year floodplain, causing risk and damage to property and threatening life safety.

The watershed plan for the American Bottom watershed aims to address these issues, as well as others. Funded by Madison County, the plan aims to focus efforts on protection and restoration of water resources within the watershed. The plan will aid stakeholders in implementing water quality and flooding solutions and recommend improvement projects within the watershed.

This Watershed Resources Inventory constitutes the first step of the plan, and is funded through a Planning Assistance to States agreement between Madison County and the U.S. Army Corps of Engineers. Madison County provided additional mapping support. Existing conditions in several categories are identified, including:

- Watershed boundaries
- Climate
- Geology
- Soils
- Watershed jurisdictions
- Demographics
- Land use and land cover
- Watershed drainage
- Flooding
- Water quality

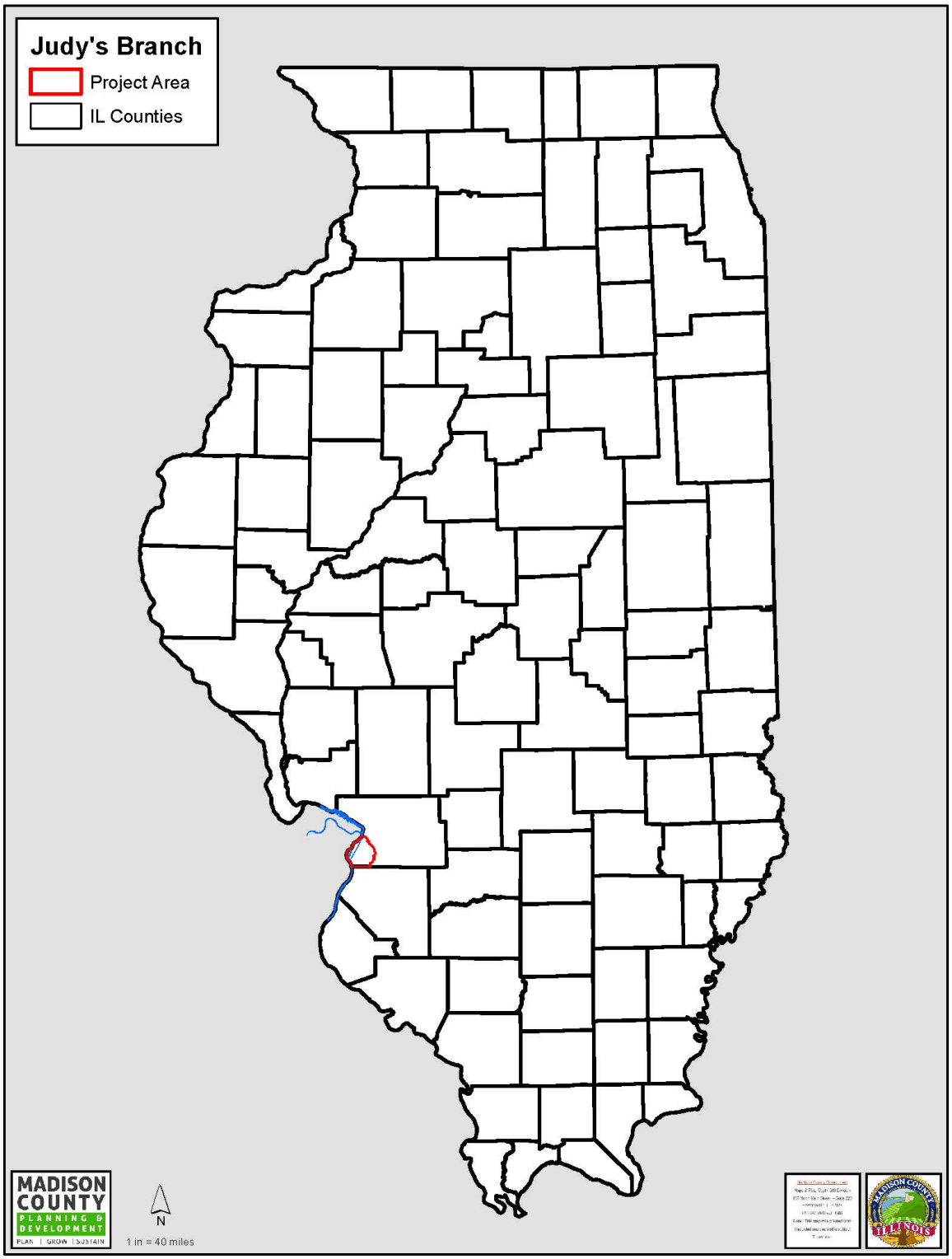
Several challenges and threats to the watershed are identified in this Inventory. Manmade changes to the waterways and the landscape have contributed to declining surface water quality and problematic

flooding issues. Approximately 67% of the streams in the American Bottom watershed are highly channelized. Streambank erosion is severe along 12% of the stream length assessed in the American Bottom watershed, causing sedimentation and siltation in the waterways. Fertilizer use on agricultural, commercial, and residential land is contributing to phosphorus loading, and increased development is contributing to both water quality and water quantity issues.

Stakeholder outreach complemented the data collection for this Inventory and educated watershed residents and business owners about the aims of the Plan. As of June 2019, about 250 key stakeholders from 25 entities have attended meetings with the planning team individually or in small groups, and approximately 46 people attended three informational Open House events about the Plan. In a flood survey to residents in the watershed, 380 respondents provided feedback on their experiences with flooding over the past 10 years. Survey results show that the vast majority of respondents place “high” importance on clean drinking water, prevention of flood damage, waterbodies suitable for recreation, and a healthy watershed that supports a wide variety of plant and animal life.

This Inventory contains the data to be used in identifying and prioritizing Best Management Practices (BMPs) in the next phase of the watershed plan development.

Figure A.1: Location of the American Bottom watershed in the State of Illinois



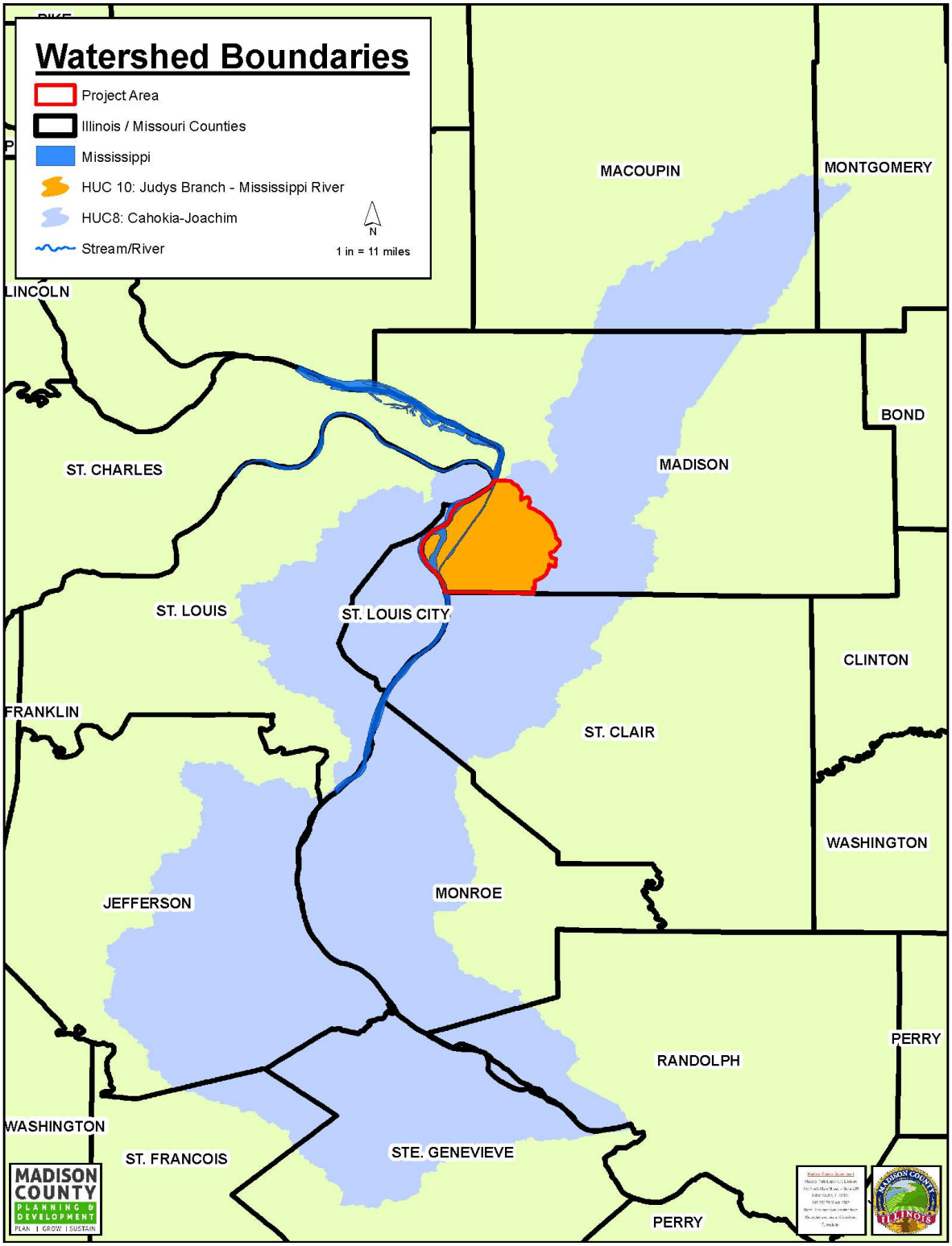
Watershed Boundaries

The U.S. Geological Survey (USGS) has established the hydrologic units system to delineate, locate and define watershed in the United States. Starting with Hydrologic Unit Code (HUC) 2 watersheds, which are the largest, down to HUC16 watersheds currently being developed around the country as the smallest. The Judy's Branch Watershed is in the Upper Mississippi River Region (HUC2), Cahokia-Joachim Catalog Unit (HUC8). The American Bottom Watershed plan area includes three HUC12 watersheds: Horseshoe Lake, Maline Creek and Schoenberger Creek. Table A.1 below shows the contributing area for the HUC 8 and HUC 10 watersheds as well as the American Bottom project area.

Table A.1: Area of the hydrologic units nested in the Judy's Branch Plan project area

Watershed	Area (acres)
Cahokia-Joachim **HUC** 07140101 (HUC 8)	1,053,318
Judy's Branch **HUC 0714010104 (HUC 10)**	128,732
American Bottom (Project Area - portion of Madison County within Judy's Branch)	43,247

Figure A.2: The American Bottom Watershed plan project area in context of the Cahokia-Joachim Creek HUC8 watershed.



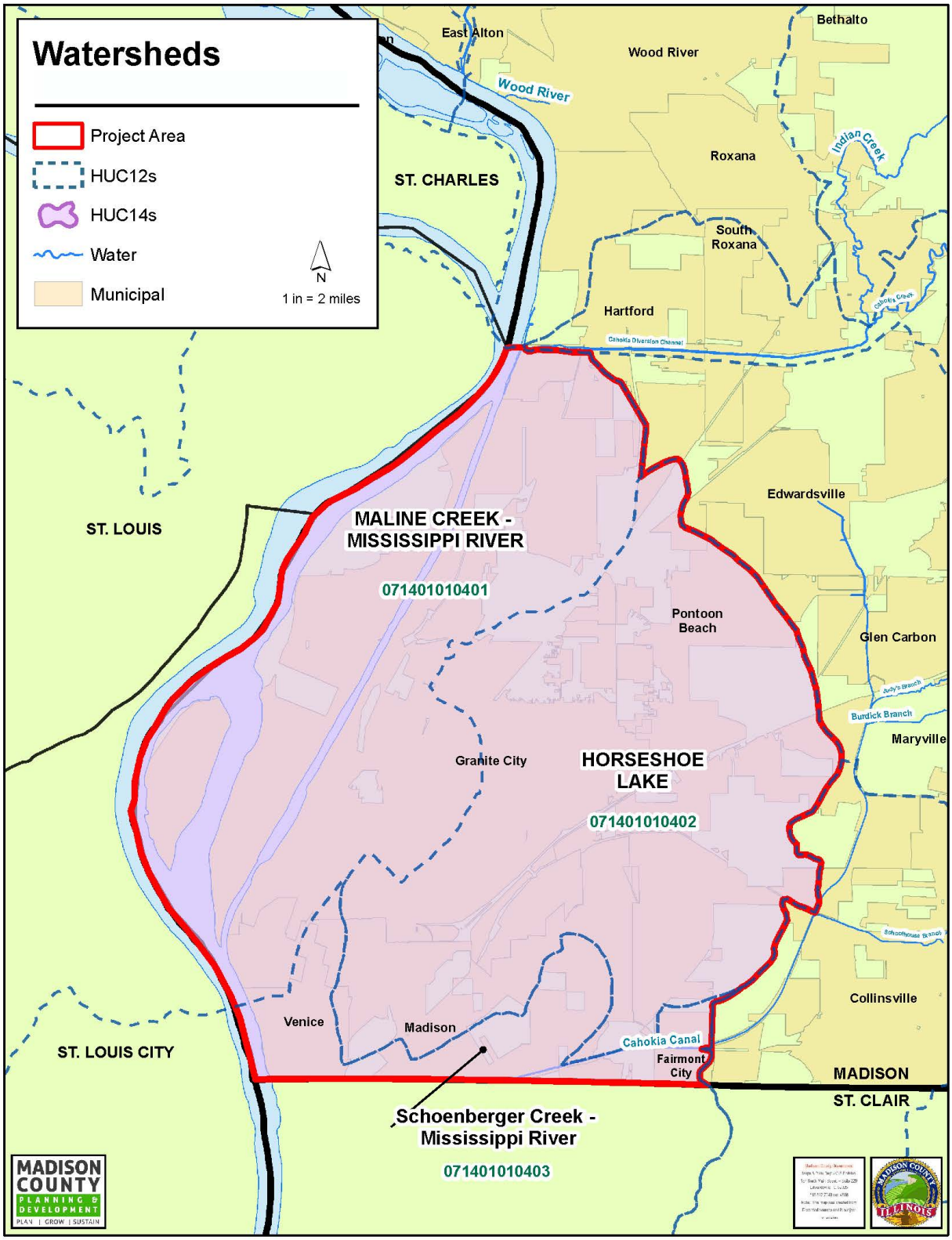
Subwatersheds

The project area contains numerous smaller subwatersheds, or hydrologic units, including parts of three HUC 12s and five HUC14s (Figure A.3). The HUC14s were delineated using GeoHMS for ArcGIS and methods employed by the USGS to define watersheds in the Watershed Boundary Database (WBD), a component of the National Hydrography Dataset (NHD). Only one HUC 12 was completely divided into HUC 14s. The other two HUC 12s only had small portions within the project area. Each HUC12 watershed contains two to three HUC 14s, which range between about 5,800 acres to 9,400 acres in size. The following Figure and table show the HUC12s and their component HUC14s.

Table A.2:HUC10 and HUC12 name and codes with HUC 14 names, codes, area and municipalities for the Project Area.

HUC12		HUC14	HUC14 Area (acres)	Municipalities Present
Name	Code	Code		
Maline Creek-Mississippi River	071401010401	07140101040101	9391.8	Madison, Hartford, Granite City, Venice
		07140101040102	9201.0	Madison, Hartford, Granite City, Venice
Horseshoe Lake	071401010402	07140101040201	6922.4	Edwardsville, Pontoon Beach, Granite City
		07140101040202	7754.9	Granite City, Pontoon Beach, Venice, Madison
		07140101040203	5817.6	Granite City, Pontoon Beach, Venice, Madison
Schoenberger Creek - Mississippi River	071401010403	Not a complete HUC 14 within Madison County		Madison, Venice, Fairmont City

Figure A.3: HUC12s and HUC14s in the American Bottom Project Area



Stream miles

The American Bottom watershed contains 88.5 stream miles. Each stream reach is labeled as one of seven categories in the NHD: artificial path, canal/ditch, coastline, connector, pipeline, stream/river or underground conduit. Of these seven categories, artificial path, canal/ditch, connector, and stream/river are present in the American Bottom watershed.

Direction of flow and major tributaries

On the Illinois side of the Judy's Branch watershed, water generally flows from north to south and east to west. The uppermost part of the watershed is where the Cahokia Diversion Channel drains the Indian-Cahokia Creek watershed into the Mississippi River. The watershed drains the area north of Granite City down through Washington Park, East St. Louis, and Sauget. Long Lake (North) drains to the Chain of Rocks Canal. Long Lake (South) and Horseshoe Lake drain into the Cahokia Canal which empties into the Mississippi River north of East St. Louis.

Waterbodies

The American Bottom watershed contains 138 waterbodies according to the NHD. These waterbodies include lakes, ponds, swamps and marshes and have an average area of 26.6 acres. The largest waterbody in the watershed is Horseshoe Lake at 1665.5 acres (not including private or industrialized portions). The next largest waterbody is a 272-acre unnamed marsh northeast of Horseshoe Lake. Canteen Lake is just south of Horseshoe Lake and is the third largest waterbody in the watershed, at 97 acres.

Topography

The topography of the American Bottom watershed is fairly flat, with gradual slopes throughout most of the watershed. The watershed has an average slope of 5.27%. The standard deviation of the slopes within the watershed is 8.05, meaning that 68.3% of the slopes in the watershed fall between 0% and 13.32%. The steepest slopes are all within manmade structures such as interstate ramps, coal power plant storage, steel plant levees, the historic Cahokia Mounds, etc.

The highest point in the watershed has an elevation of 503 feet, near the Granite City Steel Plant. The highest streams are in the northeast of the watershed sloping down toward the Mississippi River. The lowest point in the watershed, with an elevation of 389.2 feet, is in the southern most section of the Mississippi River within Madison County.

Figure A.4: Topography/elevation in American Bottom watershed project area, from the Digital Elevation Model (DEM) in the USGS National Elevation Dataset.

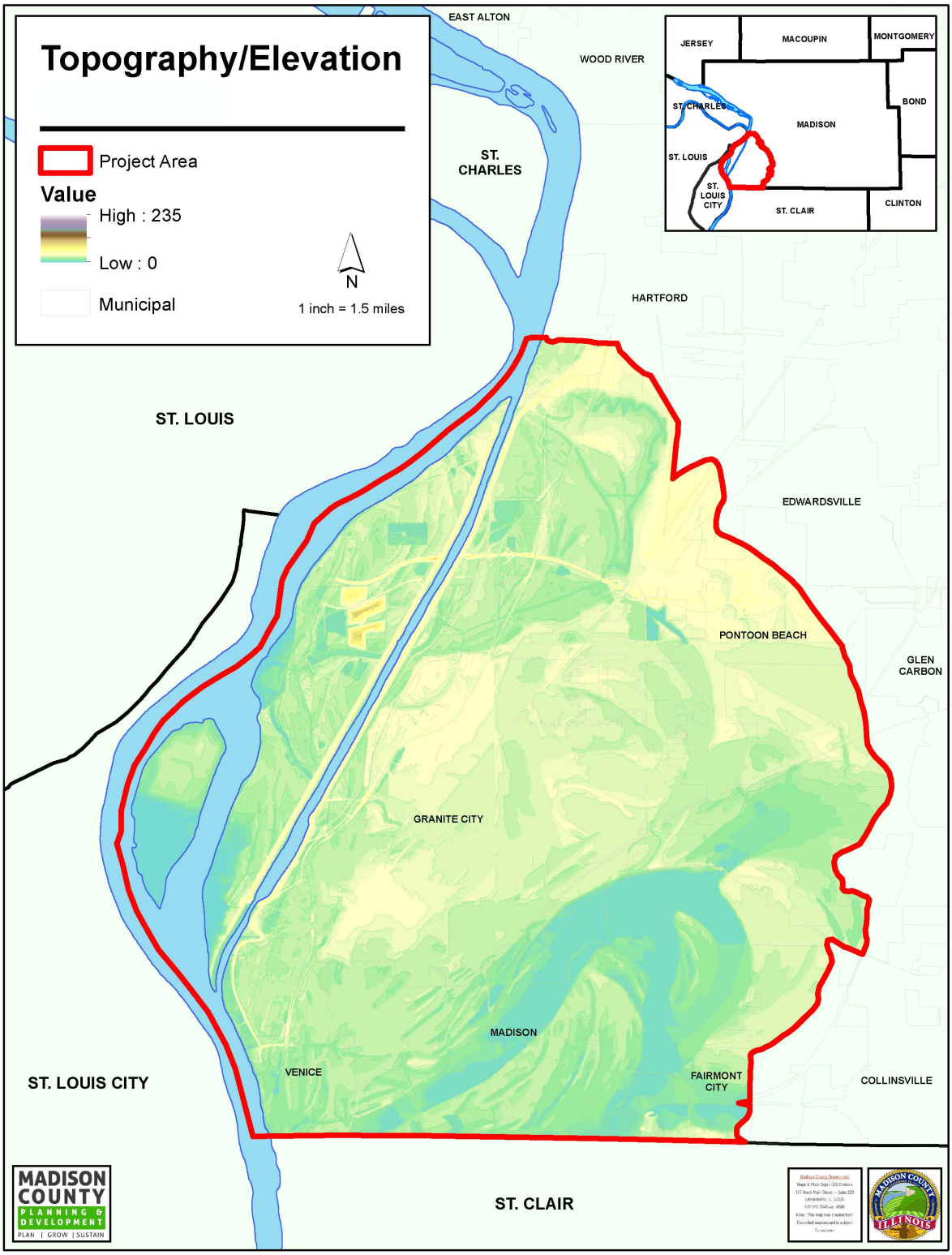


Figure A.5: Slope in the American Bottom watershed project area, in percent.



Climate

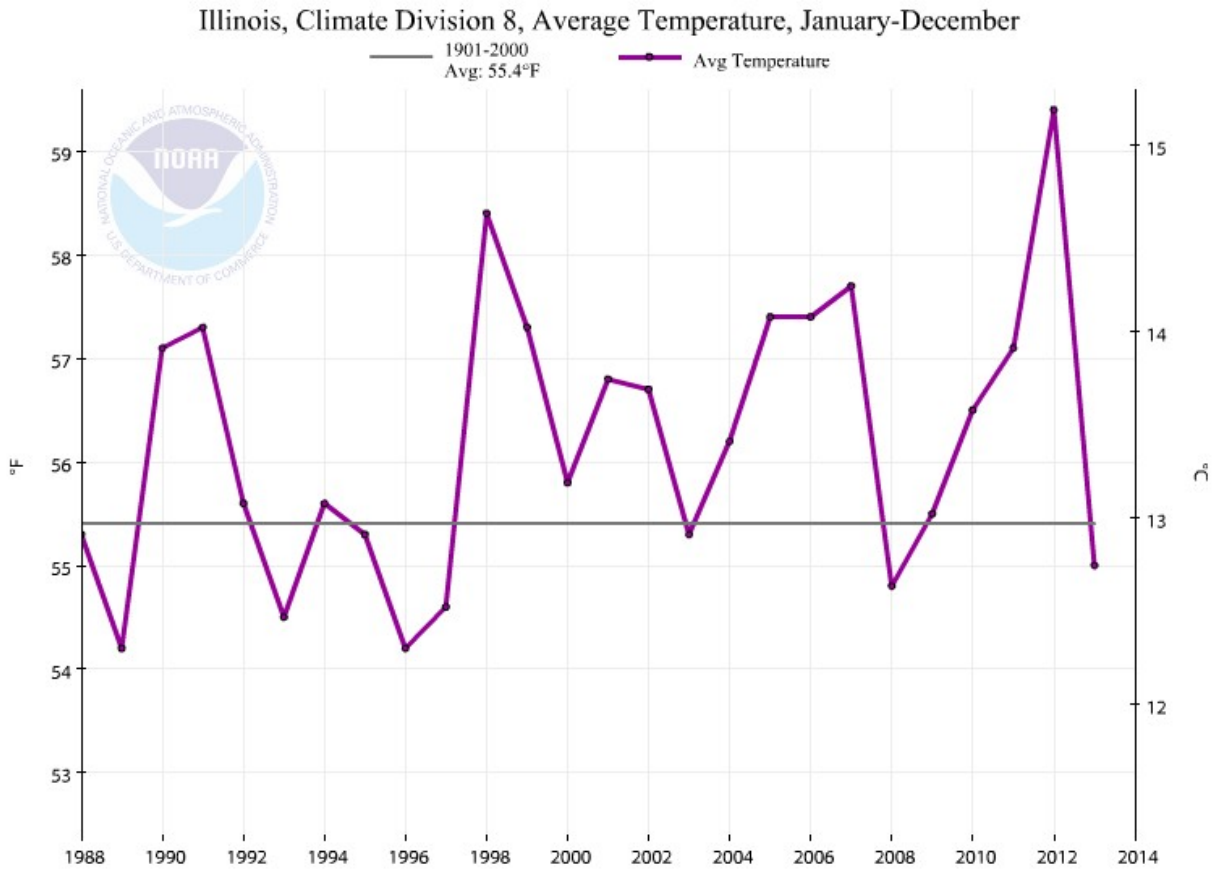
The watershed experiences typical weather for southwestern Illinois, including great variation in temperature, precipitation, and snowfall from one year to the next.

Temperature

Southern Illinois experiences an average of just over 40 days at or above 90°F and an average two days at 100°F or higher every year. The average length of the frost-free growing season in southern Illinois is more than 190 days. The average annual temperature for the region is 55.4°F (measured between 1901 and 2000). Over the past 25 years, the average annual temperature in southwestern Illinois has increased, reaching a 25-year high of approximately 59.5°F in 2012 (Figure A.6).

Between 1988 and 2013, southern Illinois has experienced 853.2 days of maximum temperature equal to or greater than 90°F. This equates to an average of 32.8 days per year of temperatures over 90°F (data from monthly averages from gaging stations in all three counties). The maximum-recorded temperature in the local counties between 1988 and 2014 was 106°F in July 2012, recorded in Alton, Madison County. The minimum-recorded temperature in the local counties between 1988 and 2014 was -20°F in December 1989 at two gage stations in Macoupin County. (1)

Figure A.6: Average annual temperatures in southwestern Illinois between 1988 and 2014, from NOAA's Climate At-A-Glance Time Series. The leftmost y-axis shows average annual temperature in degrees Fahrenheit. (2)



Precipitation

Average precipitation exceeds 48 inches a year in southern Illinois, which allows farms to rely on precipitation rather than irrigation for much of the year. (3) Precipitation gage stations in Belleville and Edwardsville measured an average annual precipitation of 39.37 inches and 38.73 inches, respectively, between 1971 and 2000. The average annual number of days with 0.1 inch or more of precipitation was 69 days (averaged between recorded data from the two stations between 1971 and 2000), with May as the wettest month and January as the driest. The average annual total snowfall recorded was 17.2 inches (between 1971 and 2000). (4)

Flooding is the single most damaging weather hazard in Illinois. Rainstorms in Illinois produce 40 or more flash floods on average per year across the state, each with four to eight inches of rainfall in a few hours in localized areas. (3) The greatest recorded 24-hour precipitation event was recorded in Belleville as 8.15 inches of rain in June 1957 (Table A.3). Flash floods can occur at any time of year in Illinois, but they are most common in the spring and summer months. (5) See flooding section for more information on occurrences of flash flooding and general flooding.

Table A.3: Maximum precipitation within 24 hours between 1948 and 2001(Belleville) and 1910 and 2001(Edwardsville). (4)

Rank	Daily Precipitation (inches)	Date	Gage Station
1	8.15	6/15/1957	Belleville
2	7.05	8/20/1995	Edwardsville
3	6.43	5/26/2009	Edwardsville
4	6.00	7/14/1912	Edwardsville
5	5.97	5/17/1943	Edwardsville
6	5.86	8/16/1946	Edwardsville
7	5.13	4/22/1944	Edwardsville
8	4.58	4/29/1996	Belleville
9	4.57	5/17/1995	Belleville
10	4.48	2/2/1986	Belleville

Drought

There has been considerable variability in precipitation in the state over time, including major multi-year droughts in the 1930s and 1950s and major multi-year wet periods in the 1970s and 1980s. (3) Madison County experienced four drought events between 1983 and 2012, three of which occurred in 2005 or later. (5) Extreme heat often accompanied rainfall and surface water shortages during these events.

Tornadoes

Illinois experiences about 29 tornadoes annually, 63% of which occur in peak months April, May, and June. (3) In Madison County, 39 tornadoes were reported between 1950 and 2006. The greatest recorded magnitude among these events was an F4 on the Fujita Scale. Typically, the area impacted by tornadoes is less than four square miles. (5)

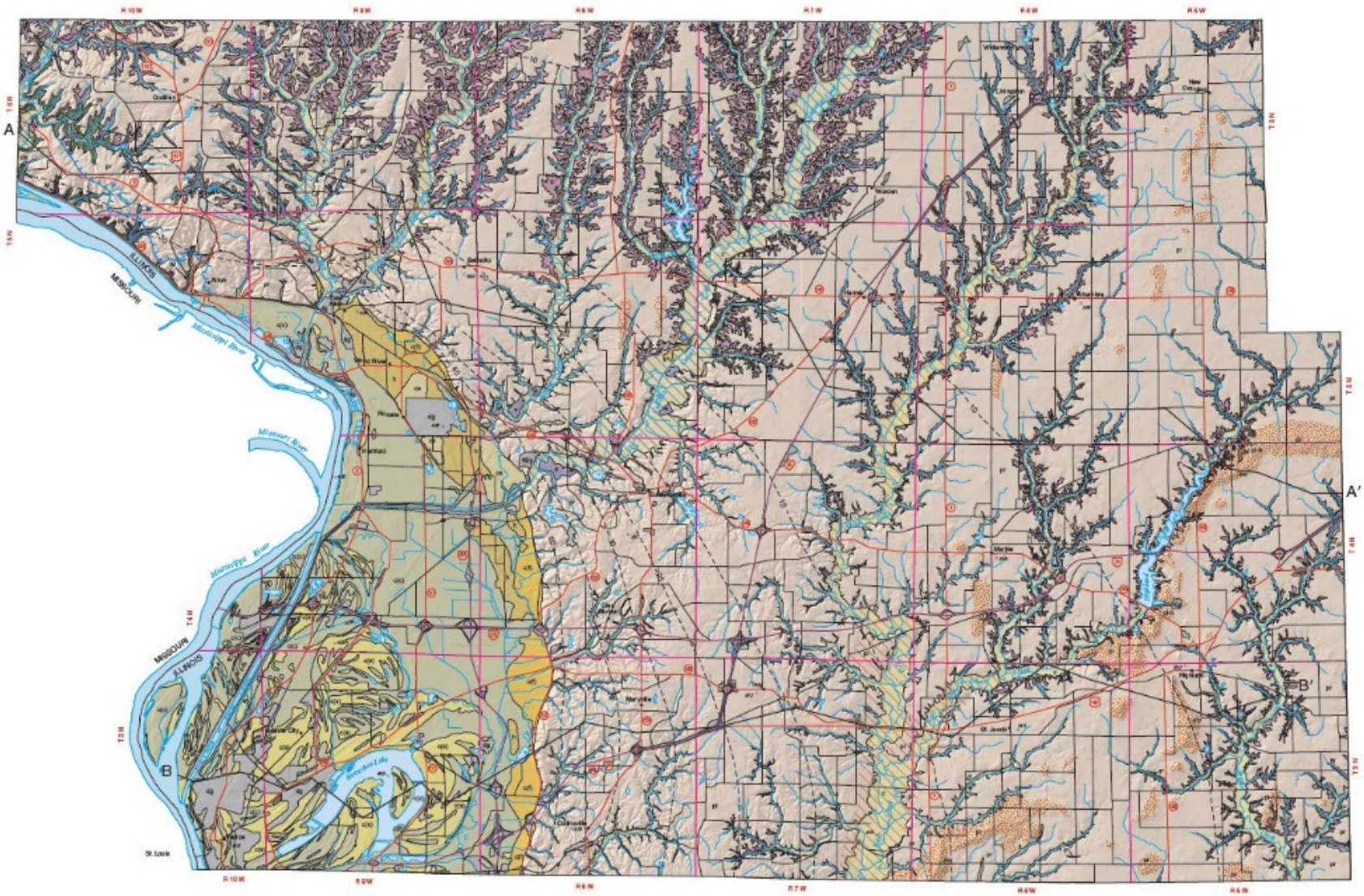
Geology

The bedrock underlying southwestern Illinois is composed of Cambrian, Ordovician, Silurian, Devonian, Mississippian, and Pennsylvanian sedimentary rocks (i.e., sandstone, shale, dolomite, and limestone) resting on crystalline basement rocks consisting mainly of granite. Tilting and folding of the bedrock surface below Madison County resulted in the present bedrock surface topography.

Blanketing the bedrock are unconsolidated deposits from glacial drift, ranging in thickness from two to 200 feet across southwestern Illinois. The glacial materials in the watershed and Madison County were deposited during the Pleistocene Epoch by the Illinoian glacial advance. The Illinoian Till Plain comprises much of the area east of the Mississippi River bluffs. A second glacial movement (Wisconsinan) did not advance on the area, but its deposits were widely transported here by wind and water. After the glaciers had receded and the deposits had dried, the wind picked up many of the fine-grained sand, silt, and clay (mostly silt) sediments and deposited them on the uplands in uniform layers known as loess. Since winds were generally from the northwest, the loess deposits are thicker on the uplands adjacent to the Mississippi River floodplain. The thickness of the glacial drift is highly variable.

The cross-sections of the landscape at line B-B’ in Figure A.7 shows that the rock layers underlying the Mississippi River Valley are, from bedrock to surface: Mississippian bedrock; Henry Formation deposits (fine, medium, and coarse sand); Cahokia Formation (sand facies) deposits (very fine, fine, and medium sand); and Cahokia Formation (clayey facies) deposits (silty clay loam, silty clay, and silty loam).

Figure A.7: Surficial geology of the American Bottom watershed area in Madison County. (6)



Legend on following page. Cross-section at line B-B' is shown in Figure A.9.

Figure A.8: Legend. Surficial geology of the American Bottom watershed area in Madison County.

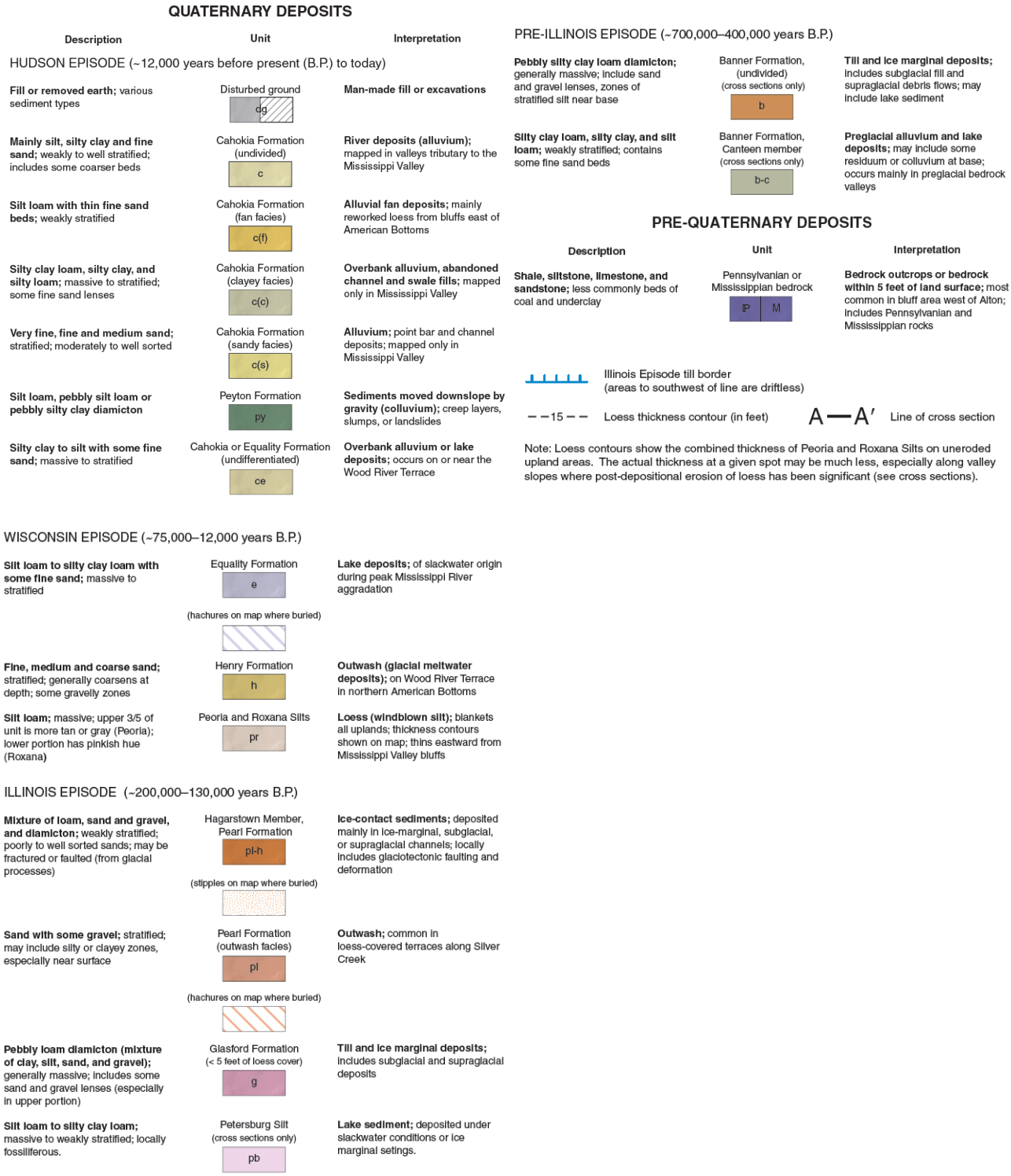
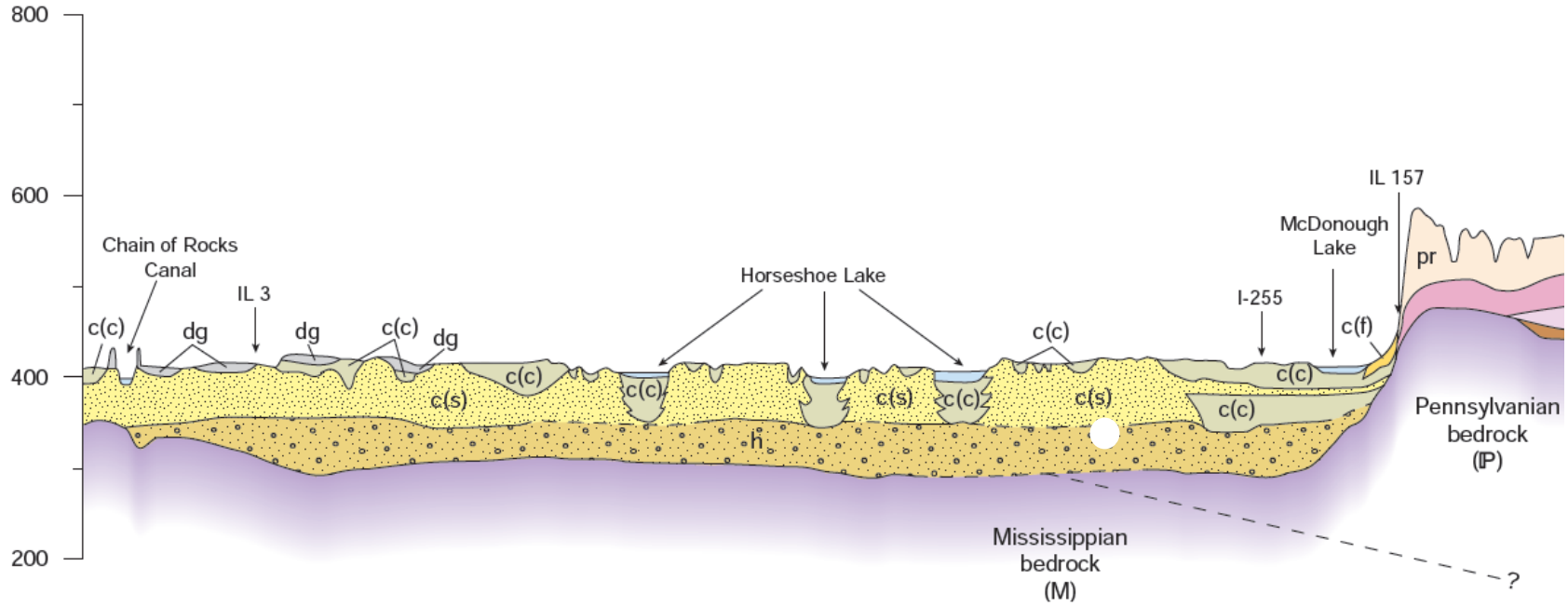


Figure A.9: Cross-sections of surficial geology at line B-B' in Figure A.7 (6)



Cross-section B-B' extends from the Chain of Rocks Canal to McDonough Lake, including Horseshoe Lake. See Figure A.8 for legend.

Aquifers

There are five types of aquifers in Madison County within the American Bottom watershed as defined by the Illinois State Geological Survey: potential shallow aquifers, major sand and gravel aquifers, major rock aquifers less than 300 feet, and two types of major rock aquifers greater than 500 feet—those containing between 2,500 and 10,000 milligrams per liter of Total Suspended Solids (TSS) and those containing more than 10,000 mg/L TSS.

Potential aquifers are defined as sand and gravel units at least five feet thick, sandstone at least ten feet thick, and fractured limestone or dolomite at least fifteen feet thick with a lateral extent of at least one square mile. The locations of these potential aquifers were determined by the presence of coarse-grained materials and permeable bedrock including bedrock, sand and gravel, and alluvial units with characteristics that suggest a potential to store or conduct groundwater and yield potable water to wells and springs. Minor aquifers of this type typically yield from five to seventy gallons of potable water per minute. (7)

Major sand and gravel aquifers cover the entire area of the watershed east of the Mississippi River and generally lie within 300 feet of the surface and have bases occurring within 500 feet. Major aquifers are defined as geologic units capable of yielding 70 gallons of potable water per minute. Potable water is defined as containing less than 2,500 milligram per liter total suspended solids (TSS). Major sand and gravel aquifers are commonly separated from shallower aquifers by layers of less permeable till or fine-grained lacustrine deposits. (7)

Major bedrock aquifers less than 300 feet from the ground surface lie just in the area between the Chain of Rocks Canal and the Mississippi River. This type of major aquifer is commonly overlain by thin layers of less permeable silts and clays.

Major rock aquifers are distributed beneath the entire watershed at depths greater than 500 feet below the ground surface. They are capable of yielding 70 gallons of water per minute. The deep aquifers beneath these watersheds do not yield potable water (containing less than 2,500 milligrams per liter of TSS). Instead, they yield water containing more than 2,500 milligrams per liter of TSS.

The entire Illinois side of Judy's Branch watershed contains both potential shallow aquifers and major sand and gravel aquifers.

Figure A.10: Known and potential aquifers underlying the American Bottom project area at various depths. These can be viewed online in Illinois SGS's Water Well Interactive Map. (8)

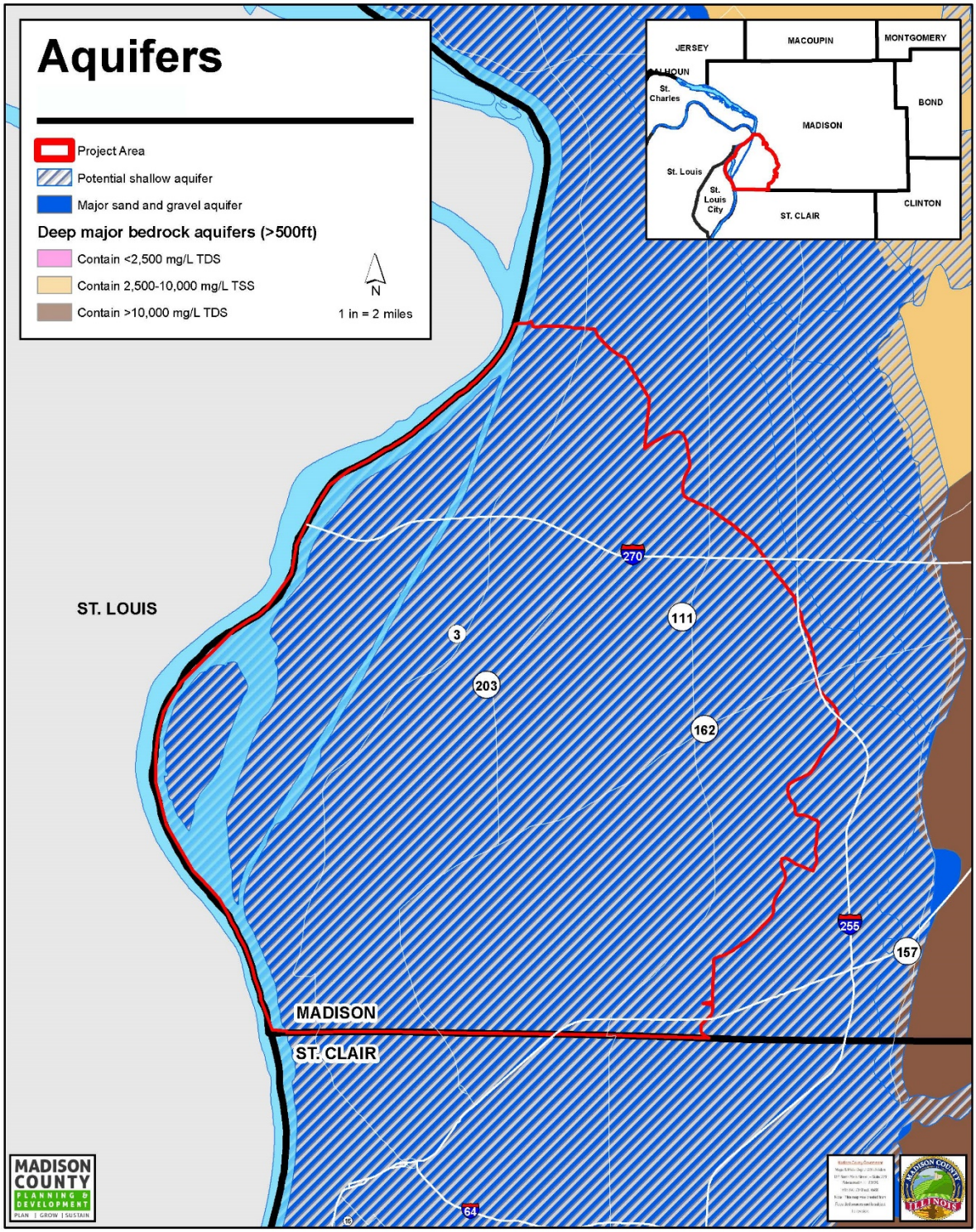


Figure A.17b. Known and potential aquifers underlying the Cahokia Creek watershed at various depths (29). These can be viewed online in Illinois SGS's Illinois Water Well Interactive Map (30).

Wells

The Illinois State Geological Survey (ISGS) has documented 775 wells located in the American Bottom watershed. Five hundred forty-seven (547) of the wells and borings are water wells (Figure A.11). (9)

Figure A.11: Wells and borings in the Judy's Branch watershed from ISGS's Wells and Borings Database.

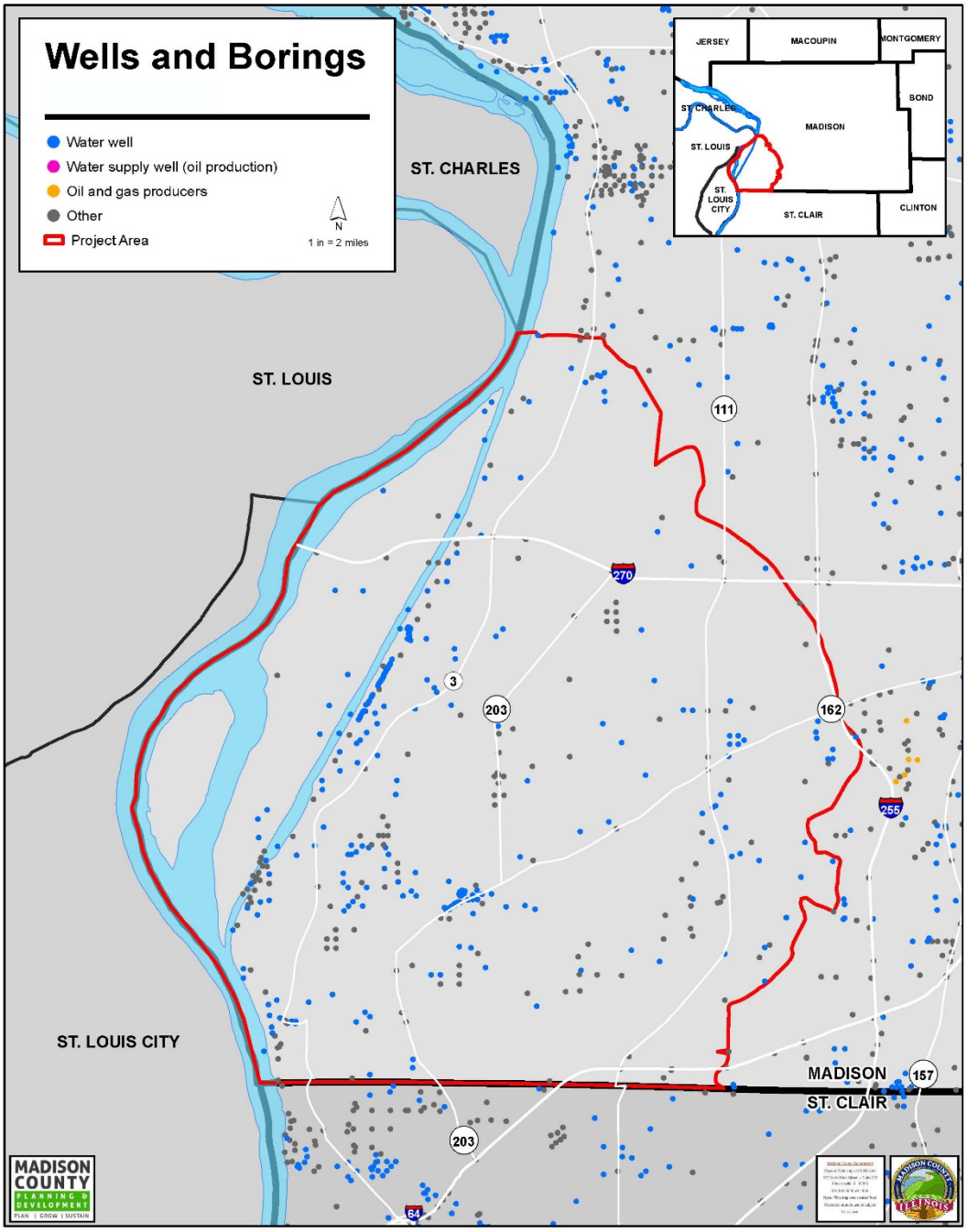


Figure A.18a. Wells and borings from ISGS's Wells and Borings Database.

Water Wells

The water wells are fairly evenly distributed across the watershed (Figure A.12). (9) The water wells category includes municipal water supply, irrigation, industrial, commercial, and several types of test wells. More detailed information on well types and specifications is available to order from ISGS for a fee. (10)

Figure A.12: Water wells and water supply wells for gas production from the ISGS Wells and Borings Database

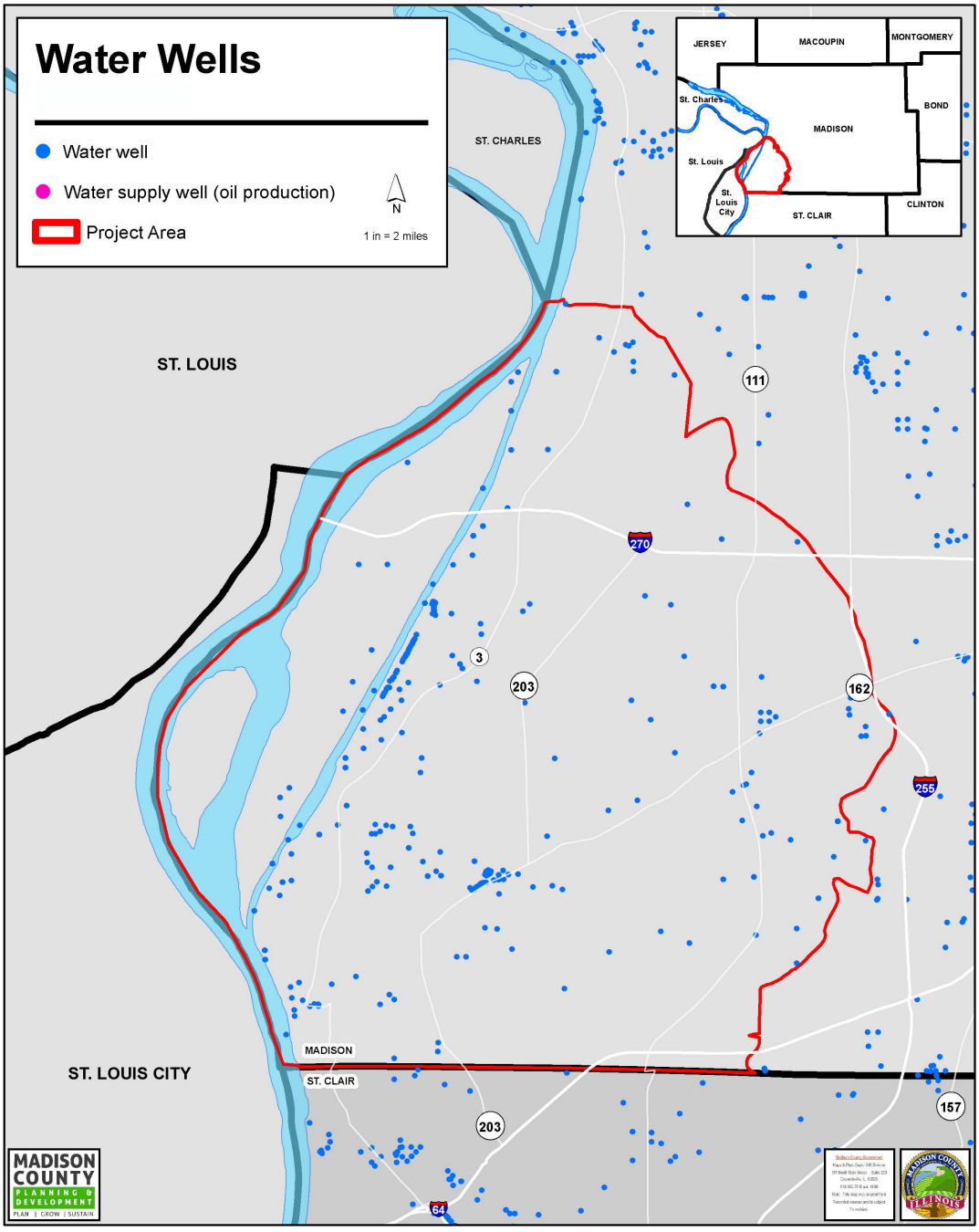


Figure A.19a. Water wells and water supply wells for gas production from the ISGS Wells and Borings Database.

Drinking water

There are two drinking water supply systems in the American Bottom watershed (Table A.4). The population served includes over 44,000 people. Both of these systems rely on surface water.

Table A.4: Water supply systems with records in US EPA's Safe Drinking Water Information System. (11)

System	Water System ID	Water System Name	County(s) Served	Population Served	Primary Water Source Type*
Community Water	IL1195030	IL American-Granite City	Madison	40,541	Surface Water
Community Water	IL1195300	Pontoon Beach PWD	Madison	3,853	Surface Water Purchased

*Water intake locations are unknown; some systems may withdraw water from outside the watershed (especially purchased water).

Soils

A combination of physical, chemical, and biological variables such as topography, climate, drainage patterns, and vegetation have interacted over centuries to form the complex variety of soils found in the Judy's Branch watershed. Data provided by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) was used to identify the soil types in the watershed. There are 44 soil types present in the watershed, each of which has a designated hydrologic soil group, hydric soil category, and erodible soil category. See full table of soil types and their attributes in the Data Tables section.

Hydrologic soil groups

Soils are classified by the Natural Resource Conservation Service (NRCS) into Hydrologic Soil Groups (HSGs) based on their infiltration and transmission (permeability) attributes. The ease with which certain soils drain water affects groundwater recharge and the type and location of suitable infiltration management measures (such as detention basins) at a given site.

HSGs are classified into four primary categories, A, B, C, and D, and three dual classes, A/D, B/D, and C/D. The soil texture, drainage description, runoff potential, infiltration rate, and transmission rate of the four primary categories are identified in Table A.5. Sandy type A soils drain much better and allow more infiltration than clay type D soils.

Soil type data was acquired from the USDA's Soil Survey Geographic database (SSURGO). The SSURGO data for the project area included 44 soil types. The NRCS county level Soil Surveys contain definitions of the soil types and note the HSG of each soil type. This corresponding data was joined to the SSURGO map layer to create maps of the HSG categories of soils in the watershed.

Table A.5: The four primary Hydrologic Soil Groups (HSGs) and their texture, drainage description, runoff potential, infiltration rate, and transmission rate.

HSG	Soil Texture	Drainage Description	Runoff Potential	Infiltration Rate	Transmission Rate
A	Sand, Loamy Sand, or Sandy Loam	Well to excessively drained	Low	High	High
B	Silt Loam or Loam	Moderately well to well drained	Moderate	Moderate	Moderate
C	Sandy Clay Loam	Somewhat poorly drained	High	Low	Low
D	Clay Loam, Silty Clay Loam, Sandy Clay Loam, Silty Clay or Clay	Poorly drained	High	Very Low	Very low

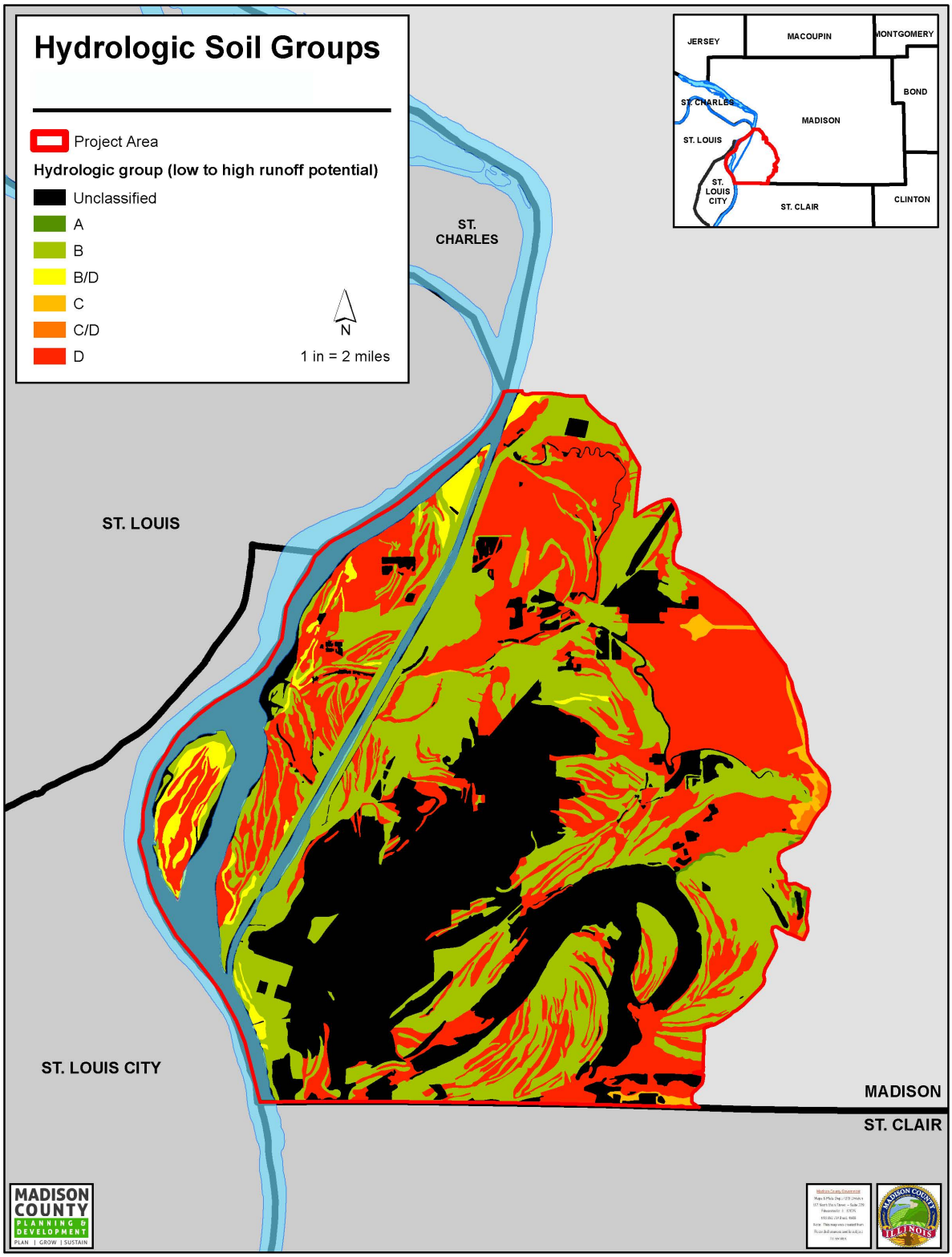
Hydrologic soil groups (HSGs) B and D are the most prevalent HSGs (after unclassified) in the Project Area, each covering approximately 32% of its area (Table A.6). See Data Tables section for a breakdown of hydrologic soil groups by HUC14 sub watershed. Group D soils are most prevalent in the northern and eastern edges of the watershed, along with a sizable portion of the canal area (Figure A.13). Group B soils cover large swaths of land in the middle of the watershed. Group C soils, which drain somewhat poorly and have low infiltration, are scattered sporadically throughout the watershed. Unclassified soil group areas include water, miscellaneous water, urban land, or dumps.

Table A.6: Hydrologic soil groups including acreage and percent of watershed. Unclassified soil group areas are listed as water, miscellaneous water, urban land, or dumps.[37, 38, 39, 40]

Hydrologic Soil Group	Area (acres)	Percent of Project Area
Unclassified	12,889	29.8%
A	46	0%
B	14,001	32.4%
B/D	854	2.0%
C	1,648	3.8%
C/D	76	0%
D	13,733	31.7%
Grand Total	43,247	100%

Fifty-five percent of the Judy's Branch watershed lies in Missouri (not included in this report).

Figure A.13: Hydrologic soil groups in the American Bottom project area.



Hydric soil types

Hydric soils are soils that are wet frequently enough to produce anaerobic conditions periodically. They generally form over poorly drained clay material associated with marshes and other wetlands. The locations and attributes of existing wetlands are discussed in the Land Use/Land Cover section. The species composition and growth of vegetation on hydric soils is distinct from non-hydric soils. Hydric soils not only indicate the presence of existing wetlands, but also of drained wetlands where restoration may be possible.

Hydric soils were identified through the three NRCS county level Soil Surveys, which identify hydric soils by soil type. A hydric soil designation was then joined to the SSURGO map layer to identify the acreage and location of hydric soils in the watershed (Figure A.14). Fourteen soil types in the watershed were identified as hydric soils, covering a total area of 14,234 acres (Table A.7). Full data on soil types in the watershed and their hydric status is included in the Data Tables section.

Hydric soils constitute 11% of the soils in the watershed (Table A.8). Soils in areas of water, urban land, and dumps were considered non-hydric. See Data Tables section for a breakdown of hydric soils by HUC14 sub watershed.

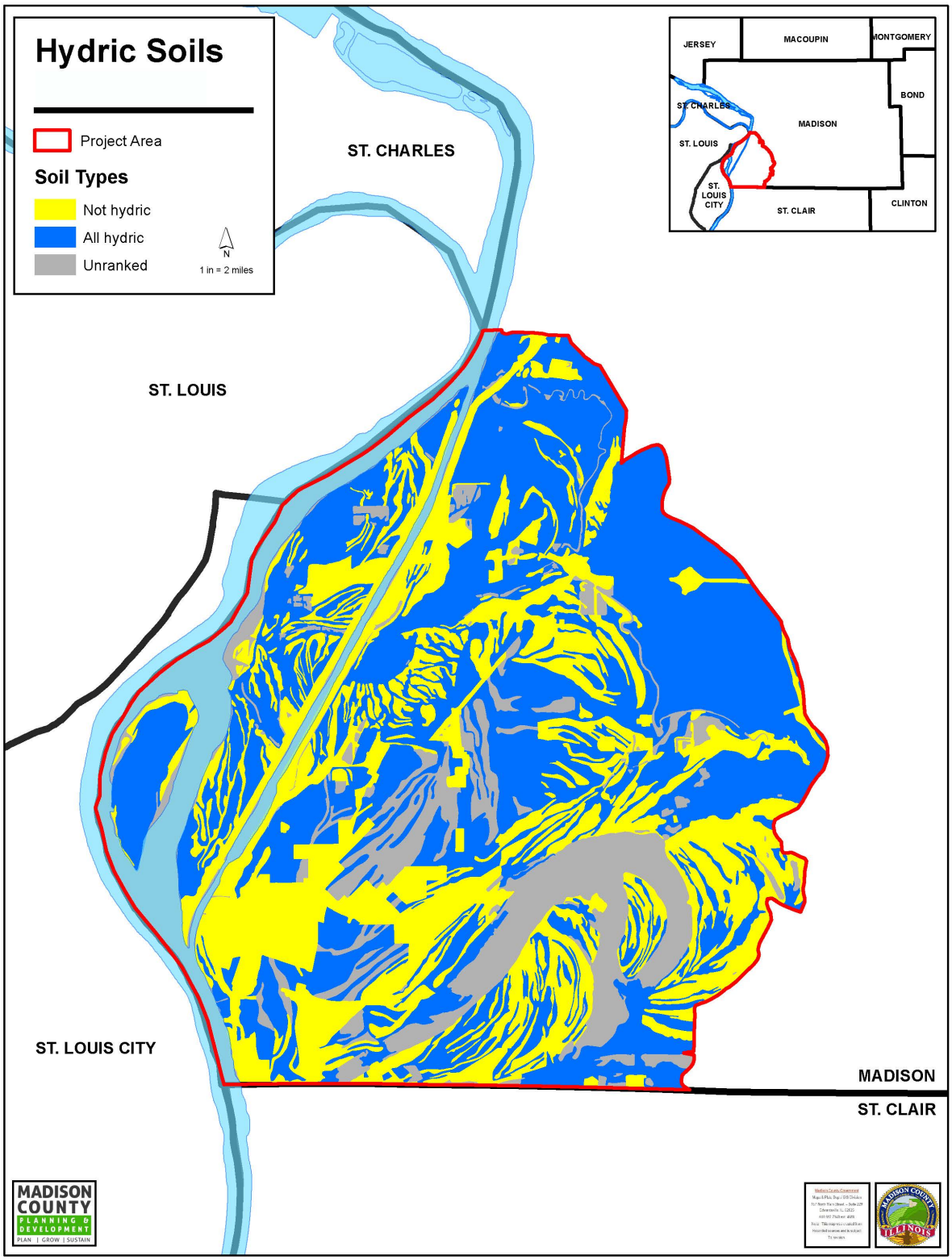
Table A.7: Soil types and their hydric status and acreage in the American Bottom project area.

Map Symbol Code	Soil Type (SSURGO map unit name)	Hydric Soil?	Hydric Soils area (acres)
B	Beaucoup silty clay loam, 0 to 2 percent slopes	Yes	830
B/D	Beaucoup silty clay loam, 0 to 2 percent slopes	Yes	828
B/D	Ambraw silty clay loam, 0 to 2 percent slopes	Yes	25
C/D	Birds silt loam, 0 to 2 percent slopes	Yes	76
D	Beaucoup silty clay loam, undrained, 0 to 2 percent slopes	Yes	1469
D	Darwin-Aquents-Urban land complex, 0 to 2 percent slopes	Yes	508
D	Darwin silty clay, 0 to 2 percent slopes	Yes	5324
Total			9,060

Table A.8: Hydric soils by acreage and percentage

Hydric Soil	Area (acres)	Percent of Project Area
Hydric Soils	9,060	21%
Non-Hydric Soils	34,187	79%
Total	43,247	100%

Figure A.14: Hydric and non-hydric soils in the American Bottom project area.



Highly erodible soils

Over time, soils exhibit some degree of risk of erosion from water and wind. Certain soils are highly erodible due to a combination of natural and human-influenced factors. Some of the natural properties of soils that make them susceptible to erosion include low permeability (<0.6 in/hour), high silt content (soil particles that measure between 0.002 to 0.53 mm diameter), significant slope (>5%), and low water holding capacity. Human activities that affect soil erosion include agriculture, especially tillage operations; livestock grazing; urbanization; and construction. No single soil property determines whether a soil will erode. Rather, it is a combination of all properties interacting simultaneously. The Natural Resources Conservation Service uses the Universal Soil Loss Equation (USLE) to calculate a potential average annual rate of sheet and rill erosion. That value is divided by a predetermined soil loss tolerance level (T) to determine if a soil is highly erodible. Variables entered into the USLE include rainfall, the degree to which a soil resists water erosion, slope length, and slope steepness to determine the potential average annual rate of sheet and rill erosion. The T-level represents the maximum annual rate of soil erosion that could occur without causing a decline in long-term productivity.

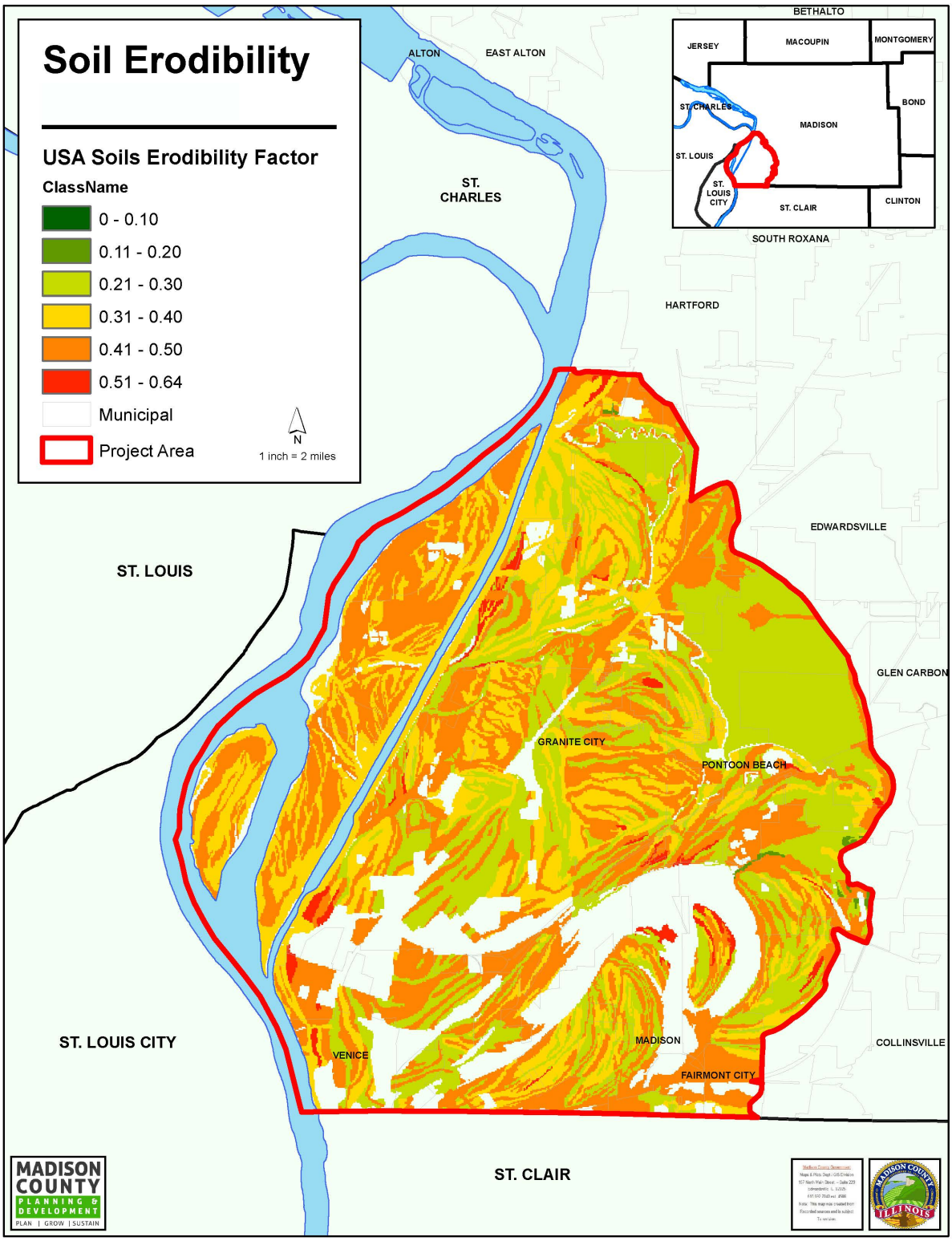
The Madison County Soil Survey was used as the primary reference for identifying highly erodible soils in the watershed. The soil survey is the most authoritative source of soils data for the watershed because it is was developed with a considerable amount of field observations combined with GIS modeling. Calculations based solely on GIS modeling can overestimate or underestimate the extent of actively eroding soils. The Madison County Soil Survey identifies which soils are currently classified as eroded or severely eroded. These soils all shared the similar properties of steep slopes (5 to 18%) and high silt content (55 to 72%). Several soil types that exhibited these same properties but were not currently classified as eroded or highly eroded were also added to the list of highly erodible soils.

Erodible soils are present throughout the watershed mostly near the Chain of Rocks Canal (Figure A.15). Most of the project area consists of soils that do not readily erode.

Table A.9: Soil erodibility by area and percentage in the watershed.

Erodibility	Acres	Percentage of Watershed
None - deposition	28,030	65%
Erodible (Class 1)	3,072	7%
Unknown	12,132	28%
Total	43,247	100%

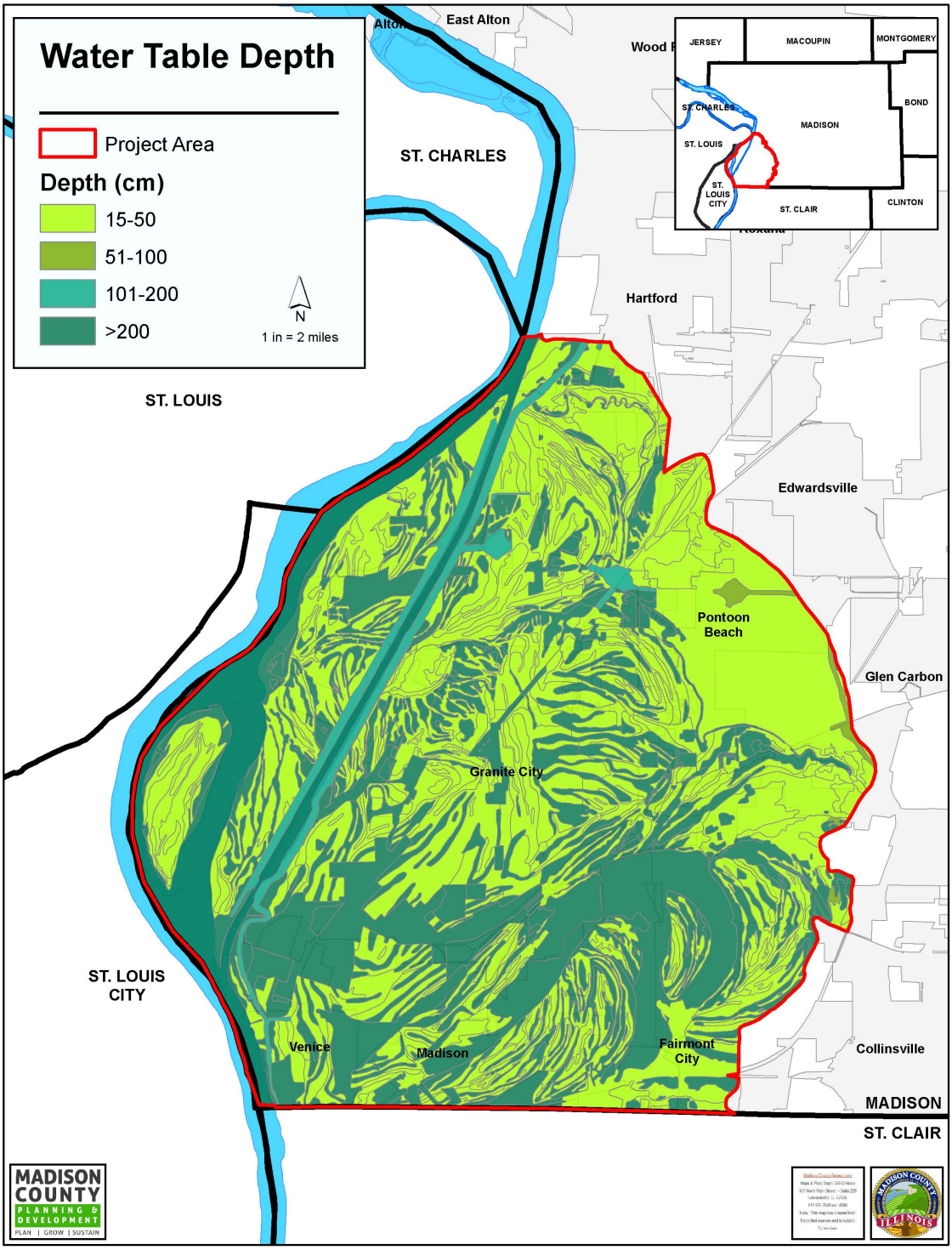
Figure A.15: Highly erodible soils identified using erodibility classifications from the Madison County Soil Survey for the American Bottom project area.



Water Table

The depth of the water table is < 50 centimeters in the soils covering 78% of the project area (Figure A.16). The soils in 3% of the project area have a water table 100 cm or more below the surface.

Figure A.16: Water table depths by soil type according to Madison County soil surveys for the project area.



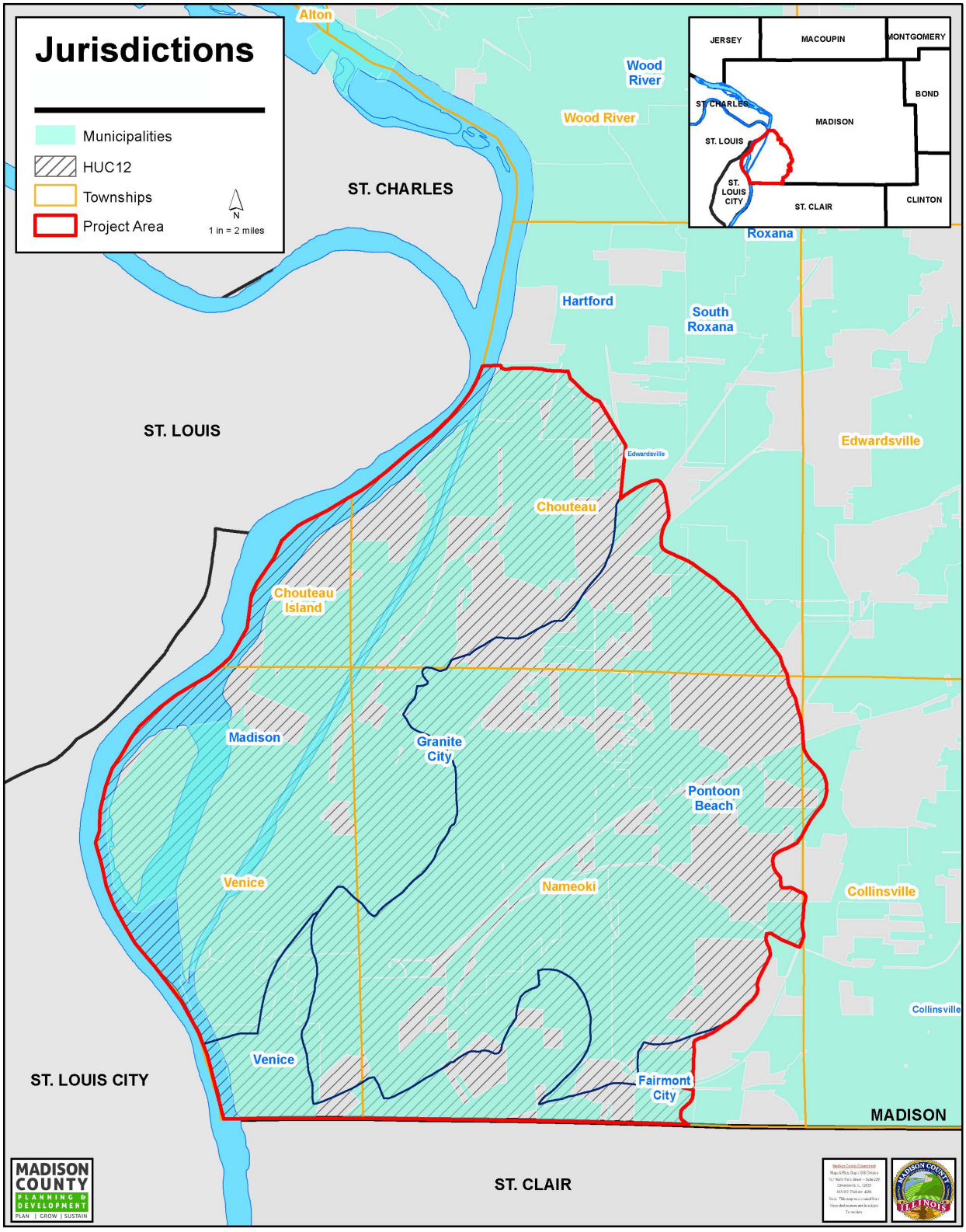
Watershed Jurisdictions

The American Bottom watershed is located in one county, five townships, and seven municipalities (Table A.10 and Figure A.17).

Table A.10: County, township, unincorporated, and municipal jurisdictions within the American Bottom watershed.

Jurisdiction	Area (acres)	Area within Watershed (acres)	Percent of Watershed
Madison County (inclusive of municipalities)	473,770	43,320	34%
Municipalities	47,779	30,184	23%
Edwardsville	12,839	282	0%
Fairmont City	658	619	0%
Granite City	13,114	13,114	10%
Hartford	3,460	627	0%
Madison	8,681	8,681	7%
Pontoon Beach	7,862	5,696	4%
Venice	1,164	1,164	1%
Unincorporated Areas	131,674	13,136	10%
Townships	77,449	43,320	34%
Chouteau	20,680	11,161	9%
Collinsville	22,839	150	0%
Granite City	9,333	9,333	7%
Nameoki	15,361	13,439	10%
Venice	9,236	9,236	7%

Figure A.17: County, township, unincorporated and municipal jurisdictions within the American Bottom watershed.



Jurisdictional roles

Several government entities at federal, state, and local levels have jurisdiction over watershed protection.

Federal and State Entities

USACE administers a regulatory program under Section 404 of the Clean Water Act. USACE, St. Louis District regulates the discharge of dredged or fill material into waters of the U.S. including wetlands. Any project that requires a work activity within a river, creek, stream, tributary, lake or wetland should consult with the USACE, St. Louis District Regulatory Branch. In conjunction with USACE, the IEPA processes applications for Section 401 water quality certification when projects require the discharge of dredged or fill material into waters of the U.S.

The Interagency Wetlands Policy Act of 1989 (IWPA) established a wetland regulatory program separate from the federal §404 permitting program under the Clean Water Act (CWA). The IWPA authorizes the Illinois Department of Natural Resources (IDNR) to regulate state-funded projects and activities that affect state wetlands. In summary, the IWPA of 1989 requires that state projects and state funded projects must achieve a goal of no net loss of wetlands.

The U.S. Fish and Wildlife Service (USFWS), Illinois Department of Natural Resources (IDNR), and Illinois Nature Preserves Commission (INPC), play a critical role in protecting high quality habitat and threatened and endangered species, often on land that contains wetlands, lakes, ponds, and streams.

The IEPA Bureau of Water regulates wastewater and stormwater discharges to streams, rivers, and lakes through the National Pollutant Discharge Elimination System (NPDES). The NPDES Phase I Stormwater Program applies to large and medium-sized Municipal Separate Storm Sewer Systems (MS4s), several industrial categories, and construction sites hydrologically disturbing five acres of land or more. The NPDES Phase II program covers additional MS4 categories, additional industrial coverage, and construction sites hydrologically disturbing more than one acre of land. Under the NPDES Phase II program, all municipalities with small, medium, and large MS4s are required to complete a series of Best Management Practices (BMPs) and measure goals for six minimum control measures, including public education and participation, illicit discharge detention, construction site runoff control, and pollution prevention. (12)

For construction sites over one acre in size, which are covered by the NPDES Phase II Program, the developer or owner must comply with all requirements including developing a Stormwater Pollution Prevention Plan (SWPPP) that shows how the site will be protected to control erosion and sedimentation and completing final stabilization of the site. Several municipalities and companies in the Judy's Branch watershed have been issued NPDES permits by Illinois for stormwater discharges to MS4s.

The county Soil and Water Conservation Districts (SWCDs), under NRCS, influence watershed protection through soil and sediment control and pre and post-development site inspections. They also provide technical assistance to regulatory agencies and the public.

Local Government

Watershed protection in Madison County is primarily the responsibility of county and municipal level government. County Boards oversee decisions made by county governments and have the power to adopt, override, and alter policies and regulations. County departments, especially those with functions

of planning, zoning, and development, help shape the policies enacted in the unincorporated areas. Local municipalities also have ordinances that address other natural resource issues, which can include conservation development, Special Service Area (SSA) or watershed protection fees, and native landscaping.

Madison County Planning and Development regulates land development in unincorporated Madison County. Madison County enforces floodplain development regulations in its Zoning Ordinance, construction and fill activities in its Fill Ordinance, future development in its Land Use Plan, regulations on new housing subdivisions in its Subdivision Ordinance, and stormwater management regulations in its Stormwater Ordinance. Madison County is also a member of the National Flood Insurance Program (NFIP). Madison County's Stormwater Ordinance (amended in 2007) regulates development activities, which alter stormwater flows and enables the county to comply with NPDES regulations. The ordinance requires several types of development activity proposed in the unincorporated area of the county to obtain a permit, including any land disturbing activity if the activity is within 25 feet of a river, lake, pond, stream, sinkhole, or wetland. Madison County is also currently in the process of adopting a Stormwater Plan, which will guide future stormwater management activities.

Several municipalities in Madison County have passed similar ordinances. Edwardsville, Granite City, and Pontoon Beach have passed Subdivision Ordinances and Zoning Ordinances. Edwardsville and Pontoon Beach have also passed Drainage Ordinances. Other municipalities in Madison County may have passed these ordinances as well; these were the participating jurisdictions in the draft Madison County Multi-Jurisdictional All Hazards Mitigation Plan. (5) Many municipalities in the watershed are members of the NFIP and have passed Floodplain Ordinances (see Flooding section for more information).

The Madison County All-Hazard Mitigation Plan also includes a summary of planning documents in effect for the county and municipalities (Table A.11).

Table A.11: Existing planning documents by jurisdiction, of the municipalities in the American Bottom watershed that participated in the Hazard Mitigation Plan, excerpt from Figure 7 in that plan (5).

Existing Planning Documents	Madison County	Edwardsville	Granite City	Pontoon Beach
Plans				
Comprehensive Plan	X	X		
Emergency Management Plan	X	X	X	
Land Use Plan	X	X		
Codes and Ordinances				
Building Codes	X	X	X	X
Drainage Ordinances	X	X		X
Historic Preservation Ordinance	X	X	X	
Subdivision Ordinance(s)	X	X	X	X
Zoning Ordinances	X	X	X	X
Maps				
Existing Land Use Map	X	X		X
Infrastructure Map	X	X		
Zoning Map	X	X	X	X
Flood-Related				
Flood Ordinance(s)	X	X	X	X
Flood Insurance Rate Maps (FIRMs)	X	X	X	X
Repetitive Flood Lost List	X	X		
Elevation Certificates for Buildings	X	X	X	

Stakeholder Outreach to Municipalities

The planning team has met with more than 250 individuals from 25 entities to date. Municipalities were asked about their drinking water source(s), wastewater treatment system(s), and flooding, as well as other issues such as erosion, siltation, and water quality. Other stakeholders were asked about these issues in their jurisdiction or on their property.

Drinking water

Three out of six municipalities acquire their water supply from Illinois American Water, which obtains its water from the Mississippi River. Edwardsville and Hartford use wells to obtain their water. Private wells supply many individual residences and businesses with water throughout both watersheds, particularly in unincorporated areas. (13)

Wastewater treatment

Municipal wastewater treatment in the watershed is largely conducted at facilities within municipal boundaries. At least three of the seven municipalities use the wastewater treatment facility just west of Granite City (Granite City, Pontoon Beach, and Madison). It is probable that Venice also sends its waste

to this plant as well. The other three municipalities only have small portions within this watershed (Edwardsville, Fairmont City, and Hartford). It is not known whether these sectors of the municipalities send their wastewater to a facility in another jurisdiction for treatment.

Granite City and Madison have combined sewers (sanitary and stormwater system combined). Several other municipalities acknowledged that leaks in the sanitary sewer infrastructure might inadvertently be creating combined sewers by letting stormwater seep in. Edwardsville shared with the project team that the city treats much more wastewater than it provides as water supply (1.85 times the amount of water supplied, based on 2014 data). This shows that a lot of rainwater/groundwater is entering its sanitary sewer system, and illustrates the huge impact of inflow and infiltration (I&I) on the sewer infrastructure.

Private sewage systems, such as septic systems, are not very common within municipal boundaries. Outside of municipal boundaries, nearly all properties have individual private sewage treatment systems. Municipalities and Open House attendees reported occasional bad smells from private sewage systems, which may indicate malfunctioning systems. (13)

Flooding

Urban flooding was probably the most important issue to the municipalities interviewed, and all had experienced at least some flooding in developed areas. Several municipalities and other stakeholders reported flooding in their jurisdictions, on their properties, and on the roads around them. Parts of several municipalities are in the 100-year floodplain. Several individuals reported more frequent, intense storms, beavers, and logjams as contributing factors to flooding. The biggest flooding issue in Granite City is along the Nameoki Ditch corridor. Water backs up two to three feet into the neighborhoods along both sides, and overtops Nameoki Road.

America's Central Port has seen flooding on and around its property, including two feet of water overtopping Route 3 near the entrance to their facility in the summer of 2016. Water was located in parking lots and streets, but did not flood any buildings.

Pontoon Beach also has significant flooding problems. Citizens had to be rescued by boat in the December 2015 floods. Long Lake is surrounded by numerous homes but only has one outfall to release water to Horseshoe Lake. The county is putting $150,000 towards building an additional outfall, but the city still needs a $400,000 loan to complete it.

The Gateway Commerce Center warehouses have been blamed for causing downstream flooding, even though the warehouses were there before some of the houses were built that have submitted the complaints. The warehouses were required to use detainment systems to hold back at least the same amount the land did before and then release it at a slow rate determined by the USACE. Unfortunately, each of the warehouses were built separately and each have its own detention system.

The Village of Madison also has some flooding issues. Most of these issues consist of basement flooding that people use backflow prevention valves and sump pumps to help manage. In a four to six inch rainfall, the water rises to push the covers off manholes. Other than these issues, there are no severe flooding issues.

Flooding was the most discussed topic during the 2016 and 2017 Open House events. At the 2016 Open Houses, participants reported that many of the homes in the floodplain with flooding issues were built in the 1960s, before the floodplains had even been delineated. In 2017, flooding in Pontoon Beach and

Granite City was mentioned, along with flooding of farmland upstream of Horseshoe Lake. (13)

Erosion

Several municipalities highlighted soil erosion issues within their municipal boundaries along creeks and ditches.

Siltation and Sedimentation

Siltation was an issue for several communities who noticed reduction in the capacity of retention basins and lakes because of increasing silt and sediment deposition. Horseshoe Lake is three to four feet deep in some areas now, and has lost a lot of capacity. Dredging should help with drainage of Mitchell, Pontoon Beach, and Granite City if IDNR allows the water level to drop. Horseshoe Lake is maintained at the 404-foot level. Nameoki Ditch in Granite City has also accumulated a lot of silt and sediment (MESD is responsible for maintenance). Long Lake in Pontoon is privately owned, so it is hard arrange dredging. MESD staff say silt is their biggest problem. They report that more silt per cubic foot comes in from Judy's Branch creek than is carried in the Mississippi River. They have talked about adding baffles to settle out some of the silt up on the bluffs before the water comes down. (13)

Surface water quality issues

There are several 303(d) impaired waters in the watershed, which affects municipalities and landowners. America’s Central Port noted that when companies have looked into using groundwater in the area, it had levels of magnesium that were too high. Drinking wells are also not permitted in this area. (13)

Recreation

Water-based recreation takes place on and around Long Lake, Horseshoe Lake, and the Mississippi River at Chouteau Island. Other lakes and ponds in subdivisions often offer boating and fishing opportunities to neighborhood residents. The Madison County Transit (MCT) trail spans the levee by the river and then connects to other inland trails throughout the county.

A summary of the input from municipalities can be found in Table A.12. (13)

Table A.12: Summary of municipal input from stakeholder engagement. Gray cells indicate that the watershed planning team was not able to meet with the municipality. Information on water supply and wastewater treatment for communities not met with is from the Safe Drinking Water Information System (SDWIS) and the Integrated Compliance Information System (ICIS) from U.S. EPA.

	Drinking water supply				Wastewater treatment systems			Flooding		Other issues			
Municipality	Municipal Groundwater (wells)	Municipal surface water	Purchased groundwater	Purchased Surface water	Municipal WWTP	Private Sewage	Combined Sewers	Urban flooding	Riverine flooding	Erosion	Siltation	Surface water quality issues	Water-based recreation
Edwardsville	X				X	X		X		X		X	X
Fairmont City													
Granite City				X		X	X	X			X	X	X
Hartford	X							X					
Madison				X		X	X	X				X	X
Pontoon Beach				X	X	X		X			X	X	X
Venice													
Collinsville Township	n/a	n/a	n/a	n/a	n/a	n/a	n/a	x	x	x	x	x	
Other Townships													

Demographics

Population

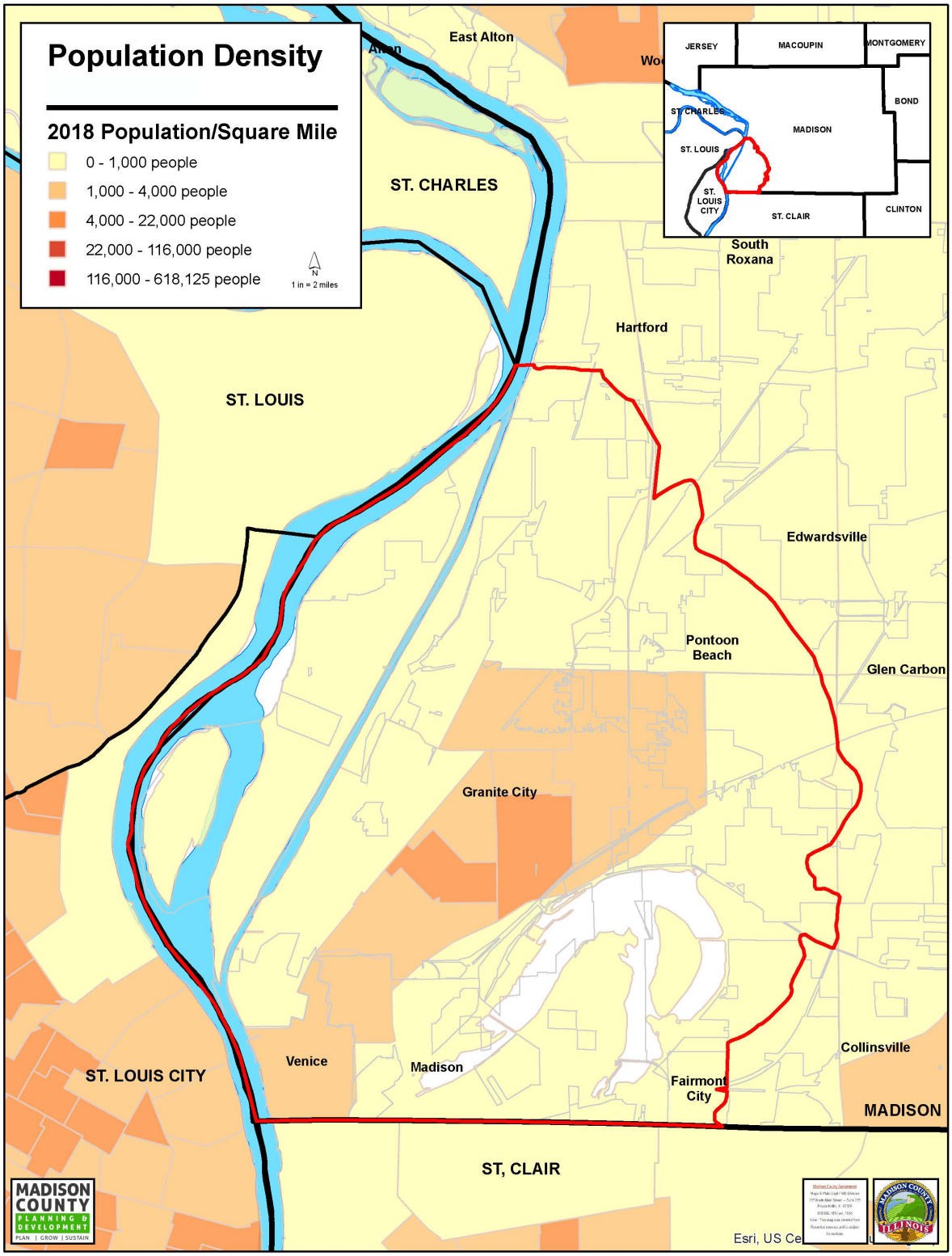
The 2010 U.S. Census found a population of approximately 42,825 in the Madison County portion of the Judy's Branch watershed. Of the municipalities represented within the project area, Granite City has the largest population (within Madison County), with 29,849 people as of the 2010 Census. The least populous municipalities in the project area include Venice and Fairmont City (Table A.13).

Population density varies throughout the watershed. The average population density within the project area is 101 to 1,000 people per square mile. The lowest population density is 100 or fewer people per square mile in several of the municipalities, and the highest population density is 1,001 to 10,000 people in parts of Venice, Madison, Granite City, and Pontoon Beach. (Figure A.18).

Table A.13: Population of the municipalities represented in the project area from the 2010 Census, official 2016 population estimate, and approximate population in each municipality living in the Project Area.

Municipality	Population (2010 Census)	Population (2016 Est)	**Approx. Population** in the **watershed (2010 Census)**
Edwardsville	24,293	25,071	534
Fairmont City	2,635	2,482	2,635
Granite City	29,849	28,908	29,849
Hartford	1,429	1,378	259
Madison	3,891	3,846	3,891
Pontoon Beach	5,836	5,609	3,767
Venice	1,890	1,905	1,890

Figure A.18: Population density by census block in the American Bottom project area, according to 2012 estimates



Population Change

Madison County experienced a population growth of 9,891 people from 2000 to 2010, which is a 3.8% increase.

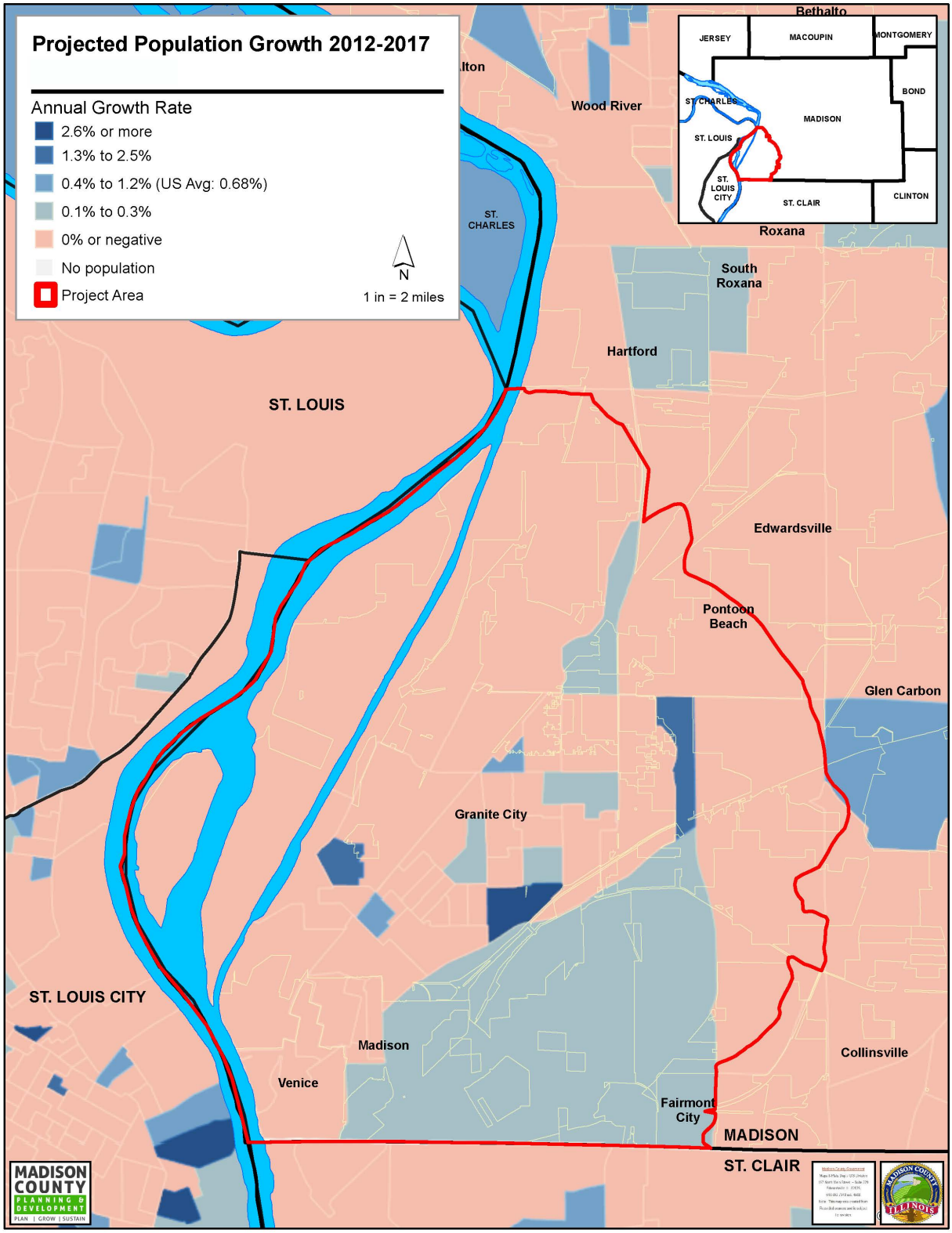
Madison County is projected to experience an actual population growth of more than 6,778 people, a 2.5% increase in population, from 2015-2025 (Table A.14). A different estimate of Madison County's projected population growth under a slow-growth scenario by the East-West Gateway Council of Governments puts Madison County's population at 290,143 in 2030, an 8.6% increase from 2013.

Madison County has a higher projected growth rate compared to the national average annual growth rate for this time period, which is 0.68%. Some parts of the watershed will experience this higher growth rate, while other areas are expected not to grow or to lose population.

Table A.14: Population of Madison County represented in the project area from the 2000 and 2010 Censuses, with official 2015 population estimates and 2025 population forecasts, and percent change between 2015 and 2025. (10) (14)

Total Population	2000 Census	2010 Census	2015 Estimate	2025 Forecast	Change from 2015-2025 (# of people)	Percent Change from 2015-2025
Madison County	259,391	269,282	266,209	272,987	6,778	2.5%

Figure A.19: Projected population growth between 2012 and 2017 in the American Bottom project area from the U.S. Census five-year population estimates.



Median Income

Median income can be an indicator of financial ability to make improvements to property, such as improved septic systems. The average Median Family Income of the municipalities either partially or wholly within the watershed is $33,359. The median family income in Madison County is $53,431 (Table A.15).

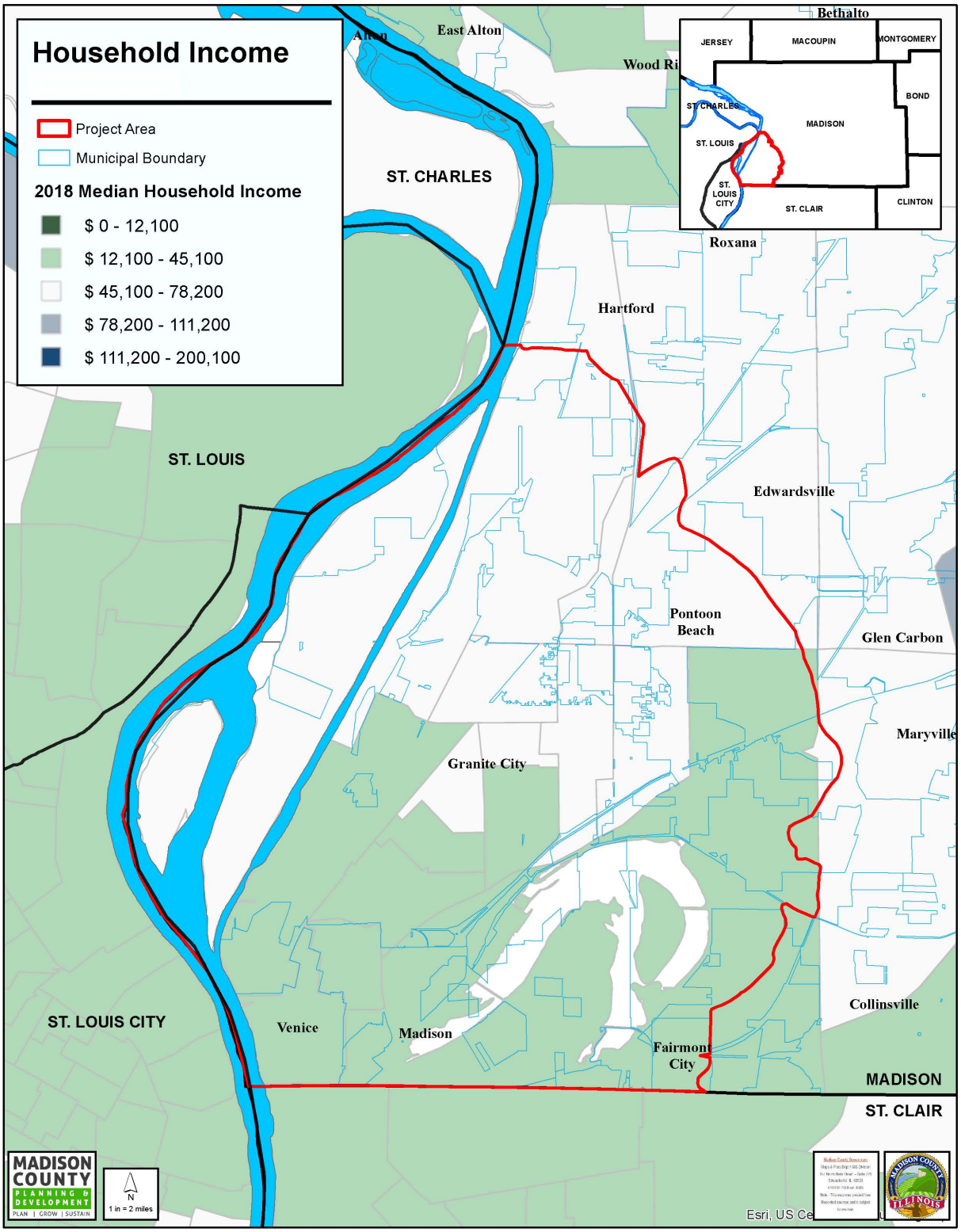
The municipalities with the highest median family income (upwards of $45,000) are Granite City, Pontoon Beach, and Edwardsville. The municipality with the lowest proportion of people with income below the poverty level is Edwardsville with 12.4%.

The municipalities with the lowest median family income (less than $25,000) are Madison and Venice. These same communities also had the highest percentages of people with income below the poverty level.

Table A.15: Median family income and poverty in the municipalities and counties in the project area. (14)

Community	Median Family Income (2015 inflation-adjusted dollars)	Percentage of people whose income in the past 12 months is below the poverty level (2015)
Edwardsville	$71,057	12.4%
Fairmont City	$33,365	30.6%
Granite City	$45,357	17.0%
Hartford	$41,667	14.5%
Madison	$22,266	37.8%
Pontoon Beach	$45,304	24.6%
Venice	$20,505	39.9%
AVERAGE	$33,359	30.0%
Madison County	$53,431	13.3%

Figure A.20: Median household income by census block in the American Bottom project area.



Employment

Employment can be an indicator of future growth and development in an area. Madison County experienced a 4.4% increase in the number of jobs between 2010 and 2015 (Table A.16). In 2015, the three industry sectors with the largest number of jobs were government (16,737 jobs), retail trade (15,264 jobs), and health care/social assistance (15,012 jobs). From 2010 to 2015, jobs in service related industries grew 6.9%. The sectors that added the most new jobs were transportation and warehousing (1,875 new jobs), accommodation and food services (1,380 jobs), and administrative and waste services (903 new jobs). The number of government jobs was relatively static, decreasing by 3.6%. Jobs in non-service industries shrank 1.9%, from 21,642 to 21,241 jobs.

Table A.16: Percentage of the workforce working in non-services, services, and government sectors in 2010 and 2015, & percentage change in that time. (15)

	Madison County		
	2010	2015	% Change 2010-2015
Percent of Total			4.4%
Non-Services Related	17.4%	16.4%	-1.9%
Farm	1.1%	0.9%	-12.5%
Forestry, Fishing & Related Activities	0.1%	0.1%	2.8%
Mining (including fossil fuels)	0.4%	0.4%	-1.7%
Construction	6.4%	5.7%	-7.4%
Manufacturing	9.3%	9.2	3.2%
Services Related	68.7%	70.7%	6.9%
Utilities	0.3%	0.4%	18.3%
Wholesale Trade	2.8%	3.0%	12.9%
Retail Trade	11.8%	11.8%	3.9%
Transportation & Warehousing	4.9%	6.1%	30.8%
Information	0.8%	0.8%	0.2%
Finance & Insurance	5.2%	4.5%	-9.6%
Real Estate, Rental & Leasing	3.1%	3.1%	3.4%
Professional & Technical Services	4.9%	4.9%	4.5%
Management of Companies & Enterprises	0.6%	0.5%	-12.8%
Administrative & Waste Services	4.0%	4.6%	18.1%
Educational Services	1.2%	1.2%	3.9%
Health Care and Social Assistance	11.9%	11.6%	1.2%
Arts, Entertainment & Recreation	2.4%	2.3%	-1.6%
Accommodation & Food Service	8.1%	8.9%	13.6%
Other Services (except public admin.)	6.6%	6.9%	9.2%
Government	13.9%	12.9%	-3.6%

Home Values

Investment and development in the American Bottom watershed has encouraged more people to buy homes to be near their place of work, local schools, and other amenities. Home values are an indication of a location's desirability, the income of community residents, and the tax base local governments have to support themselves and their activities, among other things. Changes in home values over time can show movement from a buyer's to a seller's market, or vice versa.

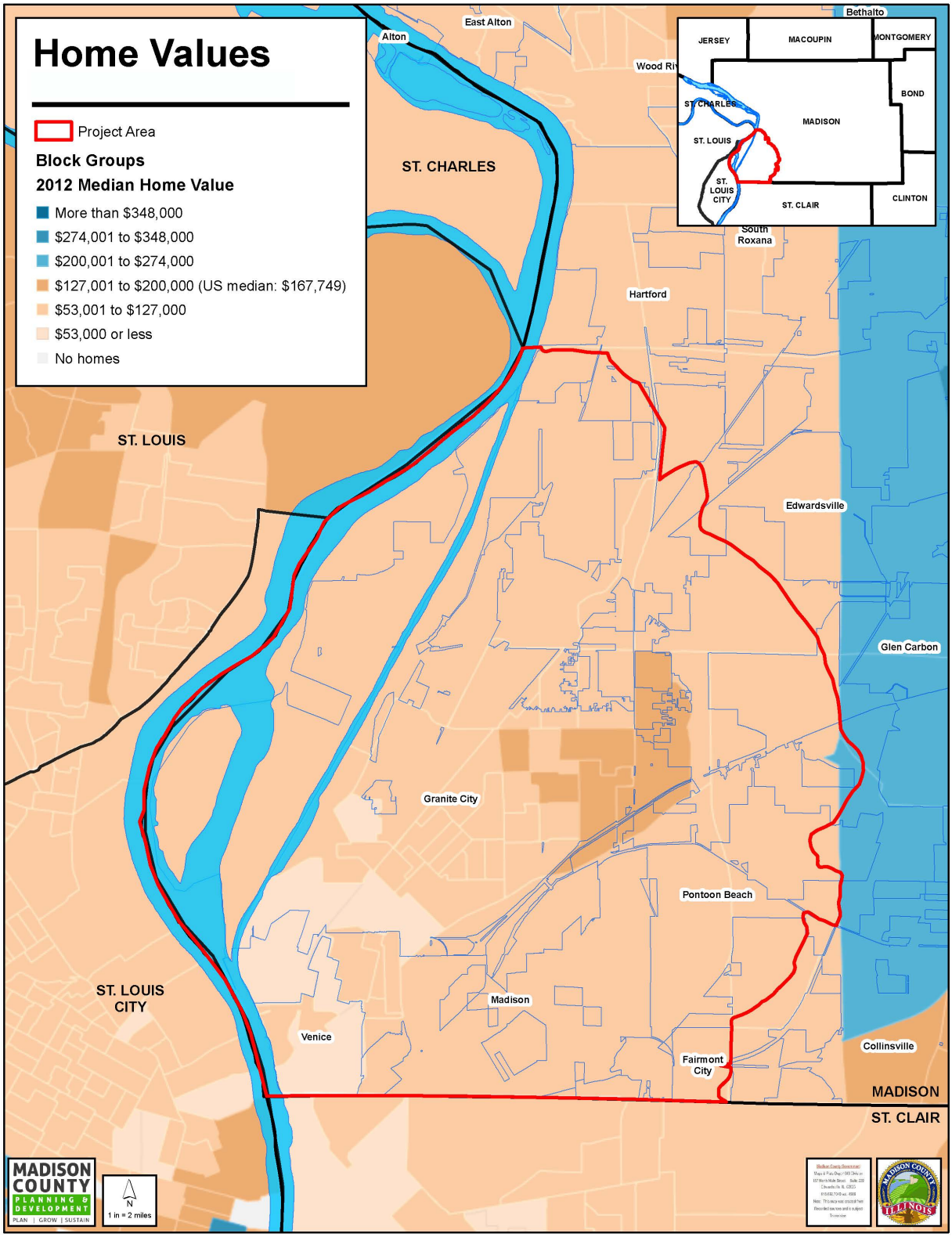
Estimates mapped by ESRI in 2012 show that median home values in the watershed are generally lower than the national average, $167,749. (16) According to data from housing website Zillow.com, the average median home price in the municipalities in the project area is $55,022 (Table A.27). The change in home values over the past year has increased 6.28%, and is predicted to increase another 1.69% over the next year.

Few homes in the watershed have negative equity, meaning the market value of the property has fallen below the outstanding amount of the mortgage secured on it. The percentage is similar to the U.S. average of 0.1% (as of June 2017). Approximately 0.0% of homes are delinquent on their mortgages in the two counties, which is the same as the 0.0% U.S. average (as of June 2017).

Table A.17: Home values, recent and predicted change in home values, and percentages of homes with negative equity and that are delinquent on their mortgages. (17)

Community	Median home value	Change in home values	Predicted change in home values	Homes with negative equity	Delinquent on mortgage
Edwardsville	$176,100	1.6%	1.6%	0.1%	0.0%
Fairmont City	$47,700	2.6%	1.4%	No Data	No Data
Granite City	$65,400	-0.3%	0.2%	0.2%	0.0%
Hartford	$58,900	12.4%	2.5%	0.2%	0.0%
Madison	$46,900	13.8%	2.6%	0.2%	0.0%
Pontoon Beach	$116,600	9.9%	2.9%	No Data	No Data
Venice	$46,600	13.6%	1.8%	0.3%	0.0%
Madison County	$110,000	4.0%	1.7%	0.1%	0.0%

Figure A.21: Median home values from 2012 by census block for the American Bottom project area. (16)

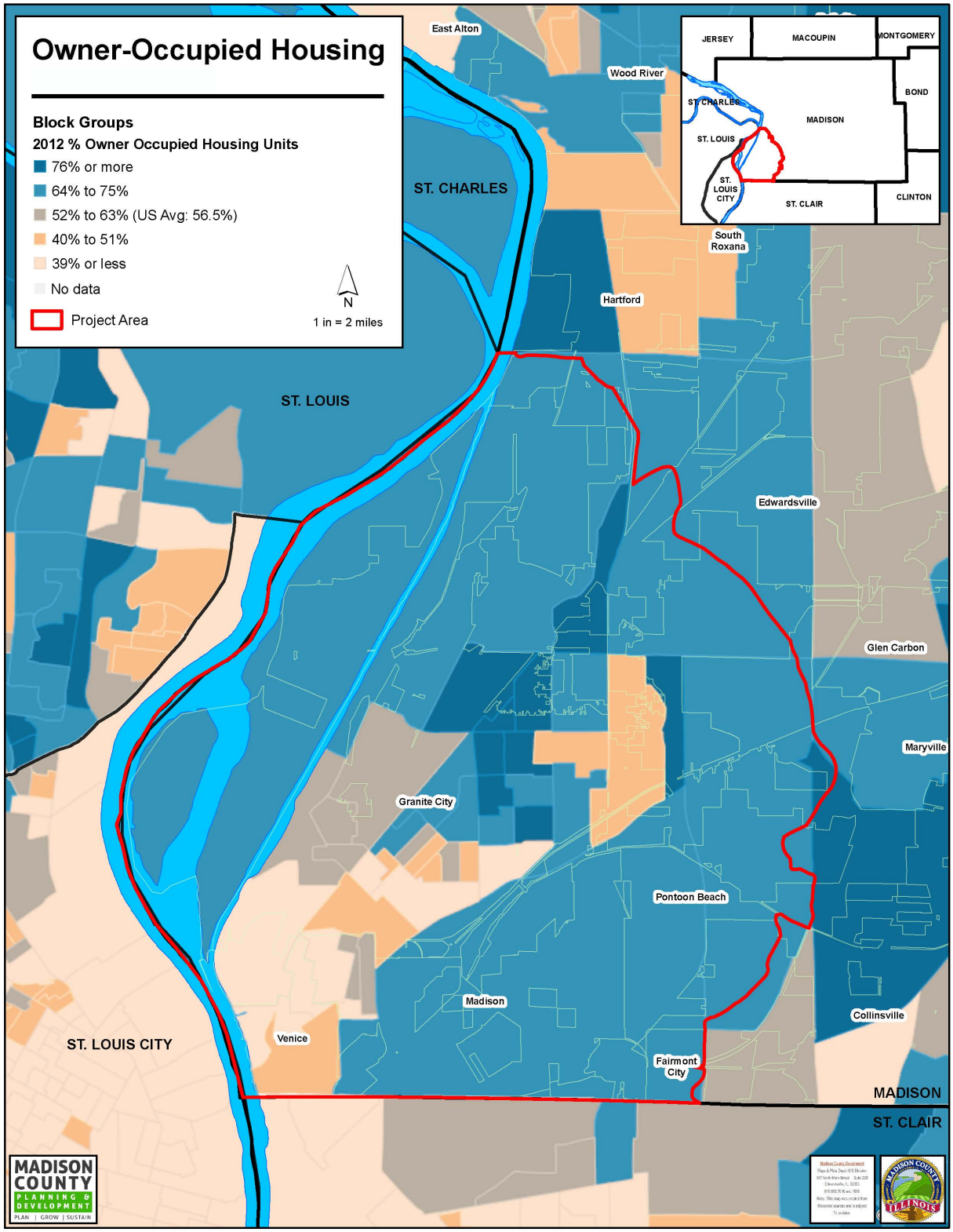


Owner-Occupied Housing

Homeownership rates can indicate transience or financial stability in a population. The U.S. Census Bureau defines the homeownership rate as the percentage of homes that are occupied by the owner, and presents homeownership data for states and major metropolitan areas. In both St. Louis and Illinois, homeownership rates have declined over the past 10 years. This change followed national trends associated with the economic recession and housing market collapse of the mid-2000s and the tendency for the millennial generation to rent homes instead of purchasing.

Owner occupied housing rates range between 15% and 88.4% across the Project Area as of 2012. The majority of the project area has rates greater than the national average of 57%. The St. Louis Metropolitan Area average is 71.2%. Rates are lower in municipalities, such as Venice and Madison. (Figure A.22). (18)

Figure A.22: Percent of owner occupied housing in 2012 by census block in the American Bottom project area.



Land Use/Land Cover

Land use/land cover data for the American Bottom watershed was collected from the 2011 National Land Cover Database (NLCD). Cultivated crops are the most common land use in the watershed at 10,423 acres or 24% (Table A.18). Other common land uses include developed, low density (7,159 acres, 17%), open water (7,079 acres, 16%), wooded wetlands (5,263 acres, 12%), and developed, open space (4,567 acres, 11%). Other land use areas that are a small percentage of the project area include medium and high intensity development, barren land, deciduous forest, grassland/herbaceous, hay/pasture, and emergent herbaceous wetlands.

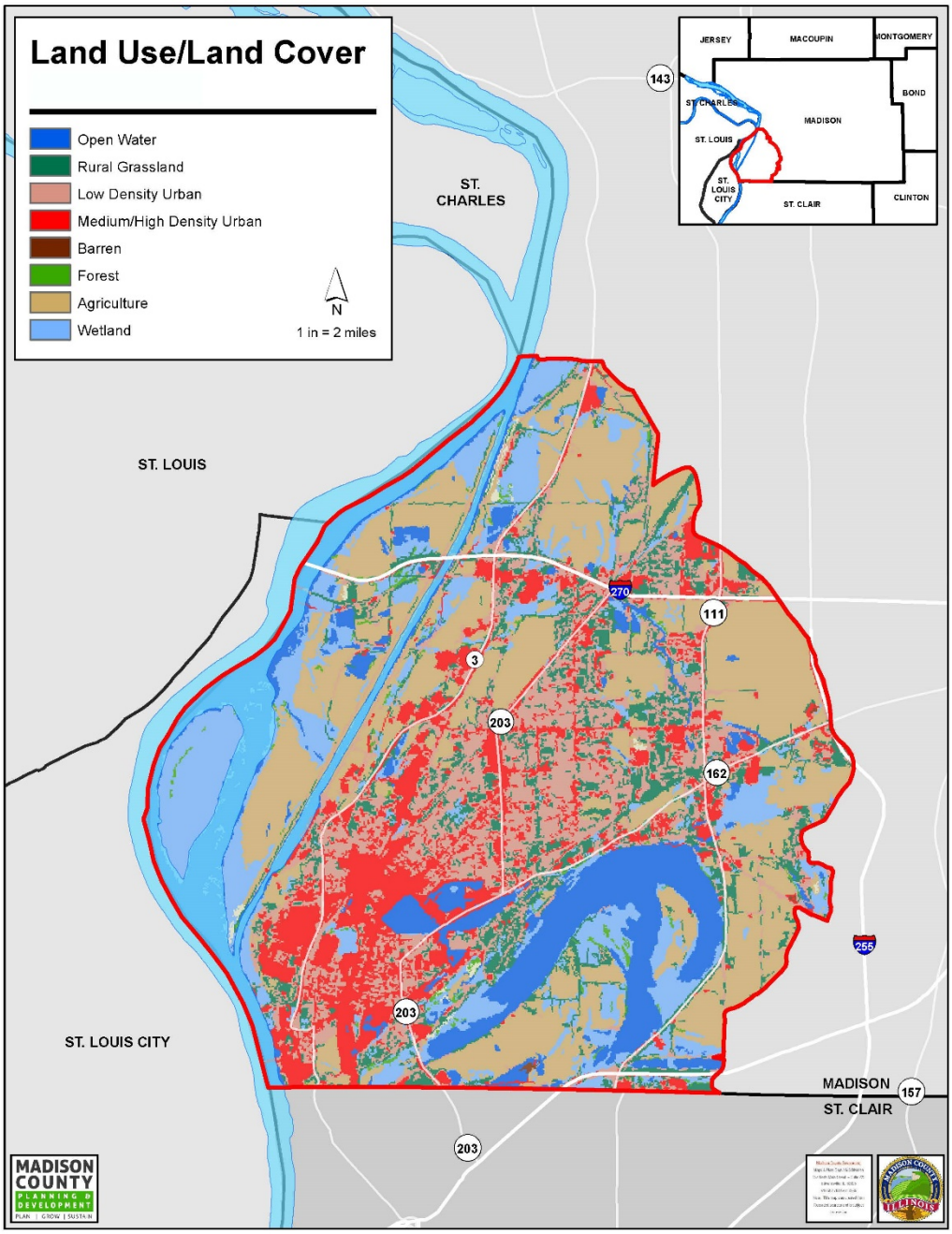
See Data Tables section for a detailed breakdown of land use by HUC14.

Table A.18: 2011 land use/land cover classifications and acreage in the American Bottom watershed.

Land **Use**	**Description**	Area **(acres)**	**Percent** of **Project Area** (%)
Cultivated Crop	Areas used for the production of annual crops, such as corn and soybeans. Crop vegetation accounts for greater than 20% of total vegetation. Includes all land being actively tilled.	10,423	24%
Developed, Low Intensity	Areas with a mixture of constructed materials and vegetation. E.g. single-family houses. Impervious surfaces cover 20-40% area.	7,159	17%
Open Water	Areas of open water, generally with<25% of vegetation or soil.	7,079	16%
Woody W**etlands**	Areas where forest or shrub land vegetation accounts for >20% of vegetative cover and the soil or substrate is periodically saturated or covered with water.	5,263	12%
Developed, Open Space	Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces cover <20% area. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.	4,567	11%
Developed, Medium Intensity	Areas with a mixture of constructed materials and vegetation. E.g. single-family houses. Impervious surfaces cover 50-79% area.	3,744	9%
Developed, High Intensity	Highly developed areas where people reside or work in high numbers. E.g. apartment complexes, row houses, commercial/industrial. Impervious surfaces cover 80-100% area.	2,401	6%
Hay/Pasture	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed of hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for >20% of total	1,431	3%
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for >80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	785	2%
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of tree species shed foliage with seasonal change.	265	1%
Herbaceous	Areas dominated by gramanoid or herbaceous vegetation, generally >80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.	110	0%

Land **Use**	**Description**	Area **(acres)**	**Percent** of **Project Area** (%)
Barren Land	Areas of bedrock, desert pavement, scarps, and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.	18	0%
Grand Total		43,245	100%

Figure A.23: Land use/land cover categories in the American Bottom watershed



Forest

Deciduous forest in the watershed contains a wide variety of tree species. On the uplands, dominant species include oaks and hickories. In the floodplains, water-tolerant species such as silver maple, cottonwood, sycamore, pecan, box elder and green ash tend to dominate. Forest currently covers approximately 1% of the project area.

Wetlands

Historically, Illinois lost 90% of its wetlands between the 1780s and 1980s, primarily because of farmland being drained for agriculture. The National Wetlands Inventory (NWI) represents the current extent, approximate location and type of wetlands in the United States, as determined using aerial imagery. Figure A.24 shows the wetlands in the American Bottom watershed, as reported in the NWI.

In the future, this area may be covered by NWIPlus—an enhanced National Wetlands Inventory database that includes attributes related to ecological functions. These functions include surface water detention, streamflow maintenance, sediment and particulate retention, carbon sequestration, shoreline stabilization, and provision of fish and shellfish habitat.

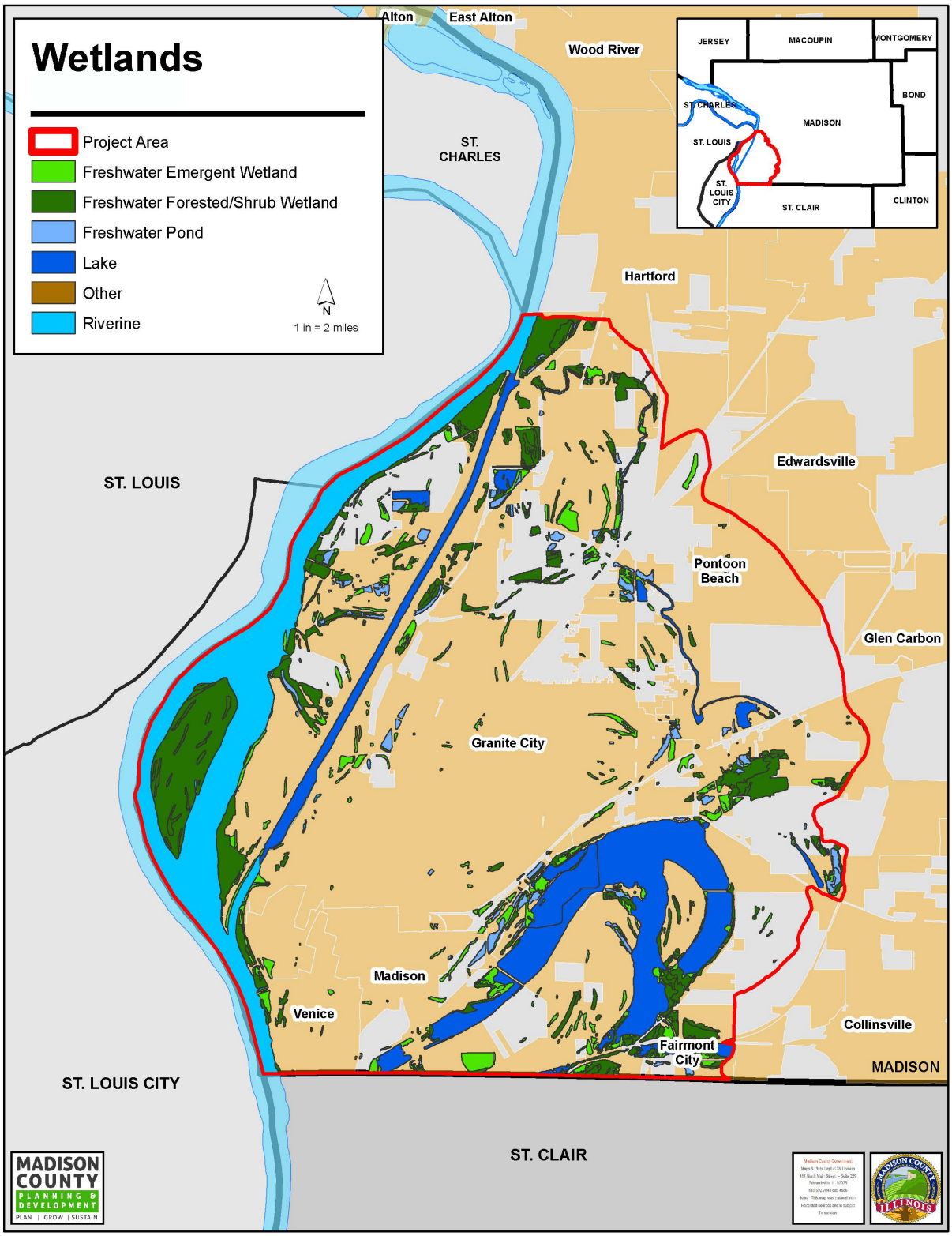
The Missouri Resource Assessment Partnership (MoRAP) created wetlands mitigation importance values and wetland restoration importance values for the watershed. Several layers of data—especially topography, soil type, and land cover—were used to create maps of existing wetlands, which it is highly important to protect, and areas that were formerly wetlands which it would be highly beneficial to restore. This work has been done previously for other areas in this region, as seen in the 2013 report, "Ecological Approach to Infrastructure Development: Wetlands Mapping and Analysis for the Mississippi and Mississippi River Floodplains."

According to the NWI, freshwater forested/shrub wetland is the most prevalent wetland type in the watershed (Table A.19), with riverine wetlands and lakes in the area as well. Field checks are needed to more accurately assess the extent of wetlands in the watershed and support the general inventory provided by the NWI. Approximately 11,587 acres (26.79%) of the watershed currently contains wetlands.

Table A.19: Wetland types and the area they occupy within the American Bottom project area.

Wetland Type	Area **(acres)**	**Percent** of **Project Area** (%)
Freshwater Forested/Shrub Wetland	3,396	7.85%
Riverine	3,210	7.42%
Lake	3,191	7.38%
Freshwater Emergent Wetland	1,272	2.94%
Freshwater Pond	518	1.20%
Total	11,587	26.79%

Figure A.24: Wetlands in the American Bottom project area as determined by the National Wetlands Inventory.



Ecological Significance

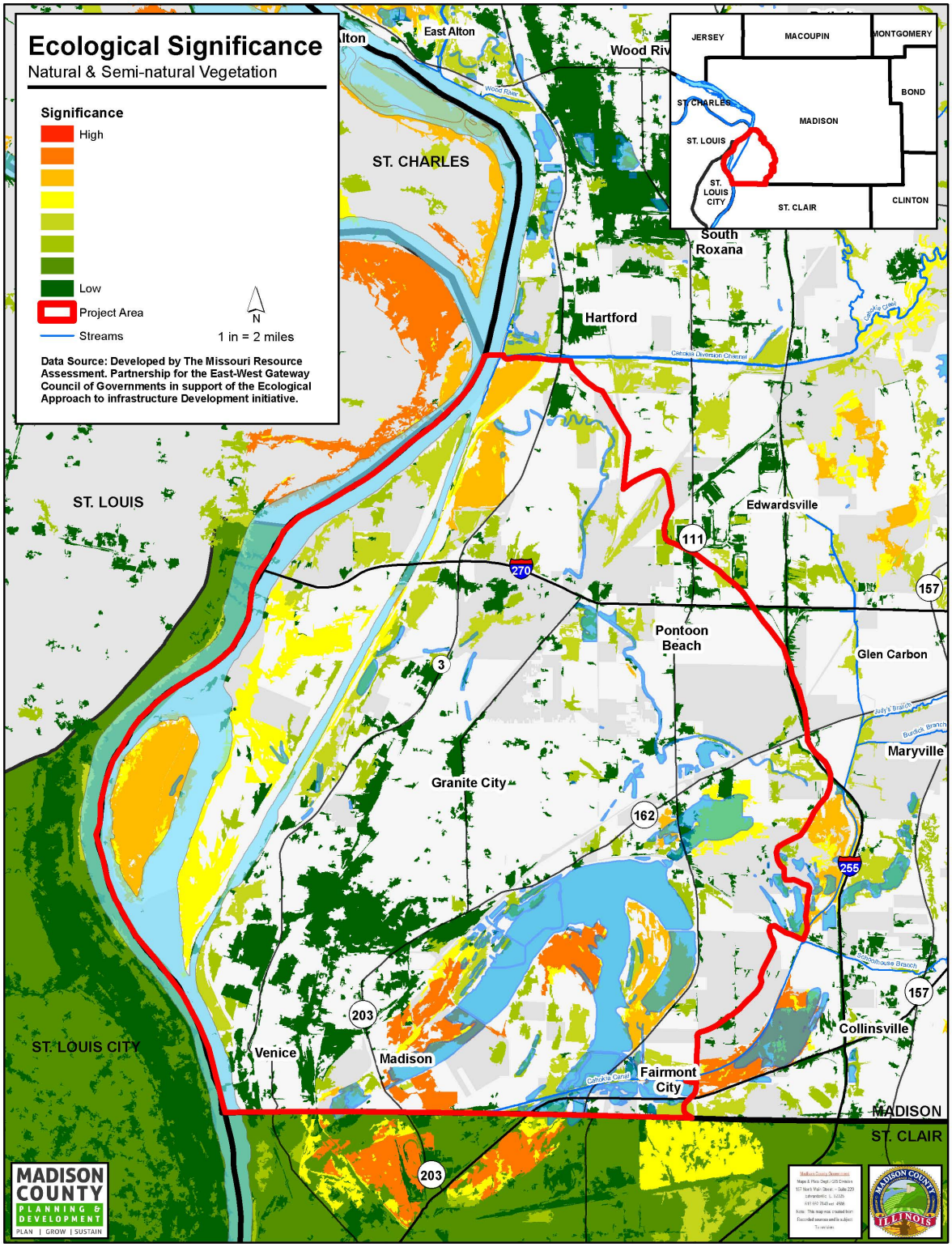
MoRAP and the East-West Gateway Council of Governments (EWG) created an ecological significance GIS data layer for EWG's eight-county planning region in 2010. The attribute variables important to ecological significance included the results of existing aquatic conservation assessments, vegetation type, vegetation patch size, natural diversity, occurrence of rare species, and land ownership (public/private). Eight tiers of importance were identified from high to low ecological significance.

In the American Bottom watershed, 71% of the land is considered to have Very Low ecological significance. Areas with the highest significance (tiers 2 and 3) in the project area include Mosenthein, Chouteau, and Gabaret islands and other areas adjacent to the Mississippi River and Horseshoe Lake, as shown in Figure A.25.

Table A.20: Ecological Significance classifications and acreage within the American Bottom project area.

Tier	Area **(acres)**	**Percent** of **Project Area** (%)
2 (Very High Significance)	682	2%
3 (High Significance)	1,955	5%
4 (Medium Significance)	1,932	4%
5 (Medium Low Significance)	2,340	5%
6 (Low Significance)	1,700	4%
7 (Very Low Significance)	30,695	71%
8 (Minimum Significance)	3,943	9%
Grand Total	43,247	100%

Figure A.25: Ecological significance attributes (out of eight tiers of importance) calculated by MoRAP and EWG for the American Bottom project area.



Threatened and Endangered Species

Ten animal and plant species are listed as threatened, endangered or proposed as threatened in Madison County. The most likely present species include the Northern long-eared bat, the decurrent false aster, and the eastern prairie fringed orchid. A full list of species is shown below in Table A.21.

Table A.21: Threatened and endangered species listed by the U.S. Fish and Wildlife Service as being present in Madison County. (19)

Species	Status	Range	Habitat
Mammals			
Indiana Bat (Myotis sodalist)	Endangered	Potential habitat statewide; Known occurrences in 28 counties in Illinois, including Madison	Caves, mines (hibernacula); small stream corridors with well-developed riparian woods; upland forests (foraging)
Northern long-eared bat (Myotis septentrionalis)	Threatened	Statewide	Hibernate in caves and mines – swarming in surrounding wooded areas in autumn; Roosts and forages in upland forests and woods
Reptile			
Eatern Massasauga (Sistrurus catenatus)	Proposed as Threatened	7 counties in Illinois, including Madison	Graminoid dominated plant communities (fens, sedge meadows, peatlands, wet prairies, open woodlands, and shrublands)
Fish			
Pallid Sturgeon (Scaphirhynchus albus)	Endangered	7 counties in Illinois, including Madison	Large rivers
Mussels			
Spectaclecase mussel (Cumberlandia monodonta)	Endangered	6 counties in Illinois, including Madison	Large rivers in areas sheltered from the main force of the current
Plants			
Decurrent false aster (Boltonia decurrens)	Threatened	20 counties in Illinois, including Madison	Disturbed alluvial soils
Eastern prairie fringed orchid (Platanthera leucophaea)	Threatened	82 counties in Illinois, including Madison	Mesic to wet prairies
Leafy prairie clover (Dalea foliosa)	Endangered	9 counties in Illinois, including Madison	Prairie remnants on thin soil over limestone

Fish

The Illinois Natural History Survey (INHS) keeps records of fish sampling in Illinois. Samples were taken in the American Bottom watershed at four locations on the Mississippi River, one location each on Horseshoe Lake and Cahokia Canal. Sampling occurred in 1963, 1970, 2006, and 2014. (20)

Twenty-one species of fish were found, and 124 individuals collected. Six of the 16 species are tolerant of various environmental perturbations, three are moderately tolerant, and two are moderately intolerant (U.S. EPA did not rate the other five). (21)

Crustaceans

The INHS Crustacean Collection database keeps records of crustaceans sampled in Illinois. Crustaceans were sampled at three locations in the American Bottom watershed. Sampling occurred in 1975, 1977, and 2014. Three species of crustaceans were found, and four individuals collected. (22)

Mussels

The INHS Mussel Collection database keeps records of mussels sampled in Illinois. Mussels were sampled at eleven locations in the American Bottom watershed. Sampling occurred in 1989, 2003, 2012 and 2013. Twelve species were found, and 41 individuals collected. (23)

Livestock and Domestic Animals

Animal (livestock) data is available from the USDA 2012 Agricultural Census database at the county level (Table A.22). (24) The watershed has no Concentrated Animal Feeding Operations (CAFOs) according to the IEPA data layer in the Resource Management Mapping Service (RMMS). (25)

Table A.22: Livestock in Madison County as of 2012.

Livestock	Madison County	
	Farms	Head
Cattle and calves	285	11,044
Hogs and pigs	14	8,885
Sheep and lambs	33	413
Goats	30	542
Equine	170	1,065
Poultry	87	

Agricultural Land Use/Land Cover

Illinois, and the American Bottom watershed, lies at the heart of the "Corn Belt." The area's gentle topography, moderate, wet climate, and location adjacent to the Mississippi River support agricultural success. However, the delivery of sediment to downstream water bodies from this landscape is an ongoing water quality problem. In 2009, the USDA NRCS launched the 13-state Mississippi River Basin Healthy Watersheds Initiative (MRBI). MRBI uses several Farm Bill programs, including the Environmental Quality Incentives Program (EQIP) and the Agricultural Conservation Easement Program (ACEP), to help landowners sustain natural resources through voluntary conservation. The overall goals of MRBI are to improve water quality, restore wetlands, and enhance wildlife habitat while ensuring economic viability of agricultural lands.

States within the Mississippi River Basin, including Illinois, have developed nutrient reduction strategies to minimize the contributions of nitrogen and phosphorus to surface waters within the basin, and ultimately to the Gulf of Mexico. MRBI uses a small watershed approach to support the states' reduction strategies. Avoiding, controlling, and trapping practices are implemented to reduce the amount of nutrients flowing from agricultural land into waterways and to improve the resiliency of working lands. MRBI has shown that focused water quality efforts in high priority areas can be effective in building strong partnerships, increasing trust and collaboration with landowners and farmers, and getting more conservation systems on the ground. In fact, the initiative has helped increase the adoption of critical water quality conservation practices, such as cover crops, no-till, residue management, grassed waterways and nutrient management by over 30 percent (based on practice obligations) compared to focus area watersheds with general EQIP alone.

The pressures of urbanization have led to encroachment on/conversion of farmland in Illinois over time. There are fewer farms and fewer acres in agricultural production in the state than at any time since the 1982 USDA's Agricultural Census. Between 1997 and 2003, 50,000 acres was converted to urban use in the Metro Area of St. Louis, which includes Madison County. The population, while relatively stagnant in overall size, shifted eastward onto larger lots and "farmettes," but often did not take up farming. (26) The American Bottom watershed appears to have a lower proportion of owner-farmers than southwestern Illinois as a whole, as much of the land is rented out to be farmed (based on anecdotal information).

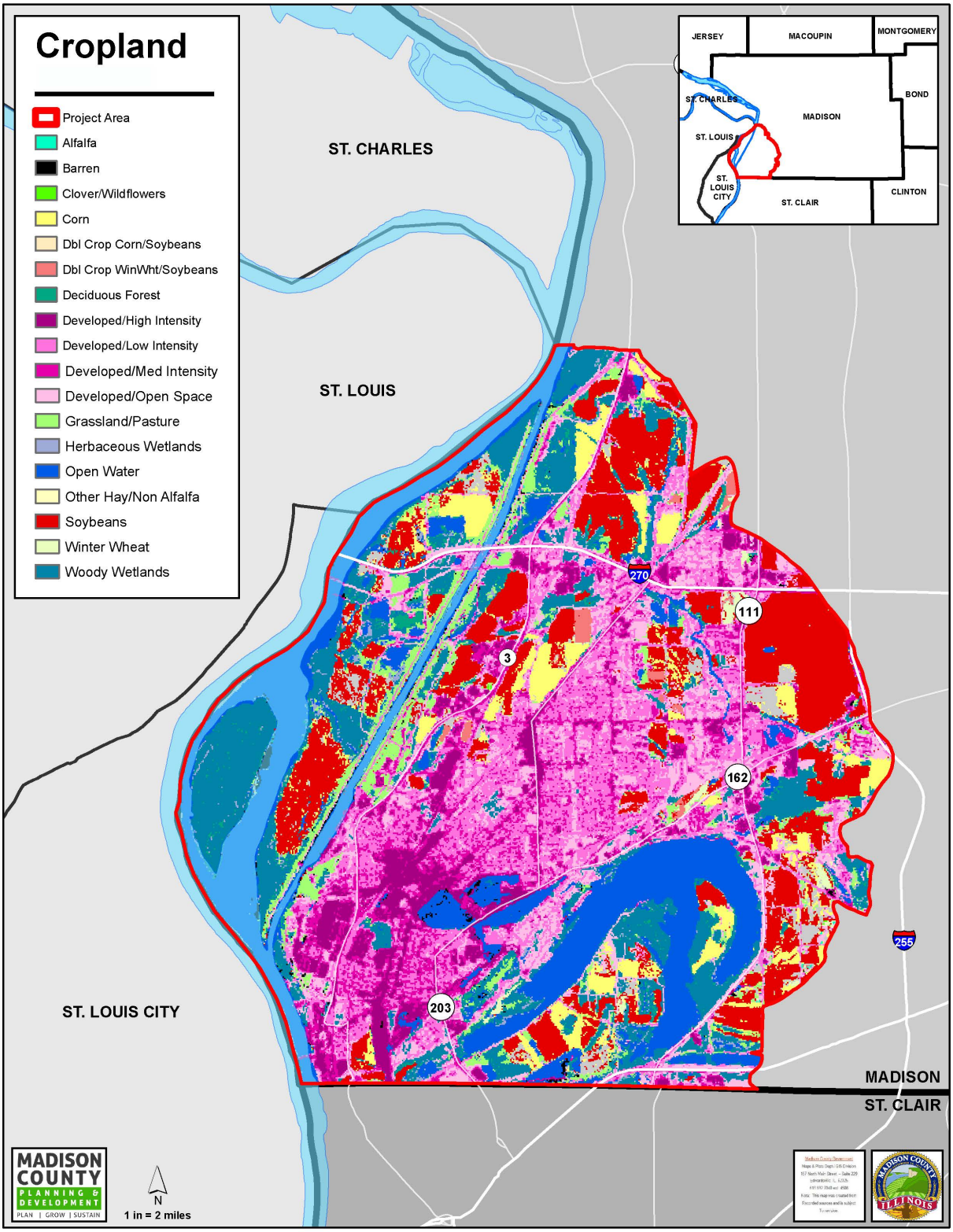
The acreage of land in agricultural use in the American Bottom watershed is 11,854 acres (27%), of which 24% is used for cultivated crops and 3% is used for hay/pasture (Table A.23). Corn, soybeans, and wheat are grown extensively in the watershed. Sorghum, horseradish, sweet corn, tomatoes, onions, potatoes, berries, and fruits are also grown. The average farm size in Madison County is 277 acres and the median size is 66 acres, indicating that there are a few very large farms. (24)

Table A.23: Data about agriculture in Madison County.

Land Use	**Madison**
Farms	1,110
Land in farms (acres)	307,135
Average size of farms (acres)	277
Median size of farms (acres)	66
Total cropland (acres)	276,513
Irrigated land (acres)	2,364
Average market value of ag products sold per farm (dollars)	$127,692
Average net farm cash income (dollars)	$31,474
Farms harvesting corn for grain	491
Acres farmed for corn for grain	116,881
Farms with hired farm labor	286
Number of hired farm labor workers	1,328
Farms enrolled in Conservation Reserve, Wetlands Reserve, Farmable Wetlands, or Conservation Reserve Enhancement Programs	179
Land enrolled in Conservation Reserve, Wetlands Reserve, Farmable Wetlands, or Conservation Reserve Enhancement Programs (acres)	3,785

Corn and soybeans were the major crops grown in the watershed in 2011, followed by double grassland/pasture and cropped winter wheat (Figure A.26). The USDA-NASS Cropland Data Layer also shows large areas of developed land and open water in the watershed. (24)

Figure A.26: Cropland types and land use from the 2011 USDA-NASS Cropland Data Layer for the American Bottom project area. (27)



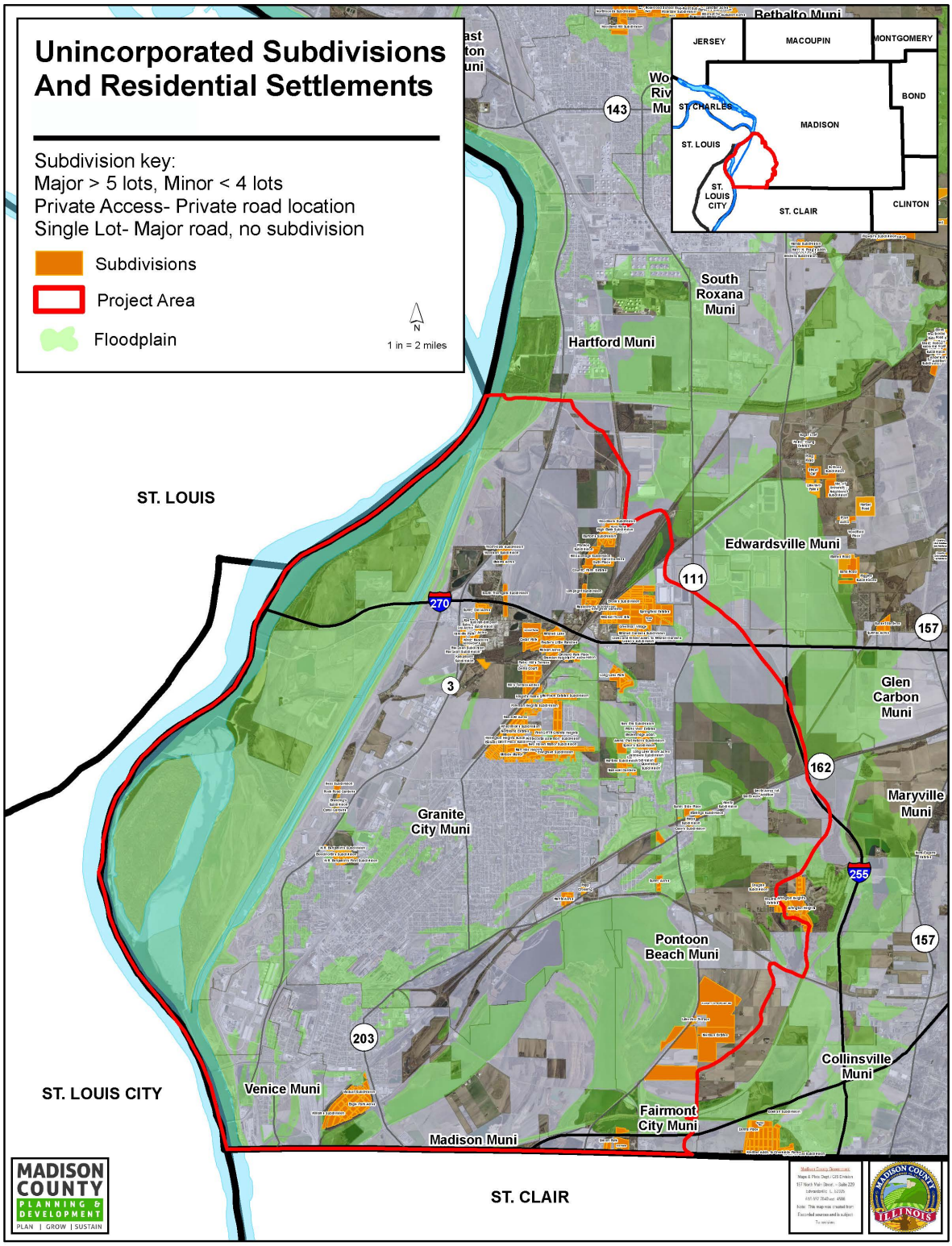
Open space

There are open spaces owned by USACE, Illinois Historic Preservation Agency (Cahokia Mounds), and IDNR in the watershed. There are 5,000 areas of open space covering 7,092 acres (5.5% of the watershed). These open spaces include state parks, state historic sites, USACE recreation areas, municipal parks, bike trails, and athletic fields. There are also four golf courses in the watershed. Cahokia Mounds State Historic Site is located within the project area immediately east of Fairmont City. (28)

Subdivisions

Madison County is currently working on assembling data on all subdivisions in the unincorporated area, with a particular focus on those subdivided in the last 10 years. The total "developed" area in the county is 1,649 acres (3.8%), which includes major and minor subdivisions. Plat years are recorded for some, but not all, major and minor subdivisions. There are many more subdivisions in the north than the south, particularly around Granite City (Figure A.27).

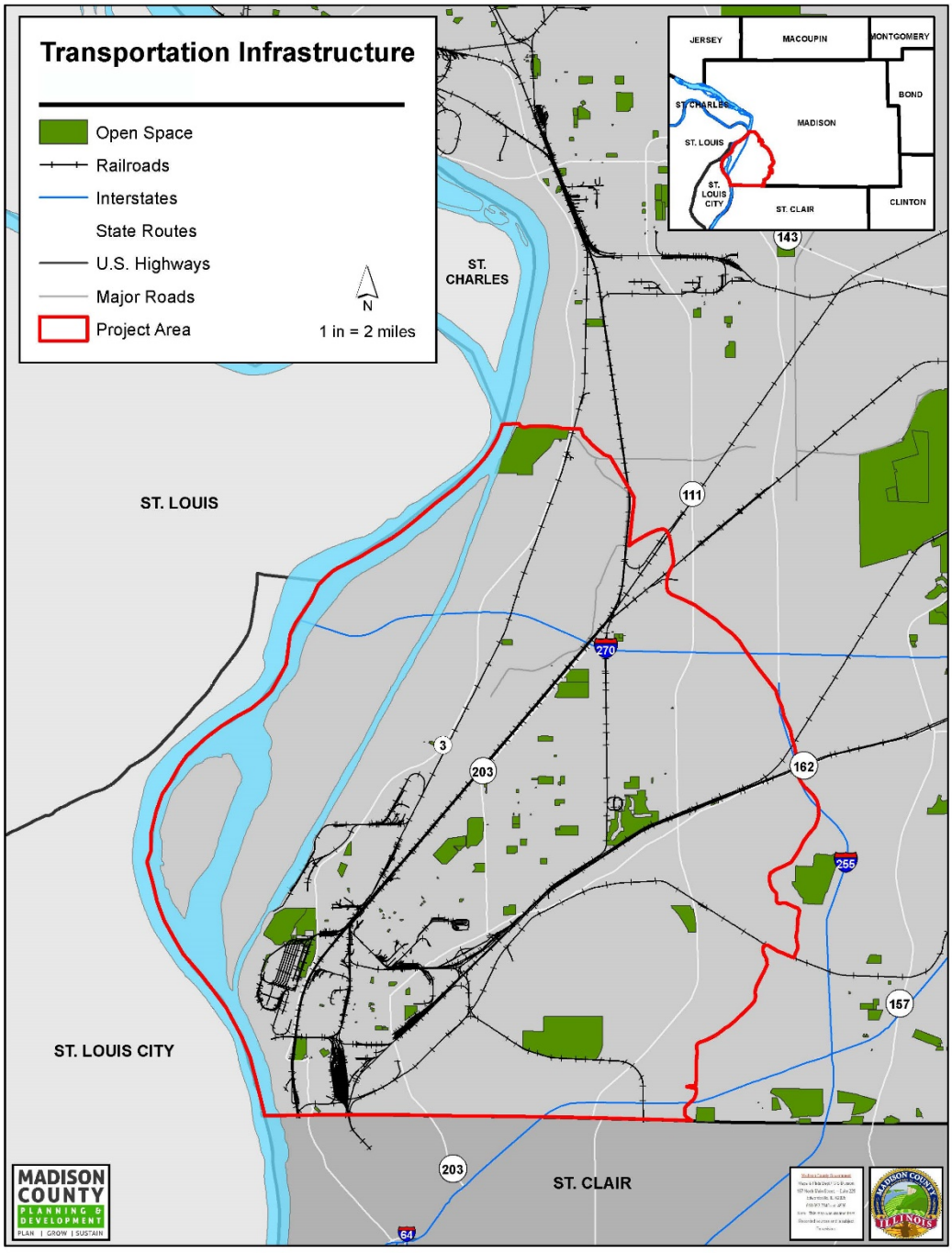
Figure A.27: Subdivisions in the American Bottom watershed.



Transportation Infrastructure

The watershed contains several important components of southern Illinois' transportation network, including railroads, state routes and interstates (Figure A.28). Interstate I-270 runs East-West across the northern part of the watershed and Illinois Route 3 runs north-south along the Mississippi River. Multiple railroad lines run various directions throughout the entire watershed. Some railroads are not currently in use.

Figure A.28: Transportation infrastructure and open space in the American Bottom project area



Cultural/Historic Resources

Cahokia, a pre-Columbian Native American city, covered about six square miles in its heyday (1200s CE) and was the largest and most influential urban settlement in Mississippian culture. Many earthen mounds were built by those peoples in and around Cahokia, including some in the Judy's Branch watershed. These mounds are identified by HeartLands Conservancy in "The Mounds – America's First Cities: A Feasibility Study" in 2014, which mapped over 550 mound sites in the St. Louis region. (29)

Thirty-eight (38) mound sites have been identified in the watershed. The famous 100-foot tall Monks Mound, the centerpiece of the Cahokia Mounds State Historic Site, is just 500 meters east of the watershed boundary. Several mounds identified inside the watershed boundary are close to Monks Mound. Others are located throughout the watershed, including a small concentration southwest of Mitchell.

Route 66, also known as the Mother Road, was one of the original highways in the U.S. highway system. First established in 1926, the highway became one of the most famous roads in America, and was a major route for those migrating west during the Dust Bowl of the 1930s. Today, much of the road has been designated as a National Scenic Byway and given the name "Historic Route 66." The road runs through the watershed, passing through Pontoon Beach, Granite City, Madison, and Venice. The route changed considerably over the years, including and excluding these places at different times. These municipalities still make the most of this history, welcoming motorists through the year and in mid-June for the Illinois Route 66 Mother Road Tour. (30)

Future land use/land cover predictions

Changes to land use/land cover in the watershed were projected from municipal Comprehensive Plans, where available. Using these Plans, percentages of the different land uses under a future build-out scenario were estimated for the 1.5-mile zone outside each municipality. A 1.5-mile buffer around the municipalities was created in ArcGIS, a Geographic Information System (GIS) software program, and the new land use/land cover percentages were applied to the buffer. The remaining land outside the 1.5-mile zone was considered to retain its current land use/land cover designations. The resulting land use/land cover predictions represent a full build-out scenario for the municipalities in the watershed, while retaining a conservative estimate of zero land use/land cover change in the unincorporated area.

Table A.24: Existing land use/land cover in the American Bottom watershed.

Land Use/Land Cover Description	Land Use Code	Current Area (acres)	Current Area (%)
Barren Land	31	18	0%
Cultivated crop	82	10,423	24%
Deciduous forest	41	265	1%
Developed, High Intensity	24	2,401	6%
Developed, Low Intensity	22	7,159	17%
Developed, Medium Intensity	23	3,744	9%
Developed, Open Space	21	4,567	11%
Emergent herbaceous wetlands	95	785	2%
Evergreen forest	42	0	0%
Hay/Pasture	81	1,431	3%
Herbaceous	71	110	0%
Mixed forest	43	0	0%
Open Water	11	7,079	16%
Shrub/Scrub	52	0	0%
Wood wetlands	90	5,263	12%

Table A.25: Predicted future land use/land cover in the American Bottom watershed.

Land Use/Land Cover Description	Area (acres)	Area (%)
Agriculture Vacant	5,648	56
General Commercial	228	2
Industry	1,528	15
Low Density Residential	2,161	21
Open Space	526	5

*predicted land use/land cover is based on zoning identified in the 2020 Comprehensive Plans of municipalities in the watershed for the 1.5-mile zone outside their current boundaries.

Impervious cover

Impervious cover is the surfaces of an urban landscape that prevent infiltration of precipitation and runoff into the ground. Imperviousness is a useful indicator of the impacts of urban land use/land cover on water quality, hydrology, and flooding. Runoff over impervious surfaces warms the water and collects pollutants causing receiving streams to experience a shift in plant, macroinvertebrate, and fish communities. Sensitive species can no longer thrive, and pollution-tolerant species begin to dominate. Higher impervious cover also translates to greater runoff volumes, resulting in changes to stream hydrology.

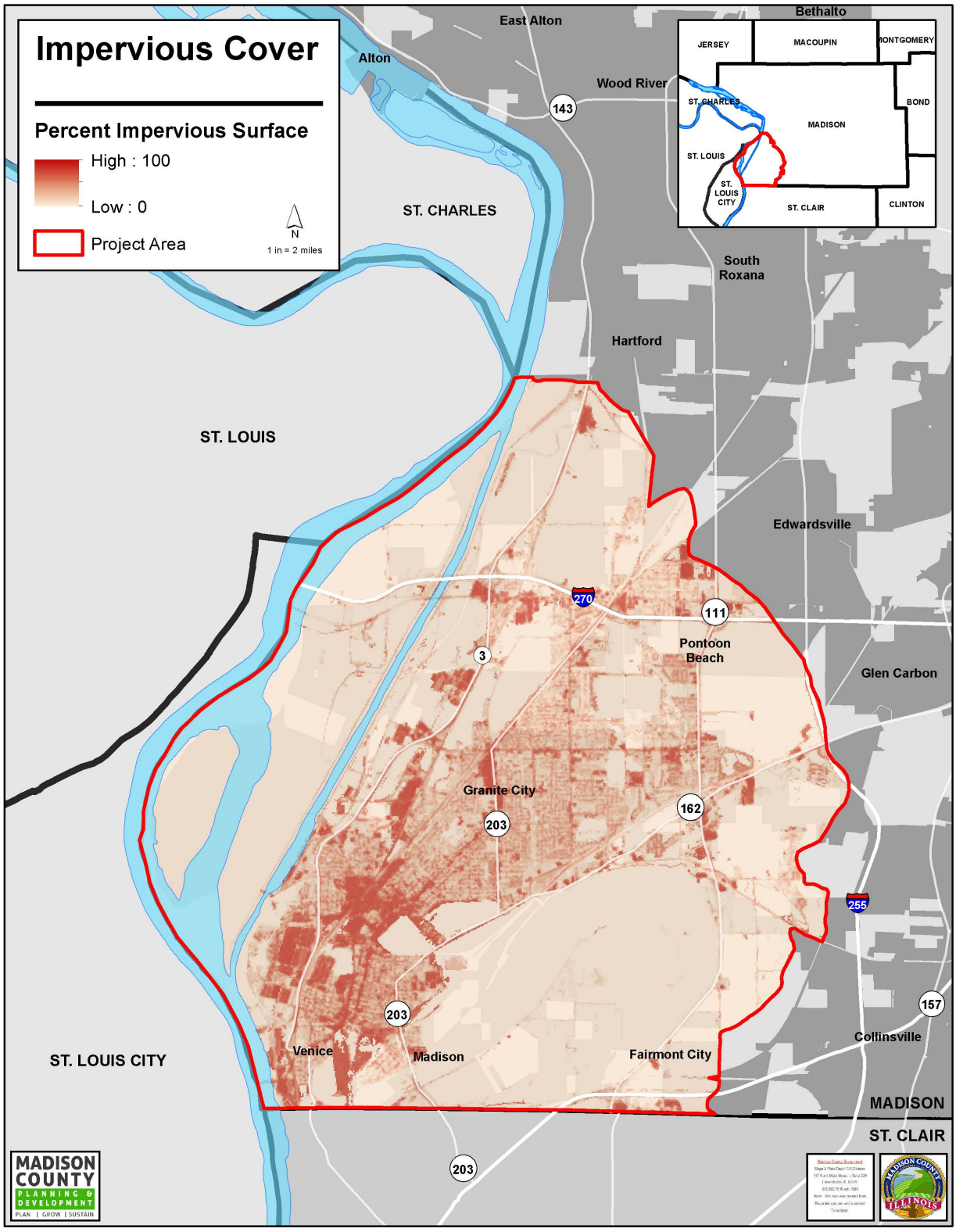
The National Land Cover Database (NLCD) Percent Developed Impervious Surface file provides nationally consistent estimates of the amount of man-made impervious surfaces present over a given area. The values are derived from Landsat satellite imagery, using classification and regression tree analysis. Values range from zero to 100 percent, indicating the degree to which the area is covered by impervious features.

In the Judy's Branch watershed, the mean imperviousness is 13.4% with a standard deviation of 24.3% (Table A.25). Most of the watershed is 0% impervious. However, select areas have a lot of impervious cover, up to 100% (Figure A.34). These areas correlate with developed land use/land cover as seen in Figure A.31.

Table A.25: Existing impervious cover by HUC 14 in the American Bottom watershed, as assessed from the NLCD Percent Developed Impervious Surface dataset

HUC14	**Existing Impervious** %
07140101040101	5.64%
07140101040102	38.98%
07140101040201	34.62%
07140101040202	71.59%
07140101040203	3.95%

Figure A.29: Impervious cover in the American Bottom watershed.



Watershed Drainage

Stream Delineation

The stream reaches used in assessing stream conditions are from the National Hydrography Dataset (NHD). A reach is a continuous piece of surface water with similar hydrologic characteristics. The NHD catalogs stream reaches, giving each reach a unique 14-digit Reach Code. The first eight digits are the same as the HUC8 code for the Cahokia-Joachim watershed (07140101). The next six digits are sequential numbers that are unique within the HUC8 watershed.

The segments are listed as perennial or intermittent streams/rivers, with the exception of certain "artificial path" or "connector" segments, which represent non-specific connections between non-adjacent segments. A full table of NHD stream reaches in the watersheds can be found in the Data Tables section. In this assessment/project, we used the NHD stream reaches as our stream units. We did not subdivide the reaches further, as we had no way to assess homogenous stream conditions on a smaller scale than the NHD within the bounds of the project.

There was little existing information about the condition of the streams in the project area. To gather information about the stream reaches, geo-referenced video footage was taken on low-level helicopter flights over the larger streams in the watershed. Fostaire Helicopter was selected to gather the flight data, using Red Hen software to collect and store the video in a GIS database. The video was collected during the winter (January 2018) when leaf cover was absent and vegetation was dormant in order to increase the visibility of the streams flown. A total of 25.2 miles or 28.5% of the total stream miles in the watershed were flown and videotaped.

The video images were then viewed to assess four different parameters for each stream: streambank erosion, degree of channelization, condition of the riparian area, and streambed erosion.

There are 206 NHD stream reaches in the American Bottom watershed, comprising 88.5 miles of streams. The average length of these stream reaches is 0.4 miles, while the range of stream lengths is 0.009 miles to 7.3 miles.

Streambank Erosion

As the video from the aerial survey was reviewed, areas of eroding streambank were identified and catalogued in a feature table in a GIS database. The feature table includes the degree of erosion based on IEPA guidelines (Table A.26), the estimated length, and the location of each stream sections determined to be eroding at a moderate or severe rate. Lengths with slight bank erosion were then determined by subtracting the length of severe and moderate erosion sections from the entire stream segment length.

The slight, moderate, and severe erosion categories were based on IEPA's guidelines for lateral recession from the IEPA Load Reduction Worksheet. (31) The very severe erosion category was not used in this assessment.

Table A.26: Lateral recession category guidelines used in classifying streambank erosion in the assessment of the video footage of aerial assessment (32)

Lateral Recession Rate* (ft/year)	Category	Description
0.01-0.05	Slight	Some bare bank but active erosion not readily apparent. Some rills but no vegetative overhang.
0.06-0.2	Moderate	Bank is predominantly bare with some rills and vegetative overhang
0.3-0.5	Severe	Bank is bare with rills and severe vegetative overhang. Many exposed tree roots and some fallen trees and slumps or slips. Some changes in cultural features such as fence corners missing and realignment of roads or trails. Channel cross-section becomes more U-shaped as opposed to V-shaped.
0.5+	Very Severe	Bank is bare with gullies and severe vegetative overhang. Many fallen trees, drains and culverts eroding out and change in cultural features as above. Massive slips or washouts common. Channel cross-section is U-shaped and stream course or gully may be meandering.

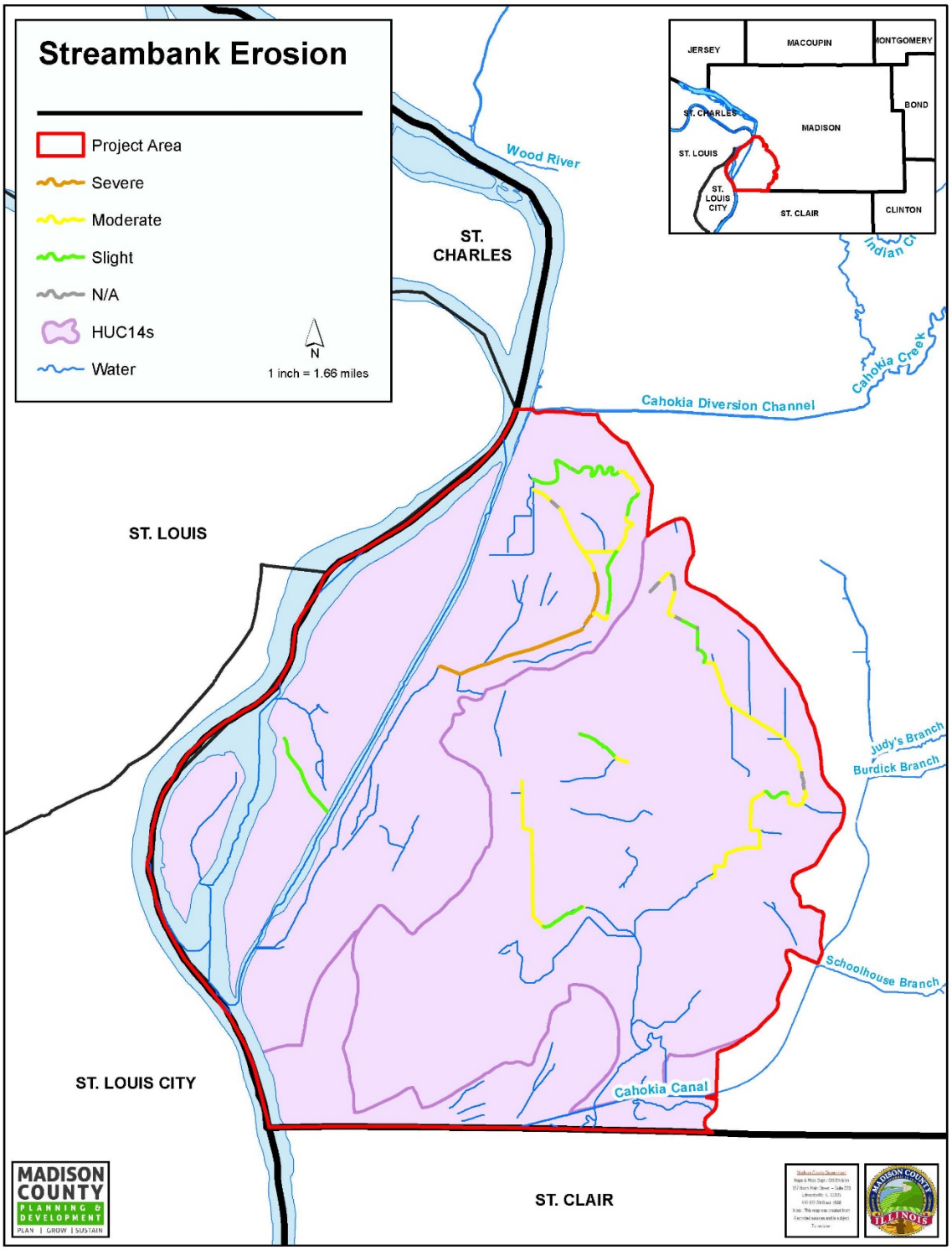
In total, 24 miles of streams were successfully assessed for streambank erosion using geo-referenced video footage. Of the assessed length, 28% had none or low/slight erosion, 60% had moderate erosion, and 12% had high/severe erosion (Table A.27).

Lengths of moderate and severe streambank erosion were identified throughout the watershed in tributaries and on the main branches (Figure A.30). Many headwater streams show up as having “none or low” erosion, but this is because they were left unmarked in several instances where visibility was poor and no erosion category could be assigned. Headwater streams often have a steeper gradient and may in fact have a higher degree of bank erosion due to higher velocities, even though flow is low.

Table A.27: Streambank erosion along assessed stream reaches in the American Bottom watershed.

	Stream Length Assessed (mi)	None or Low Erosion		Moderate Erosion		High Erosion	
		mi	%	mi	%	mi	%
Total	23.9	6.7		14.3		3.0	
Average			28		60		12

Figure A.30: Streambank erosion conditions assessed from video footage of an aerial survey of the American Bottom project area.



Degree of Channelization

Changes in stream channelization were identified from the video and geo-referenced in a feature table. The degree of channelization between geo-referenced points was then marked the same for the sections between marked locations. Lengths of high, moderate and low channelization were then determined by measurement between marked boundaries, using criteria based on stream straightness and evidence of man-made modifications (Table A.28).

Table A.28: Criteria used to assess degree of channelization

Condition	Description
Low	Natural meandering stream with no obvious evidence of modification
Moderate	Not "straight" but evidence of modification to planform by human activity
High	Straight or nearly straight channelized stream segment

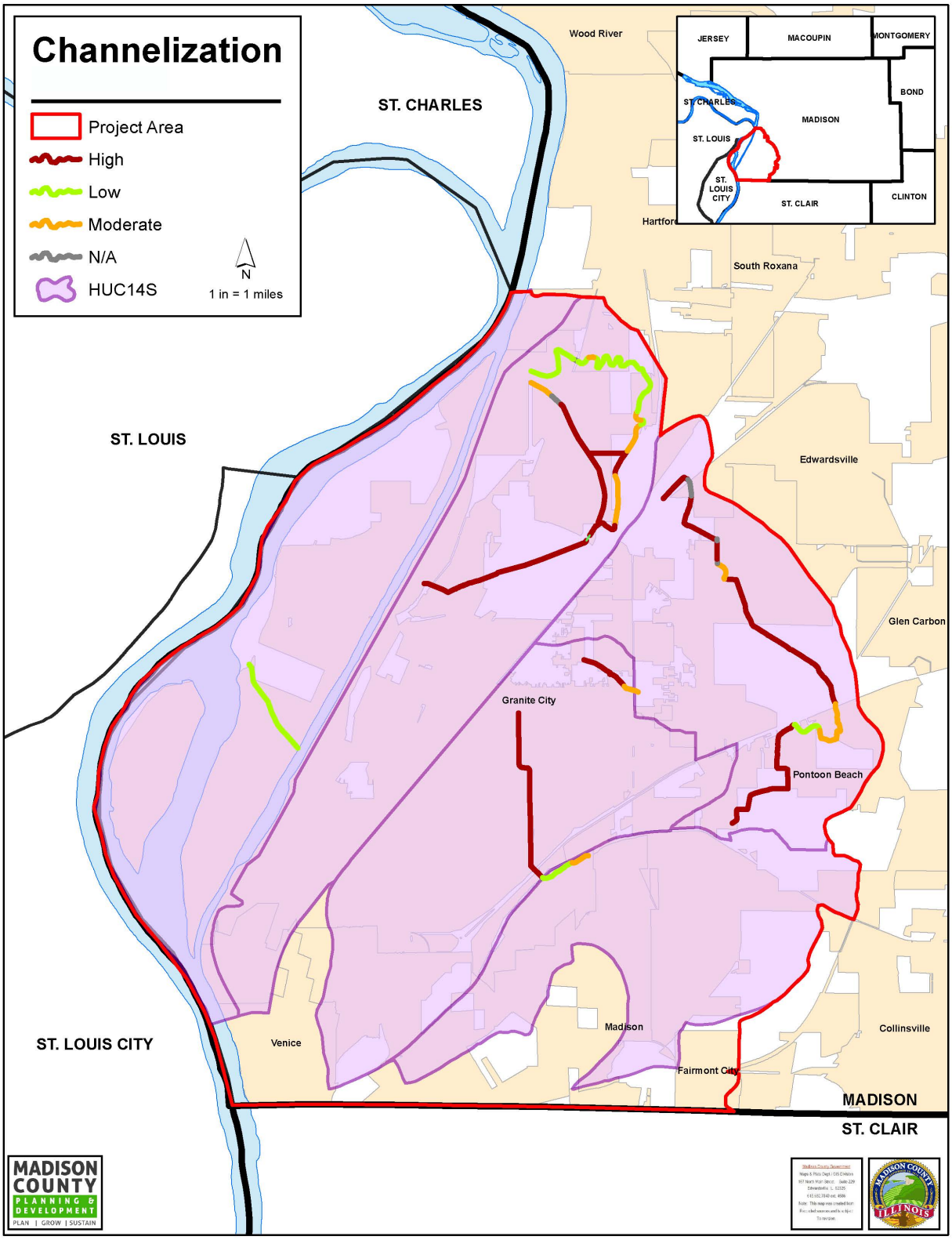
In total, 24 miles of streams were successfully assessed for streambank erosion using geo-referenced video footage. Of the assessed length, 21% had none or low channelization, 12% had moderate channelization, and 67% had high channelization (Table A.29).

Lengths of moderate and high channelization were identified throughout the watershed (Figure A.31). The headwaters often showed high channelization, likely because of their beginnings in farm fields as drainage ditches, where stream size is much smaller and channelization is less expensive. Moderately and highly channelized streams appear to be interspersed elsewhere with shorter lengths of channelization.

Table A.29: Degree of channelization along assessed stream reaches in the American Bottom watershed.

	Stream Length Assessed (mi)	None or Low Channelization		Moderate Channelization		High Channelization	
		mi	%	mi	%	mi	%
Total	24.1	5.1		2.8		16.2	
Average			21		12		67

Figure A. 31: Channelization condition assessed from video footage of an aerial survey of the American Bottom project area.



Riparian Condition

Riparian condition was assessed from the video review by geo-referencing in a feature table each location where type and extent of woody cover changed. The riparian area between geo-referenced points was then considered the same for the area between marked locations. Lengths of good, fair and poor riparian area were then determined by measurement between marked boundaries. The criteria used to assess riparian condition are based on width of vegetative cover on both sides of the waterway, extent of vegetative cover, and type of vegetation (Table A.30).

Table A.30: Criteria used to assess riparian condition

Condition	Description
Good	Wide (minimum of two stream widths) vegetative cover with woody plants on both banks
Fair	Narrow (less than two stream widths) vegetative cover of woody plants or grass cover on both banks
Poor	No woody vegetation with narrow (< 10 feet) of grass or herbaceous cover on one or both banks

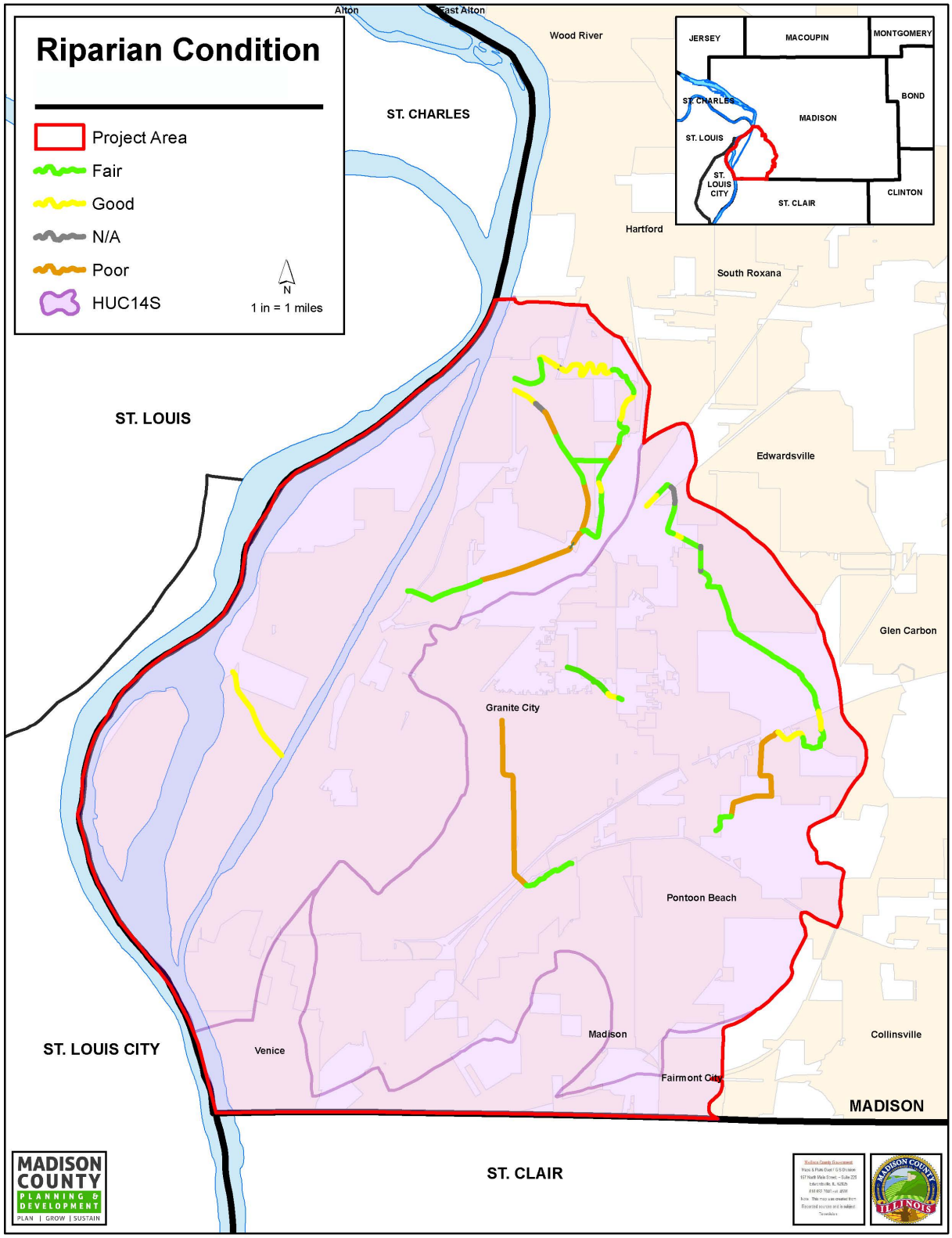
In total, 24 miles of streams were successfully assessed for riparian condition using geo-referenced video footage. Of the assessed length, 17% had good riparian condition, 41% had fair riparian condition, and 41% had poor riparian condition (Table A.31).

The stream lengths with good and fair riparian conditions are spread throughout the watershed (Figure A.32). Vegetative and tree cover is poor wherever farm fields or urban development extend out to or close to the streambank.

Table A.31: Riparian condition along assessed stream reaches in the Judy's Branch Project Area.

	Stream Length Assessed (mi)	Good Condition		Fair Condition		Poor Condition	
		mi	%	mi	%	mi	%
Total	24.1	4.1		10		10	
Average			17.0		41.5		41.5

Figure A.32: Riparian condition assessed from video footage of an aerial survey of the American Bottom project area.



Visibility and Data Collection

Limitations on visibility affected the collection of streambank erosion, channelization, and riparian condition data from the flight video. The video imaging works best on larger streams and streams with poor woody riparian areas. Those streams where the tree canopy completely covered the stream offered limited visibility of the stream condition, even with no leaf cover. In some instances no data was collected from the video imaging due to the inability to see the streambanks, and in others, data collection was incomplete or questionable due to poor visibility. Due to the long stream length assessed for erosion, channelization and riparian condition, field assessment was not a viable option for the watershed.

Streambed Erosion

Streambed erosion was assessed from the video review by geo-referencing in a feature table each location where type and extent of erosion changed. Lengths of low, moderate and high streambed erosion were then determined by aerial video assessment per the conditions described in Table A.32.

Table A.32: Criteria used to assess degree of streambed erosion

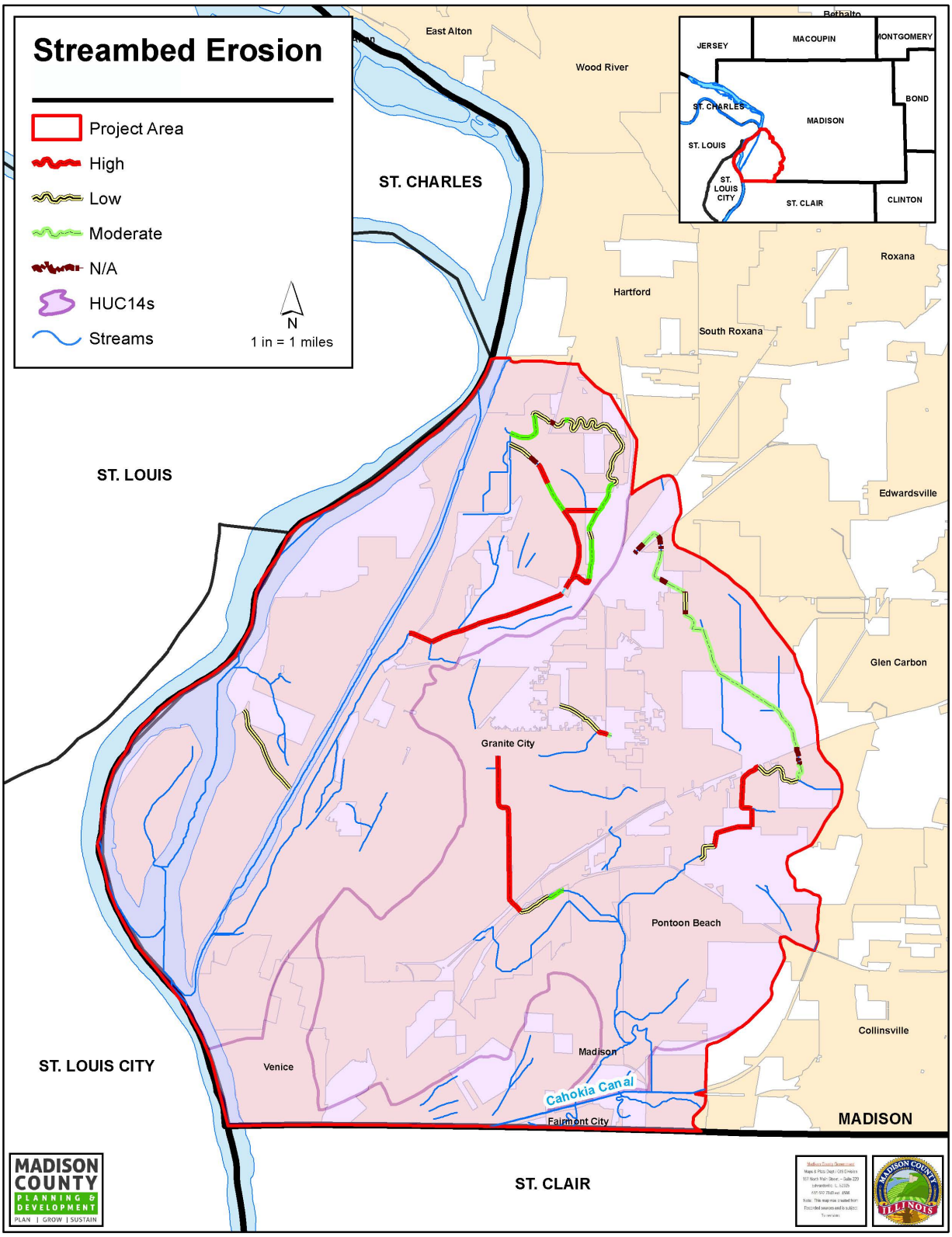
Degree of streambed erosion	Description
Low	Bedload material found deposited in stream cross-over points with evidence of frequent out-of bank flow in the adjacent floodplain. Absence of residual bed material exposed anywhere except in bottom of pools.
Moderate	Bedload material not found consistently in stream cross over locations with some evidence of residual material exposed or very near the surface in cross over locations. Evidence of out of bank flow very hard to identify (few or no trash lines over top of bank).
High	Little or no bedload found in stream cross over locations. Large areas of residual material exposed in the streambed. Trash lines primarily confined to upper portion of the bank with no evidence of out of bank flow except on rare occasions of very large storm events.

Streams in the American Bottom watershed were assessed for the degree of streambed erosion during aerial assessment. Of the 24 miles assessed in the watershed, 27% had low streambed erosion, 23% had moderate streambed erosion and 49% had high streambed erosion.

Table A.33: Degree of streambed erosion along assessed stream reaches in the project area.

	Stream Length Assessed (mi)	Low Erosion		Moderate Erosion		High Erosion	
		mi	%	mi	%	mi	%
Total	23.9	6.6		5.6		11.8	
Average			28		23		49

Figure A.33: Streambed erosion conditions noted in the American Bottom project area.



Ephemeral/Gully Erosion

The Illinois Department of Agriculture's periodic Soil Conservation Transect Survey gathers information about conservation tillage practices in the state. Its measure of ephemeral erosion indicates the extent of gully erosion by county, as surveyors identify fields in which ephemeral or gully erosion has occurred or is likely to occur in areas of concentrated surface water flow. According to the 2015 transect survey, Madison County has a higher than state average (12.6%) rate of 45%. (33)

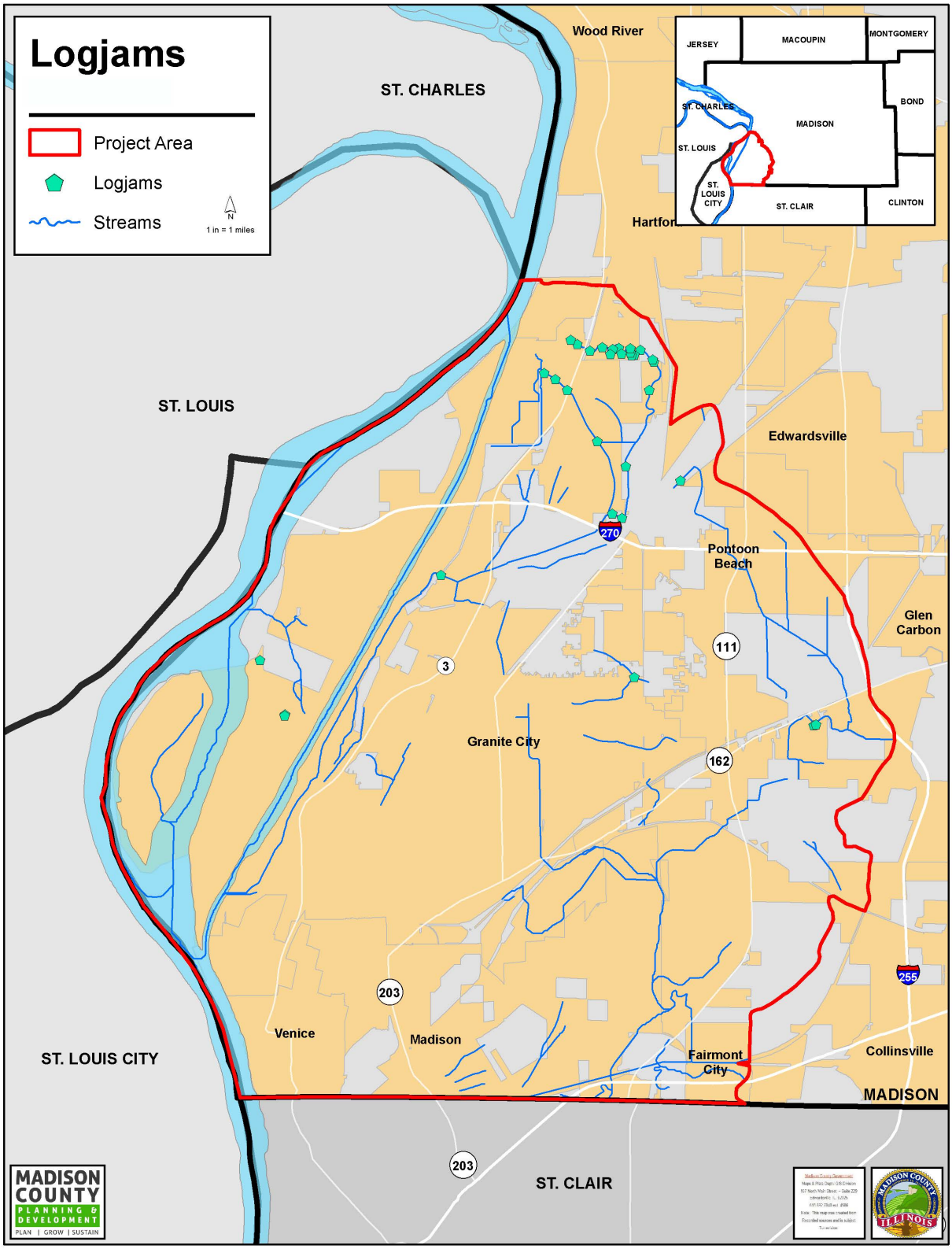
Debris Blockages (Logjams)

Logjams alter stream hydrology, increasing the scouring effect of flow on the streambank and streambed as water is channeled around the blockage. If the logjam spans the channel, the stream is more likely to overtop and flood nearby land during times of high flow. Logjams were identified in video footage from the aerial survey. Table A.34 and Figure A.34 identify the number and location of logjams in the Judy's Branch watershed, organized by HUC14.

Table A.34: Logjams identified in the Judy's Branch Project Area in video footage from the aerial survey (January 2018).

HUC14	**Logjams identified** in **aerial survey (number)**
07140101040101	3
07140101040102	24
07140101040201	3
07140101040202	1
07140101040203	0
Total	31

Figure A.34: Logjams in the American Bottom project area as identified from video footage from the aerial survey (January 2018).



Detention and Retention Basins

USACE looked at National Agriculture Imagery Program (NAIP) aerial photographs of the watershed, along with USGS topographic maps and the National Hydrography Dataset, to identify detention and retention basins. A point was created for each basin located in or very close to a group of five or more buildings. This was in order to avoid classifying natural ponds as detention basins; with significant developed area near the basin, there was a higher likelihood that the basin had been engineered or altered by man in some way. It should be noted that detention and retention basins on agricultural land are very common, but they were not included in this inventory, partly because the Agricultural Conservation Planning Framework (ACPF) used to identify BMPs also identifies likely detention locations.

Site visits were made on March 13, 2018 to 13 of the 82 sites identified in the project area in order to determine the basins condition. The sites were selected by geographic location, distributed somewhat evenly throughout the watershed, and by prioritizing basins about which the Madison County Stormwater Coordinator received complaints. On the site visits, location, type and condition of the basins were confirmed. Basins visited ranged in size between 0.1 acres and 10.56 acres, with an average area of 2.86 acres. Of the thirteen basins, eleven were wet retention basins and two were dry detention basins.

Figure A.35: Images from two detention basins from site visits on March 13, 2018.



Eighty-two (82) detention or retention basins were identified throughout the project area (Table A.35, Figure A.36). According to the imagery in ArcMap, most of the basins have water in them (89%). However, it was much easier to identify basins containing water than dry basins, and so wet basins may be overrepresented. Only ten percent (9.7%) of the basins were in the National Hydrography Dataset.

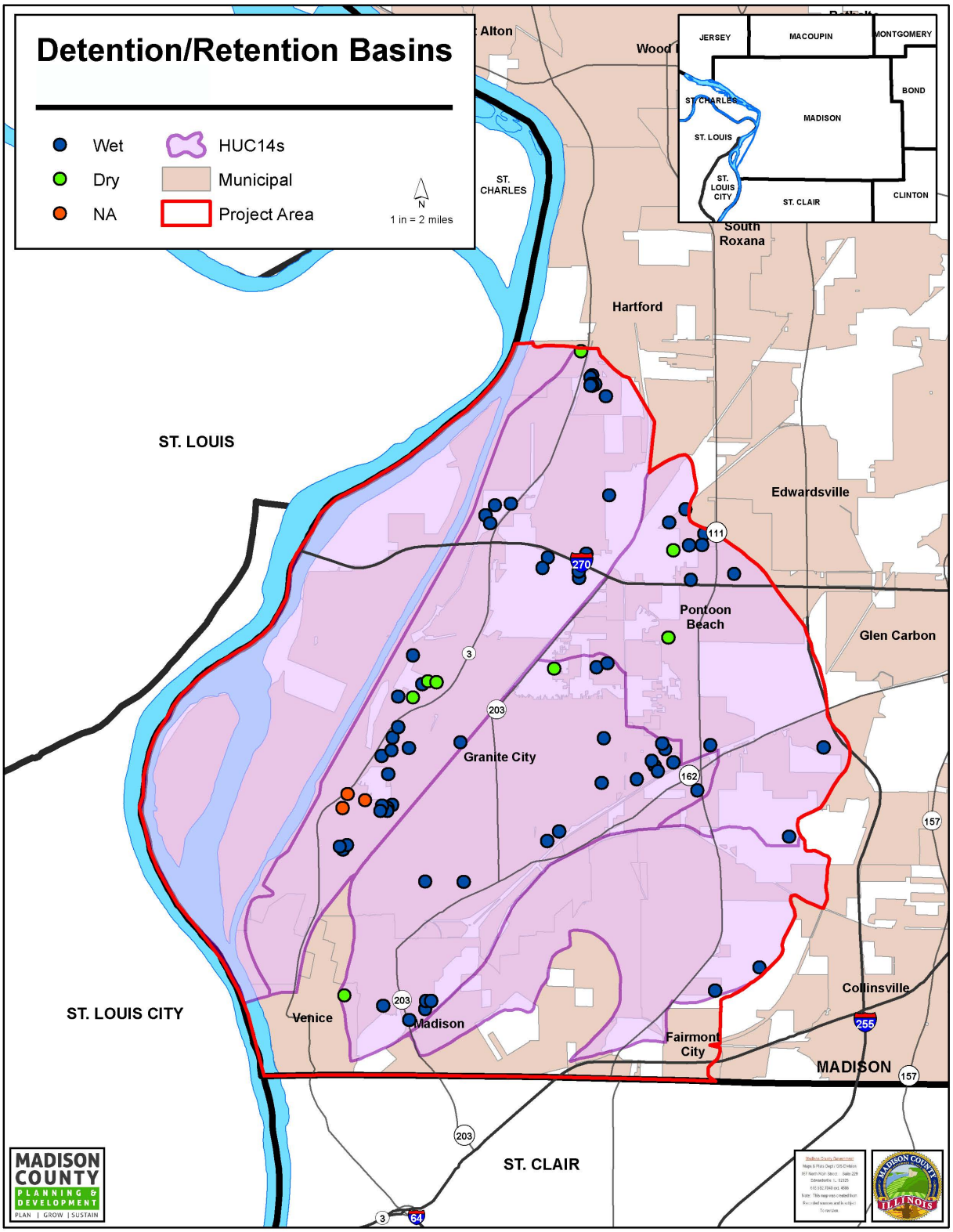
Table A.35: Number of detention and retention basins identified in each HUC14.

HUC14	Number of basins identified	Number of basins visited	Condition of basins visited
07140101040101	0	0	
07140101040102	45	4	GOOD
07140101040201	12	5	GOOD
07140101040202	23	4	GOOD
07140101040203	2	0	
Total	82	13	ALL GOOD

Table A.36: Summary of location, type, and condition of detention and retention basins inspected on site visits.

Issue	Number of Sites
Algae (submerged or on surface)	0
Sediment (reduced basin capacity)	0
Bank erosion	0
Trash	2
Blocked culvert under road leading to basin, road floods	0
Murky, milky water appearance	0
Outlet pipe leads towards power station – potentially unsafe	0
Scouring of outlet channel	0
Submerged inlet pipe	0

Figure A.36: Location of detention and retention basins identified by aerial imagery assessment.



Flooding

Flooding Types and Contributing Factors

The Federal Emergency Management Agency (FEMA) defines a flood as a general or temporary condition where two or more acres of normally dry land or two or more properties are inundated by:

- overflow of inland or tidal waters;
- unusual and rapid accumulation or runoff of surface waters from any source;
- mudflows; or
- a sudden collapse or subsidence of shoreline land.

The severity of floods are determined by a number of factors, including topography, ground cover, precipitation and weather patterns, recent soil moisture, the presence of streams and other waterbodies, as well as a location's relationship to the watershed. Floods can cause utility damage and outages, infrastructure damage, structural damage, crop loss, decreased land values and impediments to travel, including emergency access.

Two main types of flooding affect the American Bottom watershed: flash flooding and general flooding. A flash flood is a rapid rise of water along a stream or low-lying area, usually produced when heavy localized precipitation falls over an area in a short amount of time. Flash floods are considered the most dangerous type of flood event because there is often little or no warning time, and because of their capacity for damage, including the capability to induce mudslides. Vulnerability to flash flooding changes most often with a change in land use. As impervious surface area increases, the risk of flash flooding increases, as rain and snowmelt can no longer infiltrate the ground slowly and flows quickly downstream.

General flooding can be broken down into two categories: riverine flooding and shallow or overland flooding. A riverine flood is the gradual rise of water in a river, stream, lake, or other waterway that results in the waterway overflowing its banks. This type of flooding generally occurs when storm systems remain in the area for extended periods of time, when winter or spring rains combine with melting snow to create higher flows, or when obstructions such as logjams block normal water flow. One famous example of a riverine flood is The Great Flood of '93 where intense rainfall events, coupled with already saturated ground surfaces and spring snow melt in northern states, resulting in the Mississippi River flooding out of its banks for months on end.

A shallow or overland flood is the pooling of water outside of a defined river or stream, for example, in sheet flow or ponding. An overland flood generally occurs when rainfall collects on saturated or frozen ground. When surface runoff cannot find a channel, it may flow out over a large area at a somewhat uniform depth in sheet flow, or collect in depressions and low-lying areas, creating a ponding effect.[123]

Vulnerability to riverine flooding in the National Flood Insurance Program (NFIP) member communities is low as long as existing floodplain ordinances are enforced. Floodplain ordinances are the major mechanism for ensuring that new structures either are not built in flood-prone areas or are elevated or protected from floodwaters to severely limit their potential flood damage.

The general definition of a floodplain is any land area susceptible to being inundated or flooded by water from any source (such as a river or stream). This general definition differs slightly from the regulatory definition of a floodplain, which may be found in the Madison County Hazard Mitigation Plan and under the NFIP along with further definitions of base floods, base floodplains, floodway, flood

fringe, Special Flood Hazard Area, Flood Insurance Rate Maps, and flood zones. (5)

Extent of the Floodplain

In the American Bottom watershed, 38.4% of the area (16,596 acres) is designated as floodplain.

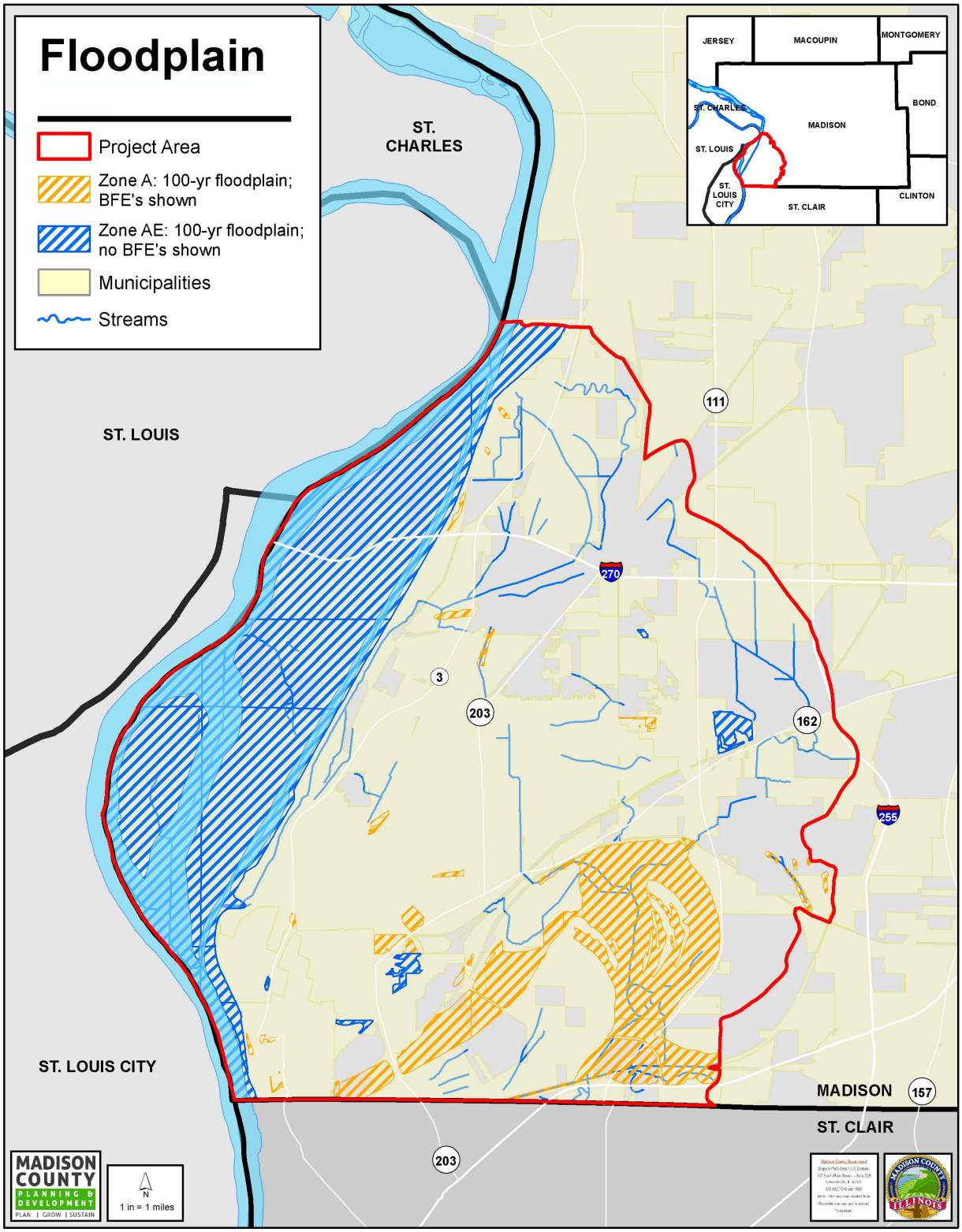
Development in the Floodplain

In the watershed, 3,422 structures in municipalities are at least partially located in the 1% chance FEMA floodplain. In the watershed area covering Fairmont City, there are no structures in the floodplain. Granite City and Pontoon Beach have the most structures in the floodplain, 1,504 in total (Table A.37). All of the communities are fully covered by Flood Insurance Rate Maps (FIRM), so the number of structures at risk from a 1% chance flood is comprehensive of the municipality.

Table A.37: Number of structures partially or wholly within the floodplain in the watershed.

Municipality	Number of Structures
Edwardsville	0
Fairmont City	0
Granite City	1,807
Hartford	0
Madison	211
Pontoon Beach	1,339
Venice	67
Total	3,424

Figure A.37: FEMA designated floodplain in the American Bottom project area.



Repetitive Loss Structures in the Watershed

FEMA defines a repetitive loss structure as one covered by flood insurance under the NFIP that has suffered flood damage on two occasions during a 10-year period. This 10-year period ends on the date of the second loss, and the cost to repair the flood damage must be at least 25% of the market value of the structure at the time of each flood loss.

Of the seven municipalities in the American Bottom watershed, three contain repetitive loss structures. There are 11 repetitive loss properties in unincorporated areas of Madison County, not just in the project area, which have made 30 claim payments. The exact location of these properties are kept on file with FEMA and are not eligible for publication. A breakdown of buildings and number of losses by municipality are shown below in Table A.37.

Table A.38: Repetitive loss information for portions of Madison County

City	Buildings	Losses	Claims	Total Claim Amount
Granite City	1	2	155	$383,855.88
Madison	1	2	15	$41,817.99
Pontoon Beach	2	5	28	$152,833.16
Unincorporated Madison County	11	30	254	$1,957,710.04
Total	15	39	452	$2,536,217.07

For the unincorporated parts of Madison County, the data provided by FEMA includes all areas within the county, not just those in the watershed boundary. All municipalities within the watershed participate in the NFIP. (34)

Critical Facilities

Some structures are particularly vulnerable to floods and require special protection to protect vulnerable populations and public health. FEMA recognizes these critical facilities under two categories:

1. At-risk essential facilities: Facilities that are vital to flood response activities or critical to the health and safety of the public before, during, and after a flood, such as a hospital, emergency operations center, electric substation, police station, fire station, nursing home, school, vehicle and equipment storage facility, or shelter.
2. At-risk critical facilities: Facilities that, if flooded, would make the flood's impacts much worse, such as a hazardous materials facility, power generation facility, water utility, or wastewater treatment plant.

According to the Illinois Natural Hazard Mitigation Plan, Madison County has the most critical facilities in the 1% chance floodplain of any county in Illinois. Facilities at risk include schools, police stations, wastewater treatment plants, and communication facilities. (35)

According to FEMA's "Hazus" multi-hazard risk assessment tool, Madison County has 239 critical facilities within the American Bottom watershed. A further breakdown of the quantity of each type of facility in each watershed is given in Table A.39.

Table A.39: Critical facilities in Madison County within the American Bottom watershed.

Facility Type	Number of critical facilities in the watershed
Agriculture	0
Animal Slaughtering Plant	3
Chemical Plant	0
Industrial products	11
Pharmaceutical preparations	2
Education	0
Private school	6
Public School	17
Emergency	0
Helipad	1
EMS	5
Fire Station	7
Shelter	37
Energy	0
Electric Power Generation Plant	4
Propane	9
Substation	8
Cities/Towns/Villages	4
Law Enforcement – Police Station	6
Mail – U.S. Post Office	3
Manufacturing	0
Wood product manufacturing	10
Public Venue	0
Campground	1
Library	6
Park	7
Place of Worship	8
Transportation	0
Airport	1
Road/Railroad bridge	68
Lock	1
Port	10
Water Supply	0
Wastewater treatment plant	2

Infrastructure in the Floodplain

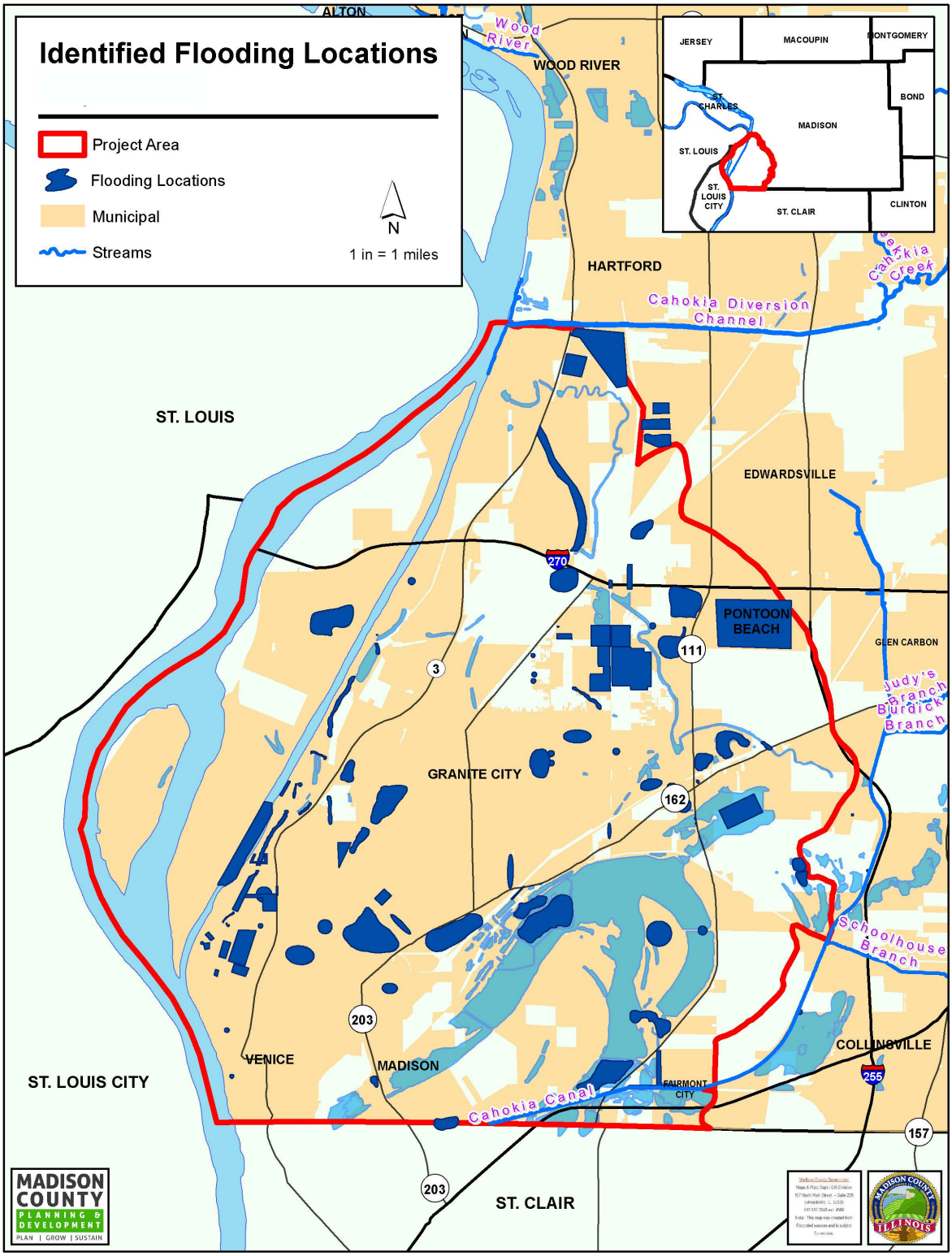
Roads, bridges, and buried power and communication lines are located within or adjacent to floodplains throughout the watershed. Nearly the entire watershed is vulnerable to both flash flooding and interior flooding from either overloaded storm sewer systems or improper drainage. A majority of the buildings, infrastructure and critical facilities that may be impacted by flooding are located outside of the base floodplain. For a count of facilities within each watershed, see the “Critical Facilities” section. Stakeholder outreach conducted for this plan helped to highlight several other instances of flooding outside of floodplains.

Locations Affected by Floods

Flooding Locations Identified at Stakeholder Meetings

Three Open House events were held to introduce the American Bottom Watershed Plan to residentsin 2016 and 2017. At these and other stakeholder meetings, input was gathered from attendees (mostly local residents). During the meetings, attendees were invited to identify flooding locations within the watershed (Figure A.38) by looking at maps that included roads, municipalities, structures, and FEMA floodplains. Points or area designations were then made to identify locations that typically flood. This input was digitized to show flooding “hot spots” within the watershed.

Figure A.38: Flooding locations identified at Open House events and stakeholder meetings.



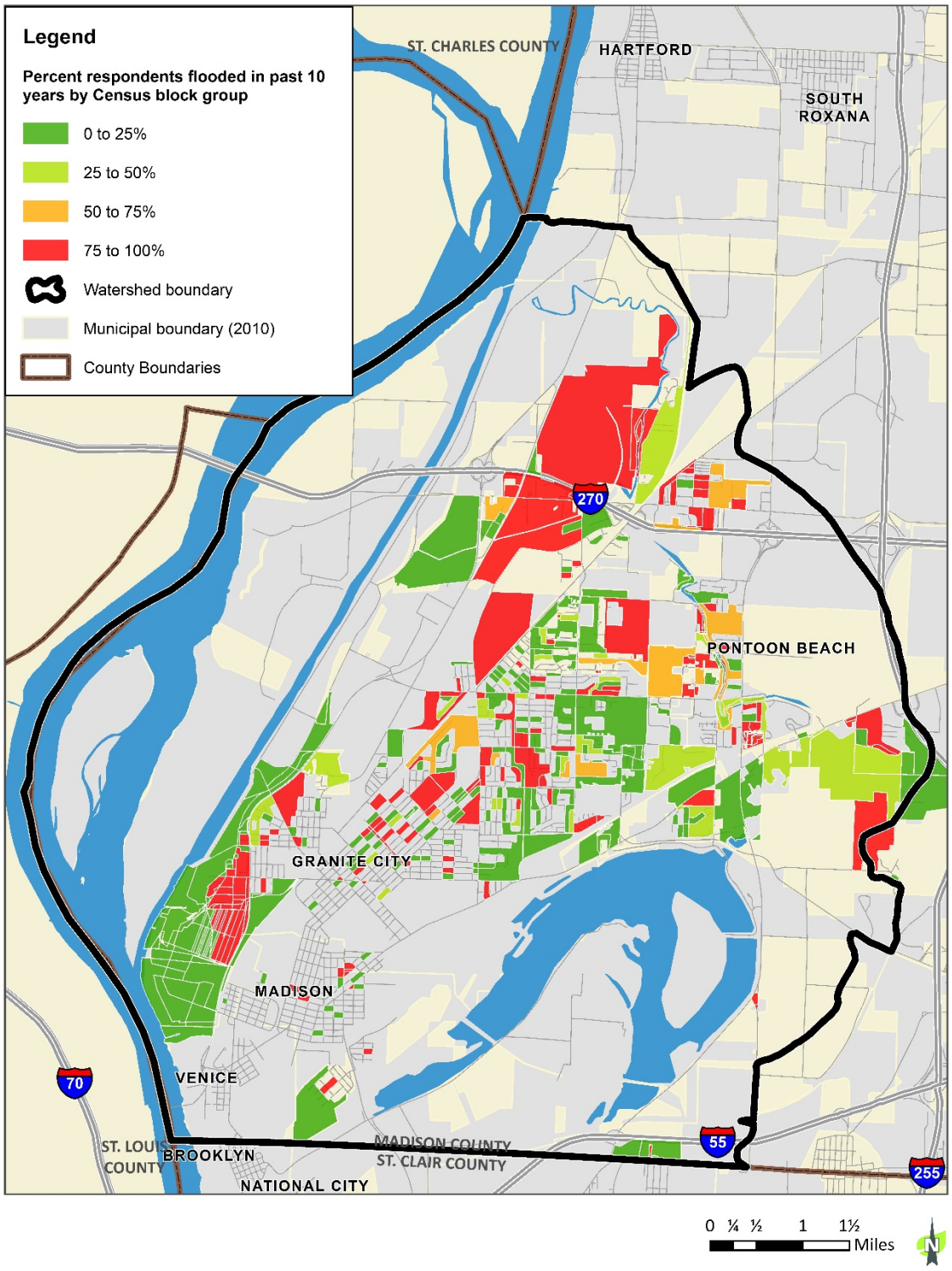
Flooding Locations Identified in the Community Flood Survey

HeartLands Conservancy and the Madison County Planning and Development Department created and distributed the Madison County Community Flood Survey to residents and businesses in the spring of 2017. The intent of the survey was to gather information regarding the location, extent, impacts and causes of flooding in the project area. The results of each community flood survey are shown in the Flood Survey Report in Appendix B.

In total, 2,100 surveys were mailed to residents and business owners, of which 384 were completed, resulting in a response rate of 18%. This total also includes surveys completed online. Well over three-quarters (83%) of respondents were from the Granite City zip code.

Survey responses showed that 45% of respondents experienced flooding in the last 10 years, with 42% of respondents noting flooding at least once per year in the past 10 years. On average, those who were flooded experienced 0.86 floods per year. The respondents with the highest proportions of flooding were in the Granite City, Pontoon Beach, and Madison zip codes. Granite City had the greatest proportion of respondents to report flooding (29%).

Figure A.39: Percent of respondents flooded in the American Bottom watershed.



Flooding Outside the Floodplains

Madison County has experienced flash floods and riverine floods, which are discussed in its countywide hazard mitigation plan.

FEMA designated floodplains cover 38.2% of the total acreage of the American Bottom watershed in Madison County. Of the flood surveys received from this watershed, 29% came from parcels wholly or partly located within these floodplains. Of all survey respondents, 2% unknowingly live on or own a property that is at least partially in the floodplain.

Survey respondents reported approximately 106 events per year taking place outside of FEMA-designated floodplains. Within floodplains, approximately 70 parcels per year were flooded. (36)

Table A.40: Frequency and location of flooding in and outside of floodplains, according to the mapped locations of responses.

		Parcels in floodplain		Parcels outside floodplain	
Flood Frequency over 10 year period	Average times per year	Number	Number of times flooded per year	Number	Number of times flooded per year
1-3 times	0.2	38	7.6	54	10.8
4-6 times	0.5	13	6.5	25	12.5
7-9 times	0.8	9	7.2	15	12.0
10-49 times	1.95	8	15.6	26	50.7
50 or more times	5	2	10.0	4	20.0
Total		70	46.9	124	106.0

Flooding on Roads

There were several road overtopping locations identified by citizen complaints. There was also a 2010 Oates Associates report generated for Madison County that had been used for previous Watershed Resource Inventories, but it did not identify any issues in the American Bottom watershed.

Flooding and Drainage Complaints

The Madison County Stormwater Coordinator keeps a record of complaints received about drainage issues. Between 2012 and 2017, 30 stormwater complaints were recorded in the American Bottom watershed. A breakdown of complaints in each municipality over time is given below in table A.43. The majority of these complaints (97%) were logged at addresses within the City of Granite City—since it is the largest municipality in the watershed, these results are not surprising. The most complaints (eight) were logged in 2012 and were followed by seven in 2013, totaling 15 complaints over the two-year period.

Table A.41: Number of complaints received by year and municipality from 2012 to 2017 in the American Bottom watershed.

Municipality	2012	2013	2014	2015	2016	2017	Total
Edwardsville	1	0	0	0	0	0	1
Granite City	7	7	3	2	6	4	29
Total	8	7	3	2	6	4	30

History of Flooding in the Watershed

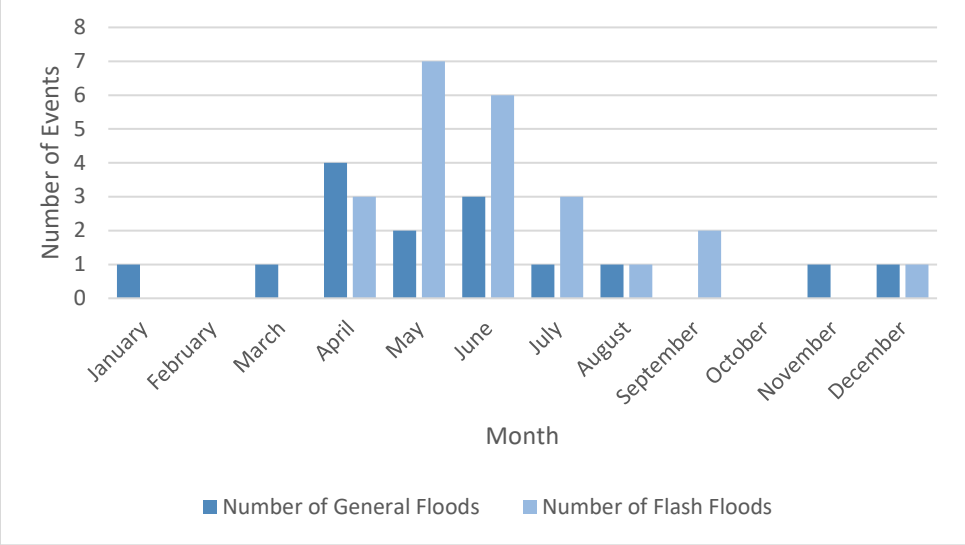
Madison County has identified flooding in the project area as a major hazard in its County Hazard Mitigation Plan. The Hazard Mitigation Plan, finalized in June 2006, lists five events where major flooding occurred in the St. Louis Metropolitan region (including Madison County): July 1947, July 1951, April 1973, August 1993, and May 1995. Since the publication of the countywide plan, the St. Louis region has also experienced flooding in 2008, 2011, 2013, 2014, and most recently during the winter of 2015-2016. All of the general flood events in Madison County, with one exception, were considered countywide events. No specific jurisdictions in Madison County experienced flash floods only in one municipality.

The greatest risk for flooding in the American Bottom watershed is in the spring and summer. The most likely month for flash floods in Madison County is May (historically 56% of events), and the most likely month for general floods is April (historically 30%) as shown in Figure A.40.

Table A.42: Occurrences of floods and most likely months for flooding to occur in Madison County within the project area.

	Madison County (1993-2012)
Number of General Floods Reported	16 (1973-2012)
Number of Flash Floods Reported	23
Total Number of Floods Reported	≥ 23

Figure A.40: Reported flood events in Madison County by month. Multi-month events are shown only in the month they began.



Impacts of Floods

Injury and Death

In Illinois, flooding causes an average of four deaths per year. Historically, the number of injuries and deaths in Madison County from flooding has been very low. No injuries or deaths were reported as a result of any of the 16 recorded general floods from 1973-2012. However, as there is often little to no warning for flash flood events, the risk to public health and safety is elevated.

The major cause of death during floods is drowning, with nearly half of all flash flood deaths occurring as vehicles are swept downstream. According to FEMA, six inches of water will reach the bottom of most passenger cars, causing loss of control and potential stalling. One foot of water will float many vehicles, and two feet of rushing water will carry away most vehicles, including SUVs and pickup trucks. USGS reports that one foot of water typically exerts 500 pounds of lateral force on a vehicle. Floodwaters also damage roadways, bridges and other transportation structures, affecting mobility including evacuation routes.

Floodwaters not only pose a harm through the volume of water transported but also in the potential contaminants in the water. Biological and chemical contaminants in floodwater also pose a risk to public health and safety. Wastewater treatment plants are often located in or near floodplains, and high water events can allow untreated sewage to mix with stormwater and be transported onto streets, yards, parks, and into buildings. If left untreated, these locations can serve as breeding grounds for bacteria and other disease causing agents. If underground utilities are disrupted by flood events, gasoline, oil and other contaminants can also contaminate floodwaters. Depending on the time of year that flooding occurs, agricultural chemicals can also be seen in high concentrations in floodwater. Once floodwaters recede, mold and mildew can pose health risks to young children, the elderly and those with asthma or allergies. (5) (37) (38)

Financial Impacts

Flooding has caused an estimated $257 million per year in damages across Illinois since 1983, making it the single most financially damaging natural hazard in the state. Structural damage to property accounts for a large portion of these financial damages and can include foundation, flooring, drywall and framing damage as well as damages to buildings contents. Losses in agricultural, commercial and industrial productivity, as well as tourism are also impacted by floods.

Between 1978 and 2013, NFIP paid out more than $3 million to Madison County policyholders alone, an average of nearly $86,000 annually. Six of the 16 general flood events in Madison County between 1973 and 2012 caused $12.5 million in crop damages and nearly $37 million in property damage. (39) Four of these six events were federally declared disasters. Madison County has experienced 23 flash flood events between 1993 and 2012, six of which caused $95,000 in crop damage and nearly $7.3 million in property damage. Damage information was unavailable for the remaining 17 reported flash floods. (5)

The Madison County Community Flood Survey questioned residents on flood frequency and costs of flood damage in the Judy's Branch watershed. Table A.43, below, shows a statistical breakdown of financial impacts as reported by residents in the flood survey.

Table A.43: Key financial impact results from the community flood survey

Respondents whose home, business or property has flooded in the last 10-years	57
Number of floods experienced annually	0.86
Of respondents who experienced flooding in the last 10 years:	
No monetary loss	37%
< $5,000	35%
$5,001-$20,000	19%
$20,001-$50,000	8%
$50,001-$100,000	2%
Total costs due to flooding in the last 10 years (low estimate)	$180,033

Other Impacts

Stress was the most commonly reported impact from flooding besides financial losses. Other effects include access to property, and major routes to/from homes, lost business income, crop damage and repair and replacement costs of goods and structures. (40) (41)

The National Flood Insurance Program (NFIP)

Congress created the NFIP in 1968 through the National Flood Insurance Act. Communities participating in the NFIP agree to adopt a floodplain management ordinance to reduce flood risks to new construction in Special Flood Hazard Areas (SFHAs), which are subject to inundation by the "base flood," also known as the "1 percent chance flood," the "100-year flood," or "regulatory flood," as designated on Flood Insurance Rate Maps (FIRMs). In return, the NFIP makes flood insurance available within the community as a financial protection against flood losses. Four percent of U.S. households in 22,000 communities participated in the NFIP as of 2010. FEMA's Mitigation Division manages the NFIP. Illinois is in Region V. (42)

Communities Enrolled in the NFIP and Their Policies

In the American Bottom watershed, five municipalities participate in the NFIP. Madison County also participates in the program, so unincorporated portions of the county that are within a FEMA designated SFHA are also eligible for flood insurance.

Madison County has 1,553 policies in effect covering over $316 million in assets. The communities of Granite City and Pontoon Beach have the most policies in effect of all municipalities within the watershed. Table A.44 gives a breakdown of the policies in the watershed, including the entirety of municipalities wholly or partially within the watershed.

Table A.44: NFIP policies in effect in the American Bottom watershed within Madison County as of 10/31/2013.

Municipality	Policies in Force	Total Premiums	Insurance in Force	Closed Losses	Cost of Closed Paid Losses	Adjustment Expense
Edwardsville	15	$11,010	$3,239,400	2	$38,359	$2,050
Fairmont City	17	$9,030	$2,458,800	0	$0	$0
Granite City	606	$361,058	$116,952,800	75	$331,619	$25,730
Hartford	52	$27,375	$14,762,000	14	$22,873	$3,070
Madison	37	$32,333	$8,986,800	11	$36,054	$3,705
Pontoon Beach	143	$111,943	$17,983,500	17	$75,017	$8,670
Venice	28	$12,167	$6,384,200	12	$65,082	$5,170
Unincorporated Madison County*	722	$552,866	$163,270,400	168	$1,609,990	$70,224
Total	1620	$1,117,782	$334,037,900	299	$2,178,994	$118,619

*this area includes large portions outside of the watershed boundary

Terms included in Table A.44 are defined below:

- Policies In Force: Policies in force on the "as of" date of the report
- Insurance In Force: The coverage amount for policies in force
- Closed losses: Losses that have been paid

Madison County is currently undergoing review of new floodplain maps for the county. (43)

Fourteen percent (52 responses) of respondents in the American Bottom watershed reported having flood insurance in the community flood survey. Twenty-five respondents (6.5%) have flood insurance on structures that are not located in a floodplain. (36)

Table A.45: Communities in the Project Area enrolled in the NFIP

Community	Initial FIRM	Effective FIRM Date
Edwardsville	01/18/1984	01/18/1984
Fairmont City	03/28/1980	11/05/2003
Granite City	06/01/1978	06/01/1978
Hartford	05/01/1979	05/01/1979
Madison	07/16/1980	07/16/1980
Pontoon Beach	07/16/1980	02/05/1982
Venice	01/05/1978	01/05/1978
Unincorporated Madison	04/15/1982	04/15/1982

Communities Not Enrolled in the NFIP

When the NFIP began, separate areas of government jurisdiction were shown on separate FIRMs. This is the case for several communities with FIRMs created in the 1980s. Some communities were not mapped, and as a result do not face any sanctions for being flood prone while not enrolled. The term

"sanctions" includes penalties for no flood insurance, no federal mortgage insurance, and no federal grants or loans for development. These communities may join the NFIP at any time.

Since the 1990s, FEMA has mapped all areas of a county on the same map to eliminate gaps and outdated information as municipalities grow and communities incorporate. (44) When the next FIRMs are created, current "holes in the map" will be eliminated and the entire county will be covered.

Federal Flood Insurance Reform

FEMA is focused on building a culture of preparedness by closing the insurance gap. Recognizing that purchasing flood insurance can be confusing and time-consuming, the NFIP is redesigning its risk-rating plan to improve the policyholder experience. FEMA is committed to a NFIP that people value and trust; one that is fair, understandable, and less complex to navigate.

Risk Rating 2.0 aims to accomplish this by leveraging industry best practices and current technology to deliver rates that are transparent, easy to understand, and better reflect a property's unique flood risk.

Risk Rating 2.0 will fundamentally change the way FEMA rates a property's flood risk and prices insurance. The current rating methodology has not changed since the 1970s. However, since then technology has evolved and so has FEMA's understanding of flood risk. Currently, FEMA develops rates based predominantly on Flood Insurance Rate Map zone and Base Flood Elevation. With Risk Rating 2.0, FEMA is pairing state-of-the-art industry technology with the NFIP's mapping data to establish a more comprehensive understanding of risk at both the community and individual level.

Risk Rating 2.0 is intended to help customers better understand their flood risk and provide them with more accurate rates based on their unique flood risk. This will include determining a customer's flood risk by incorporating multiple, logical rating characteristics (e.g., different types of flood, the distance a building is from a water source, or the cost to rebuild a home). The new rating plan will also aim to ensure customers will no longer face dramatic rate increases during map changes or at the edge of flood zones. By reflecting the cost to rebuild, the new rating plan will also aim to deliver fairer rates for owners of lower-value homes. FEMA is building a new rating engine to help insurance agents easily price and sell policies. It will also allow policyholders understand their property's flood risk and how it is reflected in their cost of insurance.

To ensure that rates will not be burdensome for homeowners, FEMA is working to protect policyholders and minimize any unintentional effects of the transition. This will help transition policyholders who may face otherwise substantial rate increases.

FEMAs goal through Risk Rating 2.0 is to help people better understand their flood risk so they can make informed decisions when it comes to protecting the financial investments they have made in their homes. New rates for all single-family homes will go into effect nationwide on October 1, 2020.

Future Development and Flood Ordinances

The 2006 Hazard Mitigation Plan for Madison County predicted little flood risk in current development trends in Madison County, as most residential growth was occurring in regions not prone to bottomland flooding, and development planned on the fringe of major drainage features would be discouraged by floodplain regulations. (5) However, the county remains vulnerable to flash flooding depending on the amount of precipitation received, topography, land use, and other factors.

Prioritizing Floods among Other Natural Hazards

Madison County's most recent Draft Multi-Jurisdictional All Hazards Mitigation Plan has a Hazard Risk Assessment Chart where hazards are ranked based upon historical events and the assessment of the potential for damage. Five hazards are then ranked from low (3) to high (1) for each municipality. All of the municipalities within the project area have flooding ranked as high risk. (5)

Water Quality

Impaired Waters

Under Section 305(b) of the Clean Water Act, IEPA must submit to the USEPA a biennial report of the quality of the state's surface and groundwater resources. The report, called the Illinois Integrated Water Quality Report and Section 303(d) List, must describe how Illinois waters meet or fail to meet water quality standards appropriate for certain "Designated Uses" assigned to them. There are seven Designated Uses in Illinois, of which six have been assigned to streams in the American Bottom watershed in:

- Aquatic Life
- Fish Consumption
- Public and Food Processing Water Supplies
- Primary Contact
- Secondary Contact
- Aesthetic Quality.

The Aquatic Life designated use represents the waterway's ability to support fish and aquatic macro-invertebrates. The fish consumption designated use is the ability for a waterbody to contain fish that are safe for consumption. The Public and Food Processing Water Supplies designated use indicates the ability to supply water to the public and for food supply. The Primary Contact designated use is the waterway's ability to support activities such as swimming and water skiing. The Secondary Contact designated use is the waterway's ability to support activities such as boating and fishing. The Aesthetic Quality designated use represents a watershed free from impairments such as: sludge, bottom deposits, floating debris, visible oil, odor, etc. When a Designated use cannot be met, a waterbody is determined to be impaired, and IEPA must list the potential causes and sources for impairment in the 303(d) impaired waters list.

The Madison County portion of the American Bottom watershed has eight impairments as of the 2016 Illinois Integrated Water Quality Report (Table A.47). The impairments occur at the following stretches of waters in the Judy's Branch watershed: Cahokia Canal, Canteen Creek, Chain of Rocks Canal, Horseshoe Lake, Schoenberger Creek, and Mississippi River. (Figure A.41).

Causes of impairments in the American Bottom watershed have changed over time and are listed in Table A.46.

Table A.46: Illinois EPA Designated Uses and Impairments for stream reaches in the American Bottom watershed.

Name	Assessment Unit ID	Size (mi)	Designated Use	Use Attainment	Impaired?	Cause of Impairment	Source of Impairment
Cahokia Canal	IL_JN-02	6.9	Aquatic Life	Not Supporting	Yes	Alteration in stream-side or littoral vegetative covers, Iron, Manganese, Dissolved Oxygen, Sedimentation/ Siltation, Total Suspended Solids (TSS), Total Phosphorus, Changes in Stream Depth and Velocity Patterns, Loss of Instream Cover	Channelization, Crop Production, Site Clearance, Urban Runoff/Storm Sewers, Combined Sewer Overflows, Loss of Riparian Habitat, Municipal Point Source Discharges, Sanitary Sewer Overflows, Natural Sources
			Fish Consumption	Not Assessed			
			Secondary Contact	Not Assessed			
			Aesthetic Quality	Not Supporting			
Canteen Creek	IL_JNA-01	0.1	Aquatic Life	Not Supporting	Yes	Alteration in stream-side or littoral vegetative covers, Barium, Manganese, Total Suspended Solids (TSS), Total Phosphorus, Changes in Stream Depth and Velocity Patterns, Loss of Instream Cover	Channelization, Crop Production, Municipal Point Source Discharges, Site Clearance, Urban Runoff/Storm Sewers
			Fish Consumption	Not Assessed			
			Secondary Contact	Not Assessed			
			Aesthetic Quality	Fully Supporting			
Chain of Rocks Canal	IL_JO	9.44	Fish Consumption	Not Supporting	Yes	Polychlorinated Biphenyls (PCBs)	Source Unknown
			Public and Food Processing Water Supplies	Fully Supporting			
			Aquatic Life	Fully Supporting			

Name	Assessment Unit ID	Size (mi)	Designated Use	Use Attainment	Impaired?	Cause of Impairment	Source of Impairment
Horseshoe Lake	IL_RJC	2,253	Aesthetic Quality	Not Supporting	Yes	Aquatic Algae, Total Phosphorus, Polychlorinated Biphenyls (PCBs), Total Suspended Solids (TSS)	Crop Production, Industrial Point Source Discharge, Littoral/Shore Area Modifications, Source Unknown, Urban Runoff/Storm Sewers
			Fish Consumption	Not Supporting			
			Aquatic Life	Fully Supporting			
			Primary Contact	Not Assessed			
			Secondary Contact	Not Assessed			
Long Lake	IL_RJI	95	Any	Not Assessed	N/A	No Source Identified	No Source Identified
Mississippi River	IL_J-02	13.83	Fish Consumption	Not Supporting	Yes	Mercury, Polychlorinated Biphenyls (PCBs)	Atmospheric Deposition – Toxics, Source Unknown
			Aquatic Life	Fully Supporting			
			Primary Contact	Fully Supporting			
			Public and Food Processing Supplies	Fully Supporting			
			Secondary Contact	Fully Supporting			
			Aesthetic Quality	Not Assessed			

Name	Assessment Unit ID	Size (mi)	Designated Use	Use Attainment	Impaired?	Cause of Impairment	Source of Impairment
Schoenberger Creek	IL_JNG	3.8	Aquatic Life	Not Supporting	Yes	Alteration in stream-side or littoral vegetative covers, Manganese, Total Ammonia, Dissolved Oxygen, Changes in Stream Depth and Velocity Patterns, Loss of Instream Cover, Total Phosphorus, Aquatic Plants, Aquatic Algae, Sludge, Turbidity	Channelization, Combined Sewer Overflows, Contaminated Sediments, Highway/Road/Bridge Runoff (Non-Construction Related), Loss of Riparian Habitat, Municipal Point Discharges, Sanitary Sewer Overflows, Streambank Modifications/ destabilization, Urban Runoff/Storm Sewers
			Fish Consumption	Not Assessed			
			Primary Contact	Not Assessed			
			Secondary Contact	Not Assessed			
			Aesthetic Quality	Not Supporting			

Figure A.41: Impaired waters in the American Bottomproject area.

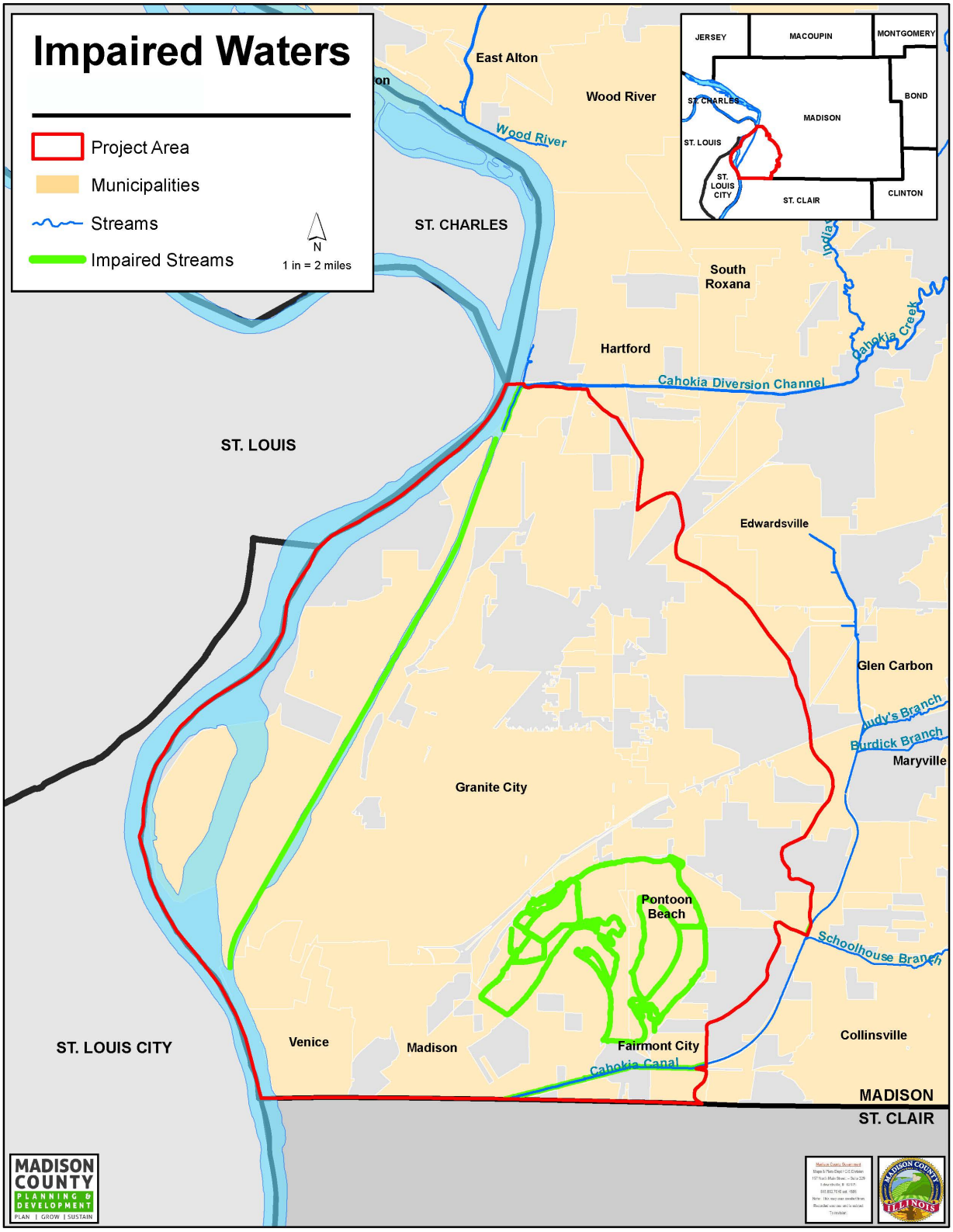


Table A.47: Impairments for the Judy's Branch HUC10 watershed (HUC 0714010104) between 2006 and 2016.

Impairments																				
Year	DO	Total Phosphorus	Iron	PCBs	Manganese	Fecal Coliform	Barium	TSS	Bottom Deposits	Zinc	Mercury	Copper	Total Nitrogen	Total Dissolved Solids	Heptachlor	pH	Total Ammonia	Color	Turbidity	Sludge	Odor
2016	X	X	X	X	X		X	X	X		X						X	X	X	X	X
2014	X	X	X	X	X		X	X	X		X						X	X	X	X	X
2012	X	X	X	X	X	X	X	X	X		X						X	X	X	X	X
2010	X	X	X	X	X	X	X	X			X										
2008	X	X	X	X	X	X	X	X		X	X				X	X					
2006	X	X		X	X			X		X		X	X	X	X	X					

Impairments Cont.							
Year	Alteration in stream-side or littoral vegetative covers	Changes in Stream Depth and Velocity Patterns	Loss of Instream Cover	Nonnative Fish, Shellfish, or Zooplankton	Aquatic Algae	Aquatic Plants	Sedimentation/ Siltation
2016	X	X	X		X	X	X
2014	X	X	X		X	X	X
2012	X	X	X		X	X	X
2010	X	X	X		X		X
2008	X	X	X	X	X		X
2006	X			X	X		X

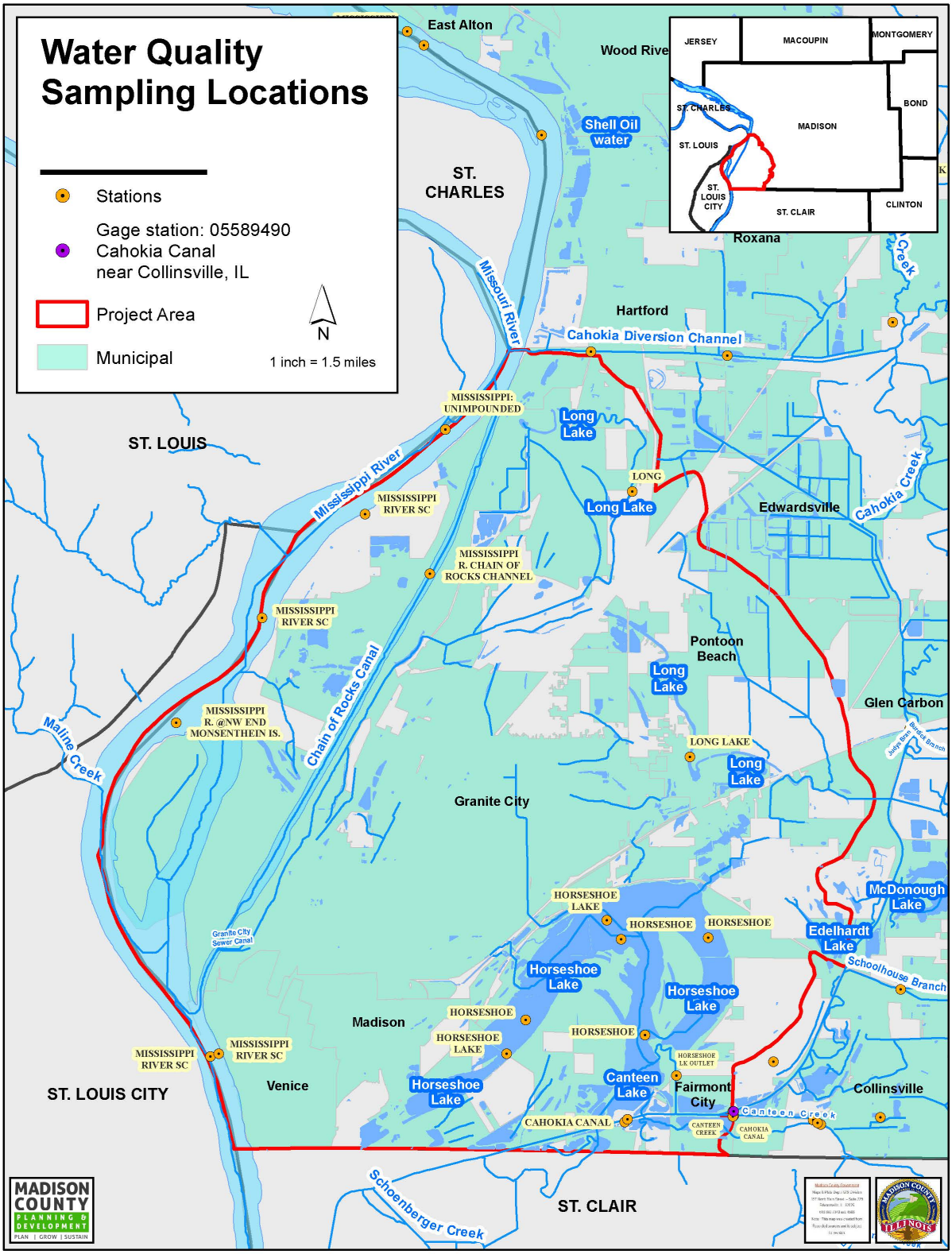
Water Quality Indicators and Research

Water quality in the American Bottom watershed is impacted primarily by developed land. Developed land in the watershed—including open space, low, medium and high intensity area—accounts for 43% of the watershed's area. As expected, the developed land in the watershed is concentrated around major municipalities including Granite City, Pontoon Beach, Madison, Venice, and Fairmont City. Urbanization is expected to increase by 11% in Madison County during the next 15 years due to its location in the Metro East area of the St. Louis metropolitan region.

Sources of Data

According to the IEPA data layer in the RMMS, there are 17 gage locations within the project area: five along the Mississippi River, 10 throughout Horseshoe Lake, and two along Long Lake. These locations are shown in Figure A.42. Data was retrieved for only five gages on Horseshoe Lake from the IEPA's STORET Central Warehouse. Since there was no stream data within the project area, a USGS gage just east of the boundary was analyzed—USGS-05589490 lies on the Cahokia Canal just before it flows into the Judy's Branch watershed. The U.S. Geological Survey-Illinois Water Science Center (USGS-IWSC) sampled this site from the late 1970s through 1997.

Figure A.42: Water Quality sampling locations.



Nitrogen

More than 92% of the nitrate-nitrite concentrations measured at the USGS gage site from 1978 to 1997 were below 2 mg/L. During peak discharge periods, values reached concentrations as high as 18 mg/L (Figure A.43 and Table A.48). The average nitrate-nitrite concentration for the Project Area from 1978 to 1997 was 1.11 mg/L, which is less than the statewide average of 3.89 mg/L from 1980 to 1996 reported in a 1999 IEPA study. (45)

Figure A.43: Nitrate + Nitrite nitrogen concentrations in Cahokia Canal at USGS gage site 05589490 near Collinsville (1978-1997).

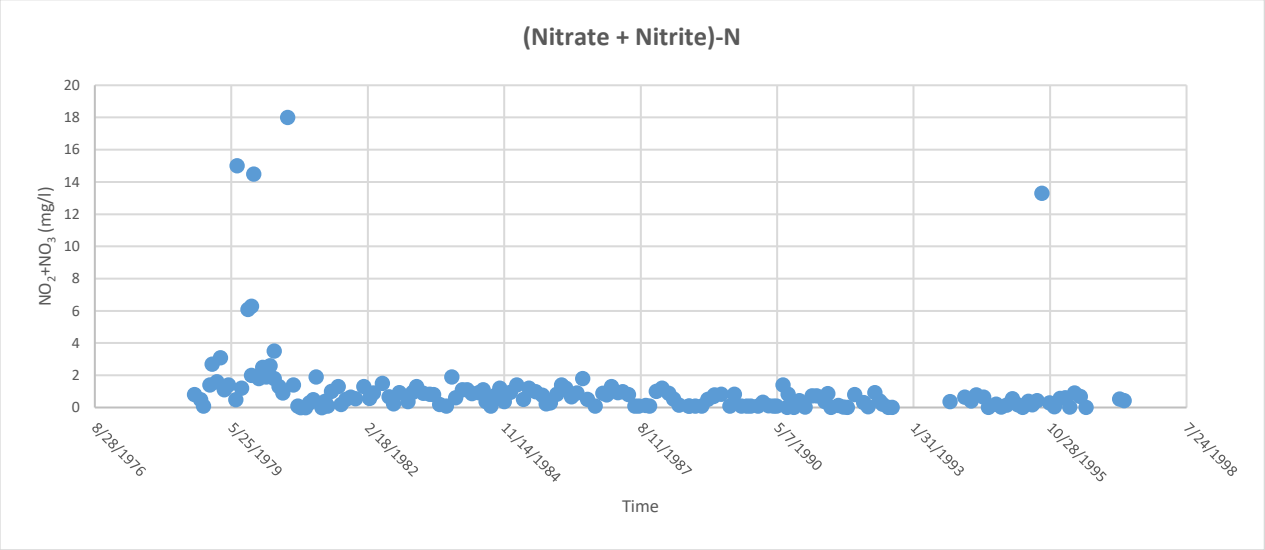


Table A.48: Statistical summary of nutrients and nutrient-related parameters measured in samples collected from Cahokia Canalat the USGS gage 05589490 between 1978 and 2005 by the Illinois Water Science Center and IEPA.

Nutrient	Unit	n	min	10th pctl	25th pctl	Median	75th pctl	90th pctl	Max	Mean
(NH3+NH4)-N	mg/L	121	0.00	0.08	0.10	0.18	0.35	5.32	18.00	1.37
(NO2+NO3)-N	mg/L	166	0.00	0.05	0.15	0.63	1.03	1.80	18.00	1.11
Organic N	mg/L	4	0.30	0.32	0.38	0.65	0.79	0.89	0.82	0.61
Kjeldahl N	mg/L	5	0.30	0.30	0.41	0.60	0.85	0.95	1.00	0.62
Total N	mg/L	4	0.40	0.40	0.54	1.39	1.80	1.80	1.80	1.24
P, Dissolved	mg/L	106	0.01	0.02	0.03	0.05	0.10	0.15	1.90	0.09
P, Total	mg/L	109	0.06	0.10	0.14	0.23	0.37	0.58	2.30	0.30
Fecal Coliforms	Col/100ml	125	20	68	200	460	1170	4860	150000	3,111

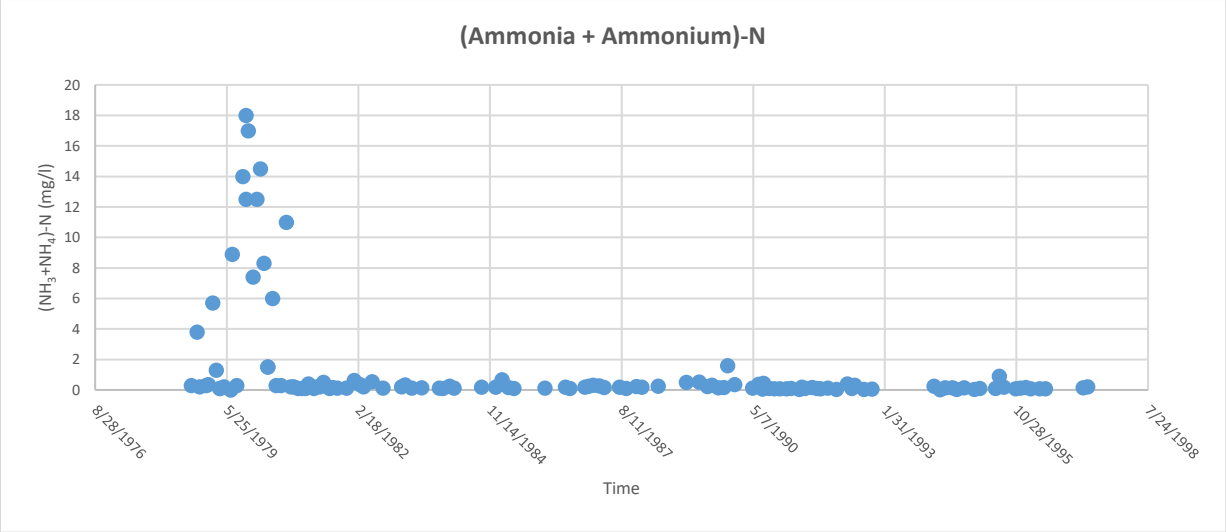
Table A.49: Statistical summary of standard water quality parameters measured in samples collected from Cahokia Canal at the USGS gage 05589490 between 1978 and 1997 by the Illinois Water Science Center and IEPA.

Standard Parameter	Unit	n	min	10th pctl	25th pctl	Median	75th pctl	90th pctl	Max	Mean
Temperature (Water)	C	165	0	2	6.15	13.8	19.5	23.38	28.9	13.11
pH		173	6.8	7	7.2	7.5	7.7	7.9	8.4	7.47
Specific Conductance	uS/cm	153	72	400.2	605	778	894.5	983.6	1270	736.47
Chemical Oxygen Demand (COD)	mg/L	141	0	7	10	16	26.5	42	150	22.33
Dissolved Oxygen (DO)	mg/L	272	0.80	5.40	6.49	8.40	11.13	13.00	15.00	8.80
Total Dissolved Solids	Ton/day	26	0.44	0.69	0.84	163.05	623.75	683	810	299.52
Total Suspended Solids	mg/L	165	4	15	26	66	150	309.6	5810	159.40
Volatile Suspended Solids	mg/L	161	1	2	4	10	17	27.8	500	16.93
Total Hardness (as CaCO3)	mg/L	101	110	202.4	310	410	450	470	570	373.15
Turbidity	NTU	119	0.5	2.7	5	12	33	80	510	40.60

Ammonium

Ammonium-nitrogen ((NH_3+NH_4)-N), which includes both ammonia (NH_3) and ammonium (NH_4) forms but is mostly the latter, was measured at the USGS gage 05589490. Between 1978 and 1997, ammonium-nitrogen ranged from 0.00 to 18.00 mg/L with a median value of 0.18 mg/L and an average of 1.37 mg/L. The average significantly higher than the statewide average of 0.32 mg/L for Illinois from 1980 to 1996. There was no available ammonium data for the period after 1997 for the USGS gage 05589490 site.

Figure A.44: Ammonia + Ammonium nitrogen concentrations in the Cahokia Canal at USGS gage site 05589490 near Collinsville (1978-1997)



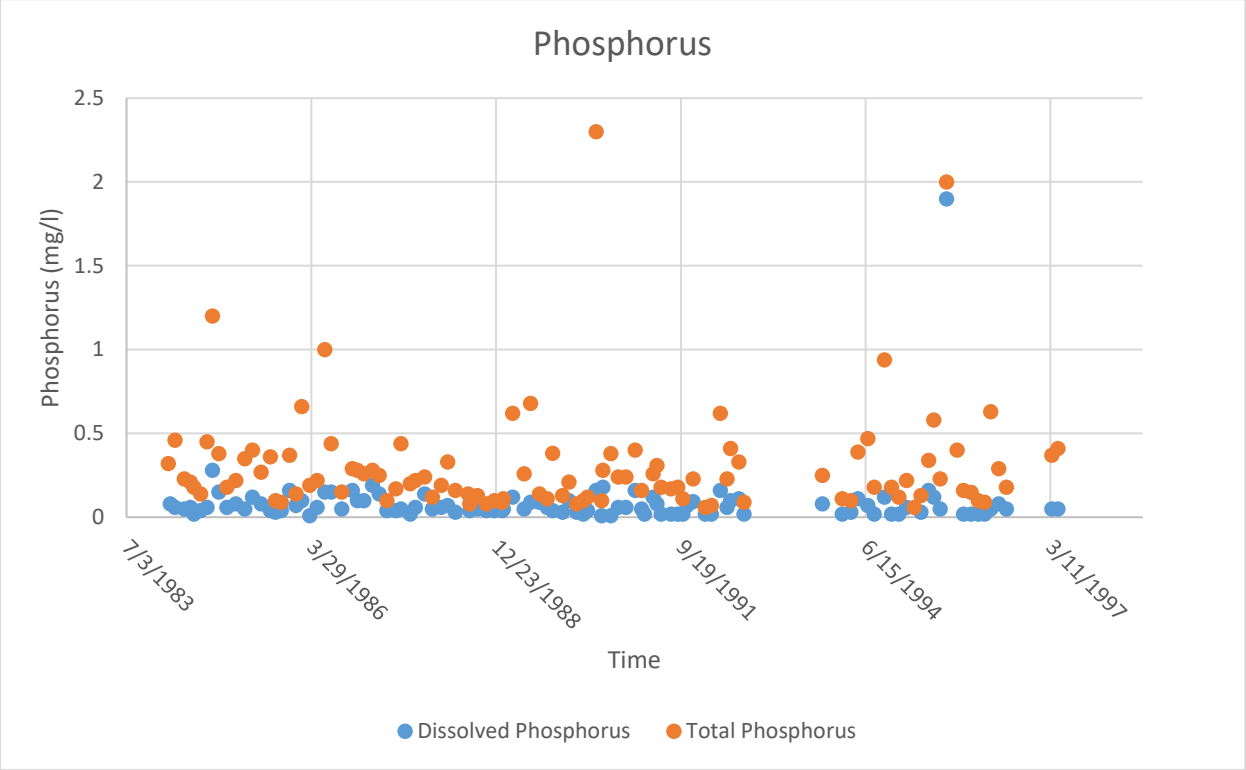
Total/Kjeldahl/Organic N

On a few occasions during the period from 1999 to 2005, other forms of nitrogen were measured at the USGS gage, including organic N, Kjeldahl N, and Total N. Nitrogen in these forms consistently followed the trend of Organic-N > Kjeldahl-N > Total-N. Kjeldahl N was measured in five samples by the IEPA, although the latter agency analyzed most of those samples. The amounts of nitrogen in these forms were smaller than the concentrations reported for nitrate and ammonium. Without additional data for these forms of nitrogen, it is impossible to discern trends over time. However, when all the forms of nitrogen are considered together, nitrogen is not a significant problem in the watershed. Total N was listed as an impairment on the 2004 and 2006 303(d) list, but since then has not been considered an impairment.

Phosphorus

Both total and dissolved phosphorus were measured at USGS gage 05589490 from 1978 to 1997. Dissolved P is primarily orthophosphate (soluble reactive phosphorus) and is biologically active. The average total and dissolved phosphorus levels for Cahokia Creek are 0.30 and 0.09 mg/L respectively, which are below the Illinois statewide average for soluble phosphorus of 1.25 mg/L.

Figure A.45: Dissolved and total phosphorous concentrations in water samples collected from Judy's Branch creek at the USGS gage 05589490 by the IWSC and IEPA.

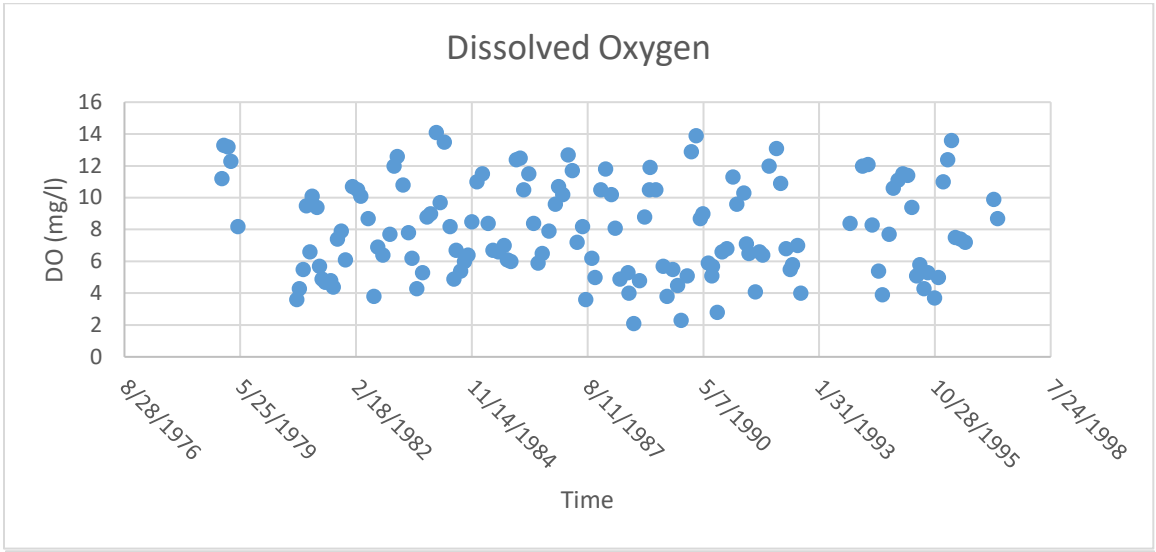


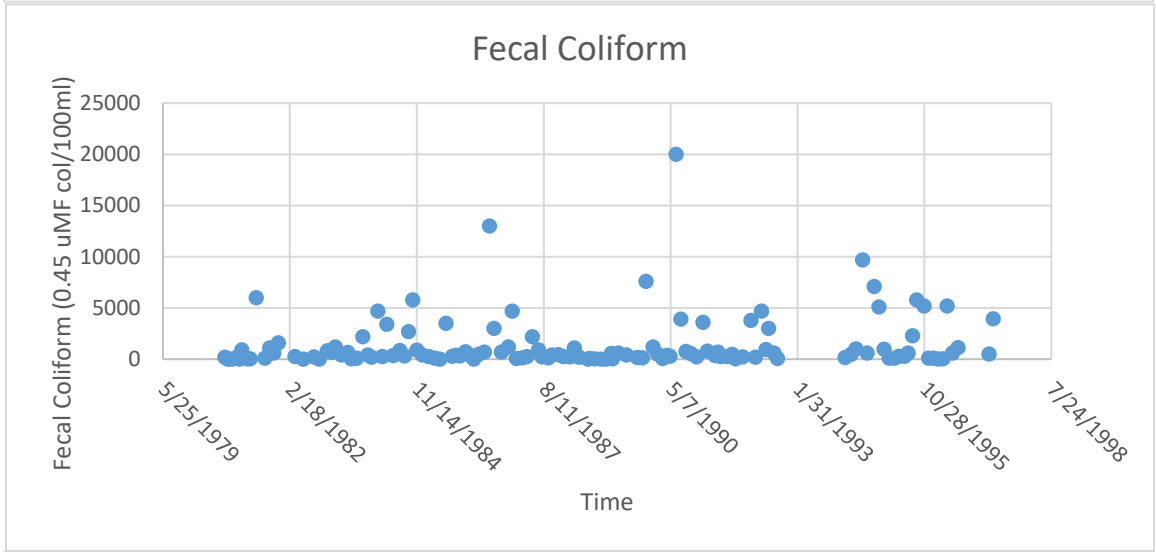
Biological Indicators of Water Quality

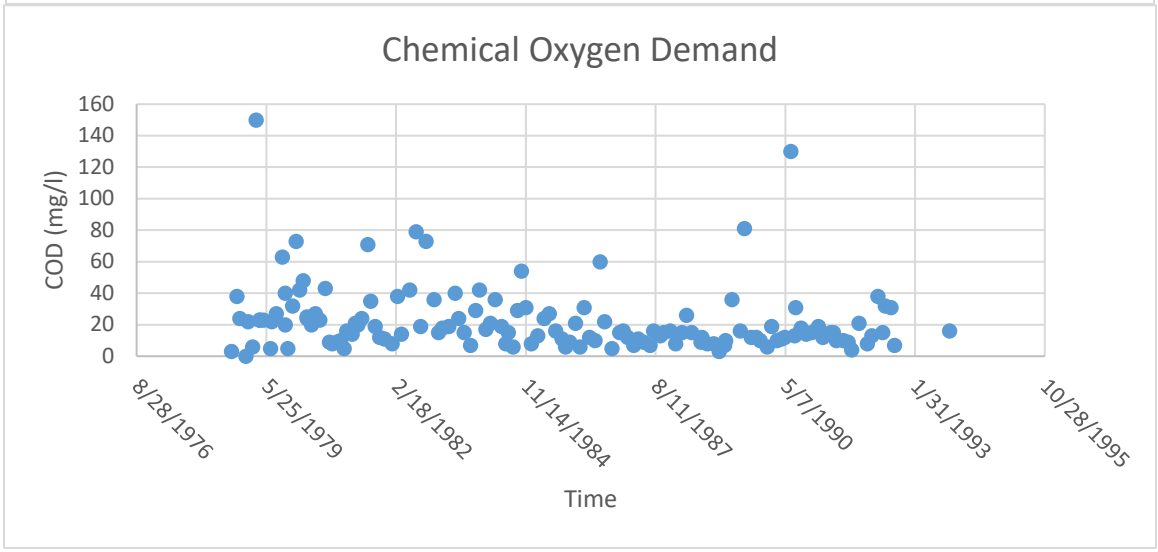
Chemical Oxygen Demand (COD) was measured from 1978 to 1993, and there was no significant trend over time (Figure A.46). Ninety-three percent of the values were below 50 mg/L, but some values ranged from 50 to 150 mg/L. The average COD is 22.3 mg/L. COD is typically below 20 mg/L in unpolluted waters, so the values measured in Cahokia Canal indicate there is a slightly high content of an organic carbon load in the stream for much of the time.

Dissolved oxygen (DO) was measured from 1978 to 1997. DO values less than 2 mg/L indicate hypoxic conditions, but none of the samples in the Judy's Branch watershed had DO values below 2 mg/L (the minimum values was 2.1 mg/L). There was no significant trend over time, except for seasonal trends with DO values generally higher in the cooler winter months and lower during the hot summer months (Figure A.46), as warmer water can hold less DO. When shade trees are removed next to streams, this has the same effect – the water becomes warmer and DO levels decrease. The median DO in the stream between 1978 and 1997 is 8.40 mg/L.

Figure A.46: Some water quality parameters relating to biological activity in water samples collected by the IWSC and IEPA at the Cahokia Canal USGS Gage 05589490 (1977 to 1997).







Fecal coliforms were measured from 1978 to 1997 as the number of colony forming units per 100mL (cfu/100mL). Reported values ranged from five to 150,000* cfu/100mL. The highest value confirmed by the USGS was 20,000 cfu/100mL. Before switching to other indicators of fecal contamination, the EPA used a threshold of 200 cfu/100mL to indicate unacceptable water quality for fishing and swimming. During the period from 1978 to 1997 when fecal coliforms were monitored, 69% of the samples had concentrations above the minimum acceptable threshold (Figure A.46). Fecal coliforms were listed as an impairment on the 2008, 2010, and 2012 303(d) list.

**NOTE – This number was collected but not verified by a technician to confirm the value.*

Organic carbon is both an important indicator of biological activity as well as a substrate for microbial activity. Only two measurements were made by the IEPA in 2005. They were both less than 6mg/L. No measurements of organic carbon were taken prior to 2002. In general, the organic carbon values are typical of rivers in the Midwest.

Earth and Trace Metals

Water quality monitoring by the USGS-IWSC and IEPA at the USGS gage 05589490 included a large number of common earth metals (Table A.50) as well as trace and heavy metals (Table A.51). In most cases, both dissolved and total forms were reported. Earth metals are typically found in high concentrations throughout the environment because they are common ingredients in soils and plants. Trace and heavy metals are also relatively ubiquitous in the natural environment, but they tend not to be found in high concentrations. High concentrations of trace and heavy metals usually indicate some type of industrial contamination. This large Cahokia Canal dataset showed that these naturally occurring elements were all within normal ranges found in natural environments.

Manganese, which is listed as one of the impairments for Cahokia Canal, is a mineral that naturally occurs in rocks and soil. In trace amounts, it is essential to the health of plants and animals. It has similar properties to iron, and is used in compounds for uses including metal alloys, antiseptic creams, preservatives, batteries, fireworks, fertilizers, and animal feed. Manganese was listed as an impairment in 2006, 2008, 2010, 2012, 2014, and 2016. Measurements taken prior to 1997 are higher than those taken more recently, perhaps as a result of more accurate measurement procedures. The method detection level prior to 1997 was >1 µg/L.

Sources of manganese include atmospheric deposition (particles in the air from industry and coal-burning power plants), groundwater as it flows through rocks and soils with high natural manganese, discharges from industrial operations (including the production of metal alloys, antiseptic creams, preservatives, batteries, fireworks, fertilizers, and animal feed), and runoff from fertilizer on cropland. When water contains too much manganese, it leaves stains on everything it encounters, including pipelines, faucets, and fabrics. At concentrations exceeding 0.15 ppm, manganese imparts an undesirable taste to beverages and stains plumbing fixtures. The value recommended by the FAO is 0.1 ppm. The U.S. EPA Secondary Maximum Contaminant Level (MCL), a recommended concentration set of drinking water for aesthetic reasons (i.e., to avoid staining to pipes) is 0.05mg/L (0.05 ppm). (46) The median manganese concentration in Cahokia Creek between 1978 and 1997 is 0.36 ppm (360 ug/L) dissolved manganese, while the maximum observed manganese was 1.10 ppm (1,100 µg /L) dissolved manganese (Figure A.47). However, surface water samples typically range from one to 200 µg/L. (47)

Figure A.47: Manganese concentrations measured at the Cahokia Canal USGS gage (1980-1997).

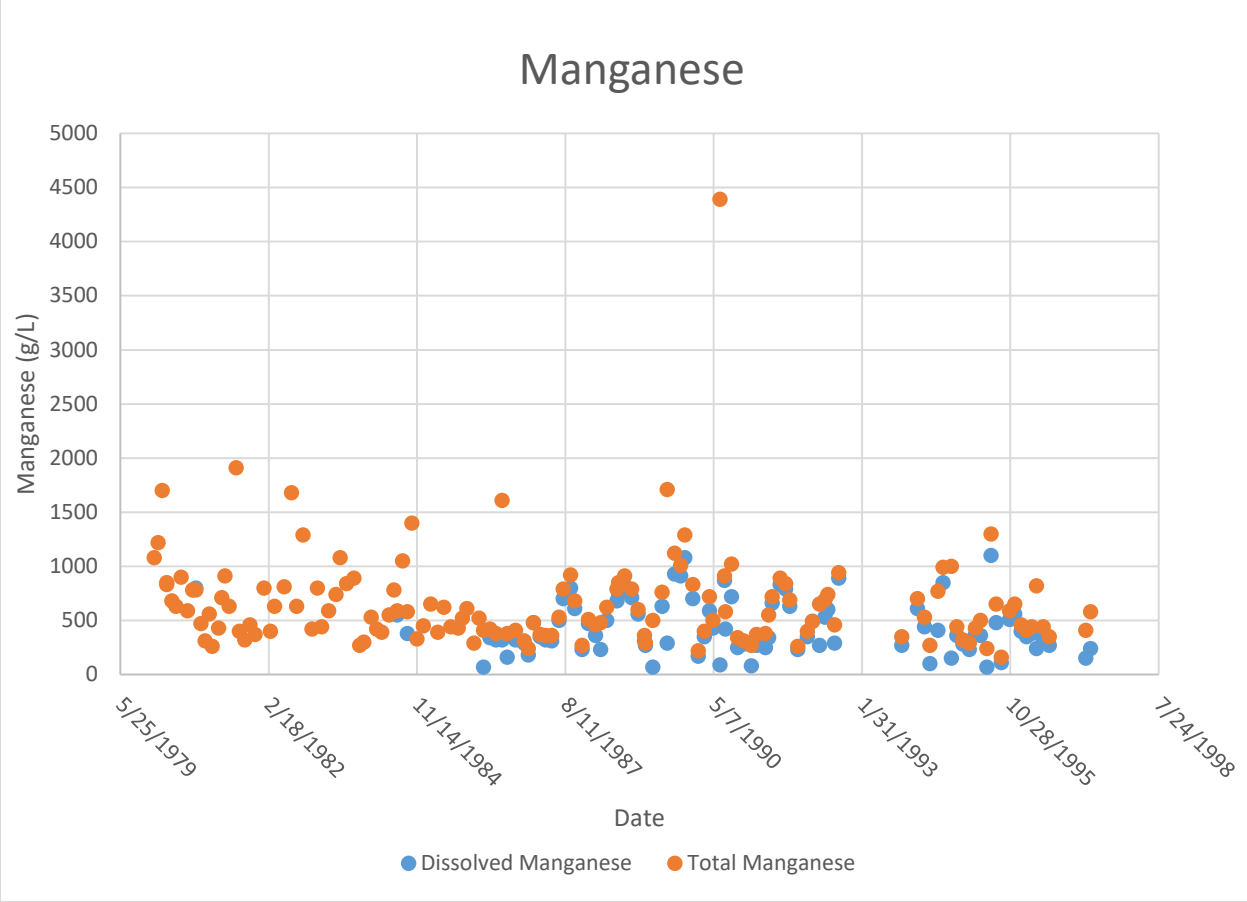


Table A.50: Statistical summary of earth metal concentrations monitored in the Cahokia Canal USGS Gage 05589490 (1977 to 1997) by the Illinois Water Science Center and IEPA.

Earth Metals	Units	n	Min	10th Pctl	25th Pctl	Median	75th Pctl	90th Pctl	Max	Mean
Aluminum, Dissolved	µg/L	34	51.00	55.50	64.75	96.50	140.00	196.50	450.00	116.32
Aluminum, Total	µg/L	106	100.00	200.00	400	1000.00	2425.00	5160.00	46900.00	2616.04
Iron, Dissolved	µg/L	54	50.00	60.00	80	160.00	455.00	1420.00	2010.00	412.04
Iron, Total	µg/L	148	140.00	1100.00	1885	2710.00	4700.00	8540.00	86700.00	5170.81
Mg, Dissolved	mg/L	90	7.20	16.10	27.00	36.00	42.25	47.00	51.00	34.02
Mg, Total	mg/L	147	9.70	21.80	30.00	40.00	46.00	50.00	60.00	37.77
K, Dissolved	mg/L	90	0.30	2.00	2.30	2.90	3.80	4.39	8.80	3.12
K, Total	mg/L	145	1.20	2.40	2.90	3.70	4.70	6.16	10.10	4.05
Silver, Total	µg/L	25	0.00	0.00	0.00	0.00	5.50	9.40	30.00	3.72
Na, Dissolved	mg/L	90	4.50	9.91	13.00	20.00	28.50	37.00	79.00	22.42
Na, Total	mg/L	147	5.30	10.80	14.00	22.00	33.00	45.40	87.00	25.51
Calcium, Dissolved	mg/L	90	22.00	41.10	65.25	86.00	95.25	100.90	126.00	79.26
Calcium, Total	mg/L	147	28.00	54.00	74.00	95.00	104.00	109.00	143.00	87.46
Chloride, Total	mg/L	164	8.00	14.00	23.25	37.00	57.00	74.00	181.00	42.11
Fluoride, Total	mg/L	3	0.30	0.30	0.30	0.30	0.40	0.40	0.40	0.33
Oil + Grease, Total	mg/L	89	0.00	0.00	0	1.00	3.50	7.00	90.00	3.43
Sulfate, Dissolved	mg/L	163	19.00	52.40	84	110.00	137.00	183.40	355.00	118.00

Table A.51: Statistical summary of trace and heavy metal concentrations monitored in the Cahokia Canal at USGS Gage 05589490 (1978-2005) by the Illinois Water Science Center and IEPA.

Trace and Heavy Metals	Units	n	Min	10th Pctl	25th	Median	75th Pctl	90th	Max	Mean
Arsenic, Total	µg/L	4	3.00	3.00	3.00	3.50	4.75	5.0	5.00	3.75
Barium, Dissolved	µg/L	89	38.00	75.00	88.5	120.00	269.50	390.00	515.00	177.93
Barium, Total	µg/L	137	100.00	100.00	100	200.00	300.00	500.00	700.00	227.74
Boron, Dissolved	µg/L	70	30.00	51.00	70	90.00	110.00	120.00	310.00	90.14
Boron, Total	µg/L	133	30.00	54.00	70	100.00	130.00	170.00	490.00	115.49
Chromium, Dissolved	µg/L	1	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Chromium, Total	µg/L	60	0.00	0.00	5	8.00	11.50	25.40	1100.00	28.48
Cobalt, Total	µg/L	16	10.00	10.00	10.00	10.00	20.00	30.00	30.00	15.63
Copper, Total	µg/L	52	0.00	0.00	0.00	10.00	20.00	30.00	80.00	13.85
Lead, Total	µg/L	31	0.00	0.00	0.00	0.00	0.00	80.00	100.00	9.68
Manganese, Dissolved	µg/L	90	70.00	151.00	270	360.00	610.00	818.00	1100.00	439.78
Manganese, Total	µg/L	148	160.00	309.00	400	570.00	797.50	1053.00	4390.00	659.12
Lithium, Total	µg/L	6	80.00	80.00	80.00	85.00	97.50	100.00	120.00	90.00
Strontium, Dissolved	µg/L	90	50.00	100.00	150.00	195.00	220.00	260.00	340.00	186.56
Strontium, Total	µg/L	147	70.00	120.00	160.00	200.00	240.00	272.00	370.00	198.84
Vanadium, Total	µg/L	33	10.00	10.00	10.00	10.00	30.00	56.00	110.00	23.64
Zinc, Dissolved	µg/L	4	60.00	61.00	62.50	85.00	160.00	170.00	180.00	102.50
Zinc, Total	µg/L	46	0.00	7.00	57.50	120.00	175.00	276.00	1950.00	162.39

Agriculture and Water Quality

Grain agriculture requires the use of nitrogen and phosphorus fertilizers. This results in the annual addition of soluble nutrients to the watershed. A 2010 study published in the Journal of Environmental Quality reported that 75% of the nitrogen inputs into Madison County were a result of fertilizer applications, with another 9.3% from manure, 6.7% from the atmosphere, and 8.6% from human activities (sewage).(48) Similarly, a 2011 study in the Journal of Environmental Quality reported that 73% of phosphorus inputs into Madison County came from fertilizer, 21.2% from manure, and 5.6% from sewage.(49) The tillage practices associated with grain production result in annual disturbance of the soil surface, making the soil more susceptible to sheet and rill erosion during precipitation events. The 2012 Illinois Department of Agriculture Soil Conservation Transect Survey reported that 75% of corn and 37% of soybeans in Madison County are produced using conventional tillage practices that result in significant soil disturbance. (33) These values are much higher than the state averages of 49.1% for corn and 21.5% for soybeans. Inversely, the amount of no till crop production is 1% for corn and 7% for soybeans, which is much lower than the state averages of 10.8% for corn and 38.6% for soybeans. It is apparent that row crop agriculture in Madison County has the greatest impact on surface water quality.

Urbanization and Water Quality

The greatest detriment to water quality from urbanization is an increase in impervious surfaces, such as asphalt. Impervious surfaces prevent the natural process of rain infiltration into the soil. Instead, rainfall is rapidly directed into stormwater sewer systems that deliver the water directly to streams. The rapid increase in runoff volume induces severe streambank and streambed erosion in the ephemeral streams that initially receive the water. Another impact of urbanization on water quality is the use of fertilizers by homeowners. Urban landowners are more likely to apply excessive amounts of nitrogen and phosphorus fertilizers on a unit of land. Although each homeowner controls a small amount of land, the cumulative effect of residential landscape fertilization can be significant in densely populated areas. Surface runoff from urban landscapes reaches streams more quickly than from agricultural or natural landscapes due to the prevalence of impervious surfaces.

Table A.52: Horseshoe Lake water quality data for RJC-1 from 2006 –2015.

Contaminate	August 2006	August 2010	July 2011	August 2015
Depth (ft)	51	53	27	54
Alkalinity	200	225	145	183
Ammonia-Nitrogen (mg/L)	3.3	4.21	0.73	5.99
Arsenic (mg/kg)	13	13.2		4.1
Barium (mg/kg)	300	347	320	289
Chloride (mg/L)		90	85.4	
Chromium (mg/kg)	23	35.4	29.3	28.6
Copper (mg/kg)	34	32.1	34	30.5
Iron (mg/kg)	31,000	34,300	32,000	31.600
Kjeldahl Nitrogen (mg/L)	3.59	5.71	1.73	7.57
Nitrate + Nitrite (mg/L)		0.032		0.039
Lead (mg/kg)	86	103	89.1	69.4
Manganese (mg/kg)	1,000	1,410	1,480	1,000
Mercury (mg/kg)	0.125	0.06	0.08	0.07
Nickel (mg/kg)	29	30.6	30.2	27.5
Phosphorus, Dissolved (mg/L)	0.037	1.16		1.90
Phosphorus, Total (mg/L)	0.137	1.71	0.281	2.00
Potassium (mg/kg)	2,500	3,230	3,350	4,140
Specific Conductance(umho/cm)		1055		
Total Suspended Solids (mg/L)		55	8	17
Volatile Suspended Solids (mg/L)		39	4	13
Zinc (mg/kg)	690	760	723	504

Table A.53: Horseshoe Lake water quality data for RJC-1 from April 2006 – October 2006.

Contaminate	April 2006		June 2006		July 2006		August 2006		October 2006	
	1’	51’	1’	54’	1’	51’	1’	53’	1’	49’
Alkalinity	210	298	186	276	128	250	120	200	152	170
Ammonia-nitrogen (mg/L)		0.899		2.6		3.4		3.3		0.038
Kjeldahl Nitrogen (mg/L)	1.59	2.50	1.57	3.4	1.95	4.24	0.818	3.59		1.75
Nitrate + Nitrite (mg/L)	0.287	0.026			0.033	0.030				
pH	8	7.2	8.4	6.7	8.0	6.7	8	6.6	8.2	7.9
Phosphorus, Dissolved (mg/L)	0.011	0.071	0.015	0.374	0.018	0.65	0.037	0.46	0.023	0.018
Phosphorus, Total (mg/L)	0.058	0.117	0.086	0.418	0.146	0.739	0.137	0.582	0.137	0.062
Specific Conductance(umho/cm)	970	1005	956	993	1003	1019	981	1055	1000	1030
Total Suspended Solids (mg/L)					25	16	59	55	26	25
Turbidity (NTU)	11		21.8		22		21.5		19.8	
Volatile Suspended Solids (mg/L)					15	8	31	39	13	11

Table A.54: Horseshoe Lake water quality data from RJC-1, RJC-2, RJC-3, RJC-4, and RJC-5 for August 2015.

Contaminate	1	2	3	4	5
Depth (ft)	1	1	1	1	1
Alkalinity	106	89.8	85.6	79.3	107
Kjeldahl Nitrogen (mg/L)	1.65	2.4	2.57	2.52	2.17
Nitrate + Nitrite (mg/L)	0.041	0.057	0.048	0.059	0.051
Phosphorus, Dissolved (mg/L)	0.024	0.046	0.019	0.019	0.022
Phosphorus, Total (mg/L)	0.198	0.259	0.197	0.248	0.215
Total Suspended Solids (mg/L)	22	39	36	56	33
Volatile Suspended Solids (mg/L)	16	26	28	27	23

NPDES Permitted Discharges

As of August 1, 2017, there are six facilities with National Pollution Discharge Elimination System (NPDES) permits to discharge into the Project Area (Table A.55). Several other facilities in the watershed have been issued NPDES permits in the past, which have now expired. The permit limits can be downloaded from the Discharge Monitoring Report (DMR) Pollutant Loading Tool.

Table A.55: NPDES Permitted Discharges into the American Bottom watershed.

HUC 12	Site Name	Permit Number	Permit Exp. Date	Average Daily Flow (MGD)
071401010401	City of Edwardsville	IL0026310	12/31/2019	4.28
071401010401	City of Granite City WWTP	IL0033481	4/30/2020	23
071401010401	Abengoa Bioenergy of Illinois	IL0078867	10/31/2020	0.805
071401010402	US Steel Corporation	IL0000329	5/31/2020	25
071401010403	Venice Energy Center	IL0000175	1/31/2020	0.0144
071401010403	IDOT Dist 8 Venice Pump Station	IL0071765	8/31/2019	4.3

Several pollutants are required to be monitored at these facilities, including residual chlorine, biological oxygen demand, fecal coliform, ammonia nitrogen, suspended solids, pH, dissolved oxygen, and total flow. Suspended solids monitored at the facilities are shown in Table A.61. All six of the permitted facilities monitored total suspended solids, and the average total of the total suspended solids from these seven facilities was 484.2 lb/d. Translated into a yearly value, that is 88.4 t/year.

Table A.56: Total suspended solids as averages from measurements from the PCS/ICIS for the American Bottom watershed.

HUC12	Name **of facility**	**Permit #**	**Average** Total **Suspended Solids Discharge (lb/d)**
071401010401	City of Edwardsville	IL0026310	257.3
071401010401	City of Granite City WWTP	IL0033481	807.1
071401010401	Abengoa Bioenergy of Illinois	IL0078867	15.0
071401010402	US Steel Corporation	IL0000329	836.06
071401010403	Venice Energy Center	IL0000175	1.94
071401010403	IDOT Dist 8 Venice Pump Station	IL0071765	987.7

All six of the facilities in the Project Area track different pollutant discharges. Table 62 shows a summary of Chlorine, Manganese, Ammonia-Nitrogen, Phosphorus, and Zinc from 2014 to 2017. Some of these pollutants have a maximum allowable value, but none has exceeded them.

Table A.57: Pollutant loads

Facility Name	Chemical Name	2014		2015		2016		2017		Average **Load** (kg/year)
		Pollutant Load (kg/yr)	Max Load (kg/yr)	Pollutant Load (kg/yr)	Max Load (kg/yr)	Pollutant Load (kg/yr)	Max Load (kg/yr)	Pollutant Load (kg/yr)	Max Load (kg/yr)	
City of Edwardsville	Chlorine	1,084	3,043	1,214	3,434	1,130	3210	674		1,026
	Manganese			181		84.2				133
	Ammonia - Nitrogen			2,882	29,705	1,315	27,705	1,970	16,704	2,056
	Total Nitrogen			80,861		76,043		71,101	1,461	76,002
	Phosphorus			9,233		10,036		10,075		9,781
	Zinc			123		105				114
Granite City WWTP	Chlorine	5,362	9,883	6,726	12,273	8,985	15,093	3,717	5,389	6,198
	Manganese					353		210		282
	Ammonia - Nitrogen	34,193	443,230	16,600	163,619	12,587	238,111	8,635	245,082	18,004
	Total Nitrogen			135,318		246,380		228,102		203,267
	Phosphorus			58,984		54,078		57,740		56,934
	Zinc							469		469
Abengoa Bioenergy of Illinois	Chlorine	0.83	14.34	1.78	19.36	1.81	24.16	3.08	9.20	1.88
	Manganese	35.1		11.99						23.55
	Phosphorus			653		567.46		506		575
	Zinc	7.88		7.58		6.52		1.15		5.78
US Steel Corporation	Manganese			1,052						1,052
	Ammonia - Nitrogen	8,715	144,875	576	98,579			1,848	57,587	3,713
	Phosphorus			3,317				2,380		2,849
	Zinc			28.1	1,986			91	822	209
Venice Energy Center	Manganese			4.82		9.61		61		25.14
	Zinc			0.387		0.486		0.51		0.46
IDOT Dist 8 Venice Pump Station	Manganese	982								982

Outfalls

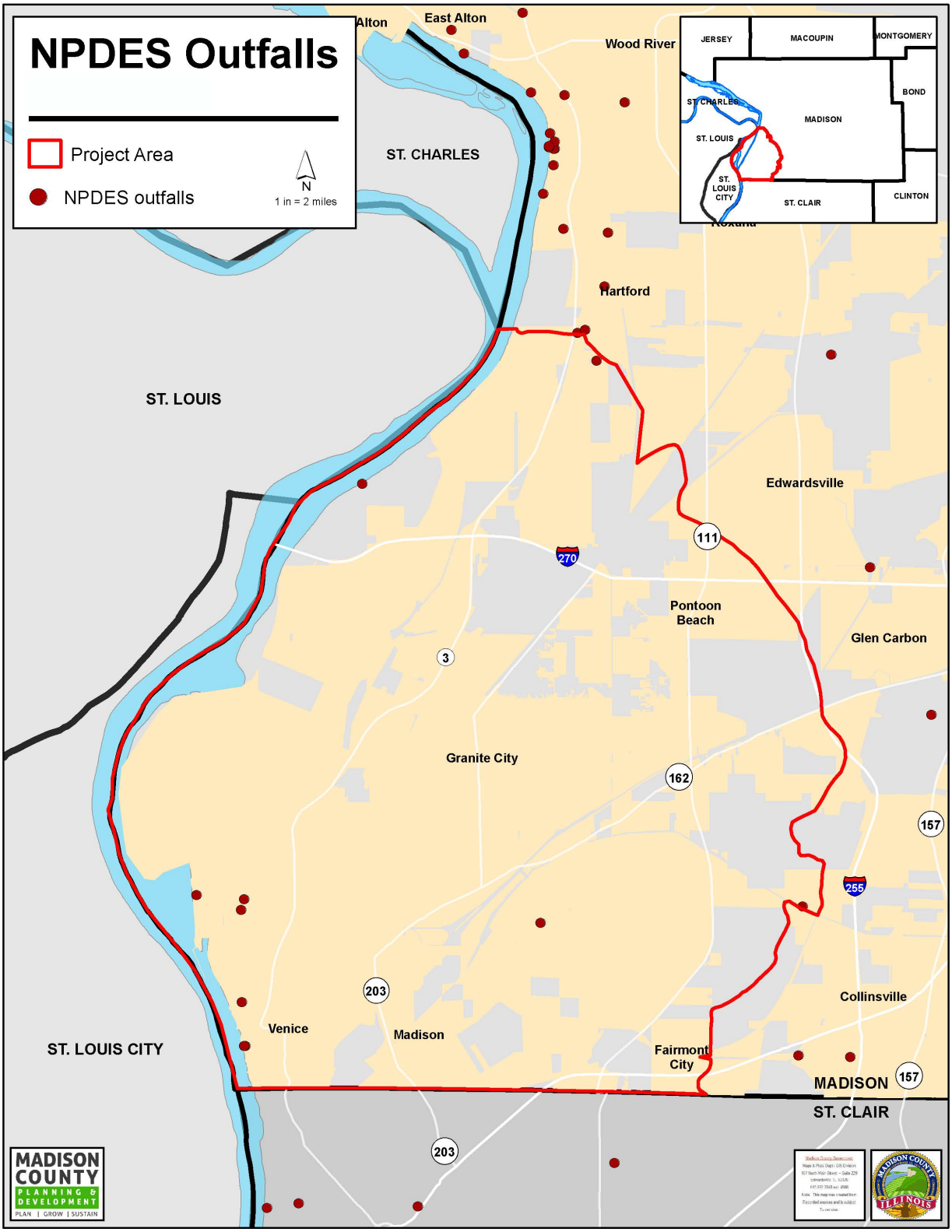
The NPDES program regulates outfalls, which are given the following Federal definition: "Outfall means a point source as defined by 40 CFR 122.2 at the point where a municipal separate storm sewer discharges to waters of the United States and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the United States and are used to convey waters of the United States."[12] NPDES outfall locations are available to download from the Illinois RMMS. Madison County also created a geo-referenced outfalls file covering the county some years ago, but it is not clear that the makers of this file used the federal definition of outfalls and the file is not accompanied by metadata that could explain its attributes.

There are seven outfalls within the watershed. Three of the outfalls are within municipal boundaries, as indicated by an asterisk by the facility name in Table A.58 (Figure A.48).

Table A. 58: NPDES Outfalls in the American Bottom watershed.

HUC14	Facility Name	NPID	Description
07140101040101	IL AMERICAN WATER-E. ST. LOUIS	IL0000281	CHOUTEAU ISL PMP STN GRIT TANK
07140101040203	US STEEL CORP GRANITE CITY WKS	IL0000329	LANDFILL LEACHATE WASTEWATER, COKE BYPRODUCTS, SEMI-ANNUAL REPORTING @ B010, QUATERLY REPORTING @ 0010, COLD ROLLING MILL WASTEWATER, TREATED PROCESS WASTEWATER
07140101040102	EDWARDSVILLE STP	IL0026310	STP OUTFALL
07140101040101	METRO EAST SD CSOS*	IL0028592	CSO-MADISON INTERCEPTOR #2, CSO-NORTH VENICE INTERCEPTOR, CSO-VENICE PUMP STATION
07140101040102	GRANITE CITY REGIONAL STP	IL0033481	TREATED CSO (OVER 34.5 MGD), SSO-84" EMERGENCY BYPASS, SSO-FLUME EMERGENCY BYPASS, SSO-108' EMERGENCY BYPASS, STP OUTFALL
07140101040203	HOLIDAY MHP STP*	IL0038288	STP OUTFALL
Non-delineated	IDOT-DIST 8 VENICE PUMP STATN*	IL0071765	WELL WATER

Figure A.48: NPDES Outfall locations in the American Bottom project area.



Pollutant Loading Analysis

Estimating Pollutant Loads by Source

Nutrient (total nitrogen and total phosphorus) and sediment loads (sheet and rill erosion) for the American Bottom watershed were calculated using the Spreadsheet Tool for Estimating Pollutant Load (STEPL), a tool developed by the U.S. EPA. (50) STEPL employs simple algorithms to calculate nitrogen, phosphorus, and sediment loads from different land uses.

Inputs required by the model include land uses, animal operations, precipitation, soil types and Universal Soil Loss Equation (USLE) parameters, septic systems, and direct discharges. Land use data was identified from the most recent National Land Cover Database (NLCD 2011). Animal (livestock) data was obtained from the USDA 2012 Agricultural Census database at the county level. (24) Runoff volumes were based on long-term precipitation records from the Southern Illinois University weather station at Belleville. The annual sediment load (sheet and rill erosion only) is calculated based on the USLE and the sediment delivery ratio. USLE parameters were from the Madison County Soil Survey. Data related to septic systems was obtained from the U.S. Census Bureau and the USEPS. The remaining user input parameters were obtained from the online STEPL Input Data Server. (50)

Sediment loads due to streambank erosion were calculated with the STEPL tool. It was assumed that the average impaired streambank location included moderate lateral recession and an average erosional height of five feet on both sides of the river within the impaired stream length.

Table A.59: Estimated current and annual pollutant load by source at the watershed scale.

Sources	N Load		P Load		Sediment Load	
	(lb/yr)	(%)	(lb/yr)	(%)	(t/yr)	(%)
Urban	615447.78	76.06%	95445.74	67.86%	14142.08	56.39%
Cropland	165796.35	20.49%	39661.69	28.20%	5812.16	23.17%
Pastureland	17343.78	2.14%	1437.25	1.02%	137.57	0.55%
Forest	1077.02	0.13%	532.66	0.38%	15.89	0.06%
Feedlots	556.05	0.07%	111.21	0.08%	0.00	0.00%
Septic	1016.03	0.13%	397.94	0.28%	0.00	0.00%
Streambank	7956.27	0.98%	3063.16	2.18%	4972.67	19.83%
Total	809193.27		140649.66		25080.37	

The STEPL model for the watershed calculated nutrient loads for each of the primary land uses as used in the NLCD (Table A.59). Urban was by far the greatest source of nutrients and sediments in the watershed. “Developed” land accounts for 43% of the total land surface in the project area, but contributes 76.06% of the nitrogen load, 67.86% of the phosphorus load, and 56.39% of the sediment load. A trend towards increasing urbanization indicates that urban sources of pollutants will account for a greater portion of pollutant loads in the future.

Cultivated Cropland also covers 24% of the watershed and contributes more than 20% of the nutrient and sediment loads. Pastures and hay field areas cover 3% of the watershed and contribute 2.14% of the nitrogen load, about 1% of the phosphorus load, and less than 1% of the sediment load. Streambank erosion is also large contributor of sediments (19.83%) in the watershed based on the observations and calculations conducted for this report.

Estimated Pollutant Loads by Subwatershed

Additional insight into the impact of land use on pollutant loads can be discerned by examining pollutant loads and land use/land cover by HUC12 subwatershed (Table A.60). It should be noted that while other sections of this report evaluate information from the American Bottom project area at the HUC14 level, the information available for the STEPL tool was only available at the HUC 12 level.

Table A.60: Annual pollutant loads by subwatershed, and area of cropland in acres.

HUC12	Total Area	Cropland	N Load	P Load	N Load	P Load	Sediment Load
	(acres)		(lb/year)		(lb/acre/year)		(ton/year)
071401010401	60,441	8,060	87537.4	20763.9	1.45	0.34	2,732
071401010402	20,492	5,073	57252.9	13899.8	2.79	0.68	2,395
071401010403	47,788	1,925	21006.1	4998.0	0.44	0.10	685
TOTAL	128,721	15,058	165796.3	39661.7	4.68	1.12	5,812

The relationship between nutrient loads and crop acreage is very strong, as is the relationship between sediment load and cropland. The correlation between total nutrient and sediment loads and all other land uses was weak or nonexistent and are not shown in Table A.101. This does not indicate that other nutrient and sediment sources are unimportant, but rather that the amounts contributed by non-crop land sources are relatively small compared to cropland.

The HUC12 with the greatest nitrogen loading is 071401010401, with 87,537.4 lb/year (Figure A.49). The same HUC12 also has the most phosphorus loading (20,763.9 lb/year), and the most sediment loading (54 tons/year). It is important to note that 07140204050101 is also the largest subwatershed in the project area. However, when adjusted for area, it produces only the second most nitrogen per acre.

The pattern is the same for phosphorus loading (Figure A.50), with HUC12 071401010402 producing the most phosphorus in total and per acre (0.68 lb/acre/year). The amount of phosphorus loading is much smaller than the nitrogen loading in terms of pounds.

Areas of high sediment loading are distributed somewhat evenly throughout the watershed, with the highest loading in HUC 071401010401, and the lowest loading in 071401010403 (Figure A.51).

Figure A.49: Nitrogen loads by HUC 12 in the American Bottom watershed, as modeled using STEPL.

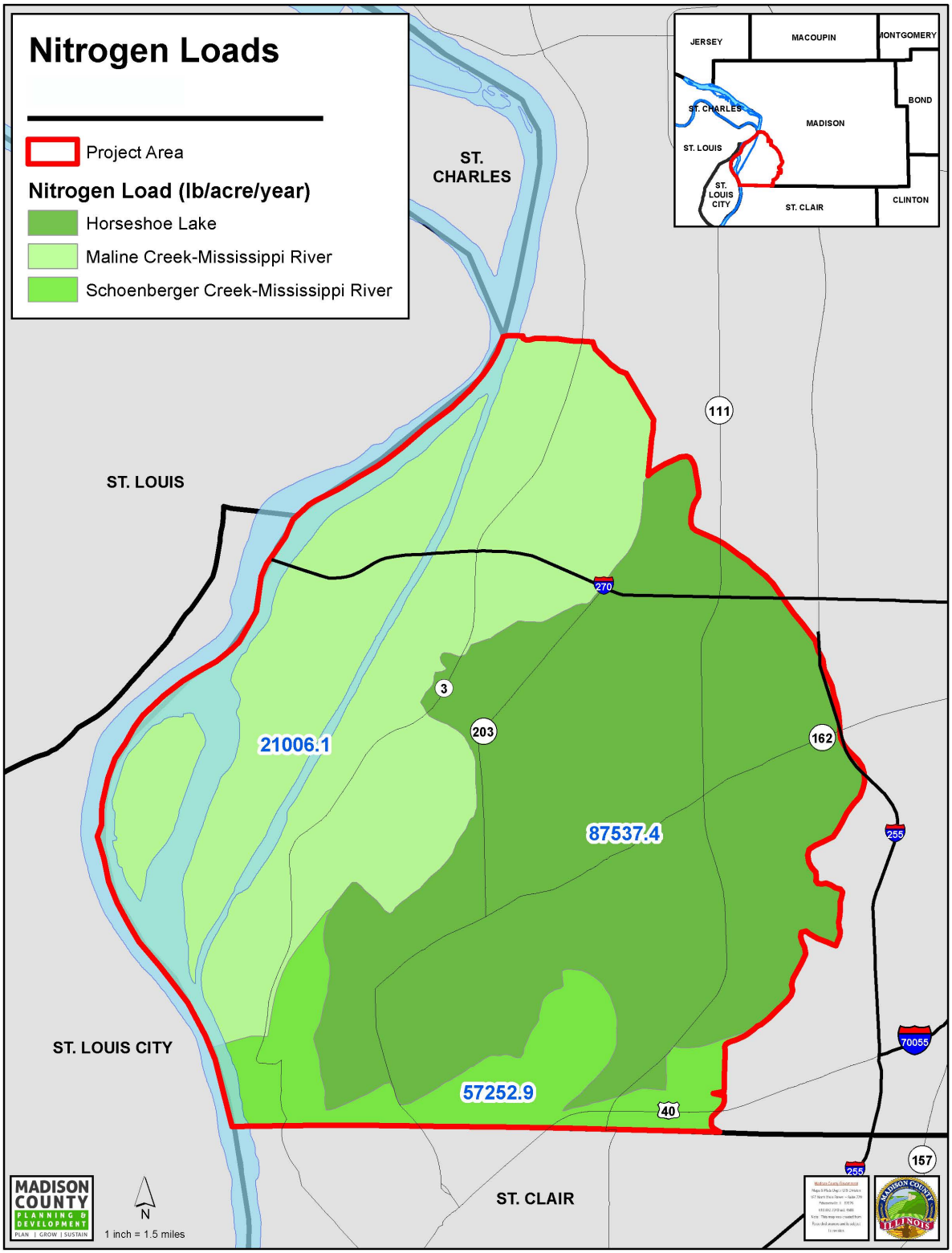


Figure A.50: Phosphorus loads by HUC 14 in the American Bottom watershed, as modeled using STEPL.

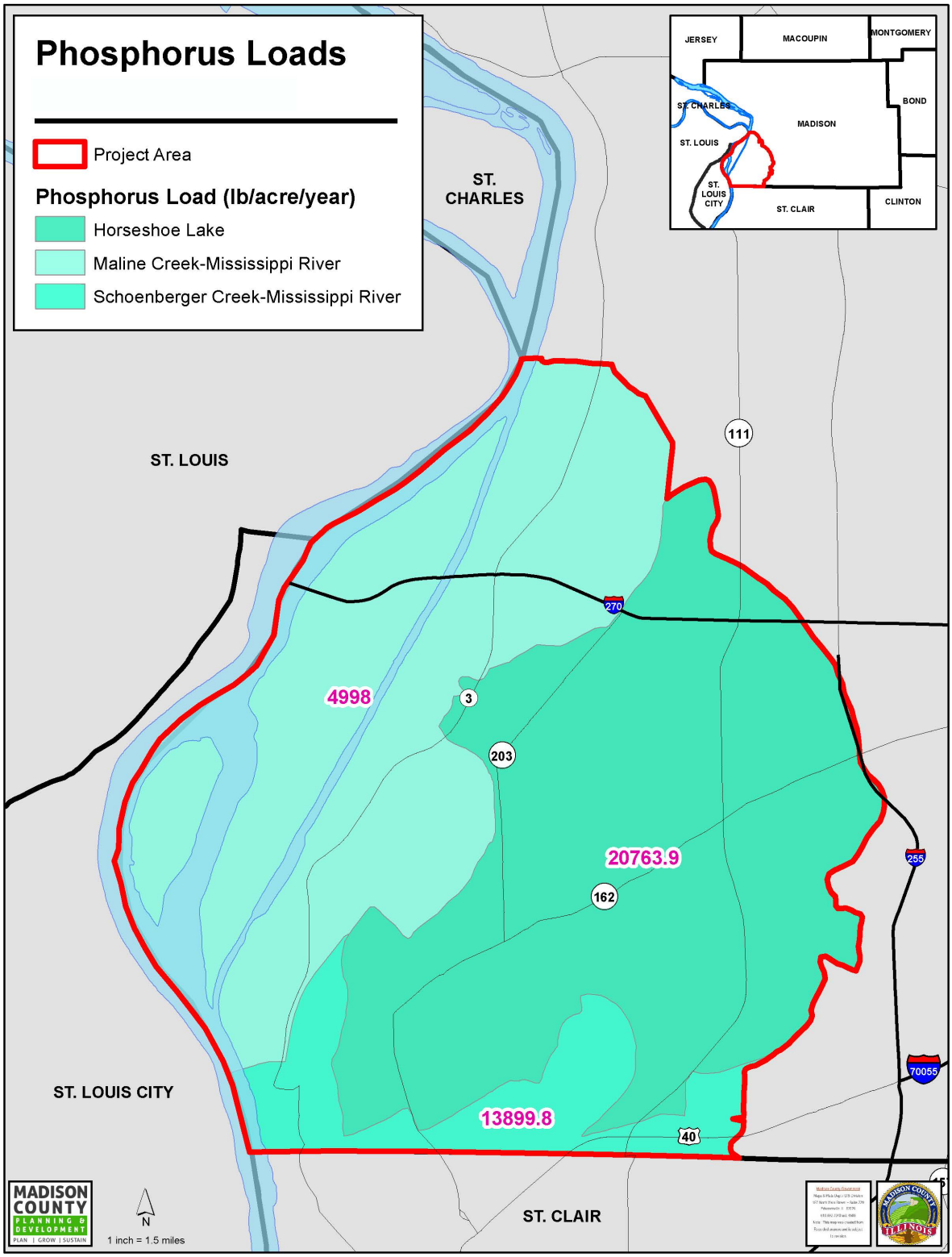
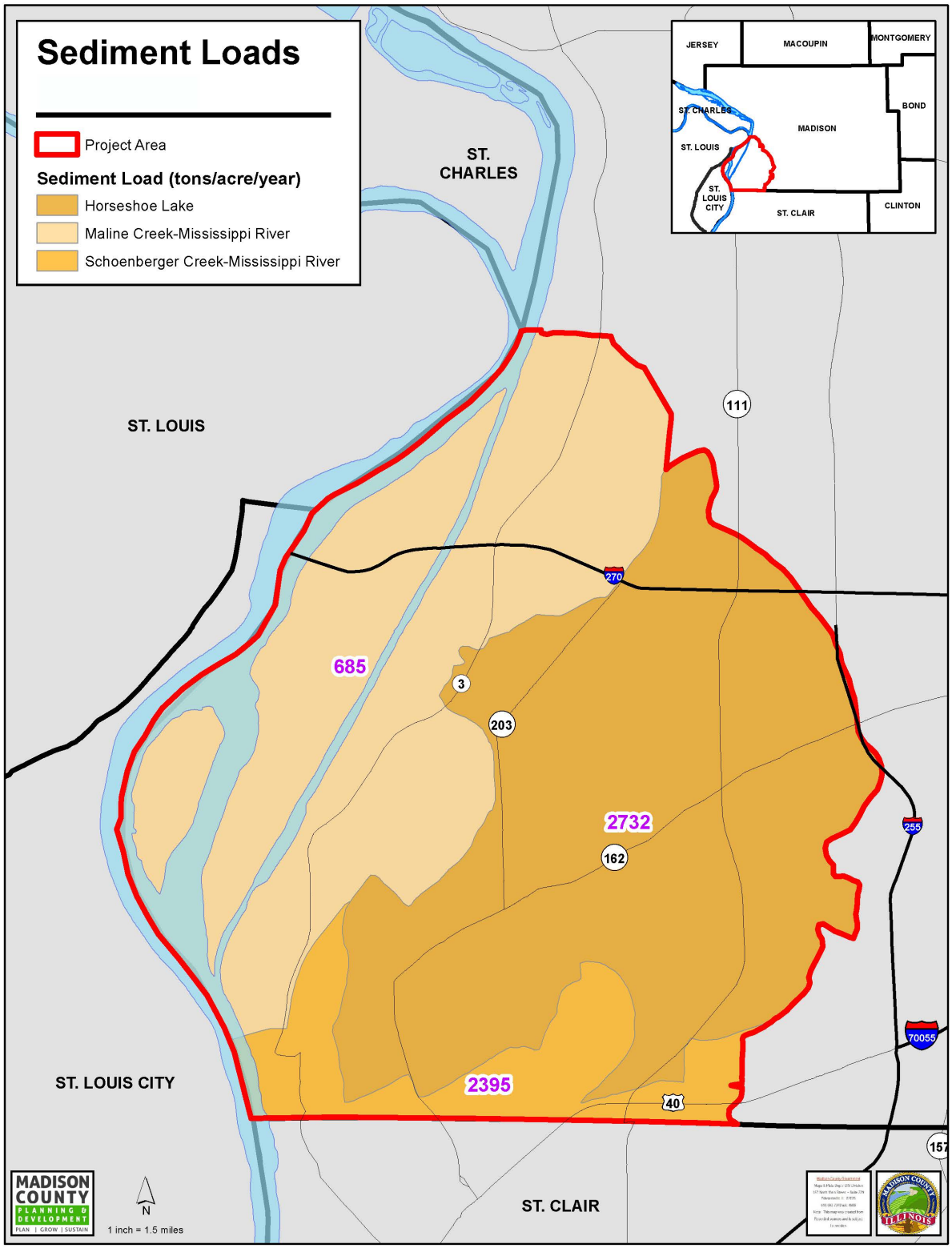


Figure A.51: Sediment loads by HUC 14 in the American Bottom watershed, as modeled using STEPL.



There are three levee systems in the American Bottom watershed: Chain of Rocks Levee, Chouteau Island Levee, and the Metro East (MESD) Levee (Figure A.52). The National Levee Database (NLD), developed by USACE, is the focal point for comprehensive information about our nation's levees. The database contains information to facilitate and link activities, such as flood risk communication, levee system evaluation for the NFIP, levee system inspections, flood plain management, and risk assessments. The NLD continues to be a dynamic database with ongoing efforts to add levee data from federal agencies, states, and tribes. For more information on the levees identified in Figure A.52, the NLD can be accessed via https://levees.sec.usace.army.mil/#/

Figure A.52: Levee Systems in the American Bottom watershed.

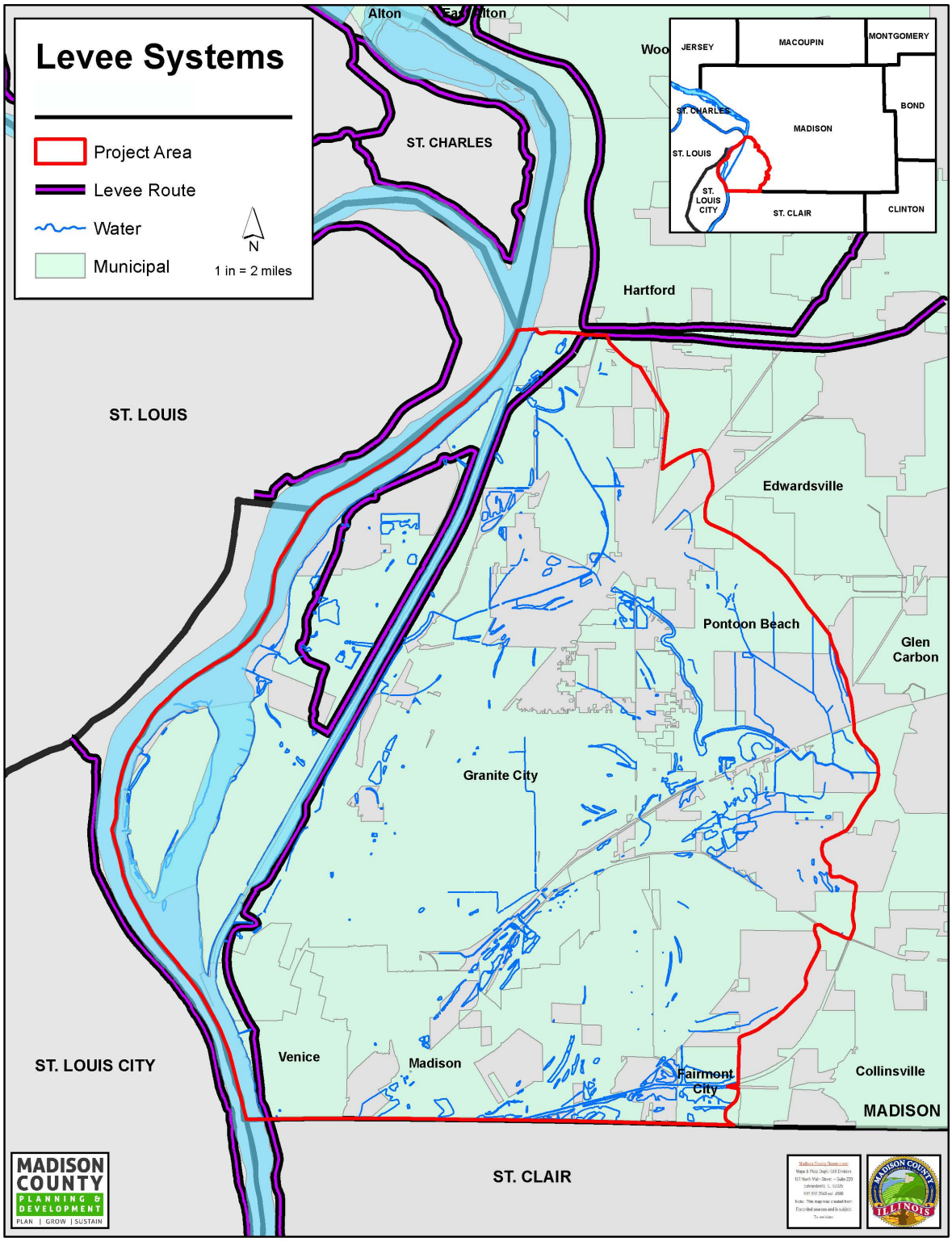
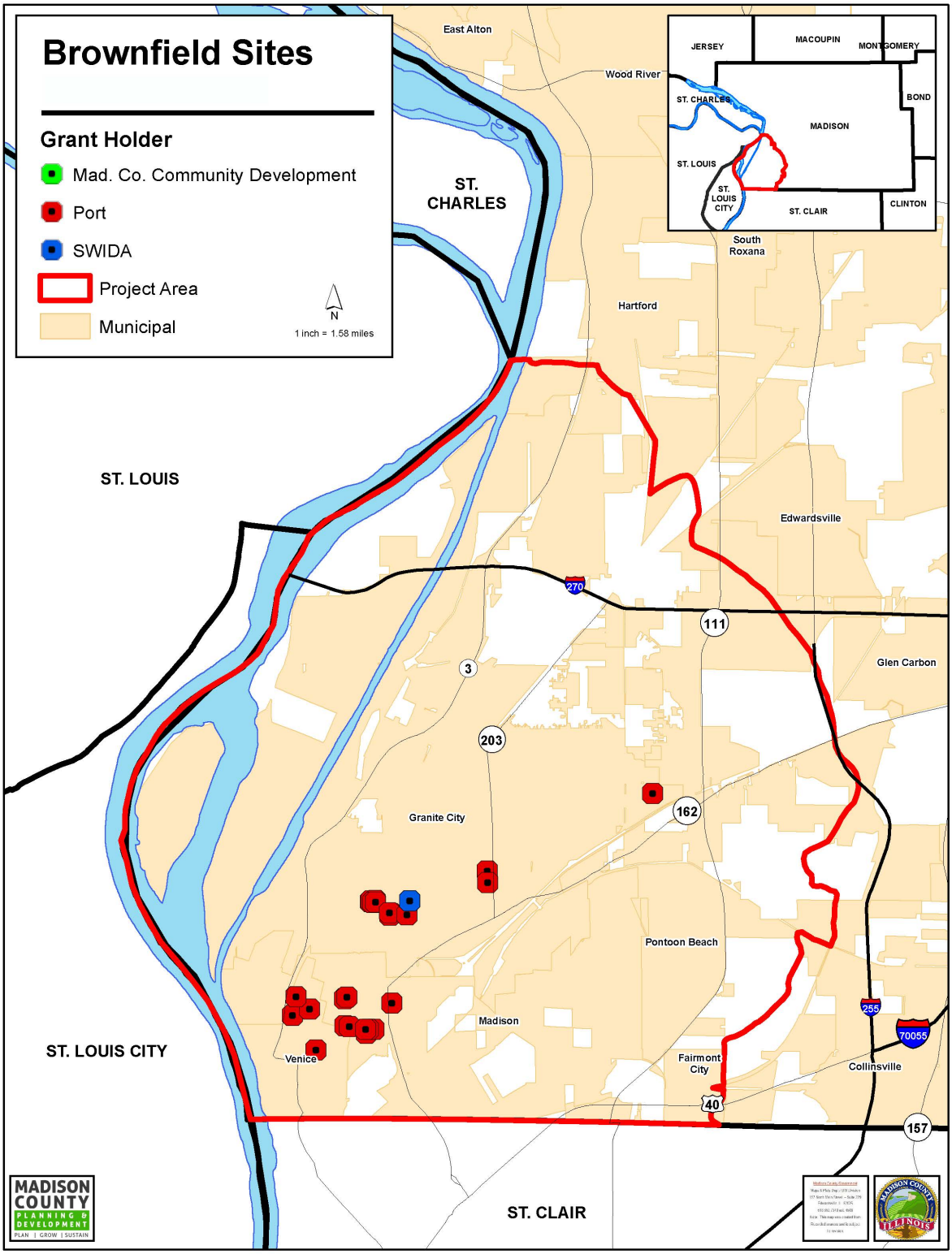


Figure A.53 shows brownfield sites in the watershed, which are previously developed lands that are no longer in use. Since its inception in 1995, the EPA's Brownfields Program has grown into a proven, results-oriented program that has changed the way contaminated property is perceived, addressed, and managed. EPA's Brownfields Program is designed to empower states, communities, and other stakeholders in economic redevelopment to work together in a timely manner to prevent, assess, safely clean up, and sustainably reuse brownfields.

Beginning in the mid-1990s, EPA provided small amounts of seed money to local governments that launched hundreds of two-year Brownfields pilot projects and developed guidance and tools to help states, communities, and other stakeholders in the cleanup and redevelopment of brownfields sites. The 2002 Small Business Liability Relief and Brownfields Revitalization Act codified many of EPA's practices, policies, and guidance. This expanded EPA's assistance by providing new tools for the public and private sectors to promote sustainable brownfields cleanup and reuse. The 2018 Brownfields Utilization, Investment and Local Development (BUILD) Act reauthorized EPA’s Brownfields Program, and authorized changes that affect brownfield grants, ownership and liability provisions, and State and Tribal Response Programs.

Brownfield grants continue to serve as the foundation of EPA's Brownfields Program. These grants support revitalization efforts by funding environmental assessment, cleanup, and job training activities. Cleaning up and reinvesting in these properties increases local tax bases, facilitates job growth, utilizes existing infrastructure, takes development pressures off of undeveloped, open land, and both improves and protects the environment.

Figure A.53: Brownfield sites in the American Bottom watershed



Glossary of Terms

100-year floodplain: Land adjoining the channel of a river, stream, watercourse, lake, or wetland that has been or may be inundated by floodwater during periods of high water that exceed normal bank-full elevations. The 100-year floodplain has a probability of 1% chance per year of being flooded.

303(d) Impaired Waters: The federal Clean Water Act requires states to submit a list of impaired waters to the U.S. Environmental Protection Agency for review and approval every two years using water quality assessment data from the Section 305(b) Water Quality Report. These impaired waters are referred to as "303(d) impaired waters." States are then required to establish priorities for the development of Total Maximum Daily Load analyses (TMDLs) for these waters and a long-term plan to meet them.

305(b): The Illinois 305(b) Water Quality Report is a water quality assessment of the state's surface and groundwater resources compiled by the Illinois Environmental Protection Agency and submitted as a report to the U.S. Environmental Protection Agency as required under Section 305(b) of the Clean Water Act.

Aquifer: A layer of permeable rock, sand, or gravel through which groundwater flows, containing enough water to supply springs and wells.

Base flow: The flow to which a perennially flowing stream reduces during the dry season. It is commonly supported by groundwater seepage into the channel.

Bedrock: The solid rock that lies beneath loose material, such as soil, sand, clay, or gravel.

Brownfield: Previously developed land that is not currently in use.

Center for Watershed Protection (CWP): Non-profit 501(c)3 corporation founded in 1992 that provides government entities, watershed organizations, and others around the country with the tools to protect streams, lakes, rivers, and watersheds.

Channelization: The artificial straightening, deepening, or widening of a stream or river to accommodate increased stormwater flows, typically to increase the amount of adjacent developable land for urban development, agriculture, or navigation.

Designated use: Appropriate use of a waterbody as designated by states and tribes. Designated uses are identified by considering the use, suitability, and value of the water body for public water supply; protection of fish and wildlife; and recreational, agricultural, industrial, and navigational purposes. Determinations are based on its physical, chemical, and biological characteristics; geographical setting and scenic qualities; and economic considerations.

Digital Elevation Model (DEM): Grid of elevation points used to produce elevation maps.

Discharge (streamflow): The volume of water passing through a channel over a given time period, usually measured in cubic feet per second.

Dissolved oxygen (DO): The amount of oxygen in water, usually measured in milligrams/liter.

Erosion: The displacement of soil particles on land surfaces due to water or wind action.

Federal Emergency Management Agency (FEMA): Government agency within the Department of Homeland Security that responds to, plans for, coordinates recovery from, and mitigates against natural and man-made disasters and emergencies, including significant floods.

Flash flood: A rapid rise of water along a stream or low-lying area, usually produced when heavy localized precipitation falls over an area in a short amount of time. Flash floods are considered the most dangerous type of flood event because they offer little or no warning time and their capacity for damage, including the capability to induce mudslides.

Geographic Information System (GIS): A computer-based approach to interpreting maps and images and applying them to problem-solving.

Geology: The scientific study of the structure of the Earth, focused primarily on the composition and origins of rocks, soil, and minerals.

Headwaters: Upper reaches of streams and tributaries in a watershed.

HUC or HUC Code: A Hydrologic Unit Code (HUC) that refers to the division and subdivision of U.S. watersheds. The hydrologic units are arranged or nested within each other, from the largest geographic area (regions) to the smallest geographic area (cataloging units). Where two digits follow "HUC," they refer to the length of the HUC code. For example, "HUC14" refers to the lowest-nested subwatershed level with a 14-digit long code, such as HUC 07140204050101.

Hydric soil: Soil units that are wet frequently enough to periodically produce anaerobic conditions, thereby influencing the species composition and/or growth of plants on those soils.

Hydrology: The scientific study of the properties, distribution, and effects of water in relation to the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hydrologic Soil Groups (HSG): Soils are classified by the Natural Resource Conservation Service into four Hydrologic Soil Groups, A, B, C and D, based on the soil's runoff potential. A's generally have the smallest runoff potential and D's the greatest.

Hydrophytic vegetation: Plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; one of the indicators of a wetland.

Illinois Department of Natural Resources (IDNR): State government agency established to manage, protect, and sustain Illinois' natural and cultural resources, provide resource-compatible recreational opportunities, and promote natural resource-related issues for the public's safety and education.

Illinois Environmental Protection Agency (IEPA): State government agency established to safeguard environmental quality to protect health, welfare, property, and quality of life in Illinois.

Illinois Nature Preserves Commission (INPC): Commission responsible for protecting Illinois Nature Preserves, state-protected areas that are provided the highest level of legal protection, and have management plans in place.
Impervious Cover Model: Simple urban stream classification model based on impervious cover and stream quality. The classification system contains three stream categories (sensitive, impacted, and non-supporting) based on the percentage of impervious cover.

Impervious cover/surface: An area covered with solid material or that is compacted to the point where water cannot infiltrate underlying soils (e.g. parking lots, roads, houses, etc.).

Infiltration: Rainfall or surface runoff that moves downward from the surface into the subsurface soil.

Loess: An unstratified loamy deposit, usually buff to yellowish brown, chiefly deposited by the wind and thought to have formed by the grinding of glaciers.

Marsh: An area of soft, wet, low-lying land, characterized by grassy vegetation and often forming a transition zone between water and land.

Municipal Separate Storm Sewer System (MS4): A system that transports or holds stormwater, such as catch basins, curbs, gutters, and ditches, before discharging into local waterbodies.

National Flood Insurance Program (NFIP): Federal program created by Congress in 1968 to help provide a means for property owners to financially protect themselves from flood risk.

National Hydrography Dataset (NHD): Digital database of surface water features, such as lakes, ponds, streams, and rivers. The NHD is used to make hydrology and watershed boundary maps.

National Pollutant Discharge Elimination System (NPDES) Phase II: Permit program authorized by the Clean Water Act requiring smaller communities and public entities that own and operate a Municipal Separate Storm Sewer System (MS4) to apply and obtain a NPDES permit for stormwater discharges to surface water. Permittees must develop, implement, and enforce a stormwater program designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable. Individual homes that use a septic system, are connected to a municipal system, or do not have a surface discharge do not need an NPDES permit. The NPDES permit program is administered by authorized states. In Illinois, the Illinois EPA administers the program.

National Wetland Inventory (NWI): U.S. Fish and Wildlife Service program that provides information on the characteristics, extent, and status of U.S. wetlands and deepwater habitats.

Native vegetation/plants: Plant species that have historically been found in a given area.

Natural Resources Conservation Service (NRCS): Government agency under the U.S. Department of Agriculture (USDA) that provides technical assistance to landowners and land managers.

Nitrogen: A colorless, odorless, unreactive gas that constitutes about 78% of the earth's atmosphere. The availability of nitrogen in soil is important for plant growth and ecosystem processes, and nitrogen is used in many fertilizers.

Nonpoint source pollution (NPS pollution): Any source of water pollution that is not from a discrete outflow point. Instead, NPS pollution comes from diffuse sources and is carried into waterways with runoff from the land. Pollutants can include oil, grease, sediment, and nutrients in excess fertilizer.

Nutrients: Substances needed for the growth of plants and animals, such as phosphorous and nitrogen. The addition of too many nutrients to a waterway causes problems to the aquatic ecosystem by promoting nuisance vegetation including excess algae growth.

Open space parcel: Any parcel of land that is not developed and is set aside for recreation or conservation purposes.

Overland flood: Flooding that occurs when rainfall collects on saturated or frozen ground. When surface runoff cannot find a channel, it may flow out over a large area at a somewhat uniform depth in sheet flow or collect in depressions as ponding.

Point source pollution: Pollution that discharges in water from a single, discrete source, such as an outfall pipe from an industrial plant or wastewater treatment facility.

Pollutant load: The amount of any pollutant deposited into waterbodies from point source discharges, combined sewer overflows, and/or stormwater runoff.

Riparian: The riverside or riverine environment adjacent to the stream channel. For example, riparian, or streamside, vegetation grows next to (and over) a stream.

Riverine flood: The gradual rise of water in a river, stream, lake, reservoir, or other waterway that results in the waterway overflowing its banks. This type of flooding generally occurs when storm systems remain in the area for extended periods of time, when winter or spring rains combine with melting snow to create higher flows, or when obstructions, such as logjams, block normal water flow.

Runoff: The portion of precipitation that does not infiltrate into the ground and is discharged into streams by flowing over the ground.

Sediment: Soil particles that have been transported from their natural location by wind or water action.

Sedimentation: The process that deposits soils, debris, and other materials either on other ground surfaces or in bodies of water.

Special Flood Hazard Area: The area inundated during the base flood is called the Special Flood Hazard Area or 100-year floodplain.

Stakeholders: Individuals, organizations, or enterprises that have an interest or a share in a project.

Stream reach: A stream segment having fairly homogenous hydraulic, geomorphic, riparian cover, and land use characteristics.

Subwatershed: Any drainage basin within a larger drainage basin or watershed.

Threatened and endangered species: A “threatened” species is one that is likely to become endangered in the foreseeable future. An “endangered” species is one that is in danger of extinction throughout all or a significant portion of its range.
Topography: The relative elevations of a landscape describing the configuration of its surface. Also, the study and depiction of the distribution, relative positions, and elevations of natural and man-made features of a particular landscape (e.g. on a map).

Total Maximum Daily Load (TMDL): The highest amount of discharge of a particular pollutant that a waterbody can handle safely per day.

Total Suspended Solids (TSS): The organic and inorganic material suspended in the water column greater than 0.45 micron in size.

United States Army Corps of Engineers (USACE): Federal group of civilian and military engineers and scientists that provide services for planning, designing, building, and operating water resources and other Civil Works projects. These include flood control and environmental protection projects.

U.S. Fish and Wildlife Service (USFWS): Federal government agency within the U.S. Department of the Interior dedicated to the management of fish and wildlife and their habitats.

United States Geological Survey (USGS): Federal government agency established with the responsibility to provide reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect quality of life.

Urban runoff: Runoff that runs over urban developed surfaces such as streets, lawns, and parking lots, entering directly into storm sewers rather than infiltrating the land upon which it falls.

Watershed: The area of land that contributes runoff to a single point on a waterbody (in this case, the outlet of Silver Creek from Madison County to St. Clair County).

Watershed-Based Plan: A strategy and work plan for achieving water resource goals that provides assessment and management information for a geographically defined watershed, including the analysis, actions, participants, and resources related to development and implementation of the plan.

Wetland: Lands that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, under normal conditions, a prevalence of vegetation adapted for life in saturated soil conditions (known as hydrophytic vegetation). A wetland is identified based upon the three attributes: 1) hydrology, 2) hydric soils, and 3) hydrophytic vegetation. A wetland is considered a subset of the definition of the Waters of the United States.

Data Tables

Hydrologic soil groups by HUC14

Table A.61: Area of hydrologic soil group by HUC14 in the Project Area

HUC14	Area of Hydrologic Soil Group (acres)							Total area (acres)
	Unclassified	A	B	B/D	C	C/D	D	
07140101040101	3618	0	2613	825	248	0	2680	9983
07140101040102	3057	0	5009	58	561	0	6128	14813
07140101040201	759	27	2946	11	331	76	4366	8517
07140101040202	4959	0	3492	25	244	0	2043	10762
07140101040203	2550	38	3290	0	400	76	2202	8558
Total	65	17350	919	1784	152	17419	52633	65

Soil types with hydric category and hydrologic group

Table A.62: Soil types in the Judy's Branch Project Area with their hydric category and hydrologic group

Hydrologic Soil Group	Map Symbol Code	Soil Type (SSURGO map unit name)	Hydric Soil?	Non-Hydric Soils Area (Acres)	Hydric Soils Area (Acres)	Total Area (Acres)
	533	Urban land	No	10188		10188
	536	Dumps	No	288		288
D	1070L	Beaucoup silty clay loam, undrained, 0 to 2 percent slopes, occasionally flooded	Yes		1469	1469
D	1071A	Darwin silty clay loam, undrained, 0 to 2 percent slopes, frequently flooded	Yes		291	291
C	1248A	McFain silty clay loam, undrained, 0 to 2 percent slopes, frequently flooded	Yes		40	40
D	2071L	Darwin-Urban land complex, 0 to 2 percent slopes, occasionally flooded, long duration	Yes		1341	1341
B	2183A	Shaffton-Urban land complex, 0 to 2 percent slopes, occasionally flooded	No	3123		3123
B	2284A	Tice-Fluvents-Urban land complex, 0 to 2 percent slopes, occasionally flooded	No	565		565
	2304B	Landes-Fluvents-Urban land complex, 2 to 5 percent slopes, occasionally flooded	No	1332		1332
	2592A	Nameoki-Fluvents-Urban land complex, 0 to 2 percent slopes, occasionally flooded	No	1279		1279
B	3038B	Rocher loam, 2 to 5 percent slopes, frequently flooded	No	1374		1374
B/D	3070L	Beaucoup silty clay loam, 0 to 2 percent slopes, frequently flooded, long duration	Yes		828	828
D	3071L	Darwin silty clay, 0 to 2 percent slopes, frequently flooded, long duration	Yes		844	844
B	3391A	Blake silty clay loam, 0 to 2 percent slopes, frequently flooded	No	2		2
D	3592A	Nameoki silty clay loam, 0 to 2 percent slopes, frequently flooded	No	1836		1836
D	466A	Bartelso silt loam, 0 to 2 percent slopes	No	47		47
B	7150A	Onarga sandy loam, 0 to 2 percent slopes, rarely flooded	No	30		30
B	7151A	Ridgeville fine sandy loam, 0 to 2 percent slopes, rarely flooded	No	34		34
A	7741B	Oakville fine sand, 2 to 5 percent slopes, rarely flooded	No	27		27

Hydrologic Soil Group	Map Symbol Code	Soil Type (SSURGO map unit name)	Hydric Soil?	Non-Hydric Soils Area (Acres)	Hydric Soils Area (Acres)	Total Area (Acres)
A	7741C	Oakville fine sand, 5 to 10 percent slopes, rarely flooded	No	19		19
B	801B	Orthents, silty, undulating	No	8		8
C	801D	Orthents, silty, steep	No	178		178
C	802B	Orthents, loamy, undulating	No	1690		1690
B	802D	Orthents, loamy, steep	No	1798		1798
B	8038B	Rocher loam, 2 to 5 percent slopes, occasionally flooded	No	497		497
B	8070A	Beaucoup silty clay loam, 0 to 2 percent slopes, occasionally flooded	Yes		830	830
D	8071L	Darwin silty clay, 0 to 2 percent slopes, occasionally flooded, long duration	Yes		5664	5664
C/D	8162A	Gorham silty clay loam, 0 to 2 percent slopes, occasionally flooded	Yes		151	151
C	8180A	Dupo silt loam, 0 to 2 percent slopes, occasionally flooded	No	121		121
B	8183A	Shaffton clay loam, 0 to 2 percent slopes, occasionally flooded	No	2236		2236
B	8284A	Tice silty clay loam, 0 to 2 percent slopes, occasionally flooded	No	1782		1782
B/D	8302A	Ambraw silty clay loam, 0 to 2 percent slopes, occasionally flooded	Yes		25	25
B	8304B	Landes very fine sandy loam, 2 to 5 percent slopes, occasionally flooded	No	3921		3921
B	8331A	Haymond silt loam, 0 to 2 percent slopes, occasionally flooded	No	32		32
C	8333A	Wakeland silt loam, 0 to 2 percent slopes, occasionally flooded	No	18		18
C/D	8334A	Birds silt loam, 0 to 2 percent slopes, occasionally flooded	Yes		76	76
B	8394A	Haynie silt loam, 0 to 2 percent slopes, occasionally flooded	No	44		44
D	8591A	Fults silty clay, 0 to 2 percent slopes, occasionally flooded	Yes		2054	2054
D	8592A	Nameoki silty clay, 0 to 2 percent slopes, occasionally flooded	No	2669		2669
C	8646A	Fluvaquents, loamy, 0 to 2 percent slopes, occasionally flooded	Yes		572	572
B	8674A	Dozaville silt loam, 0 to 2 percent slopes, occasionally flooded	No	830		830
	8831A	Fluvaquents, clayey, 0 to 2 percent slopes, occasionally flooded	Yes		49	49
	M-W	Miscellaneous water		323		323

Hydrologic Soil Group	Map Symbol Code	Soil Type (SSURGO map unit name)	Hydric Soil?	Non-Hydric Soils Area (Acres)	Hydric Soils Area (Acres)	Total Area (Acres)
	W	Water		7387		7387
	Total			33202	14234	47436

Hydric soils by HUC14

Table A.63: Hydric and non-hydric soil areas by HUC14 in the Project Area

HUC14	Area **of Non-Hydric Soils (acres)**	Area **of Hydric Soils (acres)**	**Total** area **(acres)**
07140101040101	8314	1669	9983
07140101020102	9916	4777	14693
07140101040201	4048	4279	8297
07140101040202	9163	1419	10583
07140101040203	6203	2355	8558
Total	37644	14499	52114

Highly erodible soils by HUC14

Table A.64: Area of highly erodible and non-highly erodible soils by HUC14 in the Judy's Branch Project Area

HUC14	Not eroding - deposition (acres)	Class 1 Erosion (acres)	Unclassified (acres)	Total area (acres)
07140101040101	4827	1084	3473	9384
07140101040102	6615	977	1638	9230
07140101040201	6093	321	355	6769
07140101040202	4514	320	3044	7879
07140101040203	3150	165	2503	5818
Total	25199	2867	11013	39080

Land use/land cover by HUC14

Table A.65: Land use/land cover in the HUC14s of the Judy's Branch watershed within Madison County

HUC14		071401010401 01	071401010401 02	071401010402 01	071401010402 02	071401010402 03
Barren Land	Acres	3.34	0	2.89	0	0
	%	0.04%	0%	0.04%	0%	0%
Cultivated crop	Acres	2627.19	553.63	3015.44	2957.8	1850.13
	%	33.97%	5.96%	38.47%	27.55%	18.59%
Deciduous forest	Acres	68.14	45.91	11.08	44.58	80.71
	%	0.88%	0.49%	0.14%	0.42%	0.81%
Developed, High **Intensity**	Acres	45.44	1247.37	268.13	1157.55	24.39
	%	0.59%	13.43%	3.42%	10.78%	0.25%
Developed, Low Intensity	Acres	424.56	3576.08	1815.53	2488.05	364.2
	%	5.49%	38.52%	23.16%	23.18%	3.66%
Developed, Medium **Intensity**	Acres	89.03	1535.81	704.39	1193.97	98.39
	%	1.15%	16.54%	8.99%	11.12%	0.99%
Developed, Open Space	Acres	700.16	1452.06	1259.05	1081.82	343.83
	%	9.05%	15.64%	16.06%	10.08%	3.46%
Emergent herbaceous wetlands	Acres	166.29	52.73	16.37	58.92	421.93
	%	2.15%	0.57%	0.21%	0.55%	4.24%
Evergreen forest	Acres	0	0	0	0	0
	%	0%	0%	0%	0%	0%
Hay/Pasture	Acres	113.31	16.79	82.86	549.52	1031.77
	%	1.47%	0.18%	1.06%	5.12%	10.37%
Herbaceous	Acres	16.21	27.54	2.05	26.84	51.7
	%	0.21%	0.30%	0.03%	0.25%	0.52%
Mixed **forest**	Acres	0	0	0	0	0
	%	0%	0%	0%	0%	0%
Open Water	Acres	2421.26	516.42	214.83	165.23	3476.18
	%	31.31%	5.56%	2.74%	1.54%	34.94%
Shrub/Scrub	Acres	0	0	0	0	0
	%	0%	0%	0%	0%	0%
Woody wetlands	Acres	1058.71	260.20	446.4	1010.75	2206.47
	%	13.69%	2.80%	5.69%	9.42%	22.18%
Total Area **(Acres)**		7733.64	9284.54	7839.02	10735.03	9949.7

Stream reach data

Table A.66: NHD stream reaches in the Judy's Branch watershed with length in feet and the corresponding HUC14. Some reaches are present in more than one HUC14

ReachCode	Length_ft
07140101040101	
07140101000029	912
07140101000111	5044
07140101000606	1051
07140101001423	147
07140101002027	4084
07140101002052	1805
07140101002080	117
07140101003252	276
07140101003257	920
07140101003259	883
07140101003260	2995
07140101003288	3555
07140101003300	1148
07140101003303	1799
07140101003387	15761
07140101003419	4184
07140101003426	1476
07140101003427	410
07140101003429	8120
07140101005289	1379
07140101005325	38739
07140101005327	2194
07140101005329	55
07140101005335	2378
07140101006864	1623
07140101006865	179
07140101006866	1802
07140101006867	656
07140101006868	3862
07140101007031	285
07140101007032	48
07140101007033	868
07140101040102	
07140101000573	8859
07140101000573	1679
07140101000573	1943
07140101002478	13606
07140101003151	354
07140101003151	526
07140101003187	850
07140101003191	1537
07140101005309	6071
07140101005311	4741

ReachCode	Length_ft
07140101007027	260
07140101007028	199
07140101007029	286
07140101007030	6059
07140101040201	
07140101003382	159
07140101003364	4274
07140101000594	3418
07140101002070	5406
07140101001990	858
07140101001990	3223
07140101001990	3735
07140101002484	662
07140101003364	349
07140101002070	55
07140101003364	87
07140101002070	69
07140101001990	1216
07140101000594	1658
07140101007034	262
07140101002070	2982
07140101000593	11263
07140101002484	403
07140101040202	
07140101003280	3265
07140101003281	776
07140101003281	225
07140101040203	
07140101007035	154
07140101000608	11108
07140101007044	1808
07140101000622	589
07140101000608	882
07140101007046	1052
07140101007045	462

Stream Condition by stream reach

Table A.67: Stream-bank erosion, degree of channelization, riparian condition and streambed erosion conditions along stream reaches in the Judy's Branch watershed.

HUC 14 & Reach Code	Stream Length (ft)	Stream-bank Erosion	Degree of Channelization	Riparian Condition	Streambed Erosion
07140101040101					
N/A	6443	Slight	Low	Good	Low
07140101040102					
07140101003187	850	Moderate	High	Fair	High
07140101007028	199	Severe	High	Poor	High
07140101003191	1537	Moderate	High	Fair	High
07140101007029	286	Severe	High	Poor	High
07140101007030	2763	Slight	Moderate	Fair	Moderate
07140101005309	6071	Moderate	High	Fair	Moderate
07140101002478	4542	Slight	Low	Good	Low
07140101000573	8859	Severe	High	Poor	High
07140101003151	354	N/A	N/A	N/A	N/A
07140101007027	260	Slight	High	Fair	Moderate
07140101003151	526	Slight	Low	Good	Low
07140101005311	4741	Severe	High	Poor	High
07140101000573	1679	Severe	High	Fair	High
07140101000573	1943	Severe	High	Fair	High
07140101007030	1384	Moderate	High	Fair	High
07140101007030	1364	Slight	High	Fair	Moderate
07140101007030	548	Slight	Moderate	Good	Low
07140101002478	247	Slight	High	Fair	Moderate
07140101002478	1206	Moderate	Moderate	Poor	Moderate
07140101002478	838	Moderate	Moderate	Fair	Moderate
07140101002478	488	Moderate	Low	Fair	Low
07140101002478	802	Moderate	Moderate	Fair	Low
07140101002478	2014	Slight	Low	Good	Low
07140101002478	2243	Moderate	Low	Fair	Low
07140101002478	921	Slight	Low	Good	Low
07140101002478	306	Slight	Moderate	Good	Moderate
N/A	903	Slight	Low	Good	Low
N/A	3182	Slight	Low	Fair	Moderate
07140101005309	6071	Moderate	Moderate	Good	Low
07140101005309	6071	N/A	N/A	N/A	N/A
07140101005309	6071	Moderate	High	Poor	High
07140101005311	4741	Moderate	High	Fair	High
07140101000573	8859	Severe	High	Poor	High
07140101000573	8859	Culvert	Culvert	Culvert	Culvert
07140101000573	8859	Severe	High	Fair	High
07140101040201					
07140101003281	776	Moderate	Moderate	Good	High
07140101003280	225	Moderate	Moderate	Fair	Moderate
07140101003364	3434	Moderate	High	Poor	High
07140101000594	3418	Moderate	High	Fair	Moderate

HUC 14 & Reach Code	Stream Length (ft)	Stream-bank Erosion	Degree of Channelization	Riparian Condition	Streambed Erosion
07140101002070	2867	Moderate	High	Fair	Moderate
07140101001990	1224	Moderate	High	Poor	High
07140101001990	2857	Moderate	High	Poor	High
07140101001990	2132	Slight	Low	Good	Low
07140101002070	55	Moderate	High	Fair	Moderate
07140101002070	69	Moderate	Moderate	Fair	Low
07140101001990	1265	Moderate	High	Poor	High
07140101000594	1658	Moderate	High	Fair	Moderate
07140101002070	2982	Moderate	High	Fair	Moderate
07140101000593	2226	Moderate	High	Fair	Moderate
07140101003364	1719	Moderate	High	Fair	Low
07140101001990	1604	Moderate	Moderate	Fair	Low
07140101002070	1360	Moderate	Moderate	Fair	Moderate
07140101002070	1179	N/A	Moderate	Good	N/A
07140101000593	768	Moderate	High	Fair	Moderate
07140101000593	4331	Slight	High	Fair	Moderate
07140101000593	574	N/A	High	Good	N/A
07140101000593	955	Moderate	High	Fair	Moderate
07140101000593	1305	Moderate	High	Fair	Moderate
07140101000593	1104	N/A	N/A	N/A	N/A
07140101000593	4331	Slight	Moderate	Fair	Moderate
07140101000593	4331	N/A	N/A	N/A	N/A
07140101000593	4331	Slight	High	Fair	Low
07140101000593	4331	N/A	N/A	N/A	N/A
07140101000593	2226	N/A	High	Good	N/A
07140101040202					
07140101003281	3265	Slight	High	Fair	Low
07140101003281	776	Moderate	Moderate	Good	High
07140101000608	11108	Moderate	High	Poor	High
07140101000608	882	Moderate	High	Poor	High
07140101000608	11108	Slight	Low	Fair	Low
07140101040203					
07140101007035	154	Moderate	Moderate	Fair	Moderate
07140101007044	1808	Slight	Low	Fair	Low
07140101007046	1052	Slight	Moderate	Fair	Moderate
07140101000608	11108	Slight	Low	Fair	Low

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COMMUNITY FLOOD SURVEY REPORT

2017



AMERICAN BOTTOM WATERSHED

MADISON COUNTY, ILLINOIS

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Cover photo: ***Flooding in Dobrey Slough, January 2016***

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EXECUTIVE SUMMARY

This report summarizes the findings of the Community Flood Survey for the American Bottom watershed (HUC 0714010104), which was distributed to residents and business owners to gather information about the location, extent, impacts, and causes of flooding in the watershed.

A total of 384 surveys were completed from within the study area out of 2,100 mailed giving a response rate of 18%. Some of these were collected via on-line survey.

A watershed is an area that drains to a defined point. Watersheds are defined at a variety of scales for different purposes. The American Bottom watershed is a 43,352-acre area that drains to the Mississippi River.

Survey responses are grouped according to zip code and 2010 Census Block Groups.

Key Findings

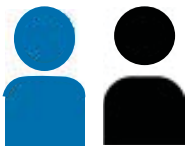
- **PREVALENCE:** 45% of respondents experienced flooding in the last 10 years.
- **FREQUENCY:** 42% of respondents with flooding experienced flooding at least once per year in the last 10 years. On average, respondents with flooding experience 0.86 floods per year.
- **EXTENT OF DAMAGE:** Of those who had been flooded in the last 10 years:
  - 28% said that the flooding had damaged their primary home or business;
  - 13% had damage to fences, auxiliary buildings, and other structures; and
  - 18% had damage to yards and landscaping.

AVERAGE

0.86

FLOODS *PER YEAR*

- **NEIGHBORS:** 44% of all survey respondents were aware of flooding on one or more of their neighbors' properties. Of the survey respondents who had been flooded, 43% said that their neighbors had also been flooded.
- **TOP FOUR CAUSES OF FLOODING**:
  1. Heavy rainstorms.
  2. Lack of drainage facilities (swales, ditches, storm sewers, etc.) to drain water from this property.
  3. Flooding from nearby river, stream, lake, ditch, or pond.
  4. Pipe, culvert, or ditch that was blocked or needs maintenance.
- **REPORTING:** 39% of respondents who had flooding did not report it to anyone. Those that did report it were most likely to contact their township (20%) or their city (18%).
- **EFFECTS FROM FLOODING**: Stress was the most commonly reported impact from flooding. Others included monetary loss due to repair of flood damage; time off work to clean up; partial loss of access to property; and monetary loss due to lost valuables or equipment.
- **MONETARY LOSS:** Thirty-three percent (33%) of respondents who experienced flooding said it caused them no monetary loss. Another 33% said their monetary loss over 10 years was less than $5,000. Nineteen percent (19%) said that their loss was between $5,000 and $20,000. Two respondents (1% of those who answered) said their losses were between $100,000 and $500,000.



43% of Neighbors Flooded Too



DIDN'T REPORT FLOODING

- **COST OF FLOODING**: Flooding over the last 10 years has cost survey respondents an estimated $385,000. The estimated average amount lost per respondent is $11,667 over 10 years. It is estimated that flooding resulted in $1,121,700 lost in the entire American Bottom watershed over the last decade.

- **RELATIONSHIP TO FLOODPLAINS:** Floodplains designated by the Federal Emergency Management Agency (FEMA) constitute 38.2% of the total acreage in the American Bottom watershed, and 29% of the survey responses came from parcels wholly or partly within a FEMA-designated floodplain. However, 2% of survey respondents did not know that they lived on or owned property in a FEMA-designated floodplain.

- **FLOODING OUTSIDE OF THE FLOODPLAIN**: Flooding mostly occurs outside of floodplains in the watershed. Respondents reported over 1,060 events per year occurring outside of FEMA-designated floodplains in the watershed. Within floodplains, 38 flood events per year were reported.

- **FLOOD INSURANCE:** Fourteen percent of respondents (52 responses) have flood insurance.

- **FLOOD INSURANCE CLAIMS:** Five percent (5%) of people who have flood insurance (17 respondents) have made one or more claims in the last 10 years. Of those respondents who have flood insurance, 25 (6.5%) have it on structures that are not in a floodplain.

- **DOWNSPOUTS:** Eighty-nine percent (89%) of respondents said their downspouts flow out onto their lawn or other ground surface. Three percent (3%) said their downspouts were connected to storm sewers, and 1% said their downspouts were connected to cisterns, rain barrels, or other rainwater harvesting storage.

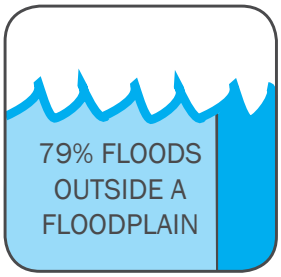
- **ACTIONS TAKEN TO PREVENT FLOODING:** 104 respondents made one or more improvements to try to prevent or reduce flooding on their properties.

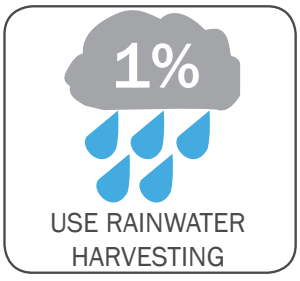
- **CROPLAND FLOODING:** None of the survey respondents own cropland that has flooded.

- **VALUING WATER MANAGEMENT:** Respondents to the survey place high value on clean drinking water, prevention of flood damage, healthy ecosystems, and water-based recreation (in that order).

$1.1 Mill

LOST DUE TO FLOODS *IN LAST 10 YEARS*

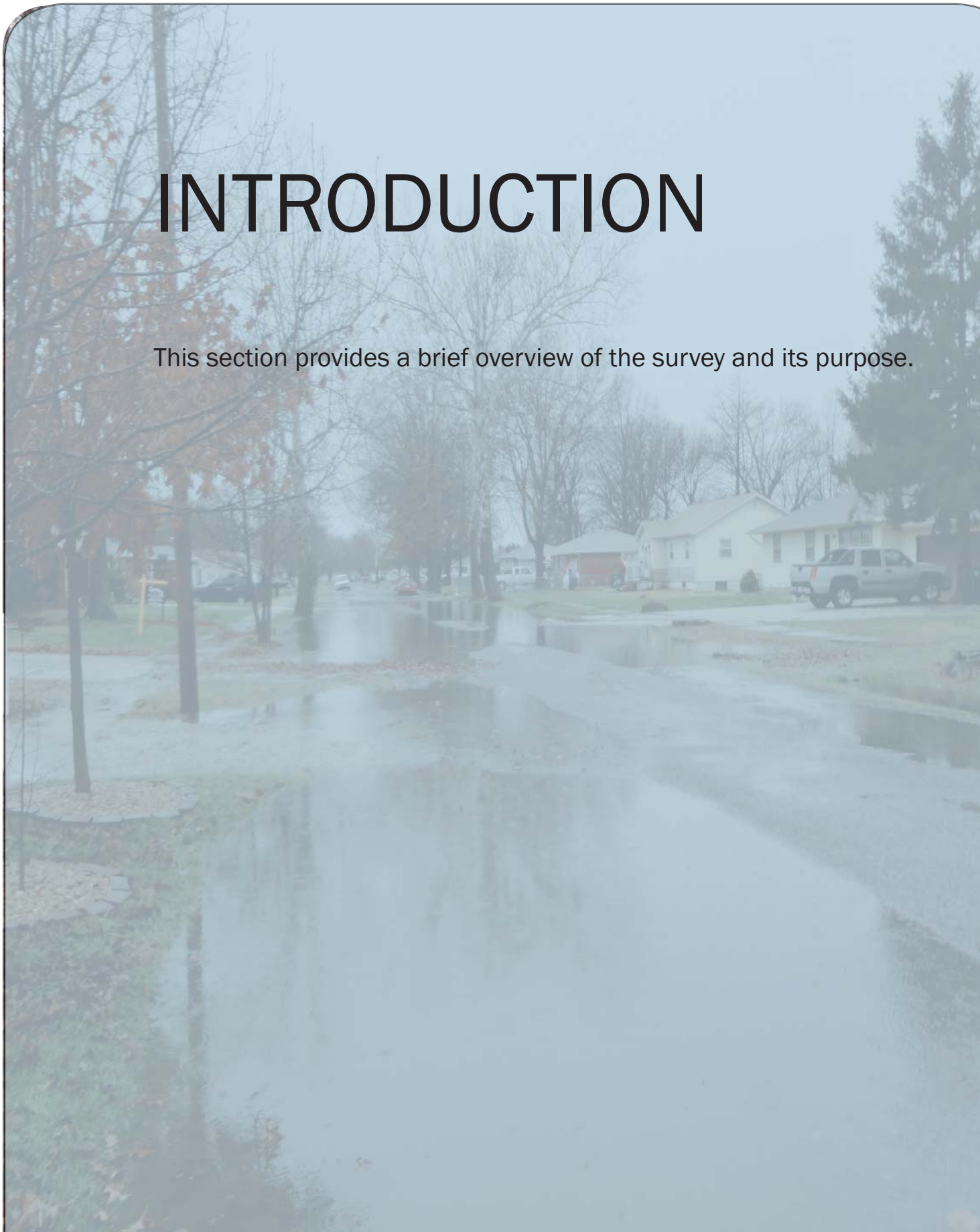




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INTRODUCTION

This section provides a brief overview of the survey and its purpose.



Overview

Several areas in Madison County regularly experience flooding. Some of this flooding occurs in floodplains designated by the Federal Emergency Management Agency (FEMA), which cover almost fifeteen percent (15%) of the county (approximately 110 square miles) and contain at least 4,128 structures with a total value of more than $213 million.[1] A great deal of flooding also occurs outside of floodplains. During heavy storms, inadequate drainage or stormwater infrastructure, coupled with large expanses of impervious surfaces, can cause flooding almost anywhere. Although structures in designated floodplains have been identified, and their owners made aware of their flood risk through the National Flood Insurance Program (NFIP), there is no data or notification system for structures outside of floodplains in Madison County.

Madison County promotes flood-safe development practices and the protection of existing development from flood risk. To determine how to best allocate resources and address flood problems, the locations, causes, and extents of flooding need to be identified. Map-based data and other data gathered by government agencies and organizations are useful to identify flood problems. However, a survey of homeowners and businesses is the most direct way to reveal the location, cause, and extent of flood problems they face.

The economic, social, and environmental consequences of flooding can be substantial to people and communities. Chronically wet houses and land result in higher insurance rates and deductibles, and industry experts estimate that wet basements decrease property values by 10-25 percent.[2] Almost forty percent (40%) of small businesses never reopen their doors following a flooding disaster.[3] In the streams, rivers, lakes, and ponds that collect floodwater, erosion becomes a significant problem and water quality declines as sediment and other pollutants enter the water supply.

The Illinois Department of Natural Resources (IDNR) conducted a survey on urban flooding in 2015, as directed by the Urban Flooding Awareness Act.[4] Urban flooding is defined in the Act as "the inundation of property in a built environment, particularly in more densely populated areas, caused by rainfall overwhelming the capacity of drainage systems, such as storm sewers. 'Urban flooding' does not include flooding in undeveloped or agricultural areas." Using this definition, the Madison County Community Flood Survey has collected data on urban flooding as well as non-urban flooding.

Survey Area: American Bottom Watershed

The American Bottom watershed is located directly northeast of St. Louis, Missouri in southwestern Illinois. The watershed is in Madison County. Water flows through the project area to join the Mississippi River through the Cahokia Canal west of Collinsville.

Much of the watershed's population lives in urban or suburban incorporated areas. Granite City, Venice, and Madison lie entirely within the watershed, along with large portions of Edwardsville and Fairmont City. All or portions of eight (8) municipalities are included in the watershed.

Horseshoe Lake, Canteen Creek, and the Chain of Rocks Canal have been identified as impaired waters by the Illinois Environmental Protection Agency (IEPA). The causes of impairment include phosphorus, Total Suspended Soilds (TSS), polychlorinated biphenyls, and barium. In addition, the watershed experiences flooding inside and outside of its 100-year floodplains, causing damage to property and threatening life safety.

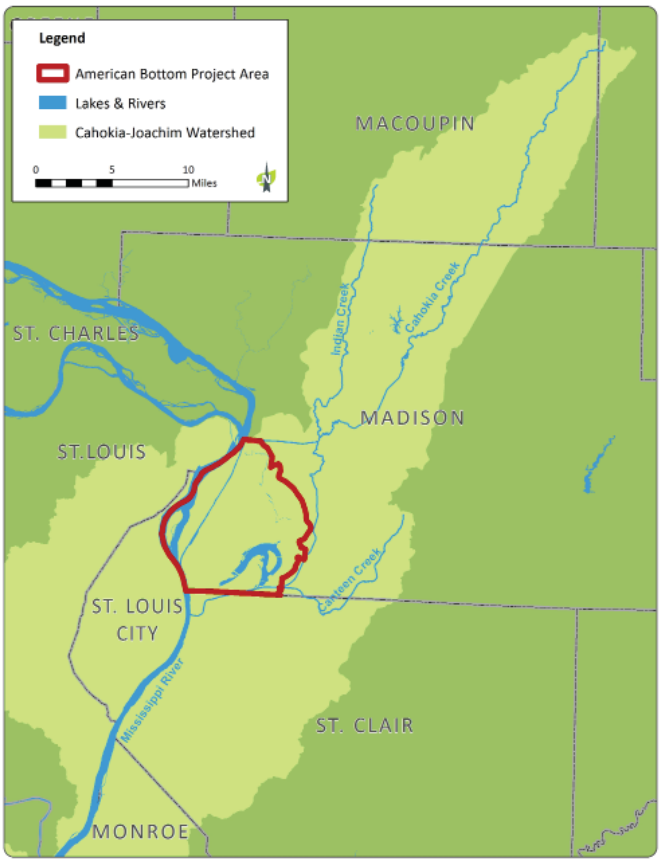


FIGURE 1. LOCATION OF AMERICAN BOTTOM PROJECT AREA

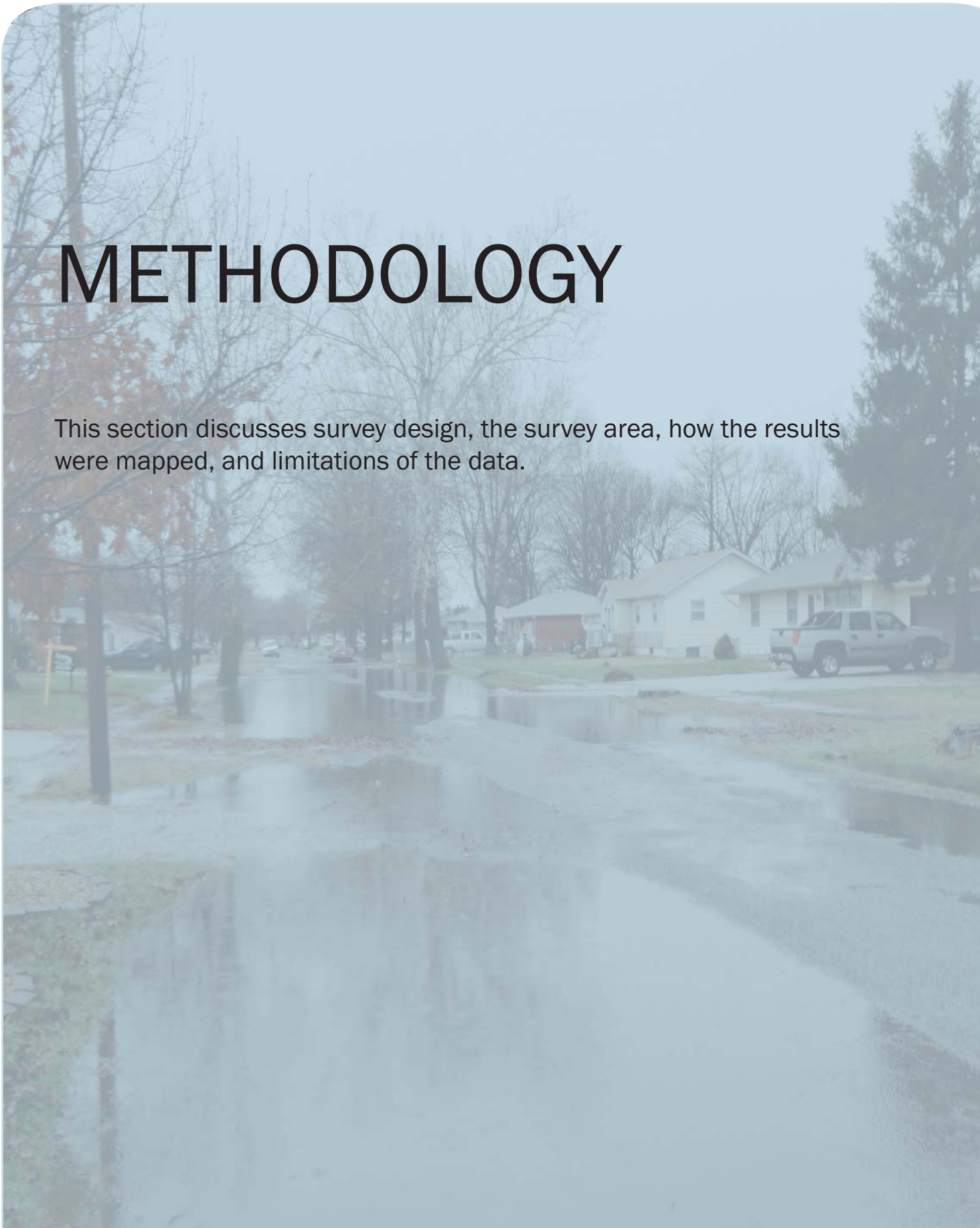
The American Bottom Community Flood Survey ("the Survey") was conducted in 2017 to get a better understanding of flooding issues in the watershed. The findings of the Survey will be incorporated in the American Bottom Watershed Plan. When completed, the Plan will provide recommendations for improving water quality and reducing flood damage.



FIGURE 2. AMERICAN BOTTOM WATERSHED PLAN AND SURVEY AREA

METHODOLOGY

This section discusses survey design, the survey area, how the results were mapped, and limitations of the data.



Survey Area

The survey was mailed to recipients in the American Bottom watershed, which encompasses 43,352 acres. This watershed extends from the north end of Granite City, down to the south where Madison and St. Clair County meet, and from the Mississippi River on the west to I-255 on the east. The survey was also available on-line for community members in the watershed. Some survey respondents provided addresses outside the watershed. These responses were not considered in the results of this report.

Subwatersheds

A watershed is an area that drains to a defined point. Watersheds are defined at a variety of scales for different purposes. As the watershed planning process for the American Bottom watershed progresses, it will be divided into smaller hydrologic units for management and analysis purposes. Each subwatershed will have a unique 14-digit hydrologic unit code (HUC), to be informally known as HUC14 subwatersheds or "HUC14s". The delineation process will follow the procedure employed by the United States Geological Survey (USGS) to define watersheds in the Watershed Boundary Dataset (WBD), a component of the National Hydrography Dataset (NHD), a nationwide database of waterways and waterbodies.

Zip Codes & Block Groups

Since HUC14 subwatershed boundaries are not yet available, zip codes and 2010 Census Block Groups were used to break down data geographically (see Figure 3). There are 14 zip codes in the watershed. Survey responses were received from 9 of these.

Survey Design

The American Bottom Community Flood Survey consisted of seventeen (17) questions covering a variety of flooding topics, including frequency of flooding, causes of flooding, the extent and costs of flood damage, flood insurance coverage, and personal values about water quality. A full copy of the survey is available in the Appendix.

Questions were created using best practices to maximize survey response, such as:

- **Powerful purpose:** The survey stated that Madison County is trying to identify and solve flooding problems to make it safer to invest and live in Madison County.
- **Simple to return:** The survey was made as easy to return as possible, with a stamped, self-addressed envelope enclosed. For those wishing to take the survey online, a QR code directed phone users directly to the survey on the website.
- **Privacy assurance:** Survey respondents feel more comfortable providing information when they know how it will be used and that it will be kept private. The first question included a disclaimer that addresses will be kept confidential.

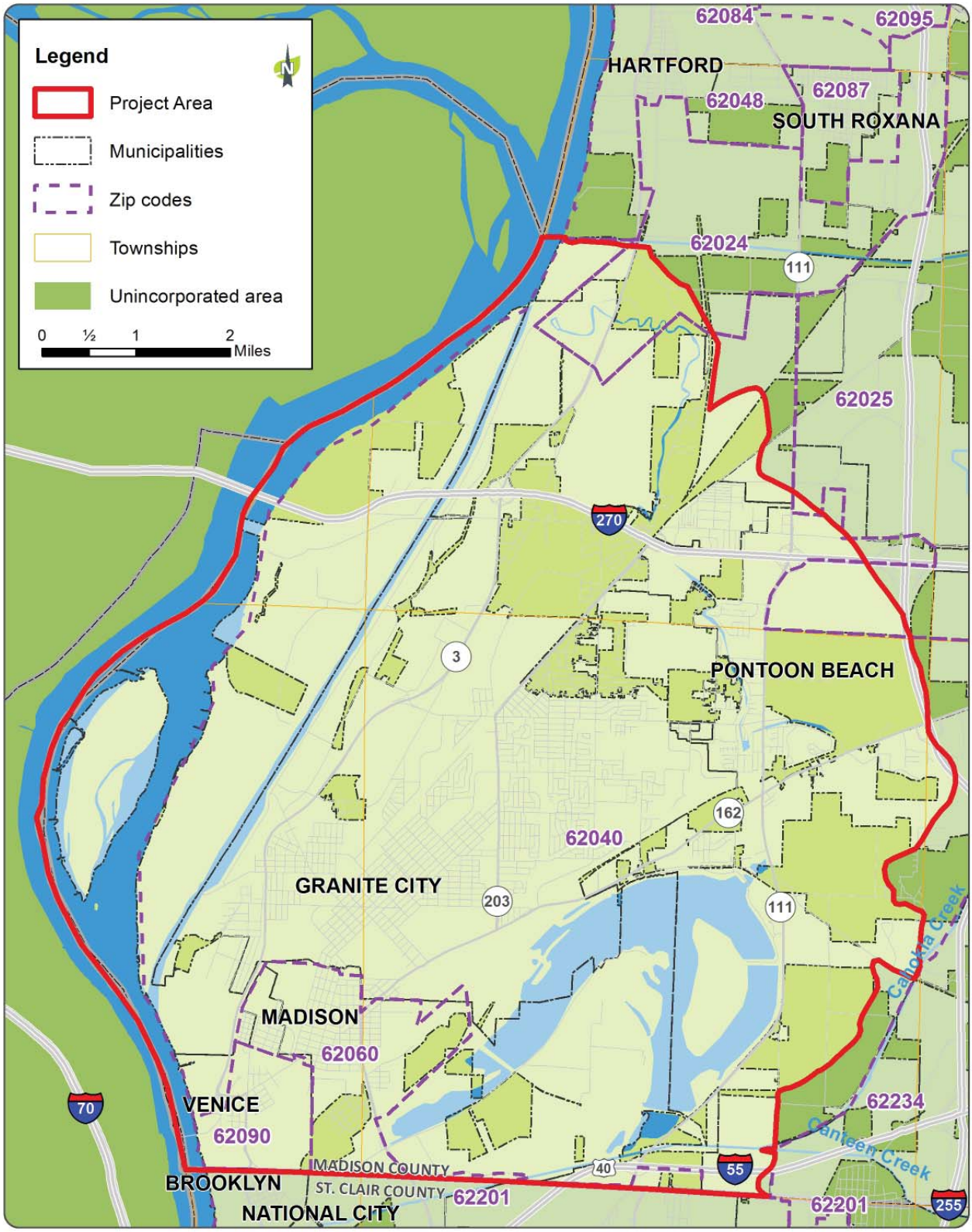


FIGURE 3. LOCAL JURISDICTIONS
American Bottom watershed project area with zip codes and local jurisdictions

Survey Distribution and Outreach

Twenty-one hundred (2,100) surveys were mailed to randomly selected addresses in Madison County in the American Bottom watershed. The randomized list of addresses was created by assigning a number to each parcel in the watershed, and then generating a set of random addresses within the range to correspond to the parcels. Duplicate addresses and names were omitted, as were P.O. Box addresses and addresses outside the watershed. These filters resulted in a mailing list of residents, businesses, and property owners currently living or working in the watershed. Madison County printed and mailed the surveys, received the returned responses, and entered the response data.

The survey was also available on the web via SurveyMonkey.com. The mailed survey contained a link to the on-line survey so recipients could fill it out on-line instead of by hand. The survey link was also sent to email addresses of interested people and organizations. Some of the recipients of the emailed link may have forwarded it to others.

The survey was publicized at individual and group stakeholder meetings, public open houses, and other meetings for the American Bottom watershed planning process.

Survey Results Mapping

For those respondents who provided an address, the parcel number associated with that address was identified so that the responses could be mapped. Parcel numbers were found using data files from Madison County and the County Assessor's on-line database.

The response data was grouped and mapped by zip code and Census block group. Further geographic breakdown of the response data, such as by Census block, was not possible while maintaining the privacy of respondents' locations.

Data Limitations

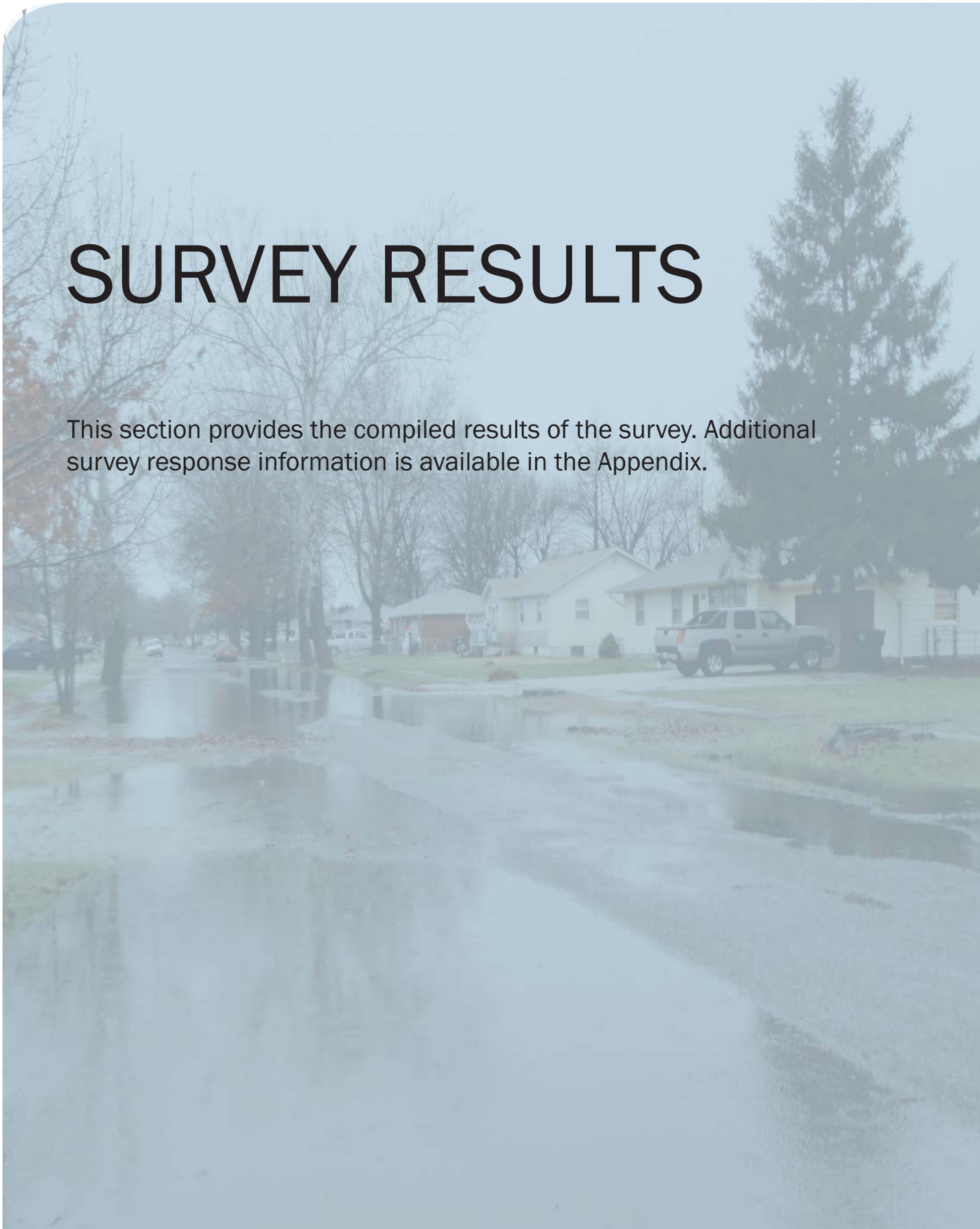
It is likely that people who have experienced flooding were more likely to reply to the survey than those who have not experienced flooding. Of those who did complete the survey, some may not have owned the property for all of the previous 10 years, meaning their estimates are underestimates of frequency and cost. Unclear handwriting may also have led to data entry errors.

Urban areas were geographically overrepresented in this survey because of the randomized parcel selection process; urban parcels are smaller and more numerous than rural parcels. This effect is compounded because a single property owner in a rural area often owns several parcels, and duplicate names were removed in the address selection process causing fewer rural parcels to be on the list. However, the cost of flood losses from rural areas may have been proportionally higher than the cost reported from urban areas because farmers are used to keeping track of flood damage for crop insurance claims. A geographically representative sample, or one that gave greater weight to answers from rural parcels based on their larger size, would have looked very different.

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SURVEY RESULTS

This section provides the compiled results of the survey. Additional survey response information is available in the Appendix.



Response Rate

Of the 2,100 surveys sent out, a total of 384 unique surveys were completed and returned from within the American Bottom watershed project area.

The number of responses exceeded the initial goal of 350 surveys. With this sample size and a population size of 22,434 households, the survey results are accurate within +/- 5% at the 95% confidence level.

The response rate of surveys within the watershed is 18%. Most surveys were returned in hard copy by mail, and other responses were entered on-line.

Survey responses were received from throughout the watershed. Eighty-three percent (83%) of the survey responses came from the Granite City zip code (62040). The number of respondents in each zip code replying that they had been flooded ranged between one (1) (e.g., Wood River) and 111 (e.g., Granite City 62040).

The total land area of the parcels from which surveys were returned is 463 acres (1.1% of the overall project area). Parcel sizes ranged between 0.07 and 120 acres, with an average of one acre.

TABLE 1. ZIP CODE OF SURVEY RESPONDENTS

ZIP CODE	RESPONDENTS IN WATERSHED	
Granite City (62040)	318	83%
Pontoon Beach (62040)	30	8%
Madison (62060)	14	4%
Mitchell (62040)	6	2%
Edwardsville (62025)	5	1%
Fairmont City (62201)	2	1%
Glen Carbon (62034)	1	0%
Godfrey (62035)	1	0%
Wood River (62095)	1	0%
No Answer	6	1%
TOTAL	384	100%

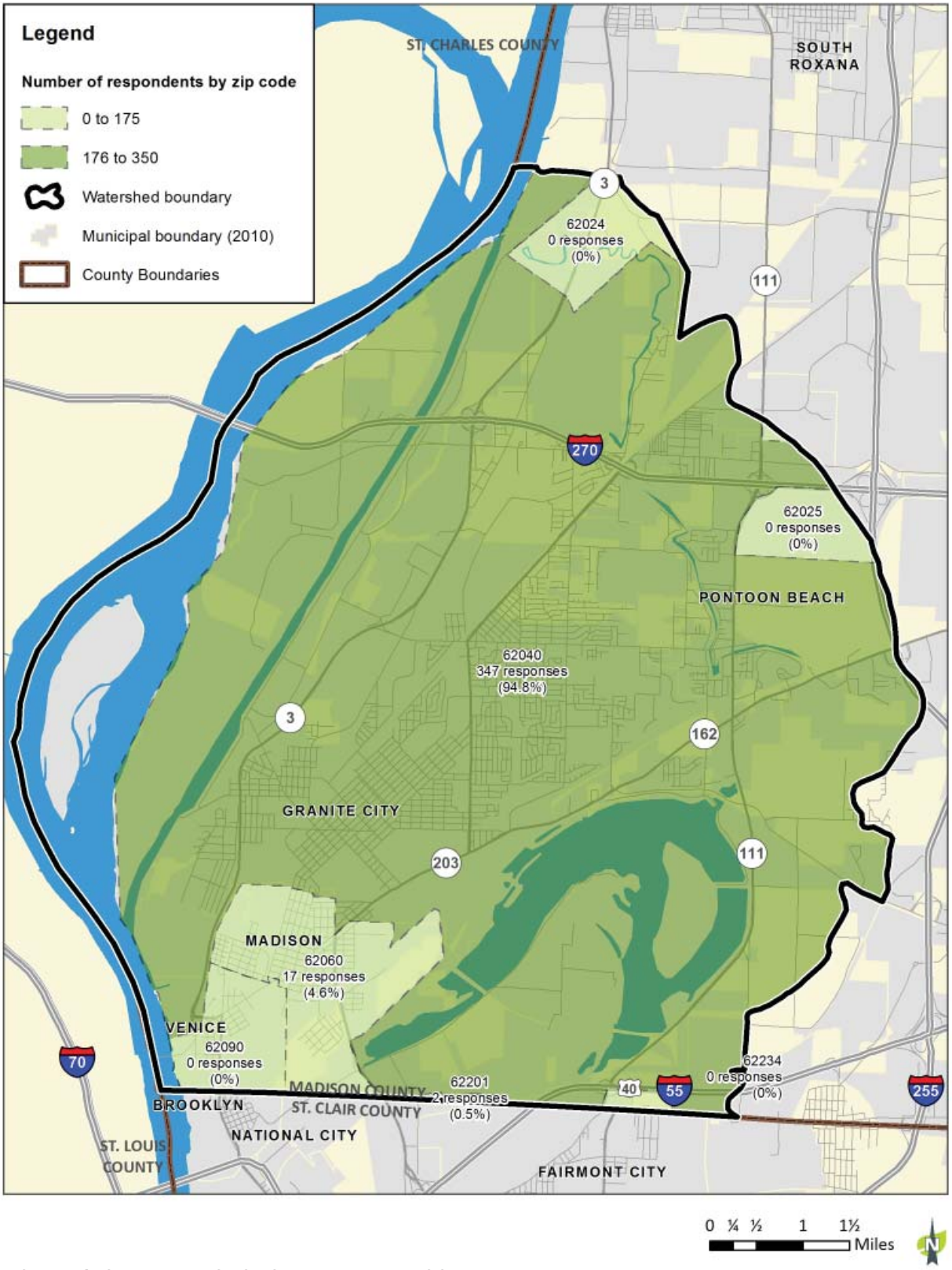


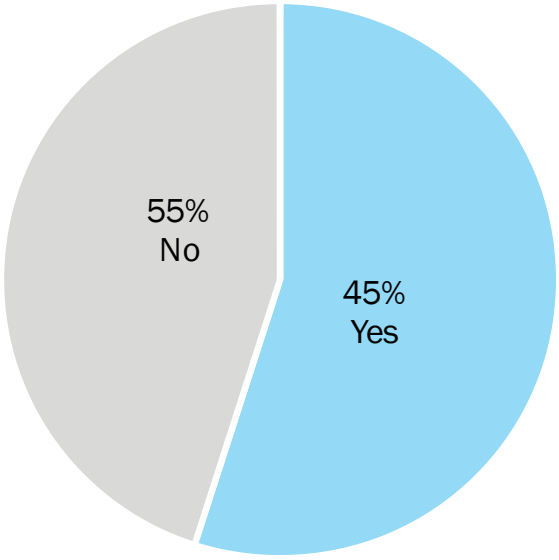
FIGURE 4. SURVEY RESPONSE RATE BY ZIP CODE

Note: Several respondents' properties were within two or more zip codes and were counted in all of them.

Prevalence

Forty-five percent of respondents (45%) replied that they had experienced flooding in the last 10 years.

FIGURE 5. PERCENT OF RESPONDENTS WITH FLOODING IN THE LAST 10 YEARS



The highest proportions of respondents with flooding were found in the Granite City, Pontoon Beach, and Madison zip codes. Granite City had the greatest proportion of respondents flooded (29%).

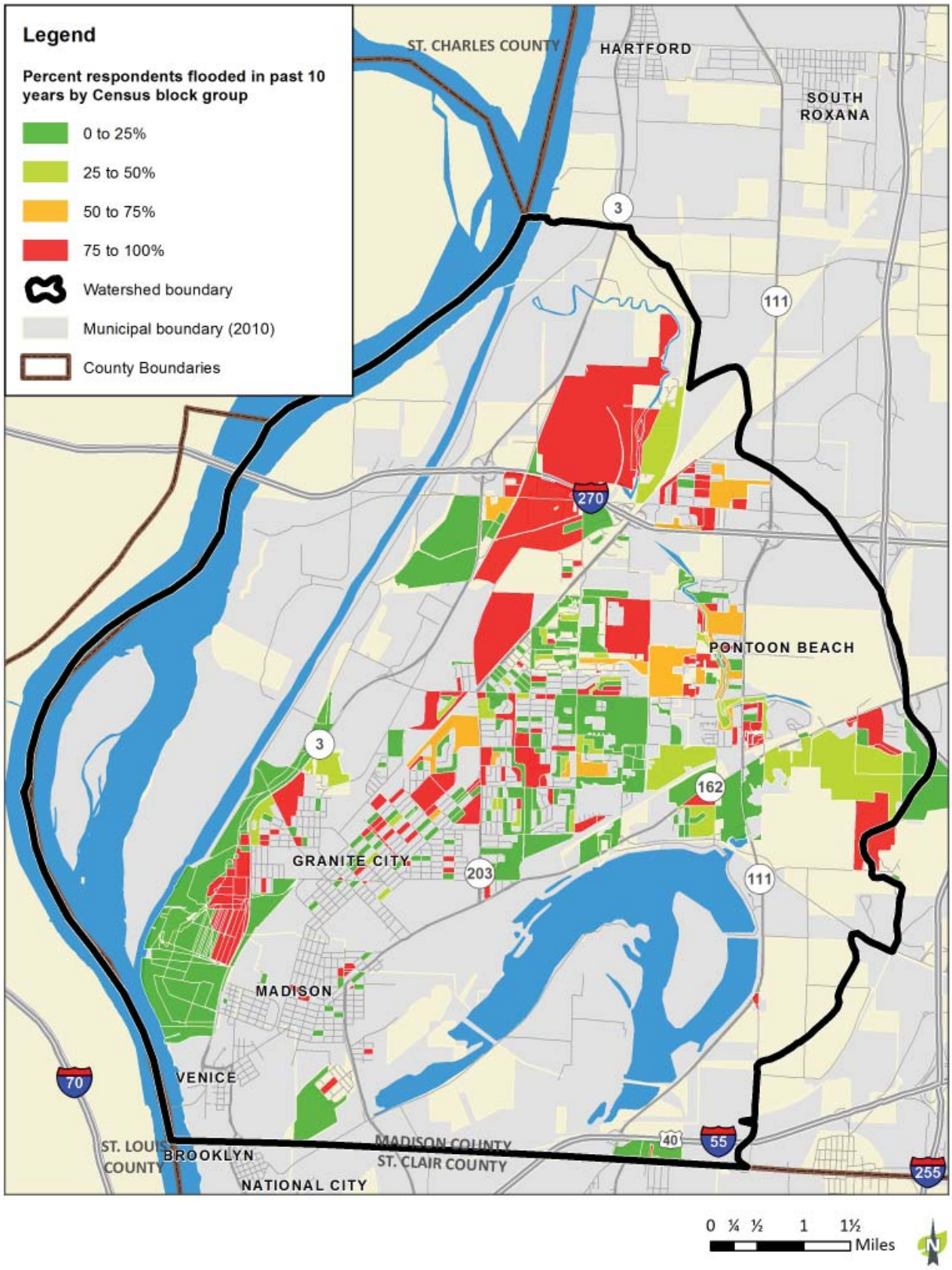


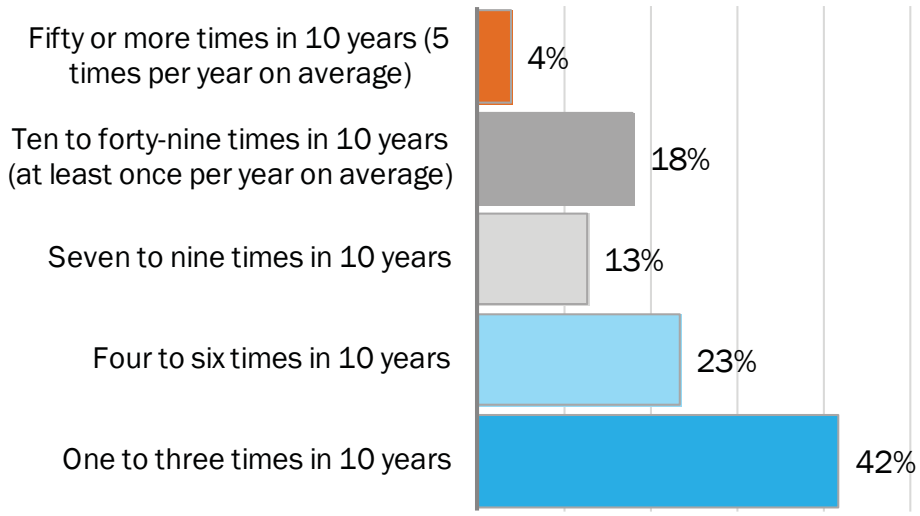
FIGURE 6. PERCENT OF RESPONDENTS FLOODED BY BLOCK GROUP.

Note: Several respondents' properties were within two or more block groups and were counted in all of them.

Frequency

Of the respondents who had experienced flooding in the last 10 years, 42% experienced flooding at least once per year in the last 10 years. The two most popular responses regarding flooding frequency were one to three times in 10 years (42%), and four to six times per year (23%). The greatest frequency of flooding reported by respondents on their property is shown in Figure 6.

FIGURE 7. FLOODING FREQUENCY OVER LAST 10 YEARS



Respondents reported a total of 299 flood events over the last ten years. Multiple respondents may have reported the same flood events, and, therefore, they may appear twice or more in the results.

TABLE 2. FREQUENCY OF FLOODING

FLOODING FREQUENCY	AVG. TIMES PER YEAR	RESPONSES		AVG. FREQUENCY x RESPONSES
1-3 Times in 10 Years	0.2	125	42%	25
4-6 Times in 10 Years	0.5	70	23%	35
7-9 Times in 10 Years	0.8	38	13%	30.4
10-49 Times in 10 Years	1.95	54	18%	105.3
50 or more Times in 10 Years	5	12	4%	60
No Answer	–	85	28%	–
TOTAL		384		255.7

On average, respondents with flooding experience 0.86 floods per year across the watershed (255.7/299).

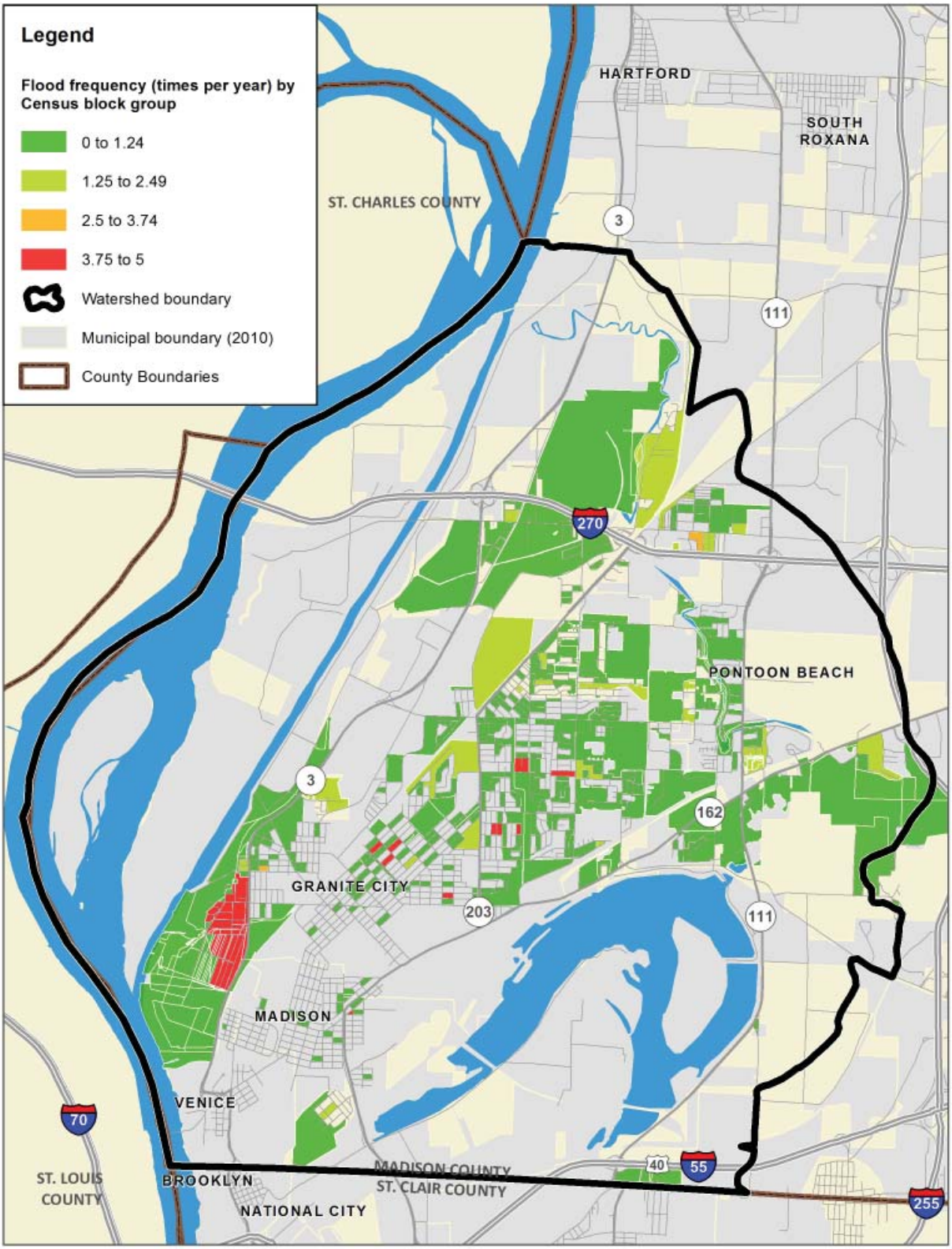


FIGURE 8. FREQUENCY OF FLOODING BY BLOCK GROUP

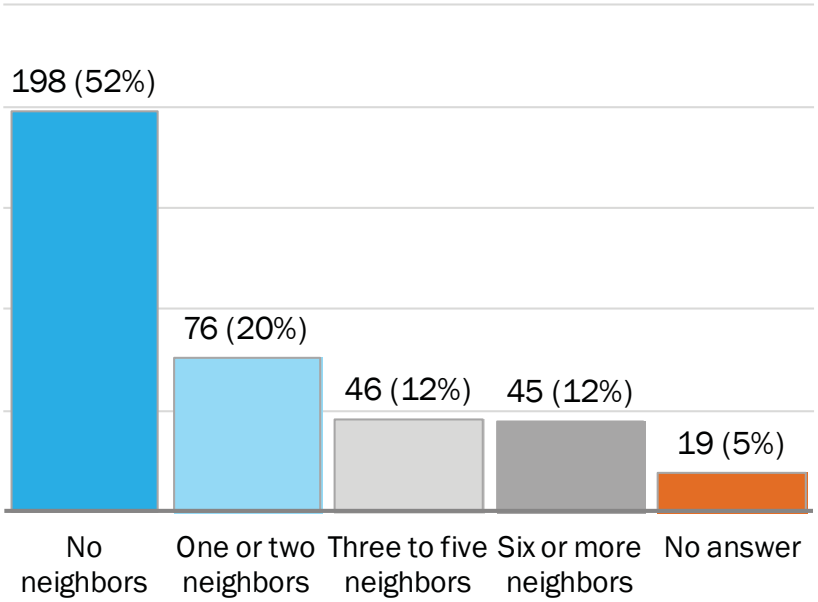
Note: Several respondents' properties were within two or more block groups and were counted in all of them.

Neighbors with Flooding

Forty-three percent (43%) of the respondents who had experienced flooding on their own property said their neighbor(s) had also been flooded in the last ten years.

Forty-four percent (44%) of all survey respondents were aware of flooding on one or more neighboring properties. Twenty percent (20%) of respondents were aware of flooding on one to two neighboring properties.

FIGURE 9. RESPONDENTS' NEIGHBORS THAT ALSO HAD FLOODING IN THE LAST 10 YEARS



Note: Although only 299 respondents reported flooding on their own properties, 383 people responded to this question about their neighbors, which is 99.5% of all survey respondents.

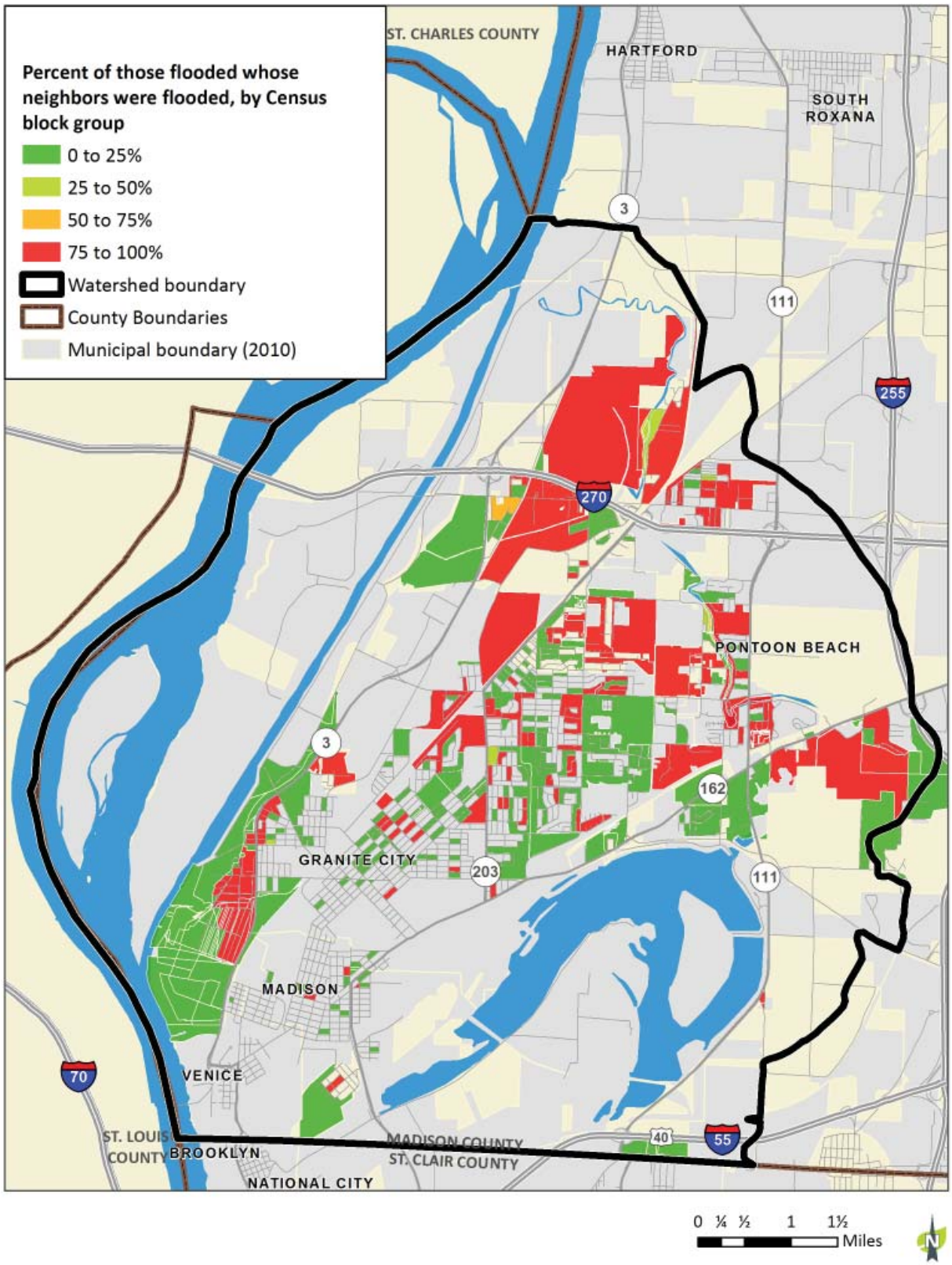


FIGURE 10. RESPONDENTS WITH AT LEAST ONE NEIGHBOR WITH FLOODING BY BLOCK GROUP

Note: Several respondents' properties were within two or more block groups and were counted in all of them. Map shows the percentage of respondents who had been flooded and who said that at least one of their neighbors had been flooded in the last 10 years, as a weighted average, by block group.

Extent of Flood Damage

Of those who had been flooded in the last 10 years, 36% had little to no yard damage; 28% said that the flooding had damaged their primary home or business; 18% had damage to yards and landscaping; and 13% had damage to fences, auxiliary buildings, and other structures.

Out of the respondents who said their primary home or business had been damaged by floods, 83% said the flooding reached the basement, and 17% (20 respondents) said it reached the first floor or habitable space.

FIGURE 11. EXTENT OF FLOOD DAMAGE IN THE LAST 10 YEARS
Note: Respondents could select more than one answer to this question

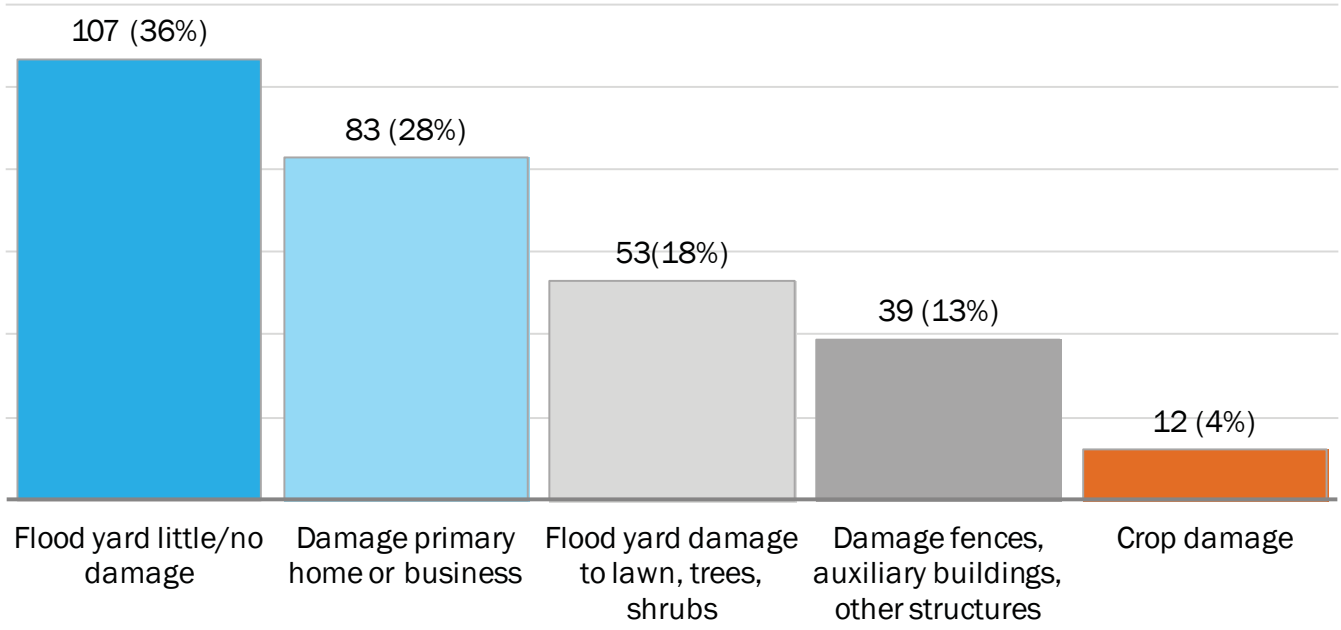
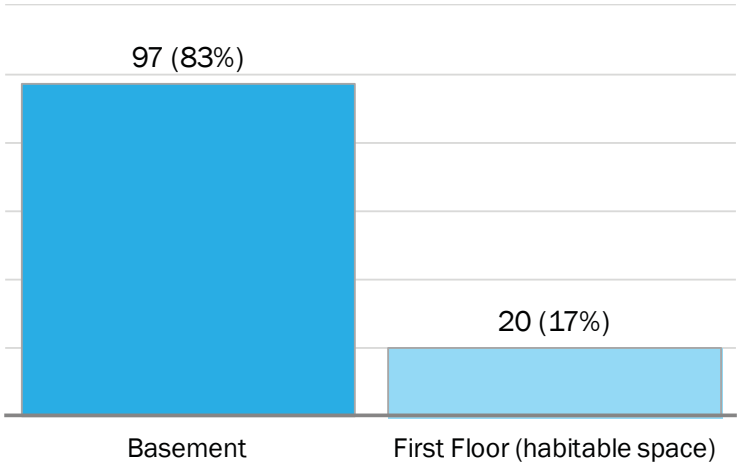


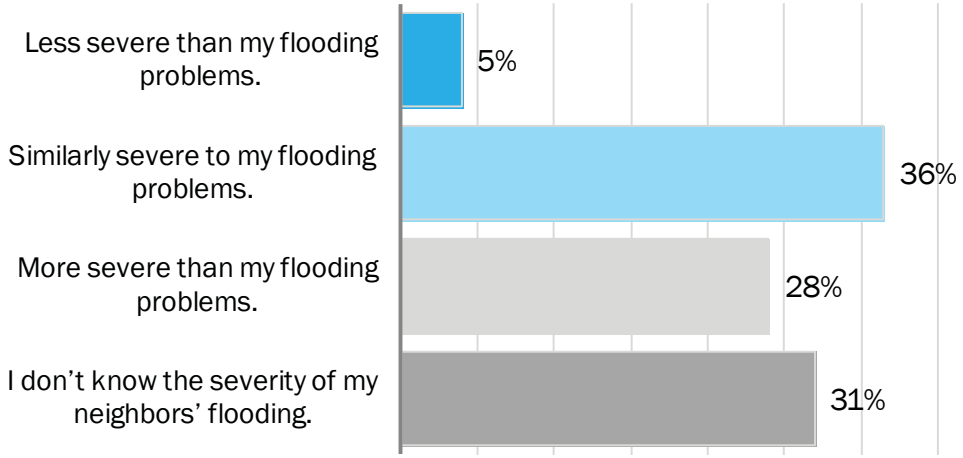
FIGURE 12. LOCATION OF DAMAGE TO PRIMARY HOME OR BUSINESS
Note: Respondents could select more than one answer to this question



Severity of Neighbors' Flood Damage

Sixty-nine precent (69%) of the respondents who had been flooded said that their neighbors had also been flooded in the last 10 years. Of these, 36% said that the extent of their neighbors' flooding was similar to their own. Another 28% said their neighbors' flooding was more severe than their own, while 5% said it was less severe. This indicates that the flood damage reported by respondents about their own property may be representative or an understatement of the wider effects of flooding on their communities.

FIGURE 13. EXTENT OF NEIGHBORS' FLOODING



Causes of Flooding

Almost 40% of respondents who had been flooded said that heavy rainstorms were a cause of their flooding. Other causes identified were a lack of drainage facilities (swales, ditches, storm sewers, etc.) (17%); flooding from a nearby river, stream, lake, ditch, or pond (12%); and a blocked or unmaintained pipe, culvert, or ditch (10%). For this question, respondents could choose more than one answer, so these responses were not mutually exclusive.

TABLE 3. CAUSES OF RESPONDENTS' FLOODING

CAUSE	RESPONSES	
Heavy Rainstorm	166	39%
Lack of Drainage Facilities to Drain Water From Property	73	17%
Flooding from nearby river, stream, lake, ditch, or pond.	51	12%
Pipe, Culvert, or Ditch that was Blocked/Needs Maintenance	44	10%
Sewer Backup	44	10%
Other (see Appendix)	32	8%
Logjam or Other Obstruction in Nearby Watercourse/Water-body	9	2%
I Don't Know	2	0%

Thirty-two (32) respondents listed other causes of flooding such as poor drainage, basement/foundation issues, and lack of maintenance. The full list is provided in the Appendix.

Reporting

At least 39% of respondents who were flooded did not report their flooding to anyone. Respondents that did report it were most likely to contact their township (20%), their city (18%), or their insurance company (14%).

TABLE 4. HOW RESPONDENTS REPORTED FLOODING

REPORTED FLOODING TO:	RESPONSES	
I did not report my flooding to anyone	99	39%
My township	50	20%
My city	46	18%
My insurance company	36	14%
The Madison County Stormwater Hotline (618-296-7788)	9	4%
Madison County*	4	2%
State Representative/Senator*	2	1%
Illinois Environmental Protection Agency (ILEPA)*	2	1%
Court/Legal action*	2	1%
Metro East Sanitary District*	2	1%
Illinois Department of Transportation (IDOT)*	2	1%
Federal Emergency Management Agency (FEMA)*	1	0%

** Written in under "Other"*

Impacts and Effects from Flooding

The most commonly reported impact from flooding was stress, followed by monetary loss, and related costs of having to take time off work. Respondents identified other specific effects under "Other" including the presence of mosquitoes in floodwater and mold/health concerns.

TABLE 5. EFFECTS OF FLOODING ON RESPONDENTS

EFFECT FROM FLOODING	RESPONSES	
It caused stress	143	31%
Monetary loss due to repair of flood damage	85	19%
Time off work to clean up	67	15%
Partial loss of access to property	52	11%
Monetary loss due to lost valuables or equipment	46	10%
No significant effect	26	6%
It affected the physical health of someone in your household or business	18	4%
Loss of crops	5	1%
Mold/Health concerns*	5	1%
Mosquitoes/Bugs*	4	1%
Lost business income (e.g. business closed, lost productivity)	3	1%
Clean-up*	3	1%
Zoning/Maintenance issues*	1	0%

** Written in under "Other"*

Costs from Flooding

Of those who said they had been flooded in the last 10 years, 33% reported no monetary loss. Thirty-three percent (33%) said that their loss was less than $5,000 over the last 10 years; and another 19% said that the loss was between $5,001 and $20,000. Two respondents (1% of those who answered) said their loss was between $100,000 and $500,000.

FIGURE 14. COSTS ASSOCIATED WITH RESPONDENTS' FLOODING OVER THE LAST 10 YEARS

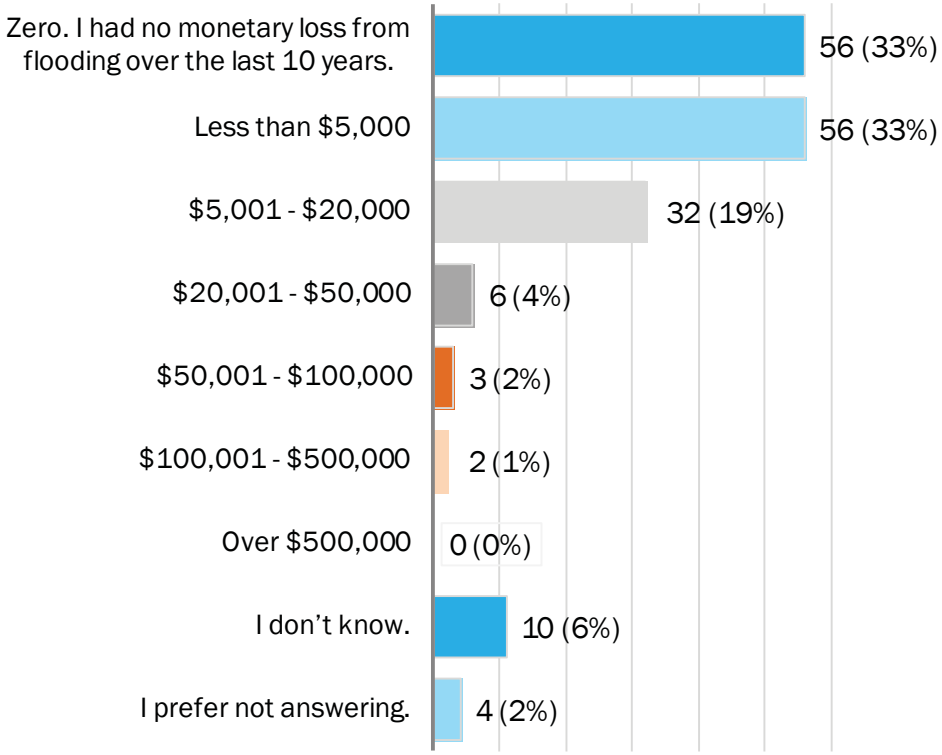


TABLE 6. COSTS ASSOCIATED WITH RESPONDENTS' FLOODING

COST OVER 10 YEARS	RESPONSES*		LOWEST COST IN CATEGORY	LOWEST COST x RESPONSES	AVG. COST IN CATEGORY	AVG. COST x RESPONSES
Zero	19	37%	$0	-	$0	-
Less than $5,000	18	35%	$1	$18	$2,500	$45,000
$5,001 - $20,000	10	19%	$5,001	$50,010	$12,500	$125,000
$20,001 - $50,000	4	8%	$20,001	$80,004	$35,000	$140,000
$50,001 - $100,000	1	2%	$50,001	$50,001	$75,000	$75,000
I don't know	4	–	–	–	–	–
I prefer not answering	1	–	–	–	–	–
No Answer	396	–	–	–	–	–
TOTAL	452		LOW ESTIMATE:	$180,033	MID ESTIMATE:	$385,000

** Percent = percentage of respondents who selected a cost range*

The lowest estimate of the total costs reported by respondents is $180,033 over the last 10 years. Using this low estimate, divided by the 33 respondents who reported a cost in this question, each respondent lost an average of $5,456 over 10 years.

Using the average cost for each response category, the estimate for total costs reported by respondents is $385,000 over the last 10 years; or an average of $11,667 lost per respondent over 10 years.

Using the lower estimate of costs, and extrapolating to the 22,434 households in the watershed (estimated using 2010 U.S. Census Bureau population map data), an estimated $1,121,700 of monetary loss has occurred due to flooding over the last 10 years in the American Bottom watershed.

Note on comparison of costs with the Upper Silver Creek flood survey report: the monetary loss estimate for the Upper Silver Creek Flood Survey Report used population rather than number of households, and also did not account for a "zero monetary loss" option in the question – the lowest category for monetary loss was "Less than $5,000". These factors led to a much higher overall monetary loss estimate for the Upper Silver Creek watershed.

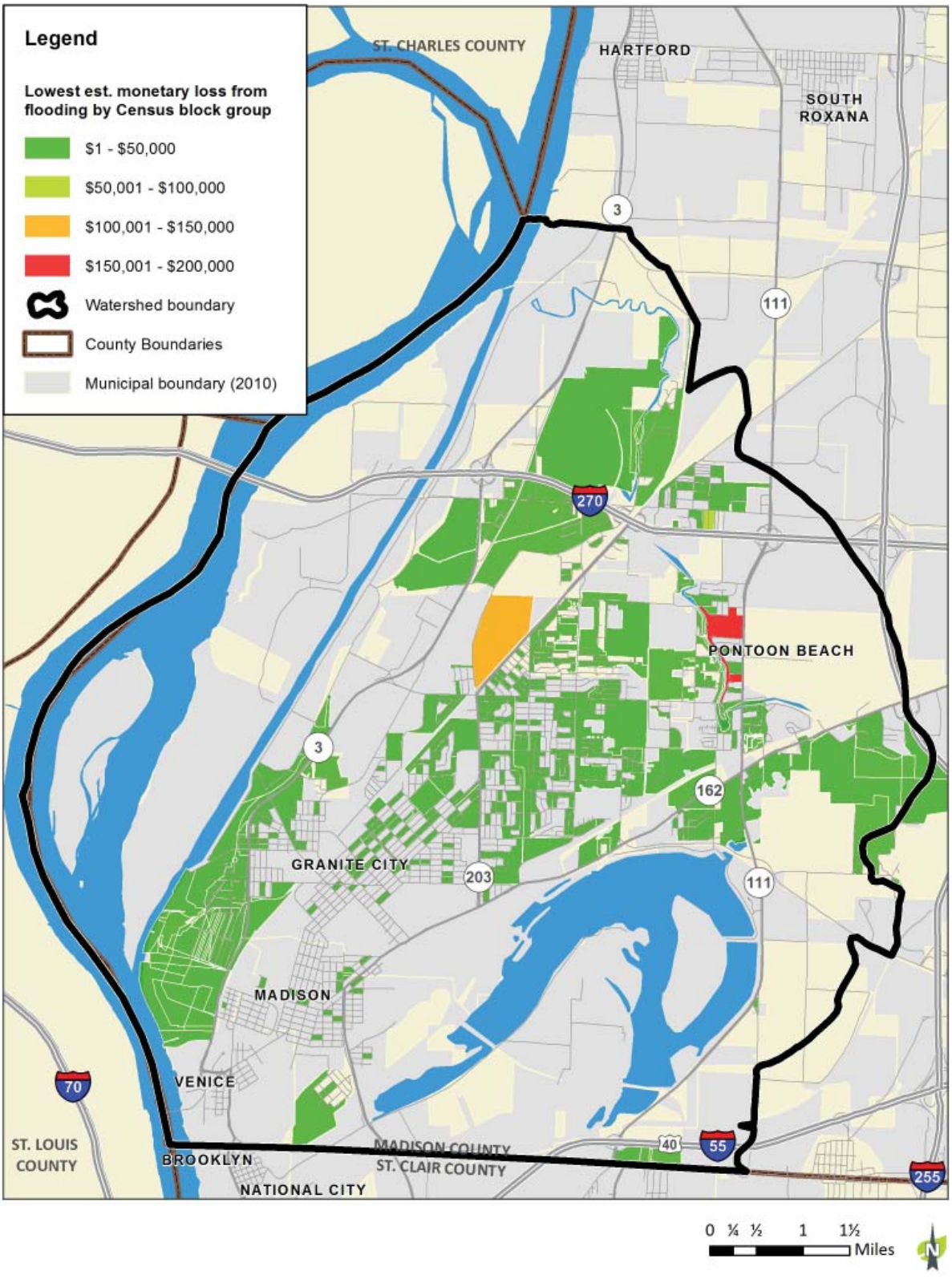


FIGURE 15. MONETARY LOSS FROM FLOODING BY BLOCK GROUP (USING LOW ESTIMATE)

Note: Several respondents' properties were within two block groups and were counted in both.

Correlation with Floodplains

FEMA-designated floodplains cover 38.2% (16,551 acres) of the total acreage in the American Bottom watershed. Twenty-nine percent (29%) of surveys came from parcels wholly or partly within these floodplains. Twenty-three people (8%) correctly responded that they were living in a FEMA-designated floodplain. Nine (9) respondents, or 2% of survey respondents, unknowingly own or live on property that is wholly or partly in a floodplain.

FIGURE 16. RESPONDENTS' LOCATION IN RELATION TO FLOODPLAIN

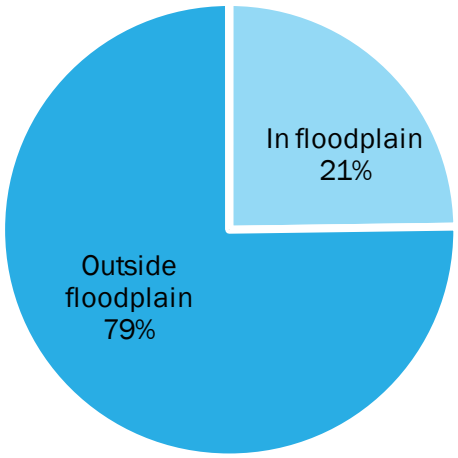
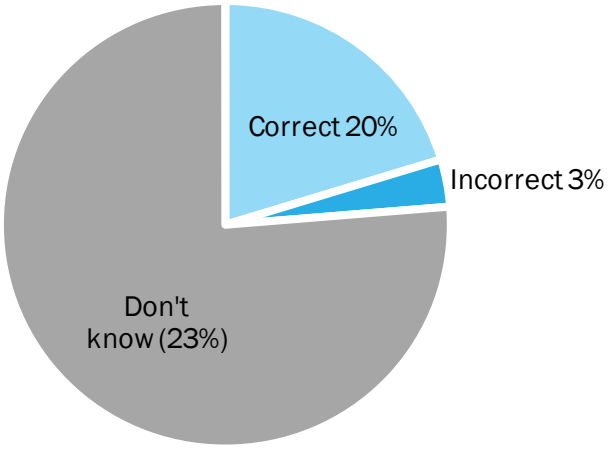


FIGURE 17. RESPONDENTS' KNOWLEDGE ABOUT WHETHER THEIR PROPERTY IS IN A FLOODPLAIN



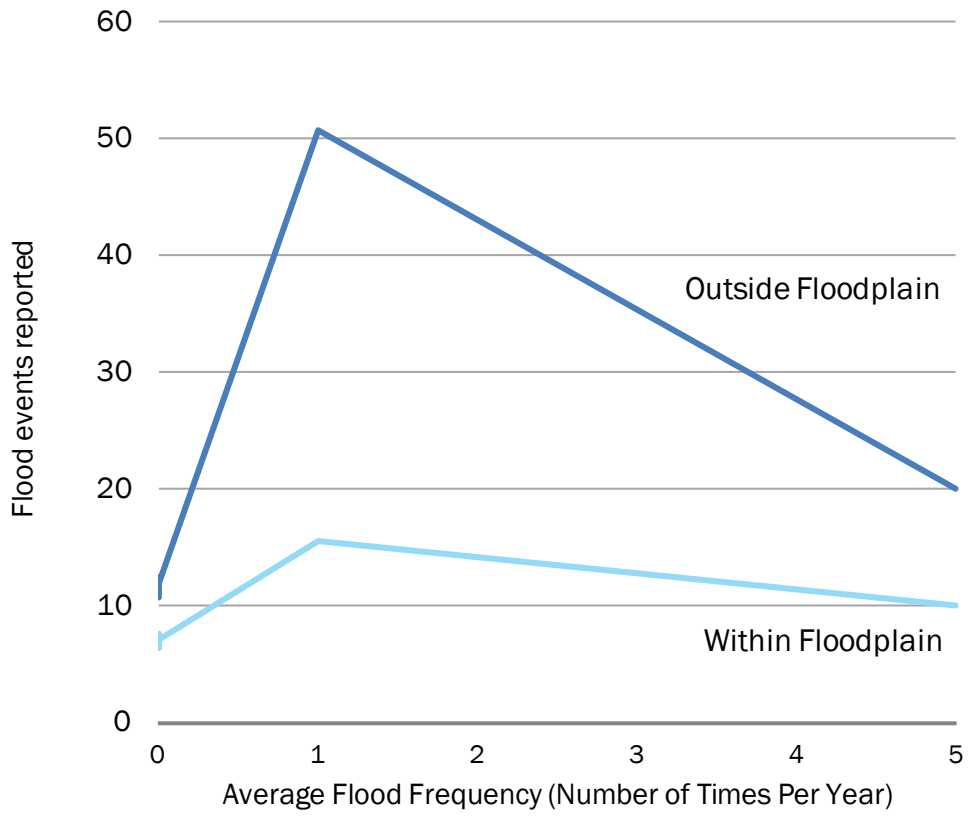
Note: In the Community Flood Survey for the Upper Silver Creek watershed, the data about whether respondents knew their property was in a floodplain was presented differently, only representing those whose property was in a floodplain.

TABLE 7. FLOOD FREQUENCY BY PROPERTY LOCATION

		PARCELS IN FLOODPLAIN		PARCELS OUTSIDE FLOODPLAIN	
FLOOD FREQUENCY	AVG. TIMES PER YEAR*	NUMBER	NUMBER OF TIMES FLOODED PER YEAR	NUMBER	NUMBER OF TIMES FLOODED PER YEAR
1-3 Times in 10 Years	0.2	38	7.6	54	10.8
4-6 Times in 10 Years	0.5	13	6.5	25	12.5
7-9 Times in 10 Years	0.8	9	7.2	15	12.0
10-49 Times in 10 Years	1.95	8	15.6	26	50.7
50 or more Times in 10 Years	5	2	10.0	4	20.0
TOTAL		70	46.9	124	106.0

*except for the *50 or more times* category, where the lowest possible frequency is used

FIGURE 18. FLOOD FREQUENCY BY PROPERTY LOCATION WITHIN OR OUTSIDE OF A FLOODPLAIN



Flood Insurance Coverage

Madison County and seven communities in the watershed are enrolled in the National Flood Insurance Program (NFIP), allowing floodplain residents to purchase flood insurance for their properties. The average flood insurance premium paid by Madison County residents is $732 per year.[5] Nationwide, approximately 20% of NFIP claims are for properties located outside floodplains, some of which are from flooding caused by local drainage problems.[6]

Fourteen percent (14%) of respondents (52 people) said that they have flood insurance. Of these respondents, 17 (5%) made a claim in the last 10 years.

Twenty-five (25), or 6.5%, of the survey respondents have flood insurance on structures that are not in a floodplain.

FIGURE 19. RESPONDENTS' FLOOD INSURANCE COVERAGE

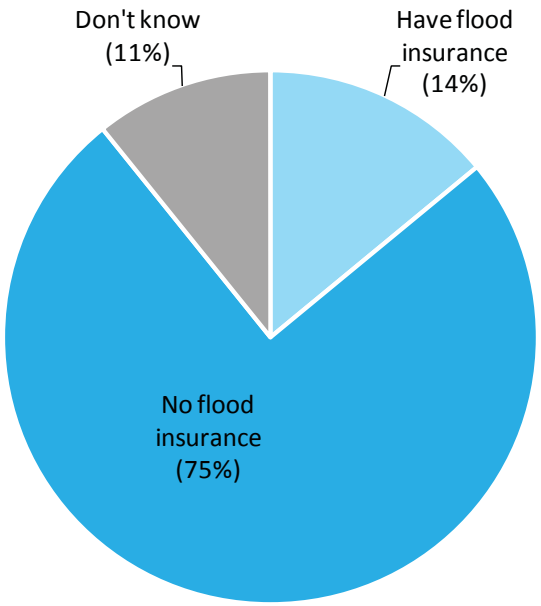
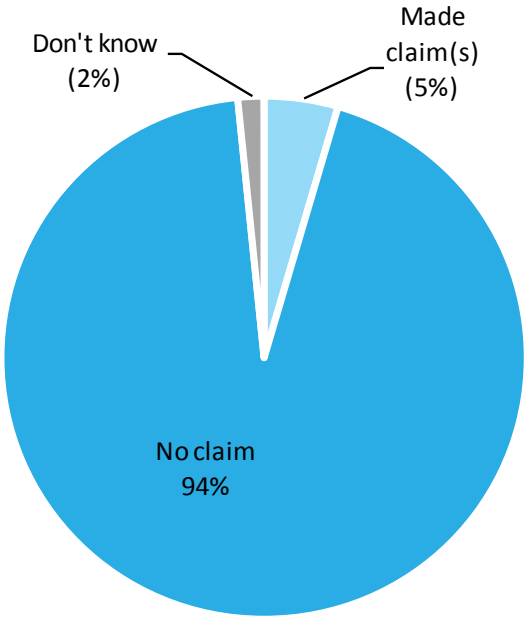


FIGURE 20. RESPONDENTS' FLOOD INSURANCE CLAIMS

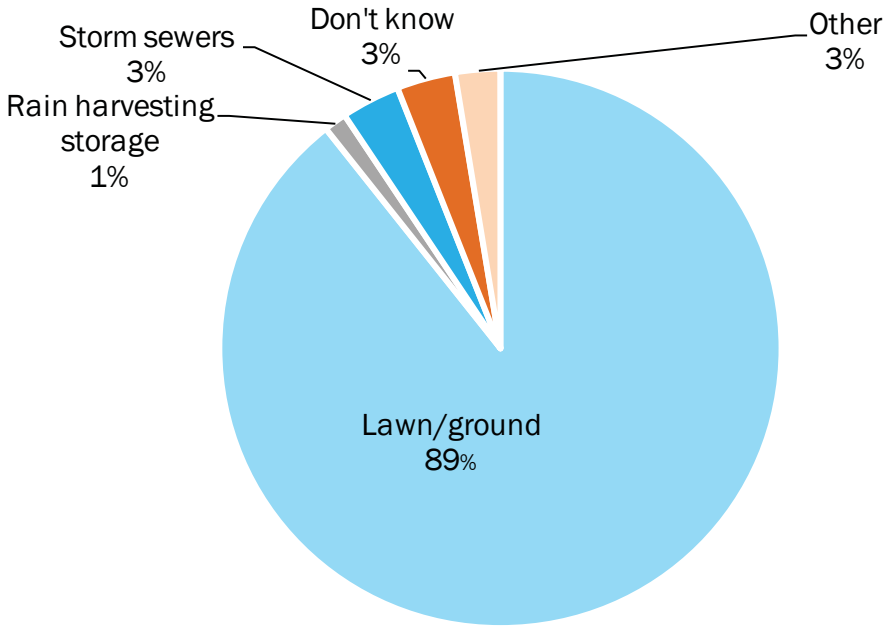


Downspout Connections

When downspouts are connected directly to a sanitary sewer system or private sewer system, heavy rainfall can lead to sewer backups into the building. When downspouts open out onto a lawn or other ground surface, the imperviousness and slope of the surface determines where and how fast the water flows. If there is inadequate infiltration, floodwaters can accumulate quickly around a building. A direct connection between downspouts and a storm sewer system quickly transports the water away from the building and into a detention pond or local waterway. Rainwater harvesting methods such as rain barrels or cisterns collect runoff from the roof, preventing it from contributing to flooding around the building or downstream. This is the optimal downspout connection scenario, as it does not allow stormwater to accumulate by the structure or downstream. Rainwater harvesting also allows for reuse of the water in gardening, for example.

The majority of respondents said that their downspouts flowed out onto their lawn or other ground surface. Much smaller proportions of respondents said their downspouts were connected to storm sewers (3%) or to cisterns, rain barrels, or other rainwater harvesting storage (1%). Under "Other", respondents wrote in that their downspouts drained to a nearby drainage ditch, buried extension (e.g. French drain), stream, pond, or waterbody.

FIGURE 21. WHERE RESPONDENTS' DOWNSPOUTS CONNECT



Measures to Prevent Future Flooding

One hundred four (104) respondents, or 27%, said they had made one or more improvements in an attempt to prevent future flooding/flood damage. Nineteen percent (19%) said they planted native vegetation or buffer strips, or another conservation measure. Thirteen percent (13%) of respondents said they extended drain lines from downspouts. Creating or enlarging ponds, detention, or retention basins and raising one or more buildings were the next most popular options, at seven percent (7%) of respondents. Respondents were given the option to write in other improvements they had made. Several noted that they graded landscape, installed sump pumps, sealed/resealed their basements, or installed drainage tiles. See Appendix for full list of "Other" responses to improvements.

TABLE 8. TOP ACTIONS TAKEN BY RESPONDENTS TO PREVENT FUTURE FLOODING

ACTION TAKEN	RESPONSES	
Planted native vegetation, buffer strips, or other conservation measures	20	19%
Extended drain lines from downspouts*	13	13%
Graded Landscape*	7	7%
Created or enlarged a pond or retention/detention basin	7	7%
Installed sump pump*	7	7%
Sealed/resealed basement*	7	7%
Raised one or more buildings	7	7%
Installed drainage tile*	5	5%
Extended drain lines from sump pump*	5	5%
Raise/redo paving*	5	5%
Installed or enlarged trenches and/or ditches*	4	4%
Installed permeable paving	4	4%
Removed debris from ditch/creek*	4	4%
Installed check valve*	3	3%
Added retaining wall*	2	2%
Installed a rain garden	1	1%
City/Township infrastructure improvement*	1	1%
Created levee around property	1	1%
Installed seawall*	1	1%

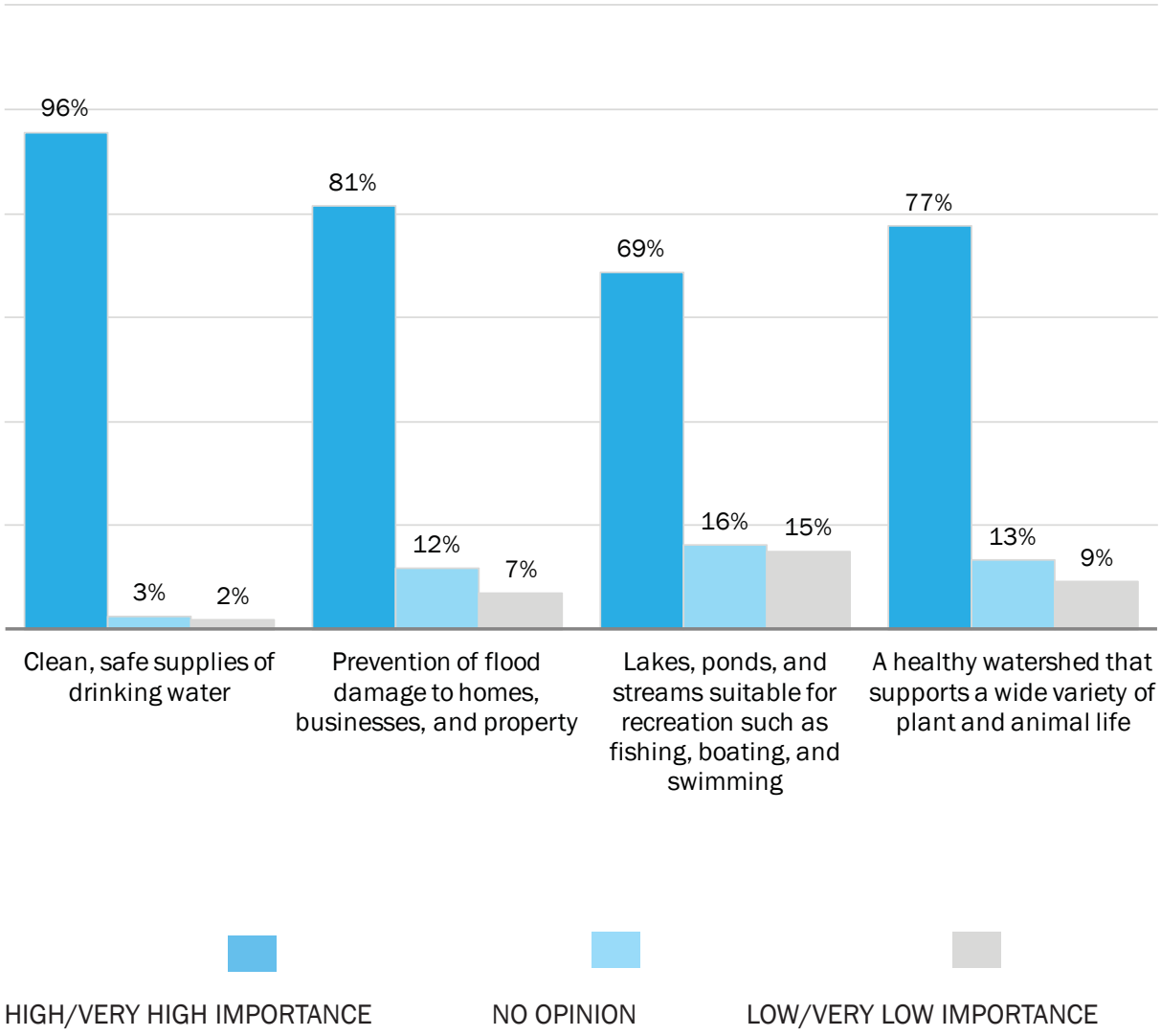
***Written in under "Other"**

Importance of Water Management

Most respondents replied to the question about their values on water-related issues, whether or not they had experienced flooding. The question asked how important four issues were to respondents on an importance scale with five options, from very low importance to very high importance.

Respondents placed the highest importance on “clean, safe supplies of drinking water”, followed by “prevention of flood damage to homes, businesses, and property”; then “a healthy watershed that supports a variety of plant and animal life”; and finally “lakes, ponds, and streams suitable for recreation such as fishing, boating, and swimming”.

FIGURE 22. IMPORTANCE OF WATER MANAGEMENT OUTCOMES





NEXT STEPS

Next Steps

The findings of this survey will be incorporated into the American Bottom watershed plan. Some data about the location and extent of flooding in the watershed has already been gathered from interviews with stakeholders including mayors, township highway road commissioners, property owners, and landowners. The results of this survey will be considered alongside this data as recommendations for mitigating water quality and flooding issues. Additionally, the survey results will be considered alongside those from the Upper Silver Creek Watershed Community Flood Survey and the Indian-Cahokia Creek and Canteen-Cahokia Creek Community Flood Surveys to assess flood impacts across multiple watersheds.

More community flood surveys may be undertaken in other watersheds in Madison County and the region as further watershed planning takes place. Having more extensive knowledge about flooding problems in multiple areas will help county and municipal governments prioritize flood mitigation and protection projects across their entire jurisdictions.

Further research into flooding issues and their solutions may include gathering data from private insurers about flood insurance claims. Insurance data would allow for the calculation of the distribution of flood insurance and the costs of flooding through verified policies and claims, rather than best estimates.

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REFERENCES



[1] Madison County Planning and Development Department and Madison County Emergency Management Department, Madison County Hazard Mitigation Plan, June 2006, http://www.state.il.us/iema/planning/Documents/Plan_MadisonCounty.pdf

[2] Center for Neighborhood Technology, The Prevalence and Cost of Urban Flooding, May 14, 2013, http://www.cnt.org/resources/the-prevalence-and-cost-of-urban-flooding/

[3] FEMA, as cited in Center for Neighborhood Technology, The Prevalence and Cost of Urban Flooding, May 14, 2013, http://www.cnt.org/resources/the-prevalence-and-cost-of-urbanflooding/

[4] Illinois Department of Natural Resources (IDNR), June 2015, https://www.dnr.illinois.gov/WaterResources/Documents/Final_UFAA_Report.pdf

[5] FEMA, Policy Statistics by state as of 9/30/2013, http://bsa.nfipstat.fema.gov/reports/1011.htm

[6] FEMA, National Flood Insurance Program Community Rating System Coordinator's Manual, FIA-15/2013, OMB No. 1660-0022, expires: September 30, 2013, http://www.fema.gov/medialibrary-data/20130726-1557-20490-9922/crs_manual_508_ok_5_10_13_bookmarked.pdf

Photo Credit: Madison County

APPENDIX

The Appendix includes:

- Causes of flooding written in by respondents under “Other”
- Improvements made to prevent future flooding, written in by respondents under “Other”
- A copy of the Madison County Community Flooding survey for the American Bottom watershed

Other Causes of Flooding

Causes written in by respondents under “Other”, by response keyword (corresponds to Table 3 on Page 22):

TABLE 9. OTHER CAUSES OF FLOODING

OTHER CAUSE	RESPONSES
Improperly designed infrastructure	2
Culvert collapse	1
Hydrostatic pressure	1
Low elevation of buildings	1
Sump pump failure or inadequacy	1

Other Actions Taken to Prevent Flooding

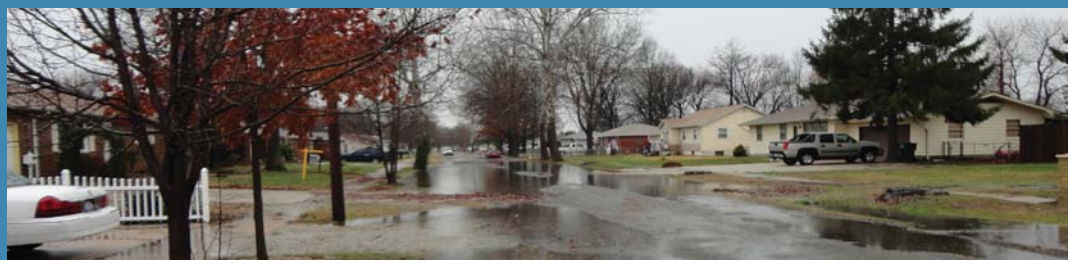
Improvements written in by respondents under “Other”, by response keyword (corresponds to Table 8 on page 32):

TABLE 10. OTHER ACTIONS TAKEN TO PREVENT FLOODING

OTHER ACTIONS	RESPONSES	
Graded landscape	7	2%
Installed sump pump	4	1%
Installed drainage tile	3	1%
Sealed/resealed basement	3	1%
Extended drain lines from downspouts	2	1%
Extended drain lines from sump pump	2	1%
Installed culvert	2	1%
Added terraced planters made of permeable stone	1	<1%
Connected downspout(s) to a rain barrel	1	<1%
Improved lakeshore seawall	1	<1%
Increased size of culverts	1	<1%
Moved auxiliary building (e.g. shed) to higher ground	1	<1%
Installed larger gutters	1	<1%
Removed debris from ditch/creek	1	<1%
Repaired a seawall	1	<1%

Madison County Community Flooding Survey

for Homeowners, Businesses, and Property Owners



We Need Your Help!

Thank you in advance for taking the time to fill out this survey regarding the impact of floods on homes, businesses, and property in Madison County. Your response is greatly appreciated. This survey is part of a larger planning effort for the the American Bottom watershed on the southwest side of the county. Your response will help determine strategies and recommendations for addressing flooding problems in the watershed.

What is a Watershed Plan?

A watershed plan identifies strategies to improve water quality and reduce the impacts of flooding. The watershed plan for the American Bottom watershed will:

- Document existing conditions.
- Develop recommended strategies to improve water quality and address flooding, and act as a roadmap for communities, agencies, and landowners to implement future improvements.
- Help reduce costs for homeowners, businesses, and taxpayers.

This watershed planning effort is an important component of Madison County's Stormwater Management Plan, and part of a larger effort to create plans for all of Madison County's major watersheds. Multiple partners are involved in this effort, including Madison County, HeartLands Conservancy, the U.S. Army Corps of Engineers, and the Madison County Soil and Water Conservation District.

Please complete and return this survey by

July 31, 2017.

Your time and input is greatly appreciated!

If you have questions about the survey or the American Bottom watershed planning process, visit:
www.HeartLandsConservancy.org/AmericanBottom.php

or contact:

Janet Buchanan at HeartLands Conservancy,
(618) 566-4451 ext. 25
janet.buchanan@heartlandsconservancy.org

You can complete this survey in two ways:

1. Fill out and return the survey via the enclosed return envelope.
2. Fill out the survey online at:
www.surveymonkey.com/r/americanbottomflood

Later in the year, an Open House event will be held to gather more information for the American Bottom Watershed Plan. Be sure to provide your email address if you want to to be notified when future Open House dates & locations are set.

MADISON COUNTY PLANNING & DEVELOPMENT
PLAN | GROW | SUSTAIN

US Army Corps of Engineers®
St. Louis District

HEARTLANDS CONSERVANCY

Madison County Soil & Water Conservation District

Turn Page to Start Survey

Start Survey

1. Please provide your address: (Note: Addresses will be kept confidential. Giving your address allows the planning team to identify locations of flooding. Follow-up information will only be sent if requested below.)

Address: _____ City: _____ Zip: _____

☐ Check here if you would like to be put on our mailing list to receive updates and more information. Provide your name, phone, and e-mail below:

Name: _____ Phone: _____

E-mail: _____

2. What type of property is at this address? It will be referred to for the rest of the survey as "this property."

☐ Residential, lot smaller than 5 acres
☐ Residential, lot larger than 5 acres
☐ Business/Commercial
☐ Agricultural
☐ Industrial
☐ Civic / Institutional / Non-profit
☐ Other (please explain): _____

3. Has this property been flooded in the last 10 years? ☐ Yes ☐ No *(If NO, skip to Question #9)*

Extent/Type of Flood Damage	Number of times flooded over the last 10 years				
	1-3	**4-6**	**7-9**	**10 - 49 (1-4.9/year)**	**50 or more (at least 5/ year)**
Yard/Open green space was flooded, with little/no damage					
Yard/Green space was flooded, with damage to lawn, trees, and shrubs					
Crops were damaged					
Fences, auxiliary buildings (sheds, etc.), or other structures were damaged					
Primary home/business was damaged					

4. If flooding damaged the primary home or business, how far did the floodwater penetrate into the home or business (furthest extent)?

i. Basement ☐ Yes ☐ No
ii. First floor (habitable space) ☐ Yes ☐ No

5. What was the cause of the flooding that affected this property? *(Select all that apply)*

☐ Heavy rainstorm.
☐ Flooding from nearby river, stream, lake, ditch, or pond.
☐ Logjam or other obstruction in nearby river, stream, lake, ditch, or pond.
☐ Pipe (not sewer), culvert, or ditch that was blocked or needs maintenance.
☐ Lack of drainage facilities (swales, ditches, storm sewers, etc.) to drain water from the property.
☐ Sewer backup.
☐ I don't know.
☐ Other (please explain): _____

6. Did you report your flooding to anyone? *(Select all that apply)*

- ☐ My city/village.
- ☐ My township.
- ☐ The Madison County Stormwater Hotline (618-296-7788).
- ☐ My insurance company.
- ☐ I did not report my flooding to anyone.
- ☐ Other (please explain): _____

_____

_____

7. How have you been affected by flooding on this property? *(Select all that apply)*

- ☐ Monetary loss due to repair of flood damage.
- ☐ Monetary loss due to lost valuables or equipment.
- ☐ It caused stress.
- ☐ Time off work to clean up.
- ☐ Other (please explain):
- ☐ Partial loss of access to property.
- ☐ It affected the physical health of someone in your household or business.
- ☐ Lost business income (e.g., business closed, lost productivity)
- ☐ Loss of crops.
- ☐ No significant effect.

_____

_____

8. If you suffered a monetary loss due to flooding over the last 10 years (such as damage to structures or buildings, lost valuables or equipment, lost wages or income, etc.), please estimate your total, cumulative loss in dollars.

- ☐ Zero. I had no monetary loss from flooding over the last 10 years.
- ☐ Less than $5,000.
- ☐ $5,001 - $20,000.
- ☐ $20,001 - $50,000.
- ☐ $50,001 - $100,000.
- ☐ $100,001 - $500,000.
- ☐ Over $500,000.
- ☐ I don't know.
- ☐ I prefer not answering.

9. Have any of your nearby neighbors experienced flooding at their home, business, or property in the last 10 years? *(Choose one)* NOTE: If you have neighbors who experienced flooding, please let them know about this survey and have them visit www.surveymonkey.com/r/americanbottomflood.

- ☐ YES. One or two neighboring properties.
- ☐ YES. Three to five neighboring properties.
- ☐ YES. Six or more neighboring properties.
- ☐ NO. I don't know of any neighbors who have experienced flooding on their home or property. *(If NO, Skip to question 11)*

10. If you answered YES above, what was the severity of your neighbors' flooding? *(Choose one)*

- ☐ Less severe than my flooding problems.
- ☐ Similarly severe to my flooding problems.
- ☐ More severe than my flooding problems.
- ☐ I don't know the severity of my neighbors' flooding.

11. Is this property located in FEMA's Special Flood Hazard Area (SFHA)?

☐ Yes ☐ No ☐ I don't know.

12. Is the property at this address covered by a flood insurance policy? (Note: Flood insurance is typically not included in a standard home insurance policy).

☐ Yes ☐ No ☐ I don't know.

13. Have you ever made a flood insurance claim?

☐ Yes ☐ No ☐ I don't know.

14. Where do your roof downspouts connect to? *(Select all that apply)*

☐ They connect to the storm sewers.
☐ They flow out onto my lawn or other ground surface.
☐ They are connected to cisterns, rain barrels, or other rain harvesting storage.
☐ I don't know.
☐ Other (please explain): _____

_____

15. Have you made any improvements to your property to help reduce stormwater or flood impacts? *(Select all that apply)* NOTE: If you would like to find out more about these or other improvements, visit www.heartlandsconservancy.org/americanbottom.php.

☐ Installed a rain garden.
☐ Created or enlarged a pond, detention/retention basin, ditch, or swale.
☐ Raised one or more buildings.
☐ Created a levee around the property.
☐ Installed permeable paving.
☐ Planted native vegetation, buffer strips, or other conservation measures.

Other (please explain): _____

_____

_____

16. How important are the following water issues to you?

	Very Low Importance	*Low Importance*	*No Opinion*	*High Importance*	*Very High Importance*
A. Clean, safe supplies of drinking water:	☐	☐	☐	☐	☐
B. Prevention of flood damage to homes, businesses, and property:	☐	☐	☐	☐	☐
C. Lakes, ponds, and streams suitable for recreation such as fishing, boating, and swimming:	☐	☐	☐	☐	☐
D. A healthy watershed that supports a wide variety of plant and animal life:	☐	☐	☐	☐	☐

17. Any other comments or questions? _____

_____

Thank you for completing this survey! Your time and input is greatly appreciated.

Survey responses will be used to help shape the recommendations in the American Bottom Watershed Plan.

Please return this survey by **July 31, 2017** via the enclosed envelope or to:

American Bottom Survey - Madison County Planning and Development

157 North Main Street, Suite 254 Edwardsville, IL 62025

MADISON COUNTY
PLANNING & DEVELOPMENT

MADISON COUNTY ILLINOIS

HEARTLANDS
CONSERVANCY
Investing In The Nature Of Southwestern Illinois

Appendix C – Critical Areas

This appendix includes descriptions of the source data used to delineate Critical Areas, and maps of each Critical Area. Maps of Best Management Practices (BMPs) as outputs from the Agricultural Conservation Planning Framework (ACPF) and BMP Siting Tool.

How locations were identified

Several sources of information were used to identify Critical Areas locations. These results from the U.S. Department of Agricultural (USDA) ACPF tools, BMP Siting Tool and analysis of wetland restoration rank from Missouri Resource Assessment Partnership (MoRAP).

Agricultural Conservation Planning Framework

The ACPF is a set of GIS-based tools developed by the USDA Research Service (USDA-ARS) that can substantially enhance watershed planning capabilities on agricultural land. The ACPF is currently available for portions of Minnesota, Wisconsin, Iowa, Nebraska, Kansas, Missouri, Illinois, Indiana and Ohio and uses new high-resolution data sources, such as soils, land use, crop rotations, and elevation (from LiDAR). The tools determine slope, flow accumulation, and other factors by HUC12, allowing analysis at watershed and field scales. Among the outputs of the tools are possible beneficial locations for different types of practices in fields, at field edges, and in riparian zones. No recommendations are made. The aim is to create a planning resource to use in watershed planning and consultation with landowners.

Table C.1. Values entered into ACPF tools to generate BMP locations for user-defined or modifiable parameters.

ACPF BMP	**Values used for user-defined or modifiable parameters**
Edge-of-Field Bioreactors	No modifiable parameters
Drainage water management	Tile-drained agricultural fields where a 1-meter (3.3 ft) contour interval comprises more than 30% of the field (representing the addition of 2 control gate structures on the tile drain), with a default minimum of 20 acres
Grassed waterways – SPI Threshold	Drainage threshold: >6 acres Standard deviations: 2
Riparian function assessment	No modifiable parameters

The BMPs recommended by the model include grassed waterways, drainage water management, and appropriate riparian vegetation. Many of the tools within the ACPF have parameters that can be adjusted by the user to chance their output.

The data analysis capabilities of the model also allow for further, independent assessment of different BMPs. Planning scenarios can be generated from the results and compared/evaluated in a simple way without additional input.

The results of the ACPF modeling were combined into one map in ArcMap. They were printed on 30 x 40 inch zoomed-in maps covering the whole watershed. These maps will be useful for the county Soil and Water Conservation Districts and Natural Resources Conservation Service (NRCS) staff to explore BMP options with farmers interested in implementing a soil conservation or waterway protection project. The ACPF results were also useful in setting the numeric targets for this watershed plan.

Analysis for Urban Stormwater Treatment

Using a GIS framework, the BMP Siting Tool was developed by Tetra Tech Inc. as a complement to the EPA's SUSTAIN model. This tool identifies appropriate areas for potential Best Management Practices within an urban setting (Tetra Tech, Inc. 2013). When used at the watershed scale or the small area scale, it can hone in on the most suitable locations derived from land use, imperviousness, slope and drainage, soil type, depth to water table, streams, and roads. This tool can be used with a few layers or with many layers, depending on the needs of the analysis (Tetra Tech, Inc. 2013). While the tool itself is useful, the user guide for the tool outlines the specific criteria and model used to identify areas for each of fourteen BMPs, based on previous studies in urban land management and BMP placement (Shoemaker 2009; Tetra Tech, Inc. 2013; USEPA 2004a, 2004b). However, because the model is no longer hosted by the EPA, the BMP Siting Tool is only functional on earlier versions of ArcMap, and too cumbersome to run on newer versions. To better identify areas in the American Bottom watershed, given the available data and understanding of the BMP Siting Tool, potential locations for five urban BMPs were ascertained through following the criteria used in the BMP Siting Tool user-guide, instead of running the tool itself.

The BMPs of interest are Dry Ponds, Infiltration Basins, Grassed Swales, Vegetated Filter Strips, and Porous Pavement. The default criteria for each BMP were based on previous studies in urban land management, and therefore were used for this analysis. Table 1.1 identifies the criteria used for identifying suitable locations for each BMP of interest, based on the Site Suitability Criteria of the BMP Siting Tool. However, this analysis did not have drainage area or imperviousness available for use. Additionally, while the tool identifies either polygons, points, or lines for the BMPs, this analysis was largely raster-based and therefore all final results are in acres.

Table C.1 Site Suitability Criteria

	DRAINAGE SLOPE (%)	HYDROLOGIC SOIL GROUP (A, B, C, D)	WATER TABLE DEPTH (ft)	ROAD BUFFER (ft)
DRY PONDS	< 15%	A – D	> 4	----
INFILTRATION BASINS	< 15%	A – B	> 4	----
GRASSED SWALES	< 4%	A – D	> 2	< 100
VEGETATED FILTER STRIPS	< 10%	A – D	> 2	< 100
POROUS PAVEMENT	< 1%	A – B	> 2	----

The BMP Siting Tool user guide identifies drainage slope, hydrologic soil group, water table depth, and road buffers as information needed to locate suitable sites for each BMP. Land use/land cover is also a layer needed for the analysis, and because urban land use and imperviousness were not used in this

analysis, the land use/land cover raster was used to identify land use types that would be suitable based on a watershed scale analysis. Land use types that were excluded from the analysis were as follows: High Density Developed, Woody Wetlands, Emergent Herbaceous Wetlands, and Open Water. High Density Developed land use was excluded due to its high imperviousness, making it unsuitable for many BMPs.

Using the Water Table Depth shapefile that Madison County provided, depth to water table, soil group, and drainage slope were extracted based on the criteria outlined above. Land use/land cover was clipped to the resulting polygons. From the resulting clipped land use/land cover raster, suitable land use types were extracted, resulting in a raster file that reflected potentially suitable locations for each BMP. To analyze acreage, a simple raster calculation was completed by summing the counts of each land-use type in the raster, multiplying that sum by the area of each pixel (in this case, each pixel was 30 x 30 meters, or 900 m^2), and converting the result into acres through dimensional analysis (Total Area m^2 x $\frac{1 \text{ acre}}{4046.86\ m^2}$). Table 1.2 demonstrates the logical flow of analysis for mathematical calculations.

Table C.2 Total area of each BMP assessed.

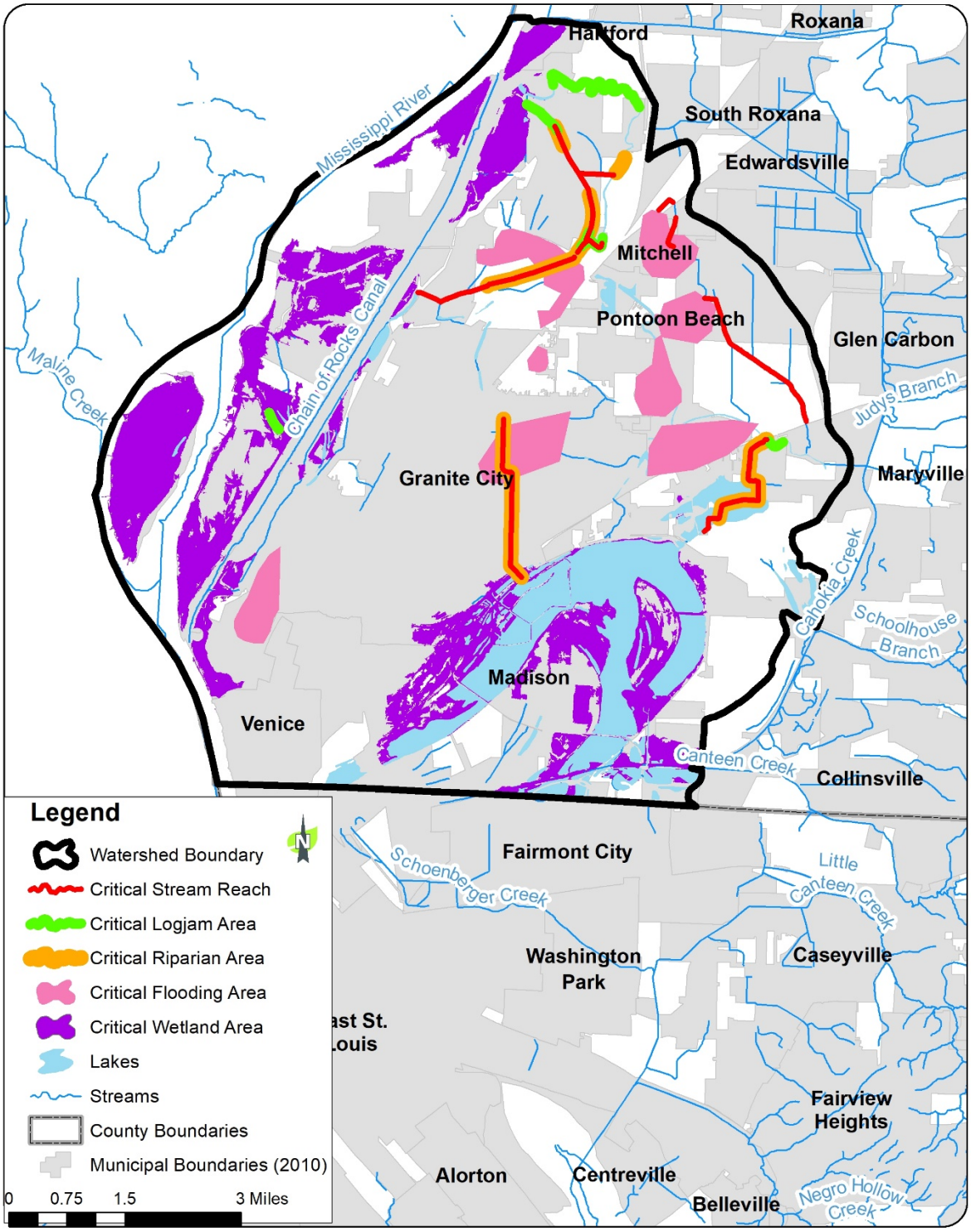
	GRASSED SWALES/VEGETATED FILTER STRIPS	***DRY PONDS***	***INFILTRATION BASINS***	***POROUS PAVEMENT***
CELL COUNT	5561	8901	7690	25
	19515	15491	9040	1567
	10190	10757	3716	1221
	9	8	8	549
	159	1177	1142	215
	72	345	306	593
	1160	3966	3938	28
	0	15776	15736	289
	1622	0	0	4349
	0	0	0	434
	0	0	0	1
TOTAL CELL COUNT	38288	56421	41576	4487
CELL SIZE (M^2**)**	30 x 30	30 x 30	30 x 30	30 x 30
CELL AREA (M^2**)**	900	900	900	900
TOTAL AREA (M^2**)** [CELL COUNT X AREA]	34459200	50778900	37418400	4038300
AREA I**N ACRES**	8515.05	12547.73	9246.28	997.88

Because of the similarity between Grassed Swales and Vegetated Filter Strips, the resulting raster file was the same for each BMP, however that does not indicate each BMP will be suitable for all locations identified in that raster. Rather, it indicates potential sites suitable for those BMPs (as is true for the other raster files). Field assessments will be needed to identify a realistic picture of site suitability for each BMP. However, these GIS analyses provide a starting point for BMP locations and recommendations.

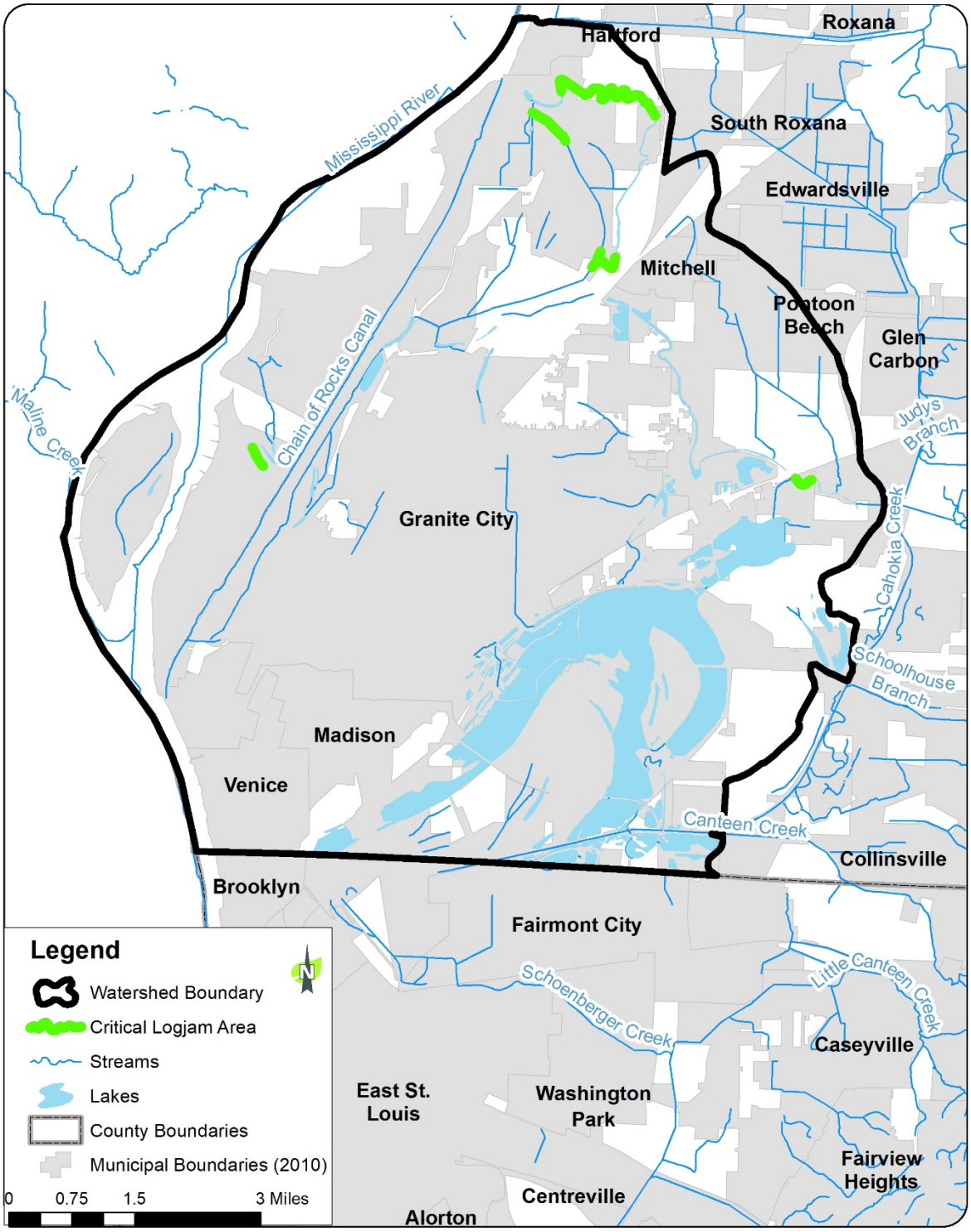
MoRAP Wetland Restoration Assessment

The Missouri Resource Assessment Partnership created wetlands mitigation importance values and wetland restoration importance values for the watershed in 2015. Several layers of data, especially topography, soil type, and land cover, were used to create maps of existing wetlands which are highly important to protect, and areas which were formerly wetlands which would be highly beneficial to restore. The 2015 report, “Ecological Approach to Infrastructure Development: Wetlands Mapping and Analysis for the Mississippi and Mississippi River Floodplains” describes the methodology of this assessment and provides information on other wetlands in the region. The top four highest ranking wetland areas were chosen as critical wetlands in the American Bottoms watershed.

Critical Areas

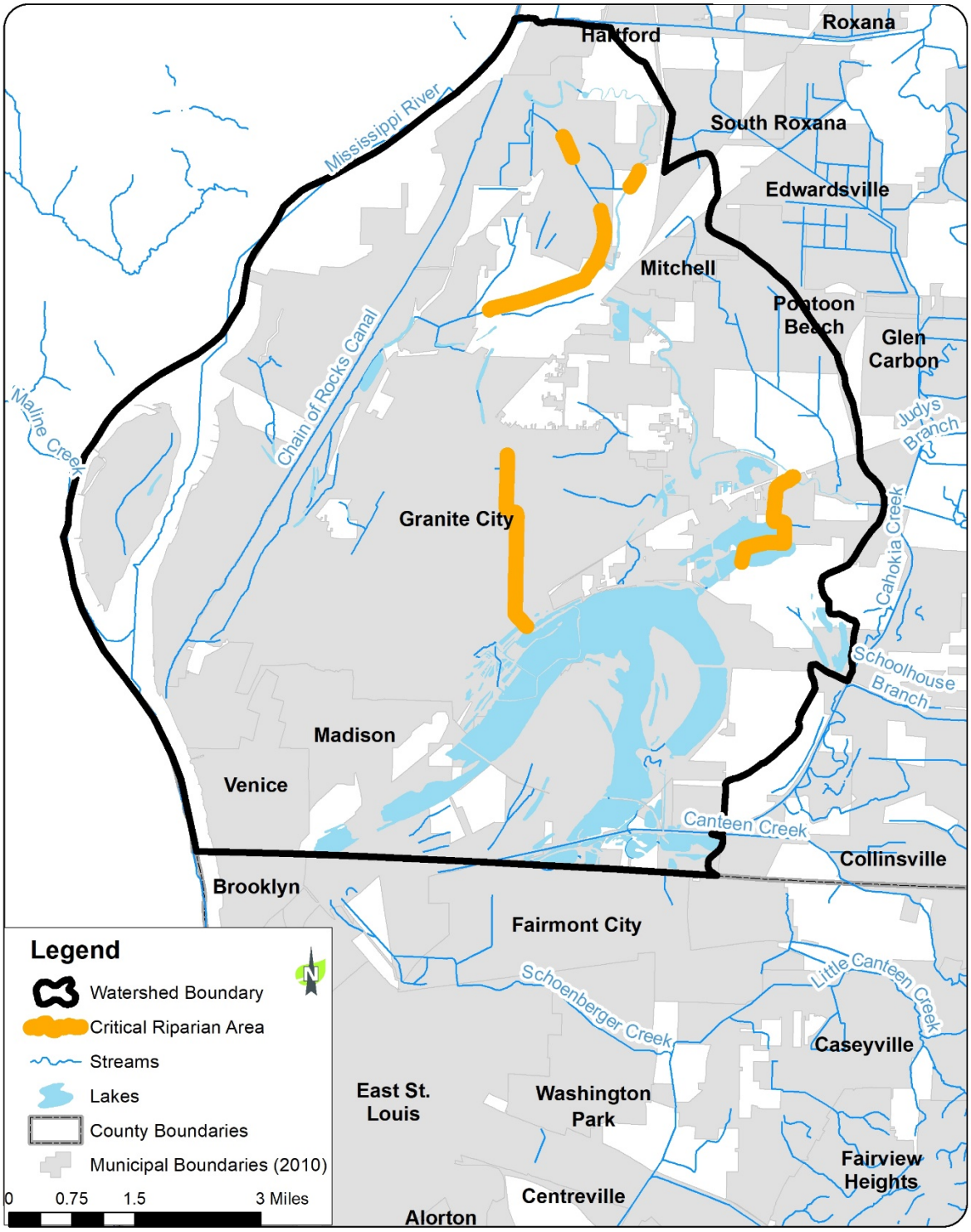


Critical Logjam Areas

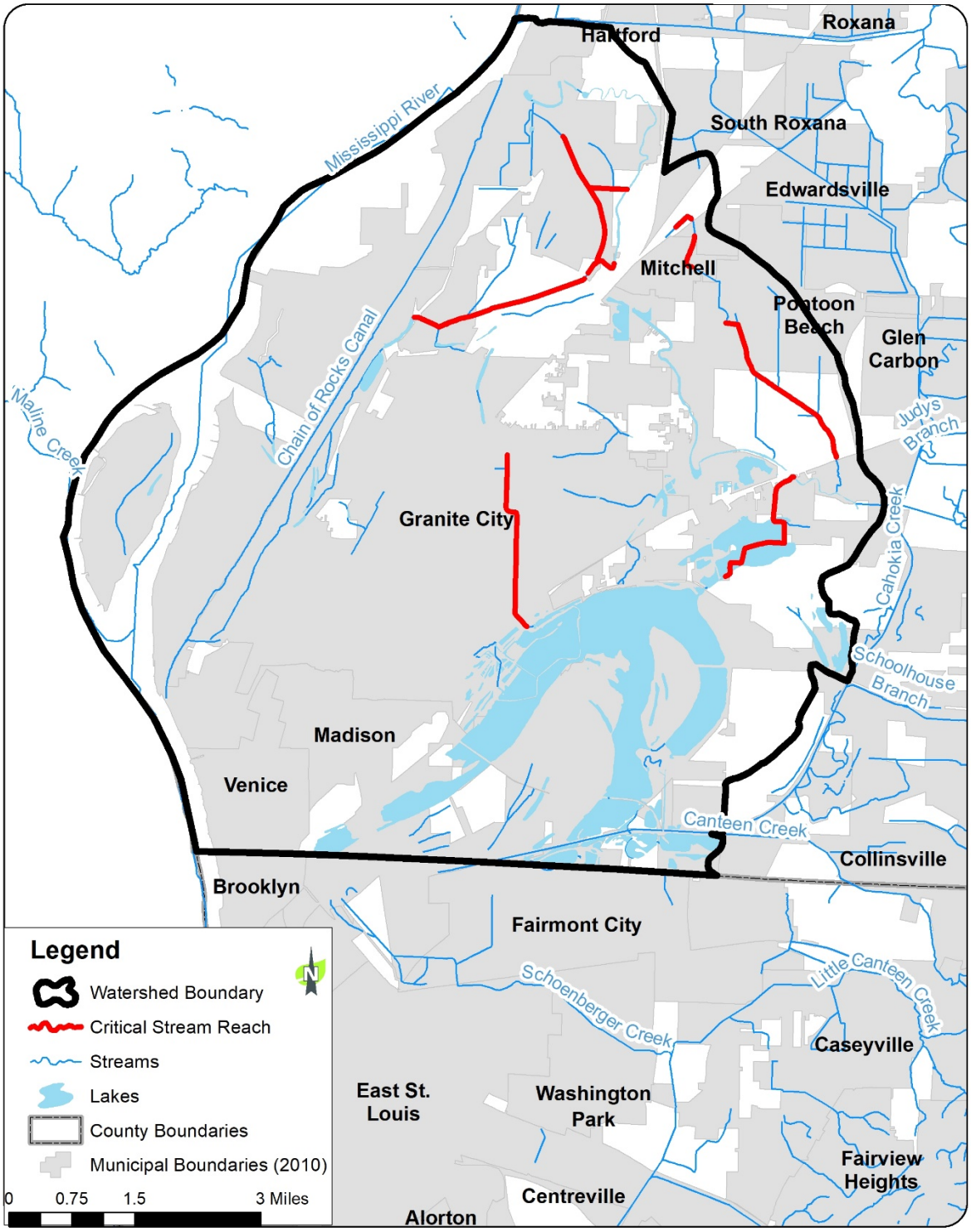


Critical Riparian Areas

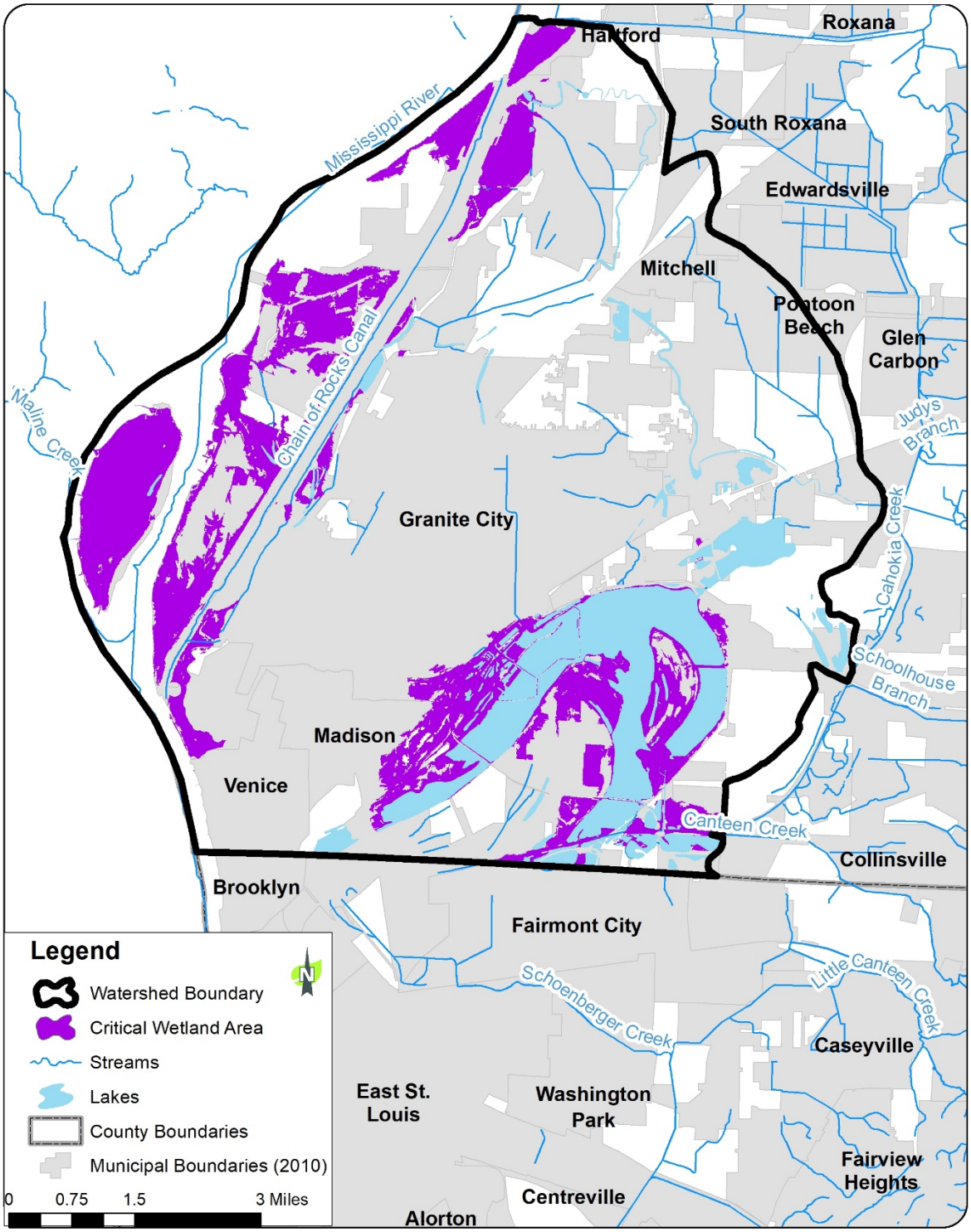
HEARTLANDS CONSERVANCY



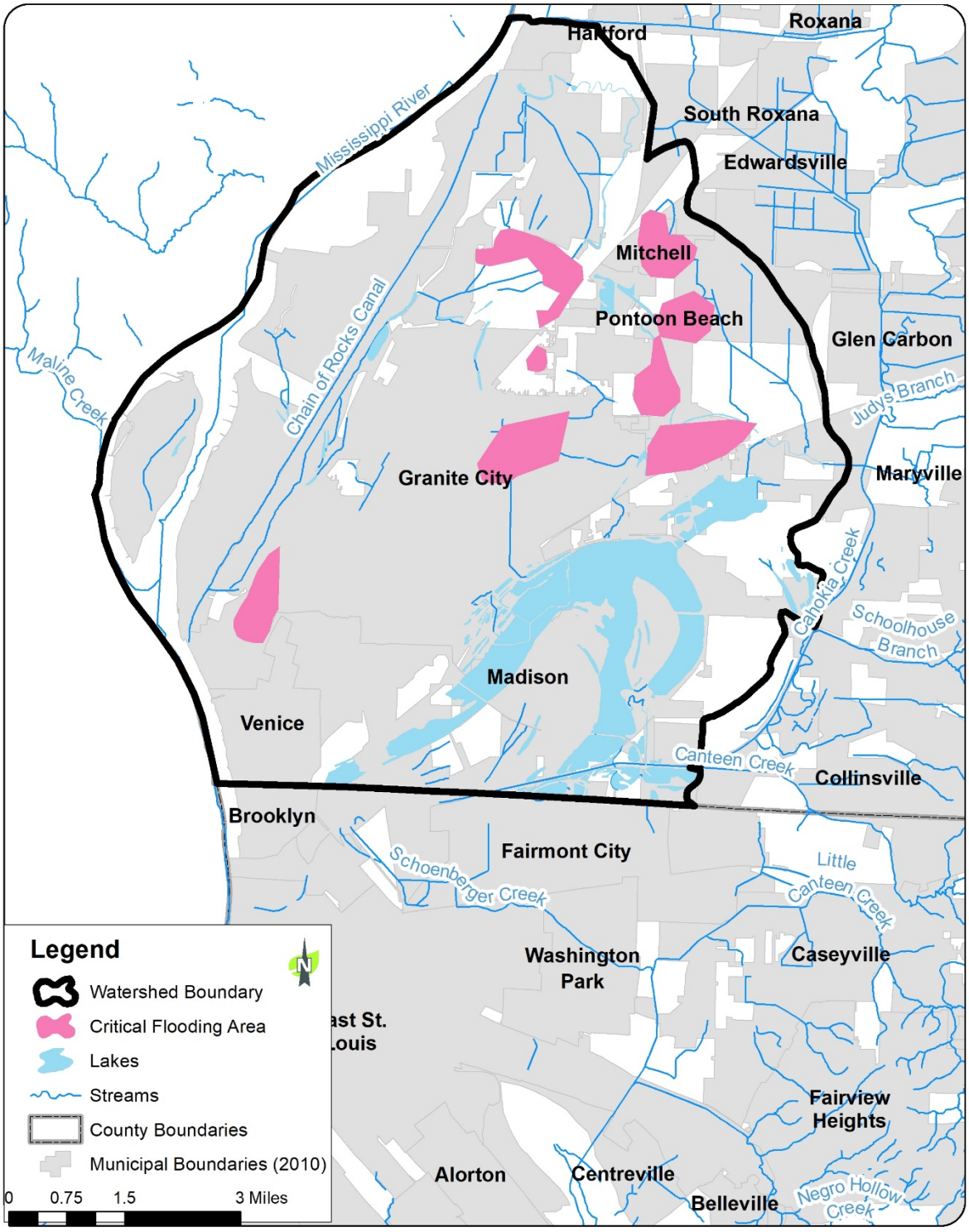
Critical Stream Reach



Critical Wetland Areas



Critical Flooding Areas



Critical Area Maps – HUC14 Subwatersheds

HUC 07140101040101: Unnamed (Chouteau Island)

This subwatershed is the western border of the American Bottom watershed. It contains Granite City and Madison, Interstate 270, Chain of Rocks Canal, and Mississippi River. This subwatershed is a mixture of wetland areas and agricultural land.

Area: 9,392 acres
Named Streams: Chain of Rocks Canal, Mississippi River
Counties: Madison
Municipalities: Granite City, Madison
Townships: Venice, Chouteau Island, Chouteau

Critical Logjam Areas: 0.25 miles of Critical Logjam Areas were identified on one stream segment in this subwatershed.

Critical Stream Reaches: No Critical Stream Reaches were identified in this subwatershed.

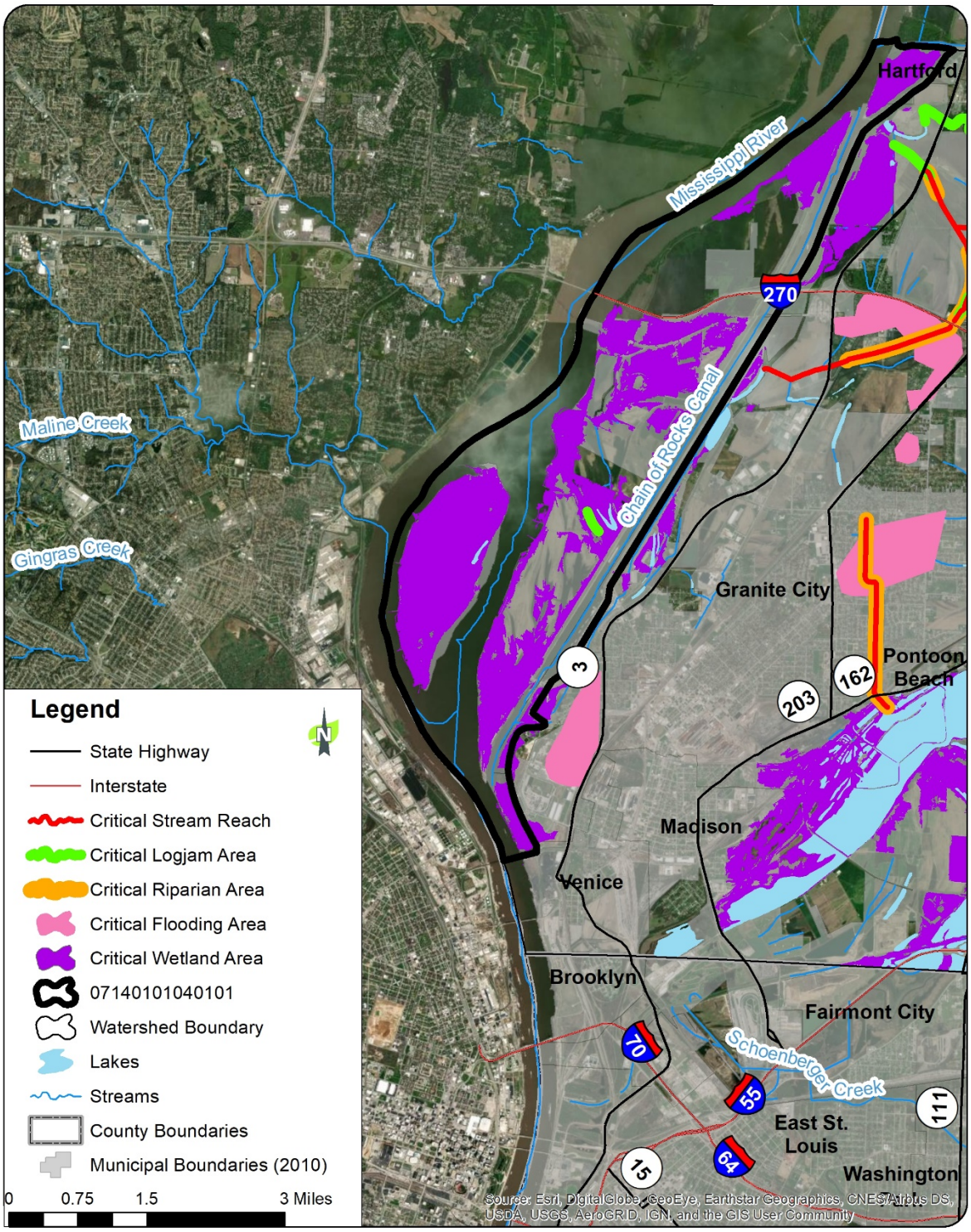
Critical Riparian Areas: No Critical Riparian Areas were identified in this subwatershed.

Critical Wetland Areas: 3,256 acres of Critical Wetland Areas were identified in this subwatershed.

Critical Flooding Locations: No Critical Flooding Areas were located in this area due to few residents living in the area. However, this area floods regularly, often multiple times per year, when the Mississippi River rises.

HUC: 07140101040101

HEARTLANDS CONSERVANCY



HUC 07140101040102: Unnamed (Granite City)

This subwatershed is in the western half of the American Bottom watershed with the Chain of Rocks Canal on its western border. It contains Granite City, Madison, and Venice, Interstate 270, and Route 3, but it does not contain any named streams. This subwatershed is a mainly urban and industrial area with some agricultural land in the northern portion.

Area: 9,201 acres
Named Streams: N/A
Counties: Madison
Municipalities: Granite City, Madison, Venice
Townships: Venice, Chouteau, Nameoki

Critical Logjam Areas: 3.0 miles of Critical Logjam Areas were identified on four stream segments in this subwatershed.

Critical Stream Reaches: 4.6 miles of Critical Stream Reaches were identified on three stream segments in this subwatershed.

Critical Riparian Areas: 2.4 miles of Critical Riparian Areas were identified on three segments in this subwatershed.

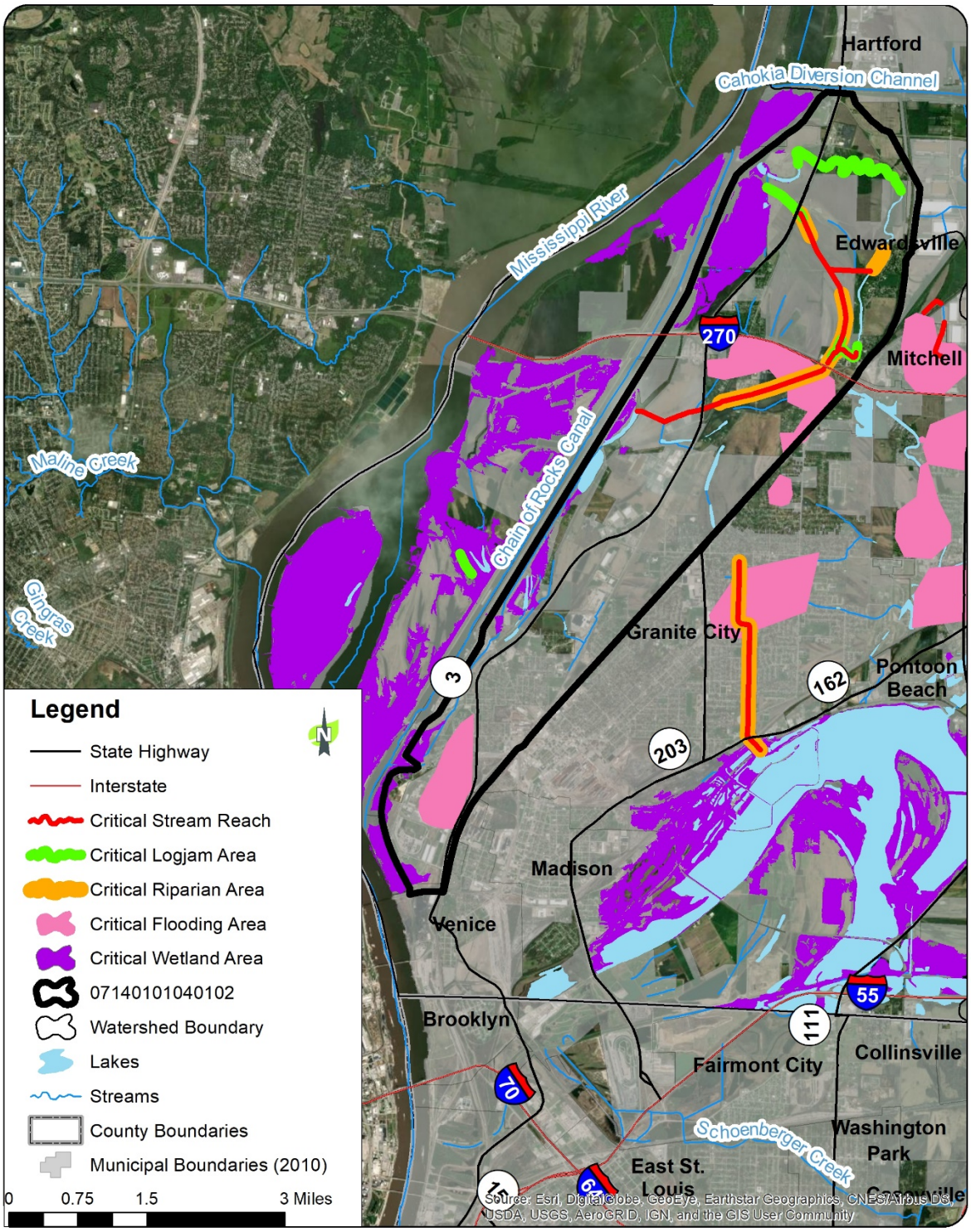
Critical Wetland Areas: 629 acres of Critical Wetland Areas were identified in this subwatershed.

Critical Flooding Areas: There are two Critical Flooding Areas identified stakeholders in this subwatershed. One flooding area is located just south of I-270. This location covers and area of approximately 419 acres and experiences, on average, 0.5 flooding events per year with some properties experiencing 2 or more flooding events per year. These floods are a result of water backing up from Long Lake to the east and overtopping of the unnamed ditch running northeast to southwest.

The other flooding location is located to the southwest of Route 3 and covers approximately 282 acres. This industrial area experiences at least five flooding events per year. The flooding is a result of drainage backup, extensive impervious surfaces, and combined sewers.

HUC: 07140101040102

HEARTLANDS CONSERVANCY



HUC 07140101040201: Unnamed (Mitchell)

This subwatershed is in the northeastern border of the American Bottom. It contains Granite City, Mitchell, Pontoon Beach, and Edwardsville, Interstate 255 and 270, Route 111 and 162, and Long Lake but it does not contain any named streams. This subwatershed is a mainly urban and industrial area with some agricultural land in the northern portion.

Area: 6,992 acres
Named Streams: N/A
Counties: Madison
Municipalities: Granite City, Mitchell, Pontoon Beach, Edwardsville
Townships: Chouteau, Nameoki, Collinsville

Critical Logjam Areas: 0.24 miles of Critical Logjam Areas were identified on one stream segment in this subwatershed.

Critical Stream Reaches: 4.9 miles of Critical Stream Reaches were identified on four stream segments in this subwatershed.

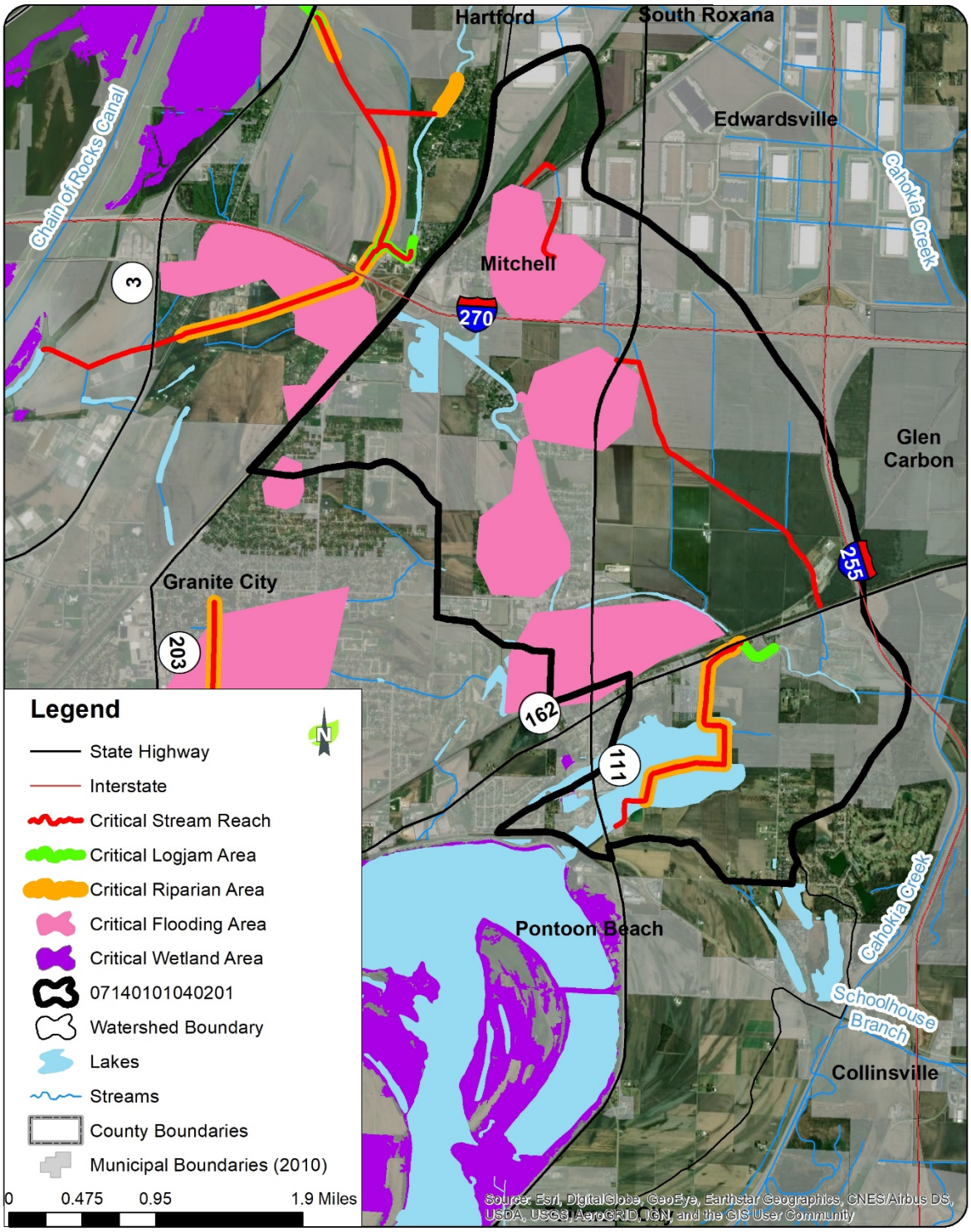
Critical Riparian Areas: 1.7 miles of Critical Riparian Areas were identified on three segments in this subwatershed.

Critical Wetland Areas: 4 acres of Critical Wetland Areas were identified in this subwatershed.

Critical Flooding Areas: There are five Critical Flooding Areas identified stakeholders in this subwatershed covering an area of approximately 1,110 acres. One flooding area is located in Mitchel municipal boundaries. These areas experience flooding between one and five times per year and depths of flood water has been as deep as three feet. The flooding is a result of high groundwater table, reduced storage capacity of Long Lake and Mallard Lake, and increased impervious surfaces.

HUC: 07140101040201

HEARTLANDS CONSERVANCY



HUC 07140101040202: Unnamed (Madison/Granite City)

This subwatershed is in the middle of the American Bottom watershed with Horseshoe Lake on its eastern border. It contains Granite City, Madison, Venice, and Pontoon Beach, Route 162 and Route 203, and Nameoki Ditch. This subwatershed is a mainly urban and industrial area.

Area: 7,755 acres
Named Streams: N/A
Counties: Madison
Municipalities: Granite City, Madison, Venice, Pontoon Beach
Townships: Venice, Chouteau, Nameoki

Critical Logjam Areas: No Critical Logjam Areas were identified in this subwatershed.

Critical Stream Reaches: 2.1 miles of Critical Stream Reaches were identified on one segment in this subwatershed.

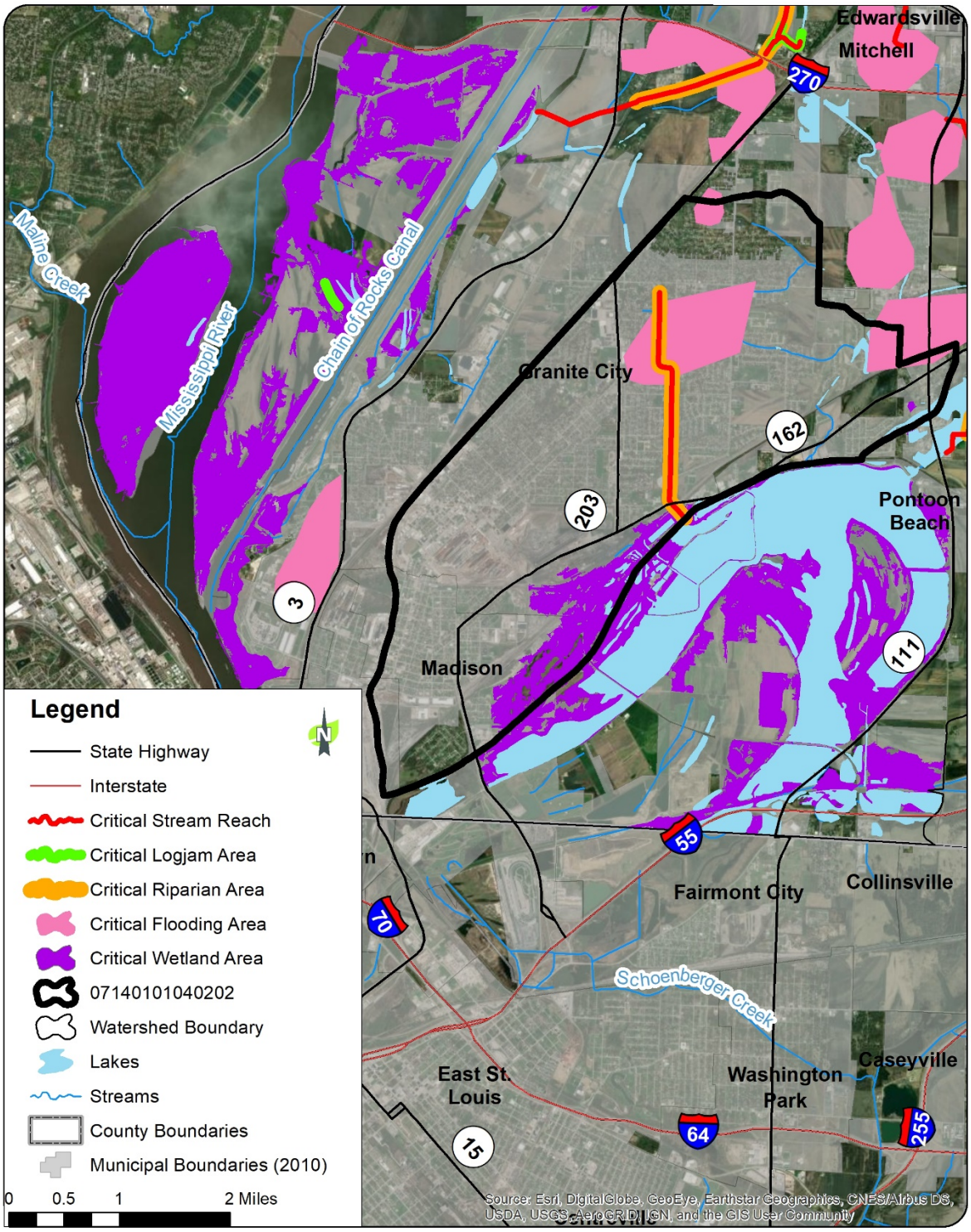
Critical Riparian Areas: 2.1 miles of Critical Riparian Areas were identified on one segment in this subwatershed.

Critical Wetland Areas: 520 acres of Critical Wetland Areas were identified in this subwatershed.

Critical Flooding Areas: There are three Critical Flooding Areas throughout this subwatershed covering approximately 569 acres. These areas experienced flooding ranging from 0.5 times per year to 5.0 times per year. Several locations required people to be rescued from the rising flood waters. These floods were predominantly caused by a lack of stormwater infrastructure to carry the stormwater away efficiently and constant high groundwater table.

HUC: 07140101040202

HEARTLANDS CONSERVANCY



HUC 07140101040203: Unnamed (Horseshoe Lake)

This subwatershed is in the southern half of the American Bottom watershed. It contains Granite City, Madison, and Venice, Interstate 270 and Route 3, but it does not contain any named streams. This subwatershed is a mainly urban and industrial area with some agricultural land in the northern portion.

Area: 5,818 acres
Named Streams: N/A
Counties: Madison
Municipalities: Granite City, Madison, Pontoon Beach
Townships: Venice, Nameoki

Critical Logjam Areas: No Critical Logjam Areas were identified in this subwatershed.

Critical Stream Reaches: No Critical Stream Reaches were identified in this subwatershed.

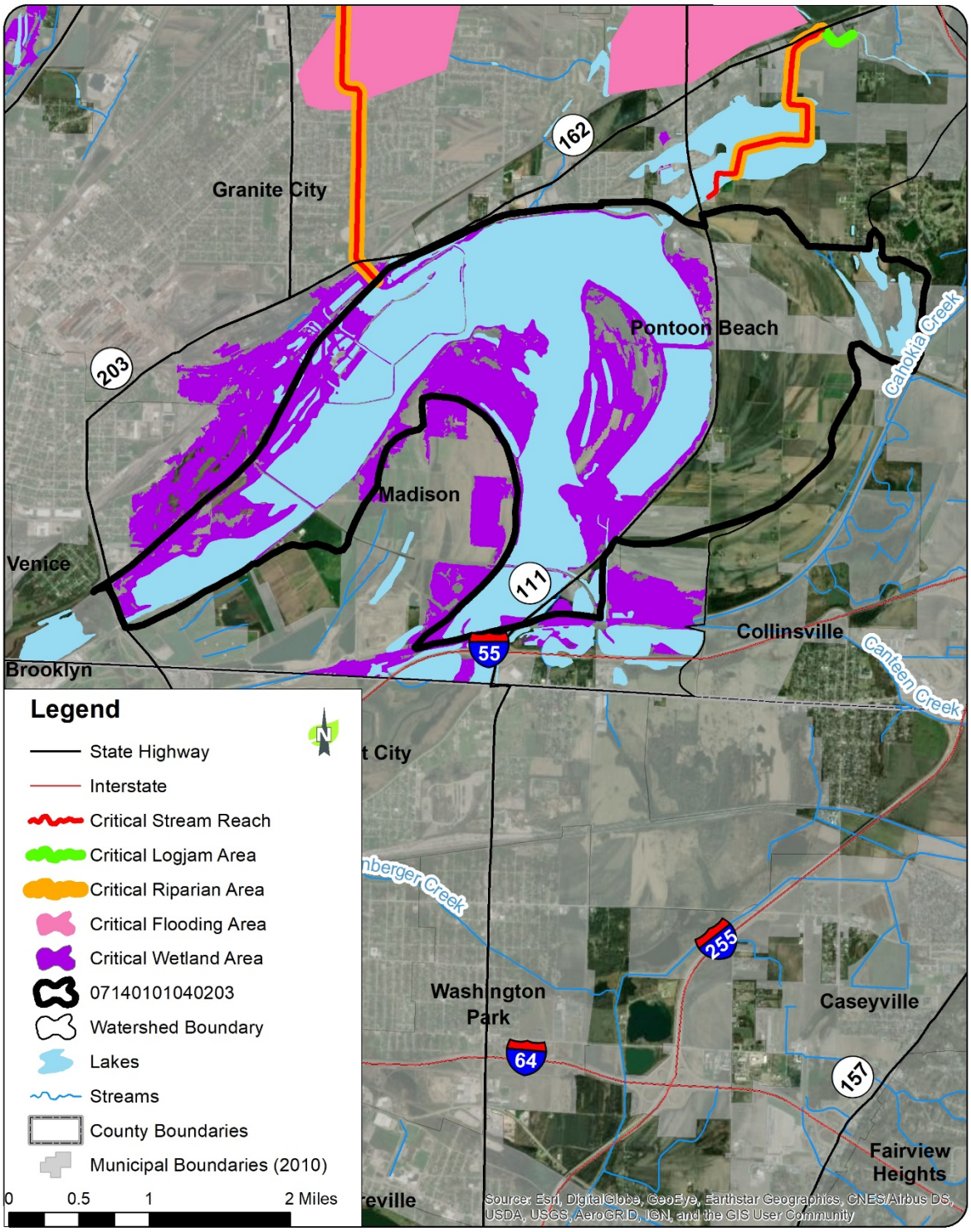
Critical Riparian Areas: No Critical Riparian Areas were identified in this subwatershed.

Critical Wetland Areas: 3,582 acres of Critical Wetland Areas were identified in this subwatershed.

Critical Flooding Areas: No Critical Flooding Areas were located in this subwatershed. However, stakeholders communicated that the eastern portion of the subwatershed does not drain efficiently and causes backups into yards.

HUC: 07140101040203

HEARTLANDS CONSERVANCY



HUC 071401010403: Unnamed (Venice)

This subwatershed is a portion of the HUC12 071401010403 because there is not a complete HUC14 subwatershed in the project area. This subwatershed is the southern border of the American Bottom watershed. It contains Granite City, Madison, Venice, and Fairmont City, Interstate 55, Route 3, 111 and 203 and Canteen Creek. This subwatershed is a mix of urban and agricultural land.

Area: 4,174 acres
Named Streams: N/A
Counties: Madison
Municipalities: Granite City, Madison, Venice, Fairmont City
Townships: Venice, Nameoki

Critical Logjam Areas: No Critical Logjam Areas were identified in this subwatershed.

Critical Stream Reaches: No Critical Stream Reaches were identified in this subwatershed.

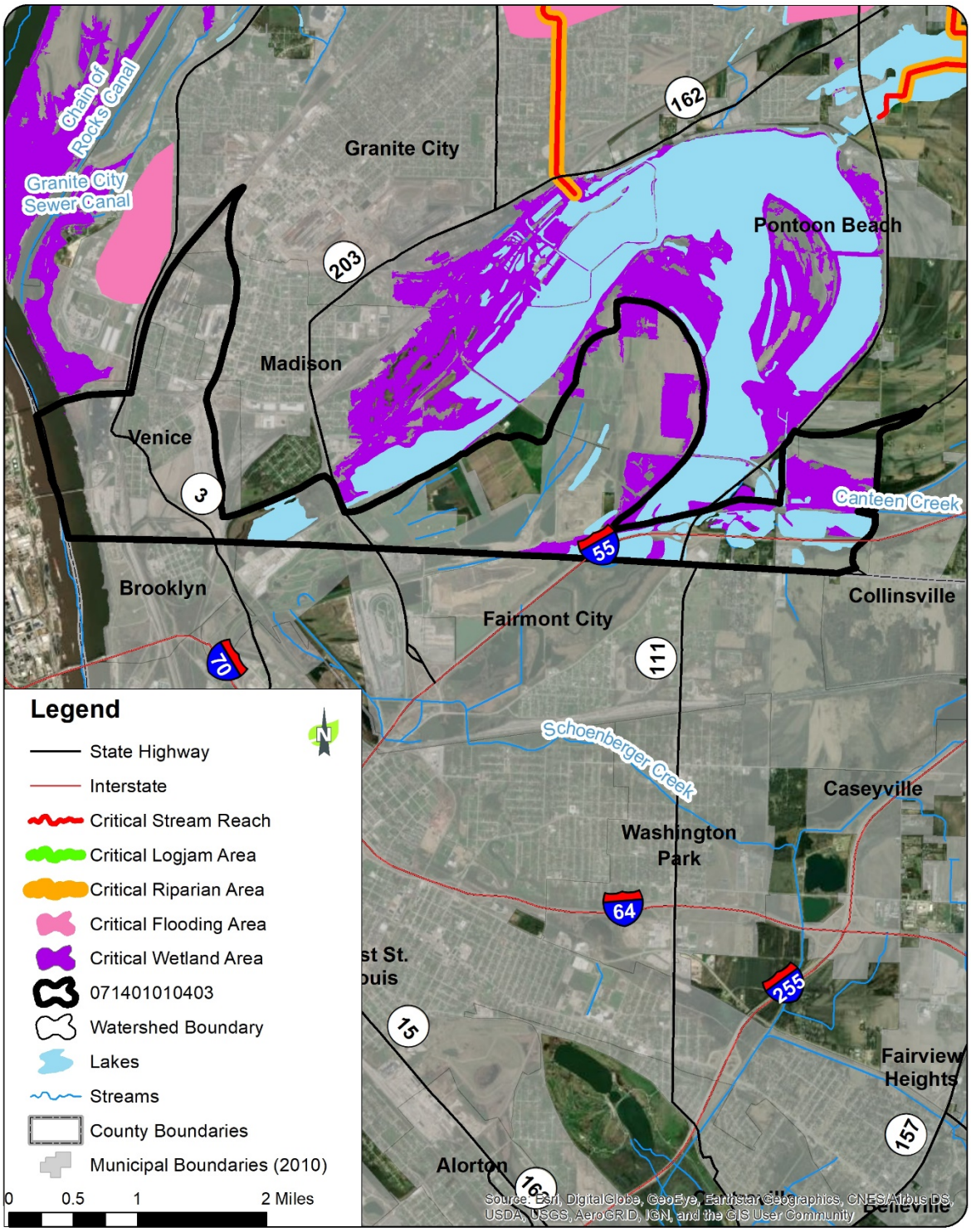
Critical Riparian Areas: No Critical Riparian Areas were identified in this subwatershed.

Critical Wetland Areas: 599 acres of Critical Wetland Areas were identified in this subwatershed.

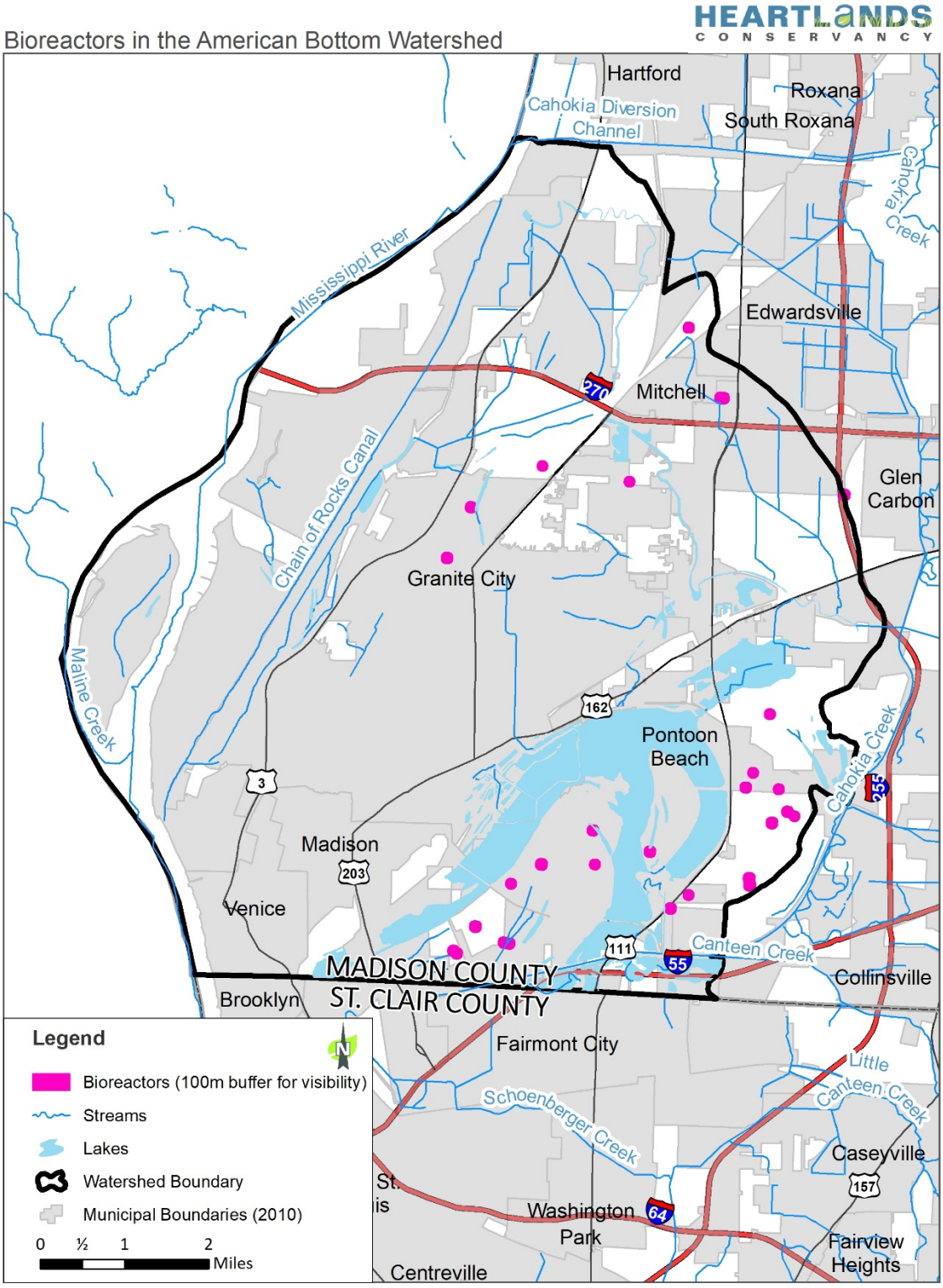
Critical Flooding Areas: No Critical Flooding Areas were located in this subwatershed.

HUC: 07140101040203

HEARTLANDS CONSERVANCY

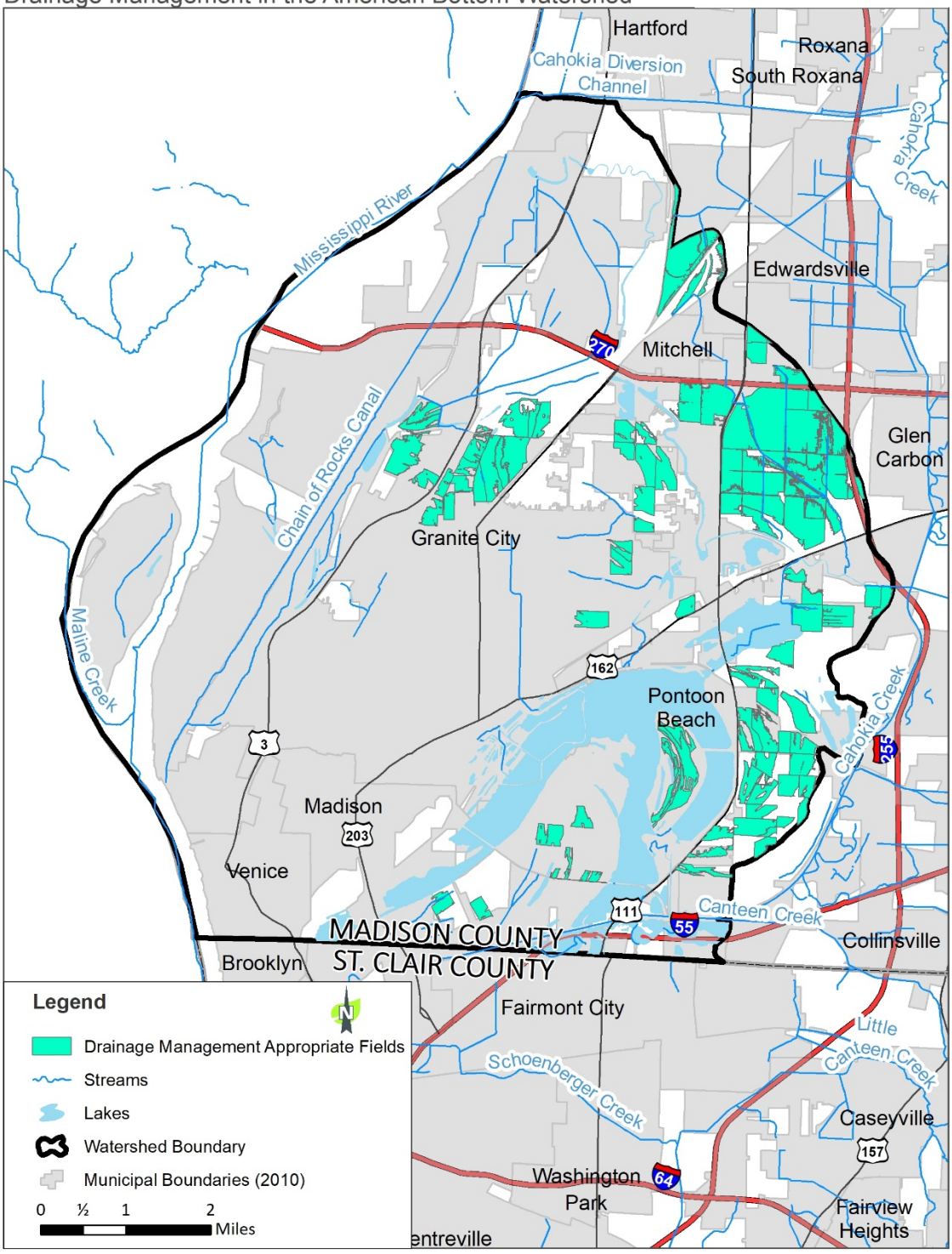


Agricultural Conservation Planning Framework (ACPF) output maps – BMPs

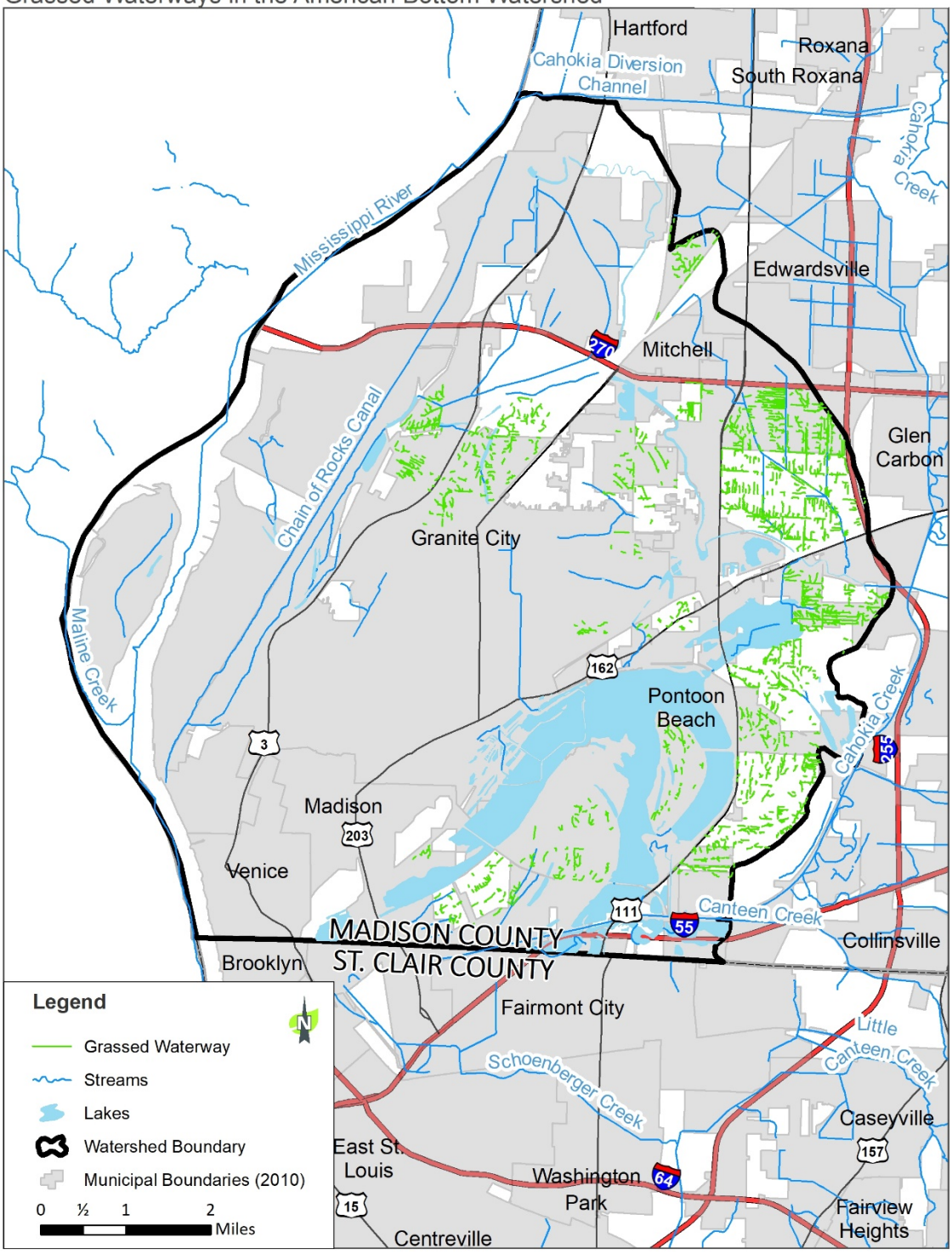


Drainage Management in the American Bottom Watershed

HEARTLANDS CONSERVANCY

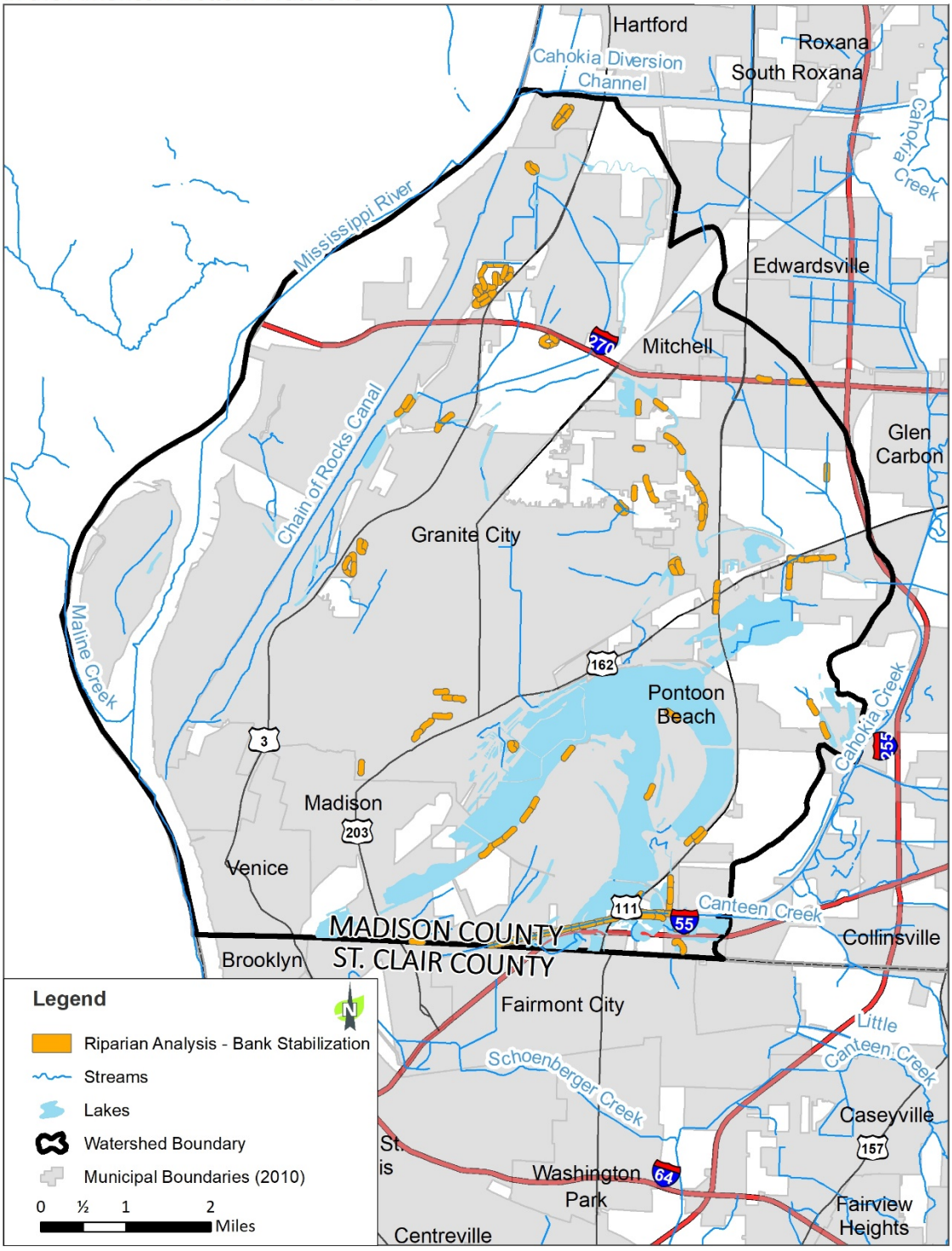


Grassed Waterways in the American Bottom Watershed



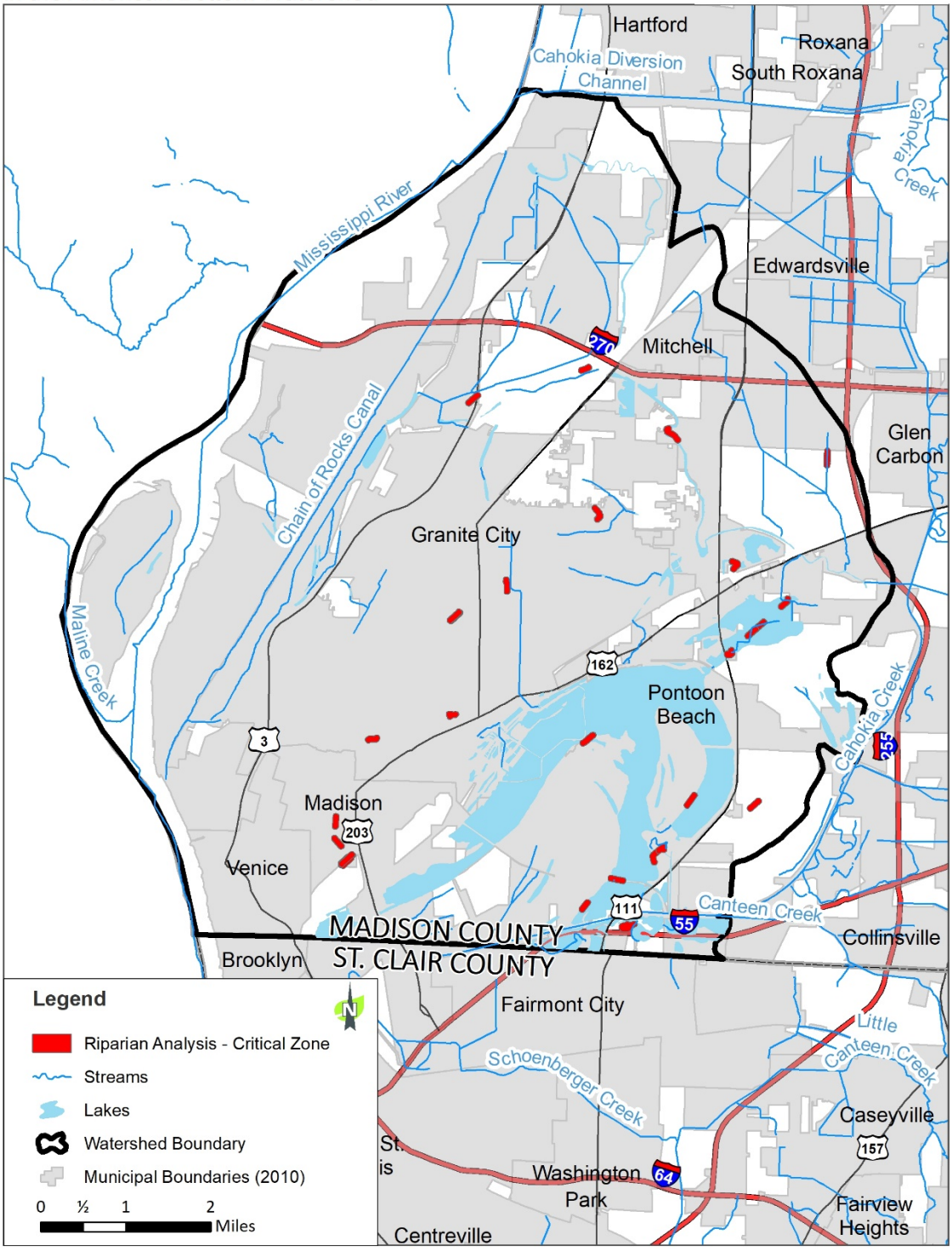
Riparian Analysis Bank Stabilization
in the American Bottom Watershed

HEARTLANDS CONSERVANCY



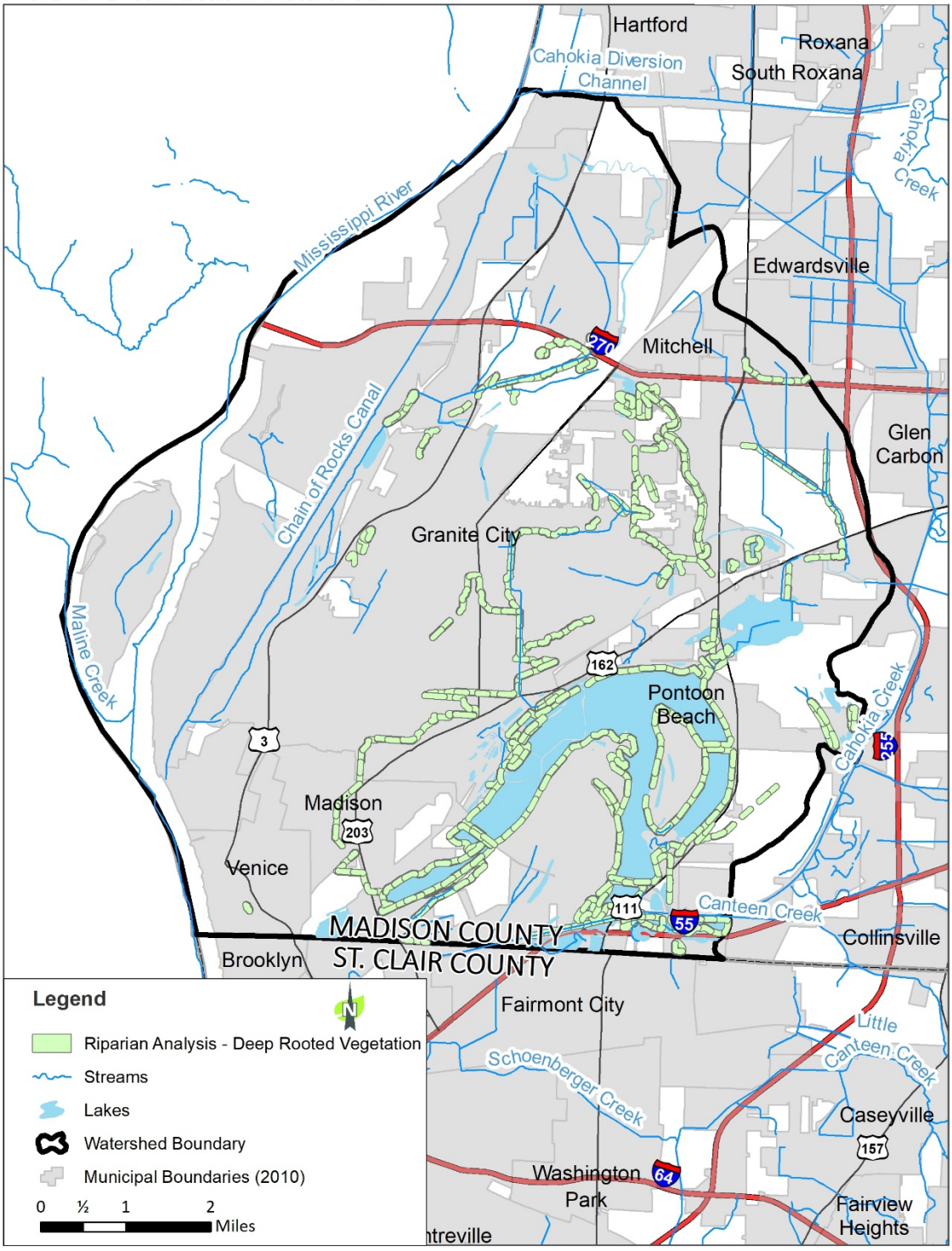
Riparian Analysis Critical Zone
in the American Bottom Watershed

HEARTLANDS CONSERVANCY

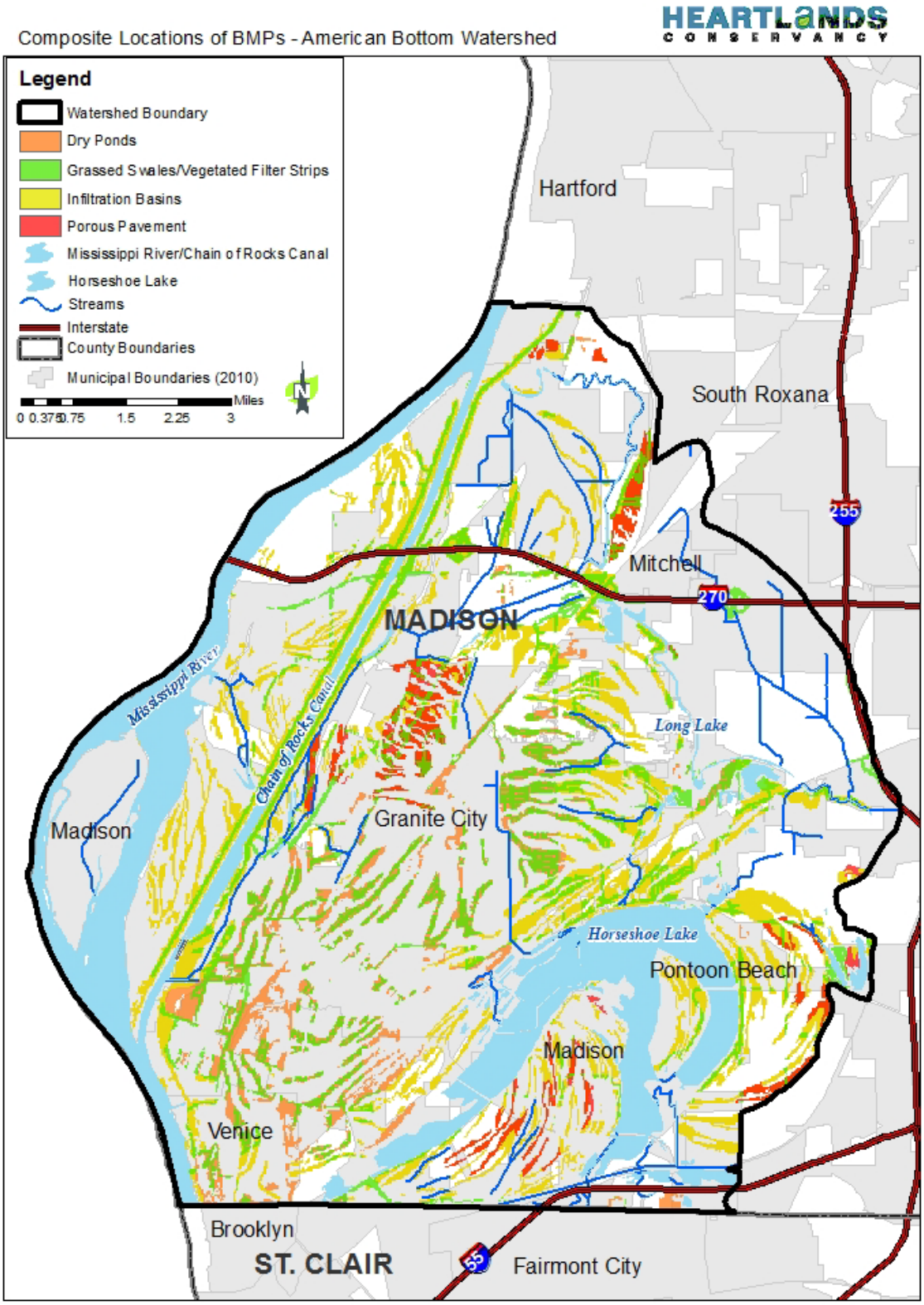


Riparian Analysis Deep Rooted Vegetation
in the American Bottom Watershed

HEARTLANDS CONSERVANCY

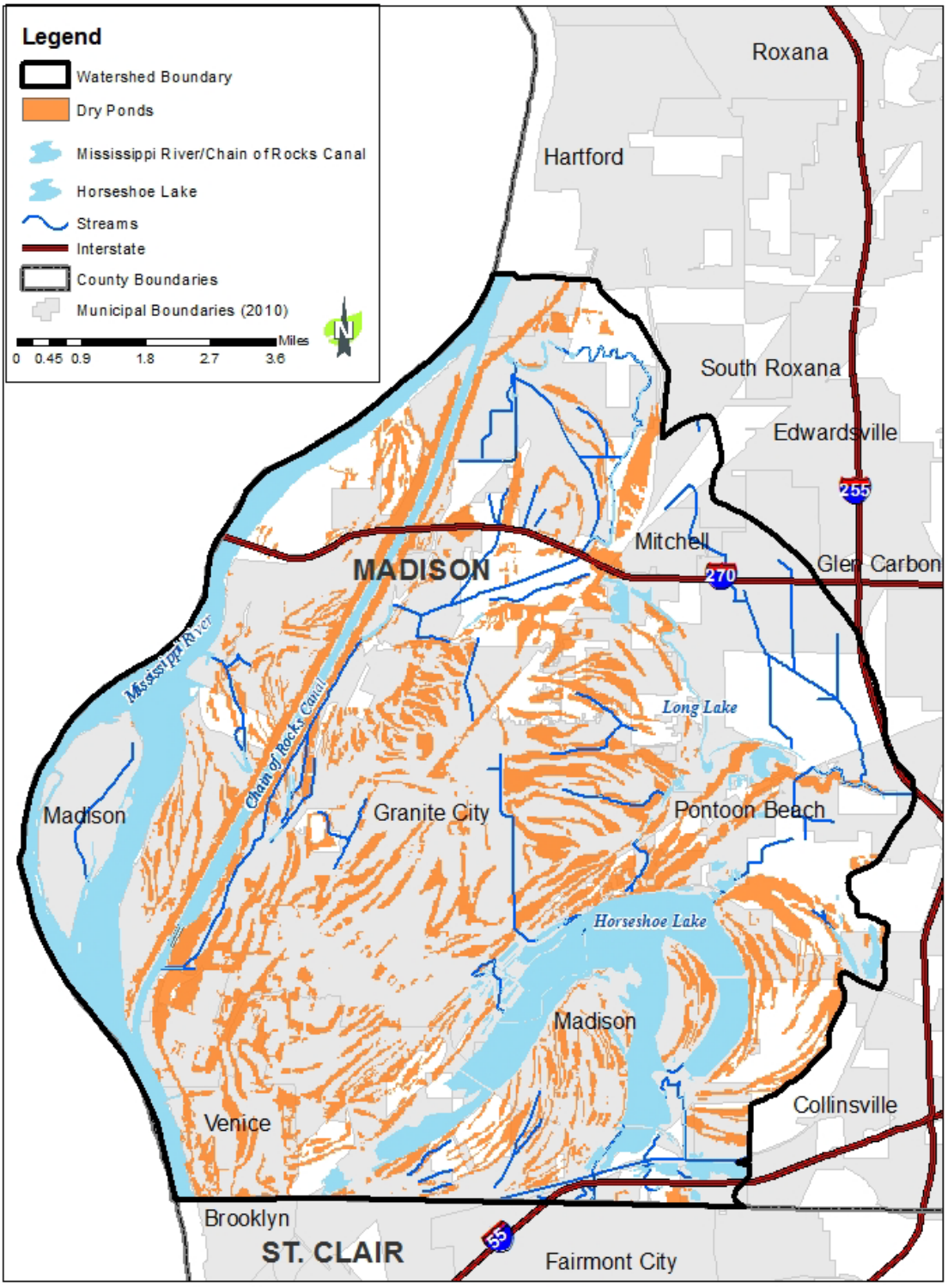


BMP Siting Tool – EPA SUSTAIN Maps



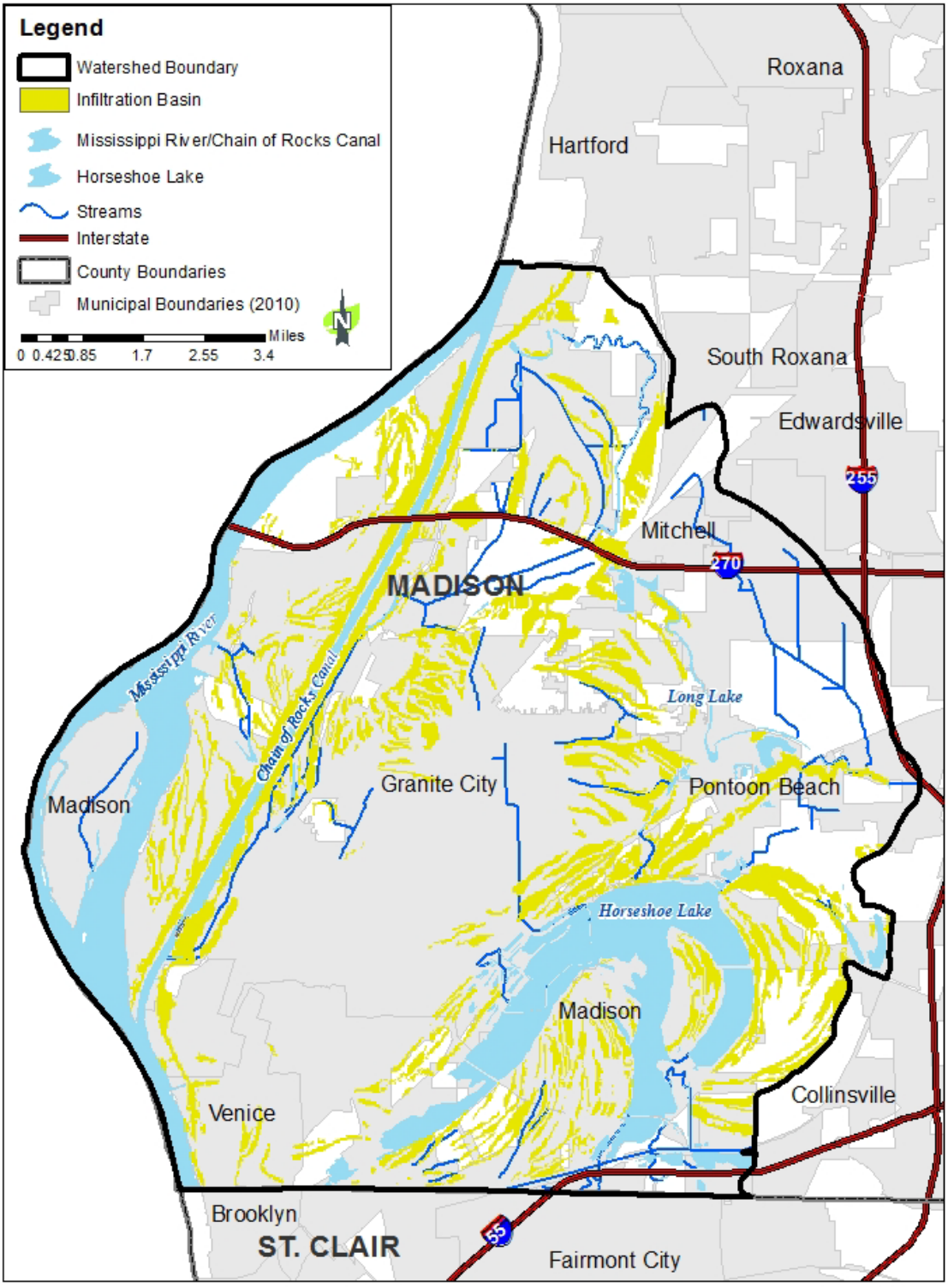
Dry Ponds - American Bottom Watershed

HEARTLANDS CONSERVANCY

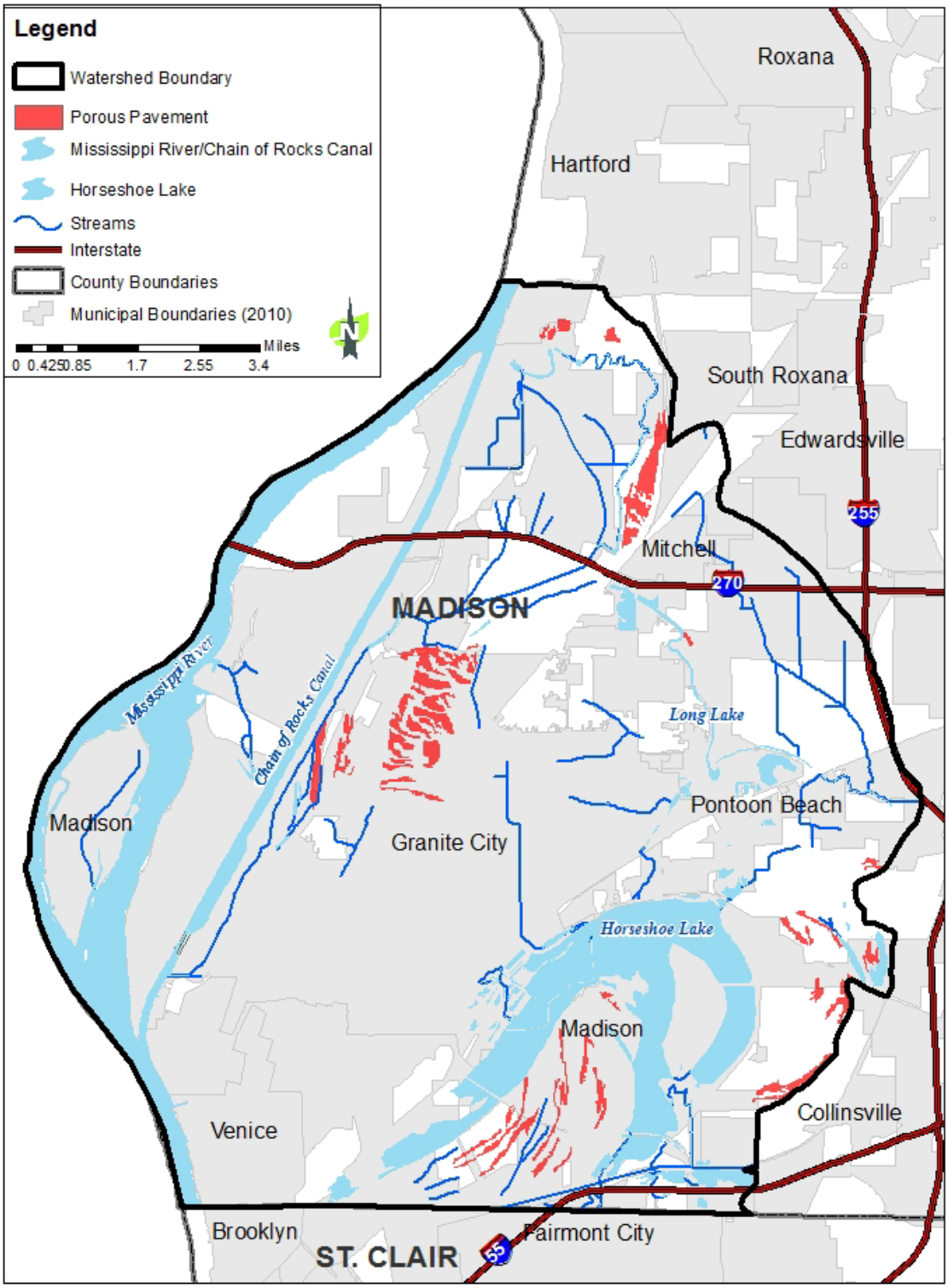


Infiltration Basins - American Bottom Watershed

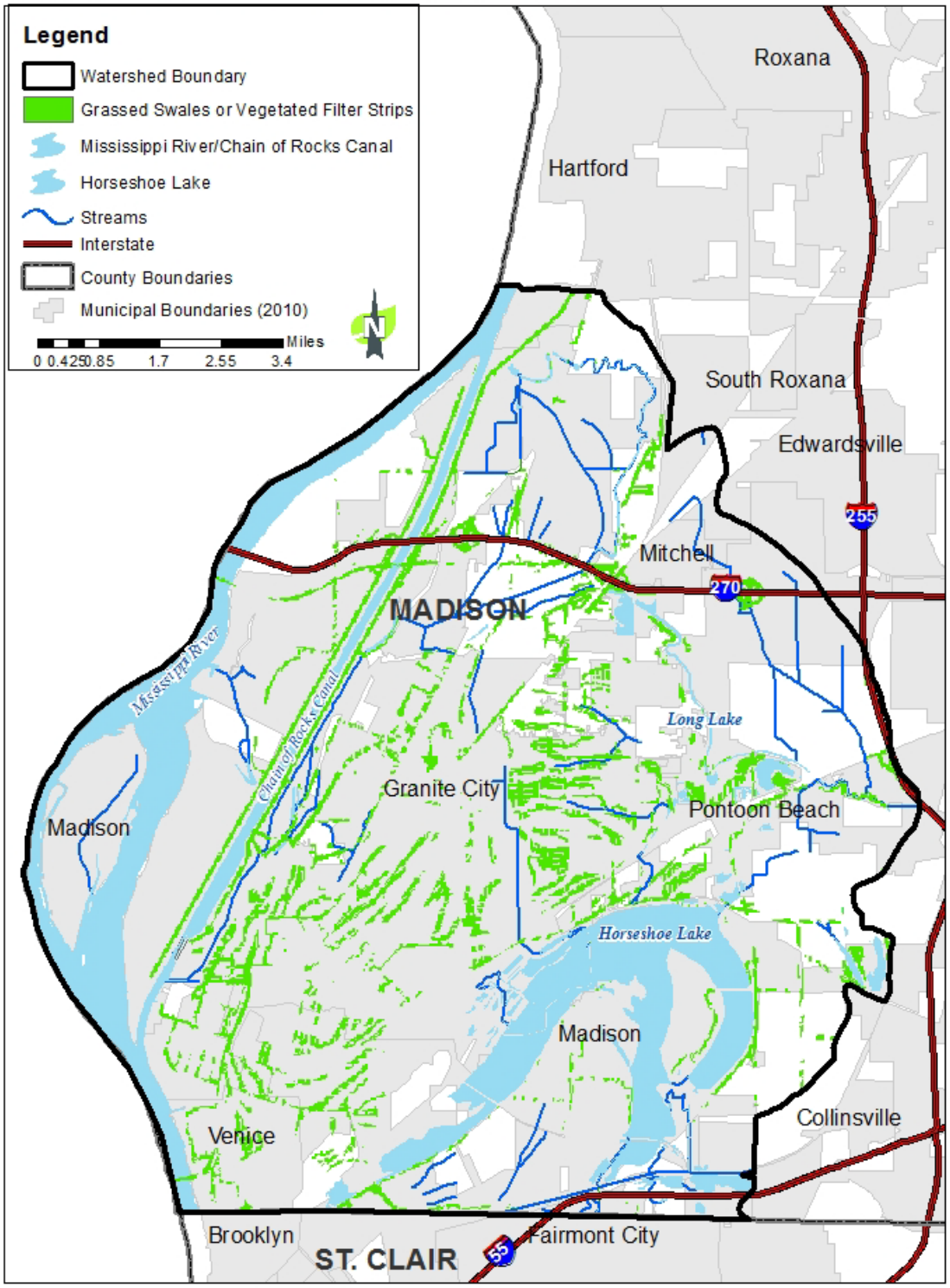
HEARTLANDS CONSERVANCY



Porous Pavement - American Bottom Watershed



Grassed Swales/Vegetated Filter Strips - American Bottom Watershed



References:

Shoemaker, L., J. Riverson, K. Alvi, J.X. Zhen, S. Paul, and T. Rafi. 2009. *SUSTAIN—A Framework for Placement of Best Management Practices in Urban Watersheds to Protect Water Quality*. EPA/600/R-09/095. U.S. Environmental Protection Agency, Water Supply and Water Resources Division, National Risk Management Research Laboratory, Cincinnati, OH. <http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1005IFG.txt >. Accessed Dec 12, 2012.

Tetra Tech, Inc. 2013. *BMP Siting Tool User Guide.* Web, 2020.

USEPA (U.S. Environmental Protection Agency). 2004a. *Stormwater Best Management Practice Design Guide*. EPA/600/R-04/121. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

USEPA (U.S. Environmental Protection Agency). 2004b. *The Use of Best Management Practices (BMPs) in Urban Watersheds*. EPA/600/R-04/184. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

APPENDIX D – MANAGEMENT MEASURES

Quantifying the impacts of potential management measures

Quantifying pollutant reduction

Several sources were used to identify typical pollutant and flow reduction associated with each Best Management Practice (BMP) recommended, where possible. These include:

- U.S. Environmental Protection Agency (USEPA) Region 5 Load Estimation Model Users Manual, Figure E6-2
- Pigeon Creek Watershed Plan, Table 67 (Waste Basin Treatment System)
- Spreadsheet Tool for Estimating Pollutant Loads (STEPL) 4.4 BMP calculator, available at http://it.tetratech-ffx.com/steplweb/models$docs.htm
- Long Run Creek Watershed Plan, Table 40, Table 41, Table 42
- Illinois Nutrient Loss Reduction Strategy (2015)
- Green Values National Stormwater Management Calculator, http://greenvalues.cnt.org/national/cost_detail.php
- Minnesota Department of Transportation - Table 2.2 in the report: "Comparing Properties of Water Absorbing/Filtering Media for Bioslope/Bioswale Design," 2017 http://www.dot.state.mn.us/research/reports/2017/201746.pdf
- National Pollutant Removal Performance Database, seen in Lower Meramec Watershed Plan, Table 20 and Table 21
- Illinois Urban Flooding Awareness Act report, 2015, https://www.dnr.illinois.gov/waterresources/documents/final_ufaa_report.pdf
- Low Impact Development Urban Design Tools website, https://www.lid-stormwater.net/
- HeartLands Conservancy, Thinking Outside the Pipe, Table 20
- Stormwater Management Center fact sheets, seen in Lower Meramec Watershed Plan, Table 20 and Table 21
- Iowa Nutrient Reduction Strategy, Table 2 and Table 3
- International Stormwater BMPs Database Pollutant Category Summary Statistical Addendum: Total Suspended Solids, Bacteria, Nutrients, and Metals, www.bmpdatabase.org,

Quantifying the costs of management measures

The implementation costs of the management measures recommended were assembled from several sources, including the following primary sources:

- Natural Resources Conservation Service (NRCS) Practice Component List FY2020
- Iowa State University, 2011, 'Woodchip Bioreactors for Nitrate in Agricultural Drainage,' page 2
- Long Run Creek Watershed Plan, Table 41 and Table 42
- Illinois Nutrient Reduction Strategy (2015), Page B-3, B-4, B-7
- Green Values National Stormwater Management Calculator, http://greenvalues.cnt.org/national/cost_detail.php
- National Pollutant Removal Performance Database, seen in Lower Meramec Watershed Plan, Table 20 and Table 21

- Illinois Urban Flooding Awareness Act report, 2015, https://www.dnr.illinois.gov/waterresources/documents/final_ufaa_report.pdf
- Low Impact Development Urban Design Tools website, https://www.lid-stormwater.net/
- HeartLands Conservancy, Thinking Outside the Pipe, Table 20
- Stormwater Management Center fact sheets, seen in Lower Meramec Watershed Plan, Table 20 & Table 21
- Iowa Nutrient Reduction Strategy, Table 2 and Table 3
- International Stormwater BMP Database Pollutant Category Summary Statistical Addendum: TSS, Bacteria, Nutrients, and Metals, www.bmpdatabase.org, linked to by USEPA
- Technical estimates from Midwest Streams Inc and Andreas Consulting Inc., 2016, 2017

The final costs used, and their sources, are shown in Table D.1. The costs were adjusted for inflation to 2020 dollars using the conversion rates given in Table D.2 from www.usinflationcalculator.com.

Table D.1. Costs of recommended BMPs and sources of cost data. - add tree planting & sources

Management measure	Cost	Cost unit	Cost data source(s)	URL
Animal waste/storage treatment system	$268,500	/acre	2016 Andreas Consulting cost for one large flushing and treatment system on dairy farm, 2016. Also see this NRCS factsheet for more detail.	https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012400.pdf
Bioreactors (denitrifying)	$163	/acre drained	2011 Iowa State University PDF, 2011, 'Woodchip Bioreactors for Nitrate in Agricultural Drainage'. Cost is $7k to $10k for treating 30 to 100 acres, so average of $8,500 per bioreactor treating an average of 65 acres, so 8,500/65 = $130.76/acre in 2011, adjusted for inflation is $142.30 in 2017.	https://store.extension.iastate.edu/product/13691
Comprehensive Nutrient Management Plans (CNMPs)	$57	/acre planned for	2017 Mike Andreas (Andreas Consulting), 2017. Further information available at the NRCS webpage ($32 average annual per animal or $6,748 average annual cost of implementation)	https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_012173.pdf
Conservation Tillage	$61	/acre	2017 Andreas Consulting, professional estimate	
Contour buffer strips	$181	/acre	2015 Iowa State University fact sheet, cost example table on page 2, sum of costs except foregone income cost	http://www.nutrientstrategy.iastate.edu/documents
Cover crops	$32	/acre	2015 Illinois Nutrient Reduction Strategy, page B-6 under "Planting Cover Crops"	http://www.epa.illinois.gov/Assets/iepa/water-quality/watershed-management/nlrs/nlrs-final-revised-083115.pdf
Grassed waterways	$8,942	/acre	2017 Andreas Consulting, professional estimate	
Nutrient Management Plan (NMP)	$14	/acre	2017 Andreas Consulting, professional estimate	
Ponds	$15,780	/acre	2017 Andreas Consulting, professional estimate	
Riparian buffers	$54	/acre	2015 Illinois Nutrient Reduction Strategy, page B-3 - B-4 under "Installing Stream Buffers", cost of planting grass only	http://www.epa.illinois.gov/Assets/iepa/water-quality/watershed-management/nlrs/nlrs-final-revised-083115.pdf
Terrace	$3.47	/linear foot	2017 Andreas Consulting, professional estimate	
Water and sediment control basin (WASCOB)	$379	/acre	2017 Andreas Consulting, professional estimate	
Wetlands	$13,600	/acre	2015 Illinois Nutrient Reduction Strategy, page B-7, "Constructing Wetlands", upfront cost (no design cost and not amortized)	http://www.epa.illinois.gov/Assets/iepa/water-quality/watershed-management/nlrs/nlrs-final-revised-083115.pdf
Forest stand improvement	$368	/acre	2017 Andreas Consulting, professional estimate	
Bioswales	$18	/acre	2007 Water Environment Research Federation Low Impact Development Best Management Practices Whole Life Cost Model, as listed in Green Values National Stormwater Management Calculator	http://greenvalues.cnt.org/national/cost_detail.php

Dry detention basins, new	$45,261	/acre	2015 USEPA BMPs webpage, now archived at the following link	https://castlehillstx.files.wordpress.com/2015/07/dry-detention-ponds-_-best-management-practices-_-us-epa.pdf
Wet detention basins, new	$49,722	/acre	2015 USEPA BMPs webpage, no longer available	http://water.epa.gov/polwaste/npdes/swbmp/Wet-Ponds.cfm
Detention basin retrofits (native vegetation buffers, etc.)	$15,742	/acre	2014 Long Run Creek Watershed-Based Plan, Table 41	http://www.longruncreek.org/watershedplan
Detention basin maintenance (dredging, mowing, burning, invasives, etc.)	$1,025	/acre	2014 Long Run Creek Watershed-Based Plan, Table 42	http://www.longruncreek.org/watershedplan
Pervious pavement	$100,558	/acre	2020, Canteen-Cahokia 319 BMP Implementation	
Rain gardens	$9.58	/sq. ft.	2008, Iowa Rain Garden Design & Installation Manual - midway value between estimates on page 15, also used in Upper Silver Creek plan from 4 cost sources, https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_007154.pdf	https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_007154.pdf
Rainwater collection	$245	per barrel/small cistern	2015, Low Impact Development Urban Design Tools website	https://www.lid-stormwater.net/
Single property flood reduction strategies	$1,088	per property	2015 Approximately, based on 2015 Illinois Urban Flooding Awareness Act report	https://www.dnr.illinois.gov/waterresources/documents/final_ufaa_report.pdf
Storm drain system cleaning and expansion	$83	/linear foot	2015 US EPA BMPs page	
Logjam removal	$32	/linear foot	2016 Midwest Streams, professional estimate	
Shoreline stabilization	$86	/foot	2017 Andreas Consulting, professional estimate	
Streambank & channel restoration	$81	/linear foot	Midwest Streams, professional estimate	

Table D.2. Inflation rates used to convert BMP costs to 2020 U.S. dollars from www.usinflationcalculator.com, accessed August 2020.

Inflation rates to convert to 2020 dollars (usinflationcalculator.com)	
2001	45.6%
2002	43.3%
2007	25.0%
2008	19.7%
2010	18.2%
2011	14.6%
2012	12.3%
2014	8.9%
2015	8.8%
2016	7.4%
2017	5.2%

Descriptions of Management Measures (Best Management Practices, or BMPs)

Programmatic Management Measures

Conservation Development

Conservation Development is a design method that attempts to mitigate the environmental impacts of urbanization by conserving natural areas and their functions. In a Conservation Development subdivision, the aim is to allow for the maximum number of residences permitted under zoning laws, while disturbing as little land area as possible. This is especially important in areas containing floodplains, groundwater recharge areas, wetlands, woodlands, and streams. Developers assess the natural topography, natural drainage patterns, soils, and vegetation on the site in the design stage. The result is compact, clustered lots surrounding a common open space.

The open space is typically preserved or restored natural areas that maintain natural hydrological processes and are integrated with newer natural stormwater features and recreational trails. This allows residents to feel like they have larger lots because most lots adjoin the open space. Conservation Development can also be used to integrate agricultural land uses harmoniously into the subdivision design.

The steps below are generally followed when designing a Conservation Development site:

1. Identify all natural resources, conservation areas, open space areas, physical features, and scenic areas and preserve and protect these areas from negative impacts from the development.
2. Locate building sites to take advantage of open space and scenic views by requiring smaller lot sizes or cluster housing in a way that protects the development rights of the property owner and maximizes the number of occupancy units permitted by zoning.
3. Design the transportation system. Roads should provide access to building sites, allow movement throughout the site and onto adjoining lands, and should not cross sensitive natural areas. Street design focuses on narrower widths, infiltration opportunities, eliminating curbs and gutters, adjusting the vehicular level of service (LOS), creating LOS for other modes of transportation, and designing connected street networks to support multiple uses.
4. Prepare engineering plans to show how each building site can be served by essential public utilities.

Conservation Development also provides long-term and permanent resource protection. Mechanisms such as conservation easements and transfer of development rights can ensure that measures protecting the open space are more than just temporary.

The Madison County Stormwater and Erosion Control Ordinance states the following general principles for new development, which support the Conservation Development design framework:

> New development or redevelopment shall be related to the topography and soils of the site so as to create the least potential for erosion. Areas of steep slopes greater than thirty-three percent (33%) where high cuts and fills may be required are to be avoided whenever possible, and natural contours should be followed as closely as possible. […] Natural vegetation shall be retained and protected wherever possible. Areas immediately adjacent to natural watercourses, lakes, ponds, sinkholes, and wetlands are to be left

undisturbed wherever possible. Temporary crossings of watercourses, when permitted, must include appropriate stabilization measures. (Section 4.2)

Many communities' zoning ordinances do not yet permit Conservation Development design, because of code requirements for features such as minimum lot sizes, setbacks, and frontage distances. These ordinances should be amended to allow for Conservation Development design.

Federal and state programs

Federal and state agricultural easement and working lands programs such as the Conservation Reserve Program (CRP), the Conservation Reserve Enhancement Program (CREP), the Environmental Quality Incentives Program (EQIP), Federal Emergency Management Agency Building Resilient Infrastructure and Communities (FEMA-BRIC), Illinois 319(h) Grant, Regional Conservation Partnership Program (RCPP) and the Agricultural Conservation Easement Program (ACEP) are designed to recompense farmers and landowners for practices that protect soil and water health. More information on these programs is available in Appendix F, Funding Sources.

Financial support for stormwater infrastructure

Stormwater infrastructure, including green infrastructure, does not have a dedicated funding mechanism in many of the communities in the watershed. Maintenance and replacement of aging infrastructure is a significant concern for these communities, and infrastructure failures such as pipe bursts can end up costing them more than timely repairs and replacement would have cost.

Consistent funding at an appropriate level enables communities to create stormwater management programs that reduce urban flood risk and improve water quality. There are several policy options that assign dedicated funding for stormwater infrastructure that prevents flooding and allows infiltration. With all of these options, a certain amount of public resistance can be expected—people generally don't like paying taxes and fees. This is why public outreach, education, and input, is important. Where there is a demonstrated need for infrastructure investment, the benefits can be shown to outweigh the costs and people will understand the need for the program.

For **counties**, the State of Illinois Counties Code (55 ILCS 5/) allows "management and mitigation of the effects of urbanization on stormwater drainage" in Madison County, and eight other counties (55/ILCS 5/5-1062.2) (see below). Stormwater Plans created by these counties can include elements such as rules for floodplain and stormwater management, fees or taxes from new development, and incentives for using green infrastructure and other approved drainage structures. Illinois **municipalities** also have the authority to adopt stormwater plans (65 ILCS/ Art 11 prec Div 110 – Flood Control and Drainage).

The 2015 Illinois Report for the Urban Flooding Awareness Act prepared by IDNR includes the following USEPA recommendations for stormwater management financing options:[1]

- Stormwater utility (or service fees),
- Property taxes/general funds,
- Sales tax,
- Special assessment districts,
- System development charges,
- Municipal bonds and state grants, and

- Low-interest loans.

A *stormwater utility* is dedicated to recover the costs of stormwater infrastructure regulatory compliance, planning, maintenance, capital improvements, repair, and replacement. The utility imposes its fees based on how much stormwater is being generated from a parcel, which can be readily calculated from the amount of impervious surface on the parcel and the annual average precipitation. Stormwater diverted from the sewer system through infiltration or temporary retention (e.g., into a rain garden or rain barrels) can be given a credit against the utility fee equal to the volume of water averted and its treatment costs. This system offers the public greater transparency as to the true societal costs of managing stormwater runoff, and offers them an economic incentive to employ practices that divert more stormwater from the stormwater collection system.

As of 2015, 21 communities in Illinois have utility fee assessments. This is a smaller number than in many neighboring Midwestern states. The communities include home rule and non-home rule communities. The Illinois Municipal Code allows communities to operate utilities, and townships also have the ability to create a stormwater program and assess a user fee per Public Works Statutes, Article 205 of the Township Code in the Illinois Compiled Statutes (60 ILCS).

A small proportion of *property taxes or general funds* can be set aside for stormwater management. An additional *sales tax*, or a proportion of an existing sales tax, can also be used.

A s*pecial assessment district*, also known as a special service area (SSA), is set up to benefit a specific portion of a municipality or county where there are specific problems to be addressed. Fees assessed only to those properties within that area. The district is often a small portion of a municipality or county. Special assessment districts can be created to address problems with stormwater, flooding, and other issues.

Low-interest loans may be secured under the **Water Pollution Control Loan Program**, which funds both wastewater and stormwater projects. Funding for the loan program comes from the state revolving fund. Eligible projects include upgrading or rehabilitating existing infrastructure, stormwater-related projects that benefit water quality, and a wide-variety of other projects that protect or improve the quality of Illinois's rivers, streams, and lakes. The **Water & Waste Water Disposal Loan & Grant Program** provides funding for drinking water systems, sanitary sewage systems, and stormwater drainage to households and businesses in eligible rural areas. The program assists applicants who are not otherwise able to obtain commercial credit on reasonable terms for these projects. Areas served must be rural or towns populated with 10,000 people or fewer. Long-term, low interest loans are the primary funding type available. Grants may be combined with a loan if necessary and if funds are available.

Flood Damage Prevention Ordinance

Madison County is a member of the National Flood Insurance Program (NFIP). As NFIP members, these communities have a Floodplain Ordinance in effect. Several features of the floodplain ordinances are based on Illinois Department of Natural Resources' Model Flood Damage Prevention Ordinance (a previous or current version).

Further steps can be taken to update communities' floodplain ordinances to protect residents and businesses from flood risk and unnecessary mitigation costs. HeartLands Conservancy prepared a draft Flood Damage Prevention Ordinance for Madison County containing options for strengthening existing

floodplain codes to protect property owners and communities, based on FEMA's Community Rating System (CRS). These options include:

- Requiring applicants for a development permit to obtain all other required local, state, and federal permits before the development permit is issued.
- Defining "substantial improvement" (which triggers compliance) as development which equals or exceeds 50% of the market value of the building before the improvement or repair is started, or increases the floor area of a building by more than 20%.
- Requiring two feet of freeboard (height above the Base Flood Elevation, or BFE) for structures in the floodplain.
- Allowing accessory structures in floodplain that are non-habitable, if they are used only for the storage of vehicles and tools (and follow several other requirements).
- Requiring all new and substantially improved critical facilities to be located outside the floodplain, unless infeasible, in which case they must be elevated or flood proofed to the 500-year flood elevation. Access routes must also be elevated to the BFE. Toxic substances must be sealed off from floodwaters.

The State of Illinois also has a Model Stormwater Management Ordinance that is intended to be an independent, stand-alone, self-sufficient ordinance for Illinois communities to adopt. For local governments without independent stormwater ordinances, the model stormwater provisions can be added to their subdivision ordinance, building code, or zoning ordinance, excluding language which is redundant with existing local government codes.[2]

Green infrastructure incentives

Green infrastructure is a vital concept that incorporates and informs many of the recommended practices in this Watershed-Based Plan. Green infrastructure can be defined as our region's natural resources, including open space, woodlands, wetlands, gardens, trees, and agricultural land. It can also be defined as the nodes and corridors of vegetation over the region, or the site-scale structures and landscaping that recreate natural processes. A regionally connected system of green infrastructure results in a higher diversity of plants and animals, removal of non-point source pollution, infiltration of stormwater, and healthier ecosystems. Corridors of green infrastructure along streams are extremely important because they provide biological conduits between hubs. However, most parcels forming corridors are not ideal green infrastructure until landowners and residents embrace the idea of managing stream corridors or creating backyard habitats.

Various regulatory incentives can be used to encourage the design and implementation of green infrastructure in new development. These incentives can include flexible implementation of regulations, fee waivers, tax abatement, access to municipal utilities, and a streamlined development review process. The incentives can be granted on a case-by-case basis.

Long-term management of natural areas

Conservation Development promotes the protection of sensitive natural areas and open space in new development, as well as incorporating green infrastructure into stormwater systems. In "traditional" development, too, there is often a piece of land set aside for a detention basin. Once set aside, this land can sometimes lose its ecosystem functions (such as water filtration, recreational value, and floodwater holding capacity) due to lack of maintenance.

Developers should be encouraged to donate those natural areas and systems to a public agency or conservation organization for long-term management. Donation can be by either fee simple purchase of undeveloped land, or by acquisition of the development rights and establishing a conservation easement. If a local government takes on ownership or maintenance of the land, it can choose to fund it through mechanisms such as Development Impact Fees and Special Service Area (SSA) taxes.

Alternatively, Homeowners Associations (HOAs) can explicitly take on the management of the natural areas, writing rules about maintenance and fees into their byelaws. The members of the HOA will then share in the costs and decisions about maintenance of the natural area. For detention basins, Madison County recently began the best practice of including the transfer of authority for maintenance of the detention basin from the developer to the Homeowners Association once a new subdivision is 90% complete. From then on, the HOA has a maintenance responsibility for the detention basin. (See "Detention basins.")

Monitoring

Appendix E - Monitoring Plan outlines an appropriate strategy for water quality monitoring in the watershed.

Native landscaping

Weed control ordinances, whose purpose is primarily to maintain a pleasing aesthetic in community landscaping, often directly or inadvertently discourage or prohibit the use of native plants. Native landscaping can look "messier" than traditional landscaping, depending on the plants used. But when native plants are well chosen and well maintained, planting areas look very pleasing and offer many water quality and wildlife benefits. Garden nurseries and other native plant providers can be involved in educating customers and displaying the different "look" that native plants offer. Weed control ordinances can be amended to allow and encourage the use of these plants and provide guidance on species and maintenance.

Open space and natural area protection

Several actions can be taken to encourage the protection of natural areas and open space in new development. Some are regulatory, including the following practices from the U.S. EPA Water Quality Scorecard:

- Establish a dedicated source of funding for open space acquisition and management (e.g., bond proceeds, sales tax).
- Adopt regulations to protect steep slope, hillsides, and other sensitive natural lands (e.g., by limiting development on slopes > 30% or requiring larger lot sizes in sensitive areas).
- Create agriculture resource zoning districts (e.g., minimum lot size of 80 acres and larger) to preserve agricultural areas.
- Adopt neighborhood policies and ordinances that work to create neighborhood open space amenities that are within 0.25-mile to 0.5-mile walking distance from every residence.

Other actions are non-regulatory:

- Provide financial support to or collaborate with land trusts or other conservation organizations to acquire critical natural areas.
- Adopt a community-wide open space and parks plan.
- Identify key natural resource areas for protection in jurisdiction's parks and open space plan.
- Allow and encourage retrofits of abandoned or underutilized public lands to serve as permanent or temporary open space and green infrastructure sites.

Private sewage monitoring

Private, residential septic systems are often not maintained properly, leading to failure. The U.S. Census Bureau has indicated that at least 10% of septic systems have stopped working. Failed septic systems can leach bacteria and nutrients into ground water or allow these contaminants to be exposed at the surface and washed into receiving streams during storm events. Currently, inspections and enforcement of private septic systems are complaint-driven—there is no plan or resources for further enforcement.

Septic inspections are required during real estate transactions, but these are often many years apart. More regular inspections should be considered by the counties and municipalities, regardless of property ownership turnover. A rule in Jefferson County, Missouri requires that homeowners annually have their sewer system serviced and submit certification of it to the county.

Private sewage data on violations and water quality parameter exceedances should be collected and mapped. Additionally, an intensive inspection of private septic systems should be considered to determine the location of any illicit discharges and to assess the condition of all septic systems in the watershed. This effort, commonly referred to as a sanitary sweep, could be eligible for grant funding. Following the identification of failing septic systems a course of action to correct these systems will need to be coordinated with the landowners, municipalities, counties, and relevant state agencies.

The U.S. EPA provides an excellent guide for septic system owners called "A Homeowner's Guide to Septic Systems" (USEPA, 2005), which explains how septic systems work, why and how they should be maintained, and what makes a system fail.

Riparian buffer ordinance

"Riparian," in its most general sense, means "adjoining a body of water." A riparian buffer is an undisturbed naturally vegetated strip of land adjacent to a body of water, such as a stream or lake. Among their many benefits, riparian buffers store floodwater, allow lateral stream movement, reduce streambank erosion, trap and remove sediment in runoff, mitigate stream warming through shade, provide habitat for wildlife, and increase property values. The literature indicates that forest provides more benefits in a riparian buffer than grassland does—with benefits including more wildlife habitat, stream shading and temperature control, and more debris as a food source for the stream—so oak-hickory forest should be the first choice in riparian buffer vegetation.

A riparian buffer ordinance protects a riparian area of a certain width from new development and other disturbances, and promotes revegetation/reforestation. A draft Riparian Buffer Ordinance was created for Madison County that would protect the riparian area in the unincorporated area of the county from certain kinds of development and activities. The ordinance has not yet been passed.

A riparian buffer ordinance may restrict the following activities and structures in the riparian buffer:

- Buildings, accessory structures, roads, parking lots, driveways, and other impervious surfaces
- Disturbance of vegetation (through clearing, construction, or other practices)
- Disturbance of soil (through grading, stripping of topsoil, plowing, cultivating, or other practices)
- Grazing of animals
- Filling or dumping
- Storage of hazardous materials

Sewage Treatment Plant upgrades/advanced treatment

Sewage treatment plants (STPs) are subject to National Pollutant Discharge Elimination System (NPDES) permit requirements. Upgrades to wastewater treatment plants in the watershed should be installed so that the limits set in these permits are not exceeded. According to recent studies, upgrades can reduce total phosphorus in plant effluent to below 1.0 mg/l and reduce total nitrogen in plant effluent to less than 5.5 mg/L. These would be significant improvements over the existing phosphorus and nitrogen concentrations in effluent from several of the sewage and wastewater treatment plants in the watershed. Funding for sewage treatment plant upgrades may be available from USEPA's Source Reduction grant program.

USEPA has published a report on advanced wastewater treatment methods to reduce phosphorus in effluent ("Advanced Wastewater Treatment to Achieve Low Concentration of Phosphorus"). The most effective treatment is the addition of aluminum- or iron-based coagulants followed by tertiary filtration, which reduces the final phosphorus level in effluent to near or below 0.01 mg/L. This treatment is affordable; monthly residential sewer fees charged by the facilities ranged between $18 and $46. Other pollutants such as BOD, TSS, and fecal coliform were also significantly reduced. Another treatment is enhanced biological nutrient removal (EBNR) in the secondary treatment process, which can often reduce total P to 0.3 mg/L or less prior to tertiary filtration. The process reduces operating costs for the tertiary filtration process and removes other pollutants as well.

Additionally, nutrient credit trading is a way to reduce overall nutrient discharge from the vicinity of the treatment plant. The plant pays for a conservation easement that reduces nutrient discharge from agricultural land, thus offsetting the plant's discharge. The two parties can agree with the state (Illinois EPA) that this amount of nutrient reduction can count against the treatment plant's discharge. These agreements have been made at several locations across the U.S.A., including Lancaster County, PA and the American Farmland Trust 3-state pilot project (Ohio, Indiana, and Kentucky). The agreement typically lasts for 10 years.

Stream Cleanup Team

A Stream Cleanup Team operated between 2008 and 2009 in Madison County and removed debris from selected streams in the county about which they received complaints. The cleanup team therefore contributed to improving water quality, reducing flooding, and monitoring stream health. The work was funded by a grant from the U.S. Department of Housing and Urban Development; the team was comprised of paid workers. During the course of the cleanup operations, logjam locations were entered into a handheld GPS unit, and later processed by the county's IT department. Many county residents were vocal in their support of the Stream Cleanup Team, and said they would like to see a reprise of the program.

The program could be replicated and expanded from its previous scope into Madison, Jersey, and Macoupin Counties. The program could include an education component and opportunities for volunteer involvement, mimicking other cleanup programs such as Missouri Stream Team, the Open Space Council's Operation Clean Stream, or Missouri River Relief Trash Bash.

Watershed-Based Plan supported and integrated into community plans

Copies of this Watershed-Based Plan will be made available to communities in the watershed. However, for maximum effectiveness, the plan should be adopted and/or supported (via a resolution). The plan will be most effective when its goals, objectives, and recommended actions are integrated with community policy.

Wetland mitigation banking/In-lieu fee mitigation

A wetland mitigation bank or in-lieu fee program can help to protect and restore critical wetland areas while other areas are developed. In-lieu fee mitigation is an opportunity to assist developers in meeting their mitigation needs while directing mitigation to high quality sites in the watershed. Under an in-lieu fee program, a developer can pay a fee in lieu of having to restore or protect wetland on the development site, or to mitigate losses of those sites by protecting or restoring wetland off-site. The fee goes to a third party organization which can direct the funds to high quality ecological sites for which restoration efforts will have the most environmental impact. Mitigation sites can include both wetlands and streams. The USEPA Water Quality Scorecard recommends compensation for damage to riparian/wetland areas to be on a minimum 2:1 basis on- or off-site.

Agricultural Management Measures

Animal waste storage/treatment system

Proper livestock waste management is very important in maintaining water quality, especially for bacteria levels. Writing a Comprehensive Nutrient Management Plan helps farmers to integrate waste management into overall farm operations. Such a plan can recommend waste storage structures and strategies that increase waste storage time, eliminate unwanted runoff, incorporate manure nutrients into crop nutrient budgets, and efficiently apply manure to cropland without runoff.

The following is a general approach to addressing bacterial pollution in streams as a result of animal manure.

- Identify known sources of bacteria to waterbodies (e.g., areas where livestock have access to streams), using local knowledge, windshield surveys, interviews with landowners, etc.
- Conduct monitoring of stream reaches, adding additional monitoring to help pinpoint potential sources of bacteria.
- Promote good manure application practices such as:
    - Using manure injection rather than surface application;
    - Applying manure to relatively dry fields;
    - Avoiding steep slopes;
    - Avoiding areas near waterbodies or drain tile intakes;
    - Avoiding areas prone to flooding; and

- Avoiding application on frozen soil.

See the NRCS "Agricultural Waste Management Field Handbook" (AWMFH) for specific guidance on planning, designing, and managing systems that involve agricultural wastes.

Bioreactors (denitrifying)

Bioreactors, also known as denitrifying bioreactors, are ditches filled with wood chips that contain denitrifying bacteria. The bioreactor is placed at the outlet of a tile drainage system, and the bacteria remove nitrogen from water leaving the system. Research has shown an estimated bioreactor lifespan of 15 to 20 years, after which the woodchips would be replaced if treatment was to be continued.

Comprehensive Nutrient Management Plans (CNMPs)

A CNMP is a strategy for farmers to integrate livestock waste management into overall farm operations. Such a plan can recommend waste storage structures and strategies that increase waste storage time, eliminate unwanted runoff, incorporate manure nutrients into crop nutrient budgets, and efficiently apply manure to cropland without runoff (e.g., manure injection). When these structures and strategies are in place, manure is a useful asset to cropland that provides benefits to soil health.

Conservation tillage

Converting intensive tillage to conservation tillage consists of switching from moldboard to chisel plowing, which leaves at least 30% crop residue on the fields before and after planting to reduce soil erosion. Converting conservation tillage to no-till consists of switching existing chisel plowing to no-till where the ground is not tilled so as to not disturb the soil. This increases water infiltration, organic matter retention, and nutrient cycling, and reduces soil erosion.

Farmers may find that, initially, less tilling leads to growth of glyphosate-resistant (Roundup-resistant) weeds. Approximately ten species of weeds in the U.S. are known to have become resistant to the herbicide. To avoid this, crop rotation and diversification is the best strategy to disrupt the weeds' emergence, following a long-term weed management plan. This plan should focus on the proper use of each herbicide, using diverse herbicide modes of action (MOA), and the rotation of both herbicides used and crops planted. See the Penn State Extension webpage for more information about how this can be achieved (http://extension.psu.edu/plants/crops/soil-management/no-till/preventing-herbicide-resistant-weeds-in-a-no-till-system).

Cover crops

Cover crops provide both annual and long-term benefits to agricultural land. On an annual basis, they protect soil from water and wind erosion by providing a vegetative cover between the fall harvest and spring planting. They take up residual fertilizer nutrients and then release them back into the soil for the subsequent spring crop. Cover crops also suppress winter annual weeds. With consistent use of cover crops, the soil organic matter content will increase, and this provides many benefits to the soil, including improved soil tilth and health, increased porosity and infiltration, and sustained biological activity. Cereal grains, annual rye grass, and radish are common cover crops for this purpose, but many other types are available. Some crops, such as radish and turnips, are selected to help break through compacted soil layers. Cover crops are often planted as a mix of multiple species that mutually provide a range of benefits.

More information about Cover Crop Plant Guides is available from NRCS' website:
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/climatechange/?cid=stelprdb1077238

Grassed waterways

Grassed waterways are vegetated channels designed to prevent gully erosion by slowing the flow of surface water with vegetation. Grassed waterways should be used where gully erosion is a problem. These areas are commonly located between hills and other low-lying areas on hills where water concentrates as it runs off the field. Grassed waterways trap sediment entering them via field surface runoff and in this manner perform similarly to riparian buffer strips.

The size and shape of a grassed waterway is based on the amount of runoff that the waterway must carry, the slope, and the underlying soil type. NRCS design standards for grassed waterways specify that the minimum capacity convey the peak runoff expected from the 10-year frequency, 24-hour duration storm. Enough freeboard above the designed depth should be provided to prevent damage to crops. The vegetation in the channel should be native plants suited to the site conditions and intended uses.

Nutrient Management Plans (NMPs)

A NMP is a strategy for obtaining the maximum return from on- and off-farm fertilizer resources in a manner that protects the quality of nearby water resources. Creating an NMP involves reviewing soil maps, field boundaries, and nutrient uptake of crops to determine nutrient needs for each field and the types and amounts of fertilizers to meet those needs.

Ponds

Ponds are popular features that also have significant pollutant removal benefits when well sited and designed. Also known as wet ponds, stormwater ponds, or wet retention ponds, they are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season). As stormwater runoff enters the pond, the sediment settles out and some nutrient uptake takes place. Nitrogen removal through denitrification (i.e., reduction of nitrates via anaerobic bacteria) can also occur in ponds.

Riparian buffers

A riparian buffer is a vegetated area along a shoreline, wetland, or stream where development and row cropping is restricted. The buffer physically protects and separates the waterbody from future disturbance or encroachment, and reduces the amounts of pollutants that reach it. If properly designed, a buffer can sustain the integrity of stream ecosystems and habitats. As conservation areas, aquatic buffers are part aquatic ecosystem and part urban forest.

Different grading and vegetation at different locations can affect water quality in different ways. Where vegetation roots can interact with the water table, carbon cycling and denitrification may be enhanced. In areas where the water table depth exceeds the rooting depth, and overland runoff is high, stiff-stemmed grasses may be beneficial to intercept and reduce runoff and sediment from reaching the stream. Where appreciable amounts of neither runoff nor groundwater can be intercepted, streambank stabilization has great benefits. Locations where these practices would be most suitable were identified by using USDA's ACPF model.

A riparian buffer ordinance is an important tool that communities can use to restrict new development in buffer areas in order to ensure that land adjacent to streams continues to protect water quality and moderate stormwater flow.

Wetlands

Wetlands, or Nutrient Removal Wetlands, provide significant water quality benefits. Wetland plants, soils, and microbes cleanse the water entering the wetland, removing approximately 78% sediment, 44% phosphorus, and 20% nitrogen from runoff, according to USEPA's STEPL tool. This is achieved through settling and biological update by wetland plants and organisms. They also recharge groundwater, store stormwater, reduce high water flows, provide food and habitat for wildlife, and increase carbon sequestration. They are appropriate for agricultural and semi-urban land only, where there is limited development.

Natural wetlands should be protected from increased stormwater runoff from development, so as to continue functioning. Wetland vegetation should consist of native aquatic plant species.

Wetland restoration is the rehabilitation of a degraded wetland or the re-establishment of a wetland so that the soils, hydrology, vegetative community, and habitat are an approximation of the original natural condition that existed prior to historic modification.

Constructed wetlands are shallow, vegetated ponds that are engineered and constructed to mimic the structure, water quality function, wildlife habitat, and aesthetic value of naturally occurring wetlands. In some cases, they occur on sites that were historically wetlands, and can be considered wetland restoration projects. Since constructed wetlands need a somewhat constant water level to sustain their functions, the soils underlying the wetland must allow limited infiltration.

Forest Management Measure

Forest stand improvement

Forest stand improvement is an approach to forest management that prioritizes forest health and wildlife habitat. Trees within the stand that are a desirable species, age class, and form are retained while those competing with these trees are "culled" (i.e., cut or girdled). This decreases competition for the desirable trees, increases growth rates, and allows managers to shape the future forest. Forest management can favor trees that produce more hard and soft mast (nuts, seeds, and fruit) to support wildlife populations. Additionally, forest stand improvement can help improve water quality by removing undesirable species, including invasive species such as honeysuckle, that increase soil erosion on the forest floor by suppressing ground cover vegetation.

Urban Management Measures

Urban runoff management is somewhat different from agricultural settings in that the larger areas of impervious surfaces cause higher runoff volumes and, often, high nutrient concentrations. Structural infrastructure designed and constructed to collect, store, infiltrate, and treat storm water are some of the most expensive watershed improvement tools to implement and require consistent maintenance.

According to Schueler and Holland (2000), the cost to maintain a storm water practice over 20 to 25 years can be equal to the initial construction costs. Nevertheless, structural storm water practices can be effective tools for pollutant removal, runoff reduction, and peak flow reduction when properly designed, constructed, and maintained.

Many of these Urban Management Measures fall under the definitions/categories of Low Impact Development (LID) and green infrastructure. They include design, construction, and post-construction (retrofit) practices. The following practices have been recommended for the American Bottom watershed.

Bioswales

Bioswales are swaled (sloped) drainage courses designed to remove debris and reduce pollution from surface water. The sides of the swale are less than six percent slope and the swale may be filled with vegetation, compost, and/or riprap. The design of the swale should maximize the time water spends there, which aids in infiltration (for groundwater recharge) and pollutant removal. Bioswales are often effective when sited adjacent to parking lots. They can capture and treat stormwater during the "first flush" of rain on the parking lot, which carries substantial automotive pollution.

In 2012, the City of O'Fallon, Illinois and HeartLands Conservancy conducted a feasibility study to determine optimal locations for implementing bioswales—including retrofitting existing concrete swales and identifying future installation areas—to reduce the volume of stormwater runoff and related pollutants and sediments. In order to analyze potential vegetative swale sites, the planning area was split into two smaller watersheds and then analyzed using two tools, Long Term Hydrological Impact Analysis and ArcGIS, to determine the potential benefits of implementation. In addition, the city studied two pilot locations for a six-month period to establish baseline flow data in existing concrete roadside swales. To encourage participation, regulatory barriers were removed that could potentially impede private property owners, the city, and developers from voluntarily implementing green infrastructure. Marketing strategies were also developed to facilitate the introduction of bioswales to the community. Overall, O'Fallon and HeartLands Conservancy recommended:

- Encouraging the implementation of bioswales and other stormwater BMPs in areas of new development, particularly in residential parcels.
- Ensuring that city ordinances allow for the utilization of BMPs for both existing and new development.
- Retrofitting existing concrete swales with bioswales in high-priority areas (i.e., residential streets), specifically when the current infrastructure is being repaired or replaced to cut costs.

Detention basins

Detention basins are human-made depressions for the temporary storage of stormwater runoff with controlled release following a rain event. Many of the existing basins are wet bottom basins, which are essentially ponds planted with turf grass on their side slopes. Dry detention ponds (a.k.a. dry ponds or extended detention basins) are designed to detain stormwater runoff for some minimum time (e.g., 24 hours) to allow particles and associated pollutants to settle, but do not have a large permanent pool of water. They are often lined with concrete. These basins do not provide much, if any, infiltration, wildlife habitat, or water quality improvements.

When designed for multiple functions, however, detention basins can improve water storage, wildlife habitat, natural aesthetics, and water quality. According to USEPA, properly designed wet bottom basins designed to have wetland characteristics reduce total suspended solids (sediment) by 77.5%, total phosphorus by 44% and total nitrogen by 20%. Dry bottom infiltration basins reduce total suspended solids (sediment) by 75%, but have lower nutrient removal reduction of total phosphorus (65%), and total nitrogen (60%).

New basins should be:

- Located in natural depressions or drained hydric soil areas (especially when native vegetation is used);
- Located adjacent to existing green infrastructure (especially when native vegetation is used);
- Oriented/located so that outlets do not enter sensitive ecological areas;
- Designed to serve multiple development sites, so that several smaller basins are not needed;
- Designed with shallow side slopes and appropriate native vegetation;
- Designed with a shelf planted with native wet prairie vegetation, if a wet bottom basin; and
- Planted with mesic or wet-mesic prairie, if a dry bottom basin.

The Madison County Stormwater and Erosion Control Ordinance contains several requirements for new detention basins in floodplains, floodways, and connected to wetlands, rivers, streams, and ponds.

Retrofits to existing basins can also attain these benefits, through minor engineering changes, addition of extended detention basins/ponds, and the use of native vegetation. Many of the dry, wet, and wetland bottom basins in the watershed present excellent retrofit opportunities. Generally speaking, three years of management are needed to establish native plant communities. During the first two growing seasons following seeding, mowing and spot herbicide applications are needed to reduce annual and biennial weeds and eliminate problematic non-native/invasive species such as thistle, reed canary grass, and emerging unwanted saplings. In addition, the inlet and outlet structures should be checked for erosion and clogging during every site visit.

Maintenance of detention basins is of vital importance in sustaining their functions and extending the life of the infrastructure. Maintenance practices include regular dredging, mowing or burning (an in-place controlled burn of native grasses) of the vegetation, and removal of invasive species. These practices are recommended in the watershed plan, and will be referenced for these sites as they are proposed for new projects.

For existing subdivisions and areas already developed, it is unusual to have a long-term maintenance agreement in place. When detention basins get full of sediment, there is no clearly identified party responsible for dredging and maintenance. Outreach is needed to educate HOAs about taking on responsibility for dredging and other maintenance, and potentially change their bylaws to reflect this responsibility. For new development, Madison County recently began the best practice of including the transfer of authority for maintenance of the detention basin from the developer to the Homeowners Association once the subdivision is 90% complete. The HOA then has a maintenance responsibility for the detention basin for the life of the project. Alternatively, developers should be encouraged to dedicate naturalized detention basins and other natural areas to a local municipality or conservation organization for long term management that can be funded by a mechanism such as a SSA tax.

Pervious pavement

Pervious pavement is also referred to as porous or permeable pavement. Areas paved with pervious pavement allow water to infiltrate through small holes to a below-ground storage area, or to a pipe that leads to such an area. Pervious pavements reduce runoff rates and volumes from traditional impervious pavements, and can be used in almost every capacity in which traditional asphalt, concrete, or pavers are used. Below ground, the stormwater can be treated through soil biology and chemistry, and the water is returned to groundwater and aquifers rather than increasing flows in streams. It is important to note that there are limitations to using pervious pavement based on subsoil composition, and that it requires annual maintenance (such as vacuuming with a specialized machine) to remain effective over time.

Design options for pervious pavement include:

- Porous pavement with underground storage/recharge beds;
- Concrete pavers infilled with soil/gravel and vegetated with grass; or
- Plastic or metal grid infilled with gravel or equivalent.

Ponds

Ponds are constructed basins with a permanent wet pool. Sediments settle out and nutrient uptake can occur with an active microbial community and healthy emergent and submerged aquatic vegetation. Widely used as a stormwater BMP, they can also be stocked with fish and used for recreation. Ponds should be located at the outflow of a small drainage area in areas that are not highly urbanized. They may be used in conjunction with other measures such as erosion control, flood control, or baseflow.

Rain gardens

Rain gardens, vegetated depressions that clean and infiltrate stormwater from rooftops and sump pump discharges, have become popular garden features. They work best when located in existing depressions or near gutters and sump pump outlets, and are typically planted with deep-rooted native wetland vegetation. Rain gardens significantly slow the flow of water, improve water quality, and provide food and shelter for birds, butterflies, and insects.

Rain gardens work well in combination with the disconnection of roof downspouts and the redirection of that water to the garden. This results in a significant increase in the infiltration of rainwater over a direct connection to the storm drain or to impervious surfaces.

Bioretention facilities are sometimes referred to as rain gardens, but the term rain garden is typically used to describe a small, planted depression on an individual homeowner's property, while a bioretention facility typically describes larger projects in community common areas as well as non-residential applications.

See "Thinking Outside the Pipe" from HeartLands Conservancy for more specifics on rain garden design and bioretention facilities.

Rainwater collection

Rainwater collection and re-use via rain barrels and cisterns is a straightforward and useful way to decrease the amount and intensity of stormwater runoff in a watershed and reduce the amount of water consumed from municipal sources. On most homes and buildings, rainwater flows from roofs into downspouts and then onto streets or into storm sewers. Reconnecting the downspouts to either rain barrels or cisterns can reduce the flood levels in local streams and make water available to the building owner for irrigation and other uses. Water re-use differs based on the type of storage and water treatment.

Rain barrels sit above ground, and are connected to downspouts. A typical rain barrel stores 55 gallons of water. The water collected is often used for irrigation, which can result in significant cost savings; in many areas, residential irrigation can account for almost 50 percent of residential water consumption. Car washing and window cleaning are other common uses of the collected rainwater.

Cisterns are larger, sealed tanks that can sit above or below ground, and also collect rooftop runoff from downspouts. If installed below ground, a cistern requires a pump to bring the water up. With appropriate sanitation treatments, the “gray water” from cisterns can be reused for toilets, housecleaning, dishwashers, laundry, and even showers. Cisterns and rain barrels both reduce water demand in the summer months by reducing the potable water used for irrigation or other household uses.

Single property flood reduction strategies

A number of practices can be used to reduce flood damage on single properties. The key to successfully mitigating future damages is to identify the source(s) of flooding at the site scale. It is important to educate property owners about possible sources of flooding, flood mitigation practices, and the costs of those practices. Coordination with local community officials is often required to identify and confirm the most appropriate flood reduction strategy. These mitigation activities include elevating structures in frequently flooded areas, sanitary sewer line repairs to prevent stormwater infiltration and sewer backups, water-proofing, internal drainage systems, and basement modifications.

The Illinois Urban Flooding Awareness Act Final Report, published in June 2015, identified typical causes of basement flooding (overland flow, infiltration, or sewer backup), and mitigation options available to address these causes. Table C.3 is taken from this report, and shows these causes, along with mitigation options and their costs.

Table D.3. Flood damage mitigation options and the causes of flooding that they address, along with estimated costs. From the IDNR Urban Flooding Awareness Act report (June 2015), Table 9.1.

Mitigation Options	Cause of Flooding			Damage reduction	Estimated Cost
	Overland	Infiltration	Sewer backup		
Structural Inspection					$250-$800 each
Raise utilities and other valuable items				x	
Insurance				x	Based on coverage
Gutter maintenance	o	x	o		
Downspout disconnection			x		
Site grading, downspout extension	o	x			
Rain gardens	o				$3-40 per square foot
Permeable/porous pavement	x				$2-$10 per square foot
Exterior drain tile		x			$185 per foot
Interior drain tile		x	x		$40-50 per foot
Seal wall and floor cracks		x	o		$300-$600 each
Sump pump with check valve	x	x	x		$400-$1,000 each
Sewer backup valves			x		$3,000-$5,000
Overhead sewer installation			x		$2,000-$10,000
x - primary reduction o - secondary reduction					

Storm drain system cleaning and expansion

Storm drain systems are vital for the timely removal of stormwater from areas where it would cause damage if it accumulated. When clogged, storm drains, culverts, and other stormwater infrastructure can cause overflows that lead to erosion and property damage. Cleaning this infrastructure increases dissolved oxygen and reduces levels of bacteria in the receiving waters. Cleaning storm drains by flushing is more successful for pipes smaller than 36 inches in diameter. Wastewater must be collected and treated once flushed through the system. For larger pipes, long pipes (700 feet or more), areas with relatively flat grades, and areas with low flows, flushing may be less effective.

In some cases, stormwater infrastructure is found to be too small to accommodate the flow it receives. Often, new development upstream has altered the watershed hydrology in some way, often increasing the amount of impervious surface and surface runoff flowing to it. In such cases, existing infrastructure such as road culverts and detention basins should be assessed and resized to accommodate the increased flows. The Madison County Stormwater and Erosion Control Ordinance requires that culvert crossings are sized to “consider entrance and exit losses as well as tailwater conditions” (3.4.12.3).

Tree planting (street trees)

Street trees are trees that are planted in the public right-of-way. They are an important component of municipal green infrastructure and provide benefits including reducing stormwater runoff, filtering pollutants in air and water, mitigating high "urban heat island" air temperatures, and providing pleasing aesthetics that increase property values.

When planting new street trees, site evaluations should be conducted to evaluate site considerations. Then, a suitable native tree species is selected. Factors such as growth rate, ornamental traits, size, canopy shape, shade potential, wildlife benefits, and leaf litter production should all be considered when choosing a tree species.[3]

Municipalities with a strong tree program can become a member of Tree City USA, a program operated by the Arbor Day Foundation. It is a nationwide movement that provides the necessary framework to manage and expand public tree inventory. Cities can achieve Tree City USA status by meeting four core standards of sound urban forestry management: (1) maintaining a tree board or department, (2) having a community tree care ordinance, (3) spending at least $2 per capita on urban forestry, and (3) celebrating Arbor Day.

Pollutant removal efficiencies for specific types of trees planted can be estimated with the Pollutant Load Reduction Credit Tool developed by the Center for Watershed Protection in 2017.[4] More general pollutant reduction efficiencies were calculated or cited by the Chesapeake Bay Program[5] and the Pigeon Creek Watershed Plan.[6]

Stream and Lake Management Measures

Logjams

A logjam is any woody vegetation, with or without other debris, which obstructs a stream channel and backs up stream water like a natural dam. Logjams occur naturally, providing beneficial stream structure and cover for fish and wildlife and allowing nutrient-rich sediments to be deposited on adjacent floodplain. However, logjams also impede the ability of streams in the watershed to drain and convey water from the land in a timely manner.

Logjams commonly form when a relatively large object, often a tree, falls into a stream channel and becomes wedged or blocked across the streambed. Populations of beavers in the watershed also contribute to the felling of trees in riparian areas. Sometimes human activities induce stream obstructions, like when yard trimmings or large appliances and other litter are dumped in a stream or left in a floodplain and subsequently are carried into the stream.

Logjams contribute to flooding by making less natural storage available in the stream channel, elevating the water out of its banks during periods of high flow. This can be significant to farm fields and residences in the floodplain and to particularly low-lying, flood-prone areas. A logjam can also lengthen the duration of inundation during these floods, which can have a significant impact on crops planted in floodplain fields. However, this does not make a big difference to overall flood elevation during large-

scale floods. Removing logjams is generally only considered an effective measure to mitigate small-scale flooding.

Water quality is also affected when a logjam is created. As sediment is deposited behind the obstruction, the water that flows on down the stream has less total suspended solids. Water is oxygenated as it stirs and mixes while cascading over, around, and through the logjam. However, not all the water quality impacts are beneficial. As the water moves around the logjam along the route of least resistance, it scours away the streambanks, introducing more sediment and debris to the water. When the stream flow is powerful enough, a streambank "blow-out" can occur around it, taking large amounts of soil and debris from the bank into the stream channel as the stream creates a new path.

Stream channel changes resulting from water being redirected around a logjam can lead to the creation of a series of meanders. In an area where the riparian zone is vegetated, and development or cropland is not directly adjacent to the stream, this meandering and stream relocation is not really a problem. In developed or row cropped areas, these changes can inflict significant property damage and necessitate an expensive channel restoration project.

Logjams affect the habitat of species living in and near the stream. When a logjam forms, it slows the flow behind the obstruction, allowing sediment suspended in the water to settle out. The sediment adds to the obstruction and causes additional debris to become trapped there as well, enlarging and compacting the obstruction. This can create new habitat for fish and aquatic plants and macroinvertebrates. However, a tightly packed stream obstruction can act as a barrier to fish migration.

Determining whether a certain logjam should be removed requires these factors to be taken into account. Where logjams and potential channel changes would be detrimental to riparian property owners and stream water quality, property owners should be prepared to conduct routine stream inspections twice a year and after significant storm events to identify obstructions that need to be removed. The easiest way to deal with logjams is to remove them before significant sediment and debris has been deposited. A useful source for determining whether a logjam should be removed is "Stream Obstruction Removal Guidelines," prepared by the Stream Renovation Guidelines Committee, The Wildlife Society, and the American Fisheries Society in 1983. The document, which was endorsed by the U.S. Fish and Wildlife Service and other agencies, can be found at http://www.lakecountyil.gov/Stormwater/Documents/Planning/North%20Mill%20Creek/2011/D_Compiled.pdf .

Shoreline stabilization

The shoreline provides habitat for fish and wildlife, supports recreation for humans, and cleans stormwater runoff before it enters the water. Shoreline erosion is a natural process that occurs on lakes and rivers and along the coast. It is the gradual, although sometimes rapid, removal of sediments from the shoreline. It is caused by a number of factors including storms, wave action, rain, ice, winds, runoff, and loss of trees and other vegetation. Stabilizing the shoreline of lakes in the watershed can reduce sediment erosion and support vegetation and wildlife habitat.

A shoreline's natural vegetation acts as a filter, preventing sediment and unnecessary nutrients from entering the waterbody. This runoff leads to poor water quality and upsets the balance needed for a healthy shoreline habitat. In the case of lawns, this runoff can include fertilizers, pesticides, lawn clippings, and pet waste. Geese are attracted to lawns, and their waste can add to this runoff.

Shorelines can provide excellent habitat for fish and wildlife. Fish and frogs often spawn in the silt in shallow water at the shore. Shoreline vegetation provides nesting spots for birds and food for insects, waterfowl, and aquatic mammals. Fallen logs and branches provide shelter and hunting areas for fish and mammals, while turtles use them to sunbathe.

Shoreline stabilization methods should include deep-rooted native vegetation (particularly trees), gentle slopes to absorb the energy of waves, and “soft armoring” of live plants, logs, root wads, vegetative mats, and other methods (to complement unavoidable "hard armoring," such as rock rip-rap, stone blocks, sheet-pile or other hard materials) where possible.

Streambank and channel restoration

Streambank and channel restoration includes streambank stabilization and stream channel improvements. These practices are typically done together alongside riparian buffer improvements. The USEPA reports that as much as 90% of sediment, phosphorus, and nitrogen can be reduced following stream restoration. Bank stabilization helps to preserve the stream environment in a natural state, building a strong, long-lasting natural system of deep rooted vegetation that will protect the topsoil from heavy wind and rain.

“Traditional” or “hard” methods of stabilization involve materials such as rip-rap, concrete, and steel. By utilizing bioengineering (natural mimicry or “soft”) methods that incorporate vegetation, the project is often cheaper, provides more effective stabilization, and reduces overall pollution going into the stream. Targeting the outer bends of stream sections with poor riparian vegetation cover where most stream erosion occurs increases the effectiveness of streambank stabilization practices. Streambank bioengineering, which uses vegetative materials in combination with structural tools such as rock at the toe of the streambank, are most needed in areas of excessive streambank erosion or loss of farmland.

Streambank and channel restoration practices appropriate for the streams in this watershed include:

- Vegetative bioengineering;
- Stone toe protection;
- Two-stage channels;
- Riffle/pool complexes;
- Rock riprap; and
- Gabions (rock and wire baskets).

Stream restoration projects present some challenges for those implementing them. First, the development patterns that created the problem are not addressed. Second, the solutions are often technical and expensive, requiring permitting and construction from a qualified contractor. And third, routine maintenance is often not maintained as landowners lack the knowledge or capability to do the needed work. Several resources are available to landowners to help them navigate these challenges.

[1]Illinois Department of Natural Resources, June 2015, Report for the Urban Flooding Awareness Act (PDF), available at https://www.dnr.illinois.gov/WaterResources/Documents/Final_UFAA_Report.pdf

[2] Illinois Department of Natural Resources, Model Stormwater Management Ordinance (PDF), 2015, https://www.dnr.illinois.gov/WaterResources/Documents/IL_Model_Stormwater_Ordinance.pdf

[3] United States Environmental Protection Agency (USEPA), September 2016, Stormwater Trees: Technical Memorandum, PDF, available at https://www.epa.gov/sites/production/files/2016-11/documents/final_stormwater_trees_technical_memo_508.pdf

[4] Center for Watershed Protection, December 2017, Pollutant Load Reduction Credit Tool, downloadable Excel spreadsheet, available at https://owl.cwp.org/mdocs-posts/pollutant-load-reduction-credit-tool/

[5]Karen Cappiella, Sally Claggett, Keith Cline, Susan Day, Michael Galvin, Peter MacDonagh, Jessica Sanders, Thomas Whitlow, and Qingfu Xiao, September 2016, Recommendations of the Expert Panel to Define BMP Effectiveness for Urban Tree Canopy Expansion, PDF, available at https://www.chesapeakebay.net/documents/Urban_Tree_Canopy_EP_Report_WQGIT_approved_final.pdf

[6]Northwater Consulting, 2014, Pigeon Creek Watershed Management Plan, PDF, available at https://www.in.gov/idem/nps/files/wmp_pigeoncreek_2014_sects_1-4.pdf

APPENDIX E – MONITORING PLAN

This monitoring plan for the Madison County American Bottom – Judy's Branch watershed outlines the monitoring activities that will provide ongoing water quality data to assess stream health, and by extension, watershed health. Monitoring is used to assess the effectiveness of urban and agricultural best management practices that are implemented as part of the watershed management plan. Continuous monitoring at USGS gage locations throughout the watershed, impaired streams, and secondary discreet sampling locations in subwatersheds will provide an assessment of the effect of land management practices on surface water quality through the year.

Within the American Bottom watershed, there are 17 gage locations; 5 on the Mississippi River, 10 on Horseshoe Lake, and 2 on Long Lake. Additionally, there is a USGS gage, USGS-05589490, which lies on Cahokia Canal, just before it flows into the Judy's Branch Watershed. This station, 5 of the 10 Horseshoe Lake stations, and the 7 stations on the Mississippi River and Long Lake were sampled for water quality by the Army Corps of Engineers to assess water quality flowing into the watershed. These stations, 13 in total, should continue to be monitored for long term assessment, and have automatic samplers set up to monitor discharge and other parameters.

Other water bodies within the American Bottom watershed that should have continuous monitoring include other IEPA 303(d) list of impaired streams, which are Canteen Creek, Cahokia Diversion Channel, and Chain of Rocks Channel. Discreet sampling should be conducted to assess improvements or further impairments within these water channels.

In addition to continuous monitoring at these USGS gage stations and IEPA 303(d) list of impaired streams, and as funding allows, secondary monitoring locations should be added to identify the relative contributions of HUC12 subwatersheds to overall water quality in the larger watershed. Sampling should be conducted from bridges during major storm-flow conditions when the majority of nutrients and sediments are transported through the watershed, as well as near the outflow of each subwatershed. This data would also help calibrate and ground-truth the pollutant modeling, such as the STEPL, used in this plan. Monitoring can be conducted on a three- to five-year cycle through the year 2030. Quality Assurance Project Plans (QAPP) should be developed for those monitoring opportunities that are selected for implementation in support of the watershed plan.

Sample collection scheduling and parameters to be monitored

The sampling schedule begins in spring 2022 following installation of the continuous sample collection equipment at the USGS gage and the identification of bridges and outflow locations suitable for discrete sample collection from subwatersheds. The exact timing of sample collection and the number of samples collected will depend on the frequency and intensity of precipitation events in the watershed. Furthermore, the location of the discrete sample collection sites may be modified during the second year and third year of the monitoring plan to better capture the impact of best management practices that are implemented in the watershed. Continuous collection of water samples at the 13 identified USGS gage stations will continue in the second year and third year, with most of the samples collected during major hydrological events.

Most sediments and nutrients are transported during periods of elevated flow following major precipitation events. Therefore, sample collection will be more frequent during periods of elevated flow and less frequent during periods of base flow.

Monitoring will be conducted in conjunction with a partnering organization, potentially RiverWatch volunteers through the National Great Rivers Research and Education Center. Organizations such as this are able to provide QA/QC samples as well as equipment that is calibrated and standardized for water quality monitoring.

At each USGS gage station to be monitored, a minimum of total suspended solids (TSS), total phosphorous (TP), and total nitrogen (TN) should be collected. However, additional parameters can be collected if equipment is available for automatic sample collection.

At discreet sample locations, such as at bridges, outflows of HUC12 watersheds, Canteen Creek, Cahokia Diversion Channel, and Chain of Rocks Channel, there are 9 abiotic parameters that should be collected if equipment is available. These parameters include, but are not limited to, TSS, TP, TN, dissolved oxygen, barium, polychlorinated biphenyls, ammonia, manganese, and fecal coliform bacteria. Other parameters, such as temperature, discharge, and specific conductance, would be beneficial to identify a broader picture of non-point source pollution.

Biotic parameters, such as macroinvertebrates, should be monitored at least every spring by trained monitors to identify a long term picture of watershed health. Trends over time can identify improvements to water quality, which may be attributed to best management practices. Table E.1 identifies an overall timeline of developing and implementing monitoring procedures.

Table E.1. Timeline for water quality monitoring in the American Bottom watershed.

	2022				2023				2024				2025-2030
Monitoring Activities	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	
Develop standard operating procedures for collection & analysis of samples													
Sampling at Gage Sites													
Install monitoring equipment													
Monitor TSS, TP, TN													
Evaluate & adjust monitoring plan													
Monitor TSS, TP, TN based on adjusted plan													
Discreet Sampling at HUC12 Level													
Identification of HUC12 discreet sampling sites													
Monitor TSS, TN, TP, barium,													
Evaluate & adjust monitoring plan													
Continue discreet monitoring based on adjusted plan													

APPENDIX F - FUNDING SOURCES

The following funding sources are available for watershed management efforts. All the sources listed here are linked to one or more of the issues identified in and practices recommended for this watershed.

These funding sources are summarized in Table F.2 at the end of this appendix.

State/Federal Government

Illinois Environmental Protection Agency (IEPA)

The **Section 319(h) Nonpoint Source Pollution Control Financial Assistance Program** implements Illinois' Nonpoint Source Management Program with federal funds through section 319(h) of the Clean Water Act. The funds can be for watershed planning, implementation of Best Management Practices (BMPs), or monitoring of water quality. Projects that address nonpoint source (NPS) pollution in Illinois waters that have impaired water quality are given priority.

The **State Revolving Fund Loan Program** includes the Public Water Supply Loan Program (PWSLP) for drinking water projects and the **Water Pollution Control Loan Program (WPCLP)** for wastewater and stormwater projects. Eligible projects include upgrading or rehabilitating existing infrastructure, stormwater-related projects that benefit water quality, and a wide-variety of other projects that protect or improve the quality of Illinois's rivers, streams, and lakes. Funds can be provided for flood relief if the projects are tied to water quality improvements. Green infrastructure projects such as street tree or urban forestry programs, stormwater harvesting programs, downspout disconnection projects, and street drainage practices that mimic natural hydrology may be funded.

Streambank Cleanup and Lakeshore Enhancement (SCALE) grants from EPA have been available in previous years (2013-2016) to support cleanup efforts under Section 319 of the Clean Water Act. The funds were paid to groups that "have already established a recurring streambank or lakeshore cleanup," and used for dumpster rental, landfill fees, and safety attire. Recipients such as Alton Marketplace/Main Street received $500 (or more if more participants were involved). This program may be funded again in future.

The **Green Infrastructure Grant Opportunities (GIGO)** Program funds projects to construct green infrastructure best management practices that prevent, eliminate, or reduce water quality impairments by decreasing stormwater runoff into Illinois' rivers, streams, and lakes. The GIGO Program is available from FY2021 – FY2025 with an annual budget of $5,000,000. Eligible projects include bioinfiltration, retention, detention pond creation, wetland creation, floodplain reconnection, rainwater harvesting, and downspout disconnections.

Illinois Department of Agriculture (IDOA)

The **Streambank Stabilization and Restoration Program (SSRP)** is designed to demonstrate effective streambank stabilization at demonstration sites using inexpensive vegetative and bio-engineering techniques. Program funds may be used for labor, equipment, and materials. Recipients of the cost-

share and project funding must maintain the streambank stabilization project for at least 10 years. This program is not currently funded, but funding may be reinstated in future.

The **Conservation Practice Program (CPP)** is implemented by the Soil and Water Conservation Districts (SWCDs) in Illinois. Cost-share funds are available through the SWCDs for various conservation practices including Filter Strips, Grassed Waterways, No-Till, and Terraces. A CPP-Special Project cost share program funds practices that meet local natural resource priorities but are not on the state-wide list of practices, such as stream crossings, rain gardens, and heavy area livestock use area protection. Applications received are prioritized based on tons of soil saved, acres benefited, cost per acre of practice, and cost per ton of soil saved. This program is not currently funded, but funding may be reinstated in future.

The **Sustainable Agriculture Grant Program** funds research, education, and on-farm demonstration projects that address one or more purposes related to sustainable farming. These purposes include minimizing environmental degradation, clarifying the connections between specific agricultural practices and types of pollution, testing approaches to on-farm research, and identifying critical research and education needs related to sustainable agriculture.

Illinois Department of Natural Resources (IDNR)

The **Urban Flood Control Program** has been implemented for many years under the authority of the Flood Control Act of 1945. IDNR's Office of Water Resources (OWR) has typically applied the program to out-of-bank riverine flooding, and to the development and construction of projects that provide an outlet for stormwater systems.

Illinois Emergency Management Agency

The **Flood Mitigation Assistance (FMA) program** is a cost-share program (75% federal, 25% local match) through which communities can receive grants for the development of a comprehensive flood mitigation plan and the implementation of flood mitigation projects. Communities must be members of the National Flood Insurance Program (NFIP). (See Table F.1.)

The **Pre-Disaster Mitigation (PDM) program** makes grants available to state and local governments to implement cost-effective hazard mitigation activities that complement a comprehensive mitigation program. Funding is awarded for the development of an all-hazards mitigation plan or for a cost-effective hazard mitigation project. (See Table F.1.)

The **Hazard Mitigation Grant (HMG) program** makes grants available to state and local governments as well as eligible private, non-profit organizations to implement cost-effective, long-term mitigation measures following a major disaster declaration. A project does not have to be in a declared county to be eligible; every community that is vulnerable to natural hazards should consider applying. (See Table F.1.)

The **Severe Repetitive Loss program** provides funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss structures insured under the NFIP. These structures are residential properties insured under the NFIP that have had two or more large claims (see the Federal Emergency Management Agency website for details). (See Table F.1.)

Illinois Department of Commerce and Economic Opportunity (DCEO)

The **Illinois Community Development Assistance Program** administers funds through the Federal Community Development Block Grants: Small Cities program. The Community Development Assistance Program is designed to help communities meet their greatest economic and community development needs, with a focus on communities with low- to moderate-income populations. The public infrastructure component of the program is used to mitigate conditions that are detrimental to public health and welfare, primarily in residential areas. These projects can include the design and construction of storm sewers. (See Table F.1.)

The following table shows Illinois EMA and DCEO funding sources with their associated program outputs, participation requirements, and funding limits (Table F.1.).

Table F.1. Sources of funding, program outputs, and participation requirements for various types of flood hazard mitigation identified in the IDNR Urban Flooding Awareness Act draft report (adapted from Table 6.1 in that report).

	IDNR/OWR UFC	IEMA FMA	IEMA PDM	IEMA HMGP	Direct Legislative Action	DCEO CDAP PI and Emergency PI	DCEO CDP PI + Design	IEPA Revolving Loan
Types of Projects/Outcomes								
Storm Sewer Improvements		x	x	x	x	x	x	x
Combined Sewer Improvements					x	x	x	x
Conveyance Improvements	x	x	x	x	x			
Levees	x				x			
Detention Basins	x	x	x	x	x			
Projects on Private Property		x	x	x				
Individual Basement Mitigation								
Repetitive Loss Structure Buyouts		x	x	x				
Planning Reports	x	x	x	x	x			
Program Outputs								
Project Specific Planning Documents	x				x		x	
Construction Documents	x				x	x	x	
Construction Funding	x	x	x	x	x	x	x	
Construction Engineering	x				x	x	x	
Local Participation Requirements								
Operation and Maintenance	x	x	x	x	x	x	x	x
Utility Relocations	x							
Land Rights Acquisition	x							
NFIP Participation	x	x	x	x		x	x	
Emphasis on Low to Moderate Income						x	x	
Pre-approved Planning		Mitigation PI	Mitigation PI	Mitigation PI		x		x
Program Funding								
Federal Disaster Declaration Required				x				
Local Cost Share		25%	25%	25%		25%	25%	Low interest loan
B/C Ratio	≥ 1.0	≥ 1.0	≥ 1.0	≥ 1.0	None	None	None	None
Funding Limits						$450,000 or $200,000 for Emergency	$450,000 max with $150,000 Design Included	

Acronyms used in Table F.1:

IDNR/OWR – Illinois Department of Natural Resources, Office of Water Resources
IEMA – Illinois Emergency Management Agency
FMA – Flood Mitigation Assistance program
PDM – Pre-Disaster Mitigation program
HMG – Hazard Mitigation Grant program
DCEO – Department of Commerce and Economic Opportunity
CDAP Pl and Emergency Pl – Community Development Assistance Program – Planning and Emergency Planning
CDP Pl + Design - Community Development Assistance Program – Planning and Design
IEPA – Illinois Environmental Protection Agency
NFIP – National Flood Insurance Program
B/C ratio – Benefit/Cost ratio
Mitigation Pl – Mitigation Plan

U.S. Environmental Protection Agency

The **USEPA Source Reduction Assistance grant program** supports pollution prevention projects that will provide an overall benefit to the environment by preventing pollutants at the source (i.e., not treatment or cleanup programs). Applicants must demonstrate new or innovative techniques for education or training that promote pollution prevention and source reduction efforts. State and local governments and non-profits are eligible to receive funds or cooperative agreements.

The **Environmental Education Grants Program** supports environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. Grants are issued to organizations including local education agencies, state schools, colleges, and nonprofit organizations.

The **Environmental Justice Small Grants Program** supports communities working on solutions to local environmental and public health issues through collaborative partnerships. One focus of successful applications is community-based preparedness and resilience efforts, particularly for climate resiliency.

The **Urban Waters Small Grants Program** improves coordination among federal agencies and collaborates with community-led revitalization efforts to improve the Nation's water systems. Funds go to research, investigations, training, surveys, studies, and demonstrations that will advance the restoration of urban waters by improving water quality through activities that also advance community priorities. Sponsored projects receive support in a number of different ways. There is currently no open Request for Proposals.

U.S. Department of Agriculture

The **Conservation Reserve Program (CRP)** is a federally funded voluntary program that contracts with agricultural producers so that environmentally sensitive land, such as wetland and floodplain, is not farmed or ranched, but instead used for conservation benefits. Farmers enrolled in the program agree to remove environmentally sensitive land from agricultural production and plant species such as native prairie grasses that will improve environmental health and quality, in exchange for a yearly rental payment. The land must be eligible for one or more conservation practices, including grass waterways, filter strips, wetland restoration, riparian buffers, flood control structures, and sediment retention. Contracts for land enrolled in CRP are 10 to 15 years in length. The long-term goals of the program are to reestablish valuable land cover that will help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.

The **CRP – Grasslands** program is part of the CRP program. It conserves working grasslands, rangeland, and pastureland while maintaining the areas as livestock grazing lands. Participants who establish long-term, resource-conserving plant covers (i.e., approved grasses or trees) are provided with annual rental payments up to 75 percent of the grazing value of the land. Cost-share assistance also is available for up to 50 percent of the covers and other practices, such as cross fencing to support rotational grazing or improving pasture cover to benefit pollinators or other wildlife. Participants may still conduct common grazing practices, produce hay, mow, or harvest for seed production, conduct fire rehabilitation, and construct firebreaks and fences.

The **Conservation Reserve Enhancement Program (CREP)** is an offshoot of the CRP that addresses high priority environmental problems in a partnership between the state and federal government. It funds

the removal of environmentally sensitive land (such as wetlands and highly erodible land) from crop production, and the introduction of conservation practices.

The **Agricultural Conservation Easement Program (ACEP)** is a Natural Resources Conservation Service (NRCS) program. It repeals the Farm and Ranch Lands Protection Program (FRPP), the Grassland Reserve Program (GRP), and the Wetlands Reserve Program (WRP) and consolidates the purposes of these programs into one easement program. The two easement enrollment components of ACEP are agricultural land easements (ACEP-ALE) and wetland reserve easements (ACEP-WRE).

- Agricultural Land Easements (ALEs) prevent the conversion of productive farmland to non-agricultural uses. Land eligible for agricultural easements includes cropland, rangeland, grassland, pastureland and nonindustrial private forest land. NRCS will prioritize applications that protect agricultural uses and related conservation values of the land and those that maximize the protection of contiguous acres devoted to agricultural use.
- Wetland Reserve Easements (WREs) provide habitat for wildlife, improve water quality, and reduce flooding. Technical and financial assistance is provided to restore, protect, and enhance wetlands. Land may be enrolled in easements for various time periods. Land eligible for wetland reserve easements includes farmed or converted wetland that can be successfully and cost-effectively restored. NRCS will prioritize applications based the easement's potential for protecting and enhancing habitat for migratory birds and other wildlife.

The **Environmental Quality Incentive Program (EQIP)**, run by NRCS, provides financial and technical assistance to individuals and entities to address soil, water, air, plant, animal and other related natural resource concerns on their land. Funding can be provided for the implementation of structural and management practices, including conservation tillage, on eligible agricultural land.

The **Conservation Stewardship Program (CSP**) helps producers maintain and improve existing conservation systems and implement additional activities to address priority resources concerns. Payments made are based on performance of the practices. Two types of payments are provided through five-year contracts: annual payments for installing new conservation practices and maintaining existing practices, and supplemental payments for adopting a resource-conserving crop rotation.

The **Healthy Forests Reserve Program (HFRP)** aims to assist landowners in restoring, enhancing, and protecting forestland resources on private land through easements, 30-year contracts, and 10-year cost-share agreements. The land must restore, enhance, or measurably increase the recovery of threatened or endangered species, improve biological diversity, or increase carbon storage.

The **Regional Conservation Partnership Program (RCPP)** encourages partnerships with producers on installing and maintaining conservation projects that increase the restoration and sustainable use of soil, water, wildlife, and related natural resources. Contracts and easement agreements are implemented through other NRCS programs: ACEP, EQIP, CSP, or HFRP. The RCPP essentially provides more funding through these programs. There are three funding pools within the program: state, federal, and Critical Conservation Areas (CCAs).

Conservation Innovation Grants (CIG) is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies in agricultural production. The program allows NRCS to work with other public and private entities to accelerate technology transfer and adoption. There have been funding opportunities at the national and state level.

The **Water & Waste Water Disposal Loan & Grant Program** provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and stormwater drainage to households and businesses in eligible rural areas. The program assists applicants who are not otherwise able to obtain commercial credit on reasonable terms for these projects. Areas served must be rural or towns populated with 10,000 people or fewer. Long-term, low interest loans are the primary funding type available. Grants may be combined with a loan if necessary and if funds are available.

The **Forest Legacy Program** protects environmentally sensitive "working forests" that protect water quality, provide habitat, forest products, opportunities for recreation, and other public benefits. It is designed to encourage the protection of privately owned forest lands through conservation easements. Program participants must prepare a multiple resource management plan for the land.

U.S. Fish and Wildlife Service

The **Partners for Fish and Wildlife Program** is run by the U.S. Fish and Wildlife Service (USFWS) under the Department of the Interior (DOI). The Partners for Fish & Wildlife program works with private landowners to improve fish and wildlife habitat on their lands through voluntary, community-based stewardship. Noting that more than 90% of land in the Midwest is in private ownership, the program promotes high quality habitat through partnerships with private conservation organizations, state and federal agencies, and tribes to reach private landowners. Funding, materials, equipment, labor and expertise can be shared to meet shared restoration and conservation goals.

Federal Emergency Management Agency

The **Building Resilient Infrastructure and Communities (BRIC)** supports states, local communities, tribes, and territories that undertake hazard mitigation projects which reduce the risks from disasters and natural hazards. BRIC will provide $500 million to these entities.

Non-Governmental Organizations (NGOs)

Several NGOs have programs or missions that support the recommendations in this plan.

Environmental non-profit groups

The following groups may have funds to help carry out their missions at any given time:

- **Ducks Unlimited (DU)** – DU's Living Lake Initiative is established to provide support in enhancing shallow lake complexes.
- **Pheasants Forever** – Local Chapters often provide food plot and native grass seed to landowners.
- **Trees Forever** – The Working Watersheds: Buffers and Beyond program provides a 50% cost share (up to a maximum of $2,000) to implement a water quality project or demonstration site. Riparian buffer plantings are the main focus of the program, but other innovative projects are also considered.
- **The Nature Conservancy (TNC)** – TNC works to protect diverse natural habitats including wetlands and forests.

- **The National Fish and Wildlife Foundation (NFWF)** – NFWF provides grants on a competitive basis to projects that support fish and wildlife. Its program areas include protecting critical habitat, capacity building for partner organizations, and wetland and forest stewardship.
- **The National Wildlife Federation (NWF)** – The NWF supports projects that protect and restore fish and wildlife habitat.
- **Water Environment Federation (WERF)** – The Water Environment Research Foundation funds water quality research and facilitates collaboration among partners.

Private Foundations/Companies

Companies such as Coca-Cola and Patagonia often have foundations or grant programs to support environmental missions. Some of these companies/foundations include:

- **Coca-Cola Foundation** – Coca-Cola's Community Support program supports funding for program areas including water stewardship and education.
- **Walton Family Foundation** – The Walton Foundation supports projects including freshwater projects that sustain healthy communities in the Mississippi River Basin.
- **Illinois American Water Environmental Grant Program** – Illinois American Water supports innovative, community-based environmental projects that improve, restore or protect watersheds through partnerships. Watershed cleanups, reforestation efforts, biodiversity projects, wellhead protection and hazardous waste collection efforts are supported through grants of up to $10,000.

Other

In-Lieu Fee Mitigation Program

In-lieu fee mitigation is a type of mitigation banking that can be used to compensate for unavoidable impacts to wetlands while directing funds to sites with high ecological value. A permittee pays a fee to a third party instead of conducting project-specific mitigation or buying credits from a wetland mitigation bank. The fee represents the estimated cost of replacing the wetland functions lost or degraded as a result of the permittee's project. The in-lieu fee mitigation program gathers several such fees and uses them to finance an extensive mitigation project. HeartLands Conservancy is in the final stages of becoming an Approved Program Sponsor. Mitigation sites will include both wetlands and streams, so fees will go towards both wetland and stream restoration.

Table F.2. Funding Sources for Watershed Management Efforts

Funding Sources	Grant Programs	Eligible Entities	Types of Practices Funded	Currently Funded (As of August 2020)
State/Federal Government				
Illinois Environmental Protection Agency	Section 319(h) Nonpoint Source Pollution Control Financial Assistance Program	Local units of government and other organizations.	Watershed planning, implementing BMPs, or water quality monitoring.	Yes
	State Revolving Fund Loan Program, including: • Public Water Supply Loan Program • Water Pollution Control Loan Program	Communities and public or private entities.	Infrastructure upgrades, stormwater projects that benefit water quality, projects that improve Illinois' rivers, streams, and lakes.	Yes
	Streambank Cleanup and Lakeshore Enhancement Grants	Groups that have established a recurring streambank or lakeshore cleanup.	Dumpster rental, landfill fees, safety attire.	No. Funding may be continued
	Green Infrastructure Grant Opportunities	Local units of government and other organization	bioinfiltration, retention, detention pond creation, wetland creation, floodplain reconnection, rainwater harvesting and downspout disconnections.	Yes
Illinois Department of Agriculture	Streambank Stabilization and Restoration Program	Landowners with severely eroded streambanks.	Labor, equipment, materials.	No. Funding may be continued
	Conservation Practice Program	N/A	Conservation practices including filter strips, grassed waterways, no-till, and terraces.	No. Funding may be continued
	Sustainable Agriculture Grant Program	Organizations, governmental units, educational institutions, NPOs and individuals.	Research, education, and on-farm demonstration projects that address sustainable farming.	Yes
Illinois Department of Natural Resources	Urban Flood Control Program	Citizens or local, state, or federal officials.	Out-of-bank riverine flooding initiatives and projects that provide an outlet for stormwater.	Yes

Table F.2. (Continued) Funding Sources for Watershed Management Efforts

Funding Sources	Grant Programs	Eligible Entities	Types of Practices Funded	Currently Funded (As of August 2020)
State/Federal Government (continued)				
Illinois Emergency Management Agency	Flood Mitigation Assistance Program	Communities that are members of the NFIP.	Development of a comprehensive flood mitigation plan, or implementation of flood mitigation	Yes
	Pre-Disaster Mitigation Program	State and local governments.	Creation of an all-hazards mitigation plan or a cost-effective hazard mitigation project.	Yes
	Hazard Mitigation Grant Program	State and local governments and non-profit organizations.	Cost-effective, long-term mitigation measures following a major disaster.	Yes
	Severe Repetitive Loss Program	Residential properties insured under the NFIP that have had two or more large claims.	Initiatives that reduce or eliminate the long-term risk of flood damage.	Yes
Illinois Department of Commerce and Economic Opportunity	Illinois Development Assistance Program	Communities with low- to moderate-income populations.	Implementation of mitigation measures, primarily in residential areas, to address issues that are detrimental to public health and welfare (e.g., design and construction of storm sewers).	Yes
U.S. Department of Housing and Urban Development	National Disaster Resilience Competition	States with counties that experienced a Presidentially Declared Major Disaster in 2011, 2012, or 2013.	Innovative resilience projects at the local level that encourage the adoption of policy changes, and activities that prepare for impacts of extreme weather and climate change.	No. Funding may be reinstated in the future.
U.S. Environmental Protection Agency	USEPA Source Reduction Assistance Grant Program	State and local governments and non-profit organizations.	Pollution prevention projects that will benefit the environment by eliminating pollution at the source.	Yes
	Environmental Education Grants Program	Local education agencies, state schools, colleges,	Environmental education projects that promote awareness and stewardship.	Yes
	Environmental Justice Small Grants Program	Communities and community-based organizations.	Solutions to local environmental and public health issues (e.g., climate resiliency, community preparedness) through collaborative partnerships.	Yes
	Urban Waters Small Grants Program	Communities and community-based organizations.	Research, training, surveys, and demonstrations that advance the restoration of urban waters through activities that also advance community priorities.	No. Funding may be continued.

Table F.2. (Continued) Funding Sources for Watershed Management Efforts

Funding Sources	Grant Programs	Eligible Entities	Types of Practices Funded	Currently Funded (As of August 2020)
State/Federal Government (continued)				
U.S. Department of Agriculture	Conservation Reserve Program	Landowners or farmers with environmentally sensitive land. Land must be eligible for one or more conservation practices, including grass waterways, filter strips, wetland restoration, riparian buffers, flood control structures, and sediment retention.	Reestablish valuable land cover that will improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.	Yes
	CRP—Grasslands	Landowners and operators.	Initiatives to conserve working grasslands, rangeland, and pastureland while maintaining livestock grazing land.	Yes
	Conservation Reserve Enhancement Program (CREP)	Farmers and ranchers that live in a state with a CREP agreement in place with the Farm Service Agency (FSA).	Removal of environmentally sensitive land (e.g., wetlands) from crop production and introduction of conservation practices.	Yes
	Agricultural Conservation Easement Program, including: • Agricultural Land Easements • Wetland Reserve Easements	Agricultural Land Easement eligibility: cropland, rangeland, grassland, pastureland, nonindustrial private forest.	Prevention of productive farmland conversion to non-agricultural uses.	Yes
		Wetland Reserve Easement eligibility: farmed or converted wetland that can be successfully and cost-effectively restored.	Habitat creation, water quality improvement, flood reduction.	
	Environmental Quality Incentive Program	Individuals and entities.	Structural and management practices that address natural resource concerns on agricultural land.	Yes

Table F.2. (Continued) Funding Sources for Watershed Management Efforts

Funding Sources	Grant Programs	Eligible Entities	Types of Practices Funded	Currently Funded (As of August 2020)
State/Federal Government (continued)				
U.S. Department of Agriculture	Conservation Stewardship Program	Landowners in compliance with highly erodible land and wetland conservation requirements who have current farm records with FSA.	Assistance in maintaining and improving existing conservation systems. Implementation of additional activities to address priority resource concerns.	Yes
	Healthy Forests Reserve Program	Any landowner whose land restores, enhances, or increases the recovery of threatened or endangered species.	Restoration, enhancement, and protection of forestland resources on private lands through easements.	Yes
	Regional Conservation Partnership Program	Partners of the Natural Resources Conservation Service.	Partnerships with producers to install and maintain conservation projects that increase the restoration and sustainable use of soil, water, wildlife, and related natural resources.	Yes
	Conservation Innovation Grants	Public and private entities.	Development and adoption of innovative conservation approaches and technologies in agricultural production.	Yes
	Water and Waste Water Disposal Loan and Grant Program	Rural areas or towns populated with 10,000 people or fewer.	Creation of clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and stormwater drainage to households and businesses.	Yes
	Forest Legacy Program	Environmentally sensitive "working forests" that protect water quality, provide habitat, and public benefits. Must prepare a multiple resources management plan for the land.	Protect privately owned forest lands through conservation easements.	Yes
U.S. Fish and Wildlife Service	Partners for Fish and Wildlife Program	Private landowners	Improvements to fish and wildlife habitat through voluntary, community-based stewardship.	Yes

Table F.2. (Continued) Funding Sources for Watershed Management Efforts

Funding Sources	Grant Programs	Eligible Entities	Types of Practices Funded	Currently Funded (As of August 2020)
State/Federal Government (continued)				
Federal Emergency Management Agency	Building Resilient Infrastructure in Communities	States, municipalities, tribes and territories	Provide funding for the installation of resilient infrastructure to prevent hazards	Yes

Table F.2. (Continued) Funding Sources for Watershed Management Efforts

Funding Sources	Grant Programs	Eligible Entities	Types of Practices Funded	Currently Funded (As of August 2020)
Non-Governmental Organizations (non-profit organizations, private foundations/companies, other) that support watershed management efforts.				
Ducks Unlimited	e.g. Living Lake Initiative	N/A	Support and enhance shallow lake complexes.	N/A
Pheasants Forever	N/A	Landowners	Local chapters provide food plot and native grass seed.	N/A
Trees Forever	Working Watersheds: Buffers and Beyond	Iowa landowners	Fifty-percent cost share to implement a water quality project or demonstration site.	Yes
The Nature Conservancy	N/A	N/A	Protect diverse natural habitats, including wetlands and forests.	N/A
The National Fish and Wildlife Foundation	N/A	N/A	Critical habitat protection, capacity building for partner organizations, and wetland and forest stewardship.	N/A
The National Wildlife Federation	N/A	N/A	Protection and restoration of fish and wildlife habitat.	N/A
Water Environment Federation	N/A	N/A	Water quality research and facilities collaboration among partners.	N/A
Coca-Cola Foundation	Community Support Program	Individuals, organizations, communities.	Water stewardship and education.	Yes
Illinois American Water	Environmental Grant Program	Communities that have a source water or watershed protection need.	Innovative, community-based environmental projects that improve, restore, or protect watersheds through partnerships. Watershed cleanups, reforestation efforts, biodiversity projects, wellhead protection and hazardous waste collection efforts are supported through grants of up to $10,000.	Yes
In-Lieu Fee Mitigation Program	N/A	N/A	Mitigation banking that can be used to compensate for unavoidable impacts to wetlands while directing funds to sites with high ecological value.	N/A
Walton Family Foundation	N/A	Organizations with projects that match the foundation's funding criteria and priorities.	Freshwater projects that sustain healthy communities in the Mississippi River Basin.	Yes

APPENDIX G – PROGRESS REPORT CARDS

PM = Progress made: A = Achieved

Goal 1: Reduce Flooding and Mitigate Flood Damage

Existing Conditions

45% of Flood Survey respondents experienced flooding in the last 10 years, reporting a total of >$385,000 in costs over that time.
Major roads and private property have been inundated with floodwater during heavy rain events.
Thousands of acres of wetlands have been lost since pre-settlement; the associated loss of ecosystem functions has been great since that time.

Watershed Impairment Reduction Targets and recommendations

New dry detention basins installed
New wet detention basins installed
Retrofits & maintenance on existing detention basins
Critical Flooding Areas prioritized
25% Critical Wetlands Areas restored
Stream flow reduced peak discharge during storm events
Programmatic changes regarding flood damage prevention ordinances, riparian buffer ordinances, and stormwater infrastructure funding

Measurement Indicator	**Milestone**				**Data source**	**Achieved?**
	Short-term (1-10 years)	Medium-term (10-20 years)	Long-term (20+ years)			
Number and extent of Management Measures (BMPs) implemented	81	161	242	… acres of Critical riparian areas ecologically restored (100% of Critical Riparian Areas identified)	SWCD, NRCS, farmers, contractors	
	716	1,432	2,148	... acres wetlands restored, enhanced, or created (100% Critical Wetlands) (cumulative)		
	33,333	66,667	100,000	… feet storm drain system maintenance (cleaning) and expansion	Municipalities, contractors	
	100	200	300	... acres new dry detention basins (cumulative)	County, municipalities, SWCD	
	100	200	300	... acres new wet detention basins (cumulative)		
	7	13	20	... acres detention basin retrofits (native vegetation buffers, etc.)		
	7	13	20	… detention basins maintained (dredging, mowing, burning, invasives, etc.)		
	200,677	401,353	602,030	…cubic yards of lake dredging		

Number and extent of Management Measures (BMPs) implemented	58	117	175	... acres pervious pavement (cumulative)		
	8,333	16,666	25,000	... square feet rain gardens (cumulative)		
	1,236,378	2,472,756	3,709,134	…square feet urban filter strips		
	123,638	247,275	370,913	…square feet bioswales		
	67	133	200	... barrels/small cisterns for rainwater harvesting and reuse (cumulative)		
	973	1,947	2,920	... properties use single property flood reduction strategies (8% of all households in the watershed) (cumulative)		
	760,000	1,520,000	2,280,000	…square feet canopy cover (~20,000 trees, i.e. street trees)		
Flow data collected under the Monitoring Plan at other HUC14 locations. Data correlated with rainfall.	PM	PM	A	No measured increase in mean peak stream discharge / Measured reductions in peak stream discharge	USGS National Water Information System, NGRREC (monitoring results)	
Number and extent of flood damage prevention ordinances, riparian buffer ordinances, and other actions by local governments to restrict construction in floodplains and riparian areas.	PM	PM	A	Counties adopt Flood Damage Prevention Ordinance and Riparian Buffer Ordinance All municipalities engaged to inform about the ordinances and encourage adoption	County, municipalities, townships	
Number of counties/municipalities with dedicated funding for stormwater infrastructure, eg a Stormwater Utility. Dollar amount of revenue streams.	PM	PM	A	Counties adopt a mechanism for dedicated funding for stormwater infrastructure All municipalities engaged to inform about stormwater infrastructure funding options	County, municipalities	

GRADE	

Notes

Goal 2: Improve Surface Water Quality

Existing Conditions

140,650 lbs/year of phosphorus, 25,080 tons/year of sediment, and 809,193 lbs/yr of nitrogen enter the American Bottom watershed every year, based on the STEPL model. Cahokia Creek (Cahokia Canal) and Schoenberger Creek were impaired for Dissolved Oxygen (DO) levels in 2018 and previous years.

Fecal coliform levels in Cahokia Creek have spiked several times between 1978 and 2005, the median level was 460 cfu/100ml. Cahokia Creek has an average observed value (mean) of 3,111 cfu/100mL. Canteen Creek has impairments for barium and manganese from 2018 and previous years. Horseshoe Lake and Chain of Rocks Canal have impairments for Polychlorinated Biphenyls in 2018 and previous years.

Watershed Impairment Reduction Targets and recommendations

25% or 35,163 lbs/year reduction in phosphorus loading by 2035, based on the Illinois Nutrient Loss Reduction Strategy.

20% or 5,016 tons/year reduction in sediment loading by 2035, based on estimated impacts of proposed BMPs.

15% or 809,193 lbs/year reduction in nitrogen loading by 2035, based on the Illinois Nutrient Loss Reduction Strategy.

No DO samples lower than the minimum concentration in streams: March – July: 5.0 mg/L at any time, 6.0 mg/L as a daily mean averaged over 7 days; August – February: 3.5 mg/L at any time, 4.0 mg/L as a daily mean averaged over 7 days, 5.5 mg/L as a daily mean averaged over 30 days. Based on 35 Ill. Adm. Code 302.

Removal of Cahokia Creek, Canteen Creek, and Horseshoe Lake from the Illinois EPA 303(d) list.

Programmatic changes regarding wastewater treatment, private sewer, and conservation easements.

Measurement Indicator	**Milestone**				**Data source**	**Achieved?**
	Short-term (1-10 years)	Medium-term (10-20 years)	Long-term (20+ years)			
Number and extent of Management Measures (BMPs) implemented	2,374	4,748	7,122	... acres conservation tillage (60% of locations identified by the ACPF) (cumulative)	SWCD, NRCS, farmers, contractors	
	2,374	4,748	7,122	… acres cover crops (60% of total agricultural land area) (cumulative)		
	64	127	191	… acres grassed waterways (25% of locations identified by the ACPF) (cumulative)		
	33	67	100	... acres ponds (cumulative)		
	167	333	500	…acres nutrient management plans (cumulative)		
	81	161	242	… acres of Critical riparian areas ecologically restored (100% of Critical Riparian Areas identified)		
	716	1,432	2,148	... acres wetlands restored, enhanced, or created (25% of Critical Wetland Areas) (cumulative)		
	17,600	35,200	52,800	…feet shoreline stabilization (20% total perimeter of shorelines named & major lakes)	NRCS, SWCD, contractors	

	30,448	60,896	91,344	... feet streambank & channel restoration (100% Critical Stream Areas plus 100% of poor streambanks) (cumulative)	NRCS, SWCD, contractors	
	19,360	38,720	58,080	... feet logjam removal sites (100% of the Critical Logjam Areas)		
Cahokia Creek, Canteen Creek, & Horseshoe Lake from Illinois EPA 303(d) list.	PM	PM	A	All streams in the watershed removed from the 303(d) list	Illinois EPA 303(d) list	
Concentrations and loads of in-stream pollutants	PM	PM	A	Measured reductions in in-stream phosphorus, sediment, nitrogen, and fecal coliform (see Monitoring Plan). Measured increases in in-stream dissolved oxygen (see Monitoring Plan).	NGRREC (water quality monitoring results)	
Nutrient removal technologies incorporated into upgrades of wastewater treatment plants	PM	PM	A	All wastewater treatment plants meet NPDES permit requirements; upgrades implemented as needed.	Individual treatment plants; US EPA Discharge Monitoring Report (DMR) Tool	
Percentage of new development projects with private sewer. Number of existing on-site treatment systems connected to public sewers.	10%	20%	30%	... new development projects have public sewer. Also, 300 on-site treatment systems connected to public sewers (~10% of private sewage systems in the watershed)	County, municipal records	
Number and extent of local ordinances and programs requiring regular inspection and maintenance of on-site sewage systems.	4	8	12	… municipalities and county require regular private sewage inspections (beyond complaint-based program)	County, municipalities	
Enrollment of land in conservation easements including CRP and CREP	1.5	2	2.5	... times the 2015 acreage enrolled in CRP and CREP	NRCS	
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Notes

Goal 3: Promote Environmentally Sensitive Development Practices

Existing Conditions

Current 3.4% impervious cover; current 4,567 acres developed open space (2011 NLCD) or 526 acres open space (recognized parks etc.)
Thousands of acres of wetlands lost since pre-settlement; loss of ecosystem functions

Regulations and common practices in new development have not and generally still do not prioritize the protection of open space or natural features.

Watershed Impairment Reduction Targets and recommendations
Preservation of open space and infiltration measures in all new and redevelopment
Increase in rain gardens and native landscaping
Increase in pervious surfaces in new and redevelopment
Decrease in impervious surfaces in new and redevelopment
Increase in land in conservation easements
Programmatic changes including use of Conservation Development design, local ordinances, green infrastructure, and in-lieu fee mitigation

Measurement Indicator	**Milestone**				**Data source**	**Achieved?**
	Short-term (1-10 years)	Medium-term (10-20 years)	Long-term (20+ years)			
Number and extent of Management Measures (BMPs) implemented	100	200	300	... acres new dry detention basins (cumulative)	Counties, municipalities, SWCD	
	100	200	300	... acres new wet detention basins (cumulative)	Counties, municipalities, SWCD	
	7	13	20	... acres detention basin retrofits (native vegetation buffers, etc.)	Counties, municipalities, SWCD	
	7	13	20	… detention basins maintained (dredging, mowing, burning, invasives, etc.)	Counties, municipalities, SWCD	
	58	117	175	... acres pervious pavement (cumulative)	Counties, municipalities, contractors	
	8,333	16,667	25,000	... square feet rain gardens (cumulative)	Counties, municipalities, contractors	

Area of impervious surfaces in new development	PM	PM	A	2% or less annual increase in impervious cover in the overall watershed	NLCD Percent Developed Impervious Surface dataset	
Enrollment of land in conservation easements including CRP and CREP	1.5	2	2.5	… times the 2020 acreage enrolled in CRP and CREP	NRCS	
Number of new development proposals using Conservation Development design to protect natural features.	20%	40%	60%	… of subdivision and other development proposals contain design elements from Conservation Development design, eg protection of open space	Counties, municipalities	
Number and extent of municipal ordinances that support: stormwater, flood management, green infrastructure, wetlands protection through in-lieu fee mitigation, and native landscaping.	PM	PM	A	Counties adopts Flood Damage Prevention Ordinance and Riparian Buffer Ordinance All municipalities engaged to inform about the ordinances and green infrastructure, in-lieu fee mitigation programs to encourage adoption	Municipalities	
Number of counties and municipalities implementing green infrastructure incentives. Number of ordinance changes to allow or encourage native landscaping.	2	4	6	... municipalities offer green infrastructure incentives such as flexible implementation of regulations, fee waivers, tax abatement, and streamlined development review process All municipalities allow and encourage native plants (eg changes to weed control ordinances)	Counties, municipalities	
Number of acres wetland restored and number of feet streambank restored under in-lieu fee mitigation program	PM	PM	A	In-lieu fee mitigation program established, covering the entire watershed Critical Wetland and Critical Stream Areas prioritized for restoration under in-lieu fee program	HeartLands Conservancy, US ACE	

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Notes

Goal 4: Support Healthy Fish and Wildlife Habitat

Existing Conditions

6.9 miles Critical Riparian Areas, 11 miles Critical Logjam Areas, and 12 miles of Critical Stream Reaches were identified.
Thousands of acres of wetlands have been lost since pre-settlement; the associated loss of ecosystem functions has been great since that time.

Watershed Impairment Reduction Targets and recommendations

100% Critical Riparian Areas restored
Majority of riparian areas in poor condition restored
100% Critical Logjam areas have logjams removed
25% Critical Wetlands Areas restored
Macrointertebrate & fish samples showing increased stream health
Programmatic changes regarding stream cleanup activities

Measurement Indicator						
Measurement Indicator Number and extent of Management Measures (BMPs) implemented	**Milestone**				**Data source**	**Achieved?**
	Short-term (1-10 years)	Medium-term (10-20 years)	Long-term (20+ years)			
Number and extent of Management Measures (BMPs) implemented Macroinvertebrate sampling results (diversity and stream health indicators) from RiverWatch volunteers and fish sample data collected by the Illinois Natural History Survey.	81	161	242	… acres of Critical riparian areas ecologically restored (100% of Critical Riparian Areas identified)	NRCS, SWCD, contractors	
	716	1,432	2,148	... acres wetlands restored, enhanced, or created (25% Critical Wetlands) {cumulative}		
	19,360	38,720	58,080	... feet logjam removal sites (100% of the Critical Logjam Areas)		
Number of programs and participants for stream cleanup activities in the watershed.	PM	PM	A	All Illinois RiverWatch samples indicate "Good", "Fair", or "Excellent" Taxa Richness, EPT Taxa Richness, and MBI water quality scores No decrease in water quality indicated by Illinois Natural History Survey fish sampling	Illinois RiverWatch, Illinois Natural History Survey	
	PM	PM	A	Stream Cleanup Team (or similar program) established Over 20 participants annually	Counties, municipalities, non-profit organizations	

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Notes

Goal 5: Develop Organizational Frameworks to Implement Watershed Goals

Existing Conditions

There are several potential partners in the region dedicated to different aspects of water quality and stormwater management, including federal agencies, state agencies, non-profits, land trusts, and local governments.

Several potential partners have funding available for projects that would further the mission of more than one group.

Watershed Impairment Reduction Targets and recommendations

Continued support from watershed partners and stakeholders, including funding.

Programmatic changes regarding local development ordinances, and open space protection.

Measurement Indicator	**Milestone**				**Data source**	**Achieved?**
	Short-term (1-10 years)	Medium-term (10-20 years)	Long-term (20+ years)			
Number of watershed partners adopt and/or support (via a resolution) the American Bottom Watershed-Based Plan as a “guidance document”.	PM	PM	A	All watershed partners adopt and/or support (via a resolution) the American Bottom Watershed-Based Plan as a “guidance document”. Municipalities engaged and encouraged to adopt the Plan as a "guidance document".	Counties, municipalities, townships, other partners	
Number and extent of municipal ordinances that support: stormwater, flood management, green infrastructure, wetlands protection (in-lieu fee mitigation), native landscaping.	PM	PM	A	Counties adopts Flood Damage Prevention Ordinance and Riparian Buffer Ordinance All municipalities engaged to inform about the ordinances and green infrastructure, in-lieu fee mitigation programs to encourage adoption	Municipalities	
Number of new and redevelopment projects protecting sensitive natural areas/open space and creating naturalized stormwater systems. Area of land donated to a public agency/conservation organization for long-term management. Number of HOAs with rules about management of the natural areas in their bylaws.	20%	40%	60%	… of subdivision and other development proposals contain design elements from Conservation Development design, eg protection of open space and creating naturalized stormwater systems (green infrastructure)	HOAs, counties, communities, HeartLands Conservancy	
	10%	20%	30%	... new development projects donate land to a public agency/conservation organization		
	33%	67%	100%	... new HOAs' bylaws include rules about management and fees for natural areas		
	17%	33%	50%	… existing HOAs change their bylaws to include rules about management and fees for natural areas		

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Notes

Goal 6: Conduct Education and Outreach

Existing Conditions

The public engagement process for the watershed plan revealed a need for education on water quality and flooding for the general public.
Many landowners came to meetings requesting technical support and assistance with obtaining funding to implement BMPs on their land. Municipalities also need access to resources and funding to implement projects in city limits.

Watershed Impairment Reduction Targets and recommendations
Increase in number of people effectively reached by outreach efforts
Increase in resident/property owner participation watershed improvements

Measurement Indicator	**Milestone**				**Data source**	**Achieved?**
	Short-term (1-10 years)	Medium-term (10-20 years)	Long-term (20+ years)			
Number of people reached by and involved in outreach efforts related to this Watershed-Based Plan.	PM	PM	A	1,000 people (2 times the ~500 people reached in the Watershed Planning process) engaged in implementation/outreach activities annually.	Counties, municipalities, townships, NGRREC, SWCD, other partners	
Percent of education/outreach session attendees who rate presentations and other activities as good or excellent.	75%	85%	95%	… of surveyed participants each year who rated outreach session(s) or presentation(s) as good or excellent.		
Percent of education/outreach session attendees who commit to action or follow-up with a watershed partner.	25%	50%	75%	… of surveyed participants who indicate a commitment to action or contact the county, SWCD, NGRREC, HLC or other partner to make improvements on their land.		
Percent of schools that incorporate a watershed-based project or learning session.	10%	20%	30%	… of schools that included at least one American Bottom watershed-related learning experience or project each year.	Schools, School Districts, Counties	

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Notes