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HYDROLOGIC UNIT CODE 070600050307
GALENA RIVER SEGMENT IL_MQ-01



GALENA RIVER

WATERSHED-BASED PLAN: PHASE I



LEAGUE OF
WOMEN VOTERS®
of Jo Daviess County

**GALENA RIVER
WATERSHED-BASED PLAN: PHASE I
for
USGS Watershed Hydrological Unit Code 070600050307
Galena River Segment IL_MQ-01**

Compiled by Beth Baranski
for the League of Women Voters of Jo Daviess County
September, 2018

Funding for this project provided, in part, by the
Illinois Environmental Protection Agency
Through Section 319 of the Clean Water Act (#3191607)

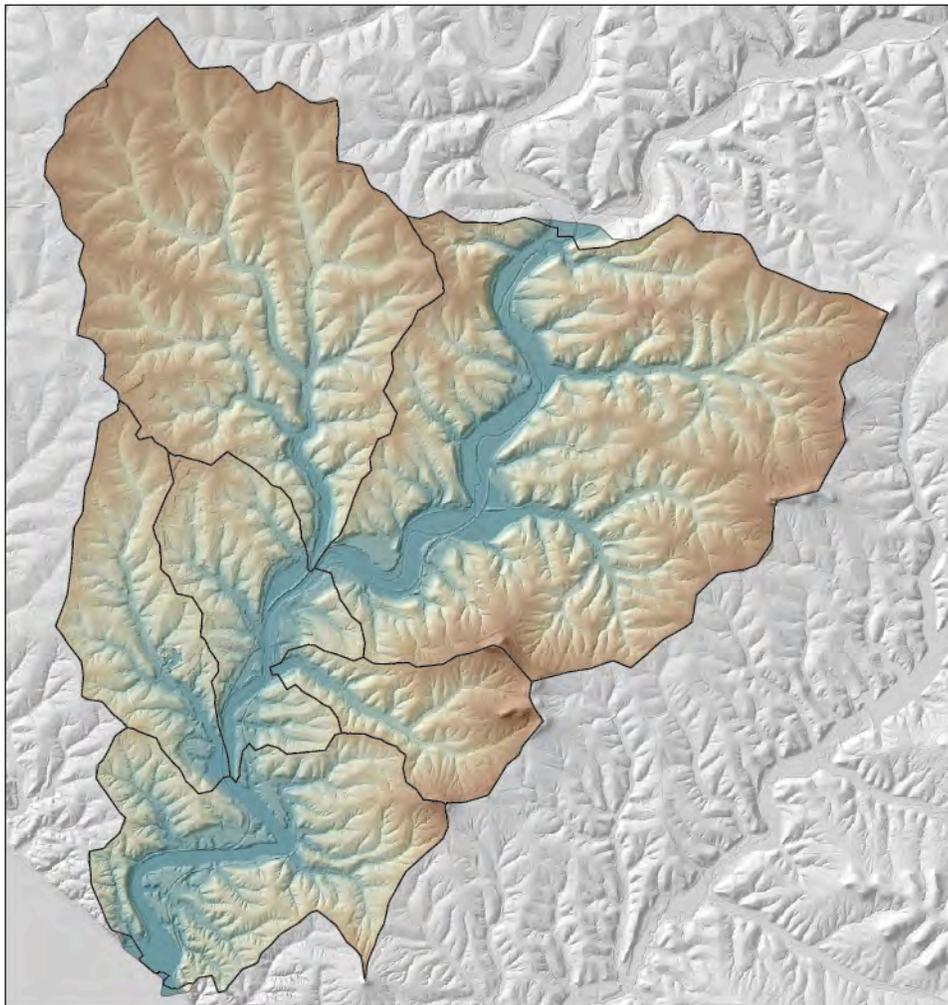


Figure 1 - Lidar image of watershed by Dr. Donald Luman, Illinois State Geological Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign.

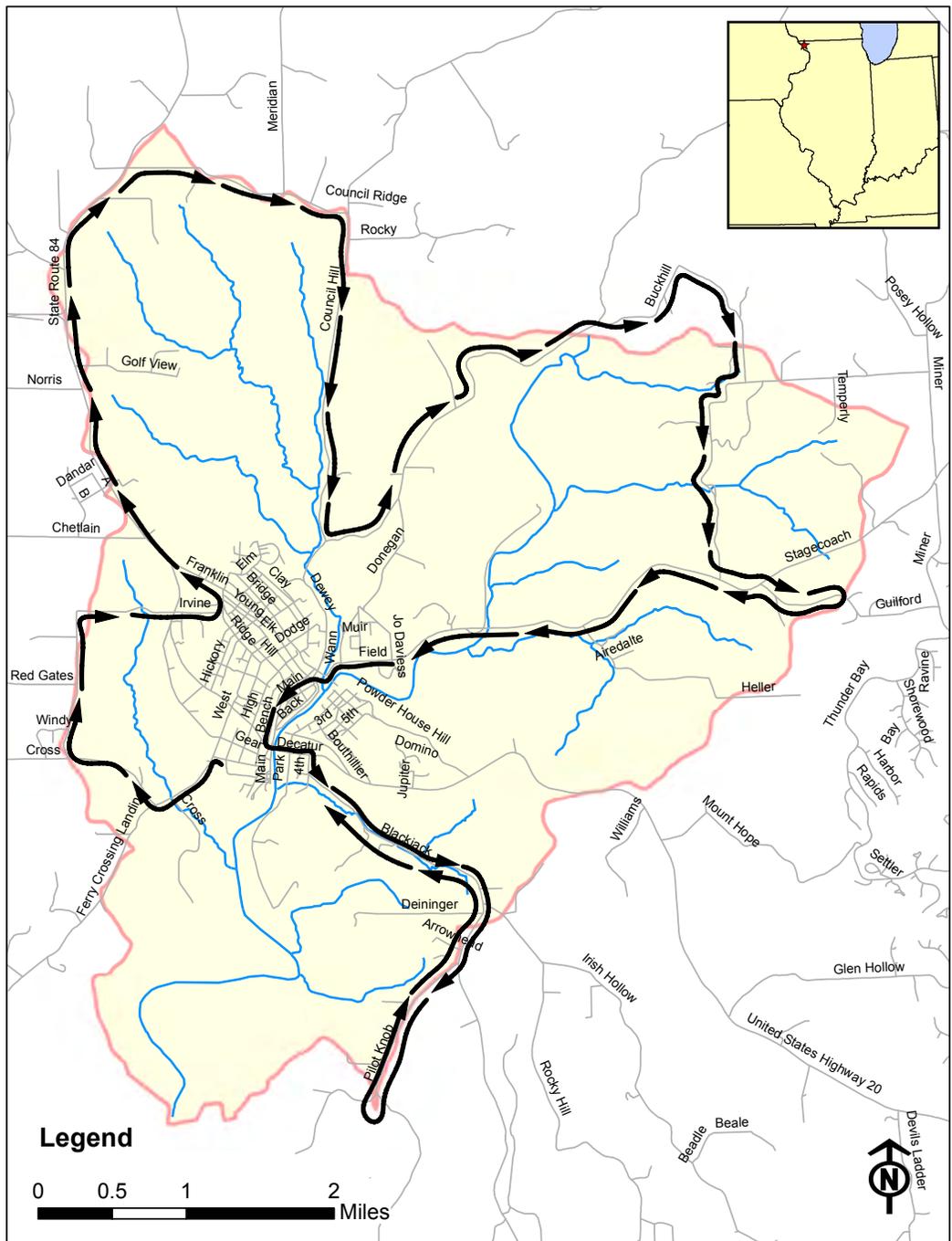


Figure 2 - Potential driving route to explore the watershed overlain on a HUC 0706000503 map created by Jo Daviess County Soil & Water Conservation District Resource Conservationist, Mike Malon for the "Galena River Watershed Resource Inventory."

GALENA RIVER WATERSHED VISION STATEMENT

As residents and property owners in the Galena River watershed, we recognize the value of our groundwater and surface-water resources.

We appreciate the important role these resources play in the ecosystem, our area's history, our economy, our future productivity, and our personal health and well-being.

We accept responsibility for the balanced management of these resources, including self-imposed limitations to enhance stormwater management, enhance groundwater management, and protect/maintain/improve water quality.

We monitor water resources to document our successful management.



Figure 3 - Mellwood Farm Spring Flow. Photo by S.V. Panno used with permission. Illinois State Geological Survey, Prairie Research Institute, University of Illinois U-C

PLANNING COMMITTEE MEMBERS



Figure 4 - Galena River Watershed-based Planning Committee. Photo by Kimberly Roark, used with permission.

Committee members as seated from left to right:

John Schultz

County Board, Farm Bureau Board,
Soil & Water Health Coalition

Larry Priske

Land Steward managing sustainable tree farm

Dan Harms

Landscape Consultant, Soil & Water Health Coalition

Charles Marsden

Engineer, Galena Boat Club President

Sandra Schleicher

Director, Jo Daviess County Environmental Health

Deb Malone

Fever River Outfitters

Judy Gratton, Committee Chair

League of Women Voters of Jo Daviess County

Mike Malon, C.P.E.S.C., C.L.M.

Army Corps of Engineers,
Jo Daviess County Soil & Water Conservation District

Beth Baranski, Project Coordinator

League of Women Voters of Jo Daviess County

**Additional biographical information about committee members
is available in Appendix A**

ACKNOWLEDGEMENTS

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Funding for this project was provided, in part, by the Illinois Environmental Protection Agency through Section 319 of the Clean Water Act. Scott Tomkins (Illinois EPA Bureau of Water, Nonpoint Source Pollution Unit) provided guidance and support critical to the planning effort. Abel Haile (Illinois EPA Bureau of Water, Planning (TMDL) Unit) coordinated the committee's participation in the development of the Galena/Sinsinawa Rivers Watershed TMDL Report. Special thanks to Chris Davis, (Illinois EPA Bureau of Water), for her ongoing support and advice.

The City of Galena allowed the committee to hold its meetings at City Hall. Mayor Renner, City Administrator Mark Moran, City staff (particularly City Engineer Andy Lewis, Zoning Administrator Matt Oldenburg, and Public Works Director Jim Rigdon), and the City Council members were essential participants in the planning process.

This plan would have been incomplete without the participation of the farmer-led Soil & Water Health Coalition including Roger Redington (Chair), Neil Timmerman, Steve Ehler, John Schultz, Dan Harms, Neal Redington, and Mike Vincent.

Essential scientific information, water sampling, data analysis, ongoing research, and mapping support were provided through the Prairie Research at the University of Illinois, Urbana-Champaign by Samuel V. Panno (Senior Geochemist, Illinois State Geological Survey), Walton R. Kelly (Head, Groundwater Section, Illinois State Water Survey), and Donald E. Luman (Principal Geologist Honorary).

Kimberly Roark contributed her energy, experience and insights to the plan's education component.

A variety of special projects that enhanced the planning effort could not have occurred without the following funding support: The Galena River water-sampling project was supported by the City of Galena, the East Dubuque Nitrogen Fertilizers Plant, The Oak Lodge Foundation, the Galena Lions Club, and the Grace Episcopal Environmental Committee. The Soil & Water Health Coalition educational event series was supported by the U.S. Fish and Wildlife Service - Fishers & Farmers Program, East Dubuque Nitrogen Fertilizers, and the Oak Lodge Foundation.

Special thanks to Patricia Grafton for writing news articles to share information about the planning process with the public, and for providing homemade baked goods (using locally-grown ingredients!) at the planning meetings.



Figure 5 - Maurie and Patricia Grafton. Document photographs by Beth Baranski unless otherwise noted, used with permission.

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Figure 6 - Seasonal views of the Galena River from the U.S. Route 20 bridge.

1.0 INTRODUCTION

In addition to general county-wide concerns about stormwater and groundwater management, the Jo Daviess County Water Resource Management Plan, completed in 2016, identified the sub-watershed area draining into the Lower Galena River (from Buckhill Road south to the Mississippi) as the first area of focus for more detailed watershed-based planning because of the number and type of impairments. The Lower Galena River has been designated by the Illinois EPA as impaired by fecal coliform, PCBs (Polychlorinated Biphenyls), sedimentation/siltation, Total Suspended Solids, zinc, and bottom deposits. These issues affect the aesthetics of the river, aquatic life, fish consumption, and recreational use. The Galena River Watershed-based Planning Committee was convened at the end of 2016 to study water resource management issues and opportunities and to produce a plan meeting the requirements of the Illinois Environmental Protection Agency 319 Grant obtained for the planning process.

The committee met for two years, gathering information at monthly meetings with presentations from Illinois EPA staff on the planning process and the Galena/Sinsinawa Rivers Watershed TMDL Report, from committee members on research on the history of land use in the watershed and the history of changes to the Galena River, from DNR staff on the history of biological sampling in the Galena River, and from Galena City staff on water resource management within the corporate limits. Audience members attending the meetings participated in the discussions and provided information important to the process.

Going beyond the monthly meetings, the committee kayaked the Galena River from Buckhill Road to Ferry Landing to study river conditions, participated in a water sampling project, studied available information on the Galena levee system, participated in the annual levee inspection, and worked with Roger Redington to bring Galena area farmers together to advise and participate in the watershed planning process.

Committee member and Resource Conservationist, Mike Malon, created the "*Galena River Watershed Resource Inventory*," an invaluable reference providing a wealth of maps and narrative information on watershed characteristics, land use practices, and drainage. The inventory also contains information derived from stream corridor assessments including valley cross-sections and descriptions of waterway conditions. Nitrogen and Phosphorous loading was estimated and sources identified, and the river impairments identified by the Illinois Environmental Protection Agency were discussed.

The committee has gathered the best available information and worked with community members, scientists, industry representatives, governmental agencies, funding sources, and service organizations to deliberate about options and approaches and to craft a plan for successfully managing water resources in the Lower Galena Subwatershed (HUC 0706000503). This document is the result of that effort.

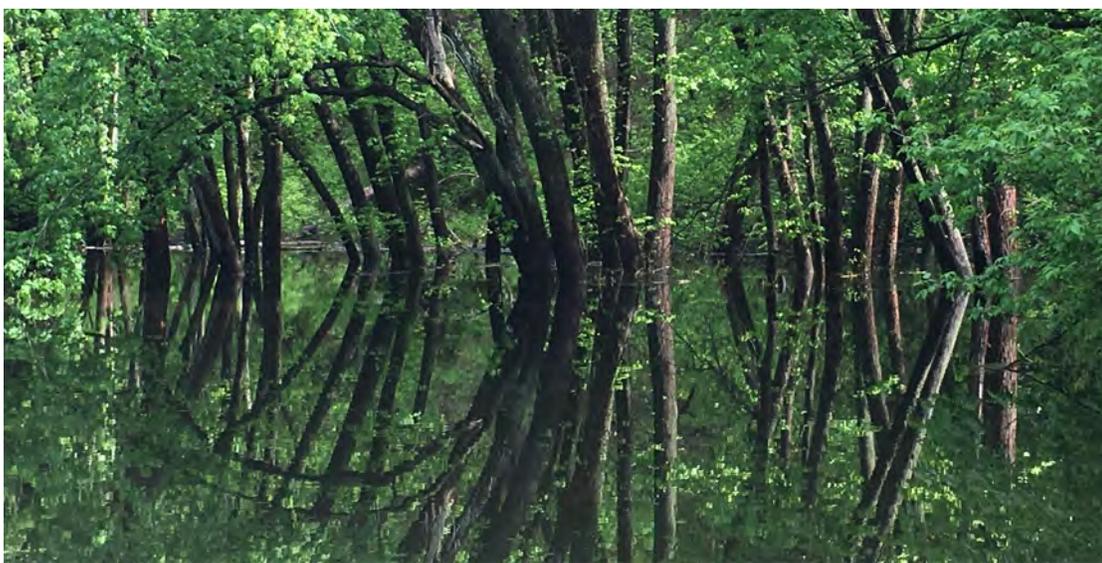


Figure 7 - Flooded banks of the Galena River.

2.0 EXECUTIVE SUMMARY

Jo Daviess County is blessed with flowing springs, plentiful waterways, and a healthy groundwater supply. These resources have been relied upon by humans in the area for drinking water, transportation, industry, and recreation for thousands of years. Perhaps because of the inherent abundance and quality, these resources have largely been taken for granted. With settlement and development come impacts that affect water resources, and this focused watershed-based planning effort is an opportunity to study, increase understanding, and address issues that have developed incrementally over time in the area draining into the lower portion of the Galena River (defined as segment IL_MQ-01). The U.S. Geological Survey's Hydrological Unit Code (HUC) for this watershed area is 070600050307.

This plan has been designed to serve as a guide for thoughtful water resource management on every acre in the watershed. More detailed information about the characteristics of the watershed is available in the *Galena River Watershed Resource Inventory* that was created as a reference for this planning process. This *Inventory* is available at the Galena Public Library, Galena City Hall and online at <http://bit.ly/2BhEKkm>.

The story of the Galena area is a rich one built upon its unique geology, glacial history and changes in human commerce. These elements have defined land uses including mining, agriculture and development that have served as the economic base for the area. All activities on a landscape affect natural resources and these land uses are no exception. Pollutants have been identified in both groundwater and surface water that affect the use of these resources. The karst hydrogeology implies a heightened level of interaction between groundwater and surface water, so both water sources must be considered. Increased precipitation, intensification of storm events and increasing run-off make stormwater management a growing imperative.

Reducing overland flow reduces both overland pollutant contributions to the waterways and flow within the waterways that can increase stream bank erosion and the associated pollutants (it's believed that 60-80% of sedimentation in the river comes from historical landscape erosion as legacy sediment eroding from the stream banks). Sediment loads can be used to trace stormwater flow. Practices that reduce sedimentation generally also reduce stormwater flow and vice versa. Estimated load reductions for Best Management Practices (BMPs) that reduce sedimentation suggest that the greatest benefits will be derived from implementing Forest Management Plans (forested areas comprise 40% of the watershed), implementing no-till and cover crops in row crop areas (13% of the watershed), increasing detention in developed areas (8% of the watershed), and strategically stabilizing streambanks.

Specific capital improvements identified to date have been prioritized using the following criteria: 1) The project reduces sediment loading in waterways; 2) The project is located in a priority area in the watershed (Hughlett Branch and the Main Stem are contributing the greatest sediment load to the Lower Galena River); 3) Landowner willingness; 4) Project planning and/or engineering status; and 5) The availability of implementation funding. Based on this process, current high priority projects are a detention basin in the Hughlett Branch subwatershed, a streambank stabilization project on Hughlett Branch, a detention basin above Hickory Street between Franklin and Fulton Streets, increased planting of cover crops, removal of a sediment island in the Main Stem, and a new canoe and kayak launch.

A broad-based understanding of watershed issues, opportunities and responsibilities is essential for effective long-term water resource management. This plan outlines an education program designed to create a community culture that understands and actively participates in water resource management in the watershed.

Finally, this plan contains checklists to be used for annual reviews. These regular reviews will be important for evaluating the success of projects that have been implemented, identifying and ranking potential projects, determining if the proposed schedule for accomplishing the plan goals is reasonable, and adapting the approach as needed. This plan is a guide, not a mandate, intended to bring those living and working in the watershed together to achieve and maintain our shared vision for water resource management.

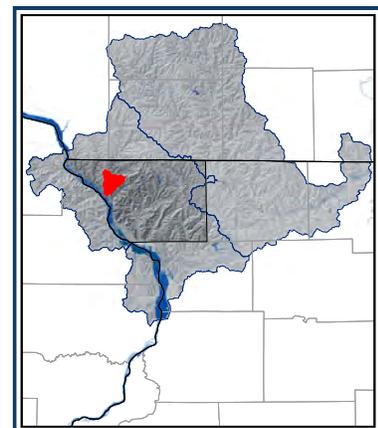


Figure 8 - HUC 0706000503 shown in red

3.0 BACKGROUND INFORMATION

3.1 A Unique Landscape

The Galena River is located within the region by-passed by ice-age glaciers and now known as "The Driftless Area." This area generally has thin fragile soils and steep slopes. As far as water resource management issues and solutions, we probably have more in common with other states in the Driftless Area than we do with the rest of Illinois.

Recognizing the value of defining areas with similar geographical features such as elevation, topography, climate, water, soils and vegetation for resource planning and management, the United States Department of Agriculture Natural Resource Conservation Service identified "Major Land Resource Areas." Jo Daviess County is located within Major Land Resource Area 105 (MLRA 105), the "Northern Mississippi Valley Loess Hills," which coincides approximately with the Driftless Area. The U.S. Department of Agriculture identified water erosion, depletion of organic matter, and poor water quality as the major resource concerns in MLRA 105.¹

The Galena River Watershed is part of a karst landscape because of the area geology.^{2,3} Bedrock in Jo Daviess County is primarily dolomite (a sedimentary rock composed of calcium magnesium carbonate). Worldwide tectonic activity has fractured the crustal rocks including the bedrock of our county. Because rainfall and snowmelt are acidic in nature, they can dissolve carbonate rock (such as limestone and dolomite). Over time (thousands to millions of years), the bedrock fractures have been enlarged, forming a network of open spaces and creating the groundwater storage area referred to as the Galena-Platteville aquifer (from which we draw our drinking water). The dissolving action has also resulted in karst features typical of karst terrains like sinkholes, caves and springs. Because of the openness of the aquifer and the relatively thin soils in the Driftless Area, surface-borne contaminants can enter the aquifer without the benefit of filtration and microbial degradation by thicker soils. Consequently, there is cause for concern that groundwater may be contaminated by constituents carried in surface water runoff.

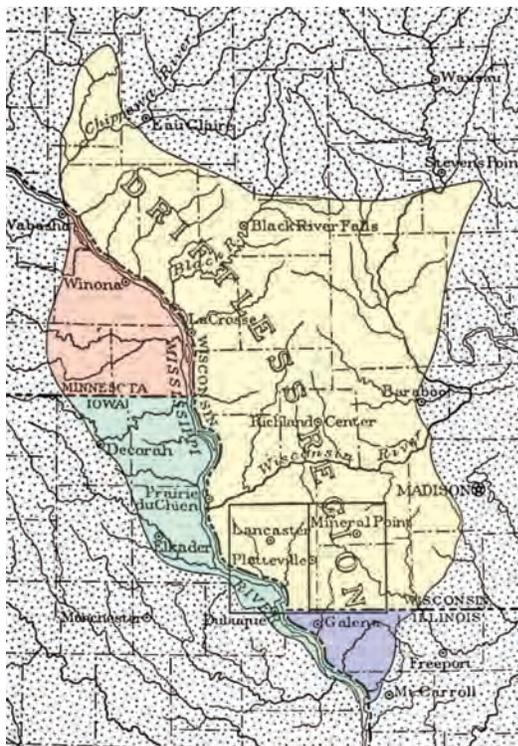


Figure 9 - Map of the Driftless Area from 1919 IGS Bulletin (color added)



*Figure 10 - Deep-rooted alfalfa finding moisture in Jo Daviess County's karst aquifer during a drought created this snapshot of fractured bedrock below our thin soils
Photo by S.V. Panno; used with permission*

3.2 History of Changes in the Landscape and to the River

The Galena River watershed as we see it today has been shaped over time by nature and by human activity, and this ongoing change is the one constant we can rely on going forward. Understanding the history of change can help us to better prepare for and manage what the future of the watershed might look like.

2,600,000 BCE - 10,000 BCE:

The Pleistocene Era was a period when continental ice sheets came down from the north (what is now Canada) and repeatedly covered parts of Illinois.⁴ The ice sheets extended to far southern Illinois, but avoided the Driftless Area due to the idiosyncrasies of the surrounding geology. The area is currently enjoying an interglacial period of warmer weather that has lasted since about 10,000 BCE.

10,000 BCE:

By about 10,000 BCE, continental ice sheets had retreated from the perimeter of the Driftless Area.⁵ Though bypassed by glaciers, our area was affected by freeze-thaw cycles and melt water that cut through the soft limestone bedrock creating bluffs and deep valleys. Northwesterly winds picked up loess from glacial deposits in Iowa and from the bed of the ancient Mississippi and deposited it in varying depths tapering from west to east, and averaging about 18 ft. This loess became the predominant soil parent material.

10,000 BCE - 1600s:

Archaeological work documents the rich pre-historic human activity in our area: early nomadic hunters and gatherers in the Paleo-Indian Period, Woodland Period cultures with extensive trade and signature mound-building, Mississippian Period culture characterized by farming and large villages, and finally the Sauk and Fox tribes that moved through the area in the 1500s and 1600s.⁶ Native Americans used fire to keep forest areas free of undergrowth to facilitate hunting, traveling, and to create berry patches. This management technique helped to establish the open oak/hickory savanna and prairie areas found by European settlers.⁷ Lead mining was also a practice of these Native Americans, who used the mineral Galena (lead sulfide, PbS), for ceremonial powder, paint, and sometimes magical charms.

1600s-Present: The earliest known map of the "Mine River" was created by Nicolas Perrot in 1690. In 1700, Pierre Charles le Seur visited the Galena mines and on a return trip to the Illinois River the next year brought back boatloads of ore. John Tyler Armstrong built the first recorded cabin in the area in 1818, and the following year Thomas H. January established the first area trading post where Hughlett Branch enters the Galena River. The federal government began issuing leases for mineral lands in 1822, initiating a rush to the lead fields. The Blackhawk War began in 1828 when the government began selling off Native American land. Chief Blackhawk's tribe fought back but their defeat ultimately led to the end of Indian resistance in the area. The federal government began selling land in 1847, further incentivizing settlement. Commerce boomed, and Galena became the largest steamboat port north of St. Louis. By 1858, Galena's population had peaked at about 14,000. Today, with a 2010 census population of just 3,429 that belies the activity of the community, Galena is a thriving tourist destination hosting over one million visitors annually.

The 1839-40 federal land survey documents that the watershed was mostly forested at that time. Soon after, the area was stripped of trees to fuel the lead smelters and to clear land for farming. The highest levels of lead and zinc residue went into the river from 1860/70 through 1955. Current residents recall that the creek that ran from the Graham Mine located off of Route 84 near Council Hill Road across Council Hill Road and into the Galena River just downstream from the Millbrig Bridge ran yellow for years and there was no plant growth on either shore. Agriculture began on a small scale in the mid-1820s. In the latter part of 1829, the slackening of lead production to create a scarcity of lead caused a three-year depression. This depression presumably resulted in an increase in agriculture. After the 1832 military suppression of tribal land claims east of the Mississippi, immigrants from Europe and the eastern United States streamed into the region to supply the boom market for agricultural produce in the mining district. From this time forward, agriculture was to overshadow both mining and manufacturing in the Galena River valley. This period is considered the beginning of the era of modern sedimentation. As you move down through the soil profile, erosion accelerates (i.e. it takes longer to erode the top 2-3" than the next 4-6"). It takes about 100 years to build an inch of soil. The heaviest siltation occurred from the 1830s to the 1850s. As a result of the mining and agricultural practices that replaced fire-managed forest and prairie areas, the river continued to experience major siltation from the early 1830s and up to the 1930s when soil conservation practices became more common in the Midwest.⁸

As the Galena River approaches the Mississippi, the grade flattens. The slower water lacks the energy to carry the sediment and it is deposited in the riverbed. Also, Lock and Dam 12 on the Mississippi at Bellevue, Iowa was put in operation in 1939, raising the water level at the mouth of the Galena River an average of 5.5 feet. The subwatershed under consideration in this plan captures the sediment and associated pollutants from the entire Galena River watershed (about 130,000 acres). Elevating the water level at the mouth of the Galena River increased the sediment and pollutants dropping out of the water as sediment. Army Corps of Engineers records referenced in 1947 suggested that the historical bottom of the Galena River at Galena lay eleven feet below modern sediment deposits at that time.⁹ While conditions have stabilized somewhat since 1947, the trend continues.

In 1843, the Galena River was reported to be 340 feet wide and three to four feet deeper than the channel of the Mississippi. In 1852, the City bought a dipper dredge and in 1854 excavated a turning basin for steamboats on the left bank at about mile 3.9. The port of Galena changed dramatically over the years. The first steamboat, the "Virginia," came up what was then called the Fever River in 1823. Historical maps show that the river was navigable six miles up from its mouth at the Mississippi. By 1834, sixty-five steamboats had made about 850 trips to the Port of Galena. Sedimentation began to affect navigation from 1827 to 1839, and dredging began to be considered. By 1854, dredging of the harbor had begun, and the dredge material was placed on the immediate shore. In some areas, the immediate shoreline is higher than further from shore for this reason and as a result of normal deposition during flood periods. In 1853, the name "Fever River" was changed to "Galena River".

The Illinois Central's first train route was established on the east side of the river in 1854, effectively creating a dike down the middle of the Galena River Watershed. Later the Northwestern ran along the west bank, but was removed in the 1940s. The Chicago Burlington & Quincy railroad crossed over the river and went up Water St. Where the railroads crossed the river, numerous pilings impeded flow and caused debris to back up. From 1840 through the 1870s, roadway and railroad bridges were built across the river. Prior to the disastrous 1937 flooding, there were seven bridges crossing the river in Galena, all of which had a negative impact on the flow of the river. Additionally, the Burlington railroad had a swing bridge near the mouth of the Galena River. This bridge was replaced with the current steel trestle bridge in 1969 after a derailment, and the new bridge has a pier in the center of the river that creates log and ice jams.

Alterations to the Mississippi and Galena Rivers have affected the water levels of the river over time, which in turn affected floodplain aggradation and waterway sedimentation. In 1870, the Harris Slough on the Mississippi was redirected into the Galena River at a point about four miles downstream from the City, connecting the Galena River two-three miles further upstream on the Mississippi and raising the level at the mouth by about one foot. In 1890 the City constructed a lock and dam at the present mouth of the Galena River just above the cut-off to Harris Slough. The lock and dam was removed in 1926. Significant sedimentation had accumulated in the pool above the dam. The sedimentation was scoured out after the lock and dam was removed. Mississippi River navigation Dam No. 12, located about eight miles below the mouth of the Galena River, was placed in operation in 1939. The effect of Dam No. 12 has been to hold an average Mississippi River water surface elevation (592.4) at the mouth of the Galena River (about 5.5 feet higher than the average before the dam). The bottom of the Galena River has risen to match the higher level of the Mississippi.

In order to protect the downtown area from flooding, levees were constructed along both banks of the Galena River in 1951.¹⁰ The levees extend 5,900 feet upstream from mile four on the east bank, and 2,800 feet from mile four on the west bank. The entrance to the downtown business district on Riverside Drive is protected by a floodgate.

The current watershed deals with physical damage from flooding, degraded recreational opportunities, poor water quality, health hazards, groundwater pollution and damage due to sediments. There is an increase in row crop production and continuous row cropping (without hay/forage crop rotation), increases in impervious surfaces, increased development, and a lack of construction-site erosion-control ordinances. On the positive side there is also growing public awareness about the issues, a return to conservation farming practices, an increase in native plantings, and more commercial and urban stormwater retention.



Figure 11 - Thought to be one of the oldest photograph of Galena, this daguerreotype was taken from Shot Tower Hill on April 5, 1852 by Alexander Hesler. Collection of Terry Miller, used with permission

3.3 Watershed Characteristics

Detailed information about the characteristics of the watershed are available in the *Galena River Watershed Resource Inventory* available at the Galena Public Library, Galena City Hall and online at <http://bit.ly/2BhEkkm>.¹¹ The highlights below have been taken from the inventory.

- ❖ As shown in Figure 12, the watershed is characterized by relatively steep slopes: The average slope for Illinois is 1.2%, Jo Daviess County has the highest average slope of any county in Illinois at 11.4%, and the Galena River watershed's average slope is 16.7%. The steepest slope areas of the watershed, shown in red, exceed 35%.

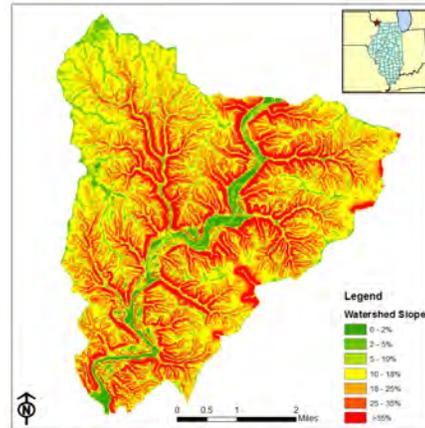


Figure 12 - Watershed Slopes

- ❖ Land uses as shown in Figure 13 (based on the 2016 National Land Cover Database) document that 40% of the watershed is forested (shown in green), 27% is grassland and pasture (shown in gold), 13% is cropped corn and soybeans (shown in brown), and 8% is developed (pink to red).

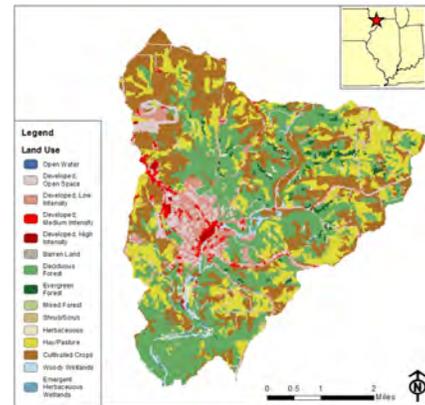


Figure 13 - Watershed Land Use

- ❖ The Lower Galena Watershed can be further broken down into land areas that drain into the tributaries that feed the Galena River within this area, as shown here. The map in Figure 14 can help us further focus management approaches based on the particular characteristics of each subarea. These subwatershed areas are referred to in this plan (in order from largest to smallest area) as the Main Stem, Hughlett Branch, Lower River, Downtown, West Galena, and Blackjack.

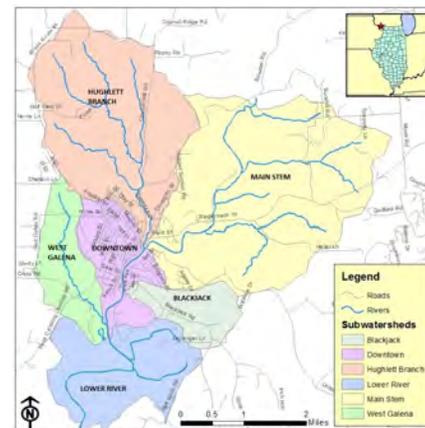


Figure 14 - Subwatersheds

- ❖ Figure 15 shows the surface bedrock in the Lower Galena Watershed. Most of area is underlain by the Galena-Platteville dolomite (shown in Yellow). The higher elevations are underlain with Maquoketa shale – shown in blue, and the highest points consisting of Silurian dolomite are shown in magenta. The area’s geology is an important consideration for effective water resource management.

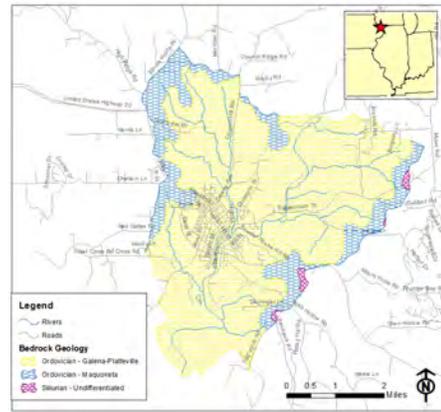


Figure 15 - Watershed Surface Geology

- ❖ Soil limitations for septic drainage fields in the watershed are presented in Figure 16. The red represents areas where the soils are very limited for septic. “Very limited” means the soil has one or more features that are unfavorable for the specified use. Yellow areas are somewhat limited. The County Environmental Health Department staff identified 462 septic systems in the subwatershed, with 122 of these systems located within the City of Galena corporate boundaries.

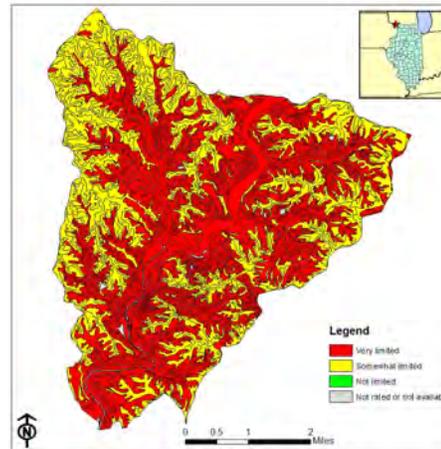


Figure 16 - Watershed Septic Limitations

- ❖ Land that has been assessed as Highly Erodible is shown in yellow on the Figure 17 map. Erodability calculations are based on the soil survey map, soil loss tolerance, and factors for water and wind erosion.

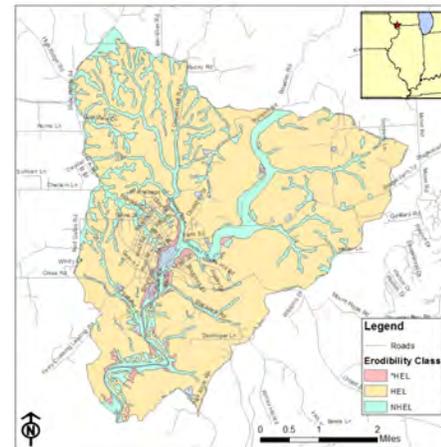


Figure 17 - Watershed Erodibility

3.4 Issues

With settlement and development come impacts that affect water resources. It's important that we understand and address issues in the watershed and learn to effectively manage water resources to ensure the area's future vitality.

We know we have stormwater management issues in our area.¹² Flooding occurs each year causing property damage and requiring costly clean-up. Unmanaged stormwater flow carries contaminants into our waterways. Erosion is a constant battle, as valuable farmland soil is lost and infrastructure stability is undermined. A trend toward more intense storm events is compounding these issues.

Surface water quality is a concern. We know that the Lower Galena River (MQ-01) has been designated as impaired by the Illinois EPA because of the levels of various pollutants that affect its use. It is impaired for fecal coliform, PCBs (Polychlorinated Biphenyls), sedimentation/siltation, total suspended solids (TSS), zinc and bottom deposits. These issues affect the aesthetics of the river, aquatic life, fish consumption, and recreational use.¹³

The Illinois Environmental Protection Agency has set total maximum daily loads (TMDLs) for zinc and fecal coliform, load reduction strategies (LRS) for sedimentation/siltation and total suspended solids (TSS), and provided recommendations for voluntarily achieving the reductions within 20 years.¹⁴

Each of the states draining into the Mississippi River has created nutrient loss reduction strategies to address the dead zone in the Gulf of Mexico. The ultimate goal is to reduce the amount of nitrogen and phosphorous lost to the river by 45%. Point sources like sewage treatment plants may see regulatory changes. The *Illinois Nutrient Loss Reduction Strategy* encourages voluntary measures for non-point nutrient sources in the landscape.¹⁵

Because our groundwater resides in a karst aquifer, it is particularly vulnerable to contamination from surface-borne pollutants.¹⁶ Dissolution of the carbonate bedrock has created a system of voids and conduits that allow for both water storage and rapid transport below grade as well as the spring, crevice, cave, and sinkhole karst terrain features prevalent in Jo Daviess County. The area has thin soils and therefore little filtering takes place before surface water enters the open aquifer system. In addition to natural connectivity between surface and ground water, an abundance of abandoned historical wells and exploratory mining drill holes in the area provide direct pathways for surface-borne contaminants to reach groundwater supplies.

Recent work by the Illinois Geological and Water Surveys (ISGS, ISWS) and the League of Women Voters of Jo Daviess County have resulted in a greater understanding of the aquifers and groundwater quality of northwestern Illinois' Driftless Area. The examination of bedrock in quarries, road cuts and croplines, and the results of sampling of groundwater from over thirty springs and private wells in the area has yielded information on the area aquifers.¹⁷ The data indicate that the Galena Dolomite is an open karst system where rainwater and snow melt enter and flow through fractures and crevices with widths ranging from hairline cracks to crevices over one foot wide. The thin soils allow surface-borne contaminants like road salt and septic effluent to flow into the aquifer unimpeded. Contaminants have been found at depths of up to 200 feet within this aquifer. Background concentrations of dissolved components of groundwater (e.g., chloride and nitrate) were calculated using a reliable statistical technique and provide a measure against which water quality samples can be compared. For example, chloride concentrations ranging from 4 to 13 mg/L, and nitrate (as nitrogen) concentrations ranging from 0.5 to 2.0 mg/L may result from natural sources. Concentrations above those ranges indicate the presence of contaminants. For example, a shallow well in the Galena area had a chloride concentration of over 100 mg/L that was determined to be from road salt contamination.



Figure 18 - Jo Daviess County Spring and Well Sampling by scientists Sam Panno and Walt Kelly to establish current groundwater chemistry

3.5 Causes and Sources of Pollution

The causes and sources of pollution in the Galena River (as identified in Table 1) can be broadly divided into two categories: legacy issues (zinc, PCBs, sedimentation/siltation) and ongoing issues (fecal coliform, sedimentation/siltation and total suspended solids (TSS), and bottom deposits). It is noteworthy that sedimentation/siltation plays a role in both categories. Though state stream nutrient standards have not been set (as of September, 2018), excess nitrogen and phosphorous are also a concern.

Impaired Use	Impairment Cause	Impairment Sources
Aesthetic Quality	Bottom Deposits	Channelization
Aquatic Life	Sedimentation/Siltation Total Suspended Solids (TSS) Zinc	Livestock (Grazing or Feeding Operations) Urban Runoff/Storm Sewers
Fish Consumption	Polychlorinated Biphenyls (PCBs)	Impacts from Abandoned Mine Lands (Inactive) Atmospheric Deposition - toxics
Primary Contact Recreation	Fecal Coliform	Source Unknown

Table 1 - Impairments in the Galena River (Segment IL_MQ-01) identified by the Illinois EPA in the Integrated Water Quality Report and Section 303(d) Lists – Volume 1 – Surface Waters - 2016

Sedimentation/Siltation and Total Suspended Solids (TSS)

The Galena River watershed has thin soils on steep slopes and nearly the entire watershed is considered Highly Erodible Land (HEL). The waterway valleys are filled with sediment that accumulated when the area was deforested to fuel lead smelters, and before farmers had implemented soil conservation practices. Studies conducted in other areas of the Driftless Region suggest that 60-80% of sediment loads are coming from legacy sediment eroding from streambanks. Several geomorphic processes affect the amount of streambank erosion, but it is generally true that increases in flow increase streambank erosion and legacy sediment loading. Streambank erosion issues are significantly exacerbated when livestock have access to waterways.

Current stormwater flow (overland and through the City of Galena's stormwater system) carries sediment and those contaminants that adhere to the soil particles (phosphorous, zinc) as well as contaminants in solution (e.g. nitrogen). Reducing stormwater flow reduces both overland pollutant contributions to the waterways and flow in the waterways that can increase streambank erosion of legacy sediment. Sediment loads can be considered "tracers" for stormwater flow, and those practices that reduce sedimentation generally also reduce stormwater flow.

Estimated load reductions for various practices suggest that the greatest source of sediment after legacy bank sediment is coming from unmanaged forested areas (40% of the watershed, about 6,800 acres). Row-cropped areas (13% of the watershed, about 2,500 acres) are another source of sediment. Developed areas (8% of the watershed, about 800 acres) are an issue as well, as concentrated stormwater flow and associated sediment and contaminants are discharged into the river.¹⁸

Zinc

Lead and zinc were deposited in bedrock fractures of the area some 270 million years ago by hot brines migrating through the rocks of the area. The lead and zinc supported a vigorous mining economy from the 1840s through the closing of the last area zinc mine in 1979 (lead mining peaked in 1845 and zinc mining peaked in 1917). The mining companies that closed before 1974 were not held responsible for mine-waste clean-up. Evidence of mining activity can still be seen today with surface mine sucker holes, exploratory drill holes, abandoned wells, and tailing piles.

Studies of zinc in Galena River sediments conducted by and under the direction of Dr. Robert T. Pavlowsky of the University of Missouri document that Galena River sediment is heavily contaminated with zinc, that there is little difference between contamination levels of the river bank and bed sediments, and that there has been a statistically insignificant change in the zinc sediment levels over the past 25 years.¹⁹ The zinc associated with stormwater runoff through tailing piles and the sediment contaminated with zinc are the potentially treatable sources of dissolved zinc impairing the Galena River. Run-off from tailing piles, bank erosion of legacy sediments, movement of riverbed bottom deposits, and urban run-off contribute to the dissolved zinc levels in the river.

Fecal Coliform

Sources of fecal coliform in the Galena River include human, livestock, pet and wildlife waste.

High fecal coliform counts recorded during dry weather are associated with permitted discharges from municipal wastewater treatment facilities and failing septic systems. Water samples were collected on the Galena River and at the mouth of tributaries that feed into the Galena River in August of 2017 during low flow conditions. Chemical analysis was conducted to establish whether the primary source of nitrate in the river was chemical fertilizer or animal waste. The nitrate levels were found to be about what would be expected in the natural environment (0.5 to 2.0 mg/L), however elevated concentrations of *E. coli* and concentrations of caffeine indicate input from septic effluent.²⁰

The Galena South Sewage plant is the only domestic wastewater treatment facility discharging within the watershed under study. The facility currently has a maximum permit limit for fecal coliform of 400 cfu/100 ml (applicable only from May through October). However, Illinois EPA is in the process of working with permittees in TMDL watersheds to lower permit limits for domestic wastewater treatment facilities to a geometric mean of 200 cfu/100 ml.

Agricultural livestock are a fecal coliform source. The extent of the contribution varies depending on the particular livestock settings being used (managed pasture, over-grazed pasture, confined livestock adhering to a Comprehensive Nutrient Management Plan or equivalent plan, or confined livestock in aged or inadequate facilities). Adjacency and access to waterways is also a factor.

Pet waste is often a fecal coliform source concern in watersheds. The City of Galena has proactively addressed pet waste with leash laws and the provision of free pet waste disposal bag dispensers along walkways throughout the community.

Animal waste from wildlife is inevitable. Of note is the fact that a 2017 community survey related to the deer population within the corporate limits revealed significant concerns about excessive deer feces in residential areas. The City is in the process of implementing a multi-pronged program to reduce negative deer impacts in the City.

Polychlorinated Biphenyls (PCBs)

PCBs belong to a broad family of man-made organic chemicals that were domestically manufactured from 1929 until manufacturing was banned in 1979. PCBs are considered a bio-accumulative chemical of concern because concentrations accumulate in biological organisms at higher and higher levels as they move up the food chain. The Galena River is impaired for fish consumption because of the levels found in the tissue of fish in the river. The Illinois EPA is not currently developing TMDLs (Total Maximum Daily Loads) for PCBs.

Though there may be multiple historical industrial sites with PCB contamination, two electric substations have been identified as highly likely sources. The southernmost station site is located directly on the river within the watershed. A Site investigation of this site was completed in April of 2018 and a determination made that it should be dropped from further Superfund site consideration, and it received a "No Further Remedial Action Planned" (NFRAP) qualifier.²¹

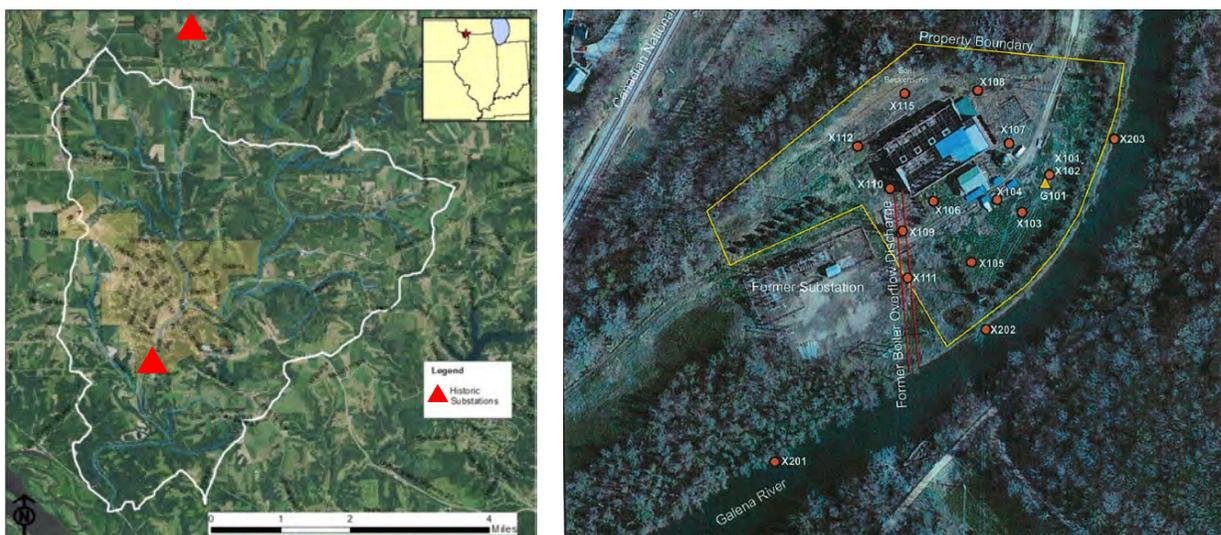


Figure 19 - Map showing locations for two known substations. Sediment sampling has been conducted at the southernmost site by Bruce Everetts, Illinois EPA (results report pending)

Nitrogen & Phosphorous

The Illinois Nutrient Loss Reduction Strategy estimates proportionate sources of total nitrogen in the Mississippi River as follows: 82% agricultural, 16% point sources, and 2% urban runoff. Total phosphorous source contributions are estimated to be as follows: 48% agricultural, 48% point sources, and 4% urban runoff. Human waste from treatment facilities is a point-source contribution that will be reduced through regulation. Non-point sources contributions from human waste (failing septic systems), animal waste (primarily livestock), and chemical fertilizers are to be reduced through voluntary actions such as those recommended in this watershed plan.

In the Science Assessment portion of the *Illinois Nutrient Loss Reduction Strategy*, the Northern Mississippi Valley area (USDA Major Land Resource Area 105), in which Jo Daviess County is located and makes up the greatest part of the Illinois portion of this area, is assumed to be primarily non-tiled land (land without subsurface drainage tile). Extrapolating from available data, 31.3 lbs. of Nitrogen (in the form of nitrate) was estimated to be lost per row crop acre per year. This is the highest rate of loss shown in the state for non-tiled areas (the next highest is 11.8 lbs. lost).²² The Science Assessment also notes “The largest manure phosphorous rate was...in northwestern Illinois, where there was a high density of livestock.”

Given the karst terrain in Jo Daviess County, it may be possible that the nitrogen losses per row crop acre are unusually high for non-tiled areas because the subsurface drainage of the karst terrain behaves like a tiled area. The Strategy notes that higher nutrient loss values tend to be found in tiled areas “except...the northwestern corner of Illinois. This is a karst region with high livestock density, and the high nitrate-nitrogen yield may be explained by these factors.”²³

Road Salt

Road deicers are dominated by NaCl (road salt) and have been generously applied to roadways in northern Illinois during the winter since the early 1960s. This approach to providing dry, ice-free roadways has resulted in elevated concentrations of sodium and chloride in groundwater and surface water in a large part of the northeastern U.S. including the Driftless Area. Elevated levels of Na and Cl in natural waters has been linked to damage of land and aquatic plants and aquatic invertebrates, and can make drinking water supplies non-potable. Water samples collected from the tributaries of the Galena River contain elevated chloride ion concentrations as high as 79 mg/L; this is well above the 1 to 13 mg/L background concentration range calculated for Northwestern Illinois’ Driftless Area.²⁴

Pharmaceuticals and Personal Care Products (PPCPs)

In August 2017, water samples were collected from eight locations in the Galena River and tributaries to determine the presence of PPCPs. The greatest concentrations were measured downstream of the town of Galena and the Waste Water Treatment Plant. The most common of the compounds analyzed for was carbamazepine, prescribed for epilepsy and neuropathic pain. All of the compounds analyzed for are indicators of human waste and they were present for all sites sampled along the Galena River indicating the ubiquitous nature of human waste and PPCPs within the river.²⁵

Microfibers and Microplastics

Recent collaborative research by the University of Illinois’ Prairie Research Institute, Loyola University and the League of Women Voters of Jo Daviess County has shown the presence of microplastics in groundwater of Illinois’ Driftless Area.²⁶ Water samples were collected from springs and shallow wells in the Galena River watershed and all but one of these samples contained microfibers. Microplastics are a relatively new class of emerging contaminants found in soils and surface waters (rivers, lakes, oceans) throughout the world and consist primarily of microfibers (synthetic fibers such as polyesters typically used in clothing, upholstery, etc.). Whereas these materials are commonly found in surface water environments, this is the first time that these contaminants have been found in aquifers. The researchers suggest that the microfibers and PPCPs are entering the aquifers of the Driftless Area as a component of septic effluent. They also suggest that the microfibers may be a reliable indicator of a karst aquifer.

Cyanide

Cyanide was used in mining operations to separate lead and zinc from rock material through flotation beginning in 1922 when the Sheridan-Griswold process was introduced. Locally, cyanide was known to have been used for this purpose at the Graham, Shullsburg and Blackjack mines. The Graham and Shullsburg mine areas drain into the Galena River (the Blackjack mine area drains into Small Pox Creek).

Septage

Septage is the liquid and solid material pumped from a septic tank, cesspool, or other primary treatment source. Concerns and questions have arisen regarding the potential negative impacts related to land application of septage in a karst area. Additional information is needed to assess and address these concerns and questions. As of September of 2018, there are no wastewater treatment plants in Jo Daviess County accepting septage waste. Many septage haulers bring waste to treatment facilities in Dubuque or Freeport. Land application taking place in the county is monitored by the County Health Department.

4.0 EDUCATION PROGRAM

A broad-based understanding of watershed issues, opportunities and responsibilities is essential for effective water resource management. The Education Program for the Galena River Watershed is designed to increase awareness of the importance of water resource management through an ongoing process of shared learning. The plan builds on educational efforts that precede the development of the watershed-based plan, and integrates existing institutions, events and tools into a meaningful whole. The program is designed for the entire watershed community, and recognizes that proactive measures will need to be taken to reach various sectors of the community. The overriding intention of the program is to create a broad-based community culture that understands and actively participates in water resource management in the watershed.

A "Watershed Moments" program will be created that can be brought to various venues. One aspect of the program could be a presentation about watersheds in general and about the Galena River watershed in particular, followed by a rain simulator demonstration, and then an opportunity for event participants to play the "Watershed Game." The short initial presentation will be designed to provide basic background information. The rain simulator is a tool that provides a dramatic comparative illustration of the infiltration and run-off rates of various land use practices. The "Watershed Game" is a fun, interactive game in which participants play on land-use teams, work together using their limited resources, purchase best management practices, and achieve pollutant load reductions in the watershed. The League of Women Voters of Jo Daviess County has purchased versions of the "Watershed Game" (2 stream, 1 river, 1 lake, and a classroom version). The games are stored at the Jo Daviess County Environmental Health office and can be checked out by the individuals in the county who have received training to facilitate the game. A list of trained facilitators is available at the County Environmental Health office for anyone who is interested. Public "Watershed Moments" will be scheduled at various venues to reach as many people as possible. The program will be brought to the high school Biology and Agriculture Education classes. Working with the University of Minnesota Extension, the creator of the "Watershed Game," a Spanish version will be created. Working with bi-lingual University of Illinois Extension Educators, "Watershed Moments" will be offered to the growing Latinx population. Special outreach to low-income residents will be undertaken through the group Women and Friends Making a Difference.

A Galena-area farmer-led group, the "Soil & Water Health Coalition," was organized to explore and discuss best management practices in the area. They have created an educational series on best management practices for farmers scheduled through March of 2019. Topics include timber management, no-till, cover crops, nutrient management, erosion control, livestock management, cost-share programs, and more. Field days are included in the events when appropriate. The group is considering expanding to a countywide scale with plans to continue educational events once the original series has been completed.

In addition to providing information about conditions in the watershed, volunteer monitoring is an important learning opportunity. Efforts will be made to increase participation in the RiverWatch volunteer biological monitoring program operated through the National Great River Research and Education Center in Alton, Illinois. In addition, an "Adopt a Stream" photo-monitoring program will be initiated in the watershed, in which "Branch Managers" submit pictures of a particular waterway location to document conditions over time.

The watershed community will be engaged in other ways as well. Informational signage will be provided at the subwatershed boundaries and at sites that demonstrate best management practices (BMPs). A competition in which the public is asked to submit photographs of best management practices in the watershed will be used to document practices, increase awareness of these practices, and collect images to be used to promote practices. Watershed information will be presented each year at the Galena Earth Day Fest, including such topics as biological and water quality monitoring, stream management, buffer strips, reducing use of lawn chemicals (pesticides and phosphorus fertilizers), nutrient management, soil testing, adoption of best practices from septic system research and development, proper septic system maintenance, the benefits of deep-rooted native perennials, using graywater, installation of water-saving devices and appliances, the relationship between energy use and water, and overall water conservation. Information about the local hydrology, karst terrain and interaction between surface and ground water will be sought and shared.

In order to continue the educational benefits that the watershed-based planning process has provided, a stakeholder group will be formally identified to carry out the plan implementation. Websites, social media and press releases will be used to publicize meetings and upcoming events, and to provide resource links. There will also be email updates and information on best management practices sent to our growing contact list. Presentations will be made to local governing boards on the progress being made on plan implementation and on monitoring results received over time.

5.0 POLLUTION REDUCTION GOALS/EXPECTATIONS

Our Galena River Watershed goals (below) are designed to achieve our vision (see p. ii) for the watershed. The goals should be considered together as a holistic approach to managing water resources in the watershed. As subtexts to every aspect of the plan, all segments of the watershed community should be intentionally involved in plan implementation, and ecological diversity should be a project design consideration.

The Implementation Schedule in Section 6 incorporates SMART (Specific, Measurable, Attainable, Relevant and Timely) prioritized objectives under each goal. When the objectives address Best Management Practices (BMPs), estimates of the expected resulting sediment, nitrogen, and phosphorous load reductions are included. The implementation tables also include anticipated timeframes for completing the objectives. Descriptions of recommended best management practices and the identification of specific project examples are provided in Section 7. Additional tables are provided to document financial and technical needs and opportunities in Section 8. Goal checklists are provided in Appendix B to track actual progress.

An adaptive management approach will be used whereby objectives will be assessed and modified as needed over time to meet the goals.

Goal 1: Improve Water Quality

This goal reflects an understanding of the Galena River's inclusion on the list of impaired waters created by the Illinois EPA to satisfy Section 303(d) of the Clean Water Act, the need to reduce nitrogen and phosphorous entering the Mississippi River to reduce Gulf of Mexico hypoxia, and growing concern about the cumulative effects of road salt and other contaminants such as pharmaceuticals and personal care products (PPCPs), and microplastics.

Goal 2: Increase Infiltration and Stormwater Storage to Reduce Runoff and Flooding

This goal is intended not only to address current flooding, erosion, and water quality issues, but also to deal with the impact that increasing precipitation and storm intensity trends are predicted to bring going forward.

Goal 3: Protect and Preserve Groundwater

This goal recognizes the fact that all in the watershed rely on groundwater for our drinking water, that high-quality groundwater is a limited resource, and that karst aquifers in our watershed are particularly vulnerable to contamination from surface-borne pollutants.

Goal 4: Enhance Water-based Recreation

This goal underscores the role the Galena and Mississippi Rivers play in providing recreational opportunities for residents and tourists as well as the social and economic importance of these activities.

Goal 5: Update and Integrate Government Plans, Policies, and Regulations at All Levels

This goal recognizes the responsibility that all governing bodies have for water resource management and the need for thoughtful coordination in order to achieve long-term success.

Goal 6: Develop and Maintain Ongoing Activities for Shared Watershed Learning

This goal supports the thinking that broad-based understanding of watershed issues, opportunities and responsibilities is essential for effective water resource management.

Goal 7. Monitor Water Resource Management Outcomes and Adapt Practices as Needed

This goal is required to measure the effectiveness of the efforts undertaken, to remain aware of issues that may arise, and to allow for appropriate new measures as needed to achieve goals.

Goal 8: Ensure Functional and Financial Sustainability of Galena River Watershed-based Planning

This goal recognizes the need to dedicate human resources and funding resources to achieve successful long-term water resource management in the Galena River watershed.

6.0 IMPLEMENTATION SCHEDULE

Goal 1: Improve Water Quality													
Objectives to Achieve Goal		Phase 1				Phase 2				Phase 3			
		5 Years 2019 - 2023				5 Years 2024 - 2028				10 Years 2029 - 2038			
Objective I.D.	Task/Best Management Practice	No. of Units	N Reduction	P Reduction	Sediment Reduction	No. of Units	N Reduction	P Reduction	Sediment Reduction	No. of Units	N Reduction	P Reduction	Sediment Reduction
1a	Explore options to reduce road salt use	N/A	0	0	0	N/A	0	0	0	N/A	0	0	0
1b	Identify, prioritize, and stabilize stream banks	12,000 feet	1,644 lbs/year	804 lbs/year	804 tons/year	12000 feet	1,644 lbs/year	804 lbs/year	804 tons/year	21,400 feet	2,932 lbs/year	1,434 lbs/year	1,434 tons/year
1c	Identify, prioritize and improve riparian buffers	25 acres	675 lbs./year	350 lbs./year	350 tons/year	25 acres	675 lbs./year	350 lbs./year	350 tons/year	50 acres	1,350 lbs./year	700 lbs./year	700 tons/year
1d	Create program to upgrade septic systems	for 10 people	60 lbs/year	23 lbs/year	0.05 tons/year	for 10 people	60 lbs/year	23 lbs/year	0.05 tons/year	for 20 people	120 lbs/year	46 lbs/year	0.10 tons/year
1e	Reduce livestock access to waterways and forested areas	1 land-owner	To Be Determined	To Be Determined	To Be Determined	1 land-owner	To Be Determined	To Be Determined	To Be Determined	2 land-owners	To Be Determined	To Be Determined	To Be Determined
1f	Take steps to control legacy contaminants (e.g. PCBs, zinc)	N/A	Unknown	Unknown	Unknown	N/A	Unknown	Unknown	Unknown	N/A	Unknown	Unknown	Unknown
1g	Remove Galena River segment IL_MQ-01 from list of impaired waters	N/A	0	0	0	N/A	0	0	0	N/A	0	0	0
			2,379	1,177	1,154.05		2,379	1,177	1,154.05		4,402	2,180	2,134.1

Table 2 - Implementation Schedule for Goal 1



Figure 20 - Among the water quality concerns in the watershed are road salt and other urban contaminants, livestock in forested areas and along waterways, and legacy sediment eroding from streambanks.

Goal 2: Increase Stormwater Infiltration and Storage to Reduce Runoff and Flooding													
Objectives to Achieve Goal		Phase 1 5 Years 2019 - 2023				Phase 2 5 Years 2024 - 2028				Phase 3 10 Years 2029 - 2038			
		No. of Units	N Reduction	P Reduction	Sediment Reduction	No. of Units	N Reduction	P Reduction	Sediment Reduction	No. of Units	N Reduction	P Reduction	Sediment Reduction
2a	Increase adoption of Forest Management Plans	25 plans	0	0	0	25 plans	0	0	0	50 plans	0	0	0
2b	Increase acreages on which Forest Management Plans are implemented	250 acres	23,050 lbs./year	11,525 lbs./year	11,525 tons/year	250 acres	23,050 lbs./year	11,525 lbs./year	11,525 tons/year	500 acres	46,100 lbs./year	23,050 lbs./year	23,050 lbs./year
2c	Increase row crop acreages doing true, constant no-till	250 acres	3,750 lbs./year	2,000 lbs./year	1,925 tons/year	250 acres	3,750 lbs./year	2,000 lbs./year	1,925 tons/year	500 acres	7,500 lbs./year	4,000 lbs./year	3,850 tons/year
2d	Increase row crop acreages incorporating cover crops *	250 acres	3,250 lbs./year	6,500 lbs./year	1,725 tons/year	250 acres	3,250 lbs./year	6,500 lbs./acre	1,725 tons/year	500 acres	6,500 lbs./year	13,000 lbs./year	3,450 lbs./year
2e	Convert row crop areas to perennial crops	25	1,435 lbs./year	600 lbs./year	578 tons/year	25	1,435 lbs./year	600 lbs./year	578 tons/year	50	2,870 lbs./year	1,200 lbs./year	1,156 tons/year
2e	Increase permeability of existing surfaces in developed areas	1,000 sq. ft.	0.36 lbs./year	0.02 lbs./year	0.01 tons/year	1,000 sq. ft.	0.36 lbs./year	0.02 lbs./year	0.01 lbs./year	2,000 sq. ft.	0.72 lbs./year	0.04 lbs./year	0.02 lbs./year
2f	Convert acreage of turf grass to deep-rooted perennials	1 acre	2.4 lbs./year	0.4 lbs./year	0.113 tons/year	1 acre	2.4 lbs./year	0.4 lbs./year	0.113 tons/year	2 acres	4.8 lbs./year	0.8 lbs./year	0.226 tons/year
2g	Increase square footage of rain gardens	200 sq. ft.	344 lbs./year	96 lbs./year	80 tons/year	300 sq. ft.	516 lbs./year	144 lbs./year	120 tons/year	500 sq. ft.	860 lbs./year	240 lbs./year	200 tons/year
2h	Increase acreages controlled by detention basins	20 acres	265 lbs./year	132 lbs./year	90.1 tons/year	20 acres	265 lbs./year	132 lbs./year	90.1 tons/year	40 acres	530 lbs./year	264 lbs./year	180.2 tons/year
			30,661.76	20,253.42	15,345.22		30,833.76	20,301.42	15,385.22		61,495.52	38,554.84	28,805.45

Table 3 - Implementation Schedule for Goal 2

*RUSLE2 software was used to model the nutrient and sediment reductions estimated here. Field experience suggests the actual reductions for our area may be as little as a third of these estimations.

FARMERS ARE INVITED

to a free morning Ag Economics program and lunch being offered from 9-12:30 on Wednesday, December 13th in the recently re-designed Ehrler Ranch Special Event Center at 11866 W. Chetlain Lane in Galena. Doors open at 8:30 a.m.

Presenters:

- Paul Dietmann, Badgerland Financial "Setting Your Farm Up for Financial Success"
- Kevin DeWen, Woodland Forestry "Current Timber Markets"
- Grant McCarty, U of I Extension "Alternative Crop Systems and Opportunities"

This program is the first in a series being offered by Galena-area farmers working with the League of Women Voters of Jo Daviess County. Program planners include Roger Redington, Dan Harms, John Schultz, Steve Ehrler, Neil Timmerman, Neal Redington, Mike Vincent and Beth Baranski. Program expenses are supported by a USFWS Fishers & Farmers grant and East Dubuque Nitrogen Fertilizers, LLC.

For questions, call Roger Redington at 815/777-0505 or Beth Baranski at 563/580-6192.



FARMERS ARE INVITED

to a free morning program and lunch being offered from 9:00 a.m. - 12:30 p.m. on Tuesday, January 16th at the Elizabeth Community Building at 402 West Street, Elizabeth, IL. Doors open at 8:30 a.m.

Presenters:

- Jerry Hatfield, National Laboratory for Agriculture and the Environment "Water Quality & Agricultural Systems: Linking All of the Pieces Together"
- John Musser, Certified Crops Advisor / Specialist, Stevenson Service Co. "Nutrient Management as a System Using Split Applications"
- Jerry Klemish, Agronomist, Innovative Ag Services "Reducing Runoff"

This program is the second in a series being offered by Galena-area farmers working with the League of Women Voters of Jo Daviess County. Program planners include Roger Redington, Dan Harms, John Schultz, Steve Ehrler, Neil Timmerman, Neal Redington, Mike Vincent, and Beth Baranski. Program expenses are supported by a USFWS Fishers & Farmers grant and East Dubuque Nitrogen Fertilizers, LLC.

For questions, call Roger Redington at 815/777-0505 or Beth Baranski at 563/580-6192.



SOIL & WATER HEALTH EVENT

Farmers are Invited

to a free morning program and lunch being offered from 9:00 a.m. - 1:00 p.m. on Wednesday, February 21st at the Ramada Galena Hotel, 11383 U.S. 20, Galena, IL. Doors open at 8:30 a.m.

- Impacts of Agriculture on Water Quality
Dr. Dennis Busch, Senior Scientist, UW-Platteville
- Experimenting to Achieve Cover Crop Success in Northwest IL
Greg Thoren, Jo Daviess County Farm Bureau Board Member
- Innovative Cover Crop Approach with Cattle Exposure
Dan Shellam, Hazel Green Farmer
- No Till: Learn How to Make it Work Before You're Forced to Make it Work
Andy Hawley, Jo Daviess County SWCD Chairman
- Water Resource Planning for Apple Canyon Lake Resort, the Galena Area, & Northwest Illinois

For questions, call Roger Redington at 815/777-0505 or Beth Baranski at 563/580-6192.



SOIL HEALTH & WATER QUALITY EVENT

Farmers are Invited

to a free morning program and lunch being offered from 10:00 a.m. - 1:00 p.m. on Tuesday, March 6th at the Ehrler Special Event Center 11866 West Chetlain Lane, Galena, IL. Doors open at 9:30 a.m.

Toolshed Meeting on Cover Crops

For questions, call Roger Redington at 815/777-0505 or Beth Baranski at 563/580-6192.



No-till Field Day

All are welcome!

5:00 - 6:30 p.m. on Tuesday, June 19th
Meet at Mel Gratton's house
7914 U.S. Route 20 West, Galena, IL

Following presentations by Mel Gratton, Steve Ehrler, and Paul Searl (NRCS) about the no-till practices that have been employed on this farm for over 30 years, attendees will be able to compare the no-till field soil with that of an undisturbed fence row in a pit that includes both areas.

When the field events have concluded (at about 6:30 p.m.), attendees are invited to Happy Joe's for pizza. After supper, a short meeting will be held to discuss the expansion of the Galena-area farmer-led group to a countywide entity.

For questions, call Roger Redington at 815/777-0505 or Beth Baranski at 563/580-6192.



Figure 21 - Notifications for first five programs offered by the Soil & Water Health Coalition, a farmer-led group in the Galena area.

Goal 3: Protect and Preserve Groundwater				
Objectives to Achieve Goal		Phase 1	Phase 2	Phase 3
		5 Years 2019-2023	5 Years 2024-2028	10 Years 2029-2038
Objective I.D.	Task	No. of Units	No. of Units	No. of Units
3a	Document increased rain barrel, cistern, and/or retention pond water use	5 instances	5 instances	10 instances
3b	Locate and seal abandoned wells	25	25	25
3c	Locate and seal exploratory mining drill holes	1	1	1
3d	Participate in Rock River Groundwater Assessment	N/A	N/A	N/A

Goal 4: Enhance Water-based Recreation				
Objectives to Achieve Goal		Phase 1	Phase 2	Phase 3
		5 Years 2019-2023	5 Years 2024-2028	10 Years 2029-2038
Objective I.D.	Task	No. of Units	No. of Units	No. of Units
4a	Construct Galena canoe and kayak launch on west river bank south of Rte. 20	1 instance	N/A	N/A
4b	Include smallmouth bass habitat improvements in streambank stabilization projects	2 projects	2 projects	22 projects

Goal 5: Update and Integrate Government Plans, Policies, and Regulations at All Levels				
Objectives to Achieve Goal		Phase 1	Phase 2	Phase 3
		5 Years 2019-2023	5 Years 2024-2028	10 Years 2029-2038
Objective I.D.	Task	No. of Units	No. of Units	No. of Units
5a	Update comprehensive plans to support watershed goals	2 City & County	2 City & County	2 City & County
5b	Update/adopt stormwater management ordinances to support watershed goals	2 City & County	2 City & County	2 City & County
5c	Update building & zoning ordinances to support watershed goals	2 City & County	2 City & County	2 City & County
5d	Incorporate practices that increase stormwater infiltration and storage into capital improvement plans	3 City, Twp., & County	3 City, Twp., & County	3 City, Twp., & County

Tables 4 through 6 – Implementation Schedules for Goals 3 through 5



Figure 22 - An effective example of rain barrel use in the watershed

Goal 6: Develop and Maintain Ongoing Activities for Shared Watershed Learning				
Objectives to Achieve Goal		Phase 1	Phase 2	Phase 3
		5 Years 2019-2023	5 Years 2024-2028	10 Years 2029-2038
Objective I.D.	Task	No. of Units	No. of Units	No. of Units
6a	Install signage to demarcate watershed boundaries	N/A	5 signs	N/A
6b	Offer watershed tours and /or river eco-trips	3 times	5 times	10 times
6c	Present watershed community education and outreach program	5 times	5 times	10 times
6d	Maintain annual watershed booth at Galena Earth Day Fest	5 times	5 times	5 times
6e	Expand volunteer stream monitoring in watershed	1 locale	1 locale	2 locales
6f	Share Galena River Watershed-based plan with local boards as a possible template	1 board	1 board	2 boards
6g	Create watershed model and keep current with available date	1 create and update model	1 update model	1 update model
6h	Update and share annual assessments of watershed conditions with the public	5 times	5 times	10 times

Goal 7: Monitor Water Resource Management Outcomes and Adapt Practices as Needed				
Objectives to Achieve Goal		Phase 1	Phase 2	Phase 3
		5 Years 2019-2023	5 Years 2024-2028	10 Years 2029-2038
Objective I.D.	Task	No. of Units	No. of Units	No. of Units
7a	Track Illinois EPA monitoring data	N/A	N/A	N/A
7b	Maintain volunteer monitoring database	N/A	N/A	N/A
7c	Conduct additional sampling to refine load reduction goals	1	1	2
7d	Track implementation of Best Management Practices (BMPs)	N/A	N/A	N/A
7e	Create and calibrate computer model of watershed	N/A	1	N/A

Goal 8: Ensure Functional and Financial Stability of Galena River Watershed-based Planning				
Objectives to Achieve Goal		Phase 1	Phase 2	Phase 3
		5 Years 2019-2023	5 Years 2024-2028	10 Years 2029-2038
Objective I.D.	Task	No. of Units	No. of Units	No. of Units
8a	Establish/maintain permanent watershed committee	1	N/A	N/A
8b	Have plan adopted by local governments	6	N/A	N/A
8c	Complete watershed plan progress checklist annually	5 times	5 times	10 times
8d	Explore permanent funding options for watershed planning and project implementation	N/A	N/A	N/A

Table 7 through 9 - Implementation Schedules for Goals 6 through 8

7.0 MANAGEMENT MEASURES AND TARGETED CRITICAL AREAS

Reducing stormwater flow both reduces overland pollutant contributions to the waterways and reduces flow in the waterways that can increase streambank erosion and its associated pollutants. Sediment loads can be used as "tracers" for stormwater flow, and those practices that reduce sedimentation generally also reduce stormwater flow and vice versa. Estimated load reductions for Best Management Practices (BMPs) that reduce sedimentation suggest that the greatest benefits will be derived from implementing Forest Management Plans (forested areas comprise 40% of the watershed), implementing no-till and cover crops in row crop areas (13% of the watershed), strategically stabilizing streambanks, and increasing detention in developed areas (8% of the watershed). Other practices will be incorporated into the education and implementation components of the plan and are described here. However, efforts to achieve necessary pollutant load reductions will be primarily focused on these practices.



Figure 23 - Sediment entering the Galena River from a storm sewer just north of the Rte. 20 bridge (left) and from Hughlett Branch just south of the Meeker St. footbridge (right) the morning after a storm event (5/14/18)

Estimations of sediment loading from the subwatersheds shown in the table below indicate that the majority of the load is coming from the Main Stem (42%) and Hughlett Branch (35%).²⁷

Subwatershed	Sediment Load (tons/year)
Lower River	1,075.0
West Galena	978.0
Blackjack	524.0
Downtown	302.0
Hughlett Branch	4,489.0
Main Stem	5,392.0
Total:	12,760.0

Table 10 – Annual Sediment Load Contributions by Subwatershed

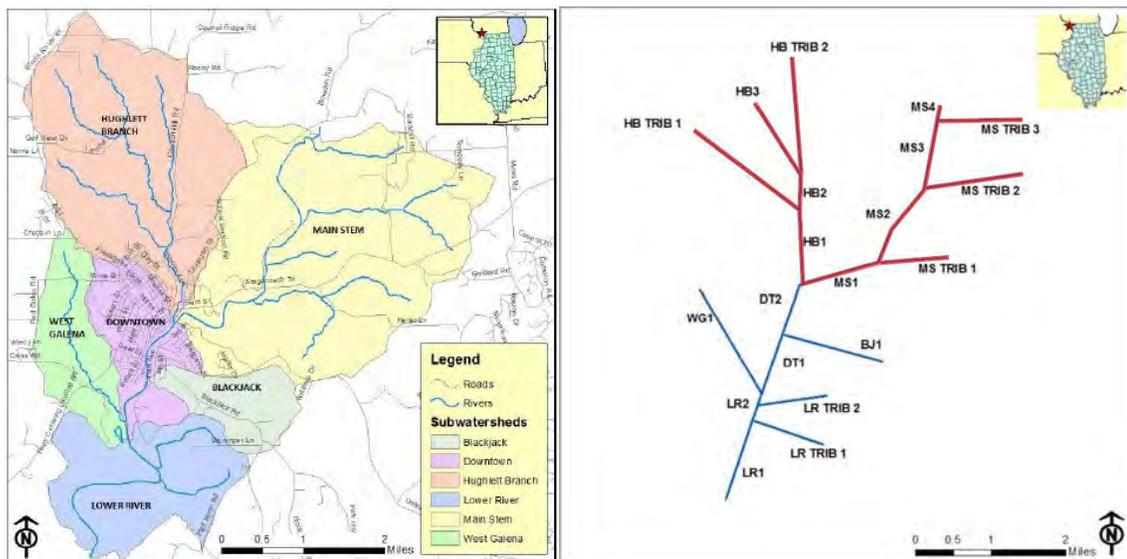


Figure 24 - Subwatersheds and reaches in the priority subwatersheds for streambank stabilization highlighted

The criteria and associated point system in the table below have been used to prioritize specific capital projects identified to date:

Criteria	Criteria Description	Points
Project Reduces Sediment Load	Project directly reduces sediment load related to erosion of streambank legacy sediments (estimated to be 60-80% of sediment load)	5
	Project increases infiltration thereby reducing sedimentation resulting from erosion in the landscape	3
	Project does not reduce sedimentation	0
Project Location	Project is located in Hughlett Branch or Main Stem subwatershed as these areas are contributing the greatest sediment load to the Galena River	5
Willing Property Owner(s)	Property owner(s) support(s) the project	5
	Property owner(s) has/have been identified	3
	Property owner(s) unknown	0
Level of Planning Completed	Planning and/or Engineering is completed	5
	Some planning and/or engineering have/has been done	3
	No planning and/or engineering work have/has been done	0
Availability of Project Funding	All funding is in hand	5
	Potential funding sources to cover total cost have been identified	3
	Complete project funding source(s) unknown	0

Table 11 – Project Ranking Criteria

Project with point totals of 10 and above are considered high priority projects, those with 5-9 points are considered medium priority projects, and projects with less than 5 points are considered low priority projects. Clearly, work needs to be done to define specific projects with potential for significant sediment reductions (e.g. implementation of forestry management plans, streambank stabilization) and move them up in the rankings. Review and ranking of potential projects should be undertaken annually.

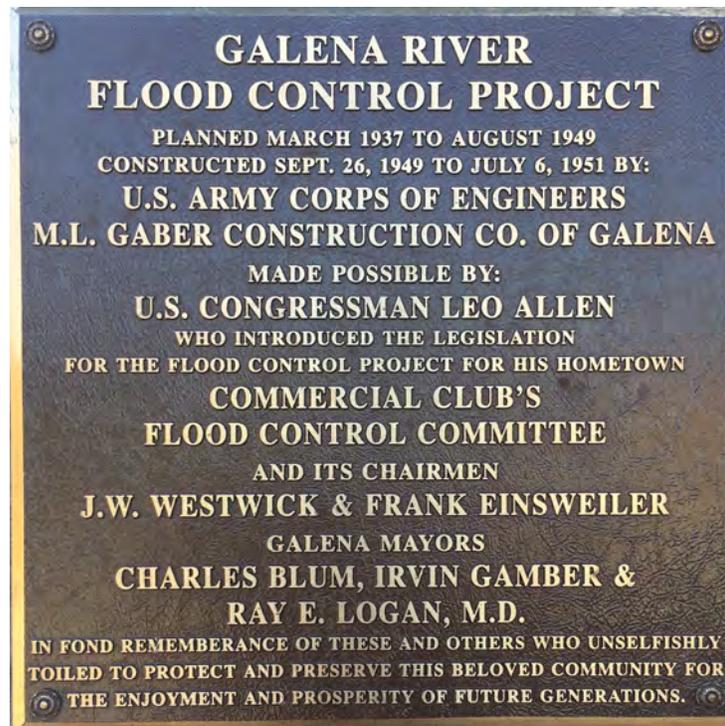


Figure 25 - Flood protection project plaque on the flood gates

The specific projects that have been identified to date are ranked in order of priority as follows:

Project Rank	Project Description	Evaluation by Criteria	Point Total	Priority
1	Hughlett Branch detention basin	Reduces legacy sedimentation (5) Located in Hughlett Branch subwatershed (5) Property owner supports (5) No planning or engineering (0) Potential funding identified (3)	18	High
2	Hughlett Branch streambank stabilization	Reduces legacy sedimentation (5) Located in Hughlett Branch subwatershed (5) Property owner supports (5) No planning or engineering (0) Potential funding identified (3)	18	High
3	Rossmiller Study detention basin #1	Reduces legacy sedimentation (5) Property owner supports (5) Some planning & Engineering (3) Potential funding identified (3)	16	High
4	Planting oover crops	Increases infiltration (3) Property owners support (5) Planning completed (5) Potential funding identified (3)	16	High
5	Main Stem 3 Island Removal	Reduces legacy sedimentation (5) Located in Main Stem subwatershed (5) Property owners identified (3) No planning or engineering (0) Funding source(s) unknown (0)	13	High
6	New canoe and kayak launch	Does not reduce legacy sedimentation (0) Property owner supports (5) Planning completed (5) Potential funding identified (3)	13	High
7	Elk/Hickory stormwater reduction	Reduces legacy sedimentation (5) Property owners unknown (0) Some planning & Engineering (3) Funding source(s) unknown (0)	8	Medium
8	Rossmiller Study Detention Basin #2	Reduces legacy sedimentation (5) Property owners unknown (0) Some planning & engineering (3) Funding source(s) unknown (0)	8	Medium
9	Rossmiller Study Detention Basin #4	Reduces legacy sedimentation (5) Property owners unknown (0) Some planning & Engineering (3) Funding source(s) unknown (0)	8	Medium
10	Rossmiller Study Detention Basin #5	Reduces legacy sedimentation (5) Property owners unknown (0) Some planning & Engineering (3) Funding source(s) unknown (0)	8	Medium
11	Rossmiller Study Detention Basin #6	Reduces legacy sedimentation (5) Property owners unknown (0) No planning or engineering (0) Funding source(s) unknown (0)	8	Medium
12	Rossmiller Study Detention Basin #7	Reduces legacy sedimentation (5) Property owners unknown (0) No planning or engineering (0) Funding source(s) unknown (0)	8	Medium
13	Rossmiller Study Detention Basin #8	Reduces legacy sedimentation (5) Property owners unknown (0) No planning or engineering (0) Funding source(s) unknown (0)	8	Medium
14	Rossmiller Study Detention Basin #9	Reduces legacy sedimentation (5) Property owners unknown (0) Some planning & Engineering (3) Funding source(s) unknown (0)	8	Medium

Table 12 – Ranked Projects

7.1 Forestry Management Plan Implementation

Largely because of the steep slopes in the watershed, 40% of the area has been left to itself (too steep for development or row-cropping) and has developed into a mixed forest. Unlike the open canopy oak/hickory savanna that existed when Native Americans managed the woodland areas with fire, a mix of primarily deciduous trees have grown up and formed a closed canopy that does not allow sunlight to reach the understory. Shallow-rooted invasive plants that do little to hold soil in place have taken hold in this environment. Given the lack of protection and, again, the steep slopes, stormwater wreaks havoc here, and significant erosion is taking place. This erosion is exacerbated when livestock is allowed to graze in these areas.

Modeling work based on the input of local data suggests that the implementation of forestry management plans could reduce sediment loading by 46.1 tons/acre/year. With over 6,700 acres of the watershed identified as deciduous forest, these areas offer tremendous potential for reducing sedimentation in the watershed. At this time, no willing landowners or specific projects have been identified. However, efforts to accomplish this must be undertaken.

Landowners will be engaged, encouraged, and (when possible) financially incentivized to adopt and implement forest management plans (FMPs) designed to open forest canopies allowing sunlight to reach forest floors and remove invasive species. These actions will promote improved forest stands with greater native species diversity and better sunlight penetration to the forest floor which in turn increases stormwater infiltration, filters non-point source pollutants, and reduces soil erosion. U.S. Department of Agriculture (USDA) funding assistance is available for both creating and implementing forest management plans through the local Natural Resource Conservation District (NRCS) office in Elizabeth. Forest management plans are estimated to cost about \$1,000. Landowners may want to cover the relatively small plan development cost to avoid delays and then approach NRCS for assistance with implementation.

Also important to forest management is the stabilization of ravines. Successful ravine stabilization has been undertaken in Mossville Bluffs Watershed (outside of Peoria) using log check dams, gabion baskets and rock lining, or coir fiber bags and their work may be a useful reference for ravine stabilization in the Galena River Watershed. Currently, successful efforts have been seen in our area using rock and sediment control basins.

Forested areas are depicted in green on the map below. Efforts will be undertaken to work with landowners in these areas, particularly those forested areas that abut waterways. The City of Galena owns some forested areas that should be managed and could be used as demonstration projects. The Jo Daviess Conservation Foundation (land trust) land owns and manage forested areas in the watershed that currently serve as demonstration projects.

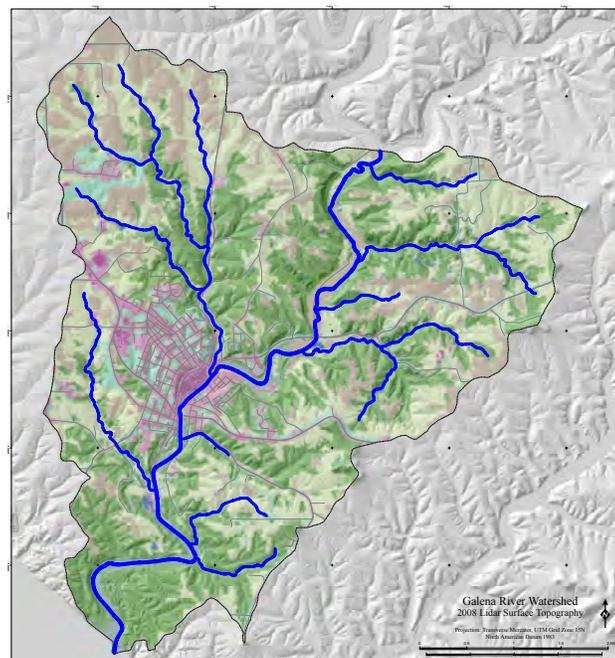


Figure 26 - Land use in the subwatershed include 40% primarily deciduous forest (green areas), over 6,700 acres. Waterways are exaggerated for easy identification of forested areas adjacent to waterways. Base map provided by Dr. Donald Luman, Illinois State Geological Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign

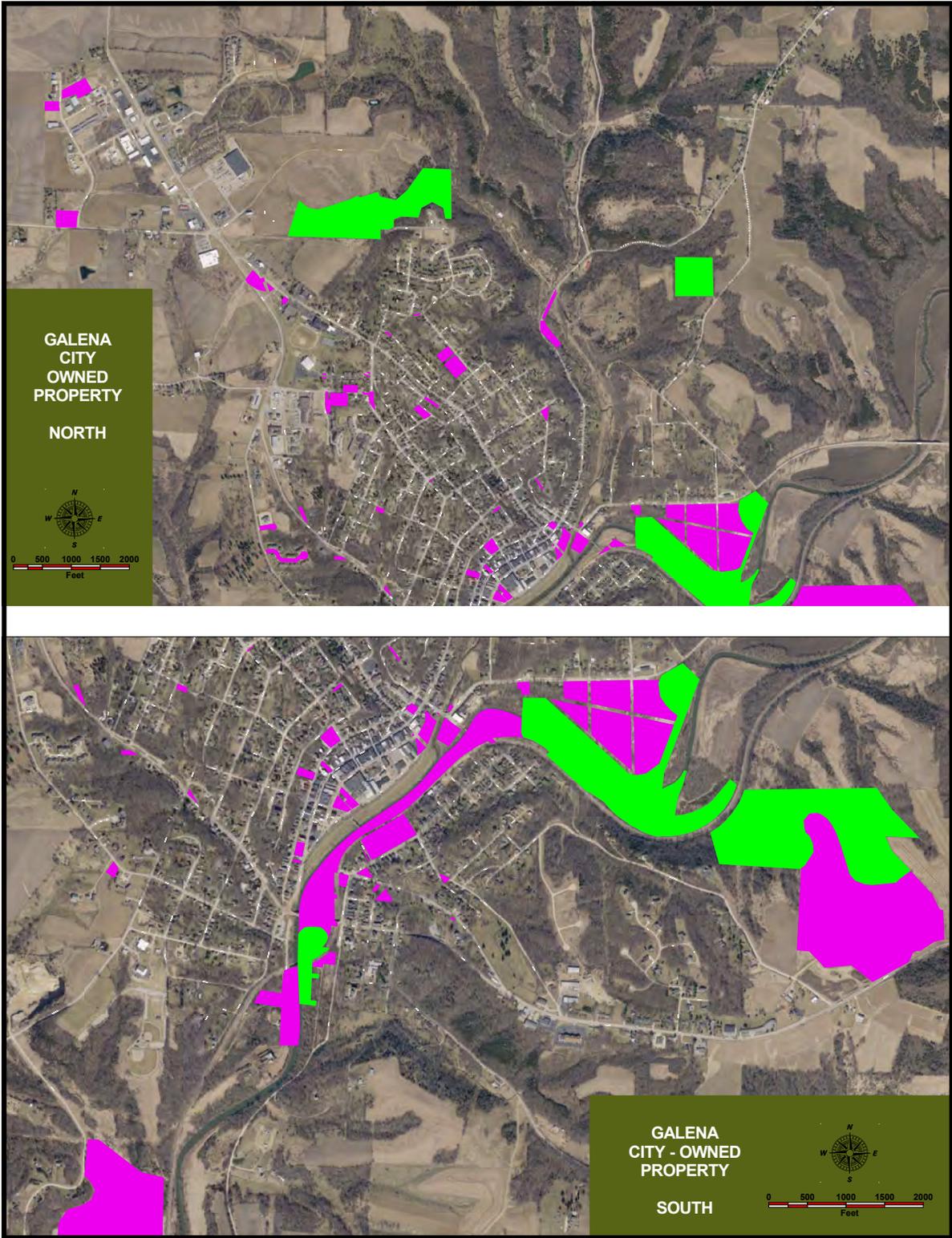
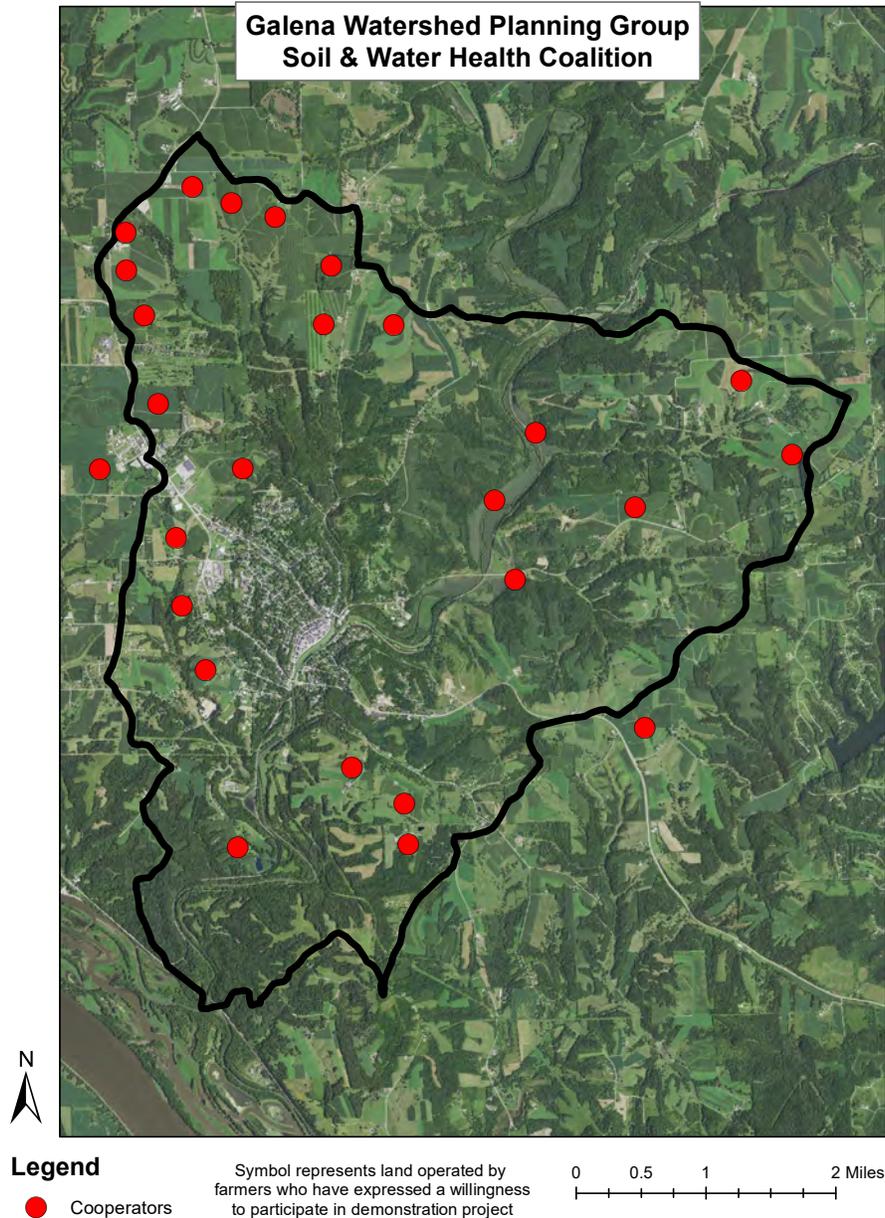


Figure 27 - Parcels owned by the City of Galena are shown in color (pink and green). Green highlights wooded areas that could be considered for demonstration forestry management projects

7.2 No-Till and Cover Crops

The list of benefits of combining no-till and cover crop practices on Driftless Area farms seems to grow daily. These practices allow for the development of healthy soil with increased infiltration, reduced run-off and associated erosion, increased microbial activity, nutrient storage and release, and increased organic matter. Given the shortened growing season and associated issues related to establishing the cover crop in the fall, cereal rye has been identified as the first cover crop that a farmer should try, as it is most likely to be successful. Working with the farmer-led group in the Galena area, the "Soil & Water Health Coalition," landowners interested in trying cover crops on 1,000 row crop acres in the watershed have been identified. The map below shows the row-crop locations of willing cooperators identified to date.

Cover Crop Demonstration Project



*Figure 28 - Locations of row crop fields owned by farmers interested in participating in a cover crop pilot program
Map created by Dan Harms*

7.3 Implementation of Perennial Crops

Perennial crops do not have to be reseeded or replanted every year, so they don't require annual tillage or herbicide to establish. They protect soil from erosion and improve soil structure, increase nutrient retention, and increase water infiltration. Apple and plum trees, grapes, hazelnuts, almonds, aronia berries, and asparagus are examples of perennial crops that are grown in our area. The Land Institute in Salina, Kansas is working to develop perennial grain, legume and oilseed options by domesticating wild perennial plants and perennializing existing annual crops.

Perennial crops take longer to establish, but once established can yield \$2-4,000 per acre annually. Research by Malon (2016) suggests that conversion of 1% of a farm per year may detract little from a farm's bottom line but has the potential to return that area of land's production income tenfold in five years. This conversion across the corn-soybean belt would help alleviate gulf hypoxia.²⁸

7.4 Streambank Stabilization

Streambank stabilization projects will need to be designed specifically for each location depending on the configuration of the stream and the causes of the instability, whether local (e.g. poor soils, high water table in banks, alignment, obstructions deflecting flows into the bank, etc.) or systemic (e.g. aggradation due to increased sediment from the watershed, increased runoff due to urban development in the watershed, degradation due to channel modifications, etc.). Stabilization projects may include approaches like stone toe protection (non-erodible materials like stone are used to protect the lower portion of the eroding banks), rock riffle grade control (adding loose rock grade control structures at locations where natural riffles would occur to create and enhance riffle-pool flow which dissipates stream energy), and floodplain excavation (removing legacy sediment material that would erode and be deposited in the waterway).

Detailed information about the character, channelization, riparian buffer condition, stream channel erosion, debris jams observed during assessment, storm flow, and stream slope can be found in the *Galena River Watershed Resource Inventory* for each of the reaches, and will be helpful when engaging landowners.²⁹ Figure 29 below shows the top ten watershed segments in terms of the length of "High Erosion" streambank in each segment. A "High Erosion" designation was given to areas where sediment is actively being delivered to the stream under regular flows. Segment rankings were as follows:

1. West Galena 1 (WG1) - 11,849 feet
2. Main Stem 3 (MS3) - 4,935 feet
3. Main Stem Tributary 3 (MS TRIB 3) - 3,816 feet
4. Hughlett Branch Tributary 2 (HB TRIB 2) - 3,513 feet
5. Lower River 1 (LR 1) - 2,989 feet
6. Main Stem Tributary 2 (MS TRIB 2) - 2,320 feet
7. Main Stem Tributary 1 (MS TRIB 1) - 2,312 feet
8. Hughlett Branch Tributary 1 (HB TRIB 1) - 2,060 feet
9. Main Stem 4 (MS4) - 1,861 feet
10. Blackjack 1 (BJ1) - 1,722 feet

The stream segment running along Council Hill Road in the Hughlett Branch subwatershed has been identified as a high priority for streambank stabilization. Erosion of this streambank is threatening the roadway construction and impacting design and cost considerations for the replacement of the Dewey Avenue bridge. A collaborative effort between the City, County, and private landowners to address issues in this area may be beneficial to all concerned.

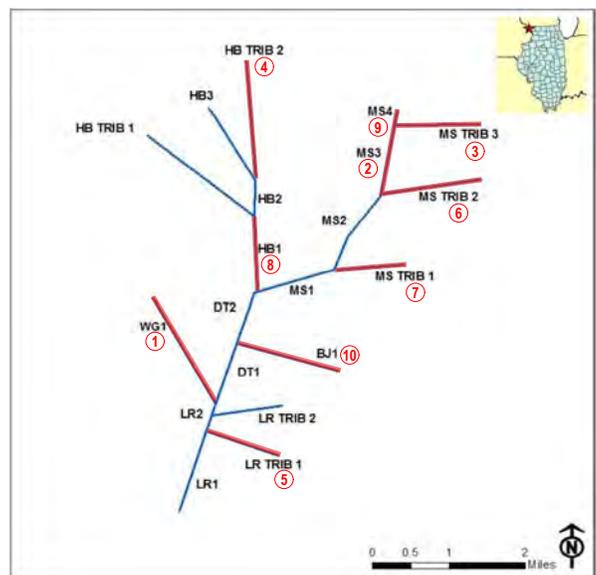


Figure 29 - Watershed stream segments with the top ten segments in terms of the length (in feet) of high erosion streambank indicated in red



Figure 30 - In addition to streambank work, there are areas in the river where sediment is being deposited and forming islands, such as the location above which is just downstream from the Buckhill Road bridge. Photo by Deb Malone, used with permission

7.5 Detention Basins

A common method for managing stormwater is to build a basin. Basins are meant to collect the water, and release it at a rate that prevents flooding or erosion. Unlike retention basins that are designed to hold a specific amount of water indefinitely, detention basins are low lying areas designed to temporarily hold a set amount of water while slowly draining to another location. In both cases the water level is controlled by a low flow orifice which is generally part of a metal or concrete structure called a riser. A detention (or dry pond) has an orifice level at the bottom of the basin and does not have a permanent pool of water; all the water runs out between storms and it usually remains dry. The basins are important for storing and slowing stormwater runoff from nearby areas, especially areas with asphalt or concrete development. Stormwater runoff flows much faster from these surfaces than naturally occurring areas and needs to be diverted to ensure the runoff occurs at the desired rate.

Because Galena was built as a river town, it's history of flooding is not surprising. The extensive levee and floodgate system constructed in 1951 protects the commercial downtown area from river flooding, but the downtown has continued to be afflicted with flooding related to stormwater from upland areas. An extensive storm-sewer system concentrates stormwater into gravity forcemains that feed directly into the river, along with any pollutants that have been picked up along the journey. In 1986, a hydrological feasibility study was completed to identify projects that would eliminate flooding in the downtown area. The Franklin Street area was identified as critical to achieving this goal, and the construction of nine detention basins with a total estimated storage volume of nearly 60 acre feet (96,800 cubic yards) was recommended of which one has been completed.

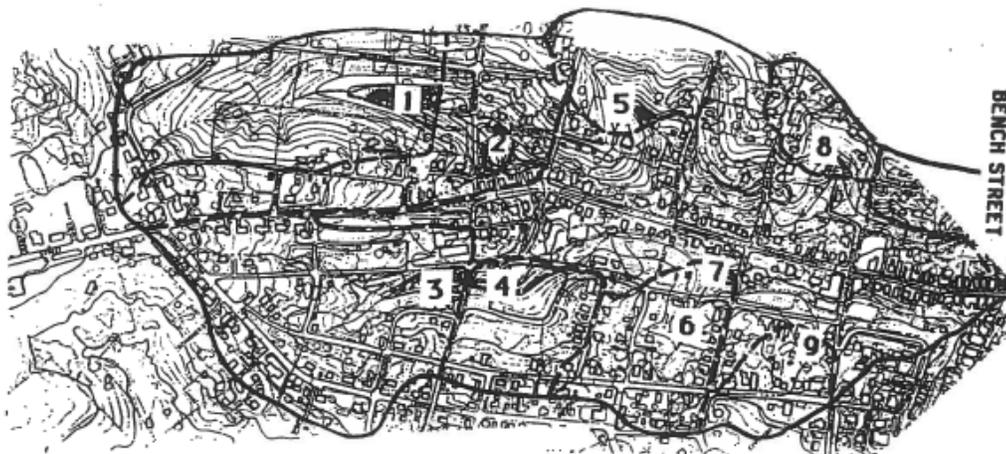


Figure 31 - Franklin Street watershed area showing location of nine detention basins as proposed in the 1986 "Hydrological Feasibility Study: Franklin Street and Downtown Watersheds Galena, Illinois" by Dr. Ronald L. Rossmiller, P.E. (often referred to as "The Rossmiller Study"). As of 2018, only basin #3 has been constructed.

Of the eight basins that remain to be built, Detention Basin #1 (upstream of Hickory between Franklin and Fulton streets) and Detention Basin #2 downstream of Hickory between the alley and Bridge Street have had some planning work done. In 2014, the City put together details on these two basins. Basin #1 is to be located on property owned by the city, and is currently undeveloped (see Figure 31 on the following page). The other basin locations are not city-owned and in most cases have residences on the site.

Detention Basin #1 as proposed would be approximately 400 feet long, 100 feet wide, average 10 feet deep, with a berm 18 feet high. It has been estimated to have a storage capacity of 12.8 acre-feet. A multistage inlet structure and associated outfall pipe would be connected to an existing culvert under Hickory Street. It is expected that much of the fill for the berm can be generated on-site with remaining material imported as needed. A number of trees will also need to be removed to allow construction. Finally, the entire area will be landscaped and seeded.

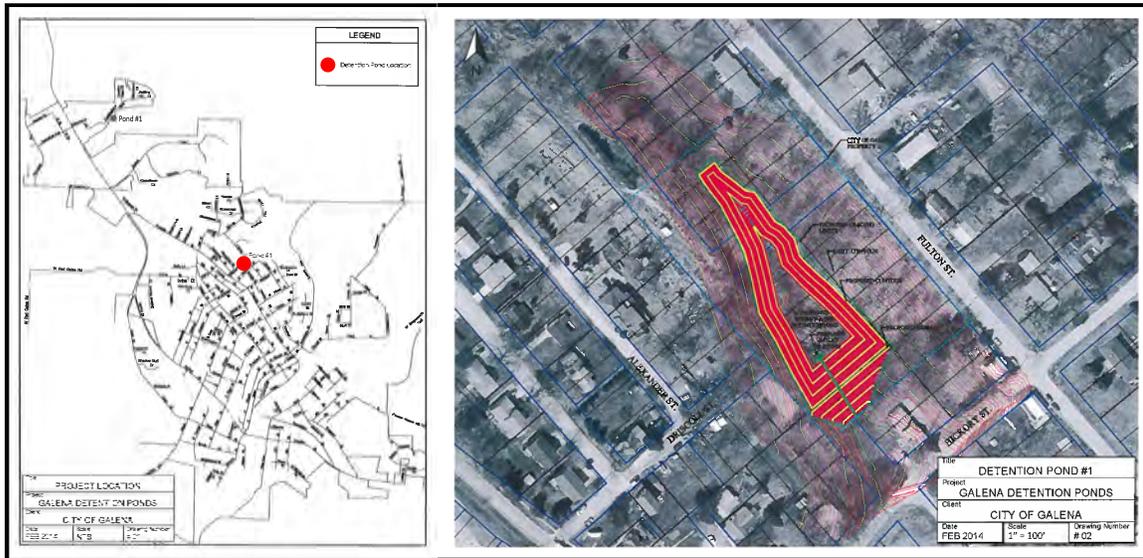


Figure 32 - Detention Basin #1 Location

Hughlett Branch Detention Basin

The City owns land at the northern edge of the city where a detention basin could be constructed to alleviate downstream issues in the Hughlett Branch subwatershed. A detention basin was proposed in the site plan for the Scenic Meadows subdivision (see Figure 32). An industrious beaver working just above the proposed basin location has built an impressive dam and created a pond.



Figure 33 - Scenic Meadows subdivision site plan depicting the proposed Hughlett Branch detention basin on the right side of the development, and the beaver dam located upstream of the proposed detention site

Water and Sediment Control Basin (WASCOB)

Water and sediment control basins (WASCOBs), a practice defined by the U.S. Department of Agricultural, Natural Resource Conservation Service, is an earth embankment or a combination ridge and channel constructed across the slope of minor watercourses to form a sediment trap and water detention basin with a stable outlet. This farm practice is intended to be employed as part of a conservation system that addresses resource concerns both above and below the basin. Where land ownership or physical conditions preclude treatment of the upper portion of the slope, a water and sediment control basin can separate this area and permit treatment of the lower slope.

7.6 Other Potential Projects

The following potential projects have been identified and should be considered for future implementation.

Contact	Project
City	<p>Gateway Park. JDCF is talking to the City about a gully forming on the lower part of the property.</p> <p>Identifying contamination sites for future mitigation, working to connect septic within the City limits to the City system (problematic – currently, if a property owner is more than 300 feet from a City main, they don't have to connect to the system)</p> <p>Obtaining an ACOE grant to enhance the environment along the levee project that may involve tree removal, sloping of the banks, and planting them with waterway grasses. The material taken during the re-sloping of the banks may be used to raise the level of the east side dike.</p> <p>Creating a demonstration vegetative swale and Exchange Drive & Rte. 20</p> <p>Permeable pavement opportunities: re-surfacing the commerce street parking lot, parking lot at new canoe and kayak launch, parking lot at recreation park, sidewalk from 20 to Cobblestone Crossing</p> <p>Stormwater problem on bike trail at viaduct</p>
County	The County Highway Engineer has new software that will allow him to do computer modeling of project scenarios that he would like to use to examine possible solutions along Blackjack Road in the “Bremen” area.
Environmental Engineering Dept., UW Platteville	<p>Rock check dams and native perennial grasses in Field Street swales</p> <p>Residential rain garden and rain barrel detention in Elk/Hickory intersection detention area</p>
Other	<p>Reference McHenry County Conservation District Nippersink re-meandering project</p> <p>Reference “Carbon Soil Cowboys” of MN, LA and MO</p> <p>Consider opening up floodplain areas along the river</p> <p>Consider dredging the sediment islands forming in the river</p> <p>Consider making the river a no-wake zone, trolling motors only</p> <p>Seek incentives to marginal rowcrop land into grazing and alternative crops</p>

Table 13 – Other Potential Projects



Figure 33 - Ian Tomkins fishing for smallmouth bass on the Galena River, Photos by Scott Tomkins, used with permission

7.7 Other Management Measures

Though the practices focused on previously are anticipated to provide the greatest advancement towards achieving the watershed goals, there are many others that can be used strategically within the watershed. In addition, some pollutants, like Polychlorinated Biphenyls (PCBs) will require specialized measures. The practices listed under each pollutant below are intended to indicate tools that can be used as appropriate when specific locations are being addressed.

Impairment	Management Measures
Sedimentation/Siltation	filter strips field borders riparian buffers conservation tillage crop rotation strip cropping conservation cover cover crop grassed waterways terracing water and sedimentation control basins (WASCOBS) sediment control basins streambank and shoreline protection grade stabilization structure
Fecal Coliform	filter strips private septic system inspection and maintenance program pasture management/fencing program for picking up after pets deer population management
Zinc	practices listed under sediment control mine reclamation passive treatments: aerobic wetland - water must have pH greater than 7 (alkaline) compost or anaerobic wetland open limestone channels - simplest passive treatment diversion wells anoxic limestone drains vertical flow reactors
Polychlorinated Biphenyls (PCBs)	half-life breakdown bio-degradation dredging
Nitrogen & Phosphorous	cover crops no-till & reduced tillage riparian buffers saturated buffers conversion to perennial crops reducing N rate to maximum return to nitrogen (MRTN calculator) phosphorous rate reduction on fields with soil test P above recommended maintenance level spring nitrogen application/split nitrogen application use of nitrogen stabilizers application of gypsum use of bioreactors wetlands on tile-drained lands

Table 14 – Other Management Measures

8.0 TECHNICAL AND FINANCIAL ASSISTANCE NEEDED

Best Management Practices (BMPs)	Cost/Annual Ton of Sediment Reduction	Total Number of Tons Sediment Reduction Per Year/Total Cost	Possible Funding Sources	Technical Assistance Required
1c - Increase row crop acreages doing true, constant no-till	-\$2.21/ton	7,700 tons per year on 1,000 acres/total annual savings estimate = \$17,000	4	
1a & 1b - Increase adoption of forest management plans acreages on which forest management plans are implemented	\$4.72/ton	41,651.4 tons per year achieved on 903.5 acres/total project cost estimate = \$196,350	7, 17	
1g - increase square footage of rain gardens	\$7.50/ton	400 tons per year on 1,000 sq. ft./total cost estimate = \$3,000	3	Landscape Consulting
1d - Increase row crop acreages incorporating cover crops	\$9.66/ton	6,900 tons per year on 1,000 acres/Total annual cost estimate = \$66,670	3, 7	
2c - identify, prioritize and improve riparian buffers in poor condition	\$48.57/ton	1,400 tons per year on 100 acres/total project cost estimate + \$68,000	4	
1h - increase acreages controlled by Water and Sediment Control Basins (WASCOBs)	\$88.89/ton	360 tons per year draining 80 acres/total project cost estimate = \$32,000	3, 4, 7	Engineering
2b - identify, prioritize and stabilize streambanks with high erosion	\$746/ton	3,042 tons per year on 45,400 feet of streambank/total project cost estimate = \$2,270,000	7, 22	Engineering
1f - convert acreage of turf grass to deep-rooted perennials	\$4,425/ton	0.452 tons per year on 4 acres/total cost estimate = \$2,000	3	Landscape Consulting

Table 15 – Best Management Practice Costs and Possible Funding Sources

Links provided below are valid as of August 1, 2018.

1. [Agricultural Conservation Easement Program](#) – provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits
2. [American Waters](#) - Project funding in the company's water service areas
<http://www.amwater.com/paaw/water-quality-and-stewardship/environmental-grants-program.html>
3. [Conservation Practices Program \(CPP\)](#) – 60% cost-share on conservation farming practices, well decommissioning, rain gardens and grade stabilization structures
4. [Conservation Reserve Program \(CRP\)](#) – Provides rental payments to farmland placed into conservation retirement for periods of 10 years or more.
5. [Conservation Stewardship Program \(CSP\)](#) – participants earn payments based on performance
6. [Ducks Unlimited](#) – <http://www.ducks.org/related/grants>
7. [Environmental Quality Incentives Program \(EQIP\)](#) – Provides fixed payment scenarios for landowners to achieve conservation practices including stream restoration, nutrient management planning, forestry planning, and nutrient control structures.
8. [EPA Clean Water Act Section 319 Grants](#) – 60% funding for watershed planning, and projects included in an approved watershed plan.
9. [Farm Bureau](#) – <http://jodaviesscfb.com/>
10. [Fishers and Farmers Partnership for the Upper Mississippi River Basin](#)
<http://fishersandfarmers.org/action-resources/>

11. Friends of Reservoirs – <http://www.waterhabitatlife.org/>
13. Hungry Canyons Alliance – <https://www.legis.iowa.gov/docs/publications/SD/524.pdf>
14. Local Non-profits – Lions Club, Rotary, Country Fair, League of Women Voters
15. Illinois Department of Agriculture and Illinois EPA Nutrient Management Plan Project – cosponsor a cropland Nutrient Management Plan project in watersheds and provide cost-share assistance
16. McKnight Foundation – www.mcknight.org/grant-programs
17. USDA NRCS National Water Quality Initiative – <https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/?cid=stelprdb1047761>
18. Partners for Conservation Program – cost sharing on a variety of practices available to Ecosystem Partnerships through the Illinois Department of Natural Resources (IDNR) - <https://www.dnr.illinois.gov/conservation/pfc/Pages/default.aspx>
19. Pheasants Forever – [www.pheasantsforever.org/Newsroom/2015-June/NAWCA-Grants-Deliver-\\$4-Million-to-Habitat-Conserv.aspx](http://www.pheasantsforever.org/Newsroom/2015-June/NAWCA-Grants-Deliver-$4-Million-to-Habitat-Conserv.aspx)
20. Private Donations
21. Sustainable Agriculture Research & Education - www.sare.org/
22. Smallmouth Bass Alliance – <http://www.illinois-smallmouthalliance.com/html/proposals.html>
23. Streambank Stabilization and Restoration Program (SSRP) – 75% cost-share program.
24. Trout Unlimited – Driftless Area Restoration Effort
<http://www.tu.org/conservation/watershed-restoration-home-rivers-initiative/embrace-a-stream>
<http://www.darestation.com/>
25. U.S. Fish & Wildlife Service - www.fws.gov/grants/
<http://www.fws.gov/birds/grants/north-american-wetland-conservation-act/how-to-apply-for-a-nawca-grant.php>



Figure 35 - "The Watershed Game" created by the University of Minnesota Extension has proven to be a very useful education tool. Twenty-eight people in Jo Daviess County have been trained to facilitate the game and can be contacted through the Jo Daviess County Environmental Health office

9.0 MONITORING COMPONENT

A variety of monitoring efforts will be relied upon to obtain indications of the impacts of practices implemented. The monitoring choices take into consideration the limited available financial resources for monitoring.

The Illinois EPA regularly collects samples and records chemical lab analysis data on the Galena River as part of its requirement to comply with the Federal Clean Water Act. A large number of parameters (55) are studied and the consistent history of data collection provides an opportunity to understand changes in water quality over time. The data is maintained in the Illinois EPA's STORage and RETrieval and Water Quality Exchange databases, STORET and WQX. This data will be the ultimate reference used to establish whether water quality standards are being attained in the IL_MQ-01 segment of the Galena River.

When funding is available, strategic water sampling will be conducted to provide reference data that clarifies the pollutant load conditions in the watershed seasonally and over the years.

Biological monitoring conducted by volunteers is a cost-effective way to track the health of streams. An effort will be made to increase the number of volunteers conducting biological monitoring by expanding participation in the RiverWatch program. The Illinois RiverWatch Network is a statewide, non-profit, volunteer stream-monitoring program run through the National Great River Research and Education Center. Citizen scientists are trained to examine indicators of water quality like stream habitat and the number and diversity of macroinvertebrate species (e.g. dragonfly nymphs, beetle larva, and midges).

A new monitoring program will be initiated which involves volunteers adopting stream areas and taking pictures, on a regular basis and after storm events, to document conditions over time. Drone filming of the overall river on a regular basis would also provide a reference for evaluating changes on the river.



Figure 36 - Monitoring projects in the Galena River Watershed

10.0 IMPLEMENTATION VISION

The plan approved by the planning committee will be offered to the local governments having jurisdiction in the watershed (the City of Galena, East Galena Township, West Galena Township, Rawlins Township, Vinegar Hill Township, and the County) for approval/adoption. The League of Women Voters will continue to work with others in the watershed community to facilitate implementation of the “Galena River Watershed-based Plan: Phase 1.” The Planning Committee will reconvene in the summer of 2019 (and annually thereafter) to complete the “Progress Checklists” in Appendix B, to assess the overall approach to implementation, and to modify the approach as needed.

Implementation involves capital projects and non-capital projects. The criteria (page 19) created for ranking projects can be seen as a to-do list for completing capital projects. For example, implementing forest management plans has been determined to be an important way to reduce sedimentation, but no specific project has been identified for ranking as of the completion of the plan. Efforts could be focused on identifying landowners in the Hughlett Branch and Main Stem watersheds who might be interested in learning more about forest management as a first step. Defining projects and identifying potential funding to complete the plans would be a logical next step. This approach can be applied to other capital projects (e.g. streambank stabilization, rain garden installation) as well. By taking these steps, projects can move up in the rankings and reach completion.

Non-capital projects relate primarily to the educational program and monitoring. The education program outlined in Section 4 has been developed in some detail, and the groundwork has been laid (project definition, commitment from individuals and entities to participate) to move forward on several elements of the program.

The monitoring program has two primary components – voluntary citizen scientist monitoring, and water sampling that requires lab analysis. Both forms of monitoring are important for understanding the conditions in the watershed and for documenting changes over time. The RiverWatch volunteer biological monitoring program has been initiated in the area, and it would be beneficial to expand the number of citizen scientists participating in this program to obtain more data throughout the watershed. The newly proposed “Branch Manager” program that would allow residents to document waterway conditions through photographs and notes would provide good data on stream conditions over time and might be a good stepping stone for individuals who might later participate in the RiverWatch program.

Efforts to obtain water quality data requiring lab analysis will continue as projects are defined and funding is made available. At the completion of this plan, a grant award is pending which would allow for grab sampling on the Galena River at the Wisconsin border and where it enters the Mississippi for a full suite of nutrients. Nineteen water samples will be grabbed at each location by U.S. Geological Survey scientists over a one-year period. This work will provide a reference point for conversations about the nutrient load coming down from Wisconsin, and about seasonal changes in nutrient loading.

Obviously, implementation success is essential to achieving the watershed vision (page ii). Success will be clearly measured through the project checklists in Appendix B.



*Figure 37 – ARC summer program children learning about Mississippi River pollution
Photo by K. Roark, used with permission*

11.0 ENDNOTES AND OTHER REFERENCES

Endnotes

- ¹ *Handbook 296: Land Resources Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin*, (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142o2_050898.pdf).
- ² Panno, S.V. et al., *Characterization of Karst Terrain and Regional Tectonics Using Remotely Sensed Data in Jo Daviess County, Illinois* (Illinois State Geological Survey Circular 589, 2015), 1-29.
- ³ Panno, S.V. et al., *The Karst of the Driftless Area of Jo Daviess County* (Illinois State Geological Survey Circular, 586, 2017), 1-39.
- ⁴ Panno, S.V. et al., *Guide to the Geology, Hydrogeology, History, Archaeology, and Biotic Exology of the Driftless Area of Northwestern Illinois, Jo Daviess County* (Illinois State Geological Survey 42, 2016) 1-7.
- ⁵ Panno, S.V. et al., *Guide to the Geology, Hydrogeology, History, Archaeology, and Biotic Exology of the Driftless Area of Northwestern Illinois, Jo Daviess County* (Illinois State Geological Survey 42, 2016) 8-11.
- ⁶ Panno, S.V. et al., *Guide to the Geology, Hydrogeology, History, Archaeology, and Biotic Exology of the Driftless Area of Northwestern Illinois, Jo Daviess County* (Illinois State Geological Survey 42, 2016) 23-31.
- ⁷ Trimble, S.W., *Historical Agriculture and Soil Erosion in the Upper Mississippi Valley Hill County* (CRC Press, 2013) 14-19.
- ⁸ Adams, Clifford, *Modern Sedimentation in the Galena River Valley: Illinois and Wisconsin* (State University of Iowa, 1940) 1-72.
- ⁹ *Definite Project Report Galena River Local Flood Protection at Galena Illinois: Appendix IV Sedimentation* (War Department Corps of Engineers, 1947).
- ¹⁰ *Definite Project Report Galena River Local Flood Protection at Galena Illinois* (War Department Corps of Engineers, 1947) 10-14.
- ¹¹ Malon, Michael, *Galena River Watershed: Resource Inventory* (<http://bit.ly/2BhEKkm>, 2017) 11-138.
- ¹² Michaud, Greg & Bostwick, Andrea. *Jo Daviess County Multi-Jurisdictional All Hazards Mitigation Plan*. Johnson, Depp & Quisenberry, 2013 Section 3, pages 1-89.
- ¹³ *Illinois Integrated Water Quality Report Section 303(d) List, 2018: Clean Water Act Sections 303(d), 305(b), and 314 Water Resource Assessment Information and List of Impaired Waters* (Illinois Environmental Protection Agency Bureau of Water, 2018).
- ¹⁴ *Galena/Sinsinawa Rivers Watershed TMDL Report* (CDM Smith, 2017) Section 9, pages 1-47.
- ¹⁵ *Illinois Nutrient Loss Reduction Strategy* (Department of Agriculture, <https://bit.ly/2vsIE8a>) Sections 1 and 2.
- ¹⁶ Panno, S.V. et Kelly, W.R. *Driftless Area Karst of Northwestern Illinois and its Effects on Groundwater Quality* (14th Sinkhole Conference, NCKRI Symposium, Rochester, Minnesota) 1-11.
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- ¹⁸ Malon, Mike. Cost/benefit analysis for assessing performance of water quality improvement techniques. Proceedings from the Illinois Lake Management Association Annual Conference. Bloomington, IL. 2013.
- ¹⁹ King, Dylan K., et al., *Long Term Mining-Zinc Contamination and Remediation Effectiveness of Stream Sediments in the Galena Watershed, SW-Wisconsin and NW-Illinois* (Missouri State, 2018) poster presentation.
- ²⁰ Panno, S.V., Personal Communication, June 2018.

- ²¹ *CERCLA Site Inspection* (Prepared by: Office of Site Evaluation Division of Remediation Management Bureau of Land, 2018) 1-33.
- ²² *Illinois Nutrient Loss Reduction Strategy* (Department of Agriculture, <https://bit.ly/2vsIE8a>) Section 3, p. 27.
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12.0 GLOSSARY

Best Management Practices (BMPs): Best Management Practices (BMPs) are 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 urban areas may include stormwater detention ponds, restored wetlands, vegetative filter strips, porous pavement, silt fences, and biotechnical streambank stabilization.

Bioswale: landscape elements designed to concentrate or remove debris and pollution out of surface runoff water.

Erosion: Displacement of soil particles on land surface due to water or wind action

Forest Management Plans: specific statement of the objectives you have for your land, followed by a series of activities that will take place in order to meet those objectives

Highly Erodible Land (HEL): land that is very susceptible to erosion, including fields that have at least 1/3 or 50 acres (200,000 m²) of soils with a natural erosion potential of at least 8 times their T value.

Hydrologic Unit Code (HUC): A sequence of numbers or letters that identify a hydrological feature like a river, river reach, lake, or area like a drainage basin (also called watershed)

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

Illinois State Geological Survey (ISGS): a part of the Prairie Research Institute at the University of Illinois at Urbana-Champaign, it is a premier state Geological Survey serving the needs of Illinois with earth science information relevant to the State's environmental quality, economic vitality, and public safety

Illinois State Water Survey (ISWS): a division of the Prairie Research Institute at the University of Illinois. The Water Survey's scientists conduct state-of-the-art research and collect, analyze, archive, and disseminate high-quality, objective data and technical information.

Karst: landscape underlain by limestone that has been eroded by dissolution, producing ridges, towers, fissures, sinkholes, and other characteristic landforms.

Natural Resources Conservation Service (NRCS): formerly known as the Soil Conservation Service (SCS), it is an agency of the United States Department of Agriculture (USDA) that provides technical assistance to farmers and other private landowners and managers.

Nonpoint source pollution (NPS or NPSP): Refers to pollutants that are caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally

Polychlorinated Biphenyl (PCB): any of a group of compounds in which chlorine atoms replace the hydrogen atoms in biphenyl: used in industry in electrical insulators and in the manufacture of plastics; a toxic pollutant that can become concentrated in animal tissue.

Pharmaceuticals and Personal Care Products (PPCP): a pollutant category for the US EPA

Point source pollution: Point sources release pollutants from discrete conveyances, such as a discharge pipe, and are regulated by federal and state agencies.

Riparian: Referring to the riverside or riverine environment next to the stream channel, e.g., riparian, or streamside, vegetation.

Runoff: The portion of rain or snow that does not percolate into the ground and is discharged into streams by flowing over the ground instead

Sedimentation: The process that deposits soils, debris, and other materials either on other ground surfaces or in bodies of water or watercourses.

Silt: Fine mineral particles intermediate in size between clay and sand

Soil and Water Conservation District (SWCD): local units of government who are required by state law to carry out natural resource management programs. Districts work with landowners and operators who are willing to help them manage and protect land and water resources on all public and private lands in the US.

Stormwater management: A set of actions taken to control stormwater runoff with the objectives of providing controlled surface drainage, flood control and pollutant reduction in runoff.

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

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

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

Watershed: An area confined by topographic divides that drains to a given stream or river. The land area above a given point on a waterbody (river, stream, lake, wetland) that contributes runoff to that point is considered the watershed.

Water and Sediment Control Basin (WASCoB): a structural sediment erosion control practice eligible for incentive payment under the USDA-NRCS Environmental Quality Incentive Program (EQIP)

APPENDIX A: PLANNING COMMITTEE BIOGRAPHIES

Beth Baranski, Project Coordinator

Beth was Development Director for the City of Galena in the early 90s, and later partner in Notheis & Baranski Inc., a community development consulting firm specializing in planning and grantwriting. Projects included flood mitigation planning for northwest Illinois following the 1993 flood, the Jo Daviess County comprehensive plan, the Jo Daviess County Greenways and Trails plan, and various municipal planning and infrastructure projects in the area. Beth is currently serving as Project Coordinator for the League of Women Voters of Jo Daviess County.

Judy Gratton, Committee Chair

Judy has a B.A. from the University of Northern Iowa. She has been a member of the League of Women Voters of Jo Daviess County for many years, serving as President for two years. Judy has a strong interest in preserving the natural resources of the county and served on committees for recycling in Jo Daviess and Carroll counties, land use planning and groundwater protection. She served on the Jo Daviess County Board for 16 years and was elected as Chairperson for four years. During her time on the Board she was a member of the Board of Health and chairperson of the Environmental Committee. Judy lives on a farm in East Galena Township that has been in her husband's family since 1892 and wants the land preserved for their three children and five grandchildren.

Dan Harms

Dan Harms has taught Natural Resource Management, Horticulture, Drafting and Geographic Information Systems as well as operated a Landscaping company in Northwest Illinois for the past 46 years.

Mike Malon, C.P.E.S.C., C.L.M.

Mike Malon is a navigation specialist for the U.S. Army Corps of Engineers, Rock Island District. In previous roles he has served as resource conservationist for the Jo Daviess County SWCD, biological technician for the IL Dept. of Agriculture and US Forest Service, and conservation worker for the IL Dept. of Natural Resources. Michael is a Certified Lake Manager and Certified Professional in Erosion and Sediment Control; earning a M.Sc. in environmental policy, and a B.Sc. in environmental science. In addition to being part of the Galena River Watershed Planning group he compiled the Resource Inventory for the Galena River Watershed, led the Apple Canyon Lake Comprehensive Watershed Based Plan, served on the planning group for the Jo Daviess County Water Resource Management Plan, and served on the board of the Yellow Creek Watershed Plan. Michael also serves on the board of the Jo Daviess County Horticultural Society.

Deb Malone

Deb Malone began Fever River Outfitters in Galena, 16 years ago, and enjoys sharing outdoor adventures with her customers and friends. She's a 1989 graduate of Loyola University Chicago, an ACA Certified Paddling Instructor, avid outdoors enthusiast, athlete and business owner. These days what motivates Deb most is the quiet time she spends paddling the Galena River, the Mississippi Backwaters and surrounding rivers. Recreational opportunities on these rivers are quite important to her.

Charles Marsden

Charlie is a fifth generation Galenian with strong roots involving the Galena and Mississippi Rivers. He received his Bachelor of Science Degree in Mechanical Engineering from the University of Illinois and also completed post graduate studies in mechanical engineering. Part of his focus was on fluid mechanics, hydraulics, and hydrology, which eventually turned into a hobby of studying the flow characteristics of rivers and streams, especially in the Driftless. Upon graduation he returned to John Deere where he had been a summer employee, working in Plant Engineering. This was his first experience in building infrastructure design including stormwater management and stream channelization. Later he was part owner of a mechanical contracting firm and then spent 36 years at Durrant. He began his career at A/E firm Durrant as a mechanical engineer, advanced to director of engineering, and then moved into management as President, COO and then CEO. This provided more experience in stormwater management and energy conservation. He was a Registered Professional Engineer in 19 states. He was an author and symposium speaker involving both engineering topics and consulting firm management, and was a Member of the Alumni Board of the College of Engineering at Illinois. He retired in 2012. Upon retirement he started volunteering his time to activities and organizations that improve the quality of life in his hometown of Galena. Additionally, he has been President of the Galena Boat Club for over 20 years.

Larry Priske

Larry was an employee for John Deere for nearly 30 years. Activities included project management and directing employee development. Local endeavors include the 20-year operation of a Christmas Tree Farm and, since 1986, management of a Timber Stand Improvement (TSI) process on 120 acres of timber along Hughlett Branch.

John A. Schultz

John is a life-long farmer, retired math and science teacher, township official, county board member, Jo Daviess County Farm Bureau member for 32 years (26 as treasurer), Pilot Knob Cemetery Board (Treasurer), and member of numerous committees including Galena School Improvement, Greenways and Trails, and Jo Daviess-Carroll-Stephenson Free Trade Zone.

Sandra Schleicher

Sandra is the Director of Environmental Health at the Jo Daviess County Health Department where she has worked for the past 10 years. Environmental Health programs include food protection, private sewage disposal, and private water protection, as well as many other others. She has a B.A. in Biology from Augustana College in Rock Island.

APPENDIX B: PLAN PROGRESS CHECKLISTS

Progress checklists should be completed at the end of each calendar year (beginning in 2019) by the Galena River Watershed Committee.

Goal 1: Improve Water Quality			
Timeframe and Objectives	Date Completed	Not Completed	Comments (attachments as needed)
2018-2022 <ul style="list-style-type: none"> - Explore options to reduce road salt use - Stabilize 12,000 feet of streambanks with high erosion - Improve 25 acres of riparian buffer areas in poor condition - Upgrade septic system service for 10 people - Reduce livestock access to waterways & forested areas on one farm - Take steps to control legacy contaminants (PCBs, zinc) - Remove Galena River IL_MQ-01 from list of impaired waters 	 <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	 <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	
2023-2027 <ul style="list-style-type: none"> - Explore options to reduce road salt use - Stabilize 12,000 feet of streambanks with high erosion - Improve 25 acres of riparian buffer areas in poor condition - Upgrade septic system service for 10 people - Reduce livestock access to waterways & forested areas on one farm - Take steps to control legacy contaminants (PCBs, zinc) - Remove Galena River IL_MQ-01 from list of impaired waters 	 <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	 <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	
2028-2037 <ul style="list-style-type: none"> - Explore options to reduce road salt use - Stabilize 2,400 feet of streambanks with high erosion - Improve 50 acres of riparian buffer areas in poor condition - Upgrade septic system service for 20 people - Reduce livestock access to waterways & forested areas on two farms - Take steps to control legacy contaminants (PCBs, zinc) - Remove Galena River IL_MQ-01 from list of impaired waters 	 <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	 <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	

Goal 2: Increase Stormwater Infiltration and Storage to Reduce Runoff and Flooding

Timeframe and Objectives	Date Completed	Not Completed	Comments (attachments as needed)
<p>2018-2022</p> <ul style="list-style-type: none"> - Adopt 25 new forestry management plans - Forestry management plan implementation increased by 250 acres - No-till implementation increased by 250 acres - Cover crops implementation increased by 250 acres - Permeability increased on 1,000 square feet of existing surfaces in developed areas - Convert 1 acre of turf grass to deep-rooted perennials - Increase rain garden areas by 200 square feet - Construct Water and Sediment Control Basin(s) to control 20 acres of drainage area 	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<p>2023-2027</p> <ul style="list-style-type: none"> - Adopt 25 new forestry management plans - Forestry management plan implementation increased by 250 acres - No-till implementation increased by 250 acres - Cover crops implementation increased by 250 acres - Permeability increased on 1,000 square feet of existing surfaces in developed areas - Convert 1 acre of turf grass to deep-rooted perennials - Increase rain garden areas by 300 square feet - Construct Water and Sediment Control Basin(s) to control 20 acres of drainage area 	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<p>2028-2037</p> <ul style="list-style-type: none"> - Adopt 50 new forestry management plans - Forestry management plan implementation increased by 500 acres - No-till implementation increased by 500 acres - Cover crops implementation increased by 500 acres - Permeability increased on 2,000 square feet of existing surfaces in developed areas - Convert 2 acres of turf grass to deep-rooted perennials - Increase rain garden areas by 500 square feet - Construct Water and Sediment Control Basin(s) to control 40 acres of drainage area 	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	

Goal 3: Protect and Preserve Groundwater			
Timeframe and Objectives	Date Completed	Not Completed	Comments (attachments as needed)
2018-2022 - Document 5 new uses of rain barrels, cisterns and/or detention ponds - Document sealing of 25 abandoned wells - Participate in Rock River Groundwater Assessment	<hr/> <hr/> <hr/>	<hr/> <hr/> <hr/>	
2023-2027 - Document 5 new uses of rain barrels, cisterns and/or detention ponds - Document sealing of 1 abandoned well - Participate in Rock River Groundwater Assessment	<hr/> <hr/> <hr/>	<hr/> <hr/> <hr/>	
2028-2037 - Document 10 new uses of rain barrels, cisterns and/or detention ponds - Document sealing of 1 abandoned well - Participate in Rock River Groundwater Assessment	<hr/> <hr/> <hr/>	<hr/> <hr/> <hr/>	

Goal 4: Enhance Water-based Recreation			
Timeframe and Objectives	Date Completed	Not Completed	Comments (attachments as needed)
2018-2022 - Upgrade Galena canoe and kayak launch - Include smallmouth bass habitat improvements in 2 streambank stabilization projects	<hr/> <hr/>	<hr/> <hr/>	
2023-2027 - Upgrade Galena canoe and kayak launch - Include smallmouth bass habitat improvements in 2 streambank stabilization projects	<hr/> <hr/>	<hr/> <hr/>	
2028-2037 - Upgrade Galena canoe and kayak launch - Include smallmouth bass habitat improvements in 2 streambank stabilization projects	<hr/> <hr/>	<hr/> <hr/>	

Goal 5: Update and Integrate Government Plans, Policies, and Regulations at All Levels

Timeframe and Objectives	Date Completed	Not Completed	Comments (attachments as needed)
<p>2018-2022</p> <ul style="list-style-type: none"> - Update City/County comprehensive plans to support watershed goals - Incorporate practices that increase stormwater infiltration and storage into capital improvements plans 	<p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p>	
<p>2023-2027</p> <ul style="list-style-type: none"> - Update/adopt City & County stormwater management ordinances to support watershed goals - Update City/County building & zoning ordinances to support watershed goals 	<p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p>	
<p>2028-2037</p> <ul style="list-style-type: none"> - Update City/County comprehensive plans to support watershed goals - Update/adopt City & County stormwater management ordinances to support watershed goals - Update City/County building & zoning ordinances to support watershed goals - Incorporate practices that increase stormwater infiltration and storage into capital improvements plans 	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	

Goal 6: Develop and Maintain Ongoing Activities for Shared Watershed Learning

Timeframe and Objectives	Date Completed	Not Completed	Comments (attachments as needed)
<p>2018-2022</p> <ul style="list-style-type: none"> - Offer 3 watershed tours and/or river eco-trips - Offer 5 presentations of watershed community education and outreach program - Maintain annual watershed booth at Galena Earth Day Fest - Add 1 new RiverWatch volunteer stream monitoring locations - Share Galena River Watershed-based plan with 2 local boards as a possible template 	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<p>2023-2027</p> <ul style="list-style-type: none"> - Install 5 signs to demarcate watershed boundaries - Offer 5 watershed tours and/or river eco-trips - Offer 5 presentations of watershed community education and outreach program - Maintain annual watershed booth at Galena Earth Day Fest - Add 1 new RiverWatch volunteer stream monitoring locations - Share Galena River Watershed-based plan with 2 local boards in as possible template 	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	
<p>2028-2037</p> <ul style="list-style-type: none"> - Offer 10 watershed tours and/or river eco-trips - Offer 10 presentations of watershed community education and outreach program - Maintain annual watershed booth at Galena Earth Day Fest - Add 2 new RiverWatch volunteer stream monitoring locations - Share Galena River Watershed-based plan with 2 local boards as a possible template 	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	

Goal 7: Monitor Resource Management Outcomes and Adapt Practices as Needed			
Timeframe and Objectives	Date Completed	Not Completed	Comments (attachments as needed)
2018-2022 - Track Illinois EPA monitoring data - Maintain volunteer monitoring database - Conduct additional sampling to refine load reduction goals - Track implementation of Best Management Practices (BMPs)	_____	_____	
2023-2027 - Track Illinois EPA monitoring data - Maintain volunteer monitoring database - Conduct additional sampling to refine load reduction goals - Track implementation of Best Management Practices (BMPs)	_____	_____	
2028-2037 - Track Illinois EPA monitoring data - Maintain volunteer monitoring database - Conduct additional sampling to refine load reduction goals - Track implementation of Best Management Practices (BMPs)	_____	_____	

Goal 8: Ensure Functional and Financial Stability of Galena Watershed-based Planning			
Timeframe and Objectives	Date Completed	Not Completed	Comments (attachments as needed)
2018-2022 - Establish permanent watershed committee - Have plan adopted by City, 4 Townships and County - Complete watershed plan progress checklist annually - Explore permanent funding options for watershed planning and project implementation	_____	_____	
2023-2027 - Maintain permanent watershed committee - Complete watershed plan progress checklist annually	_____	_____	
2028-2037 - Maintain permanent watershed committee - Complete watershed plan progress checklist annually	_____	_____	

Illinois EPA Total Maximum Daily Load (TMDL) Targets				
Parameter	Current Level*	25% by 2022	50% by 2027	100% by 2037
Zinc	82 µg/L	76.1 µg/L	70.2 µg/L	58.37 µg/L
Sedimentation/Siltation	37.59 mg/L of TSS	34.22 mg/L of TSS	30.85 mg/L of TSS	24.1 mg/L of TSS
Total Suspended Solids (TSS)	37.59 mg/L of TSS	34.22 mg/L of TSS	30.85 mg/L of TSS	24.1 mg/L of TSS
Fecal Coliform	453 cfu/100 ml	390 cfu/100 ml	327 cfu/100 ml	200 cfu/100 ml

*Geometric mean of available samples from 2000-2014

Is there evidence that these targets are being met? Yes _____ No _____

**APPENDIX C: Watershed-wide Summary of BMPs Recommended for Implementation
(After First 10 Years)**

BMP Name (a)	Amount (b)	Unit (c)	Cost (d)	Sediment (tons/yr.) (e)	Total Suspended Solids (lbs./yr.) (f)	Phosphorus (lbs./yr.) (g)	Nitrogen (lbs./yr.) (h)
Identify, prioritize, and stabilize stream banks	24,000	feet	\$600,000 (\$50/foot)	1,608 tons/yr.	To Be Determined	1,608 lbs./yr.	3,288 lbs./yr.
Identify, prioritize and improve riparian buffers	50	acres	\$34,000 (\$680/acre)	700 tons/yr.	To Be Determined	700 lbs./yr.	1,350 lbs./yr.
Increase acreages on which Forest Management Plans are implemented	500	acres	\$50,000 (\$100/acre)	23,050 tons/yr.	To Be Determined	23,050 lbs./yr.	46,100 lbs./yr.
Increase row crop acreages doing true, constant no-till	500	acres	-\$8,500 (-\$17/acre)	3,850 tons/yr.	To Be Determined	4,000 lbs./yr.	7,500 lbs./yr.
Increase row crop acreages incorporating cover crops	500	acres	\$33,336 (66.67/acre)	3,450 tons/yr.	To Be Determined	13,000 lbs./yr.	6,500 lbs./yr.
Convert row crop areas to perennial crops	50	acres		1,156 tons/yr.	To Be Determined	1,200 lbs./yr.	2,870 lbs./yr.
Increase permeability of existing surfaces in developed areas	2,000	sq. ft.	\$19,000 (\$9.50/sq. ft.)	0.02 tons/yr.	To Be Determined	0.04 lbs./yr.	0.72 lbs./yr.
Convert acreage of turf grass to deep-rooted perennials	2	acres	\$1,000 (\$500/acre)	0.226 tons/yr.	To Be Determined	0.8 lbs./yr.	4.8 lbs./yr.
Increase square footage of rain gardens	400	sq. ft.	\$1,200 (\$3/sq. ft.)	160 tons/yr.	To Be Determined	192 lbs./yr.	688 lbs./yr.
Increase acreages controlled by detention basins	40	acres	\$16,000 (\$8,000/20 acres drained)	180.2 tons/yr.	To Be Determined	264 lbs./yr.	530 lbs./yr.
ESTIMATED TOTAL ANNUAL LOAD REDUCTIONS				34,154 tons/yr. ¹	To Be Determined lbs./yr. ²	44,015 lbs/year ³	68,832 lbs./yr. ⁴

¹ Data from land use and BMPs in the watershed suggest a total sediment load entering the river of 12,760 tons/yr. Based on research on other Driftless Area streams, it is estimated that sediment entering the river from the landscape represents just 20-40% of the total load, with legacy sediment from the streambanks representing 60-80% of the total load. This would suggest that total sediment loading lies in the range of 31,900-63,800 tons/yr.

² The Galena/Sinsinawa Rivers Watershed TMDL Report notes recorded actual TSS load levels ranging from 5,554 lbs/day to 122,452 lbs/day, and calls for reductions ranging from 0-81% to meet the TMDL Endpoint or Target Value of 24.1 mg/L given various flow conditions. Currently, we have insufficient data to calculate TSS reductions for specific practices. However Suspended Solid Concentrations (SSC) will be obtained in a sampling project scheduled for Fall 2018 - Fall 2019. USGS has provided a formula relating SSC and TSS (SSC=126+1.0857 TSS), and the new data will assist in efforts to estimate load reductions by practice going forward.

³ Data from land use and BMPs in the watershed suggest a total nitrogen load entering the river from the landscape of 79,053 lbs./yr.

⁴ Data from land use and BMPs in the watershed suggest a total phosphorous load entering the river from the landscape of 18,613 lbs./yr. Given the relationship between soil and phosphorous, it is assumed that there is additional phosphorous loading related to legacy sedimentation (31,900-63,800 lbs./yr.).