3 watershed inventory and analysis

3.01 INTRODUCTION

The Duck Creek watershed, located in eastern Scott County, Iowa and the Rock River Ravine Study Area located in northern Rock Island County, Illinois comprise two subwatersheds of the Quad Cities area that contribute surface water that ultimately flows to the Mississippi River. Conservation Design Forum (CDF) is assisting with watershed planning for these two areas under the direction of River Action, Inc. As part of this planning effort, CDF is responsible for conducting an assessment of the existing conditions of the waterways (rivers, creeks, and contributing influences) within each watershed. This information forms the base from which the recommendations for improvement will be derived.

A solid understanding of the unique features and natural **hydrologic** (water-based) processes that form the underlying framework of the watershed -- as well as a clear comprehension of the current and predicted future conditions of these processes if no action is taken -- is critical to developing an effective watershed plan. The watershed inventory and analysis section of this report organizes, summarizes, and presents data and observations gathered about the current conditions of the watershed in a manner that clearly communicates the current issues and processes so that those that live and work in the watershed (stakeholders) can make informed decisions about the watershed's future. This inventory and analysis helps to identify causes and sources of watershed impairment, and provides the basis for recommending actions intended to improve conditions within the watershed, which are found in Chapter Five. Factors that have influence on the degree of watershed impairment that may be observed include water quality, surface water quantity, erosion, type of land cover, etc.

To conduct the inventory and assessment, CDF and other members of the project team collected and reviewed available watershed data and reports, investigated and photographed stream reaches in the field, and gathered input from watershed stakeholders. Examples of information that was investigated for the Rock River watershed include historic water quality data; field observation of streambank and channel conditions and erosion; soil characteristics; and maps of existing wetlands, floodplains, the stormwater drainage system, and land use.

The Rock River near Silvis and Carbon Cliff.

Geographic Information System (GIS) software was used to compile and display this complex geographic information in graphic and map format to help stakeholders and other readers of this report more easily understand the condition and location of watershed resources and problems. The project team also investigated water quality by modeling the amount of different pollutants that are expected from various land uses.

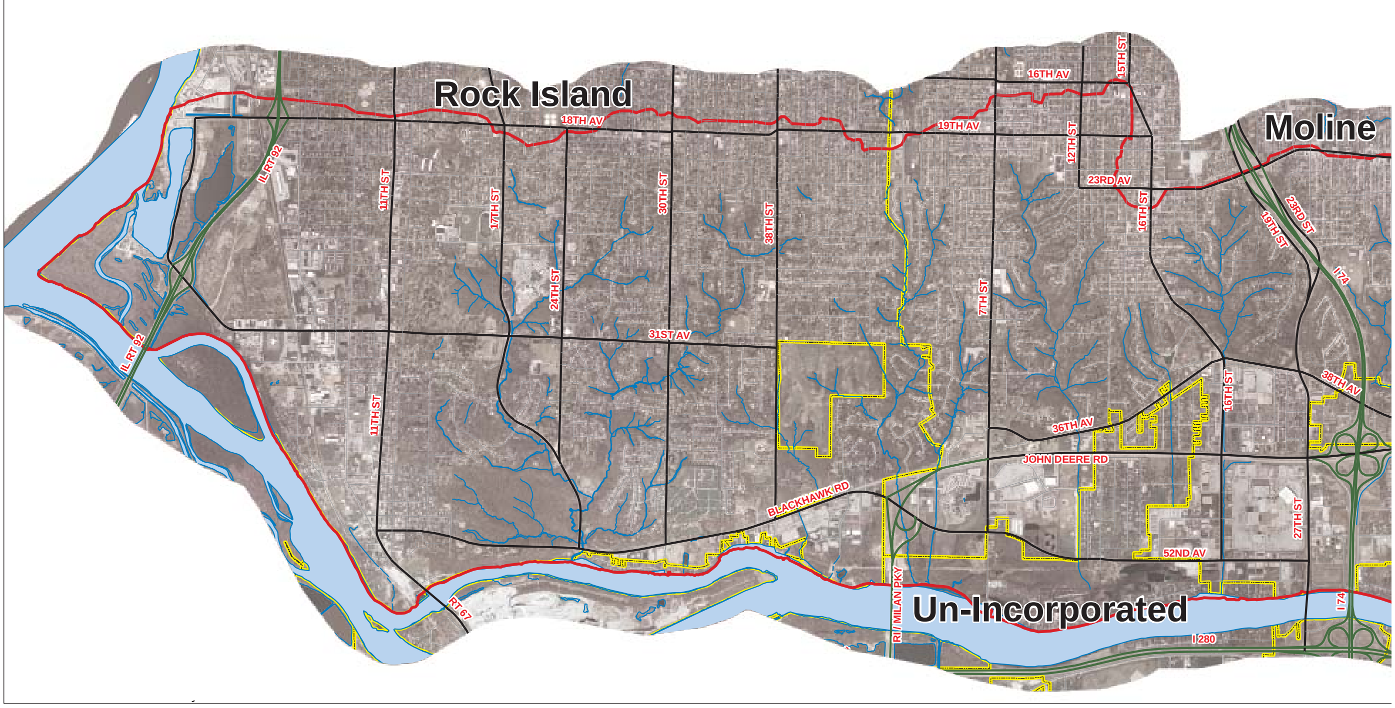
This chapter presents the results of the inventory and analysis in a narrative form accompanied by an illustrative series of maps, tables, and photographs. A 'Summary and Conclusion' section completes the chapter.

3.02 WATERSHED SETTING

As shown in **Figure 3.02.1**, the 25 square mile (16,068 acres) within the Rock River Ravine Study Area watershed extends from the confluence of the Rock and Mississippi Rivers in the west to where I-84/Colona Road crosses the Rock River in the east. Its northern boundary traces a ridge line that runs east to west and generally follows 18th Avenue in Rock Island, 23rd Avenue in Moline and Avenue of the Cities in East Moline and Silvis. From this point the boundary angles northeast to 2nd Avenue in Carbon Cliff and then turns southeast and follows the railroad line to the Rock River. The ravines, which are the most significant feature of this watershed, generally drain from north to south, and from west to east in the far eastern portion of the study area. **Figure 3.04.1** shows how these ravines appear to be standing like a line of trees whose trunks end at the base of the steep slopes that rise up from the Rock River flood plain. The line of the floodplain follows Blackhawk Road in the west, 36th and 38th Avenues in Moline, and John Deere Road further east. From this point, the southern watershed boundary extends to the Rock River.

With the exception of the ravines themselves and some land between John Deere Road and the river, most of the Rock River Ravine Study Area is heavily developed with residential uses, and with commercial and industrial uses on the western border and along the southern edge within the Rock River floodplain. The floodplain and wetland areas of the Rock River Study Area are heavily influenced by upland drainage through the ravines and the Rock River itself. Because of these significant landscape features and the intensive development over the majority of this watershed, the importance of managing watershed resources to protect and enhance both the ravines and floodplain, and the water quality contributed by this system to the Mississippi River, can not be overstated. Due to the overwhelming influence of the entire Rock River watershed on this small study area, however, there is little that can be done within the ravines to influence the floodplain, wetlands, or the Rock River itself.

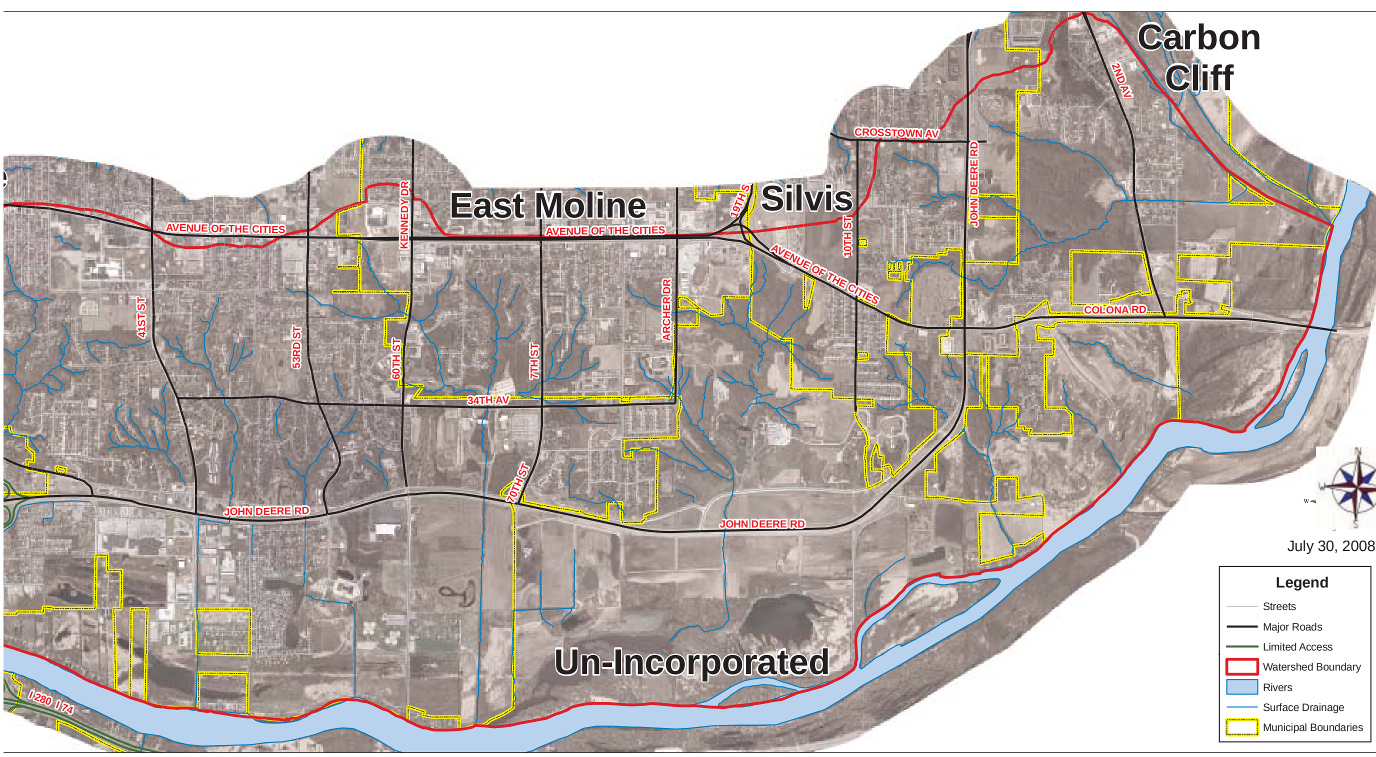
Figure 3.02.1 Study Area



The overall quality and connection of the Rock River systems relative to the overall quality of the Mississippi River and, ultimately, the Gulf of Mexico, is critical. An appreciation and understanding of this connection should influence the proper management and stewardship of our valuable and degraded aquatic resources.

3.03 CLIMATE AND PRECIPITATION

The climate of the Rock River Ravine Study Area watershed and of the Quad Cities region in general exhibits a wide range of temperatures over the calendar year. Mean high summer temperatures are in the low eighties; mean low winter temperatures are in the low teens. Precipitation and snowfall in the watershed average 38.04 and 35.3 inches per year, respectively. Precipitation is greatest during the late spring and summer and is typically associated with low-pressure weather systems. These systems result in the thunderstorms that are commonplace across the Midwest during the summer months. Table 3.03.1 presents the 1971–2000 temperature and normal precipitation for the watershed.



3.04 GEOLOGY AND TOPOGRAPHY

Glacial action has significantly shaped the landscape character of the Quad Cities region. The first glaciers to reach this area advanced from the northwest about 300,000 years ago and crossed the present-day upper Mississippi River valley into eastern Iowa, scouring the bedrock and depositing sediments as they advanced and retreated. Within the last 25,000 years, the region was covered by a glacial lake that deposited massive quantities of sediment as it drained. Subsequently, as the glaciers made their final retreat, fine-grained sediments were transported by wind from the front of the ice sheet to be deposited as a thick blanket of loess, a buff to gray deposit of fine-grained, calcareous silt or clay. These multiple glacial deposits range in thickness from less than 25 feet to nearly 100 feet over the bedrock of the region. Soils along the lower reaches of the Rock River in Illinois clearly show this history by being composed almost entirely of well-drained, silty loam with very little clay content, typical of glacial outwash. Some areas have a high percentage of sand.

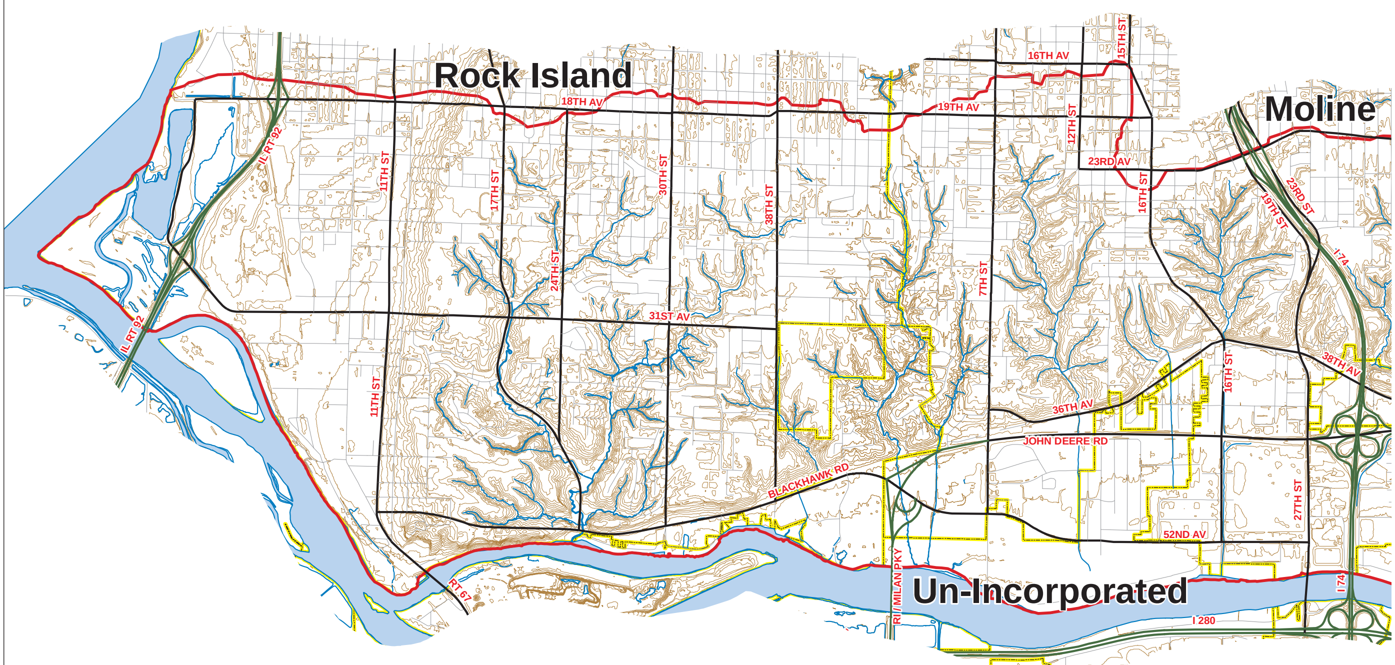
As with soil composition, the regional topography is influenced by both bedrock geology and the surficial processes that have occurred over time. Receding glaciers deposited

Table 3.03.1 1971-2000 Precipitation and Temperature data for Moline climate station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Totals
Precipitation (in)	1.58	1.51	2.92	3.82	4.25	4.63	4.03	4.41	3.16	2.80	2.73	2.20	38.04
Snow (in)	10.2	7.2	4.9	1.3	0.0	0.0	0.0	0.0	0.0	0.2	3.0	8.5	35.30
High Temp (F)	29.8	35.6	48.3	61.7	73.3	82.7	86.1	83.9	76.5	64.4	48.0	34.5	60.4
Low Temp (F)	12.3	18.2	29.0	39.3	50.0	59.7	64.5	62.4	53.4	41.6	30.1	18.3	39.9
Mean Temp (F)	21.1	26.9	38.7	50.5	61.7	71.2	75.3	73.2	65.0	53.0	39.1	26.4	50.2

Source: Data from Illinois State Water Survey Climate Office, 1971-2000 averages, Moline Station, IL

Figure 3.04.1 Topography Map



broad, irregular mounds of sediment known as moraines, creating local variations in the topography and landform that resulted in steep slopes of up to 60 degrees such as are seen along the Rock River ravine drainage system. These variations become more pronounced as you move from the flat or rolling uplands along the northern border of the watershed boundary down into the Mississippi and Rock River floodplains. Streams have carved these ravines and valleys into the surface deposits as surface water has been drained through the system rather than infiltrated. Eroding surface soils by water action has exposed dolomite, shale, and limestone bedrock at the land surface in some locations. River dynamics have deposited sediment (alluvium) within the broad, flat floodplains in the lower reaches of the system that have first been favored by agriculture and, second, followed by industry seeking large flat areas and access to water for use in industrial processes and to transport raw materials and products into and out of the area.

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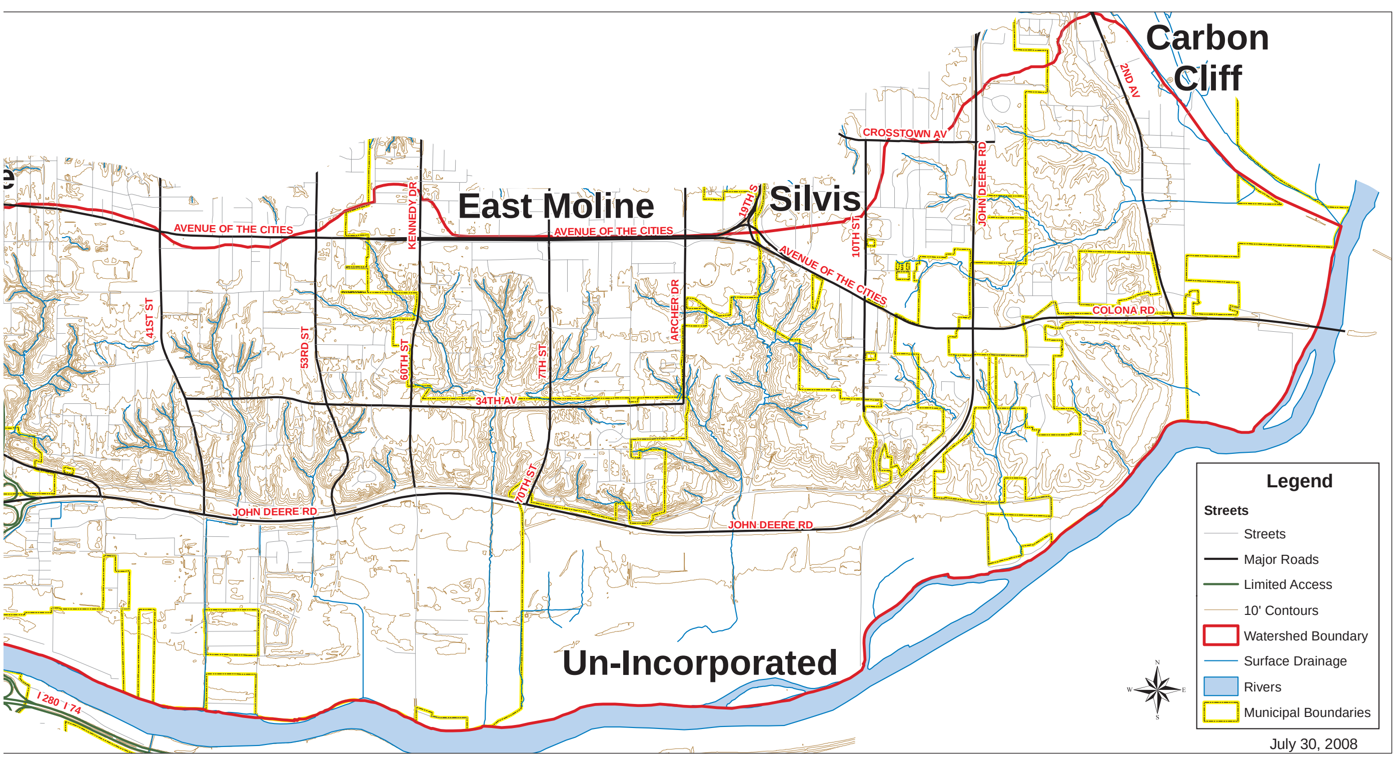
Shale outcropping within the TPC Golf Course near Silvis and Carbon Cliff



3 watershed inventory and analysis

The topography of the Rock River study area is comprised primarily of a relatively flat ridge and a flat floodplain connected by steep ravines. The northern edge of the watershed, at approximately 710 feet in elevation, follows a ridge that bisects Rock Island, Moline, and East Moline. The ravines begin very near this northern edge and run from north to south, trending to running west to east on the eastern end of the study area. The Rock River floodplain is broad and flat in the eastern two-thirds of the study area.

ROCK RIVER RAVINES

The Rock River ravines are of special interest in this study. Not only do they convey surface water runoff from the urbanized uplands, they also have the potential to support unique ecosystems such as a rare wetland complex known as a fen. In addition, the ravines, as unique landforms, are valuable features to the residential properties that line their upland edges.

The ravines formed prior to European settlement when water running off the higher areas of the watershed towards the river found the path of least resistance creating small channels down the slope of the landscape. As more water followed these same courses, the channels grew until the ravines were deeply cut into the landscape.

Over time, the ravines developed some interesting characteristics. The incision of the ravines into the underlying soils eventually intersected with the groundwater table in some locations, and water slowly seeped out through the steep ravine banks. This water caused wetland-like conditions to develop at the base of the slopes based on the unique, groundwater-fed growing conditions where the groundwater supply is constant and has a stable temperature year round. Plant assemblies adapted to these conditions are called fens or seeps. While true fens were not found, there is evidence that they may have existed, and may be able to be restored. These fens are rare in the Quad Cities region and deserve special consideration for restoration and preservation.

Ravines also experience microclimates, small areas where the climatic conditions (such as temperature and humidity) are different from those of the surrounding landscape, sometimes due to air masses moving up and down the ravines from the Rock River valley. These air masses have different characteristics than those outside of the ravines, which creates unique growing conditions and communities of plants and animals that are likely not found elsewhere in the region.

Due to the development that has occurred within the watershed, the increase in impervious cover that has resulted, and the current design of stormwater collection and conveyance systems, a significantly larger volume of rain water runoff reaches the streams and ravines more quickly today with greater velocity than in the past. This subjects the relatively fragile slopes of the ravines to more destructive runoff energy than prior to development. The increased speed and volume of runoff entering the ravines has destabilized and eroded the stream and ravine banks and deeply incised the stream bed, cutting it off from its floodplain. Debris blockages, common in ravines, can trap sediment and cause water to back up behind the blockage and, in some cases, cause flooding. Blockages also divert water towards the streambanks, further exacerbating erosion problems. Development near or adjacent to ravine edges and bluffs has further compromised these systems. Removal of vegetation for development further reduces the stability of the soil which can cause significant and catastrophic bank failure, threatening property and infrastructure. Roof and footing drains that direct water into the ravines, further increase the amount and velocity of the water, adding to the erosional forces that further degrade the banks.

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Streambank erosion is a significant problem along most stream reaches, particularly within the ravines.

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A ravine in spring with a fairly open forest canopy and thick ground vegetation

© Conservation Design Forum

Some ravines appear fairly stable with moderate stream habitat.

3.05 SOILS

Three aspects of the soils in the region were investigated and mapped for this inventory: hydric soils, hydrologic soil group, and soil erodibility. The hydrologic soil group and hydric soil classifications provide valuable information for determining the appropriate management practices for different applications throughout the watershed. For example, understanding the extent and location of hydric soils helps to identify possible locations for restoring former wetlands. Erodible soils indicate areas where development or improper management may cause erosion, and where maintaining vegetative cover can help hold soils in place. Accurate soil mapping in developed areas is not possible as defining soil characteristics are lost as part of the construction process.

HYDRIC SOILS

The hydric soils data was obtained from the County Soil Survey that is developed and published by the Natural Resources Conservation Service. Hydric soils are formed when soils have been saturated, flooded, or ponded long enough during the growing season to develop anaerobic (oxygen-lacking) conditions in the upper part of the soil layer. These conditions favor the growth and regeneration of wetland, or hydrophytic, vegetation; that is plants that grow either partly or totally submerged in water or in waterlogged soil. Hydric soils have unique physical and chemical properties that can be detected and identified in the field even if the soils are dry, therefore hydric soils that are drained will retain those chemical and physical properties.

Knowledge of the location of hydric soils is important for a number of reasons. Hydric soils provide an indication of historic wetlands and locations for potential wetland restoration. Hydric soils are also areas that may be prone to flooding or otherwise wet conditions if the infrastructure that drains the soil (tiles and ditches) is not maintained. Hydric soils occur along natural drainageways and therefore can be useful in identifying natural connections between isolated wetlands where no apparent connection exists, and where restoration can improve the surrounding hydrology.

Within the Rock River Ravine Study Area hydric soils are generally confined to the Rock River floodplain in the southern

Figure 3.05.1 Hydrologic Soil Groups

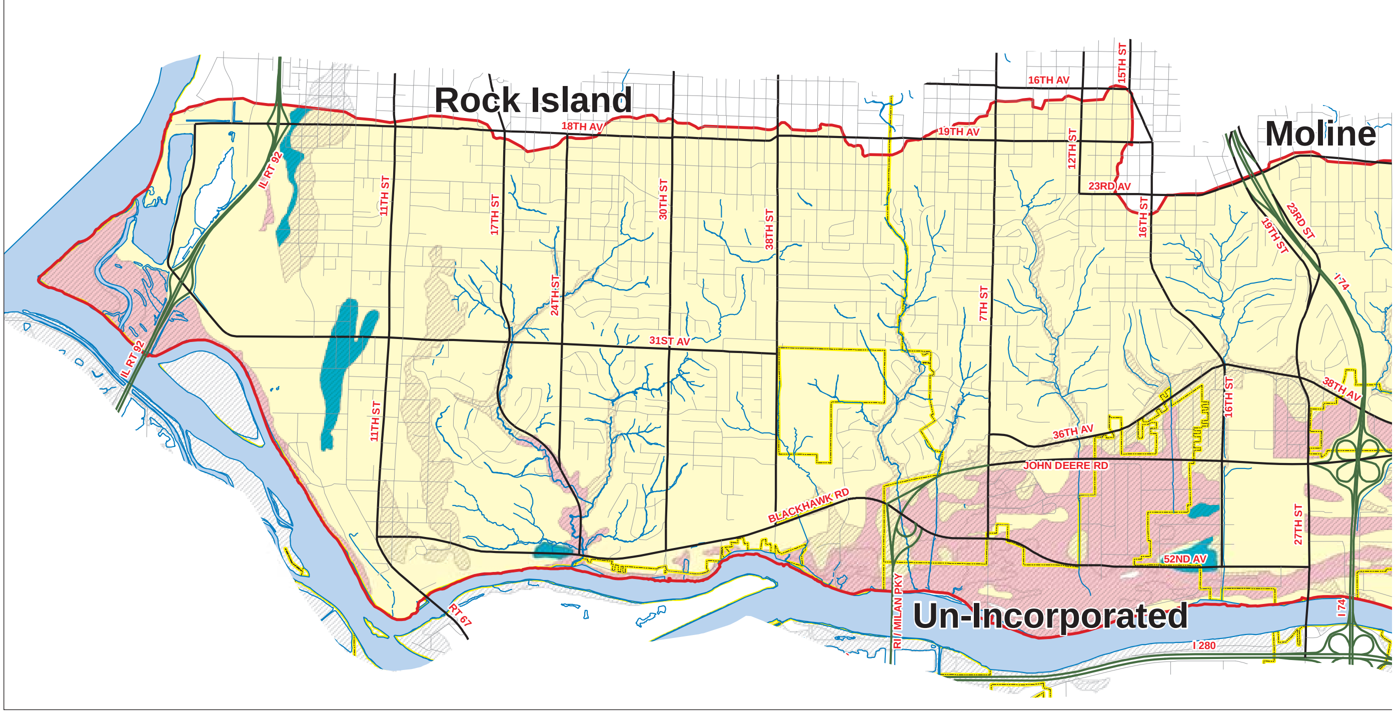


Table 3.05.1 Hydrologic Soil Groups and Hydric Soils

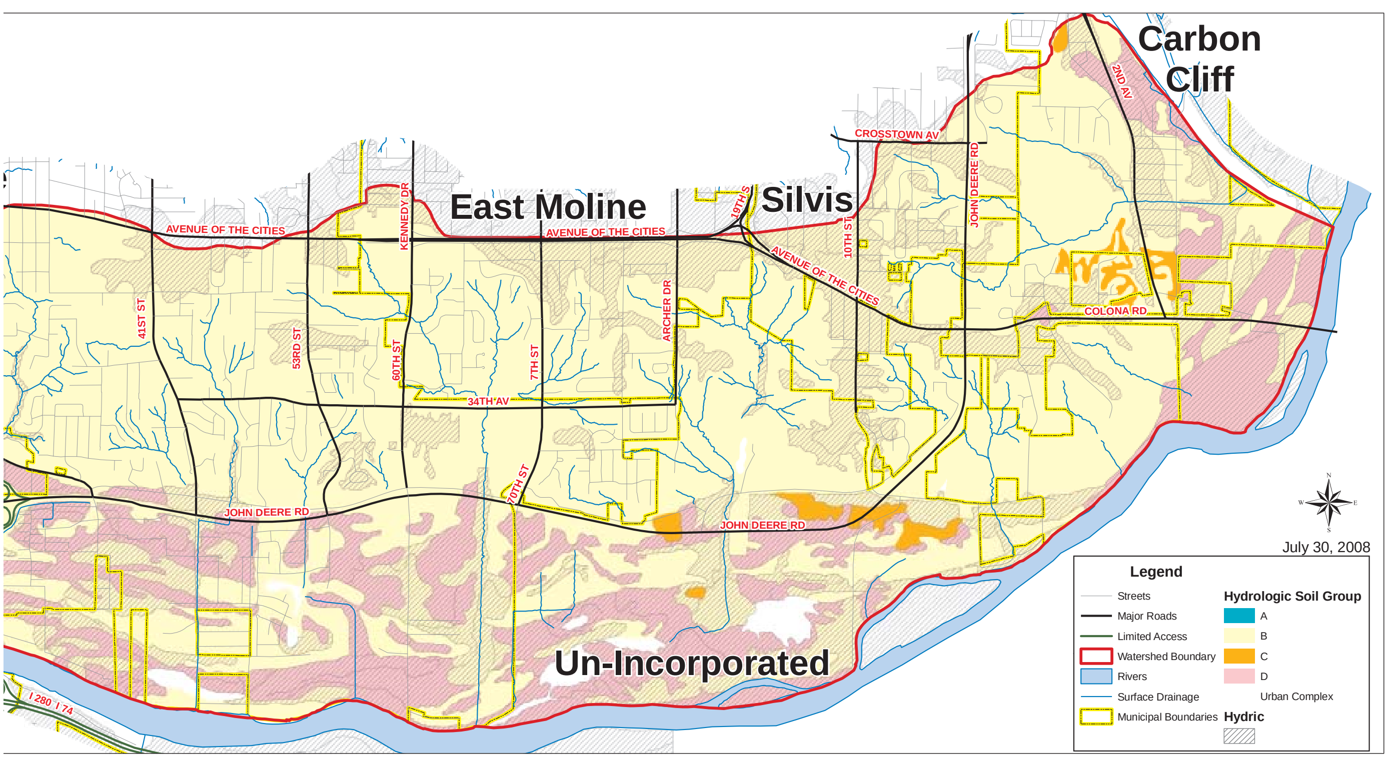
Hydrologic Soil Group	Acres	Percentage
HSG A	95	1
HSG B	13,290	83
HSG C	99	1
HSG D	152	1
HSG B/D	2,225	14
HSG C/D	21	0
No Data	186	1
Hydric Soils	4955	31

1/3rd of the watershed with some smaller sections that extend south from the northern border in East Moline south of the Avenue of the Cities from 7th Street east to beyond Archer Drive (**Figure 3.05.1**, Hydrologic Soil Groups). There is also a long linear hydric soil pocket that runs north-south east of the ridge line that runs along 11th Street. This area may have the potential to support a fen ecosystem, however, since the Study Area is highly developed both within and outside the floodplain, opportunities for wetland restoration will be limited.

HYDROLOGIC SOIL GROUP (HSG)

Under a system devised by the U.S. Department of Agriculture, soils are classified into one of four hydrologic soil groups -- A, B, C, or D -- based on the degree to which the soil continues to absorb water during a long rain event. Precipitation that is not absorbed or infiltrated becomes runoff. Therefore, the hydrologic soil group classifications within a watershed are one determinant of how much rainfall will run off as surface flow to streams. In general, Group A (sandy soils) has the highest permeability and least runoff potential whereas Group D (predominantly clay soils) has the lowest permeability and highest runoff potential. For mapping purposes, hydric soils labeled as B/D were mapped as D soils. The percentages of each HSG classification in the watershed are shown in **Table 3.05.1**.

As shown in **Figure 3.05.1** (Il watershed Hydrologic Soil Groups), HSG D soils are limited to the lower flats of the Rock River flood plain along the south and east sides of the Study Area where silty depositions during flooding events have covered this area with the smaller-particle soils that don't absorb water very efficiently. Smaller pockets of HSG



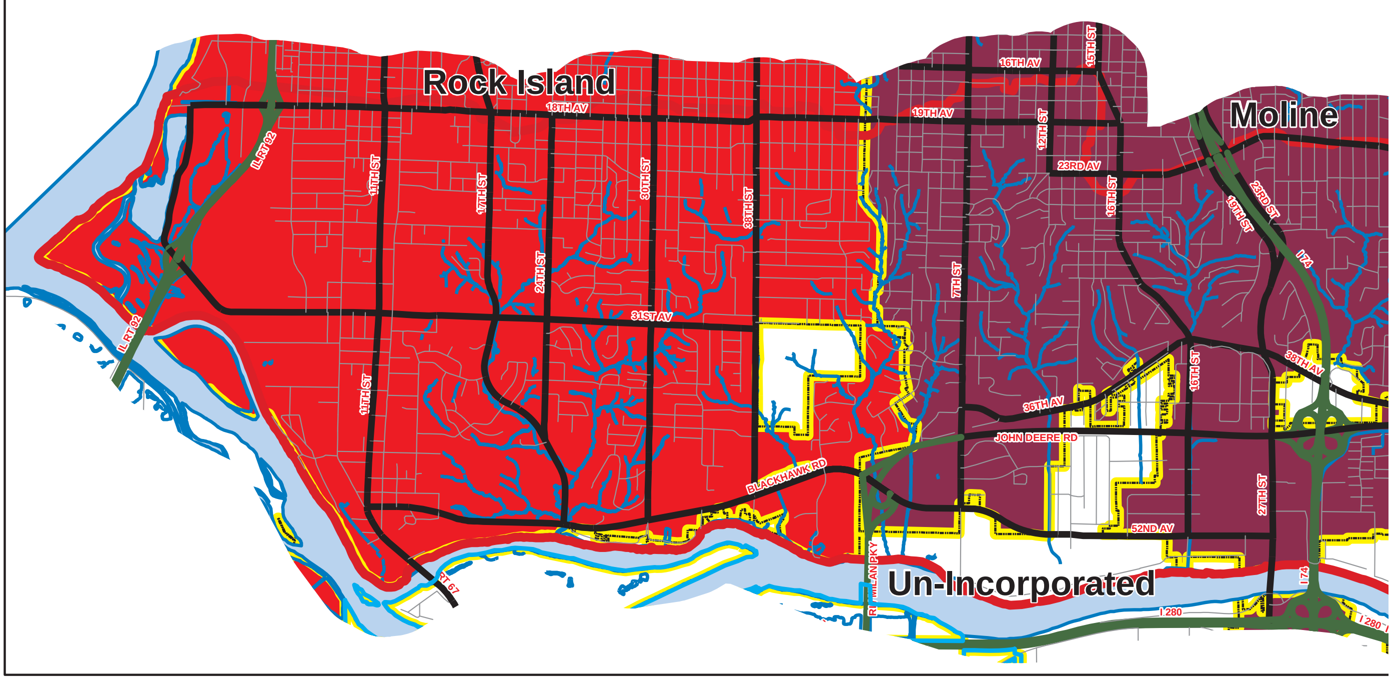
C soils are located at the base of the slopes just north of John Deere Road near the intersection of Colona Road and 2nd Avenue.

All HSG D soils in the Rock River Ravine Study Area watershed are also hydric. In the upland areas above the floodplain, the soil HSG group is predominantly B, a more well drained soils whose coarser texture improves its absorptive capacity. It is likely, however, that much of the soil character has been lost as a result of the conversion to agriculture and further development that has occurred within the watershed.

3.06 WATERSHED JURISDICTIONS

The Quad Cities area encompassed by Davenport, Moline, and Rock Island Metropolitan Statistical Area has a population of 377,291 and 150,409 households. The 2010 and 2025 project populations are 381,580 and 400,320 respectively. The Rock River Study Area watershed municipalities include Rock Island, Moline, East Moline, Silvis, and Carbon Cliff as well as Rock Island County (Refer to **Figure 3.06.1**).

Figure 3.06.1 Watershed Jurisdictions



3.07 LAND USE

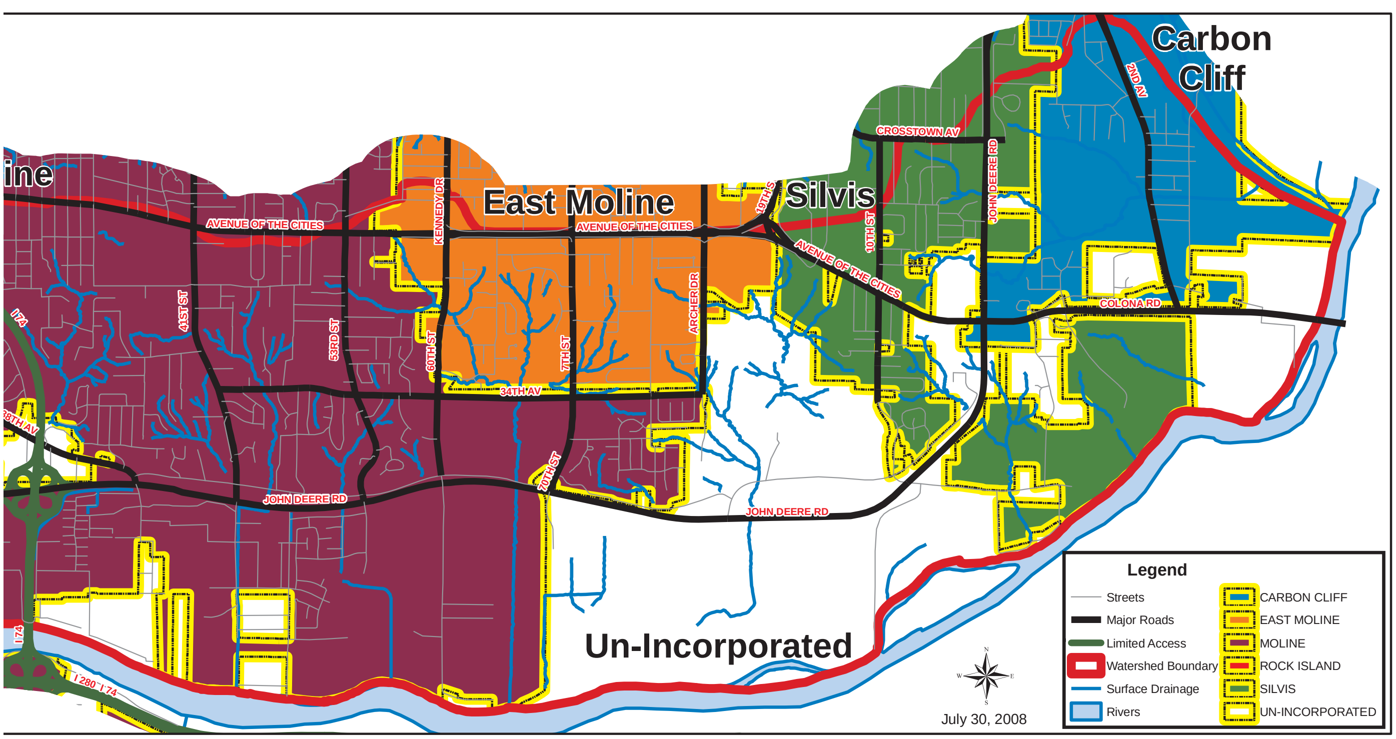
Land use and land cover refer to the type of use assigned to a section of land (parcel), such as residential or agricultural, and the type of surface coverage found on that parcel, such as forest or grassland, respectively. This information, as well as an understanding of the landscape characteristics prior to European settlement, provide a foundation for understanding the impact of current and future land use decisions on watershed resources and the restoration potential of a particular parcel within the watershed. For example, a parcel that is being farmed will have a much higher restoration potential than one where a large big box commercial complex has covered the landscape in large impermeable areas of roof and parking lot.

PRESETTLEMENT VEGETATION

Prior to European settlement, much of the Quad Cities region consisted of a mix of wet to dry prairie and open woods, with some Mississippi River bottomland near the mouth of the Rock River a mix of forest, prairie and wetland systems that included river bluffs, limestone cliffs, and rugged terrain bordering the Mississippi River floodplain.

According to a number of sources (Braun, 1950; Kuchler, 1964; Schwegman, 1973), the dominant presettlement condition for much of the study area floodplains (is this word out of place?) included wet and mesic prairie, wet (sedge) meadow, and marsh. Of these types of systems mesic prairie is the driest and marsh the wettest. With the exception of the mesic prairie, all are considered a type of wetland. Wet prairie species found historically included prairie cordgrass, various wetland sedges, and blue-joint grass. Associated plants in the mesic prairie were ironweed, boneset, swamp milkweed, and water hemlock.

Non-forested wetlands included duckweed, various grasses, tickseed, jewelweeds, soft rush, rice cutgrass, smartweeds, broadleaf cattail, prairie cordgrass, river bulrush, sedges, clearweed, and arrowhead, bur cucumber, swamp iris, blue vervain, sweetflag, spikerush, moneywort, scouring rush, swamp milkweed, and horsetail. Shrubs include buttonbush, red osier dogwood, alternate-leaved dogwood, elderberry,



willows, swamp rose, halberd-leaved rosemallow, and ironweed.

Forests in the lowest floodplain areas were subject to seasonal and prolonged flooding. Floodplain forest species include silver maple, American elm, green ash, some oak and hickory species, black cherry, black walnut, basswood, sycamore, cottonwood, hackberry, and honey locust. Shrub species included dogwood, blackberry, brier, Virginia creeper, and gooseberry. The herbaceous ground layer included white snakeroot, great lobelia, bur cucumber, smartweeds, knotweeds, stinging nettle, Solomon's seal, moneywort, moonseed, violets, and jewelweed.

There may have been areas of savanna (a drier area with a mix of oaks scattered within a prairie grassland) and oak woodlands (wooded areas dominated by oak species but also including other tree and shrub species) along the ridges and ravines. The savannah ecosystem type, which is now globally rare, occurred along the intersection of the great Eastern forests and the Midwestern open prairies. Its open, pleasant character and fertile soils resulted in mass conversion of these lands for agriculture and settlement. Oak woodland landscapes were more densely wooded than savanna, but would have been considered open by today's standards, with an understory of grasses and forbs.

Except for the oak woodlands along the ravines, most of the presettlement vegetation cover types have been converted to agriculture and urban land uses to provide living, working, learning, recreation, and other uses for people.

EXISTING LAND USE

Based on the Existing Land Use for the Rock River Ravine Study Area (See Table 3.07.2 and Figure 3.07.1), there is no data for 17% of the land included in the Land Use Map. Generally this includes unspecified space bordering the Rock River and extending north to John Deere Road east of 79th Street per City of Moline Current Land Use Map. Excluding whatever land may be developed within the 2,716 acres where land use is not specified, approximately 70% of the watershed is currently developed with 63% of this concentrated in residential land uses north of the Rock Creek

Figure 3.07.1 Existing Land Use

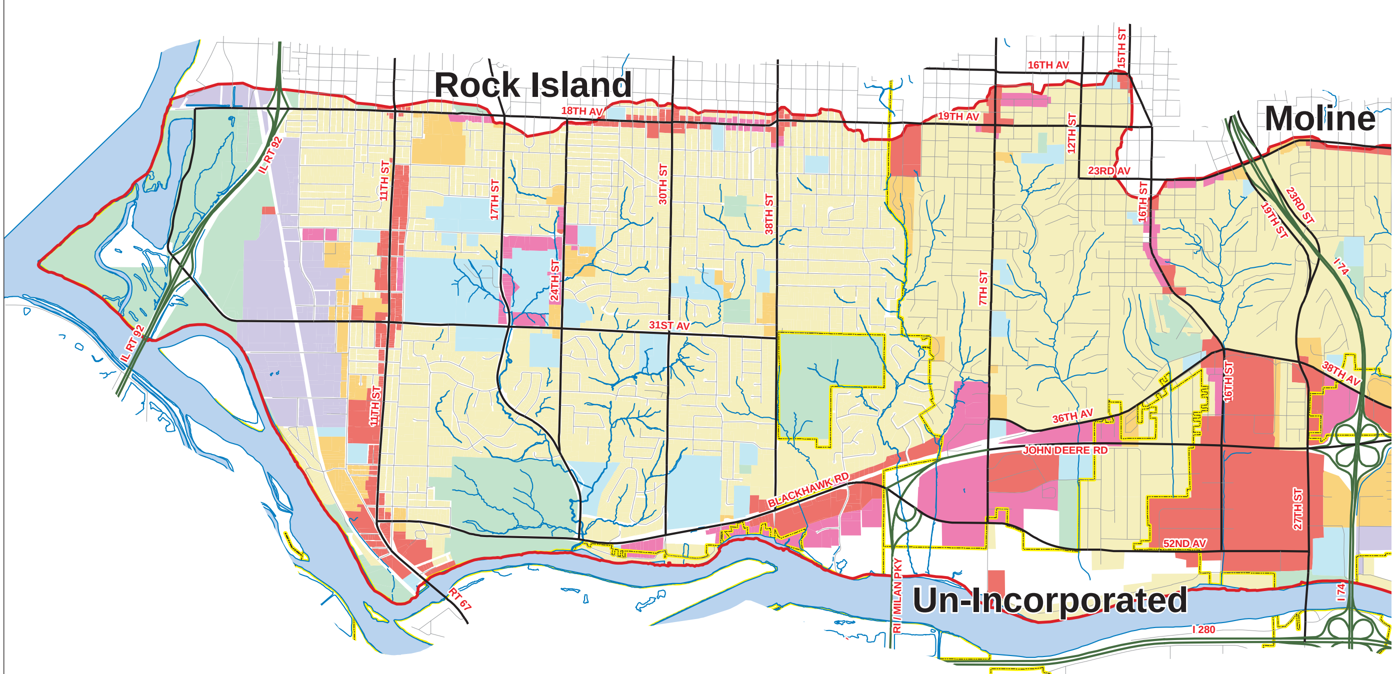
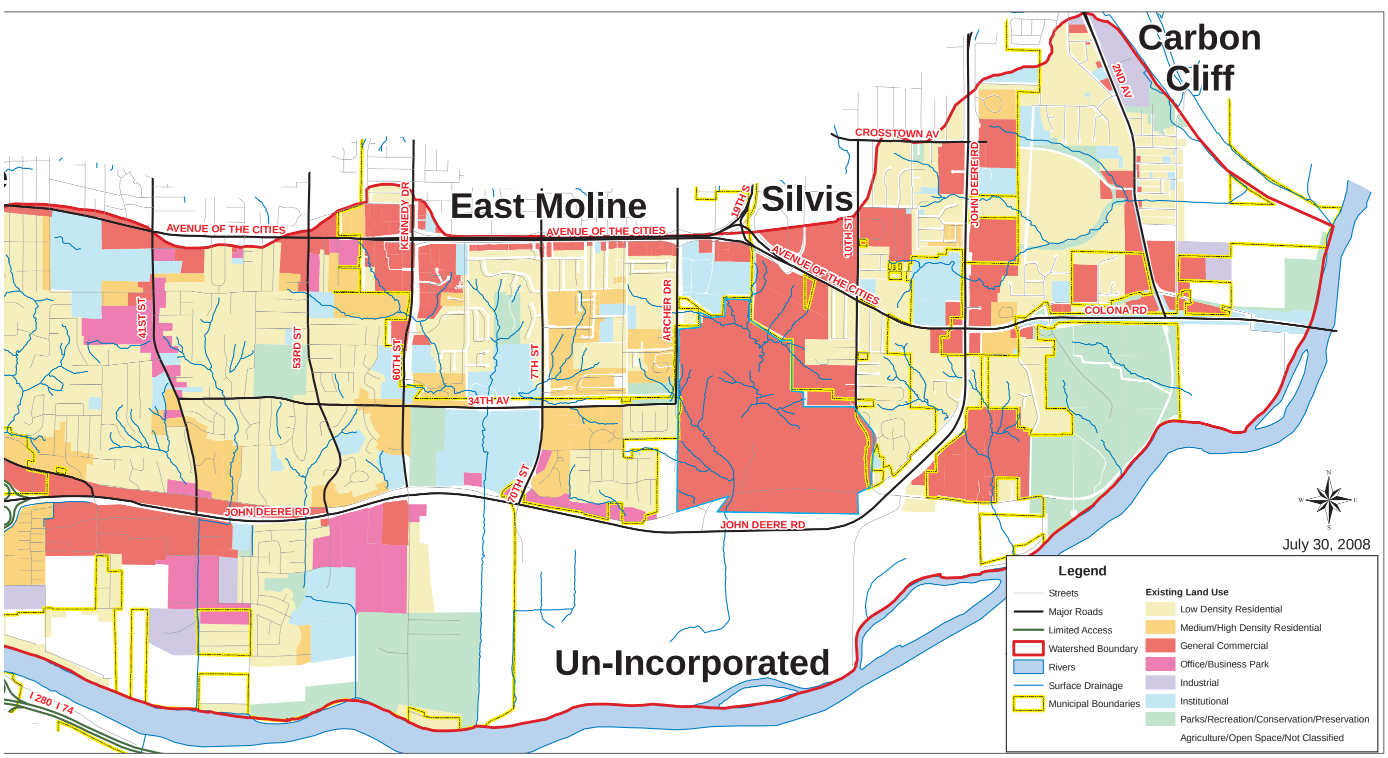


Table 3.07.1 Land Use Categories

Land Use & Cover Category	Definition
Agricultural	Cropland, pastureland, orchards, nurseries and greenhouse operations, and horse farms and stables.
Commercial / Office Business Park	Shopping malls and parking, office and research parks, office buildings and hotels, and retail (such as department stores, grocery stores, hardware stores).
Parks / Recreation / Conservation / Preservation	Parks, golf courses, nature preserves, playgrounds and athletic fields, forested land or grassland that is under public or private ownership for the purposes of preservation of natural resources and/or recreation.
Institutional	Medical and health, educational, correctional, and religious facilities.
Industrial	Mining, mineral extraction, manufacturing and processing, warehousing and distribution centers, wholesale facilities, and industrial parks.
Medium / High Density Residential	Apartment and retirement complexes.
Open Space	Vacant or underutilized land in private ownership.
Low Density Residential	Single homes, duplex homes, townhomes, and farmhouses.
Unclassified	Roads and transportation rights-of-way and land that is unclassified within another land use listed above.



floodplain. Currently industrial and Office Business Park land uses account for only 2.4% and 3.7% respectively. The General Commercial areas of Moline and East Moline are the largest non-residential land use at 2018 acres (12.55%). With the exception of the unspecified land, there is very little undeveloped land available within the watershed. Most land use change, therefore, may require conversion of an existing developed land use. Refer to **Table 3.07.1** for a description of the Land Use Categories.

FUTURE LAND USE

Based on the data projected for future land use within the watershed (**Figure 3.07.2** and **Table 3.07.3**), office business park use will expand by 74.16% while industrial land uses remain constant. The office business park land use shows the most growth by far of all categories. Following these, general commercial use will also expand by 8.52% and land devoted to parks and conservation will increase by 6.60%.

This growth will be achieved largely through conversion of 15.5% of non-designated land and 5.52% of low density residential to one of the above uses. With this growth, 71% of the available land within the watershed will be covered by a land use that increases impervious cover and run-off. This amount of development could present significant challenges to the community and local officials who seek to make water-related improvements within the watershed. Since the majority of this land use/land cover change will occur south of John Deere Road, there will be no additional negative affect placed on the ravine systems as a result of this growth, however, since virtually all of the land drained by the ravine creeks is developed, the quality impacts of this condition are already severe and ongoing.

Figure 3.07.2 Future Land Use

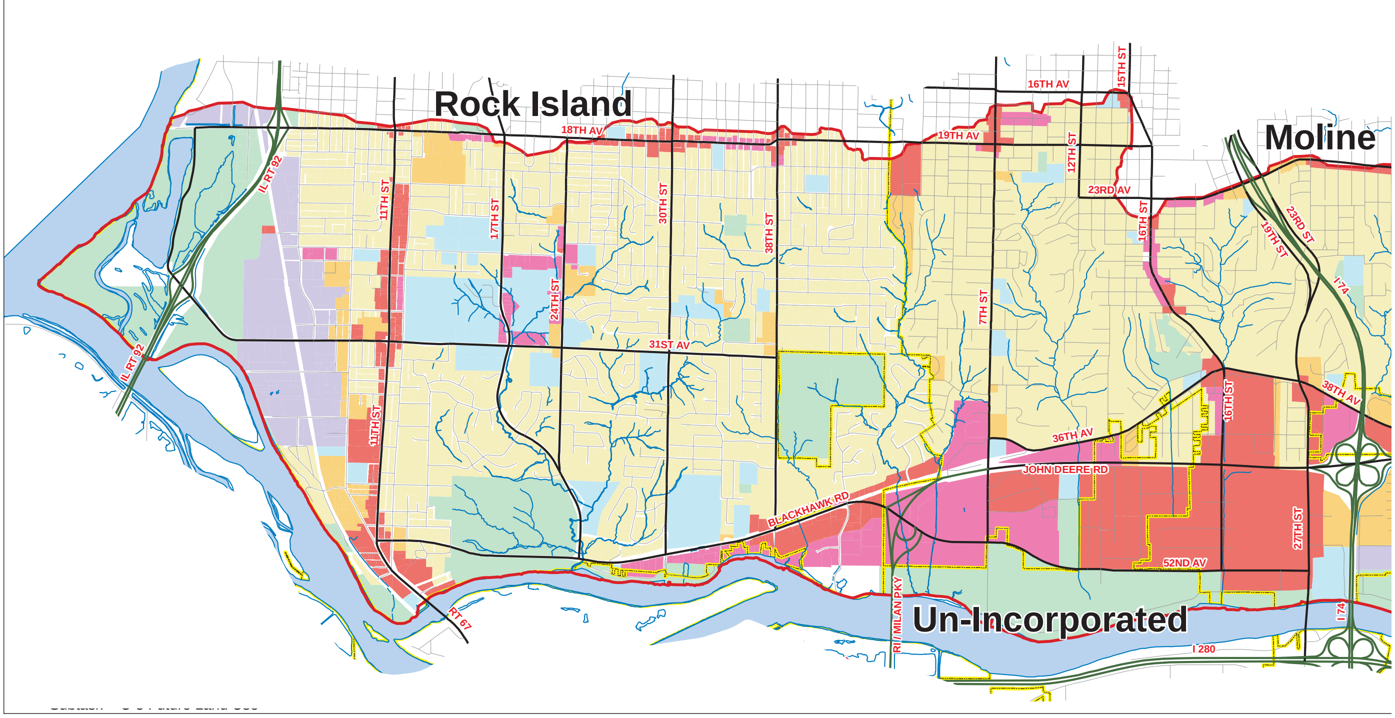
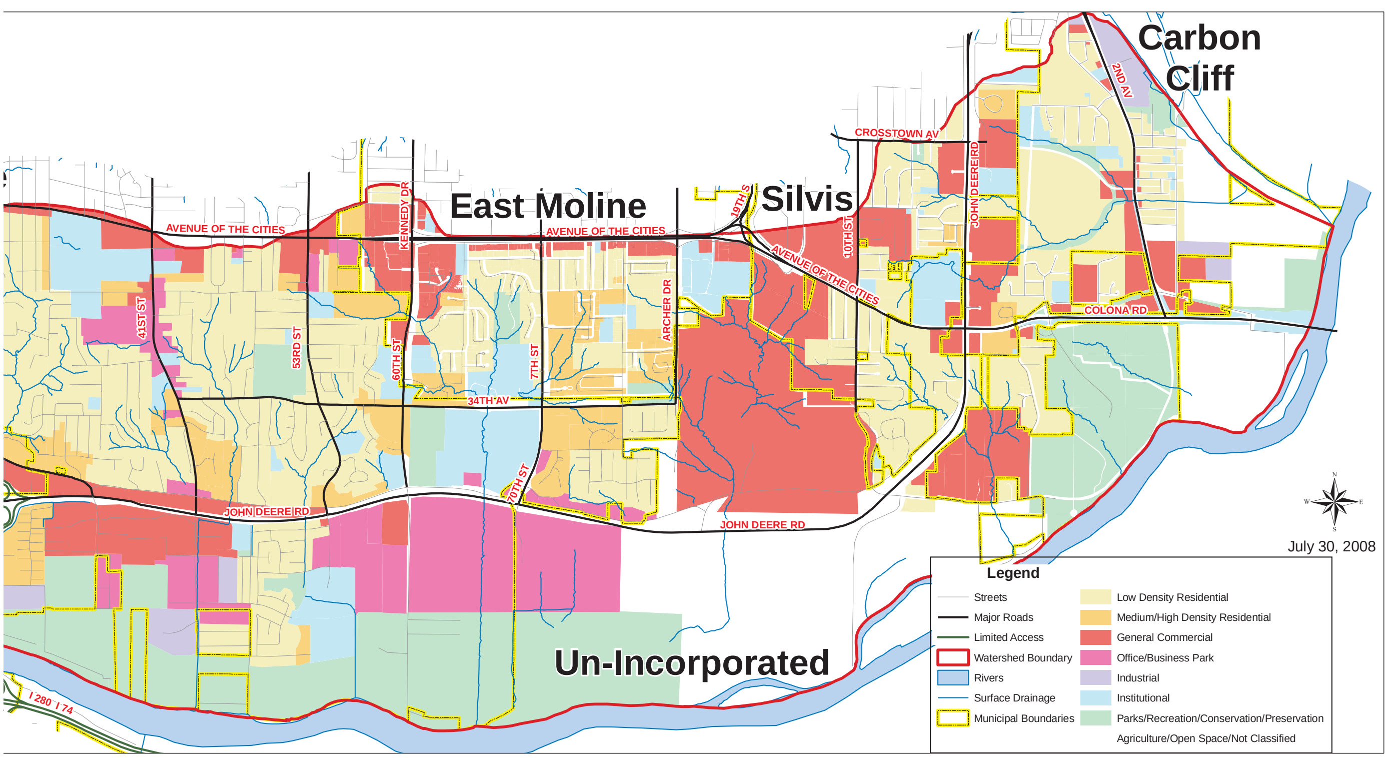


Table 3.07.2 Existing Land Use

Land Use	Acres	Percentage
Low Density Residential	6138	38%
Medium/High Density Residential	893	6%
General Commercial	2018	13%
Office Business Park	596	4%
Industrial	392	2%
Institutional	1102	7%
Parks/Rec/Conservation/Preservation	2213	14%
Agriculture	716	4%
Open Space	1082	7%
Not Classified	918	6%

Table 3.07.3 Future Land Use

Land Use	Acres	Percentage
Low Density Residential	5,799	36.0%
Medium/High Density Residential	893	5.6%
General Commercial	2,190	13.6%
Office Business Park	1,038	6.5%
Industrial	392	2.4%
Institutional	1,102	6.9%
Parks/Recreation/Conservation/Preservation	2,359	14.7%
Agriculture/Open Space/Not Classified	2,295	14.3%



3.08 GREEN INFRASTRUCTURE AND NATURAL AREAS

One of the goals of the watershed planning process is to identify green infrastructure that is important and should be preserved as a functional part of the natural drainage system. The intent is to plan a possible watershed green infrastructure system of open space, greenways, streams, wetlands, and natural areas that form an interconnected support system for natural functions and processes, particularly natural hydrologic functions and the aquatic environment. Some definitions of green infrastructure, such as that of the US Environmental Protection Agency, include storm water management as a component or benefit: Figure 3.08.1 documents the locations of green infrastructure within the study area.

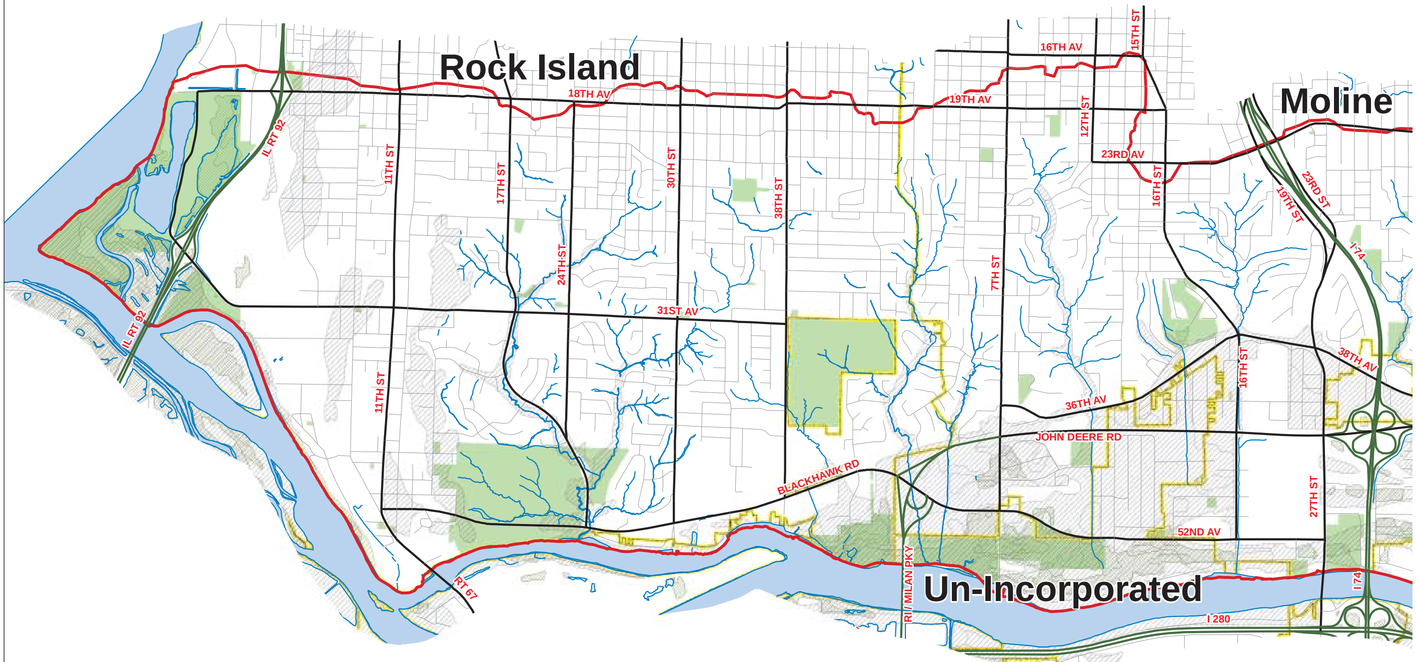
Green infrastructure represents a new approach to storm water management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure techniques utilize natural systems, or engineered systems that mimic natural landscapes, to capture, cleanse and reduce storm water runoff using plants, soils and microbes.

On the regional scale, green infrastructure consists of the interconnected network of open spaces and natural areas (such as forested areas, floodplains and wetlands) that improve water quality while providing recreational opportunities and wildlife habitat.

On the local scale, green infrastructure consists of site-specific management practices (such as rain gardens, porous pavements, and green roofs) that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls. (See Figure 3.08.2)

Appropriate preservation and management of a green infrastructure system can help allow movement of runoff through the watershed in a manner that enhances the aquatic ecology of the watershed, and at the same time provides natural conveyance, floodwater storage, water quality benefits, stream bank stabilization and restoration, natural resource preservation, wetlands, and habitat. Green

Figure 3.08.1 Green Infrastructure



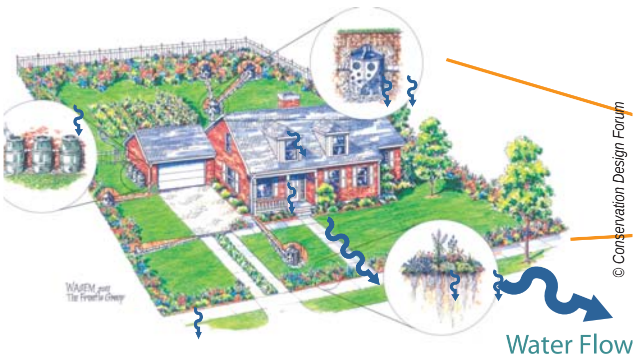


FIGURE 3.08.2 LOCAL GREEN INFRASTRUCTURE AT THE SITE SCALE

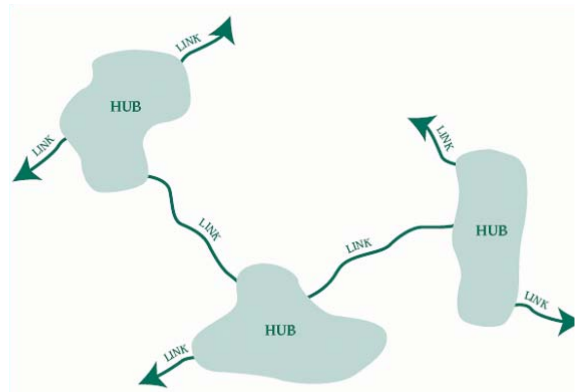


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FIGURE 3.08.3 CONCEPTUAL GREEN INFRASTRUCTURE HUBS AND CONNECTING LINKS

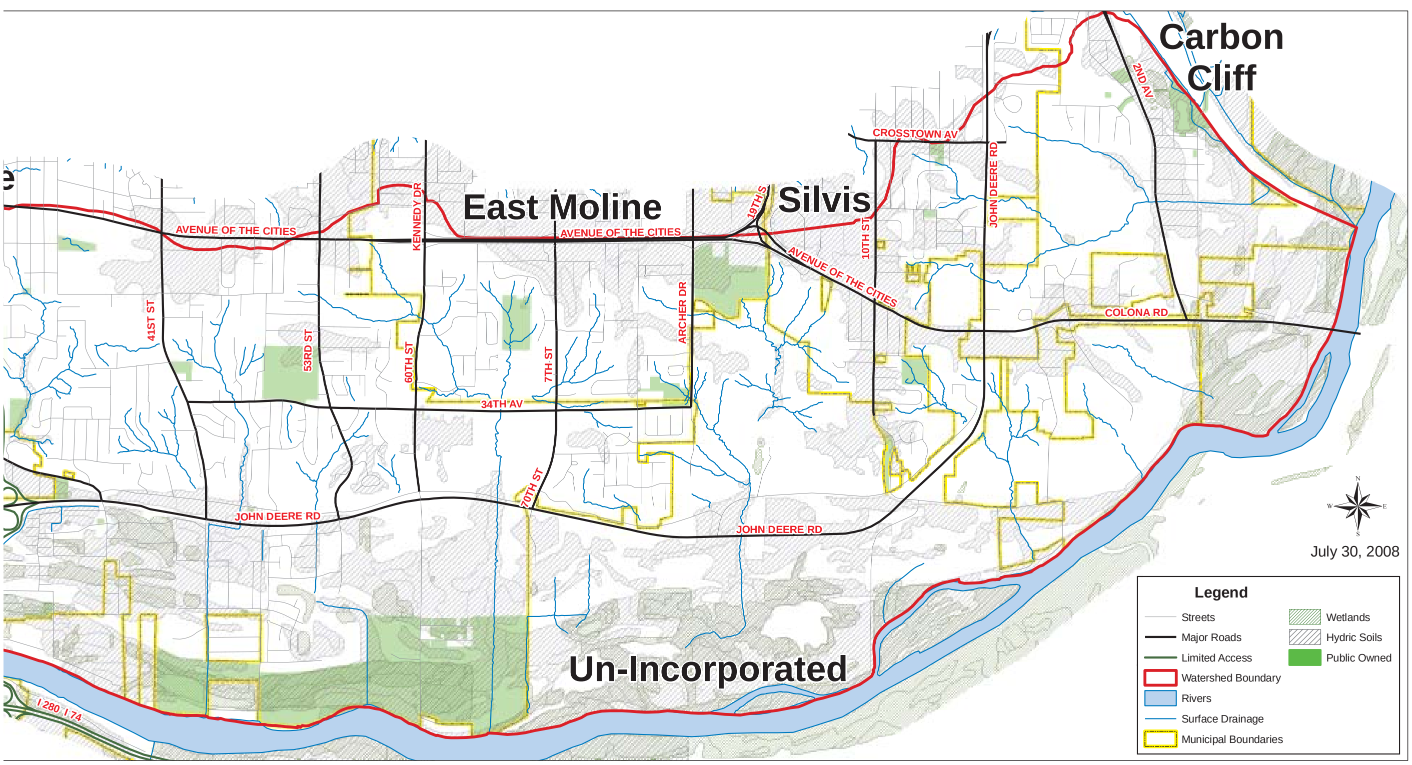


Table 3.08.1 Rock River Ravines Parks and Open Space: Significant parklands and open space land holdings include, from west to east:

Park	Location	Primary Use	Potential for Restoration
Sunset Park & Marina	Rock Island along the Mississippi River and Rock Rivers	Recreation, natural	Good
31st Avenue Park	Rock Island along the Rock River.	Natural	Good
Douglas Park	Rock Island, northern boundary of study area (may be outside)	Recreation / ball fields	Poor
Longview Park	Rock Island, northern boundary of study area (may be outside)	Recreation / walking paths	Possible
Reservoir Park	Rock Island, northern boundary of study area (may be outside)	Recreation	Poor
Black Hawk State Historic Site	Rock Island along Rock River	Natural	Good
Hodge Park	Rock Island	Recreation / ball fields	Poor
Saukie Ballfield	Rock Island	Recreation / ball fields	Poor
Saukie Municipal / Welch Memorial Golf Course	Rock Island County	Recreation / golf	Possible
Ben Williamson Park	Rock Island along the Rock River	Natural	Good
Prospect Park	Moline	Recreation / walking paths	Good
Jefferson Park	Moline	Recreation / ball fields	Poor
Green Valley Park	Moline along the Rock River	Natural	Good
Wiman park	East Moline	Natural / walking paths?	Good?
Millennium Park	East Moline	Natural / walking paths?	Good?
Rock Island County Fairgrounds	East Moline	Recreation	Poor
TPC at Deere Run	Silvis / Rock Island County	Recreation / golf, natural	Good

infrastructure network elements typically include hubs (large, intact blocks of natural areas that support a diversity of habitats and wildlife and provide space for recreation and storm water management) and links (natural corridors and greenways that link larger natural areas). Figure 3.08.3 illustrates the relationship between these features. Hubs and links may be composed of:

- Lakes, ponds, and wetlands.
- Stream corridors and waterways.
- Parks, recreational areas, greenways, and trails.
- Public and private conservation lands.
- Nature preserves, natural areas, and wildlife habitat (woodlands, savannas, and prairies).
- Open space and vacant lands.
- “Working lands” such as forests, farms, and ranches.

As part of the effort to connect and expand existing green infrastructure elements, such as creek corridors, the green infrastructure inventory identified publicly owned parcels of land with the potential to contribute to the watershed green infrastructure system. Table 3.08.1 shows the location of these parcels. Some of the publicly-owned green infrastructure parcels are protected status, such as parks and golf courses, meaning that there is very low risk that they could be converted to other land uses.

NATURAL AREAS AND DIVISIONS

The boundaries that define the edges around and divisions within the Rock River Ravine study area are formed by natural geologic landforms left by the last ice age. They include major rivers, floodplain bottomlands and wetlands, uplands, wooded ravines, and river bluffs.

The most significant biological resources within the Rock River Ravine Study Area are found within the undeveloped wetlands of the Rock River floodplain and the Black Hawk Forest Nature Preserve within the Black Hawk State Historic Site. Black Hawk Forest (101 acres) is one of the few remaining areas representative of the narrow, forested bluff lines which were once more prominent along the Mississippi River. The woodlands of the Preserve include a high quality upland forest and contain a rich understory of more than 30 species of woodland wildflowers, including wild orchids, and ferns. This area and the Rock River provide much needed habitat for a variety of wildlife. Approximately 175 species of birds have been observed, including 20 warbler species, during the year, and spring is a favorite time for observing the migration. Several oak species of the upland forest ecosystem are dominant and plentiful at Black Hawk, along with a variety of other hardwoods. The Black Hawk Forest Nature Preserve is one of the least-disturbed forest systems in Illinois. Green Valley Park in Moline also includes a nature preserve that shows promise for restoration.

To the casual observer, the forested ravines of the Rock River Ravine Study area appear to be 'natural' in that they are not cleared or developed. In addition, these areas likely support a number of common urban bird species and other wildlife such as raccoons, squirrels and chipmunks which the eye of the untrained observer equates with a natural area. The probability of finding significant biological resources within these ravine areas, however, is significantly low due to the negative impacts of storm water runoff and the surrounding land uses (primarily residential). In spite of this, the stream survey revealed some intact hydrology within a limited number of the ravines, where groundwater seeps were observed in the ravine banks. Prior to settlement, the plant communities of these ravines were fed by this slow, consistent groundwater flow. This provided a cool constant regulated base flow within the ravine stream channels that was non-erosive in most rain storm conditions.

The Environmental Resources Inventory identified a number of animal species that are found within the area. Reptiles and amphibian species known to occur in the area include cricket frog, upland chorus frog, northern leopard frog, green frog, bullfrog, garter snake, milk snake, watersnake, painted turtle, and soft shell turtle. Mammal species include muskrat, beaver, bats, squirrels, fox, opossum, raccoon, mink, rabbit, skunk, deer, woodchuck, mice, mole, and shrew. The floodplain forest in the bottomlands along the Rock River provides a generally low quality habitat for terrestrial animals because of the poor palatability of the dominant vegetation and lack of extensive shrub layers due to seasonal flooding. The floodplain area, however, is valuable as habitat for waterfowl and aquatic or semi-aquatic animals.

Because of its location in the Mississippi flyway, many bird species can be seen as visitors in the Quad Cities region during the spring and/or fall migration. Bald eagles once commonly nested along the larger rivers, and important wintering sites for them are still found along the Mississippi. Eagles which nest further north migrate to this area to feed on the fish below the dams where the turbulent water remains open even in the coldest winters. One important winter roost is just upstream from the Quad Cities at the Elton E. Fawks Bald Eagle Refuge Nature Preserve. Heron and osprey use the area as well. These and other threatened or endangered species for the County can be found in Table 3.08.2.

The Deere & Company land holdings present an opportunity for restoration and management of landscape ecosystems that have been lost to development in other parts of the Rock River ravine study area . The local U.S. Fish and Wildlife Service office is working with Deere to identify restoration opportunities.

Wildlife such as this kingfisher depend on healthy aquatic resources

Table 3.08.2 Rock Island County: State and Federally listed Threatened and Endangered species

Common Name	Scientific Name	Class	State Status	Federal Status
Lake Sturgeon	Acipenser fulvescens	Fish	Endangered	
Western Sand Darter	Ammocrypta clarum	Fish	Endangered	
Downy Yellow Painted Cup	Castilleja sessiliflora	Plants	Endangered	
Longnose Sucker	Catostomus catostomus	Fish	Threatened	
Spotted Coral-root Orchid	Corallorhiza maculata	Plants	Threatened	
Spectaclecase	Cumberlandia monodonta	Freshwater Mussels	Endangered	
Cerulean Warbler	Dendroica cerulea	Birds	Threatened	
Butterfly	Ellipsaria lineolata	Freshwater Mussels	Threatened	
Spike	Elliptio dilatata	Freshwater Mussels	Threatened	
Blanding's Turtle	Emydoidea blandingii	Reptiles	Threatened	
Gravel Chub	Erimystax x-punctatus	Fish	Threatened	
Ebonyshell	Fusconaia ebena	Freshwater Mussels	Threatened	
Bald Eagle	Haliaeetus leucocephalus	Birds	Threatened	Endangered
Four-toed Salamander	Hemidactylium scutatum	Amphibians	Threatened	
Pallid Shiner	Hybopsis amnis	Fish	Endangered	
Higgins Eye	Lampsilis higginsii	Freshwater Mussels	Endangered	
Black Sandshell	Ligumia recta	Freshwater Mussels	Threatened	
Running Pine	Lycopodium clavatum	Plants	Endangered	
Yellow-crowned Night Heron	Nyctanassa violacea	Birds	Endangered	
Black-crowned Night Heron	Nycticorax nycticorax	Birds	Endangered	
Sheepnose	Plethobasus cyphyus	Freshwater Mussels	Endangered	
Yellow-headed Blackbird	Xanthocephalus xanthocephalus	Birds	Endangered	
Federally Endangered Species: Any species which is in danger of extinction throughout all or a significant portion of its range.				
Federally Threatened Species: Any species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.				
State Endangered Species: Any species which is in danger of extinction as a breeding species in the state.				
State Threatened Species: Any breeding species which is likely to become a state endangered species within the foreseeable future in the state.				

GREENWAYS AND TRAILS

The greenway and trail systems of the Rock River Ravine Area watershed include:

1. There is an Active & Passive Greenway along the Rock River that supports boating, canoeing, fishing, biking, hiking, and motor touring. Due to frequent flooding in the spring, some of the wetland areas along the Rock River serve as significant habitat for a variety of species and thus are designated for passive recreational use only. The greenway connects a number of significant parks, green spaces, and public holdings along the Rock River including TPC at Deere Run Golf Course, Green Valley Park, Ben Williamson Park and Parkway, and the Black Hawk State Historic Site. Part of this greenway follows the Kiwanis Trail along the northern shore of the Rock River.
2. The Great River Trail (GRT) and the Illinois segment of the Mississippi River Trail and portions of the national coast-to-coast American Discovery Trail (ADT) and Grand Illinois Trail (GIT) follow the Mississippi River shoreline on the Iowa and Illinois side of the river. The Great River Trail follows the Mississippi for 70 miles with a south branch that terminates at Sunset Park. The Mississippi River Trail is 2000 continuous miles between the river's headwaters in Minnesota and the Gulf of Mexico and coincides with part of the Grand Illinois Trail western route. The ADT does not cross the RRR study area.
3. A new segment of the Grand Illinois Trail – Carbon Cliff – (under development, current alignment is on-road route) will join the Hennepin Canal State Trail to the Great River Trail, through Colona and Carbon Cliff.
4. 17th Street on-street Bike Lane Corridor, Rock Island. Provides a north/south connection between the Mississippi River and the Rock River.
5. 19th Street / 27th Street Multi-use trail Corridor, Moline. Provides a north/south connection between the Mississippi River and the Rock River.
6. 60th Street Multi-use Trail Corridor, Moline. Provides a north/south connection between the Mississippi River and Green Valley Park on the north bank of the Rock River.
7. The ravine system that runs through Carbon Cliff from west to east is identified as a passive greenway, which means that they are identified for land and water conservation, protection of the existing watershed and maintaining the natural environment. Most passive corridors focus on stormwater and floodplain management, wetland preservation, erosion control, natural water filtration, wildlife migration and the preservation of vegetation.

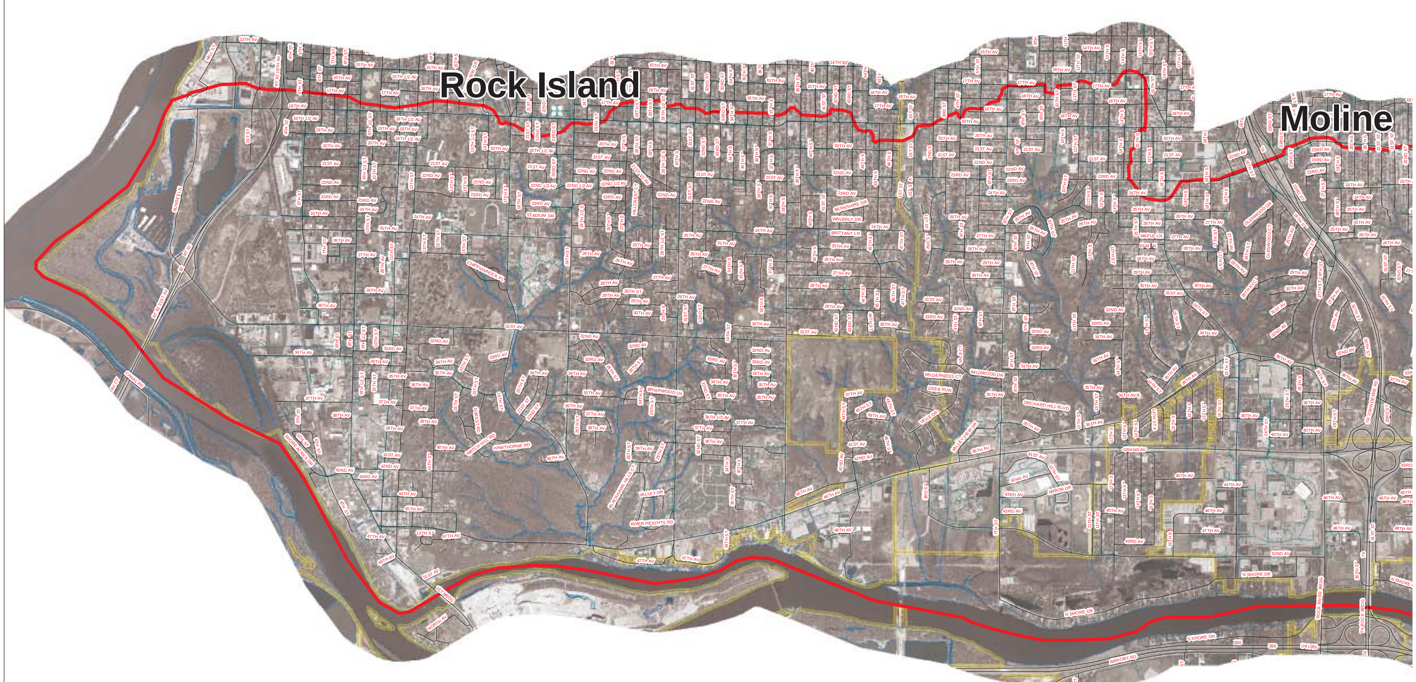
3.09 STREAM INVENTORY

The Rock River Ravines flow from headwaters near 19th Avenue and Avenue of the Cities south and east into the Rock River. The municipalities of Rock Island, Moline, East Moline, Silvis, and Carbon Cliff, as well as parts of Rock Island County, are within the watershed study area. Drainage occurs primarily through twelve unnamed ravine systems that have been labeled with “Rock Ravine #” beginning with Rock Ravine 1 near the mouth of the Rock River (west) and moving east towards Carbon Cliff. Land use is primarily residential throughout the ravine areas, with more commercial, light industrial, and recreational uses within the Rock River floodplain. Refer to Figure 3.09.2 and Table 3.09.1 for references to stream morphology.

Very little historic sampling and survey data exists for the Rock River Ravines prior to the spring and fall of 2008 when the Iowater program of the Iowa Department of Natural Resources assisted with sampling in Rock Island, Illinois. This data was included in this watershed assessment, however, further data collection is necessary to understand water quality trends. Future data should be incorporated into revisions of this watershed plan. The majority of the assessment for these ravines consists of the field work conducted by the planning team and complimented by an understanding of the dynamics of ravine systems and urban watersheds.

Though the Rock River itself has been studied and assessed by state and federal agencies, the ravine systems represent a very small proportion of the entire Rock River watershed area and most are intermittent streams. This section of the assessment attempts to summarize information gathered by the project team while in the field to generate an overall understanding of ravine and stream quality and to identify issues and impairments not identified through other means.

Figure 3.09.1 Stream Inventory



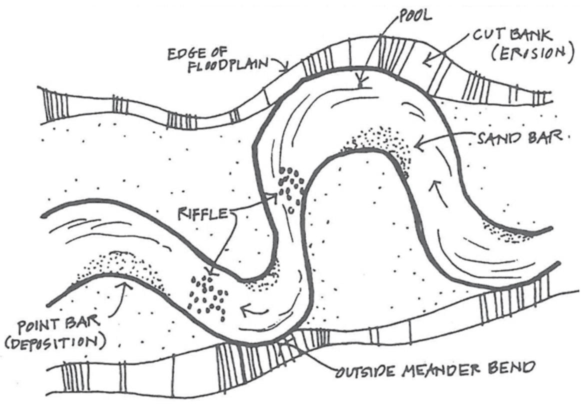


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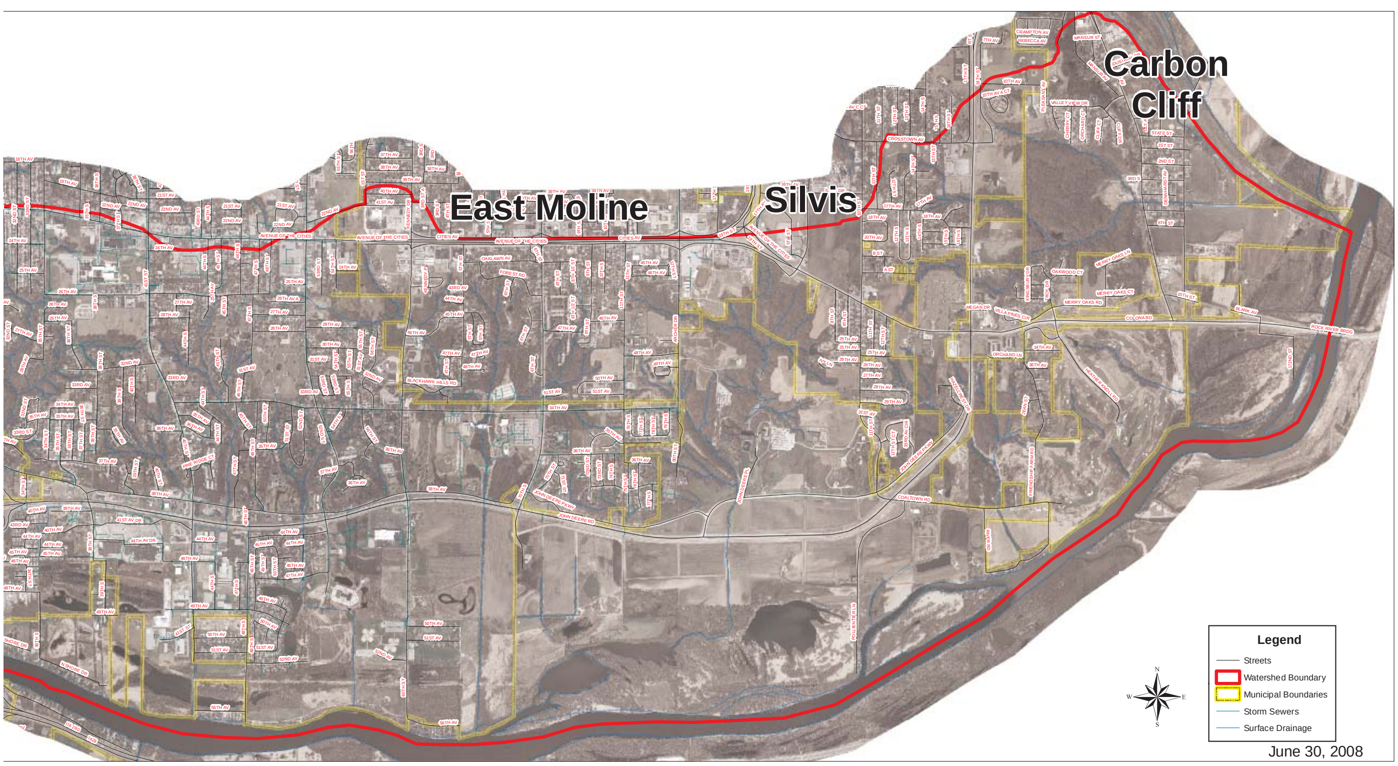
FIGURE 3.09.2 NATURAL STREAM MORPHOLOGY

Table 3.09.1 Useful Definitions

Term	Definition
channelization	straightening or ditching of a stream channel
sinuosity	degree of stream channel turns and bends
pool and riffle	alternating series of deep pools and shallow rapids
bank erosion	the loss of streambanks due to scouring by water flow
sediment accumulation	build-up of soil, sand, and gravel in the streambed
debris load	natural and man-made debris including leaves, sticks, logs, lumber, and trash



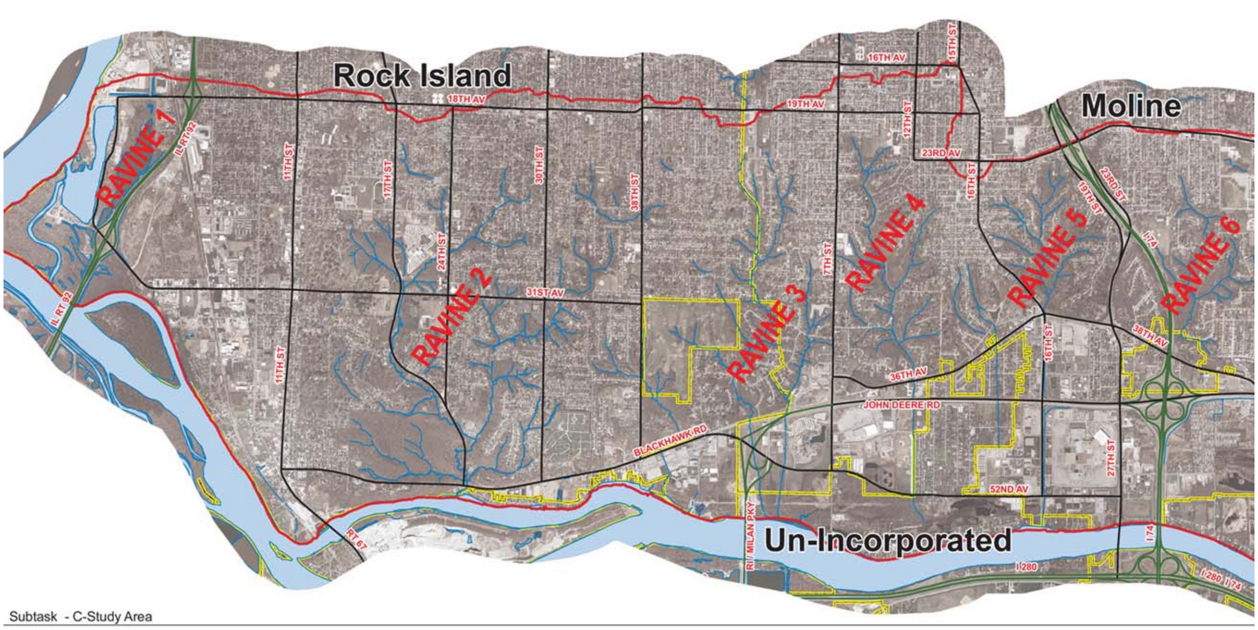
ROCK RIVER RAVINE AND STREAM INVENTORY

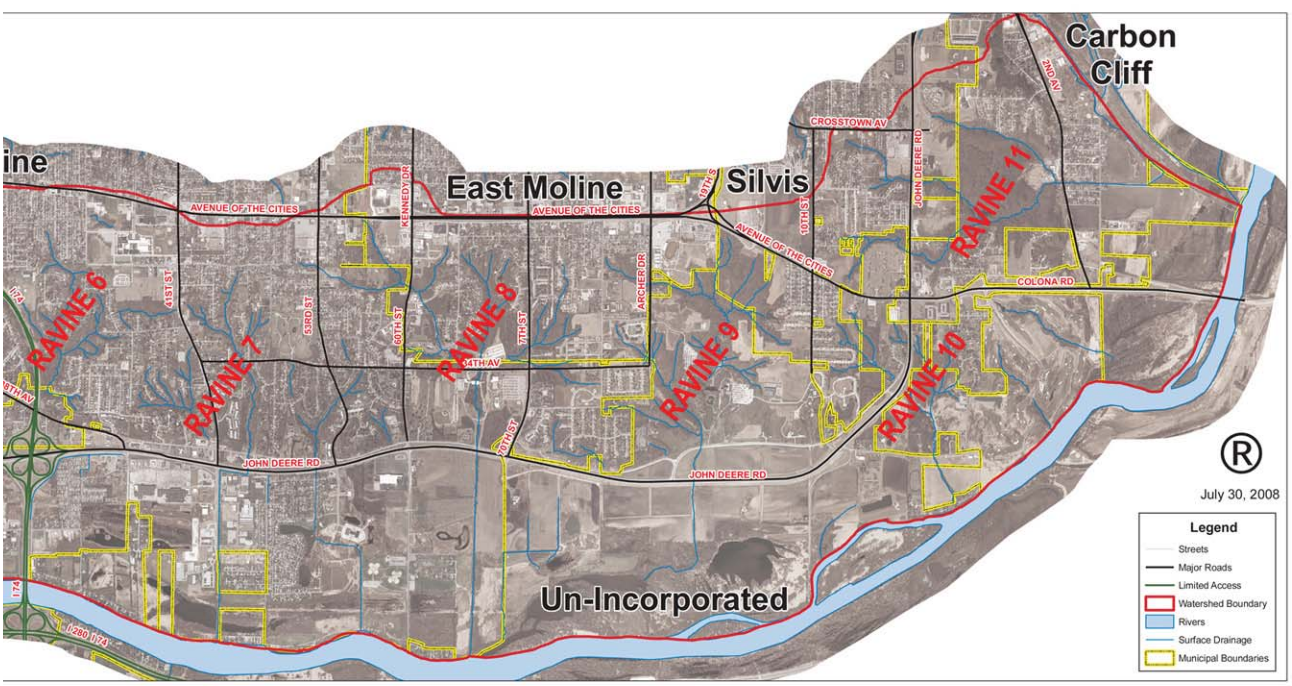
In June of 2008, the project planning team conducted a stream inventory of the Rock River Ravines to assess condition and characteristics. Left and right bank are oriented as one looks downstream. The Rock River ravine systems exhibit a range of conditions fairly typical of Midwestern streams flowing down a ridge towards a river or lake that have been impacted by land use changing from natural to urban and suburban. Many of the creeks problems can be attributed to the impact of this land use change on the flow and quality of water as it flows across the landscape and into the ravines. The symptoms of this condition are evident within the vast majority of the ravines: eroding and unstable streambanks; lack of quality habitat conditions; and an overgrown riparian corridor impacted by residential land uses and lack of appropriate management. The assessment findings for each inventoried point are summarized below.

ROCK RAVINE 1

Rock Ravine 1 spans the flat area from the Mississippi River and Rock River confluence on the west to 12th Street on the east. Land uses along and to the west of the railroad tracks include industrial and recreational uses (Sunset Park and Marina) near the confluence of the Rock and the Mississippi. To the east of the tracks are additional light industrial operations and residential neighborhoods. No data points were collected in RR1 due to the lack of surface drainage; most, if not all, of the waterways are contained in underground storm sewers.

Figure 3.09.3 Rock River Ravines





ine
East Moline
Silvis
Carbon Cliff
Un-Incorporated
RAVINE 6
RAVINE 7
RAVINE 8
RAVINE 9
RAVINE 10
RAVINE 11
AVENUE OF THE CITIES
JOHN DEERE RD
COLONA RD
CROSSTOWN AV
41ST ST
53RD ST
60TH ST
KENNEDY DR
7TH ST
ARCHER DR
10TH ST
2ND AV
34TH AV
70TH ST
I-74
I-280 I-74
July 30, 2008
Legend
Streets
Major Roads
Limited Access
Watershed Boundary
Rivers
Surface Drainage
Municipal Boundaries

ROCK RAVINE 2

Rock Ravine 2 (RR2) incorporates the drainage area bounded generally by 12th Street on the west and 38th Street to the east. Land use in the area is primarily residential, with higher density residential development in the flat, upper reaches of the drainage area. Other land uses include Trinity Medical Center Campus, Chippiannock Cemetery, Blackhawk State Park and Rock Island Memorial Park Cemetery.

In general, RR2 exhibits narrow, overgrown channels and ravines in the upstream areas and wider channels (up to 30' in some locations) with greater flow volume downstream. Bank heights range from flat to 10' or more in some locations, particularly in the ravines where the stream channel continues to down cut into the landscape. Recent and active channel erosion, downcutting and widening were observed in most ravines. Erosive activity threatens property and infrastructure, causes damage and failure of stormwater outfalls and culverts, and causes trees and debris to fall into the creek creating obstructions to water flow.

A high level of bank erosion and drainage system failures are occurring throughout the RR2 system. In a few locations, residential drain pipes from roof or footing drains that discharge to the ravine banks instead of the bottom of the channel also can hasten erosion. In an attempt to address erosion, rock and concrete armoring and grade control (stabilizing the channel itself with rock and other measures) have been installed in a few locations such as near the intersection of 17th Street and 35th Avenue, near 26th Street and 35th Avenue intersection, and just East of Chippiannock Cemetery. East of Black Hawk State Park near 24th Street a storm sewer has been undermined.

The upper reaches of the ravines have a predominantly sandy and rocky substrate, with some clay layers found within the stream banks. A number of seeps (locations where groundwater is seeping out of the streambank and into the creek) were found near 24th Street and 36th Avenue, west of 40th Avenue and 28th Street, and south of 35th Avenue and 26th Street. These seeps indicate that groundwater hydrology is somewhat intact and that unique ecosystems that depend on groundwater seepage may have once been common along the ravines.

In many locations, yard waste and other debris dumping is causing degradation of the ravines. Fallen trees, yard waste, concrete dumping, and grass clippings contribute to debris jams and water quality impairment. One particular dumping location at the storm outfall near the southwestern corner of the Trinity Medical Center West Campus parking lot was observed to be particularly bad.

Rock Ravine 2 has a prominent, heavy forest canopy throughout many of the ravines, which creates a naturalistic, forested atmosphere, but can exacerbate erosion problems by shading out understory vegetation that can help prevent erosion. In the few places where the forest canopy has been thinned, thick ground plane vegetation is thriving and contributing to a more stable bank and ravine system and a greater potential for quality habitat. One such area was observed northwest of the Trinity Medical Center West Campus near the intersection of 25th Avenue and 24th Street. In some locations residents have mowed to the edge of the bank or ravine, which also exacerbates erosion.

Within Blackhawk State Park, there is evidence of a healthier natural system, with conservative ground vegetation and a soil structure that retains some of its presettlement characteristics.

ROCK RAVINE 3

Rock Ravine 3 (RR3) spans three jurisdictions: Rock Island, Moline, and part of Rock Island County. Its western limit is roughly 38th Street in Rock Island, and it is bound on the east by 7th Street in Moline. RR3 has distinct areas of land use that influence the health of the ravine. North of John Deere and Blackhawk Road, land use is characterized primarily by relatively dense residential neighborhoods. Thick forested riparian buffers line the creek as it winds through these neighborhoods. South of 31st Street, land use diversifies into a mix of lower density residential nestled along the creek, open space in the form of Welch Memorial Golf Course to the west, and office and commercial uses near the intersection of John Deere Road and 7th Street. South of John Deere / Blackhawk Road, primary land uses are commercial, retail and institutional uses such as Trinity Medical Center's 7th Street Campus. Most of the wetland areas within the floodplain of Rock River Ravine 3 remain

RR2.1: debris jams can worsen erosion as water flows around them.

RR2.3: water flow from stormwater outfalls commonly causes erosion.

RR2.4: dumping of yard waste along ravines.

RR2.8: streambank armoring projects can be large and expensive.

RR2.9: stormwater culverts under roads are common points of erosion.

RR2.13: erosion at stormwater outfalls can cause stormwater infrastructure to fail and become dislodged, requiring expensive repairs.

open, though it is likely that some former wetlands have been drained and/or filled.

As a system, RR3 is notable for its relatively broad stream bottoms. However, evidence throughout the ravine indicates that during storm events, RR3 experiences a large volume of water flow that erodes stream banks, threatening stormwater infrastructure and a few nearby homes. The banks erode and slump due to high peak stream flows, and a few 10' and 20' banks were noted. Erosion is found at the base of culvert openings, and broken storm sewers and outfall pipes were observed just south of Saukie Golf Course near the intersection of 44th Avenue and 29th Street. Some residential drain pipes are hastening erosion as they discharge erosive flow into the ravine edges and stream banks. One streambank stabilization project was observed, though it appeared to be in the early stages of failure as water flow undermines soil lifts that were built on nearly vertical slopes. A more gradual, gentle sloping bank would be a more appropriate bank slope in this location.

Throughout the length of the ravine, large accumulations of heavy debris were also observed. Some of this debris is the result of yard waste dumping from surrounding land uses, and some of it is woody debris from trees along the banks being undermined by bank erosion.

ROCK RAVINE 4

Bordered by 7th Street (west) and 14th Street (east), the majority of Rock Ravine 4 (RR4) is located in Moline, but the tributary joins the Rock River in Rock Island County. The upper part of the ravine is influenced by relatively dense residential development. South of John Deere Road, the riparian buffer becomes very tight and narrow as the stream flows past recreational fields on the right and residential development along the left bank. West of the recreational fields are big box commercial operations and light industrial uses, both of which have large impervious surface parking lots that generate runoff concerns for the stream. The lower reaches of the stream are highly channelized as they flow across the flat floodplain and into the Rock River.

As a system, RR4 shows relatively decent pool and riffle development in areas with a flat gradient and a relatively more intact drainage system, possibly due to the smaller drainage area and lower volume of flow. However, it also exhibits many similar problems seen throughout the Rock River Ravines including sedimentation, erosion, and debris buildup. Heavy sedimentation south of 52nd Avenue has buried tree collars, indicating heavy deposition from upstream sources. Erosion is causing some gullies to form in the ravine, and producing unstable areas through channel downcutting. Debris, yard waste, and material dumping are consistently observed. Infrastructure also seems to be much more stable and functioning well.

ROCK RAVINE 5

Rock Ravine 5 (RR5) extends from 14th Street on the west in Moline to Interstate 74 on the east. As is typical in the rest of the Rock River Ravines, the upstream part of the ravine is surrounded by dense residential neighborhoods. South of 23rd Avenue, these neighborhoods become less dense and conform to the meandering route of the forested ravines. South of 36th Avenue, where the gradient is flatter, a few residential areas are interspersed with large commercial retail uses. The creek flows from the forested ravine buffer into a narrow, muck filled, grass-lined channel along 16th Street before emptying into the Rock River.

As a system, Rock Ravine 5 is characterized by eroded cut banks and other associated problems. North of 38th Avenue, cut banks vary from 1' to 6' high and cause multiple instances of fallen trees in the ravine. Slumping is a problem even at the farthest point upstream on Glenwood Drive south of 23rd Avenue / Avenue of the Cities, threatening nearby houses. Seeps were also found in this ravine, and debris and grass clippings contribute to the poor quality and condition of the system. South of 38th Avenue, sheet pile and gabion walls attempt to minimize erosion due to high flows from the upstream watershed area.

RR2.15: this stormwater management wetland facility uses native plants and is designed to improve water quality and provide habitat.

RR2.16: rock armoring is often used to stabilize eroding streambanks.

RR2.16: streambank erosion can be caised by residential drain pipes.

RR3.1: mowing turf grass to the edge of a stream can hasten erosion problems.

RR3.3: erosion can expose and damage stormwater infrastructure.

RR3.5: erosion below a stormsewer outfall.

ROCK RAVINE 6

Moline and Rock Island County have jurisdiction over the upstream and downstream reaches of Rock Ravine 6 (RR6) respectively. Interstate 74 borders the ravine to the west and 38th Street borders it to the east. Land use in the ravine is primarily residential, although Moline High School and commercial uses line Avenue of the Cities and John Deere Road, with some commercial but mostly open floodplain and wetland south of John Deere Road.

Like other ravines, the current condition of RR6 is much degraded from its likely past, which may have included old timber woodland with seeps along the ravine edges. Today RR6 exhibits severe erosion with very high cutbanks (15-20' in some locations) in the upstream reaches, indicating that the system is rapidly falling apart. Sources of erosion vary but include high runoff rates from surrounding development flowing through stormwater discharges such as the one near the intersection of 32nd Avenue and 36th Street.

ROCK RAVINE 7

Rock Ravine 7 (RR7) runs through Moline, spanning the area between 38th Street to 50th Street. Residential neighborhoods are the predominant surrounding land use of the upper reaches, with residential density spread evenly throughout the drainage area. Commercial land uses continue to parallel the Avenue of the Cities and John Deere Road. South of John Deere Road, a mix of open space, residential, and light industrial land uses are found.

Like other areas in the Rock River watershed, the disturbances affecting RR7 relate primarily to an excess of stormwater discharging to the ravine. Erosion is destabilizing banks, causing steep vertical cut banks to form. A large blowout occurred near the intersection of 26th Avenue and 44th Street. Siltation and sedimentation were also noticed, with a mix of silt and muck seen overbank near 34th Avenue and 46th Street. Check dams were installed in one location to stem channel erosion, though improper installation is leading to early signs of failure; these structures need to be tied more strongly into the adjoining banks. Residential stormwater drains discharging on the ravine or streambank area are also causing erosion.

As in most of the ravines, yard waste and woody debris are creating numerous debris jams within the ravine. However, one resident was observed employing the good practice of containing their yard waste in an enclosed area to prevent it from entering the creek system.

Although it is experiencing common ravine problems, RR7 contains a few remnant natural systems and restoration opportunities. Weeping soils, seeps and springs are still present, and fen remnants were also observed near 26th Avenue and 44th Street. A few good meanders are in place in the ravine, and pool and riffle formation is active in two different locations. In fact, shiners were noted in one reach, indicating a healthier stream system and baseflow than in other areas. These remnants may be the result of lower residential densities and, thus, a lesser volume of stormwater being discharged to this system.

A notable restoration opportunity also exists near the confluence of RR7 with the Rock River. The lower reaches of RR7, in the floodplain near the Rock River confluence, are channelized and loaded with silt and sediment. However, this general area contains some backwater bayous and natural areas that harbor potential for restoration to a higher quality state. Surprisingly, the channelized reach just downstream of John Deere Road along 41st Street exhibited a mildly meandering and braided small channel with a decent sand and gravel substrate.

ROCK RAVINE 8

The limits of Rock Ravine 8 (RR8) pass through parts of Moline, East Moline, and Rock Island County. Its runs from 50th Street to the west to its eastern edge that follows 70th Street to 36th Avenue, and then heads east to 11th Street in East Moline. Land use in the western part of RR8 is primarily lower density residential with a few commercial locations and open space in the Rock River floodplain. Downstream near the ravine's confluence with Rock River, the Green Valley Sports Complex abuts the left bank looking downstream. Riparian buffers in the ravine are primarily narrow, forested edges in residential areas, before moving into a narrow, grassed channel south of John Deere Road where it flows through two detention basins. In the eastern

RR3.6: stormdrain labeling can help educate residents and landowners about the impacts of their actions.

RR4.3: twin stormwater outfalls.

RR3.7: a streambank stabilization project.

RR4.6: rock can be used to stabilize an eroding stream channel.

RR3.9: this rock and wetland facility helps cleanse and retain stormwater runoff from the adjacent parking lot.

RR5.3: one of the confluences of a Rock River Ravine drainage and the Rock River.

half of RR8, Blackhawk College, Wimon Park and the Rose Lawn Memorial Estate are all prominent land uses north of John Deere Drive. Wide, forested riparian buffers line the ravine here, and south of John Deere Drive, land use is almost exclusively agriculture and open space / wetland. Here the stream buffer becomes a narrow line of trees and grasses.

As a system, RR8 is experiencing problems common to ravines. Currently, the Heritage Neighborhood south of John Deere Road and west of 53rd Street floods regularly in some locations. Stormwater is causing the streams to become incised in some areas, exposing underlying rock substrate such as shale near 51st Street and John Deere Road. Shale, though not expected to be found, is a geologic feature consistent with the former coal operations in Carbon Cliff and Silvis. Vertical cut banks and erosion are problems in the upstream reaches of the ravine. Drainage problems and failed / damaged stormwater infrastructure occur in a few locations. Wide reed fills one grassed channel near the terminus of 55th Street Court, and inexplicable mowing near Blackhawk College is likely contributing to bank instability along the creek. Lawn waste dumping is a problem within this ravine as well.

However, some of the existing drainage facilities present opportunities for implementing green infrastructure to improve ravine function, particularly the Heritage neighborhood detention facilities and the grassed channel, which exhibited some rock outcrops and decent structural components.

ROCK RAVINE 9

Rock Ravine 9 (RR9) runs through three different jurisdictions: Rock Island County, East Moline, and Silvis. The western edge follows 70th Street to 36th Avenue, and then heads east to 11th Street in East Moline. The eastern border is 11th Street in Silvis. Scattered residential neighborhoods line the western and northern edges of Rock Ravine 9, but the two primary land uses in the ravine are the Deere and Company World Headquarters that span from Avenue of the Cities to John Deere Road, and agricultural fields and floodplain wetlands adjacent to the Rock River south of John Deere Road. As has been typical in other ravines, the riparian buffers are wide and densely forested upstream and narrow


© Conservation Design Forum

RR5.4: many streams in the Rock River floodplain have been channelized and significantly modified from their original condition.


© Conservation Design Forum

RR5.7: streams naturally form this meandering pattern, causing erosion on the outside bank and depositon of sediment on the inside bank.


© Conservation Design Forum

R5.8: yard waste dumping is a common problem in the Rock River Ravines.

RR5.9: this ravine has an intact ground vegetation layer.

RR5.10: erosion around a stormsewer outfall.

RR5.11: yard waste and residential drain pipes cause ravine and stream degradation but are easily addressed.

RR6.3: streambank erosion

RR6.4: a stormwater outfall causing erosion.

RR7.5: evidence of early stream downcutting within this turf grass stream corridor.

within the agricultural areas, where trees are limited to the banks of the creek to maximize arable land.

The main issues confronting the ravine are problems related to its stormwater infrastructure. An outfall southeast of Millennium Park is stable but causing vertical cut banks downstream. At the ravine's intersection with Archer Drive upstream, debris is collecting in front of a culvert and blocking conveyance of water. As is typical of ravines, erosion is an ongoing problem.

ROCK RAVINE 10

Within the confines of Silvis, Rock Ravine 10 (RR10) is bounded by the Rock River along its southern and eastern edges, roughly bordered to the north by Colona Road, and bound on the west by 11th Street in Silvis. Rock Ravine 10 is a relatively undeveloped area influenced by the large Tournament Players Club at Deere Run golf course in the eastern half of the ravine, and some agriculture / floodplain / wetland along the Rock River. Parts of the ravine upstream are well protected by large tracts of intact forest, although a similarly narrowing of the channel occurs in the agricultural areas in the southeastern part of RR10.

The lack of dense development and wide riparian buffers has mitigated some of the environmental impacts on the ravine, but it is still experiencing problems associated with runoff and impacts of the golf course. Downcutting of 1-2' was observed along Friendship Farm Road, and a blowout was seen at the confluence point for the ravine near the TPC course. Erosion around outfall pipes was also spotted upstream.

ROCK RAVINE 11

Located in the northeastern part of the study area, Rock Ravine 11 (RR11) is north of Colona Road and east of 11th Street in Silvis. The Rock River forms its eastern boundary. Carbon Cliff is the primary jurisdiction for the area, although both Silvis and Rock Island County have jurisdiction over small parts of the drainage area. The upstream portion of the ravine has relatively narrow forested edges and winds through residential developments and public open spaces such as Friendship Park and Greenview Memorial Gardens. A large patch of forest buffers the central part of the ravine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RR7.7: an attempt to halt stream channel and bank erosion.


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RR7.7: a residential drain pipe causing erosion.


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RR7.7: a moderate quality wetland and proper yard waste handling in a compost bin.

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RR7.9: debris dumping.

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RR8.1: this stream corridor presents a good opportunity for restoration activities to protect water quality and stream habitat.

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RR8.1: eroding banks of this detention basin contribute to water pollution.

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RR8.2: massive erosion and stream destruction at this culvert.

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RR8.7: an attempt to reduce the erosive energy of this stormwater outfall.

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RR8.7: some turf grass areas, such as this one on the Black Hawk Community College campus, could be converted for stormwater management.

before narrowing to a thin buffer strip downstream amid the agriculture and wetlands along the Rock River.

Evidence of alternating cycles of siltation and scouring was found between 4th and 5th Streets indicating how stormwater and erosion are affecting the ravine. Recent dredging was apparent along the channelized drainage in Carbon Cliff in an attempt to remove excess siltation and improve water movement. Dumping of soil, wood, and grass clippings contribute further to declines in creek quality within this basin.


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RR10.6: this stormwater discharge is eroding away a pool below the outfall.

BIOLOGICAL ASSESSMENT

Four Illinois Department of Natural Resources fish sampling sites exist on the Rock River from the mouth upstream to the I-74 Bridge. A number of native, intolerant, and riverine species were collected between the years 1960 and 2000, and according to the IL DNR, any of the fish species collected could potentially use the tributaries and/or ravines as habitat depending on water levels and spawning habits. It is difficult to say, however, whether the drainageways within the study area have deep enough water for fish to move up and down the stream systems. A tributary with deep enough water would have almost all the same species as the Rock River. However, it is clear that the floodplain wetlands of the Rock River basin, which are within the study area, are extremely important for Rock River fish species that use the wetlands as nursery areas for spawning and raising young.


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RR10.7: these plastic drain pipes are causing erosion.

According to an Environmental Resources Inventory prepared for the US Army Corps of Engineers (1980), the aquatic habitats of the Rock River are not considered to be of optimum quality to support large populations of fish and macroinvertebrates. However, there is a potential for the occurrence of 71 species of fish in the Rock River, including shovelnose sturgeon, shortnose gar, bowfin, skipjack herring, smallmouth buffalo, and largemouth bass. Other species caught by fishermen include catfish, bass, walleye, bullhead, and panfish.


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RR11.1: this dredged and channelized stream provides little habitat and is actively eroding.

During the watershed planning team's stream inventory, data was collected on the floristic quality of the Blackhawk State Park. As noted in the pre-settlement vegetation discussion above, at the time of settlement, the plant communities

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RR8.9: a well vegetated riparian corridor is better for stream health and water quality.

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RR8.10: early stages of erosion and channel-forming within residential areas can be corrected using deep rooted plant species.

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RR8.10: residential flooding of streets and yards can be partially corrected using rain gardens, vegetated swales, and other practices.

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RR9.3: road parkways such as this present opportunities for incorporating stormwater management practices into the landscape.

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RR10.1: parking lots generate runoff and pollutants.

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RR10.3: this stormwater discharge is creating an eroded plunge pool.

within the study area varied from wet to dry prairie and open woods, with some Mississippi River bottomland along the Rock River and near the confluence with the Mississippi River. In each acre of any of the plant communities there resided no fewer than 100 native species of plants. The plants ranged in character from native "camp followers" to highly specialized species growing in unique, site-specific assemblages.

These plant species are designated with Coefficients of Conservatism, ranging from 0 to 10, which are an indicator of the quality of the habitat in which the plants grow. The Mean C (an average of the Coefficients of Conservatism for the area) at the time of settlement was approximately 5.0. Each 1 point of incremental increase of Mean C value can be regarded as about 10 times more complex and higher in quality. Thus an area with a Mean C value of 3.0 is 10 times less complex and of lower quality than an area with a Mean C value of 4.0. The floristic quality of the area is a product of the species richness and Mean C and is expressed as the Floristic Quality Index (FQI), which was about 50 for each acre within the Rock River Ravine study area.

The floristic quality data on the timbered remnant Blackhawk State Park was collected on about 20 acres, so the number of species exceeds that likely to be seen in any given acre. However, the Mean C value of 3.8 and an FQI of 41 indicate a system approximately 10 times less complex and of lesser quality than the original pre-settlement landscape condition, indicating that the woodland has suffered some degradation. Most of this degradation has resulted from the fire suppression that has occurred in the modern era, along with some grazing and surface erosion. Another visit, late in the season in a complex system remnant such as this, would likely yield another 46 species or more and yield a Floristic Quality Index of about 48 or 50, a moderate quality natural area as compared to other surveyed areas.

ROCK RIVER RAVINES OBSERVATION SUMMARY POINTS

1. *Stormwater runoff is creating flashy conditions* within the ravines, causing significant and rapid fluctuation in water levels ("flashy hydrology") that is destabilizing and eroding the banks of the creeks. In some locations, steep eroding banks up to 20' high are exposed and being actively eroded, causing damage to property and infrastructure. In some cases, homes are becoming increasingly threatened by erosion, which will become a more common occurrence if hydrology remains as is. Severe erosion is found more frequently in the steeper gradient portions of the ravines that receive significant volumes of stormwater runoff. Large bank blowouts are commonly found immediately downstream of stormwater discharge points and culverts. The steeper gradient may be causing faster downcutting and incision, deepening the ravines and creating steep deep valleys. In sum, the altered hydrology is causing the stream system to disassemble and fall apart, with restoration becoming increasingly difficult the more degraded it becomes. Erosion is less common within the flat gradient areas of the Rock River floodplain. Erosion is causing the loss of property, trees and vegetation, and sediment loading, which may settle in the stream bottoms in the low gradient reaches impairing habitat, or be carried to the Rock and Mississippi and ultimately the Gulf of Mexico.
2. *Stormwater management infrastructure* (outfalls, headwalls, and culverts) is damaged and failing in some places, and causing bank erosion in other places due to high flow rate and volume.
3. In some locations, *streambank armoring and stabilization* measures appear to be holding well, in other locations it is failing, and in other locations the armoring is merely causing erosion problems to occur elsewhere, i.e., move downstream. In others, armoring will be needed to slow erosion. Some stormwater outfalls and culverts have also been armored, with varying results. Continued attempts to stabilize the system should be tried.
4. *Water clarity* following storm events is very turbid, particularly in downstream reaches, indicating a heavy load of suspended sediment. Suspected sources are urban sediment and runoff from impervious surfaces

,and streambank and streambed erosion.

5. There is still some relatively intact *habitat structure* (meanders, pools, riffles and runs) within some of the ravines, with cobble, gravel, and sand substrates, which are more supportive of wildlife than silt and muck, which tend to settle out in the lower reaches. In steeper, upper reaches, the faster, shallower flow may be carrying suspended sediment into the lower reaches. Lower reaches, those in the flat floodplain, tend to be highly channelized / altered with silt muck bottoms and little habitat structure.
6. Well *vegetated streambanks* and ravines are more stable, though even the most dense deep-rooted vegetation can not hold against the erosive forces of a very flashy hydrology.
7. The *riparian buffer* is of varying widths within the ravines, in some cases a very narrow strip of turf grass, which does not provide the functions a riparian buffer should serve. In some locations turf grass is mown right to the edge of the stream bank. In other locations, the buffer is densely forested (i.e., thick and overgrown) with little ground vegetation to help hold soil in place and heavy leaf litter in other locations. Exposed fine roots of trees and other vegetation indicate that these roots do not adequately anchor the soil in place and that erosion is current and active. Buffers in the lower reaches are either non-existent or turf grass mown to the edge, though those near the Rock River confluence tend to be more heavily vegetated and protective of the stream channel. Conditions in upper reaches are not adequate to protect the streambanks from the erosive forces of a flashy hydrology, though deep-rooted ground vegetation with a few trees may be the best available option.
8. *Channel incision* is a major concern within the ravine areas. The increased volume and rate of runoff to these steep gradient channels is causing downcutting and erosion (incision) of the channel, which deepens and steepens the ravines and ultimately causes the ravine to slowly widen and erode away property and infrastructure.
9. *Residential impacts* were observed, including dumping of yard waste, residential stormwater discharge pipes, and inappropriate management of the buffer / ravine edge by mowing and other alterations.
10. *Biologically*, the riparian stream corridor is significantly impacted by land use change and the changing hydrology of the system. Little of the original native system remains, though there are a few spots where some native plants have held ground. Some of the ravines, which were probably formerly densely forested, have been thinned / opened up to reduce canopy shading. In these locations a thick ground vegetation has grown in, which creates a more diverse and possibly stable condition. There is also evidence that some of the original groundwater hydrology pattern may be intact. The presence of seeps within the ravine banks, a couple of flowing springs, a few native species that are dependent on such a condition, and the presence of shiners indicate flowing groundwater and there may be an intact, consistent baseflow within some of the ravines, which means that the systems have a chance of significant restoration. There are a few locations of remnant native systems within the ravines, such as small fen, wetland, and woodland remnants that should be located and assessed for restoration. There are also a few exceptional opportunities, primarily within the lower reaches in the floodplain / wetland areas, many of which are publicly owned, and some of which display some significant opportunities for restoration. Blackhawk State Park shows some remaining diversity, conservative species, soil structure, and a very restorable state. The TPC golf course and John Deere headquarters present additional opportunities.
11. *Debris loading* was problem observed in most of the ravines, with numerous occurrences of woody buildup, some obstructing the channel and conveyance structures (culverts). Some dumping of concrete blocks was seen, sometimes clearly an attempt at grade stabilization other times merely a convenient disposal location. Frequent dumping of yard waste along the ravine edges, in the ravines, and very close to the channel was observed.
12. It appears that there are good *opportunities for improving the stormwater drainage system*, both in the upper and lower reaches.

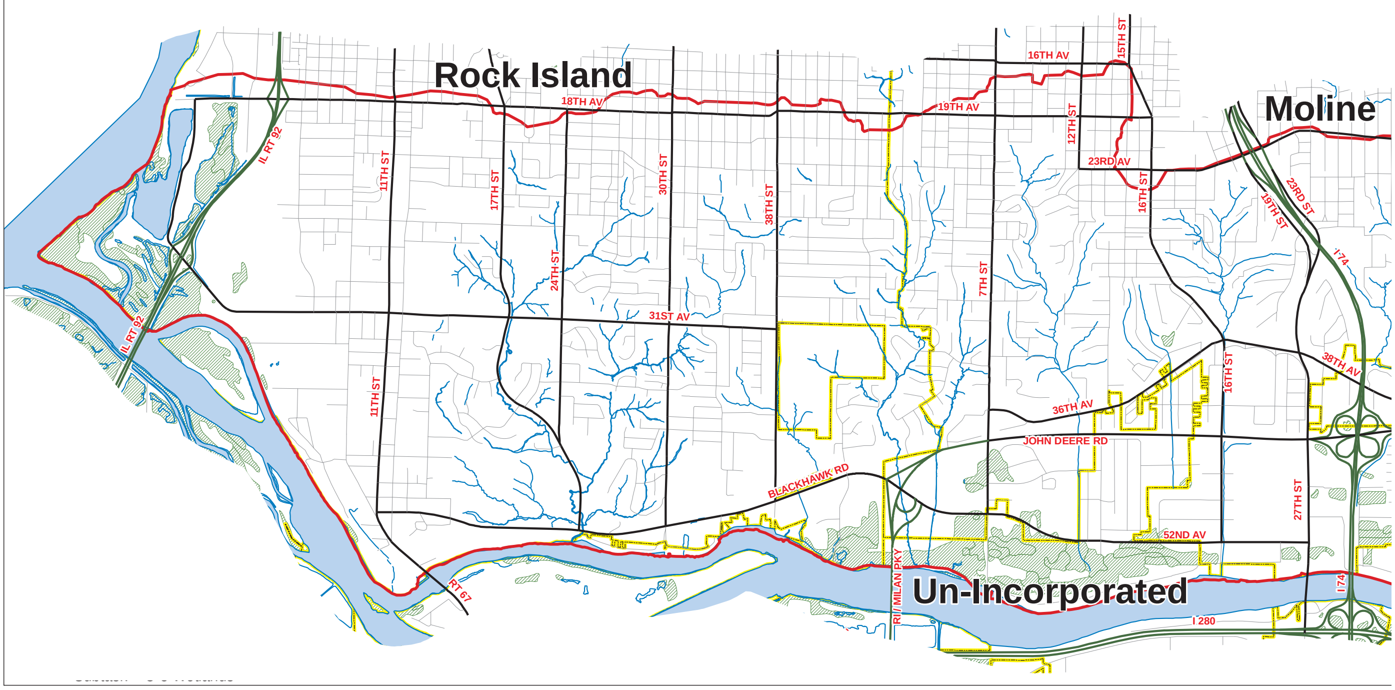
3.10 WETLANDS

Wetlands are of interest to watershed studies of this sort due to the benefits they provide. These benefits include absorbing and moderating the flow of runoff from the landscape, reducing the risk and damage of flooding by providing space for excess water to go, filtration and cleansing pollutants from runoff, and as important habitat for watershed wildlife. They are extremely important for fish species that use wetlands as nursery areas for spawning and the raising of young. Ducks and geese, deer, raccoon, mink, muskrats, frogs, salamanders, turtles, snakes, non-game birds such as herons and egrets, eagles and others use the wetlands as well. Many bald eagles over winter in the Quad Cities due to the hunting and fishing areas created by the locks and dams on the Mississippi River. Eagles use the large trees along the river and in the wetlands for resting and nesting.

Currently, approximately 1179 acres of wetlands (7% of the entire watershed area) exist within the Rock River Ravines watershed (16,068 acres), 10,765 acres (81%) less than an estimated original 6,134 acres. The number of acres of wetland lost was estimated by calculating the area of hydric soil not classified as wetland, assuming that these areas were once wetlands and have since been drained and/ or developed. These losses have occurred largely within the floodplain area south of John Deere Road, though there have also been losses higher up in the watershed, particularly in the eastern quarter. The ongoing development within the Rock River floodplain is threatening the integrity and quality of remaining wetlands. Wetlands and hydric soils are shown in **Figure 3.10.1**.

The Illinois Quad City - Rock River Valley Special Area Management Plan (SAMP) Technical Map Presentation report was prepared in response to three issues: development pressure and road widening projects within the Rock River Valley on both sides of the Rock River; the desire to protect portions of the Rock River Valley; and the extensive permitting requirements for development within the study area. The study mapped and prioritized wetland areas based on the presence of hydric soils, potential for flooding, and for their functional values including: ground water recharge, ground water discharge, flood storage,

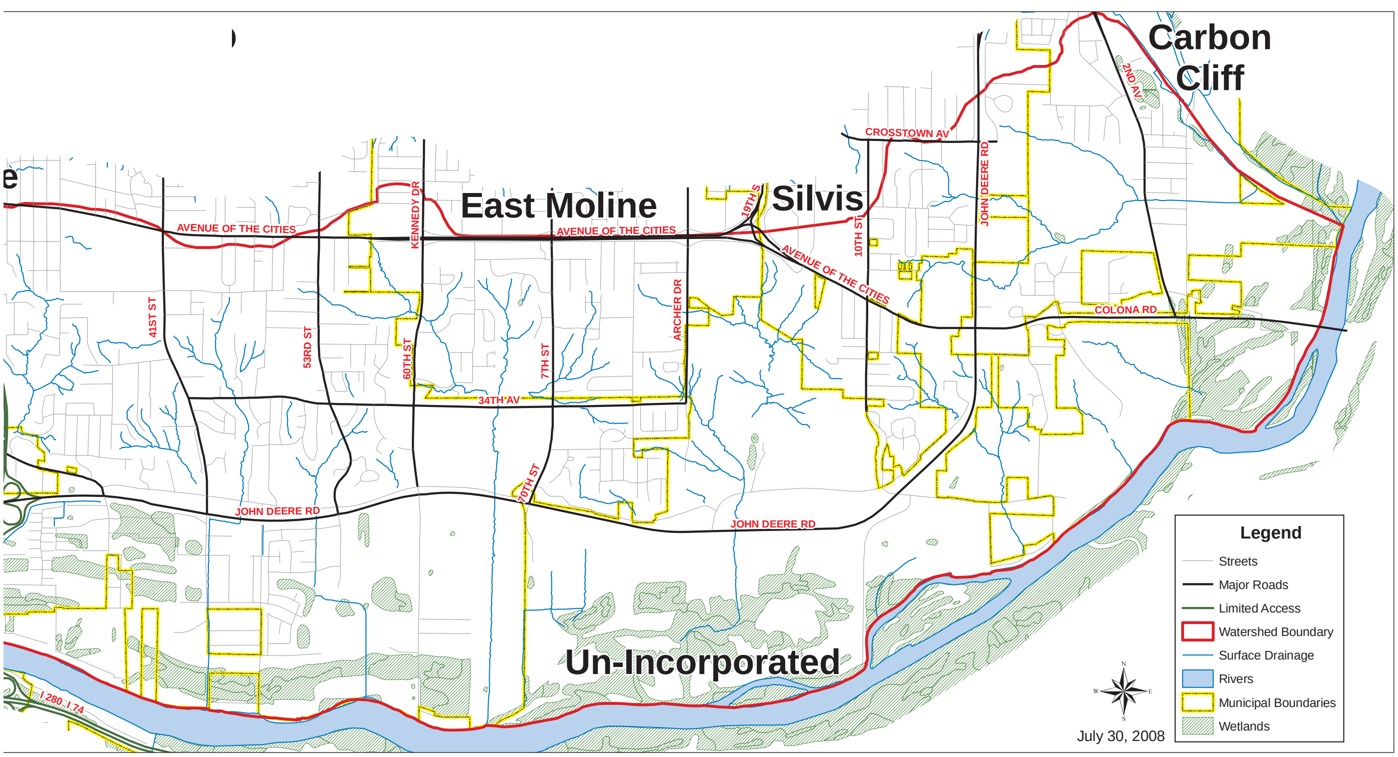
Figure 3.10.1 Wetlamds



shoreline anchoring, sediment trapping, nutrient retention, food chain support, fisheries habitat, wildlife habitat, and recreation. Floodplains, floodways, non-wetland hydric soils, and farmed wetlands were also mapped. (Source: Bi-State Regional Commission, US Fish and Wildlife Service, Natural Resources Conservation Service, and US Army Corps of Engineers, Rock Island District; May 1996)

Though a significant proportion of the original wetlands within the Rock River Ravines have been lost, significant acreages remain, particularly within the Rock River floodplain. The watershed wetlands are threatened and degraded by urban and agricultural runoff as well as lack of management and stewardship. As a result, many of the wetlands have been invaded by non-native species (e.g. purple loosestrife, reed canary grass, common buckthorn, and glossy buckthorn) that are tolerant of degraded runoff conditions and thrive under conditions of fire suppression.

Significant efforts should be made to preserve and maintain remaining wetlands. Additionally, An assessment should be conducted to determine the feasibility and location of wetland restoration potential throughout the watershed. The goal of the study, and of restoration and management efforts, would be to recover the flood water storage and water quality benefits that tend to mitigate the impacts of urban and agricultural development. Fire is the most critical stewardship activity to maintain these native landscapes that evolved under a regimen of burn management. Ongoing stewardship of the native landscape will improve floristic and habitat quality; reduce runoff and surface erosion through improved soil health; enhance water quality through filtration; and increase the aesthetic quality of the area. When properly restored, the existing habitat diversity contained throughout these areas will afford a marvelous resource that offers a setting of rare, natural beauty, as well as cultural significance. Ecological monitoring of the wetland areas should be implemented to assess landscape response to watershed management and stewardship activities and to guide management plan revisions.

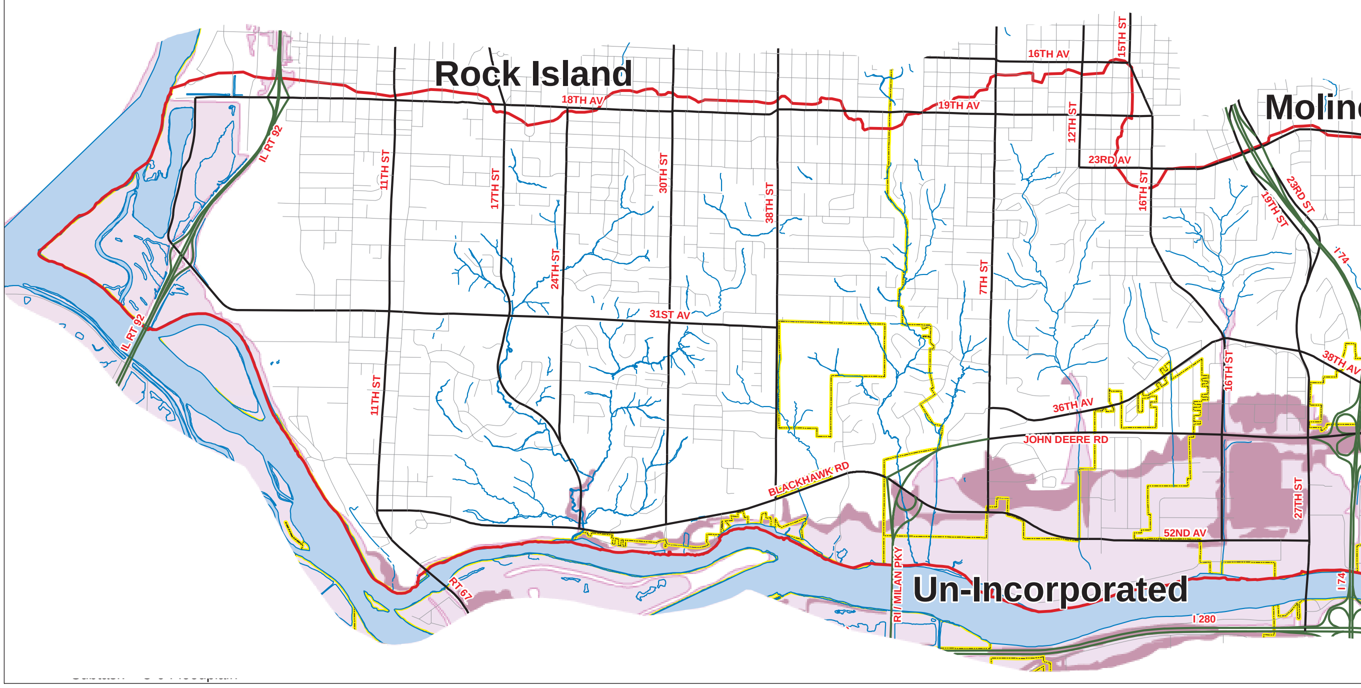


3.11 FLOODPLAIN

Floodplains are shown on **Figure 3.11.1.** Floodplains are an important component of stream ecology and also serve to moderate flow rates and stream energy during high flow runoff conditions. When floodplain areas and volumes are reduced, additional flood potential as well as increased streambank erosion can occur. The floodplain is important for identifying potential flooding issues and developing Plan recommendations. The 100-year floodplain is the area of land that is expected to be flooded, or has a 1% chance of being flooded, in any given year. Likewise, 10-year floods have a 10% chance of occurring in any given year. Similarly, the 500-year floodplain is the area of land that is expected to be flooded, or has a 0.2% chance of being flooded in any given year.

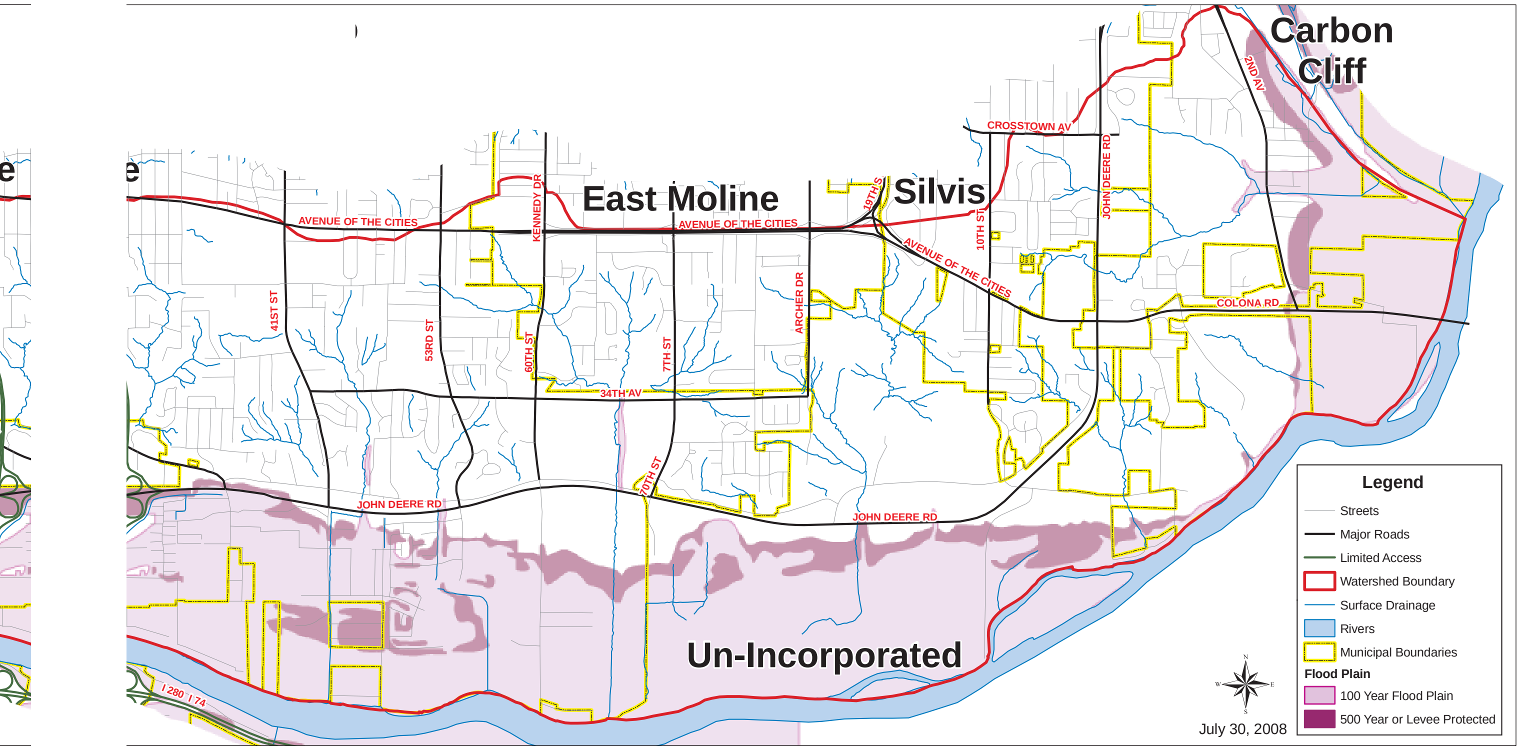
Within the Rock River Ravine study area, 3498 acres are within the 100-year floodplain, and an additional 670 acres are within the 500-year floodplain, as illustrated in **Figure 3.11.1.** Due to development pressure in the Rock River floodplain, and depending on the compensatory requirements with the relevant jurisdiction, these acreages may be likely changing over time and may not represent the current condition.

Figure 3.11.1 Floodplains



3.12 TRANSPORTATION NETWORK

The impact of streets and highways on the watershed, particularly water quality, is significant. **Table 3.14.1** lists a number of water quality pollutants and their sources, all of which are associated with the transportation system. Rain water flowing over the surface of streets carries these pollutants into wetlands, streams and ultimately the Mississippi River and the Gulf of Mexico, where they can accumulate and impair the quality of these resources for aquatic life.



3.13 SUBWATERSHED MANAGEMENT UNITS

The Rock River Ravines watershed has been subdivided into 11 Subwatershed Management Units (SMUs) based on major ravine systems, as shown in Table 3.13.1 and Figure 3.13.1. This organizational structure allows the planning effort to examine the watershed at a scale smaller than the entire watershed. SMUs are drainage systems that drain to the most downstream point in the SMU, in the case of the Rock River Ravines, these systems drain into the Rock River itself. These 11 SMUs form the management units within which the action recommendations are organized, which simplifies the management structure of the plan.

3.14 WATER QUALITY

When rain flows across the landscape, pollutants such as oil and grease, road salt, eroding soil and sediment, metals, bacteria from pet wastes, and excess nutrients (nitrogen and phosphorus) from fertilizers are washed from streets, buildings, parking lots, construction sites, lawns and golf courses into the streams and the Mississippi River. Table 3.14.1 displays common transportation-related pollutants. This kind of pollution is called nonpoint source pollution, because it comes from the entire watershed rather than a single point, plant, or facility. These pollutants accumulate as the water flows downstream and eventually begin to degrade the quality of our streams and the Mississippi River for aquatic life, as well as for human uses such as fishing, swimming, and bird watching. In this way, every small bit of pollution adds up to a very large problem.

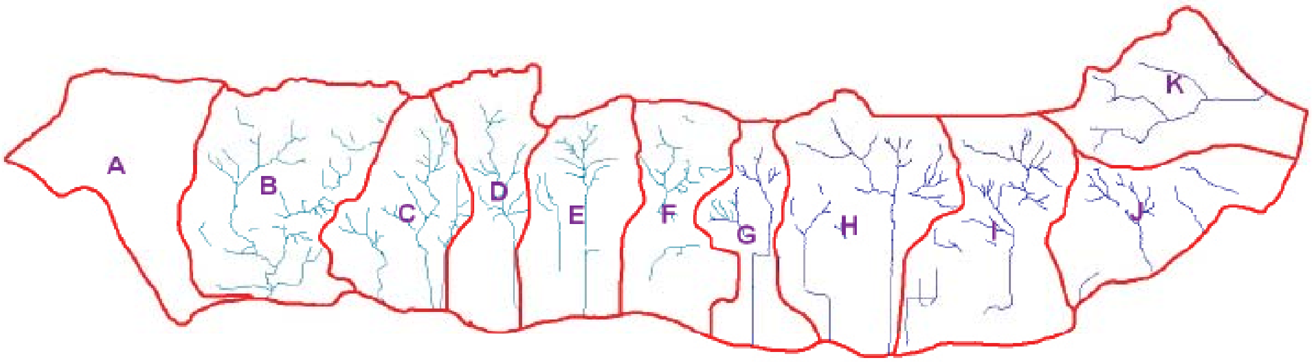
Table 3.14.1 Common Transporation-related Pollutants

Constituent	Primary Sources (USEPA, 1993)
Particulates	Pavement wear, vehicles, atmoshper
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Tire wear, automobile exhaust
Zinc	Tire wear, motor oil, grease
Iron	Auto body rust, steel highwway structures, moving engine parts
Copper	Metal plating, brake lining wear, moving engine parts, bearing and bushing wear, fungicides and insecticides
Cadmium	Tire wear, roadside insecticide application
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wearr, asphalt paving
Manganese	Moving engine parts
Cyanide	Anticake coumpound used to keep deicing salt granular
Sodium, Calcium, Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks, or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate

Table 3.13.1 Rock River Subwatershed Management Units

SMU	Area (acres)
A	1558
B	2131
C	1226
D	1135
E	1304
F	1209
G	887
H	2047
I	1878
J	1298
K	1395

Figure 3.13.1 Subwatershed Management Units



In addition to chemicals and other substances picked up from the landscape, non point source pollution includes other measures such as temperature, acidity, and the amount of oxygen in the water. Aquatic organism, including fish and insects that are critical links in the food chain, need oxygen that is dissolved in the water to breathe. Low flows and non-point source pollution can cause the dissolved oxygen levels in the water to fall below healthy levels. When this happens, some plants and animals will die, in some cases causing large fishkills, and others will leave that location to try to find more habitable waters.

Water temperature can also cause problems. Many fish and other aquatic animals require cool or cold flowing water to survive. As rainwater flows across urban surfaces and through the sewer system, these surfaces warm the water causing the overall temperature of the receiving stream to be too warm for many aquatic plants and animals. This water can also be either more acidic or more alkaline than is healthy for these organisms to survive.

Wastewater infrastructure, whether in the form of septic systems or sanitary sewer lines, are another potential source of pollution. Non-point source pollution can be traceable to issues (cross connections with the stormsewer system, leakage into or out of the sanitary sewer system, overflows of the sanitary sewer system due to stormwater infiltration or combined sewers) with the sanitary or sewer system.

Investigations turned up very little water quality information for the Rock River Ravines study area, and it is unlikely that they have been studied or sampled prior to the development of this watershed plan. However, the Iowater stream sampling program of the Iowa Department of Natural Resources has graciously offered to record data collected in Rock Island, beginning in May of 2008, as discussed below. Nonetheless, this water quality assessment relies primarily on the non-point source pollutant loading modeling data and the professional opinion of the planning team. Typical urban runoff pollutants are likely to occur in the water column within the Rock River Ravines. These include chlorides during winter months, phosphorous, suspended solids (sediment), toxic substances, and low dissolved oxygen levels, primarily due to low flow conditions that many of these ravines likely experience at some point during the year. Low quality habitat should also be considered an impairment of water quality.

Sampling data was collected on a few Rock Island streams in spring and fall of 2008 as part of the Iowa Department of Natural Resources Iowater program. The spring data is included in Table 3.14.2 (the fall data was provided too late to be included in this plan). This data provides a single point snapshot of water quality conditions in Black Hawk Creek and an unnamed creek. The data indicate potentially elevated concentrations of Phosphorous (in the form of Phosphate), chloride, and E.coli. However, without additional sampling

Table 3.14.2 Rock River Ravine Sampling Data (May 13, 2008)

Sampling Point Location	pH	Nitrite + Nitrate (mg/L)	Dissolved Oxygen (mg/L)	Phosphate (mg/L)	Chloride (mg/L)	E. coli (MPN/100mL)
Rock Island 2 - Black Hawk Creek - 2735 24th Street, Rock Island	9	2.8	8	0.6	142	540
Rock Island 3 - Black Hawk Creek - 3231 30th Street, Rock Island	9	2.8	8	0.8	154	990
Rock Island 4 - Black Hawk Creek - Blackhawk Road, Rock Island	8	0.15	8	0.1	<25	930
Rock Island 5 - Unnamed Creek - Blackhawk Road and Velie Drive, Rock Island	9	2.5	8	0.3	118	510

data by which trends can be assessed, these results are inconclusive with regard to identifying impairments for Rock River Ravines. However, Phosphorous and Chlorides have been identified as typical pollutants in urban streams such as these, and are included as assumed impairments to be addressed by this plan. E. coli concentrations, however, which exceed the generally accepted standards for single E. coli samples shown in Table 3.14.3, is not an assumed pollutant but should be monitored for possible addition to the list of impairments at a later date.

Kevin Geedey, a professor at Augustana College, samples the Rock River and associated wetlands within the Beiling ecological preserve south of Trinity Hospital, which drain into the Rock River. Though this data can not serve as a proxy for water quality within the stream channels of the Rock River Ravines, it is included here to provide a point of reference in the absence of other sources of data. Kevin and his class sample for phosphorous, nitrogen, conductivity, dissolved oxygen, fecal coliform / bacteria, temperature, and pH. Table 3.14.4 presents sampling data for two dates in 2006. These data indicate elevated levels of conductance and salinity readings in the June sample. Comparable data from other systems in 2006 indicate salinity in the 0-0.2 ppt range and conductivity in the 200-600 micro siemens range. The elevated levels may be related to salt application to control winter snow and ice that has not yet been flushed out of the wetlands. Alternately, high conductivity could be a sign of high concentrations of nutrients in runoff, which may be related to contamination from septic fields after heavy rain and flooding events. The low dissolved oxygen levels are likely due to warmer water temperatures in July, when oxygen levels are naturally lower.

Table 3.14.3 Generally Accepted Standards for Single E. coli Samples

Assumed Water Body Use	Standard (colonies / 100mL)
Designated Beach Area	235
Moderate Full Body Contact Recreation	298
Lightly Used Full Body Contact Recreation	406
Infrequently Used Full Body Contact Recreation	576

Table 3.14.4 Sampling Data for Rock River & Associated Wetlands

Parameter	6/15/06	7/26/06
pH	7.53	7.33
Specific conductance	1689 micro Siemens	1199 micro Siemens
Salinity	0.9 ppt	0.6 ppt
Oxygen	5.88 mg/l	2.87 mg/l
Temperature	20.7 degrees C (69 degrees F)	23 degrees C (73.4 degrees F)

When found in elevated concentrations in the stream, *chloride*, a chemical found in salts, can indicate inputs of human or animal waste or road salt runoff following application for snow and ice control. Road salt can occur at toxic levels in the water column at intermittent times when the weather conditions demand its use and can cause spikes in the water column. Normal stream concentrations are generally 20-30 mg/L. There is no evidence indicating contamination from human or animal waste as a source of chlorides. However, it is likely that during winter months salt applied to control snow and ice makes its way through the storm sewer network and into the ravines, making them inhospitable for aquatic life until the chlorides are flushed out of the system. That said, it is unclear whether there is any significant aquatic life within these ravines that should be of concern. Nonetheless, consideration should be given to the potential for restoration of these systems to a condition that would support a diversity of aquatic species.

Algae and aquatic plants in the creek elevate *dissolved oxygen* (DO) concentrations during the day (due to photosynthesis) and lower DO concentrations at night (due to respiration). Low DO conditions typically exist in mid to late summer when air and water temperatures are high and water levels are low. DO concentrations below the Illinois Environmental Protection Agency standard of 5.0 mg/L can stress many fish species, and concentrations below 1.0 mg/L (hypoxic conditions) can be detrimental to aquatic life. Low dissolved oxygen conditions can lead to fish kills although no such reports were discovered during this inventory. Low dissolved oxygen levels also create conditions that only some fish and aquatic organisms can tolerate, causing the diversity of species to be reduced, which is an indicator of an impaired system. Although there is no evidence suggesting low dissolved oxygen levels in the Rock River Ravines, the planning team assumes that during low flow conditions dissolved oxygen levels fall below the 5 mg/L threshold important for aquatic life.

Phosphorous levels above 0.05 mg/L can result in excessive algae growth in the water. Algae blooms due to phosphorous impair the habitat quality of water resources and block light from reaching desirable aquatic plants. When the algae dies, the decomposition process can deplete dissolved oxygen levels in the water, impairing the habitat quality for aquatic wildlife. When this algae dies, the decomposition process consumes oxygen in the water. If too much of the dissolved oxygen is consumed, the water becomes uninhabitable to some sensitive aquatic wildlife species. Although there is no evidence that there is a problem with phosphorous concentrations within the Rock River Ravines, the planning team assumes that there are elevated phosphorous concentrations because it is a pollutant typically found in urban runoff. Stream or streambank dumping of yard waste, grass clippings, and leaves collected in the fall, a condition found throughout the Rock River Ravines, can also contribute significant nutrient loading to the stream.

Total Suspended Solids (TSS) and sedimentation are likely sources of impairment within the Rock River Ravines, though the impairment is not considered to be severe. The primary impact of high suspended solids concentrations in streams occurs when these solids settle in depositional areas of the stream system and cover the more desirable gravel substrates. Excessive levels of particulate material also create difficult conditions for gill breathing fish and some of their food sources, including macroinvertebrate organisms. The sources of TSS appear to be streambank erosion (due to hydrologic instability) with contributions from urban runoff over impervious surfaces. Suspended solids can be transported to the streams and lakes, even from remote areas of the watershed, via tile drainage, storm sewers, and roadside ditches. Another significant source of TSS in some reaches is runoff through overgrown woodlands along the stream corridor that have little or no ground cover vegetation to prevent surface erosion. Increases in impervious cover combined with introduction of stormwater drainage systems and loss of wetlands has lead to significant changes in watershed hydrology (flow alterations). This has in turn lead to increased streambank and streambed erosion and degradation of instream habitat in many reaches.

Potential sources of petroleum based hydrocarbons (oil and grease), metals, and synthetic organic compounds (SOCs) to the stream include stormwater runoff from urban land uses such as transportation, commercial, industrial, and residential. These *toxic substances* impair the quality of aquatic habitat and can bioaccumulate (concentrate within animal flesh and fat) through the food chain. Oil and grease and other organic compounds also use oxygen as they decompose and therefore can deplete dissolved oxygen. Because these pollutants exist in stormwater runoff, "dumping" or "spills" are not necessary for these to be present. Normal wear and tear on vehicles, machinery, and other equipment can contribute metals and other toxic materials to the water column.

Observations of *habitat quality* of the Rock River Ravines and riparian corridors indicate a significantly impaired system due to the lack of habitat features, significant erosion of stream banks, moderate sedimentation, and low flow conditions during drier periods, which results in low dissolved oxygen concentrations. Some locations exhibited moderate quality habitat features such as gravel stream substrates and groundwater seepage from the ravine banks. In general, the riparian corridors are fairly intact, i.e., they are wide enough to provide adequate buffering from adjacent land use. However, most of them suffer from yard waste dumping, which smothers desirable habitat features, and an overgrown forest canopy that shades out ground plane vegetation. In other locations, turf grass is being mown to the stream edge, which provides little water quality filtration, streambank stabilization, or habitat. However, a few locations where the forest canopy has been cleared exhibited decent riparian conditions and healthy ground plane vegetation.

Watershed stakeholders also have raised the issue of *Combined Sewer Overflows* occurring within the watershed and the potential for discharge of pollutants during high rainfall events. Although the duration and impact of these events are unknown, the potential for significant impact is included here and in the list of impairments, causes, and sources.

NON-POINT SOURCE POLLUTANT LOAD MODELING ASSESSMENT

For each of the eleven subbasins in the Rock River Ravines watershed, twelve non-point source pollutant loads were calculated. Loading was determined using unit area loading rates in lbs/acre/year for each land use category and for each pollutant. The land use specific unit area loading rates were multiplied by the area of each of the land uses in the particular subbasin and summed to obtain the total load for the subbasin (in units of lbs/year). The twelve pollutants assessed are displayed in Table 3.14.3.

The unit area loading rates were determined using the U.S. EPA Simple Method popularized by the Center for Watershed Protection. This method uses an event mean concentration (EMC, the average storm pollutant concentration) along with average annual rainfall and a runoff coefficient to determine an average annual pollutant load for each land use and constituent. Typical EMC values for urban areas were based on work during the National Urban Runoff Program, from the Northeastern Illinois Areawide Water Quality Management Plan, and from the Wisconsin DNR.

It should be noted that this analysis is based strictly on loading rates that are typical for the given land uses and not on any watershed-specific data. The analysis also does not reflect the influence that watershed landscape features such as depressional storage and wetlands have on delivery of pollutants to the watershed outlet. Thus, the watershed totals in are likely higher than what is actually leaving the watershed. Instead the values should be viewed as the total load to various water resource areas both inside and outside the watershed.

For this modeling assessment, four pollutants in particular are considered as pollution indicators for this watershed: total suspended solids / sedimentation (TSS), total phosphorous (TP), chemical oxygen demand (COD), and biological oxygen demand (BOD). TSS and TP are typical indicators of high urban pollutant loadings. TSS can lead to excessive sedimentation in stream reaches and ultimately cover and impair instream habitat. TP can lead to excessive productivity levels of aquatic plants in slow moving reaches and in lakes and wetlands. This can then lead to low DO levels as the plant material decays, which can make the stream uninhabitable for some species of aquatic life. Since COD and BOD represent oxygen demanding substances they were included in the list of indicator pollutants for this watershed.

For each pollutant, subbasins were classified as High, Medium, or Low based on the subbasin average loading rate (lbs/acre/year) relative to the watershed average loading rate, as described below:

- If a subbasin average loading rate was greater than 1.5 times the watershed average loading rate, that subbasin was classified as a High contributor of the particular pollutant and given a rating of 3.
- If a subbasin average loading rate was between 1.25 times and 0.75 times the watershed average, that subbasin was classified as a Medium contributor of the particular pollutant and given a rating of 2.
- If a subbasin average loading rate was less than 0.5

times the watershed average, that subbasin was classified as a Low contributor of the particular pollutant and given a rating of 1.

After each subbasin was rated according to its loading contribution for each pollutant, a composite rating for the subbasin was determined based on the average of the rating of the four indicator pollutants (TSS, TP, BOD, and COD). The results of this assessment indicate that only Subwatershed Management Unit A ranks as a potential high contributor of non-point source pollutants relative to the other SMUs. The results are displayed in Table 3.14.6.

3.15 SUMMARY AND CONCLUSIONS

This watershed inventory and assessment provides important insight into the issues and problems in the watershed and the opportunities available for preserving and improving watershed resources. The vast majority of the impacts and impairments to watershed resources identified above are the result of years of modification of the stream and from a landscape changing from natural to agricultural to urban. The impacts of this changing landscape on watershed resources are summarized here and actions for addressing these impacts are included in the Action Plan in Chapter 5.

It is important to identify potential causes and sources of impairment in the watershed so that preventive and remedial measures can be planned and implemented. The impairments, issues, causes and sources identified below and in Table 3.14.6 are based on available data and the best estimate and professional judgment of the planning team and the watershed planning committee based on the watershed inventory assessment and input from watershed stakeholders. The impairments have not been identified nor confirmed by the state agency that determines water quality impairment designations by the state. Thus, they should be considered as potential rather than confirmed until additional sampling and surveying can be done.

Table 3.14.5 Pollutants Modeled During this Study

Non-point Source Pollutants
Total Phosphorous (TP)
Total Suspended Solids (TSS)
Chemical Oxygen Demand (COD)
Biological Oxygen Demand (BOD)
Total Dissolved Solids (TDS)
Total Nitrogen (TN)
Total Kjedahl Nitrogen (TKN)
Dissolved Phosphorous
Cadmium (Cad)
Lead (Lead)
Copper (Cop)
Zinc (Zn)

Table 3.14.6 Pollutant Ratings

SMU	Pollutant Contribution Rank
RRA	High
RRB	Moderate
RRC	Moderate
RRD	Moderate
RRE	Moderate
RRF	Moderate
RRG	Moderate
RRH	Moderate
RRI	Moderate
RRJ	Moderate
RRK	Moderate

The causes and sources of impairment displayed in Table 3.14.5 are selected primarily from a more complete list included in the Illinois Environmental Protection Agency and Iowa Department of Natural Resources 305(b) and 303(d) water quality reports and supplemented to a limited extent by professional opinion. Table 3.14.7 includes those impairments, causes, and sources that are most relevant to the Watershed-Based Plan nine element requirements of the United States Environmental Protection Agency. Because this table is intended to satisfy one of these nine requirements, it does not include all of the issues and problems identified below. However, they all have been addressed within the Action Plan included in Chapter 5.

WATER QUALITY

The most important water quality issues that need to be addressed include the following.

- low dissolved oxygen concentrations due to low flow;
- elevated chloride levels, possibly resulting from application of salt for snow and ice control on roads;
- sedimentation and poor water clarity within the stream channel that is the result of streambank erosion and runoff from the urban landscape including roads and highways;
- toxic substances in the water column from urban runoff from impervious surfaces including roads and highways;
- nutrients that contribute to the potential for other water quality problems in the stream and downstream resulting from urban runoff and inappropriate disposal of yard waste along the stream channel;
- impacts from Combined Sewer Overflow events;
- potentially higher non-point source pollution loading from Subwatershed Management Unit RRA.

STREAM CHANNELS

The most important issues related to stream channels that need to be addressed include the following.

- streambank erosion resulting from flashy hydrology (higher high flows, flooding conditions, and lower low flows), unstable streambanks, and stormwater discharges;
- stormwater discharges from residential and municipal stormwater management systems that cause erosion of the streambanks and stream channel;
- streambank and stream channel armoring that is intended to control erosion but is not designed, installed, or maintained adequately, resulting in erosion problems;
- debris buildup and obstruction within the stream channel that is the result of streambank erosion and dislodged trees and vegetation;
- sedimentation buildup within the stream channel, primarily within lower reaches;
- channelized and incised stream channels and channel widening / lateral movement;
- loss / lack of habitat characteristics such as pools and riffles;
- damaged or endangered stormwater infrastructure along the stream channel.

RIPARIAN CORRIDORS

The most important riparian corridor issues that need to be addressed include the following.

- inappropriate management of riparian land uses, such as turf grass to the water or stream bank edge, which destabilizes streambanks and provides no water quality or riparian habitat benefits;
- dumping of yard waste along the stream banks, which smothers ground level vegetation and adds organic matter and nutrients to the water;
- narrow riparian buffers in a few locations;
- a dense tree and shrub canopy along the streambanks and riparian corridor of some reaches that shades ground cover, exposing soils to erosion;
- invasive species, such as reed canary grass, that degrade the natural quality of the riparian zone;

RAVINES

The most important issues related to the watershed ravines that need to be addressed include the following.

- inappropriate land and water management by landowners, including dumping of yard waste and a dense tree canopy that shades out stabilizing ground vegetation;
- discharge of residential stormwater from roof and footing drains onto the edge or the slopes of the ravines causing erosion;
- flashy watershed hydrology that is causing erosion of stream and ravine banks;

Table 3.14.7   Rock River Ravine Area Impairments Causes and Sources

Impairment	Cause	Source
Water Quality	Total suspended solids / sedimentation and siltation	Urban runoff / storm sewers
		Streambank modification and destabilization
		Runoff from forest / grassland / parkland
		Highway / road / bridge runoff
Water Quality	Low dissolved oxygen	Hydrologic disturbance / flow alteration (low flow)
Water Quality	Nutrients (primarily phosphorous)	Urban runoff / storm sewers
		Runoff from forest / grassland / parkland
		Inappropriate waste disposal (e.g., yard waste)
Water Quality	Aquatic life toxicity (chlorides / total dissolved solids)	Urban runoff / storm sewers
		Road salt and storage / highway maintenance and runoff
		Highway / road / bridge runoff
		Combined sewer overflows
Habitat degradation and alteration	Lack of habitat characteristics (pools, riffles, substrate, meandering, cover, streambanks)	Channelization / incision (lower reaches)
		Streambank modification and destabilization
		Habitat modifications
		Impacts from hydrostructure flow regulation / modification
Habitat degradation and alteration	Hydrologic disturbance / flow alterations (increase or decrease of streamflow	Urban runoff / storm sewers
		Site clearance / development / land use conversion
		Loss / drainage of depressional / wetland storage
		Impacts from hydrostructure flow regulation / modification
Habitat degradation and alteration	Draining, filling, and degradation of wetlands	Draining, filling, loss of wetlands
		Urban runoff / stormsewers
		Habitat modifications
Habitat degradation and alteration	Exotic and invasive species (natural areas and riparian zone)	Spread from existing infestations
		Habitat modification
		Impacts from hydrostructure flow regulation / modification
		Impacts from hydrostructure flow regulation / modification
Habitat degradationand alteration	Loss / reduction / degradation of natural buffer; streamside alterations	Draining, filling, loss of wetlands
Habitat degradationand alteration	Channelization / incision	Spread from existing infestations
		Inappropriate land management
		Streambank modification / destabilization
		Habitat modification / loss of riparian habitat and vegetation
		Loss of riparian habitat and vegetation

- lack of landowner awareness, management, and restoration of the natural quality of the ravines, including natural seeps and appropriate vegetation.

GREEN INFRASTRUCTURE

The most important issues related to green infrastructure that need to be addressed include the following:

- lack of substantial preserved and managed green infrastructure corridors along the ravines to connect the larger green infrastructure 'hubs';
- unpreserved green infrastructure areas within the Rock River floodplain

NATURAL AREAS

The most important issues related to watershed natural areas include the following:

- few areas of moderate or higher biological / vegetative quality within the watershed;
- poor habitat quality along the ravines;
- lack of management and restoration plans and action to preserve and restore native habitat;
- invasive species infestations that degrade natural habitat;
- modified hydrologic / streamflow patterns that degrade natural habitat;
- impacts from upstream influences, such as erosion and sedimentation.

WETLANDS

The most important issues related to watershed wetlands include the following:

- lost wetland acreage and services due to drainage, filling, or other cause: water quality improvement, water retention and storage, and habitat;
- impairment of natural hydrologic patterns that support healthy wetlands resulting from stormwater discharge;
- lack of restoration and management plans and action for existing and former wetlands.

LAND USE

The most important land use issues that need to be addressed include the following:

- lack of appropriate development best management practices, particularly with regard to stormwater management, incorporated into existing or new development;

As noted above, these issues are addressed in the Action Plan in Chapter 5. With dedication and determination, these issues can be addressed and the watershed can be restored to health and well-being.