Olson Ecological Solutions, LLC

Clear Creek Watershed

Inventory & Analysis

Submitted to:

State of Illinois
Illinois Environmental Protection Agency
Bureau of Water

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On behalf of:

Lost Nation New Landing River Conservancy District

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April 29, 2010

Acknowledgements

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This Inventory would not have been possible without the input, research and direction of many people. We would especially like to several committee members who provided guidance and much of the technical information within these pages.

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We would also like to thank:

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Dave Larson, Illinois State Geological Survey
Amy Kuhel, Natural Resources Conservation Services
Nathan Hill, Geologist and GIS Specialist
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Abstract

The Clear Creek Watershed is a 7.22-mile basin that drains 11,130 acres (17.4 mi^3) in Ogle and Lee counties in north-central Illinois. Major waterbodies Clear Creek and Lost Lake refer to HUC 0709000506. The nature of this watershed is generally explained by its physical and natural features, land use and population characteristics, watershed and waterbody conditions, pollutant sources, and waterbody monitoring data. Streams in the watershed flow through mostly flat to rolling agricultural land, The Nature Conservancy's Nachusa Grasslands, and a subdivision situated around Lost Lake before it enters a former Biologically Significant Stream section of the Rock River. The watershed is an important agricultural area, as over 90% of the soils are designated as either prime or of statewide importance. About 56% of the watershed is in row crops and 5% is grazed. Only about 2.3% is developed. The watershed consists of only 0.22% floodplain, 2.4% wetlands on the National Wetlands Inventory, and 5.9% hydric soils, all predominantly located along the creek corridor. Bedrock in the watershed varies, with a depth of 75 feet at the Lost Lake dam. There are five reported archaeological sites in the western portion of the watershed. No future land use changes are planned for the watershed by either county. The designated uses for Clear Creek and Lost Lake are Aquatic Life, Fish Consumption, Primary Contact, Secondary Contact, and Aesthetic Quality. The only designated uses assessed are the Aquatic Life and Aesthetic Quality of Lost Lake, but the data found is insufficient to make a meaningful statement. Therefore, the lake is considered a Category 3 waterbody. No TMDL reports apply to the watershed.

The Clear Creek Watershed is of great importance to many wildlife species classified as Species in Greatest Need of Conservation and houses several threatened and endangered species. The watershed contains high priority grasslands at Nachusa Grasslands and two Conservation Opportunity areas of high value to wildlife, the Rock River Conservation Opportunity Area and the Nachusa-Franklin Creek-Castle Rock-Lowden Miller Conservation Opportunity Area. It is within one of three Forest Legacy Areas in Illinois. Habitat types present in the watershed include forest, rural grassland, prairie, and wetlands. The Nature Conservancy is the only agency permanently protecting land within the watershed. They own 1,490 acres and have conservation easements on 400 acres. Other critical habitat is provided by over 5,500 acres of state-protected lands within the vicinity. The Illinois Department of Natural Resources sampled fish at Nachusa Grasslands in 2006 and ranked the site as a Moderate Aquatic Resource with an Index of Biotic Integrity (IBI) of 35. Further studies of macroinvertebrates in Clear Creek and Lost Lake suggest moderate to good water quality.

Limited data provided by the Environmental Protection Agency's sampling of Lost Lake in 2007 support that excessive amounts of suspended solids, nitrogen, and phosphorus contribute to decline of water quality in the surface waters of the watershed. Likely sources of sedimentation and pollution have been identified and some measures have been installed to mitigate and prevent these threats. Known major contributors to sedimentation in the watershed include Highly Erodible Lands covering 31% of the watershed, channelization of about 10% of the open waterways, runoff and soil compaction of cropland affecting about 59% of the watershed, lack of vegetation along riparian zones, livestock on 550 acres with free access to 17,330 linear feet of stream, and worsening unstable stream banks. The likely nonpoint sources of pollution and erosion to surface and ground waters include livestock and runoff from agricultural fields and residential lawns. Impervious surfaces account for considerably less than 10% of the watershed and were therefore not assessed as sources of pollution. The only known point source of

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pollution in the watershed is a wastewater treatment plant for the subdivision, which has incurred multiple violations by the Environmental Protection Agency. The entire Clear Creek watershed falls into the "excessive" category of Keefer's mapping of aquifer sensitivity to contamination by pesticide leaching. Technical and financial assistance are being utilized by stakeholders for implementation projects to combat sedimentation and pollution. The Lost Lake Utility District has reduced some pollutants from the current wastewater treatment plant and is in the process of constructing a new plant to be opened in July 2010 to meet stricter requirements recently implemented by the Environmental Protection Agency. Support for reducing nonpoint source pollution comes from the Natural Resources Conservation Service, Soil and Water Conservation District, and Lost Nation New Landing River Conservancy District. No Section 319 nonpoint source projects are currently in progress for the watershed, although one application is in the approval process and another application is being drafted. Local ordinances regarding land management practices in the watershed originate from Ogle and Lee Counties and the Lost Nation New Landing River Conservancy District of Illinois.

Some information about the watershed was not readily available, including fish consumption advisories, Source Water Assessment; annual drinking water report; septic system number, locations, or failures; drain tile locations; or livestock population, management, or land application of manure. Wells were located, but information about well contamination was not available. Septic systems outside the subdivision are not considered a significant source of nonpoint pollution due to low density.

Physical and Natural Features

Watershed Boundaries

The Clear Creek Watershed lies within the Upper Rock River Watershed Environmental Protection Agency Basin 6, and Rock River Hill Country Natural Area Division in north-central Illinois (IDNR, 2005). The Clear Creek Watershed lies largely within Taylor Township in Ogle County, and it extends into adjacent townships and Lee County. The Clear Creek flows into the Rock River watershed, which empties into the Mississippi River and then into the Gulf of Mexico (IDNR, 2001). It contains 11,130 acres (17.78 sq. mi.), based Watershed Boundary Dataset GIS database of watersheds at a scale of 1:24,000 (Hill, Pers. Comm.).

The boundaries of the Clear Creek Watershed are roughly as follows: The boundary begins about one half mile north of Lighthouse Road just east of Highway 27, then runs southeast to a point one mile east of Hoosier Road on the Ogle County line. The boundary then turns mostly west and a little south. This boundary line goes west and the other corner ends a mile north of Naylor Road and west of Daysville Road at the south end of the watershed. The boundary line then runs northwest, roughly parallel with the east side of the watershed, and ends a mile or so west of the Lost Lake dam, where it then runs northeast back up to Lighthouse Road.

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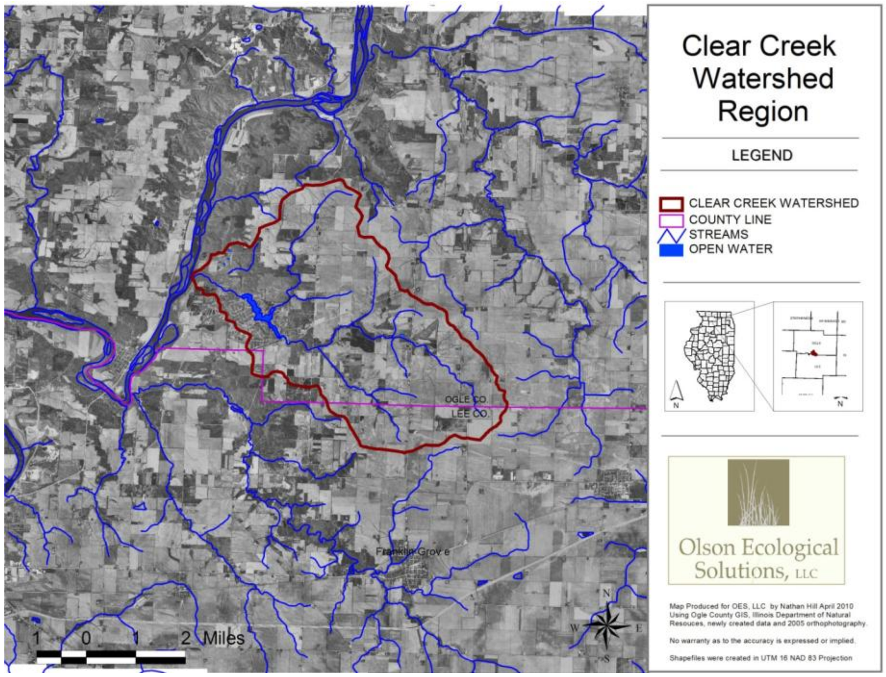
Map 1: Clear Creek Watershed boundaries.



Hydrology

Hydrology of the watershed is defined by stream reaches, floodplain, peak flow, and waterbodies including Lost Lake, ponds, and wetlands.

Stream Reaches

The Clear Creek Watershed is named for the main stream running through it, Clear Creek (Assessment Unit IL_PZU, HUC 0709000506). It has one large tributary, Babbling Brook, which begins at the northern section of the watershed and flows south. Babbling Brook has two main branches that merge and drain into Lost Lake separately from the main Clear Creek stem. The main channel of Clear Creek generally flows east and north (IDOC, 1968). It starts as six "branches" that merge into one stem of Clear Creek, which empties into Lost Lake. From Lost Lake the creek continues as Clear Creek over the dam for another mile to the Rock River.

Clear Creek flows into a stream segment of the Rock River that was considered a Biologically Significant Stream Segment prior to the 2008 update, extending from the confluence of Clear Creek upstream to the confluence of Honey Creek (IDNR, 2008 *a;* Szafoni, pers. comm.; and Ogle County Zoning and Planning Department, 2004).

The basin length of Clear Creek is about 7.22 to 7.3 miles, according to ortho-photography, GIS analysis, and the ArcHydro method (Hill, Pers. Comm. and USGS, 2009). A GIS analysis measured all perennial and intermittent streams in the watershed as summarized in Table 1. "Clear Creek Upstream" refers to the segment upstream of Lost Lake. Intermittent streams and grassed waterways only flow during and shortly after rain events.

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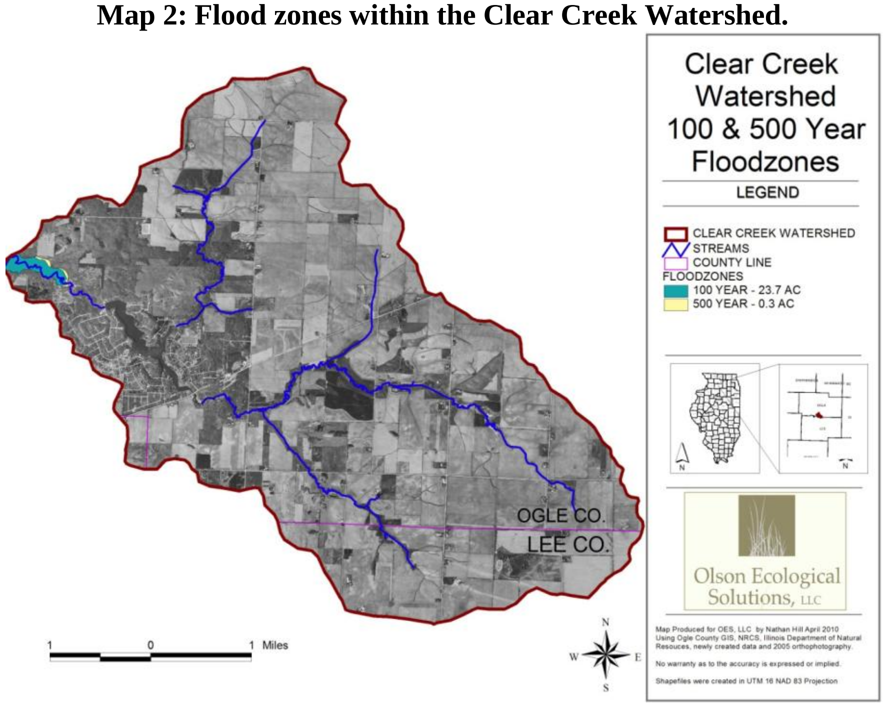
Table 1: Stream Length in Clear Creek Watershed			
Stream Section	**Type**	**Length (lf)**	**Length (miles)**
Clear Creek - Upstream	Perennial	28,900	5.47
Clear Creek - Below Dam	Perennial	9,200	1.74
Babbling Brook	Perennial	23,400	4.43
Subtotal		*61,500*	*11.65*
Clear Creek - Upstream	Intermittent	82,200	15.57
Clear Creek - Below Dam	Intermittent	12,800	2.42
Babbling Brook	Intermittent	82300	15.59
Subtotal		*177,300*	*33.58*
Total		**238,800**	**45.23**
Source: National GIS Database at a scale of 1:24,000 (Hill, Pers. Comm.)			

Floodplain

Floodplain is an important component of stream ecology and serves to moderate flow rates and stream energy during high flow runoff conditions. However, the floodplain area of the Clear Creek watershed is a scant 24 acres (0.22% of the watershed), as identified by the Federal Emergency Management Agency (FEMA). Of this acreage, 23.7 acres are considered as the "Special Flood Hazard Areas Inundated by 100-Year Flood" and 0.3 acres are considered 500-year floodplain (Map 2). This floodplain extends for about one mile along Clear Creek to its confluence with the Rock River. Flood stages on the Rock River can rise rapidly and remain high for considerable lengths of time (FEMA, 2009).

Map 2: Flood zones within the Clear Creek Watershed.



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Stream Flow

During a downpour event in the Clear Creek Watershed, stormwater has relatively few places to go. Factors such as lack of floodplain, high base flow, runoff typical of the area, variable peak and average flow levels, and increases in average stream flow over historic levels help to explain changes in lake levels and flash flooding occurrences. Problems associated with flash flooding are being addressed by local planning groups.

As illustrated above, the watershed has very little floodplain located only within its last mile. Sustained base flow levels during dry periods are very high compared to the rest of the state, along with the Rock River Assessment Area (IDNR, 2001). Runoff accounts for roughly 25% (8.7 inches) of the average annual precipitation (34 inches) in the watershed, which is similar per unit of drainage area to other watersheds within the Upper Rock River Assessment Area (IDNR, 2002*a).* Peak flow rates vary greatly, and can often reach over 1,000 ft^3/s of maximum instantaneous flow (Table 2) (USGS, 2009*b*). Historically, the average magnitude of these peak flow discharges has remained similar over the past 100 years. Average stream flow rates also vary greatly. Historically, the highest averages on record have occurred over the past 30 years. There have been significant increases over the past 60 years, which level out to only slight increases when viewed over the past 100 years (IDNR, 2001).

Table 2: Streamflow statistics for Clear Creek Watershed.

Statistic	Flow (ft3/s)	Prediction Error (%)	Equiv. Yrs. of Record	90% Prediction Interval Min.	90% Prediction Interval Max.
PK2	536	40	2.6	283	1010
PK5	900	41	3.1	474	1710
PK10	1160	42	3.8	598	2240
PK25	1480	45	4.6	734	2970
PK50	1720	47	5.2	831	3570
PK100	1950	49	5.6	909	4170
PK500	2490	55	6.2	1070	5780

Key:

PK# =	maximum instantaneous flow that occurs on avg. once in every # years (USGS, April 12, 2010a).
Equiv. Yrs. of Record =	# of years a station should be in operation to predict reliable flow stats.
90% Prediction Interval =	There is a 90% probability that the actual flow rate falls within the range of the given values.

Source: USGS, 2009*b.*

Due to the factors above, stormwater causes water level changes at Lost Lake and flash floods throughout the watershed. Lost Lake is poorly equipped to handle surges in flow rates because of the large watershed to lake-ratio. Lost Lake can rise very quickly and does not drop to a low-water condition. However, it will return to pool quickly. During times when the rainfall is heavy and significant, the lake rises quickly and significant damage can occur (Rush, Pers. Comm.). Stakeholders confirmed that the watershed is prone flash flooding. They identified two significant flash flood events in December 2008 and on June 21, 2009 as examples. On June 21, 2009, about four to six inches fell in three to four hours on already saturated ground over the entire watershed. Examples of damage include wash outs of bridges, livestock fences, roads, gabion baskets, and property (Photo Set 1). During these floods, the Lost Nation/New Landing River Conservancy District sustained $33,000 of damage and lost gabion basket erosion control structures within the Clear Creek silt containment area. The Property Owner's Association lost a bridge. Homeowners on Lost Lake lost docks and boats and sustained damage to their individual property (Clear

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Creek Watershed Planning Committee, Pers. Comm.). Upstream, bridge repair work on Daysville Road included shot rock installation along ditches entering the stream, straightening of the stream, and cement reinforcement of the streambanks. Many other examples were given, including destruction of fences and roads (Baker, Pers. Comm).

Photo Set 1: Examples of damage to Babbling Brook banks after June 21, 2009 storm.

Source: Rush, Pers. Comm.

Several goals of the Clear Creek Watershed Planning Committee, Ogle County Comprehensive Plan, and Draft Lee County Comprehensive Plan reflect the need to address flash-flooding issues. The Planning Committee would like to minimize stormwater run-off, flashy hydrology, and related sedimentation and pollutant loading into the streams (Clear Creek Watershed Planning Committee, Pers. Comm.). Both the Ogle County Comprehensive Plan and the Draft Lee County Comprehensive Plan contain goals and objectives to discourage development within the floodplain; protect wetlands near or adjacent to streams; and preserve natural areas as water retention areas, groundwater recharge areas, and habitats for plants and animals (Ogle County Planning & Zoning Dept., 2008 and Vandewalle and Associates, 2010). Both County Boards require the Soil and Water Conservation District in each county to complete a Land Use Site Assessment Report (LESA) to aid in the consideration of value of on-site resources prior to land use change decisions.

Waterbodies

Waterbodies in the watershed include Lost Lake, ponds, and wetlands.

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Lost Lake

The 88-acre Lost Lake (Assessment Unit IL_RPZF, HUC 0709000506) was formed by damming Clear Creek (IDOC, 1968). The original dam created a 32.5-acre lake in 1963 by the Lost Nation Development Company as a recreation feature for residents of their subdivision six miles south and two miles west of Oregon (IDOC, 1968). The lake was increased to its current size of 88-acres in 1972 by constructing a separate dam (Finch, 1973.). The lost Nation/New Landing subdivision now has 820 lots, 351 or which are built on and 469 that are not (Steffens, Pers. Comm.).

When the lake was enlarged to its current size in 1973, engineers provided information regarding the lake's hydrology to the Illinois State Water Survey. According to this report, the average annual evaporation of Lost Lake at that time was 26.4 inches with a four-hour time of concentration. Estimated seepage losses were 165 acre-feet. Average annual runoff was 10.2 inches, or 9,620 acre-feet. The net yield considering evaporation, runoff, and seepage was 2,998 M.G. The engineers designed the discharge rates of the lake based on a peak rate of inflow of 3,500 cfs to be a maximum discharge of 3,050 cfs and a maximum discharge volume of 252 acre-feet, or 0.28 inches, per hour (Finch, 1973).

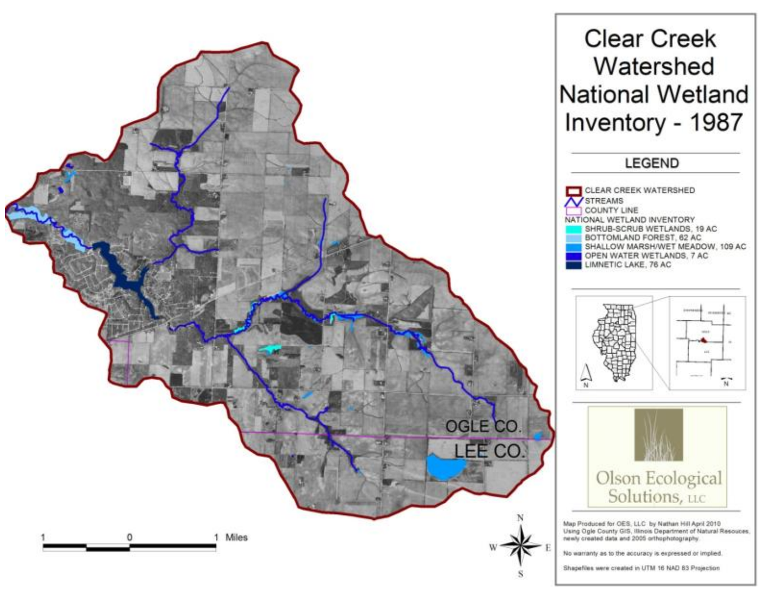
Ponds

There are ten ponds, mostly man-made, that account for a total of ten acres, as located on Map 12. Three ponds located off of Hay Road in the northwest corner of the watershed are part of National Wetlands Inventory sites and have native vegetation present. These sites are discussed in further detail in the "Habitat" section of this Inventory. Information regarding the other seven ponds is not yet known.

Wetlands

The watershed has a total of 273 acres of various National Wetland Inventory wetland types, representing 2.5% of the watershed and located mostly along the creek corridors (Map 3). There are 109 acres of shallow marsh/wet meadow, 62 acres of bottomland forest, 19 acres of scrub-shrub wetlands, 7 acres of open water wetlands, and 76 acres of limnetic lake (Hill, Pers. Comm.).

Map 3: National Wetlands Inventory sites in the Clear Creek Watershed.



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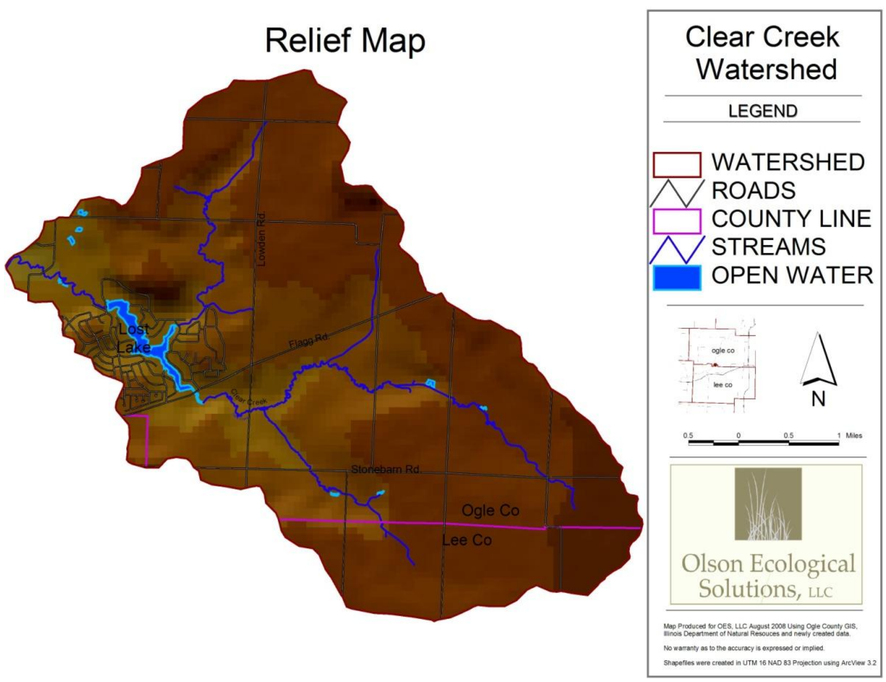
Topography

The topography of the Clear Creek Watershed is mostly flat to rolling (Map 4), the result of both erosion processes and irregularities in the bedrock surface that influenced total drift thickness (Ogle County Planning & Zoning Dept., 2008). It has been glaciated but has a relatively thin glacial deposition (IDNR, 2002*a*). The two glacial ages of particular importance to the physiographic development of Ogle County were the Illinois Episode and the more recent Wisconsin Episode, which ended approximately 10,000 years ago (Ogle County Planning & Zoning Dept., 2008). From the upstream water course to Lost Lake, the difference in elevation is 180 feet (Finch, 1973). The Lost Lake has a normal pool elevation averaged at 687 feet (Rysso et. al., 2008). The lowest point in Ogle county is 650 feet above mean sea level on the Rock River at the county line between Ogle and Lee Counties near the watershed (FEMA, 2009).

Map 4: Clear Creek Watershed topographic relief.



Soils

Soils in the watershed are defined by predominant soil associations, hydric soils, and hydric soil groups.

Predominant Soil Associations

The Clear Creek Watershed is made up of predominantly three soil associations: Plano-Catlin-Saybrook, Lawson-Comfrey-Jasper, and Boone-Eleva-Chelsea. All three associations share erosion as a major management concern. All are used for pasture, beef livestock, and hogs. The first two associations are primarily used for corn, soybeans, small grain, and hay. The latter is often used for woodlot and is moderately suited for dwellings. Most of the soil in the Clear Creek watershed is Plano-Catlin-Saybrook. This soil association covers the majority of the east part of the watershed, the northern reaches of Babbling brook, and south to the northern Taylor township line. It is level to sloping, moderately well

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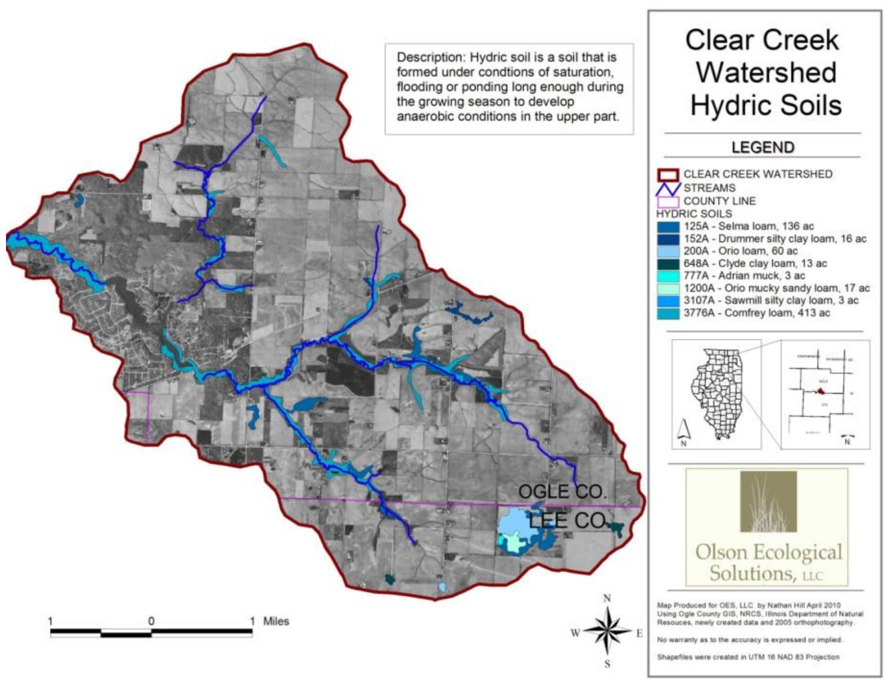
drained, found on ridge tops and side slopes of uplands, and formed in loess over outwash or in loess over glacial till. Lawson-Comfrey-Jasper is found where the mouth of Clear Creek runs into the Rock River and to the north and south. This is the smallest section of soil association in the watershed. It is nearly level to sloping, somewhat poorly drained, poorly drained, and well-drained soils that formed in silty and loamy alluvium or in loamy material over outwash. It is found on terraces and bottom lands. Boone-Eleva-Chelsea is a somewhat even band of soil that runs north and south over the portion of the watershed that contains Lost Lake and Nachusa Grasslands. It abruptly tappers off at the north, then veers west. It consists of gently sloping to very steep, excessively drained to well-drained soils that formed in sandy or loamy material over sandstone bedrock or sandy material found on ridge tops, valley slopes, and strong side slopes (Ogle Co. Planning & Zoning Dept., 2008).

Hydric soils

Hydric soils are poorly drained soils associated with wet prairies, forested floodplains, and wetlands and are prone to flooding or wet conditions if they are not drained (NRCS, 2010). In the watershed, hydric soils comprise 5.9% of the soils (Kuhel, Pers. Comm.), or 661 of the 11,132 acres (Map 5). They are predominately on the floodplains and major drainage areas, although there are a few isolated areas in shallow depressions on terraces.

Map 5: Hydric Soils in the Clear Creek Watershed.



The majority of hydric soils in the watershed have been artificially drained using sub-surface, perforated drain tile for farming purposes. In areas of defined drainage patterns, grassed waterways have been installed to safely carry surface water from agricultural fields to drainage ditches or natural streams without causing gully erosion. During early spring and excessive periods of precipitation, these tiles will run for months before slowing down. Where hill side seeps, natural springs, or additional tile from uphill properties feed the tile system, some will only stop during winter months when soils are frozen. The

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majority of the upper reaches of the tributaries are fed from sub-surface drain tiles, which is basically where the surface waters begin (Pierce, Pers. Comm.).

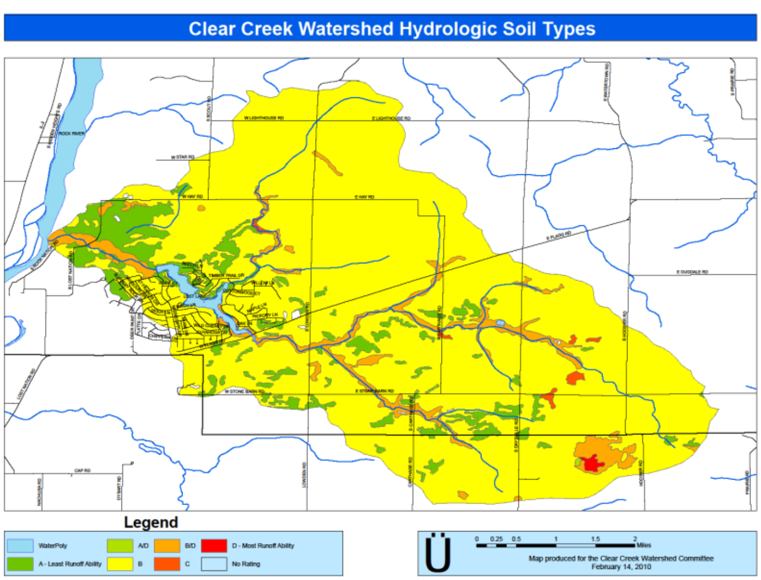
Hydrologic soil group (HSG)

Hydrologic soil groups (HSG) help to define the runoff potential of soils. They are categorized into A, B, C, and D soils based on texture, permeability, and level of drainage. The ranking applies to hydric soils in their drained state. HSG A has the least runoff potential while HSG D has the greatest runoff potential. If the soils are not drained, they are assumed to have a runoff potential of HSG D soils. The Clear Creek Watershed has the following percentages of HSG (Kuhel, Pers. Comm.):

Table 3: Percent Hydrologic Soil Group (HSG) in Clear Creek Watershed	
HSG	**% in Watershed**
A	7.9
B	84.8
B/D	5.9
C	0.4
D	0.2
Source: Kuehl, Pers. Comm.	

The vast majority of the watershed is HSG B (84.8%). HSG A (7.9%) is found in a large patch near the mouth of the Rock River around the small floodplain and scattered throughout the watershed, mostly near streams. HSG B/D (5.9%) follows the streams and covers most of the largest wetland complex within the southeast corner of the watershed. Smaller wetlands throughout the watershed overlap with HSG A, B, or B/D. The small amounts of HSG C (0.4%) and D (0.2%) are found in small portions within the southeast corner of the watershed, some occurring within a wetland complex (Table 3 and Map 6).

Map 6: Hydrologic Soil Groups in the Clear Creek Watershed.



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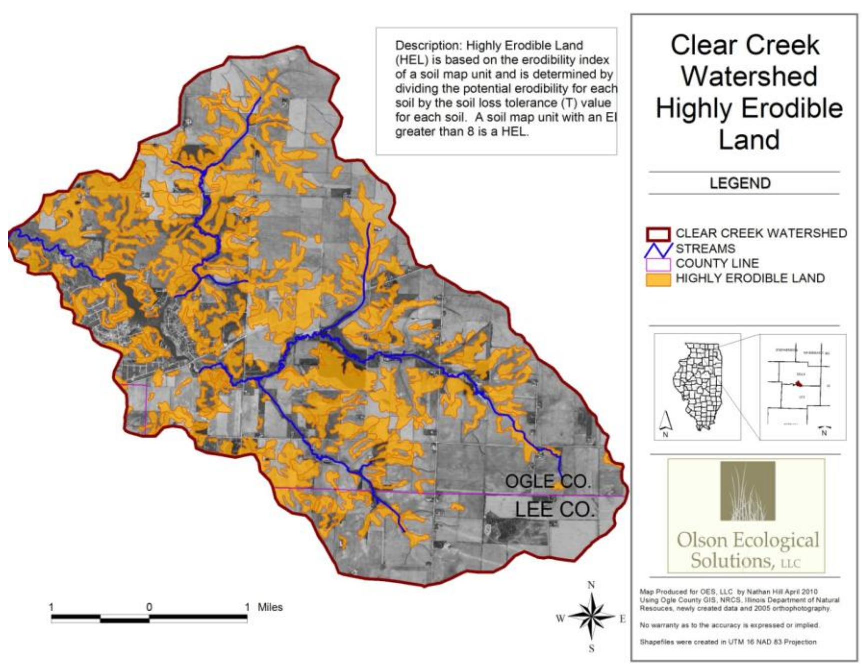
Soil Erodibility

Soil in the watershed is usually eroded by water. Wind is not a strong factor of erosion in north-central Illinois. Highly Erodible Land (HEL) percentages and soil erosivity (Kw) values give insight to soil erodibility in the watershed. HEL is based on the erodibility index of a soil map unit and is determined by dividing the potential erodibility for each soil by the soil loss tolerance (T) value for each soil. A soil map unit with an erodibility index greater than 8 is an HEL (Hill, Pers. Comm.). Soil erosivity (Kw) measures how easily soil detaches and is transported by rainfall (tons per acre). Soil with a higher Kw factor, on a scale of 0.02 to 0.69, is more susceptible to sheet and rill erosion by water. There are 3,415 acres (30.7% of the watershed) of soils that are considered HEL with slopes ranging from 5% to 35% (Map 7) (Meisenheimer, Pers. Comm.). The highest Kw factors in the watershed are 0.43 and 0.49, which account for 5.1% of the soils (Kuhel, Pers. Comm.). Typically, soil erosion of cropland and CRP land by water is approximately three to five tons/acre/year in north-central Illinois (Muckel, 2004). In 21% of the watershed, or 2,373 acres, the soils are already considered to be eroded (Meisenheimer, Pers. Comm.).

There are three land covers in the watershed that are likely sources of intensified erosion: cropland, streambanks, and construction sites. In order to obtain a clearer picture of cropland and streambank erosion patterns in the watershed, the Natural Resources Conservation Service is in the process of analyzing a "Rapid Assessment," which estimates cropland and streambank erosion for the watershed based on measurements taken over 10% of the watershed. This assessment will provide statistical information to use in a water erosion prediction equation. Factors usually considered for such an equation include: (1) amount and intensity of rainfall, (2) ability of the soil to hold together, (3) surface cover, (4) distance for action (slope length), and (5) slope gradient (Muckel, 2004). The three sources of erosion are further discussed below.

Map 7: Highly Erodible Lands (HEL) in the Clear Creek Watershed.



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Cropland Soil Erosion

There is no known data relating to cropland soil erosion in the watershed. The USDA Natural Resources Conservation Service Center of Ogle County measured sheet and rill erosion in 2009 and are in the process of analyzing the data.

Streambank Erosion

Bank erosion is a problem in areas of the Clear Creek Watershed, as documented from various sources. Field studies and observations are being conducted by the Natural Resources Conservation Service and have been documented by the Illinois Department of Natural Resources, Applied Ecological Solutions, JadEco, and Olson Ecological Solutions. The Natural Resources Conservation Service has completed field work for a rapid assessment of the watershed's fields and streams. Data has yet to be analyzed, at which time a map will show stream reaches sampled. The photographs in Sets 2, 3, 4, and 5 show samples of banks throughout the watershed, some of which are experiencing excessive erosion (Meisenheimer, Pers. Comm.). Karen Rivera from the Illinois Department of Natural Resources (2006) documented that the stream was incising, or down-cutting its bed, within a 260 linear-foot sample section of Clear Creek at Nachusa Grasslands. Applied Ecological Services (2001) observed that bends covered with non-stabilizing vegetation is more than likely contributing to a large percentage of erosion, and that straightened stream segments and cleared riparian vegetation is resulting in increased sediment loads and water velocity. JadEco and Olson Ecological Solutions measured average bank height, bank length, and soil texture on both sides of a 1,013-foot section of Babbling Brook (2,026 feet of bank). Data is presented in Table 4.

Photo Set 2: Two photographs from Stream Segment S-1 associated with the NRCS Rapid Assessment (Meisenheimer, Pers. Comm.).

Photo Set 3: Three photographs from Stream Segment S-3 associated with NRCS Rapid Assessment (Meisenheimer, Pers. Comm.).

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Photo Set 4: Four Photographs from Stream Segment S-8 associated with the NRCS Rapid Assessment (Meisenheimer, Pers. Comm.).




Photo Set 5: Three Photographs from Stream Segment S-10 associated with the NRCS Rapid Assessment (Meisenheimer, Pers. Comm.).



Table 4: Field data collected for Illinois Environmental Protection Agengy's bank stabilization worksheet.								
Joe Rush, JadEco and Rebecca Olson, Olson Ecological Solutions								
Shorelines of Lost Lake (LL), North Bank of Babbling Brook (N.BB), and South Bank of Babbling Brook (S.BB)								
9-Aug-09								
Bank Height Sample (ft.)					Soil Samples			
Sample #	LL	N.BB	S.BB			LL	N.BB	S.BB
1	2.58	1.75	7		# of samples	3	3	4
2	3.00	6.33	6.33		Note: Samples for each site combined for an average.			
3	0.67	3.5	5.08					
4	1.33	5.17	3.17					
5	1.08	6.08	2		Bank Length (ft)			
6	1.50				Proposed Action	LL	N.BB	S.BB
7	1.25				Total Length		1013	1013
8	1.00				BioEng.		544	663
9	5.00				No Action		70	0
Avg.	1.94	4.57	4.72		Slope/Seed		399	350
Note: Measured from normal water (pool) height to top of bank. Collected 0-6" soil depth.								

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Construction Erosion

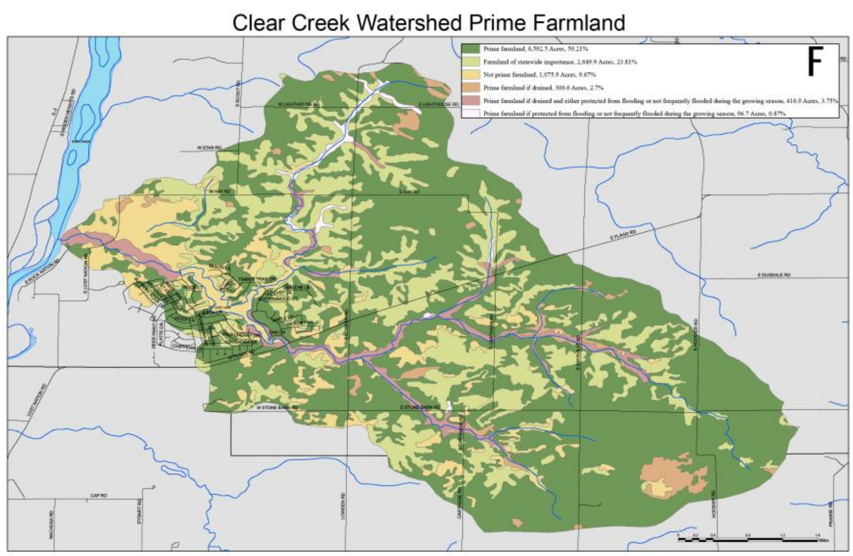
The amount of erosion from construction sites in the watershed is not known. Although construction activities may affect only a relatively small acreage of land in the watershed, they can be a major source of sediment and increased water runoff. Construction activities often leave the soil disturbed, bare, and exposed to the abrasive action of wind and water, which lead to erosion that is commonly 100 times greater than that on agricultural land. On site, compaction of soil caused by heavy equipment driving and parking on-site lowers the rate of water infiltration and reduced available water-holding capacity. This results in restricted plant growth, greater watering requirements, and a greater percentage of precipitation running off the site (Muckel, 2004).

Prime Farmland

More than 90% of the soils within the watershed are of great importance for farming purposes. 59.21% of the watershed (6,591.5 acres) is considered prime farmland (Map 8 and Table 5). An additional 7.32% (814.2 acres) is prime farmland if drained, protected from flooding or not frequently flooded, or both. Farmland of statewide importance covers another 23.81% of the watershed (2,649.9 acres). Only 9.67% of soils (1,075.9 acres) are not considered prime farmland (Kuhel, Pers. Comm.).

Table 5: Farmland Classification of soils in the Clear Creek Watershed		
Farmland Classification	**Acres**	**%**
All areas are prime farmland (Dk. Green)	6591.5	59.21
Farmland of statewide importance (Lt. Green)	2649.9	23.81
Not prime farmland (Lt. Peach)	1075.9	9.67
Prime farmland (if drained) (Dk. Peach)	300.6	2.70
Prime farmland (if drained & either protected from flooding or not frequently flooded during the growing season) (Pink)	416.9	3.75
Prime farmland (if protected from flooding or not frequently flooded during the growing season) (White)	96.7	0.87
Total	**11131.6**	**100.00**
(Source: Kuehl, Pers. Comm.)		

Map 8: Prime farmland in the Clear Creek Watershed.



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Climate

The climate of this region has four distinct seasons. It is an especially important factor to the crop producers in the area, as only one producer in the watershed uses irrigation. Climactic factors included in this analysis are precipitation, snow and ice cover, temperature, wind speed, and evaporation.

Precipitation and Snow and Ice Cover

Average precipitation in the Clear Creek Watershed and the rest of the Upper Rock River Assessment Area vary greatly from year to year and between decades. The highest average has occurred over the past 20 years. Trends over the past 60 years show significant increases, while the same data only amounts to slight increases when considering the past 100 years (IDNR, 2001). On average, the watershed and the rest of northern Illinois receives from 32 (ISWS, 2003) to 34 (FEMA, 2009 and Finch, 1973) inches of precipitation annually and is subject to droughts, major prolonged wet periods, and flash-floods that drop four to eight inches of rainfall in a few hours in localized areas. There are on average 110 days of measurable precipitation, including eight days with one inch or more of rainfall and 12 days with one inch or more of snowfall. Once per year on average, the area may experience a snowfall of six inches or more. The average annual snowfall is 36 inches (ISWS, 2003). May and June are typically the wettest months and January and February are the driest (ISWS, 2003). Of the annual average rainfall, 65% (22 inches) usually falls April through September (FEMA, 2009). Thunderstorms account for about 50-60% of the precipitation, half of which occur between June and August (ISWS, 2003). Typically, snow storms that release one inch or greater of snowfall per storm occur between November 20th and March 26th (Table 6) (ISWS, 2003).

Temperature

Average annual temperatures in the watershed are 48°F. Average winters see highs in the 30s and lows in the teens, with an average of 140 days at or below 32°F and 16 days at or below 0°F. Average summers have highs in the 80s and lows in the 60s with 10 days at or above 90°F and one day over 100°F occurring about every other year. Spring and fall have moderate temperatures, with spring highs around 57°F and lows of 36°F and fall highs of 60°F and lows of 40°F. The average length of the frost-free growing season is 160 days. The last occurrence of 32°F in the spring is on average April 28th and the first occurrence of this temperature in the fall is on average October 7th (Table 6) (ISWS, 2003).

Table 6: Average monthly temperatures and precipitation for Dixon, Illinois (ISWS Station 112348) for 2008 (2009 incomplete).

Year	Month	Precip (inches)	Rain Days	High Temp (°F)	Low Temp (°F)	Mean Temp (°F)	Snow (in.)	Daily Max Precip (in.)	Snow Days
2008	Jan.	2.2	10	30.3	9.6	20	13.9	0.42	6
2008	Feb.	4.08	13	26.7	8.2	17.5	25.3	0.98	10
2008	Mar.	1.61	5	41.5	23.3	32.4	4	0.6	1
2008	Apr.	4.97	11	60.2	38.4	49.3	0	1.08	0
2008	May	4.93	8	68.3	44.8	56.6	0	1.96	0
2008	Jun.	4.88	8	80.2	59.2	69.7	0	1.48	0
2008	Jul.	4.58	7	82.4	61.5	72	0	1.09	0
2008	Aug.	2.26	6	80.4	58.7	69.6	0	1.1	0
2008	Sep.	8.57	6	74.9	53.5	64.2	0	3.06	0
2008	Oct.	2.2	6	61	40	50.5	0	0.83	0
2008	Nov.	1.14	5	50.2	32	41.1	0	0.35	0
2008	Dec.	6.24	13	30.4	8.1	19.3	19.3	1.52	8

Source: ISWS, April 11, 2010. http://www.isws.illinois.edu/data/climatedb/ for Dixon, IL.

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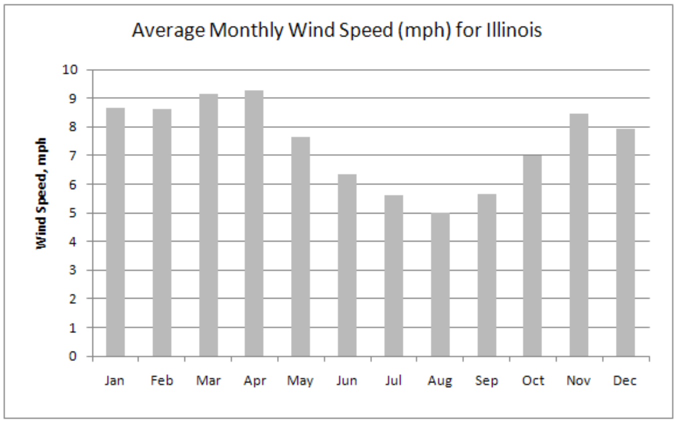
Wind Speed

Winds usually reach monthly averages of 5 mph to just over 9 mph in the state of Illinois (Figure 1). No information specific to the watershed was found. Information provided is based on data from 1991 to 2000 and measured at the standard height of 33 feet (10 meters) (ISWS, 2010).

Figure 1: Average Monthly Wind Speed (mph) for Illinois.

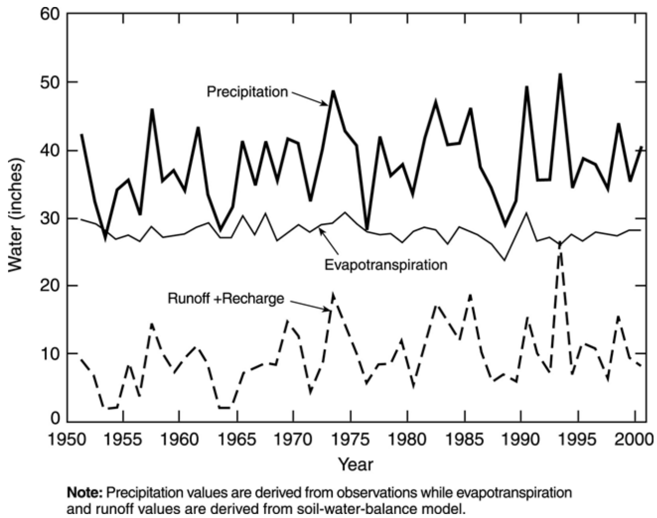


Source: ISWS, 2010.

Evaporation

Evaporation data specific to the watershed was not found. Evapotranspiration for the entire state averaged around 30 inches per year, as summarized and related to precipitation and runoff plus recharge (Figure 2) (ISWS, 2010).

Figure 2: Time series of annual fluctuations of the difference between precipitation and evaporation, averaged for the entire state, 1951-2000.



Source: Illinois State Water Survey, 2010.

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Habitat

The watershed provides aquatic and terrestrial habitat primarily in the form of streams, a lake and ponds, prairies, wetlands, forest, and rural grasslands. This complex system can be discussed as natural areas, wetlands, potential wetland restoration sites, and threatened and endangered plant species. Aquatic habitats are further described in the "Fish and Wildlife" section of this Inventory.

Natural Areas

Natural areas exist within and surrounding the watershed (Maps 9 and 10), and the watershed is identified as important habitat by the Illinois Wildlife Action Plan (IDNR, 2005) and Forest Legacy Program (Gillespie, Pers. Comm.). Within the watershed, Nachusa Grasslands is the only permanently protected site, although one unprotected site has been identified. Just outside of the watershed, over 5,500 acres of state protected lands provide critical habitat to wildlife species. Nachusa Grasslands contains 1,490 within the watershed. It is considered "high priority grassland" by the Illinois Wildlife Action Plan, providing wet prairie, dry sandy prairie, open sandstone cliffs, savanna, and aquatic habitats to fish and wildlife. One additional site in the watershed has been identified by Jay Friberg (1990) as part of a study of the flora of Ogle County. This is the Bottomland Forest wetland located closest to the Rock River in Sections 5 and 6 of Taylor Township (R10E, T43N) on both sides of Lost Nation Road between Clear Creek and Hay Road. This area may still include some of the habitat types and plant communities found by Friberg, including streams and shallow ponds, muddy margins of streams and ponds, elevated sandy terrace of Rock River with degraded prairie, wet sphagnous sandy meadows, dry sandy prairies, shaded sandstone cliffs, sandy open woods, alluvial forest, mesic upland forest, dry upland forest, and margins of woodlands. In addition to habitat within the watershed, habitat within the immediate surrounding area needs to be considered for migratory or otherwise highly mobile species that utilize the watershed. The Illinois Wildlife Action Plan recognizes the Rock River Conservation Opportunity Area and the Nachusa-Franklin Creek-Castle Rock-Lowden Miller Conservation Opportunity Area as areas of high value to wildlife that overlap the Clear Creek Watershed. Large state parks and forests that are connected to the watershed are the other 1,310 acres of Nachusa Grasslands (2,800 acres total), Lowden-Miller State Park (2,291 acres), Castle Rock State Park (2,000 ac.), and Franklin Creek State Park (664 ac.). Lowden Memorial State Park (273 acres), Kyte River Land and Water Reserve (235 ac.), and a Forest Legacy Conservation Easement on adjacent private land (80 ac.) are just upstream on the Rock River (Natural Land Institute, 2008) near the point where the former Biologically Significant Stream segment of the Rock River begins. All of these natural areas, other than Franklin Creek State Park and a portion of Nachusa Grasslands, are located within watersheds that drain to the former Biologically Significant Stream segment of the Rock River. Castle Rock and Lowden Miller State Parks form the largest forest in the region and host a highly diverse nesting community of Neotropical migrants (IDNR, 2005).

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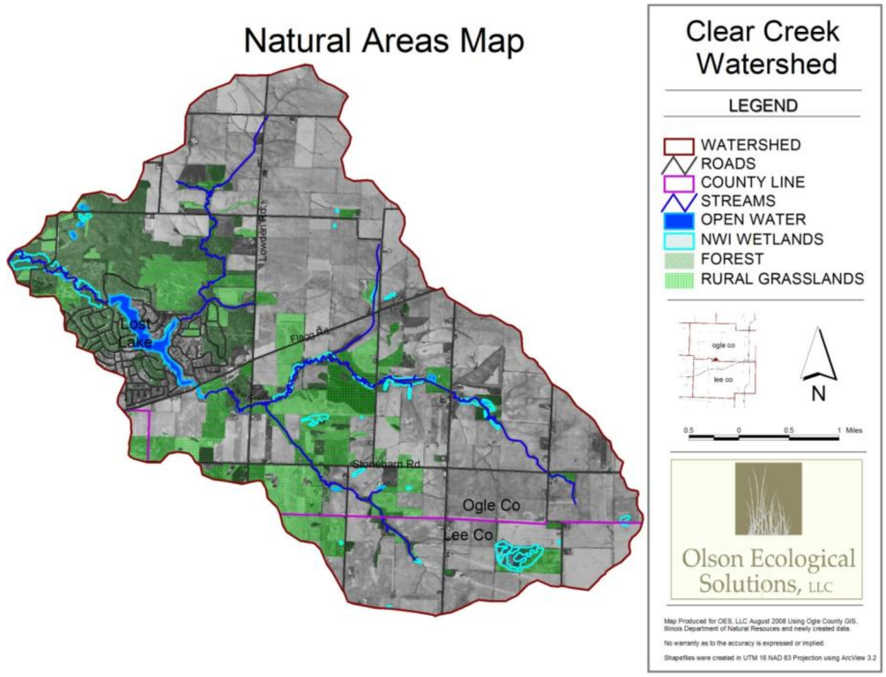
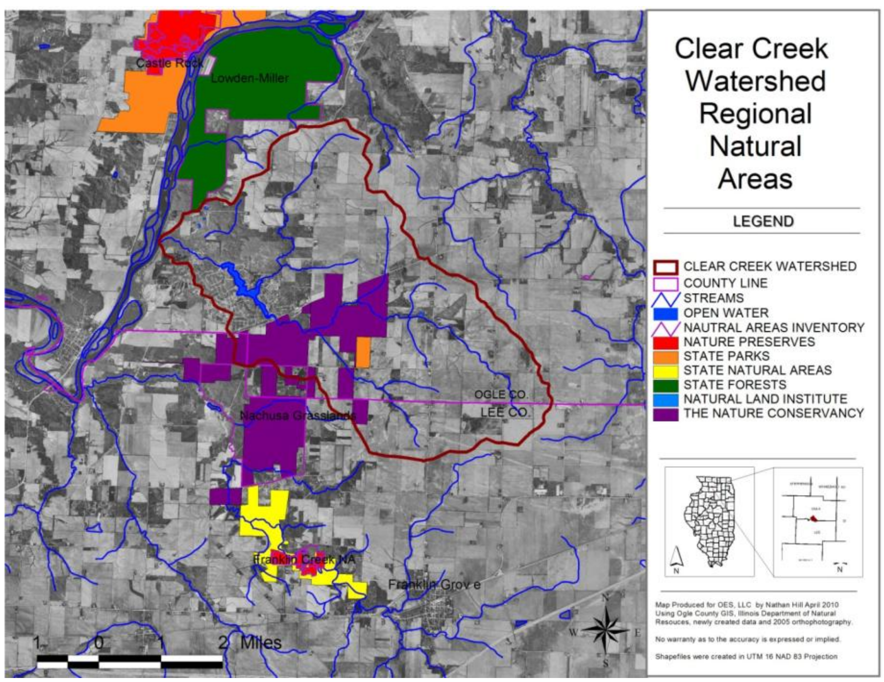
Map 9: Natural areas within Clear Creek Watershed.



Map 10: Protected natural areas connected to the Clear Creek Watershed.



Wetlands

Wetlands within the watershed are known from the National Wetland Inventory (NWI) (Map 9). A wetland inventory has not yet been conducted, but a plant list is associated with the three small, isolated

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wetlands identified in the northwest corner of the watershed and surrounding uplands (Table 7). Most of the wetlands identified by the NWI have both native and non-native vegetation present (Photo Set 6) (Kleiman, Pers. Comm.).

Photo Set 6: Photographs of sample wetlands within the Clear Creek Watershed.

Wetland #1:

Wetland #2: Beaver Pond

Wetland #2: Beaver Pond

Source: Kleiman, Pers. Comm.

Table 7: Plants found at three wetlands near Hay Road by Bill and Susan Kleiman and Jeff Meiners on June 16, 1997.

Scientific Name	Common Name
Sanquinaria canadensis	bloodroot
Amorpha canescens	lead plant
Lithospermum canescens	hoary puccoon
Tradescantia ohiensis	spiderwort
Koeleria macrantha	June grass
Potentilla simplex	cinquefoil
Panicum spp. 1	panic grass
Panicum spp. 2	panic grass
Luppinus perennis	lupine
Carex muhlenbergii	sand bracted sedge
Senecio pauperculus	balsam ragwort
Verbena stricta	hoary vervain
Rudbeckia hirta	black eyed susan
Specularia perfoliata	Venus's looking glass
Rosa carolina	pasture rose
Rosa multiflora	multiflora rose
Asclepias verticillata	whirled milkweed
Asclepias amplexicaulis	sand milkweed (blunt leaved)
Lespedeza capitata	round headed bush clover
Solidago sp.	goldenrod
Rubus flagellaris	dewberry
Rubus occidentalis	black rasberry
Hieracium longipilum	long-bearded hawkweed
Hypericum perforatum	common St. John's wort from Europe
Apocynum cannabinum	dogbane (Indian hemp)
Rumex acetosella	field sorrel (sheep sorrel)
Cacalia atriplicifolia	pale Indian plantain
Tragopogon pratensis	yellow goat's beard
Antennaria plantagifolia	pussytoes
Achillea millifolium	yarrow
Equisetum sp.	scouring rush
Oxalis stricta	wood sorrel

Source: Kleiman, Pers. Comm.

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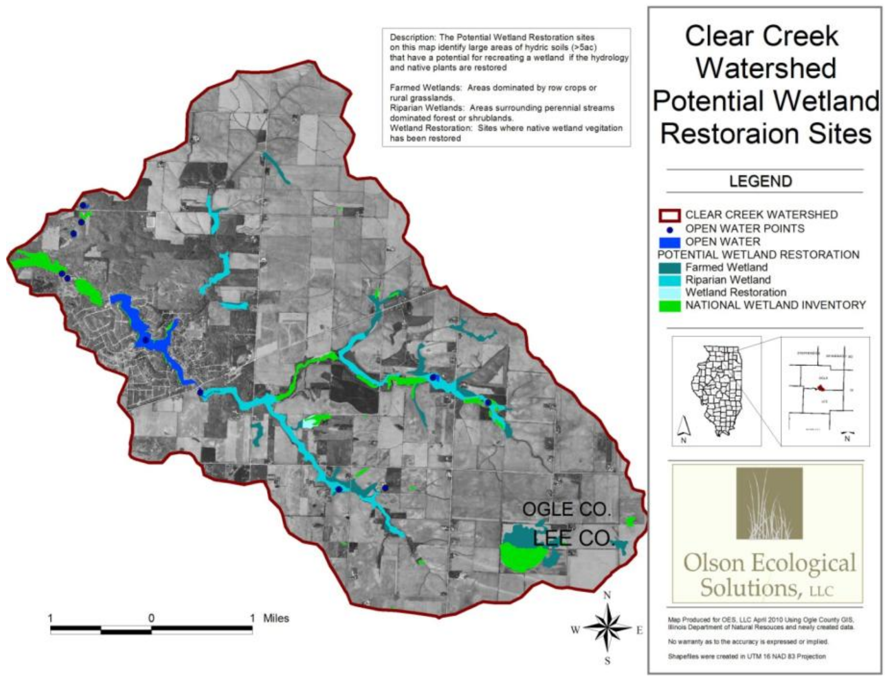
Potential Wetland Restoration Sites

Wetlands, aquatic habitat, and riparian buffers that provide food and nesting for fish and other aquatic species have been lost by the filling and tiling of headwaters for grass waterways and channelization (Schafer, Pers. Comm.). Knowledge of the NWI wetlands was combined with hydric soils data to predict potential wetland restoration opportunities within the watershed (Map 11). Sites were considered to have good restoration potential if they were hydric, more than five acres in size, adjacent to existing wetlands, or formed corridors between existing wetlands. Much of these sites are found along the creek corridors, although isolated wetland restoration opportunities do exist.

Map 11: Potential Wetland Restoration opportunities in the Clear Creek Watershed.



Threatened and Endangered Plants

The following protected plants are found in the watershed and listed on the Illinois Natural Resource Database, although exact locations are not available: Prairie Bush Clover (*lespedeza leptostachya),* Queen-of-the-Prairie *(Filipendula rubra)*, and Kittentails *(Besseya bullii)* (Kieninger, Pers. Comm.). An EcoCAT report also indicated the following protected plants may be in the vicinity of the watershed: Downy Yellow Painted Cup *(Castilleja sessiliflora)*, Hairy Woodrush *(Luzula acuminata)*, Rusty Woodsia *(Woodsia ilvensis)*, and Prairie Dandelion *(Nothocalais cuspidata)* (IDNR, 2008*b*).

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Fish and Wildlife

Species in Greatest Need of Conservation

There are many Species in Greatest Need of Conservation listed in the Illinois Comprehensive Wildlife Action Plan (IDNR, 2005) that have been found within the watershed, as documented by the Illinois Department of Natural Resources and The Nature Conservancy (Tables 8 and 9). Specific locations of these species are not known, but the species most likely utilize the mapped natural areas (IDNR, 2005). Karen Rivera of the Illinois Department of Natural Resources has surveyed fish species in Clear Creek at Nachusa Grasslands (2006). Half of the species present are recognized as target species for The Grand Prairie, an area close in proximity and similar to Clear Creek. (Species information for the Rock River Hill Country in which the watershed is found is under developed.) Southern Redbelly Dace *(Phoxinus erythrogaster)* and Blacknose Dace *(Rhinichthys atratulus)* are present, both of which require clean, cold water temperatures. Brook Stickleback *(Culaea inconstans)* is also present, a species that requires cold water and abundant aquatic vegetation. The Johnny Darter (Etheostoma nigrum) and the Fantail Darter (Etheostoma flabellare), present in the stream, are generally intolerant of poor water quality conditions and most often are found in streams with good flow and clean sediments, although both named species are more tolerant than most darters to silt. Non-game indicator species present include creek chub, spotfin shiner, bluntnose minnow, and sand shiner (Rivera, 2006 and IDNR, 2005). Emphasis game species present are green sunfish and bluegill. Sediment threatens the habitat of these and other species, because it covers the stream bottom, making the living conditions difficult for small aquatic insects which require clean, rocky substrates. As the insects decline, so do the small fishes which rely on them for food (Rivera, 2006).

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Table 8: Bird Species in Greatest Need of Conservation that have been sighted in the Clear Creek Watershed.										
		Criteria								
Species Name	Habitat Association	1	2	3	4	5	6	7	8	Source
Pluvialis dominica (American golden-plover)[1]	Agricultural, mudflat, grassland	0	0	1	1	0	1	0	1	TNC, 2010
Scolopax minor (American woodcock)	Successional fields, ecotones	0	0	1	1	0	0	0	0	TNC, 2010
Haliaeetus leucocephalus (bald eagle)	Forested streams, lakes	FT ST	0	0	0	0	1	0	0	TNC, 2010
Vireo belli (Bell's vireo)	Successional fields, grassland	0	0	1	1	0	0	0	0	TNC, 2010
Chlidonias niger (black tern)	Marsh	SE	0	1	1	0	0	1	0	TNC, 2010
Coccyzus erythropthalmus (black-billed cuckoo)	forest	0	0	0	0	0	0	0	0	TNC, 2010
Nycticorax nycticorax (black-crowned night-heron)	Swamp	SE	0	1	1	0	0	0	0	TNC, 2010
Vermiforma pinus (blue-winged warbler)	successional, forest	0	0	0	0	0	0	0	0	TNC, 2010
Dolichonyx oryzivorus (bobolink)	Grassland	0	0	1	1	0	0	0	0	TNC, 2010
Buteo platypterus (broad-winged hawk)	Forest	0	0	1	1	0	0	1	0	TNC, 2010
Certhia americana (brown creeper)	Bottomland forest, forest	0	0	RR	0	0	0	0	0	TNC, 2010
Toxostoma rufum (brown thrasher)	successional	0	0	0	0	0	1	0	0	TNC, 2010
Aythya valisineria (canvasback)	Rivers, lakes	0	0	1	1	0	1	0	0	TNC, 2010
Dendroica cerulea (cerulean warbler)	bottomland forest	ST	0	1	1	0	0	1	0	TNC, 2010
Chaetura pelagica (chimney swift)	swamp, urban	0	0	1	0	0	1	0	0	TNC, 2010
Chordeiles minor (common nighthawk)	urban, barren, grassland	0	0	1	0	0	0	0	0	TNC, 2010
Spiza americana (dickcissel)	Grassland	0	0	1	1	0	1	0	0	TNC, 2010
Spizella pusilla (field sparrow)	successional	0	0	1	0	0	1	0	0	TNC, 2010
Stema forsteri (Forster's tern)	Marsh	SE	0	1	1	0	0	0	0	TNC, 2010
Ammodramus savannarum (grasshopper sparrow)	Grassland	0	0	1	1	0	0	0	0	TNC, 2010
Ardea alba (great egret)	Forested streams, lakes	0	0	RR	1	0	0	0	0	TNC, 2010
Tringa melanoleuca (greater yellowlegs)[1]	Vernal pool,mudflat, marsh	0	0	1	1	0	0	1	0	TNC, 2010
Ammodramus henslowii (Henslow's sparrow)	Grassland	ST	0	1	1	0	0	0	0	TNC, 2010
Ammodramus leconteii (LeConte's sparrow)[1]	Grassland, marsh	0	0	1	1	0	0	0	0	TNC, 2010
Ixobrychus exilis (least bittern)	Marsh	ST	0	1	1	0	0	0	0	TNC, 2010
Aythya affinis (lesser scaup)	Rivers, lakes	0	0	1	1	0	1	0	0	TNC, 2010
Lanius ludovicianus (loggerhead shrike)	Grassland	ST	0	1	1	0	0	0	0	TNC, 2010
Cistothorus palustris (marsh wren)	Marsh	0	0	1	1	0	0	0	0	TNC, 2010
Colinus virginianus (northern bobwhite)	Successional field, grassland	0	0	1	0	0	1	1	0	TNC, 2010
Colaptes auratus (northern flicker)	savanna, grassland	0	0	1	0	0	1	0	0	TNC, 2010
Circus cyaneus (northern harrier)	Grassland, marsh	SE	0	1	1	0	0	1	0	TNC, 2010
Pandion haliaetus (osprey)	Forested streams, lakes	SE	0	1	1	0	0	0	0	TNC, 2010
Seiurus aurocapillus (ovenbird)	Forest	0	0	1	0	0	0	0	0	TNC, 2010
Falco peregrinus (peregrine falcon)	Urban, cliffs	FE ST	0	1	1	0	0	0	0	TNC, 2010
Podilymbus podiceps (peid-billed grebe)	Marsh, lakes	0	0	RR	1	0	0	0	0	TNC, 2010
Protonotaria citrea (prothonotary warbler)	bottomland forest	0	0	0	1	0	0	0	0	TNC, 2010
Buteo lineatus (red-shouldered hawk)	Bottomland forest, forest	0	0	RR	0	0	0	1	0	TNC, 2010
Grus canadensis (sandhill crane)	Marsh	ST	0	1	1	0	0	1	0	TNC, 2010
Passerculus sandwichensis (savannah sparrow)	Grassland, agricultural	0	0	1	0	0	0	1	0	TNC, 2010
Cistothorus platensis (sedge wren)	Grassland, marsh	0	0	0	1	0	0	0	0	TNC, 2010
Limnodromus griseus (short-billed dowitcher)[1]	Marsh, vernal pool, mudflat	0	0	1	1	0	0	0	1	TNC, 2010
Asio flammeus (short-eared owl)	Grassland	SE	0	1	1		0	0	0	TNC, 2010
Bartramia longicauda (upland sandpiper)	Grassland	SE	0	1	1	0	0	1	0	TNC, 2010
Caprimulgus vociferus (whip-poor-will)	Forest, successional	0	0	1	0	0	0	1	0	TNC, 2010
Empidonax trailli (willow flycatcher)	marsh, successional	0	0	0	1	0	0	0	0	TNC, 2010
Hylocichla mustelina (wood thrush)	forest	0	0	0	0	0	0	1	0	TNC, 2010
Coccyzus americanus (yellow-billed cuckoo)	Forest, savanna	0	0	1	1	0	0	0	0	TNC, 2010
Icteria virens (yellow-breasted chat)	Successional fields, edges	0	0	1	0	0	0	0	0	TNC, 2010
Botaurus lentiginosus (American bittern)	Marsh	SE	0	1	1	0	0	1	0	DNR, 2002*b*
Egretta thula (snowy egret)	Forested streams, lakes	SE	0	1	1	0	0	0	0	DNR, 2002*b*
Egretta caerulea (little bleu heron)	Forested streams, lakes	SE	0	1	1	0	0	0	0	DNR, 2002*b*
Nyctanassa violacea (yellow-crowned night-heron)	Swamp	SE	0	1	1	0	0	0	0	DNR, 2002*b*
Anas rubripes (American black duck)	Forested streams, lakes	0	0	1	1	0	0	0	0	DNR, 2002*b*
Lophodytes cucullatus (hooded merganser)	Forested streams, lakes	0	0	1	0	0	0	0	1	DNR, 2002*b*
Buteo swainsoni (Swainson's hawk)	Savanna, grassland, agriculture	SE	0	1	1	1	0	1	0	DNR, 2002*b*
Cotumicops noveboracensis (yellow rail)[1]	Marsh	0	0	1	1	0	0	0	0	DNR, 2002*b*
Laterallus jamaicensis (black rail)	Marsh	SE	0	1	1	1	0	0	1	DNR, 2002*b*
Rallus elegans (king rail)	Marsh, grassland	SE	0	1	1	0	0	0	0	DNR, 2002*b*
Gallinula chloropus (common moorhen)	Marsh	ST	0	1	1	0	0	0	0	DNR, 2002*b*
Calidris himantopus (stilt sandpiper)	Vernal pool, mudflat, marsh	0	0	1	1	0	0	0	0	DNR, 2002*b*
Tryngites subruficollis (buff-breasted sandpiper)[1]	Vernal pool, mudflat, marsh	0	0	1	1	0	1	0	1	DNR, 2002*b*
Phalaropus tricolor (Wilson's phalarope)	Marsh, vernal pool	SE	0	1	1	0	0	0	0	DNR, 2002*b*
Sterna hirundo (common tern)	Beach	SE	0	1	1	0	0	0	0	DNR, 2002*b*
Tyto alba (barn-owl)	Savanna, grassland, agriculture	SE	0	1	1	0	0	0	0	DNR, 2002*b*
Empidonax virescens (Acadian flycatcher)	forest	0	0	1	0	0	0	0	0	DNR, 2002*b*
Thryomanes bewickii (Bewick's wren)	Successional areas, forest	SE	0	1	1	1	0	0	0	DNR, 2002*b*
Helmitheros vermiforma (worm-eating warbler)	forest	0	0	0	0	0	0	1	0	DNR, 2002*b*
Oporornis formosus (Kentucky warbler)	forest	0	0	1	1	0	0	1	0	DNR, 2002*b*
Oporornis agilis (Connecticut Warbler)[1]	Forest	0	0	1	0	0	0	0	1	DNR, 2002*b*
Euphagus carolinus (rusty blackbird)[1]	Swamp, bottomland forest	0	0	1	1	0	0	0	1	DNR, 2002*b*
Aquila chrysaetos (golden eagle)	Rocky cliffs, tall trees									Walters, 2010

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Table 9: Other wildlife Species in Greatest Need of Conservation that have been sighted in the Clear Creek Watershed.

Species Name	Habitat Association	Criteria 1	2	3	4	5	6	7	8	Source
Mammals										
Lontra canadensis (river otter)	Streams, impoundments	0	0	RR	0	0	0	0	0	DNR, 2002*b*
Lynx rufus (bobcat)	Forest, ecotones	0	0	RR	0	0	0	1	0	TNC, 2010
Microtus pinetorum (woodland vole)	deciduous forest, successional forest	0	0	1	0	0	0	0	1	DNR, 2002*b*
Mustela nivalis (least weasel)	Grassland, successional, ecotones	0	0	0	0	0	0	1	0	TNC, 2010
Ondatra zibethicus (muskrat)	Marshes, streams, ponds	0	0	0	1	0	0	1	0	TNC, 2010
Spermophilus franklinii (Franklin's ground squirrel)	grassland, early successional areas	ST	0	0	1	0	0	1	0	TNC, 2010
Taxidea taxus (american badger)	Grassland, agricultural	0	0	0	0	0	0	1	0	TNC, 2010
Urocyon cinereoargenteus (gray fox)	Forest, successional areas	0	0	0	0	0	0	1	0	DNR, 2002*b*
Reptiles										
Emydoidea blandingii (Blanding's turtle)	marsh	ST	0	1	1	0	0		0	TNC, 2010
Heterodon nasicus (western hognose snake, Plains h	sand prairie, sand savanna	ST	0	1	1	1	0		0	TNC, 2010
Liochlorophis vernalis (smooth green snake)	grassland, savanna, marsh, successional	0	0	1	0	0	0		1	DNR, 2002*b*
Ophisaurus attenuatus (slender glass lizard)	grassland, savanna	0	0	1	1	0	0		1	DNR, 2002*b*
Terrapene ornata (ornate box turtle)	grassland	0	0	1	1	0	0		1	TNC, 2010
Amphibians										
Hemidactylium scutatum (four-toed salamander)	pools, streams, forest	ST	0	1	1	0	0		0	DNR, 2002*b*
Necturus maculosus (mudpuppy)	gravel-bottom streams, lakes	0	0	1	1	0	0		1	DNR, 2002*b*
Rana palustris (pickerel frog)	cool, rocky headwaters, cave entrances	0	0	1	1	0			1	TNC, 2010
Fish										
Campostomoa oligolepis (largescale stoneroller)	streams, rivers over gravel, rock	0	0	1					1	DNR, 2002*b*
Carpoides velifer (highfin carpsucker)	pools, backwaters of streams, rivers	0	0	1					1	DNR, 2002*b*
Cottus bairdi (mottled sculpin)	Lake Michigan	0	0	1						DNR, 2002*b*
Culaea inconstans (brook stickleback)	vegetation in cool streams	0	0	1	1	0	0	0	0	Rivera, 2006
Erimystax x-punctatus (gravel chub)	rivers w/ gravel substrate	ST	0	1	1	0	0	1	1	DNR, 2002*b*
Ichthyomyzon fossor (northern brook lamprey)	streams and rivers	SE	0	1	0	0	0	0	1	TNC, 2010
Micropterus dolomieu (smallmouth bass)	cool streams, rivers over gravel, rock	0	0	0	0	0	0	1	0	DNR, 2002*b*
Moxostoma carinatum (river redhorse)	high-gradient rivers over rocky	ST	0	1	1	1	0	1	1	DNR, 2002*b*
Moxostoma duquesnei (black redhorse)	streams over sand, rock	0	0	1						DNR, 2002*b*
Notropis nubilus (Ozark minnow)	pools, streams, over gravel	0	0	1						DNR, 2002*b*
Notropis rubellus (rosyface shiner)	rocky runs of small-med. rivers	0	0	1						TNC, 2010
Notropis texanus (weed shiner)	vegetated streams over sand	SE	0	1	1	0	0	1	0	DNR, 2002*b*
Noturus exilis (slender madtom)	high-gradient streams, rivers over gravel, rock	0	0	1	1	0	0	1	0	DNR, 2002*b*
Perca flavescens (yellow perch)	Lake Michigan	0	0	1						DNR, 2002*b*
Phoxinus erythrogaster (southern redbelly dace)	cool streams over sand, gravel	0	0	0	1	0	0	1	0	Rivera, 2006
Rhyinichthys atratulus (blacknose dace)	cool streams over sand, gravel	0	0	0	1	0	0	1	0	Rivera, 2006
Stizostedion canadense (sauger)	large rivers	0	0	0	0	0	0	1	0	DNR, 2002*b*
Stizostedion vitreum (walleye)	streams, rivers, lakes	0	0					1		DNR, 2002*b*
Mollusks										
Alasmidonta viridis (slippershell mussel)	Streams	ST		1						DNR, 2002*b*
Cyclonaias tuberculata (purple wartyback)	Streams, large rivers	ST		1						DNR, 2002*b*
Elliptio dilatata (spike)	Streams	ST		1						DNR, 2002*b*
Epioblasma triquetra (snuffbox mussel)	Streams	SE	G3	1						DNR, 2002*b*
Fusconaia ebena (ebonyshell)	Large rivers	ST		1						DNR, 2002*b*
Lasmigona costata (fluted shell)	Streams			1						DNR, 2002*b*
Ligumia recta (black sandshell)	Streams, large rivers	ST		1						DNR, 2002*b*
Plethobasus cyphus (sheepnose mussel)	Streams, large rivers	FC SE	G3	1						DNR, 2002*b*
Quadrula metanerva (monkeyface)	Streams, large rivers			1						DNR, 2002*b*
Venustaconcha ellipsiformis (ellipse)	Streams		G3	1						DNR, 2002*b*
Crustaceans										
None										
Insects										
Speyeria idalia (regal fritillary)	xeric/mesic prairie	FC ST	G3	1						Kieninger, Pers. Comm.
Other invertebrates										
None										

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Game fish species in Lost Lake

Historically, a survey in 1967 reveals the fish population within Lost Lake to be in balance even though there is a continuous influx of creek species (IDOC, 1968). Most of the sport fish are stocked in the lake, including walleye, muskie, and bass. Ken Clodfelter, Illinois Department of Natural Resources Fisheries Biologist, has recently surveyed the lake (October 2009) and states that the sport fish population sample collected is excellent. He recommends developing "weed beds," providing cover for small fish, stocking smallmouth bass, and attempting to control the carp populations because carp remove aquatic vegetation and cause water to be muddy (Clodfelter, 2010). The River Conservancy District and homeowners have recently added spawning opportunities for smallmouth bass during lake shore stabilization projects using rip rap in 2009. Efforts are scheduled to continue in 2010. The River Conservancy District has controlled carp in the past and continues to implement carp control projects through bow fishing and possibly commercial fishing (Rush, Pers. Comm.).

Land Use and Population Characteristics

Land Use and Land Cover

Land uses and land cover have changed dramatically in the watershed throughout history, but no major land use changes are planned for the future. Historically, forest (green) and prairie (gold) dominated the landscape in the 1840s (Map 12). More recently, agriculture is the dominant land use, with residential development accounting for only 2.3% of the watershed (Hill, Pers. Comm.). The most recent, readily available land cover data is from 1999. Much has changed since then, so information using 2005 orthophotography, local knowledge, and shapefiles of more recent grid files (2000-2007) from the Illinois geospatial data clearing house are referenced (Map 13). The most dramatic land use changes between the 1840s and 2007 are the decline of about 7,200 acres of natural lands (65% of the watershed) and the rise of 6,235 acres (56%) of cropland with little to no habitat benefit. However, 85% of the original forested acreage and all of the bottomland remains (Table 10), and much of Nachusa Grasslands is being restored to prairie and other plant communities by The Nature Conservancy. Land uses and land cover continue to change. Land actively used for agricultural purposes has declined between 2000 and 2007 by 1,000 acres (9%): from 64% in 2000 to 59% in 2006 to 56% in 2007 (Hill, Pers. Comm.). The Ogle County Comprehensive Plan does not project any land use changes for the area (Ogle County Planning and Zoning Department, 2004). Lee County has a draft land use plan, which does not identify any future economic development areas or wind mill farm opportunities within the watershed (Vandewalle & Assoc., 2009).

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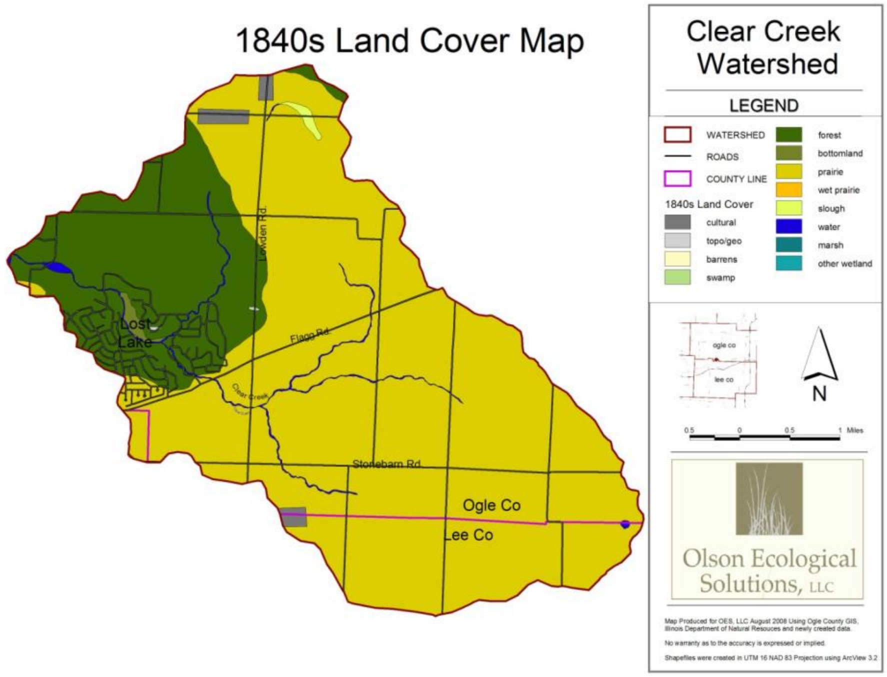
Map 12: Historical land cover of the Clear Creek Watershed.



Map 13: Current land cover in the Clear Creek Watershed.

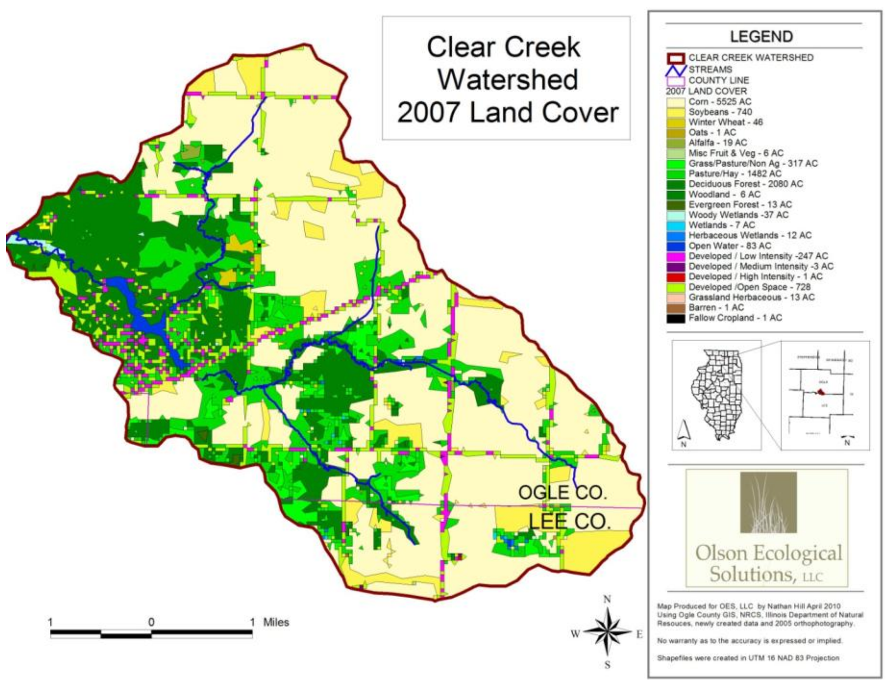


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Table 10: Land use cover changes from the 1840s to 2007 (in acres).					
Year	**Forest**	**Rural Grassland**	**Open Water**	**Bottomland**	**Cropland**
2007	2099	1812	83	37	6337
1840s	2471	8623	105	36	102
Difference	-372	-6811	-22	1	6235
Source: Nathan Hill used information from the Illinois Geospatial Data Clearinghouse (2005-2007 gridfiles), 2005 orthophotography, and local knowledge. April 2010.					
Notes:					
Forest measured is >80% canopy cover.					
Rural grassland with little or no trees and prairie are grouped under "Rural Grassland."					
Small acreages and roadside ditches are not included.					

Land Management Practices

Nonpoint Source Projects

There are no nonpoint source projects under Clear Water Act section 319 currently in the watershed. A grant application for implementing and demonstrating bank stabilization techniques on shoreline of Babbling Brook and Lost Lake has been submitted by the Lost Nation/New Landing River Conservancy District in August 2008 and is in the final stages of acceptance. The RCD is drafting another grant application to provide a silt containment area at the point where Babbling Brook flows into Lost Lake and will submit it in August 2010.

Local Ordinances

Local ordinances and comprehensive plans that apply to the watershed address stormwater management, flood control, and sediment and erosion control during construction in the watershed in order to lessen associated problems. These requirements originate from Ogle and Lee counties and the Lost Nation New Landing River Conservancy District of Illinois.

The Ogle County Comprehensive Stormwater Management Ordinance and Lee County Code Title 11 Chapter 3 primarily regulate activities which have the potential to increase stormwater runoff, damage and impair downstream channels, and pollute streams and lakes. The Ogle County Special Hazard Areas Ordinance, Lee County Code Title 11 Chapter 4, and stormwater ordinances control development in 100-year floodplains or areas known to flood "as identified by the community." Both county stormwater ordinances also contain the purpose of preserving the natural characteristics and functions of watercourses and floodplains. These ordinances include permit requirements and construction standards for floodplains, but include substantial sections for variances (Special Hazard Areas Ordinance, 2003 and Lee County Code, 2010). Comprehensive plans for both counties address similar issues and strive to maintain and protect riparian areas and wetlands for their water retention and infiltration capabilities (Ogle County, 2008, Lee County 2010). To control sediments and erosion during construction, Ogle County refers to the "Procedures and Standards for Urban Soil Erosion and Sedimentation Control in Illinois" by The Urban Committee of the Association of Illinois Soil and Water Conservation Districts. Lee County requires new developments follow the "County Development Manual" (Lee County Code, 2010).

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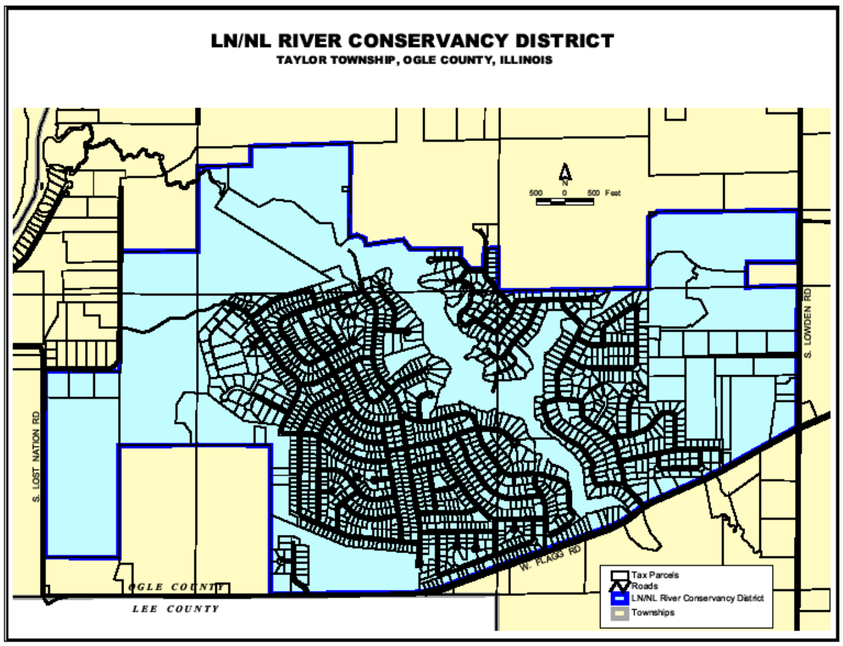
The River Conservancy District has the power to effectuate river and flood control, drainage, irrigation, conservation, sanitation, navigation, recreation, development of water supplies and the protection of fish life over their area of jurisdiction, which extends slightly beyond the Lost Nation New Landing subdivision (Map 14). The River Conservancy District formed the Lake Management Committee in 2006 to preserve and protect the Clear Creek watershed by promoting understanding and through comprehensive management plans for the land and watershed ecosystems. They adopted standard operating procedures for shoreline re-vegetation prepared by Kaskaskia Engineering Group (2008), initiated a rebate program for homeowners to stabilize their shorelines, and they initiated a zero phosphorus lawn fertilizer program in May 2009, which is an educational tool for homeowners (Breckenfelder, Pers. Comm.).

Map 14: Lost Nation New Landing River Conservancy District jurisdiction.



Source: Lost Nation New Landing River Conservancy District, April 15, 2010.

Land and Water Conservation Measures

The Nature Conservancy, Natural Resources Conservation Service, Soil and Water Conservation District, and Lost Nation New Landing River Conservancy District practice land and water conservation measures in cooperation with private landowners.

The Nature Conservancy uses conservation easements and fee simple purchase of land to address their mission to protect and restore natural lands. Much of Nachusa Grasslands has already been restored to a natural state, but some continues to be farmed temporarily until resources are available to restore the land. They have conservation easements on 400 acres of private land in the watershed. They also have partnered with Northern Illinois University conduct experimental livestock grazing within Nachusa Grasslands, which will replace conventional grazing practices that do not restrict stream access from livestock. This new program will rest the stream bank from grazing pressure, especially during the first five years, after which time low intensity grazing may be reintroduced, while livestock will mainly be restricted to fenced, experimental areas (Kleiman, Pers. Comm.).

The Natural Resources Conservation Service delivers technical assistance, mostly focused on the development of individual farm or ranch conservation plans. They also conduct planning is at a level larger than the individual farm or ranch in order to address many natural resource issues. The Natural Resources Conservation Service and Soil and Water Conservation District have about 380 acres in the watershed enrolled in various conservation practices (Table 11).

Table 11: NRCS/SWCD conservation practices in the Clear Creek Watershed.

Practice	Code	Acres
Already Estab. Grasses	CP10	213
Already Estab. Trees	CP11	14.3
Wildlife Food Plot	CP12	0.3
Native Grasses	CP2	6.8
Filter Strips (Native/Cool)	CP21	16.7
Riparian Forest Buffer	CP22	2.8
Hardwood Tree Planting	CP3a	9.5
Wildlife Habitat	CP4d	108.22
Grassed Waterway	CP8a	7.6
TOTAL		**379.22**

Source: Meisenheimer, Pers. Comm.

The River Conservancy District has been active over the years in improving and maintaining the ecological integrity of the lake community. In addition to volunteer monitoring efforts, they have successfully controlled goose populations and constructed a silt basin on Clear Creek in the 1980s that has trapped a significant amount of sediment by settling the sediments prior to their entry into the lake. The basin is approximately 1.1 acre in size with a maximum depth of about 4 feet, which is relatively small for the incoming water volume. It and is mechanically dredged every other year or as needed (Rush, Pers. Comm.). Due to the success of the existing basin for Clear Creek, the River Conservancy District is planning to construct a similar basin for Babbling Brook.

Master Plans

The watershed is in an area that receives well-deserved attention from local, state, and federal organizations and agencies that focus on natural resources preservation. It is recognized by the Illinois Department of Natural Resources' Comprehensive Wildlife Conservation Plan and Strategy, USDA Forest Service's Forest Legacy Program, Ogle County Regional Greenways Plan, and Clear Creek Watershed Planning Committee formed in conjunction with an Environmental Protection Agency's Section 319 grant. The watershed is not of economic interest to either Ogle or Lee County.

Illinois Comprehensive Wildlife Conservation Plan and Strategy

Two Conservation Opportunity Areas partially cover the watershed. The Rock River Conservation Opportunity Area includes land surrounding the Rock River (Map 15). The Nachusa-Franklin Creek-Castle Rock-Lowden Miller Conservation Opportunity Area encloses most of the watershed and Nachusa Grasslands as it meanders between lands just north of Lowden Miller State Forest south to Franklin Creek State Park (Map 16) (IDNR, 2005). Conservation practices within the watershed would apply to goals of the Illinois Comprehensive Wildlife Conservation Plan and Strategy for a larger geographical area (Table 12).

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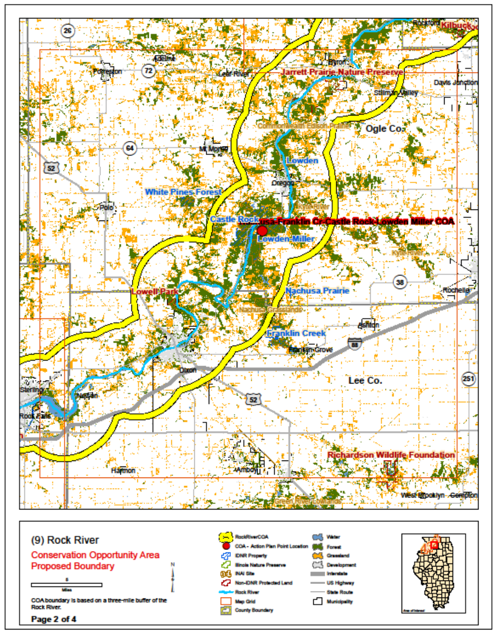
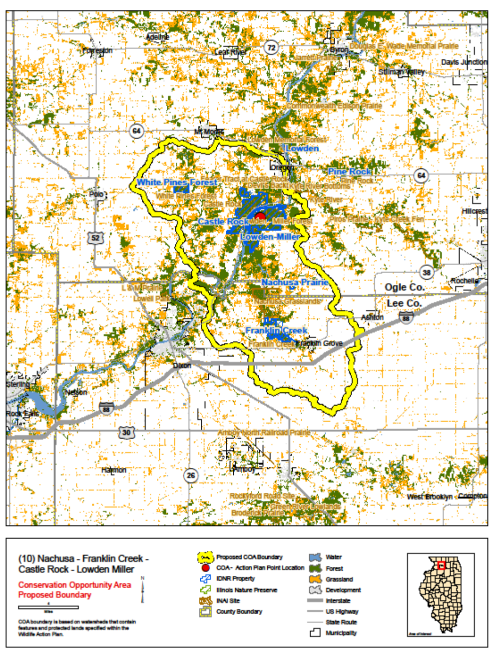
Map 15: Rock R. Conservation Opportunity Area overlaps with Clear Creek Watershed.



Source: Renn, Pers. Comm.

Map 16: Nachusa-Franklin Creek-Castle Rock-Lowden Miller Conservation Opportunity Area includes most of the Clear Creek Watershed.



Source: Renn, Pers. Comm.

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Table 12: Goals of the Illinois Comprehensive Wildlife Conservation Plan and Strategy that apply to Clear Creek Watershed and a larger geographic area.	
Habitat	**Goal**
Forest	Increase forest acreage by about 14,400 acres.
	Expand and improve bottomland forest habitat.
	Inventory and prioritize forested blocks of 500 acres for adding or linking other forest blocks.
	Encourage sound management practices to promote healthy upland forests.
Open Woodland/ Savanna	Increase savanna/open woodland acreage by about 15,000 acres.
	Manage existing habitat and restore degraded habitats.
	Encourage habitat in isolated woodlands <15 acres in size.
Grassland	Increase grasslands by about 52,000 acres.
	Manage rural grasslands for diverse structure and composition to support native species.
	Establish grassy buffers and terraces to reduce agricultural runoff and erosion from construction sites into waterways.
Wetland	Increase wetlands by 1,500 acres.
	Establish buffer between wetlands and adjacent agricultural land to prevent herbicide runoff and sedimentation.
Source: IDNR, 2005.	

Forest Legacy Program

The watershed is part of a larger Forest Legacy Area, one of three nationally recognized for the state of Illinois for its mature forests (Gillespie, Pers. Comm.).

Ogle County Regional Greenways and Trails Plan

The Ogle County Regional Greenways and Trails Plan maps potential greenways and trails. It suggests a potential recreational and canoe trail following the Rock River and a secondary trail along the north side of Lost Lake (Scheaffer, 2003).

Economic Development Plans

The watershed is not identified as economic development areas by either Ogle or Lee county (Vandewalle & Assoc, 2009 and Ogle County Planning & Zoning Dept, 2008).

Clear Creek Watershed Planning Committee

The Clear Creek Watershed Planning Committee has draft, preliminary goals and objectives to improve the water quality, protect and enhance natural and agricultural resources, and protect the rural lifestyle (Table 13).

Table 13: Draft, preliminary goals and objectives of the Clear Creek Watershed Planning Committee, March 9, 2010.

Preliminary Goals (Draft)	Preliminary Objectives (Draft)
1. Minimize erosion and sedimentation.	a. Decrease streambank and shoreline erosion.
	b. Deter flashy hydrology.
	c. Minimize stormwater runoff.
	d. Reduce soil loss from crop fields.
	e. Implement best management practices as pilot projects to use as examples and to test procedures.
	f. Reduce negative environmental impact of road improvement projects and the installation of culverts.
2. Minimize pollutant loading into surface waters and groundwater.	a. Manage fertilizer, herbicide, nutrients, and insecticide loss.
	b. Reduce pollutant leaching into the groundwater.
	d. Reduce pollutant loading into the stream from subsurface sources.
	e. Reduce pollutant loading into the stream from surface runoff.
	f. Practice conservation tillage.
3. Protect "Class A" and other productive soils.	
4. Protect wildlife and their habitats.	a. Protect existing wildlife habitat and high quality natural areas.
	b. Create corridors between existing wildlife habitat and natural areas.
	c. Buffer existing wildlife habitat and natural areas.
	d. Reduce fragmentation of wildlife habitat and natural areas.
	e. Manage wildlife habitat and natural areas.
5. Protect the rural lifestyle.	a. Maintain relative percentages of current land uses.
	b. Support opportunities for recreation, hunting, and fishing.
	c. Create recreation trails.
	d. Consider the economics involved for the individual producer in each conservation action.

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Demographics

Population Statistics

Population statistics are available at for Ogle and Lee counties, but the watershed is too small to derive any meaningful census data (Table 14).

Table 14: Population Statistics for Ogle and Lee Counties in 2006-2008.							
Category	**Statistic**	**Ogle**	**Lee**	**Category**	**Statistic**	**Ogle**	**Lee**
Households	# of Households	20000	14000	Age	Median Age	38.3 yrs.	40.1 yrs.
	# of People/Household	2.7	2.4		Under 18 yrs. Old	24%	22%
	% Households of Families	71%	68%		Over 65 yrs. Old	14%	16%
	%Nonfamily Households	29%	32%	Ethnicity	White non Hispanic	89%	90%
Mobility	No mobility w/in 1 year	87%	88%		Black or African Am.	1%	4%
	Moved w/in county in past yr.	7%	6%		Am. Indian/Alaska Native	0.50%	0.50%
	Moved into county w/in yr.	7.50%	5.50%		Asian	1%	0.50%
Education	High School Graduate	70%	70%		Native Hawaiian/Pacific Islander	0.50%	0.50%
	College Graduate or Higher	17%	15%		Other	2%	1%
	No High School Degree	13%	15%		Hispanic	9%	4%
	School Enrollment Total	14000	8200		2 or More Races	2%	2%
	PreK & K Enrollment	1700	820	Housing	Total Housing Units	22000	15000
	Elem. & High School Enroll.	9800	5300		Vacant Housing Units	7%	7%
	College Enrollment	2600	2100		Single Unit Structures	83%	78%
Occupation	Sales & Office	26%	20%		Multi-Unit Structures	14%	17%
	Management & Professional	25%	27%		Mobile Homes	3%	5%
	Production & Transportation	23%	23%		Built since 1990	21%	
	Service	16%	20%		Occupied Housing Units	20000	14000
	Construction, Maint., Repairs	9%	10%		Owner Occupied	74%	73%
	Private Wage	79%	79%		Renter Occupied	26%	27%
	Federal, State, Local Gov't.	12%	14%	Median Mo.	Mortgage Owner	$1,347	$1,145
	Self-Employed	8%	7%	Costs	Nonmortgage Owner	$481	$439
Commute	1 Person per Carload	78%	80%		Renter Occupied	$612	$577
	Carpool	10%	10%	Home Price	Median Home Price in 2009	$130,000	$86,000
	Public Transportation	1%	2%		Average Home Price in 2009	$140,423	$104,176
	Other Means	7%	3%	Income	Median Income	$55,635	$49,705
	Work from Home	5%	6%	(not	Earnings Received	82%	78%
	Avg. Commuting Time	24.5 min.	22.4 min.	mutually	Retirement Benefits (non SS)	18%	20%
Population	Total	55000	35000	exclusive)	Social Security	28%	29%
& Gender	Female	28000	17000		Avg. Income from SS	$15,630	$14,802
	Male	27000	18000		Poverty	6%	11%

Source: US Census Bureau, 2008 and Illinois Association of Realtors, 2009.

Land Ownership

Of the 11,130 acres in the watershed, all is privately owned except the 88-acre Lost Lake and 1,490 acres of Nachusa Grasslands. The lake is owned by the Lost Nation/New Landing River Conservancy District, a governmental body. Nachusa Grasslands is owned by The Nature Conservancy, a not-for-profit organization.

Public Opinion Poll

The Lost Nation/New Landing River Conservancy District (2008) surveyed the attitudes and opinions about the watershed of their constituents and received 289 responses. No such survey has been repeated for other stakeholders of the watershed. Responses suggested the following:

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1. 84.7% of respondents either agree (39.7%) or strongly agree (45%) that the economic stability of their community depends on good water quality and clarity.
2. 87.6% of respondents either agree (40.8%) or strongly agree (46.8%) that taking action to protect water quality at Lost Lake is important.
3. 52.5% of respondents did not think that their household activities had much impact on the lake's water quality.
4. 37.9% of respondents did not think that their activities on their land had much impact on the lake's water quality.
5. 50.9% of respondents indicated a willingness to improve the lake shore to protect water quality and clarity and stop erosion.

Respondents were either extremely or somewhat concerned about many environmental factors associated with the lake.

- Over 80% of respondents were concerned about excessive nutrients, septic contamination, sediment import from water and /or loss of lake volume, and sediment contamination.
- Over 70% of respondents were concerned about shoreline erosion, lack of management in the watershed, decreased water clarity, aquatic habitat destruction, and loss of native aquatic plants and animals.
- Over 60% of respondents were concerned with over-management of the lake/chemical treatments and litter and debris.
- Over 50% of respondents were concerned with algal blooms, fish die-off, and road maintenance (i.e. de-icing).

However, only 6% of the respondents think that Lost Lake is much polluted and 58.1% feel that the lake community to be a pristine natural area.

Respondents indicated that they often performed the following behaviors to protect the lake:

- 34.2% often pick up pet waste,
- 23.5% often use phosphorous-free fertilizer,
- 30.6% often time application of fertilizer according to the rain forecast,
- 51.9% often follow manufacturer's guidelines for fertilizer application,
- 39.1% often sweep fertilizers and/or pesticides off of impervious surfaces,
- 30.7% often leave or create a buffer of native plants between their home and the lake,
- 20.7% often control soil erosion on their property,
- 36.9% often keep yard waste away from shorelines,
- 54.9% often discourage feeding Canada geese, and
- 36.4% often think about the impact of the watershed and inlets on the lake.

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Waterbody and Watershed Conditions

Water Quality Reports

Water quality can be gleaned from existing water quality reports, water quality standards, watershed-related reports, and watershed action strategies. Some such documents exist for the watershed.

Illinois Integrated Water Quality Report and Section 303(d) List

The Illinois Environmental Protection Agency reported the condition of the surface and groundwater in the state through the *Illinois Integrated Water Quality Report and Section 303 (d) List-2008* to fulfill the requirements of Section 305(b), 303(d) and 314 of the Clean Water Act (IEPA, 2008). From this report, designated uses and water quality standards were identified for Lost Lake and Clear Creek.

Water Quality Standards

Illinois' water standards provide the basis for assessing whether the beneficial uses of the state's waters are being attained. Illinois waters are designated for various uses including aquatic life, wildlife, agricultural uses, primary contact (e.g. swimming, waterskiing), secondary contact (e.g. boating, fishing), industrial use, drinking water, food-processing water supply, and aesthetic quality. The five designated uses for Clear Creek and Lost Lake are: Aquatic life, Fish consumption, Primary contact, Secondary Contact, and Aesthetic Quality. Of each of the designated uses, only Aquatic Life and Aesthetic Quality had been assessed for Lost Lake. However, Lost Lake is a Category 3 waterbody because the data was found insufficient to make any meaningful statement (IEPA, 2008).

Watershed-Related Reports

No existing watershed-related reports are in place for the watershed, like existing TMDL Reports or Source Water Assessments. Well locations and potential for contamination supply some information.

<u>Existing TMDL Reports</u>

There were no TMDL Reports found for Clear Creek or Lost Lake.

<u>Source Water Assessments</u>

Source Water Assessment and annual drinking water quality reports were not readily available for any public water supply in the watershed. Wells were located, and potential for agricultural chemical contamination of groundwater was assessed, but information about well contamination was not available (Map 17). Using Keefer's (1995) mapping of aquifer sensitivity to contamination by pesticide leaching, which has six categories from excessive to very limited, the entire Clear Creek watershed falls into the "excessive" category (Map 18) (IDNR, 2002*a*).

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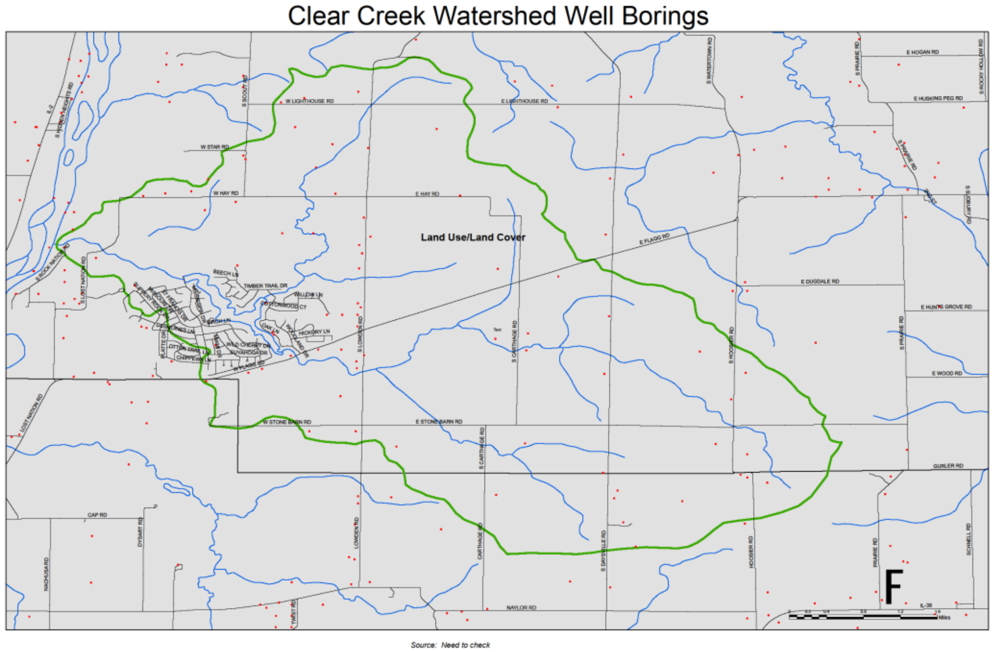
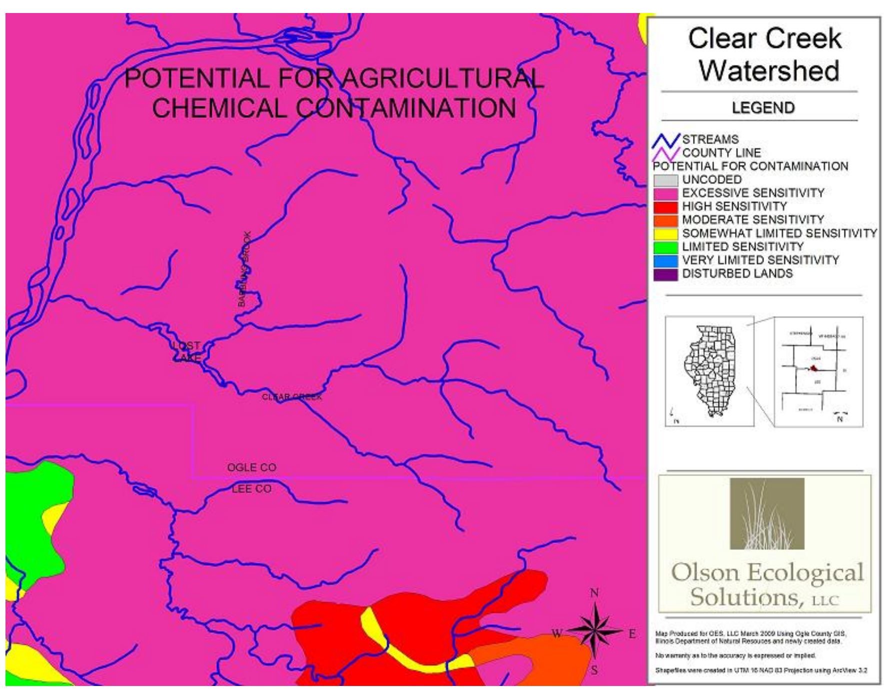
Map 17: Well boring locations in the Clear Creek Watershed.



Map 18: Potential for Agricultural Chemical Contamination



<u>Watershed Restoration Action Strategies</u>

No Watershed Restoration Action Strategies were found for the Clear Creek Watershed.

<u>Field Assessments</u>

An assessment by JadEco and Olson Ecological Solutions in 2009 gives insight to the condition of the shoreline along a stretch of Babbling Brook and Lost Lake. Soil samples collected are sandy loam with low to very low organic matter , moderate to high levels of phosphorus, two to five pounds per acre of surface nitrate, and a soil pH of 7.4 to 8.0 (Table 15). A more complete "Rapid Assessment" is in progress from the Natural Resources Conservation Service." They have completed field assessments at multiple stream and field locations, and they are now analyzing the data (Meisenheimer, Pers. Comm.).

Table 15: Soil Analysis Report for soil samples taken from Babbling Brook and Lost Lake shores.

August 14, 2009. Samples taken by Joe Rush, JadEco and Rebecca Olson, Olson Ecological Solutions and analyzed by Midwest Laboratories, Inc.

Sample Location	Organic Matter	Phosphorus strong bray	Nitrate	pH	Soil Type	Sand	Silt	Clay
BB North Shore	1.6 % (L)	58 ppm (H)	3 ppm (5 lbs/ac)	7.9	Sandy Loam	66%	28%	6%
BB South Shore	1.3 % (VL)	29 ppm (M)	1 ppm (2 lbs/ac)	7.4	Sandy Loam	76%	16%	8%
Lost Lake	1.2 % (VL)	36 ppm (M)	1 ppm (2 lbs/ac)	8	Sandy Loam	66%	24%	10%

*BB = Babbling Brook, VL = Very Low = Low, M = Moderate, H = High, VH = Very High

Pollutant Sources

Pollutants to the water resources come from both point and nonpoint sources. The only significant point source in the watershed is a wastewater treatment plant for the Lost Lake New Landing subdivision. Nonpoint sources include livestock and runoff from agricultural fields and residential lawns.

Point Sources

Permits

Two NPDES permits are associated with the watershed, one active and one permanently closed. The active permit is a wastewater permit. The closed permit is owned by Krahenbuhl Oil Company, Inc. of 217 Mulberry Lane, Dixon, Illinois 61021 (EPA Plant ID#110001386214). The compliance information is unknown and the information had been last updated August 25, 2008 (EPA, April 28, 2010). There are no permits for stormwater, concentrated animal feed operations, or industrial facilities.

Wastewater Permits

A wastewater treatment facility is permitted for Lost Lake Utility District of 100 Park Avenue, Dixon, Illinois 61021 until July 31, 2012. The plant is located at 900 Missouri Drive in Dixon, Illinois 61021 (41 55'05" North latitude and 89 22' 11" West longitude). The main discharge number and name for the existing plant is 001 STP Outfall (Keller & Dragovich, 2009), and the permit identification is IL0026590 (USEPA, 2010). Discharge flows into Clear Creek, which is classified as general use, is not rated for Biological Stream Characterization, and is not on either the 2006 or draft 2008 Illinois 303(d) list. The receiving stream has a seven day once in ten year low flow (7Q10) of 0.17 cfs (Keller & Dragovich, 2009). The status of the facility is "Effective," and the database is ICIS-NPDES (USEPA, 2010).

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The facility was installed around 1970, has a 1,000-home capacity, and serves 177 homes on the west side of the Lost Nation New Landing subdivision. Any new homes constructed, or any homes with septic located within 200 feet of the main sewer line, are required to hook into the system (Steffens, Pers. Comm.). East-side residents use private septic (Breckenfelder, Pers. Comm.). The design average flow (DAF) for the facility is 0.10 million gallons per day (MGD) and the design maximum flow (DMF) for the facility is 0.25 MGD. Treatment consists of SBR process tank, disinfection/dechlorination, and aerobic digestion (Keller & Dragovich, 2009).

The facility is in disrepair (Photo Set 7). The former owner, New Landing Utilities, has incurred multiple violations and has been threatened with a lawsuit by the Environmental Protection Agency sometime around 2007. The Lost Lake Utility District has been formed to purchase the plant from New Landing Utilities and build a new facility, which is scheduled to open in July 2010. A list of monthly average influent and effluent is found in Table 16 (Chase, Pers. Comm.). Violations were listed at the following link:

http://www.epa-echo.gov/cgi-bin/effluents.cgi?permit=IL0026590&charts=viols&monlocn=all&outt=all

To correct the problems of the wastewater treatment plant, Lost Lake Utility District plans to open a new facility in July 2010 by order of the Attorney General's Office (Chase, Pers. Comm.). The design flows and corresponding load limits have been changed from DAF/DMF of 0.10/0.25 MGD to DAF/DMF of 0.05/0.205 MGD. Treatment will consist of septic tanks, recirculation/dilution tanks, sand filter, and disinfection/dechlorination. Dissolved oxygen limits have been added for the proposed plant pursuant to the final rule adapted by the Illinois Pollution Control Board under Docket No. R04-25. The EPA requires a sample frequency of once a month (Keller & Dragovich, 2009).

Photograph Set 7: Condition of the wastewater treatment equipment at the Lost Lake Utility District facility.

Source: Chase, Pers. Comm.

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Table 16: Annual and monthly influent and effluent readings for the Lost Nation subdivision's wastewater treatment plant from 2006 to 2010.											
New Landing Utilities											
		Flow Gallons/day		**pH**		**BOD mg/l**		**Suspended Solids mg/l**		**Ammonia Nitrogen mg/l**	
Year		**Influent**	**Effluent**	**Influent**	**Effluent**	**Influent**	**Effluent**	**Influent**	**Effluent**	**Influent**	**Effluent**
2006	Total	486,400	486,400	58	57.8	2444	489	2310	344	168.56	238.98
2006	**Average**	**48,640**	**48,640**	**7.3**	**7.2**	**306**	**61**	**330**	**49**	**42.14**	**23.90**
2006	Maximum	51,200	51,200	7.7	7.5	720	270	1130	178	61.6	40.32
2006	Minimium	38,400	38,400	7.1	6.8	110	2	124	13	32.48	2.8
2007	Total	588,000	588,000	92.8	95.2	3685	329	2597	460	92.4	279.59
2007	**Average**	**45,231**	**45,231**	**7.1**	**7.3**	**283**	**25**	**200**	**35**	**46.2**	**21.51**
2007	Maximum	51,200	51,200	7.4	7.8	440	74	693	78	47.6	44.8
2007	Minimum	38,400	38,400	6.8	6.9	127	8	76	9	44.8	0.28
Lost Lake Utility District											
		Flow Gallons/day		**pH**		**BOD mg/l**		**Suspended Solids mg/l**		**Ammonia Nitrogen mg/l**	
Year		**Influent**	**Effluent**	**Influent**	**Effluent**	**Influent**	**Effluent**	**Influent**	**Effluent**	**Influent**	**Effluent**
2008	Total	640,000	640,000	99.6	100.3	3867	133	2475	173		214.11
2008	**Average**	**45,714**	**45,714**	**7.1**	**7.2**	**276**	**10**	**177**	**12**		**15.29**
2008	Maximum	51,200	51,200	7.7	7.4	427	29	312	21		34.72
2008	Minimum	38,400	38,400	6.6	6.9	153	3	58	5		0.22
2009	1/8/2009	38,400	38,400	7.4	7.2	207	9	93	17		14.56
2009	2/5/2009	38,400	38,400	7.2	7.5	233	6	106	10		25.98
2009	3/3/2009	38,400	38,400	7.7	7.6	307	18	500	24		32.48
2009	4/8/2009	51,200	51,200	7.3	7.5	293	4	88	7		37.24
2009	5/28/2009	51,200	51,200	6.8	7.1	250	30	106	26		34.72
2009	6/11/2009	51,200	51,200	6.7	7.1	287	11	104	14		27.00
2009	7/7/2009	51,200	51,200	6.7	7.3	373	4	304	18		35.84
2009	8/17/2009	51,200	51,200	6.7	7.0	367	4	87	9		0.93
2009	9/2/2009	51,200	51,200	7.1	7.2	387	1	232	10		0.22
2009	10/13/2009	51,200	51,200	7.3	7.2	300	3	200	7		0.95
2009	11/3/2009	38,400	38,400	7.3	7.2	420	2	340	9		0.17
2009	12/15/2009	38,400	38,400	7.1	7.1	393	3	263	7		0.34
2009	Total 2009	550,400	550,400	85.3	87	3817	95	2423	158		210.43
2009	**Average 2009**	**45,867**	**45,867**	**7.1**	**7.3**	**318**	**8**	**202**	**13**		**17.54**
2009	Maximum 2009	51,200	51,200	7.7	7.6	420	30	500	26		37.24
2009	Minimum 2009	38,400	38,400	7.1	7.0	207	1	87	7		0.17
2010	1/27/2010	38,400	38,400	7.5	7.7	233 mg/l	14 mg/l	90 mg/l	14 mg/l		32.62 mg/l
2010	2/8/2010	38,400	38,400	7.3	7.4	307 mg/l	6 mg/l	132 mg/l	9 mg/l		36.68 mg/l
2010	3/8/2010	38,400	38,400	7.4	7.4	307 mg/l	6 mg/l	90 mg/l	14 mg/l		32.34 mg/l
Source: Chase, Gary. Pers. Comm. April 6, 2010.											

Stormwater Permits

There are two stormwater outfalls that drain stormwater from the upstream watershed into Lost Lake, but no NPDES permits associated with them. There are no known stormwater detention areas (Rush, Pers. Comm.).

Nonpoint Sources

Nonpoint pollution, such as nutrients and bacteria, likely originate from livestock and runoff from agricultural crop fields and affect surface and ground waters in the watershed.

Livestock

Livestock producers are present in the watershed. Livestock graze on about 550 acres (Bettner, Pers. Comm.) and have free access to approximately 17,330 linear feet of stream: 10,480 feet on Clear Creek

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and 6,850 feet on Babbling Brook (Hill, Pers. Comm.). Information regarding population, management, and land application of manure are not readily available for the watershed.

Cropland Sources

Croplands likely contribute to nonpoint source pollution by channelizing stream segments, clearing land of riparian vegetation (IDNR, 2005 and AES, 2001), converting head waters to grass waterways, compacting soils, and baring land of native, vegetative cover. All of these activities contribute to increased soil loss, erosion, decreased capabilities of infiltration and evaporation, and decreased holding time for water. Data to quantify these claims has been collected by the Natural Resources Conservation Service and is in the process of being analyzed (Meisenheimer, Pers. Comm.).

<u>Channelization</u>

Channelization, primarily for agricultural production, affects about 10% of the open waterways within the watershed (Pierce, Pers. Comm.), or 2.2 miles of stream. The first three miles of the main channel of Clear Creek, located above Lost Lake, has retained its original meandered stream channel and woodland and grass buffers have been maintained. Further upstream, the creek has been channelized for over 3,200 feet. A tributary stream north of the main channel has been channelized for over 2,200 feet and nearly the entire length of a tributary stream south of the main channel has been channelized for a length of 6,400 feet (Schafer, Pers. Comm.).

These areas were manipulated prior to the early 1970's when there was a big push to gain farmland. Modern day drainage provisions have ceased this activity, other than maintenance to remove debris and construct channels back to original design criteria. While the attempts by landowners have tried to drain surface water from their properties faster, these activities have only complicated the drainage systems for downstream owners. Once the increased flows return to the natural meanders, out of bank flooding occurs more often and at increased severity. Generally speaking, manipulated channels are always under ongoing rechanneling due to natural attempts to return the stream to its natural course. These areas are usually sites of high silt loading to downstream areas (Pierce, Pers. Comm.).

Streams flow faster without the meanders to slow the currents, which results in increased down cutting of the streambed and sloughing of the stream banks. This can result in the formation of a headcut, or overfall, which will migrate upstream until it reaches a stable point. The headcut can migrate into previously undisturbed stream, causing erosion damage and instability. The increased flow through channelized regions will also result in aggravated flooding and increased streambed and bank erosion downstream in the meandered reaches. Increased streambed down cutting and bank erosion will result in the loss of vegetated stream buffers, including mature trees and riparian wetlands. As the bank sloughs, the tree roots are exposed and the trees become unstable and fall into the stream or become stressed and die (Schafer, Pers. Comm.).

<u>Conversions of Head Waters to Tiled Grass Waterways</u>

Many of the waterways in the upper headwaters of Clear Creek have been filled and converted to grass waterways or tiled for drainage for the purpose of agricultural production. This has likely resulted in the loss of wetlands (Schafer, Pers. Comm.), along with their water filtering capabilities.

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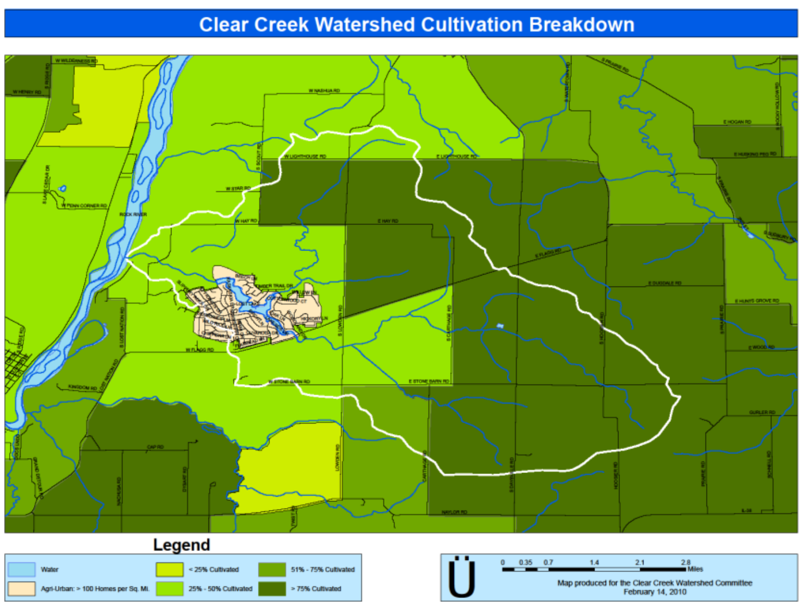
Cultivation

The eastern portion of the watershed is over 75% cultivated, and the west side is between 25% and 50% cultivated, excluding the subdivision (Map 19). The Clear Creek Watershed Planning Committee (Pers. Comm.) recognizes that most landowners within the watershed adhere to standard conservation farming techniques. A rotation of corn and beans is standard practice. Information about fertilizer application is not readily available.

Any runoff from these fields is entering the stream and then Lost Lake at a faster rate compared to runoff through native vegetation, resulting in increased soil erosion. Increased above-ground runoff carries suspended sediments and agricultural chemicals to surface waters. Subsurface drainage tiles carry suspended sediments and water soluble nutrients and chemicals directly into the streams. These pollutants affect the water quality of Lost Lake. Increased flow velocities from the watershed will result in more frequent rises of floodwater in the streams and lake following rain events (Schafer, Pers. Comm.).

Map 19: Cultivation densities in the Clear Creek Watershed.



Urban sources

Impervious surfaces in the watershed are created by roads and residential roofs and driveways, which may increase water velocity and runoff. The literature generally shows that water quality and habitat decline if there are more than 10-15% impervious surfaces in a watershed (Schueler, 1994 *IN* WIDNR, 2000). Impervious surfaces account for noticeably less than 10% of the watershed; therefore, they were not assessed.

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Onsite Wastewater Systems

Homes on septic systems dominate the watershed, with 174 homes in the Lost Nation New Landing community (Steffens, Pers. Comm) and all homes in the rural areas. Within the residential community, there are no current requirements for septic field testing. Local agencies are not able to provide estimates of total number of septic systems on a scale appropriate for the watershed. The local health department is not able to supply information about malfunctioning septic systems. Septic systems outside of the subdivision were judged insignificant as a nonpoint source of pollution due to low density.

Silviculture Sources

Some silviculture practices occur in the watershed associated with natural area restoration efforts by The Nature Conservancy, including site preparation, prescribed burning, and chemical applications. During the fall of 2009 and spring of 2010, The Nature Conservancy burned just over 2,000 acres in and around the watershed (Kleiman, 2010 unpublished). Timber harvesting and road construction were not assessed.

Wildlife Sources

There are no wildlife population estimates for the watershed (Ostling, Pers. Comm.). The Lost Nation/New Landing River Conservancy District has been controlling the goose overpopulation problem at Lost Lake since 2003. This process, permitted through the Department of Natural Resources, includes non-lethal techniques such as stopping the feeding of the geese, fencing, barrier plantings, and egg addling. Over the past seven years, a total of 324 eggs have been destroyed, with an average of 46 eggs per year (Breckenfelder, Pers. Comm.).

Waterbody Monitoring Data

Water Quality and Flow Data

National databases did not contribute water quality and flow data for the watershed, including STORET, national listing of fish advisories, NWISWeb, BEACH Program, WATERS, and National Sediment Inventory. Limited local information is provided on fish advisories, beach closings, volunteer monitoring program data, and local sediment monitoring efforts.

National Listing of Fish Advisories

There are no fish consumption advisories specifically for Lost Lake or Clear Creek because there are no fish samples available from either water body. However, there is a state-wide advisory for women of childbearing age and children under 15 to limit their consumption of predator fish species (fish that eat mainly other fish such as bass and pike) from all lakes and streams in Illinois, including waters not accessible to the public, to one meal per week due to mercury contamination (Hornshaw, Pers. Comm.).

Beach Closings

Beaches at Lost Lake are monitored every two weeks as required by the Illinois Department of Health. Beaches have been closed eight times between 2002 and 2009, twice due to flood damage, four times due

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to high levels of E. coli, and once due to an undocumented reason. The satisfactory level of E. coli ranges from <1/100mL to 209.8/100mL. Times of beach closings had much higher readings between 517.2/100mL and 1,553/100mL (Breckenfelder, Pers. Comm.).

Volunteer Monitoring Program Data

The lake association of Lost Lake is involved in the Environmental Protection Agency's Volunteer Lake Monitoring Program. Monitoring water chemistry and physical parameters has allowed them to assess the water quality of their lake and make better decisions on management practices. The Illinois EPA ambient lake monitoring program sampled alongside volunteers from May through October 2007 as a quality control check on the samplers and laboratory. The vast majority of parameters sampled are considered within Non-Detect, Low, or Normal categories as defined by Mitzelfelt (1996). Exceptions are silver and potassium, which fall into the "Elevated" category. The reason for elevated concentrations of silver is unknown (Lesnak, Pers. Comm.). Samples indicated average levels of total suspended solids in 2007 of 8 mg/L. This relatively low level for a reservoir should cause a decrease in water clarity but should not play a large part in inhibiting algal growth (Carruso, 2008 unpublished).

Sediment Monitoring Data

Sediments have been a problem within Lost Lake and Clear Creek, as supported by sediment monitoring efforts throughout the history of the lake. It was apparent in 1968 that Lost Lake already had an excessive siltation problem stemming from the large watershed feeding it. The lake was dredged within five years of being formed, where Clear Creek entered the lake (IDOC, 1968). When the dam was built in 1972, sedimentation was reported to the Illinois State Water Survey by the engineers with an estimated depth of 2 feet and 18,000 cubic yards removed (Finch, 1973). Integrated Lakes Management assessed sediment deposition at the silt basin located on Clear Creek just upstream from Lost Lake. They found that the 1.1-acre silt basin held 930 cubic yards of sediment in March 2008 and 1,231 cubic yards of sediment in October 2008. They claimed that the 132% increase in sediment was due to erosion upstream caused by storm events. They took a comparative measurement in 2006 of 1,288 cubic yards of sediment (Rysso et. al., 2008). The River Conservancy District has also dredged the lake and Clear Creek silt basin on a regular basis. In 2003, 47,000 cubic yards of silt were removed from the lake for $3.65/yd, for a total of $172,062.13 (Breckenfelder, Pers. Comm.).

The sediments at the bottom of Clear Creek sampled by Karen Rivera of the Illinois Department of Natural Resources at Nachusa Grasslands consisted of 40% silt/mud and 40% sand, with approximately 10% gravel, 8% cobble, and 2% boulders. The deeper pools were quite mucky, with ankle deep silt lying over a sand bottom. The riffles were composed of gravel and cobble, with some fine silty sediment in the quieter areas. Filamentous algae were present on the rocks, and overhanging terrestrial grasses provided shade along the edges. The stream in this area was incising, or down-cutting into its bed. Down-cutting causes the banks to become steep and vertical. These banks eventually fail and fall into the stream along with the trees and other vegetation growing on them. The resulting sediment covers the stream bottom. Over time, this sediment will make its way downstream and contribute to the filling of Lost Lake (Rivera, 2006 unpublished).

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Biological Indicators

Biological indicators in the watershed have been sampled, including the algal toxin microcystin, fish, and invertebrates, resulting in rankings of trophic status and biological stream segments.

Algae

Filamentous algae were present on the rocks in Clear Creek (Rivera, 2006 unpublished) and algal blooms have been experienced at Lost Lake (Rush, Pers. Comm.). During the summer of 2007, field biologists from the Illinois Environmental Protection Agency (IEPA) measured levels of microcystin, chlorophyll-*a*, phosphorus, and nitrogen in Lost Lake. Microcystin, a toxin produced by some blue-green algae, is known to harm human and animal health when ingested in large quantities. There is no standard for surface water exposure, but the World Health Organization does have a standard for drinking water of 1 µg/L of water. This standard isn't relevant for surface water (lakes and streams) where exposure to the water is minimal, but it was the only reference found for comparison. Microcystin samples were taken at sites where the most human contact was possible, including boat launches, fishing piers, and bathing beaches. Most, but not all, of the samples fell in the range of less than 0.15 µg/L, which was well below the standard of 1 µg/L. Five samples fell in a mid-range group from .22µg/L and .75µg/L. Two samples approached but did not exceed 1.0µg/L. There were three samples that exceeded 1.0µg/L, one greatly with a value of 3.56µg/L. The other two had values of 1.04 and 1.12µg/L. These values could be natural occurrences of the toxins in the lake. The July and August samples did not show spatial similarities between different lakes in the area. The lake has experienced algal blooms, probably coinciding with the areas of higher microcystin content. The samples that were higher than typical were most likely due to algal blooms. All of these results were considered normal and shouldn't cause health problems to people who may have had minimal exposure to the water at these times (Carruso, 2008 unpublished). The blooms were treated during the summer of 2008 (Rush, pers. comm.).

Without suspended solids to inhibit algal growth, limiting factors for growth were phosphorus and nitrogen. Lost Nation showed a good correlation between available chlorophyll *a* concentrations and total phosphorus levels. The water quality standard for phosphorus of 0.05 ug/L for surface water of lakes was violated by all three sample sites during all of the sample months except for May. Nitrate/nitrite nitrogen levels greatly exceeded the statistical guideline on all sampling dates and at all three sites. In October 2007, one site exceeded the ammonia statistical guideline of above the 85th percentile for lakes in Illinois (Carruso, 2008 unpublished).

Fish

<u>Index of Biotic Integrity (IBI)</u>

Clear Creek at Nachusa Grasslands has an Index of Biotic Integrity (IBI) of 35, based on a fish survey conducted by Karen Rivera of the Illinois Department of Natural Resources on June 28, 2006. This IBI translates to a Moderate Aquatic Resource (C) rating on a scale of 12 (worst) to 60 (best). A C rating indicates loss of species intolerant of pollution, fewer species and a highly skewed trophic structure (Table 17). Older age classes of top predators may be rare. This IBI is lower than expected most likely due to the blockage of the stream by the dam, which prevents migratory species like channel catfish and

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suckers from reaching the upstream end of the stream for spawning. The IBI could be improved slightly if deep water habitat is created that would allow channel catfish and smallmouth bass from the lake to find suitable habitat in the stream for at least part of their life cycles. For comparison, the Rock River at Castle Rock State Park has an IBI of 43 and Paige Park in Dixon (below the dam) has an IBI of 40. The area of the Rock River between these two sites is also likely to be in the 40's (Rivera, Pers. Comm.).

Table 17: Parameters used to establish an IBI for Clear Creek at Nachusa Grasslands (Rivera, 2006).

Parameter	# Species or % Popn.	Extrapolation
Native fish species	16	16 (4)
Native minnow species	10	10 (5)
Native sucker species	1	1 (2)
Native sunfish species	2	2 (5)
Benthic invertivore species	3	3 (3)
Intolerant species	1	1 (2)
Prop. specialist benthic invertivores	6%	0.06 (3)
Prop. geneneralist feeders	85%	0.85 (2)
Prop. mineral-substrate spawners	22%	0.22 (3)
Prop. tolerant species	25%	0.25 (6)
IBI		**35**

Fish Kills

One fish kill within the Rock River near the mouth of Clear Creek occurred shortly after a train wreck upstream in Rockford, Illinois on June 19, 2009. The relation of these two events is under investigation by the U.S. Fish and Wildlife Service. Results are unknown at this time (Kenney, Pers. Comm.).

Invertebrates

Lost Lake

The Illinois Environmental Protection Agency sampled benthic invertebrates at three sites on Lost Lake at the beginning of the fall season of 2008. Sites sampled were the lacustrine area (nearest the spillway and most "lake-like" in its morphology), the riverine section (which is most "river-like"), and the center of the lake (transitional zone) between the two other sample sites and is characteristic of both the other zones. The biotic indices developed by Verneaux (2004) and Blocksom (2002) were used to evaluate the abundance and tolerance of the macroinvertebrate community within Lost Lake. The tolerance value scale ranges from 0.1-1.0, with 0.1 indicative of higher pollution and lower oxygen levels and 1.0 representative of the most pristine water conditions. Diversity was measured using the Shannon Diversity Index, which measures the number of species found and their abundance (species evenness) using a scale of 0-1.0. A score of 1.0 means that each species found has the same number of individuals in the sample, or complete evenness in the community. The macroinvertebrate community in Lost Lake consisted of a high diversity of species possessing a range of tolerance of water conditions, resulting in a moderate biotic index value of 0.506 for Lost Lake on a scale of 0 to 1. Only 0.395% of the species were intolerant of organic pollutants (between the tolerance range of 0.8 – 1.0), and 39% of the species were very tolerant (between the tolerance range of 0.1 – 0.4). The Shannon Diversity index was 0.734 when applied to the

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entire lake, which represented a fairly high evenness score. Chironomids accounted for approximately 50% of the diversity (Carusso, 2008 unpublished).

Clear Creek

Invertebrate sampling was conducted on Clear Creek by EcoWatch volunteers in 1996. EcoWatch volunteers monitored two locations along Clear Creek two and three times since 1996 (dates unknown). Clear Creek had an average overall biological score when compared to other streams within the Rock River Hill Country and the state of Illinois (0.30 and 0.52 compared to the averages of 0.44 and 0.39, respectively). This accounted for a slightly higher than average to average macroinvertebrate index (6.01 and 5.56 compared to averages of 5.52 and 5.77, respectively); less than average total taxa richness (6 and 8 compared to averages of 9.23 and 8.53, respectively); less than average EPT taxa richness representing mayfly, stonefly, and caddisfly (1 and 1.5 compared to averages of 2.66 and 2.47, respectively) and variable habitat scores (0.3 and 0.77 compared to averages of 0.69 and 0.56, respectively) (CTAP 2008 *a and b*). Overall, the studies above suggested moderate to good water quality in Clear Creek. Ed Dewalt of the Illinois Natural History Survey supported these conclusions by saying,

> "Clear Creek has a relatively healthy community of aquatic insects and other aquatic invertebrates. EPT (mayflies, stoneflies, and caddisflies) fauna tally near 15, which would rate it as "Good" in the Critical Trends Assessment Program criteria. The stream would rate better than most of the streams in the region, with the exception of Wade Creek, although these streams are fundamentally different. The latter is a true coldwater stream with the insect and fish populations to prove it (Dewalt, pers. comm.)."

Trophic Status

Trophic status of Lost Lake was determined to be between eutrophic and hypereutrophic by analyzing macroinvertebrate samples and secchi transparency. The eutrophic status was supported by the macroinvertebrate sample, which included chironomidea found in areas of good water quality in the littoral and profundal zones in the lake. The secchi transparency suggested that the lake may be more hypereutrophic, but the accuracy of this test may have been compromised by sample time, weather, or glare on the water. In the future, a more accurate representation of the lake can be found applying the Trophic State Index to the total phosphorus concentrations or the chlorophyll a concentrations (Carruso, 2008 unpublished).

Biologically Significant Streams

The Clear Creek Watershed empties into a stream segment of the Rock River between Rockford and Dixon identified as a Biologically Significant Stream Segment by the Illinois Department of Natural Resources in 2007 (IDNR, 2008 *a;* Szafoni, pers. comm.; and Ogle County Zoning and Planning Department, 2004). Biologically Significant Streams (BSS) are defined generally as those streams that have a high rating based on datasets from at least two taxonomic groups (Bol et. al., 2007).

Geomorphology (characteristics, origin, and development of land forms)

Geology provides subsurface framework and landscape (topography) of a watershed. It partially determines the degree to which erosion occurs and the rate and direction of flow of groundwater and surface water, thus influencing the water quality and biology of the watershed. Geologic materials produce the soils within a watershed. The lateral extent, thickness, and properties of the geologic materials, and their variability, are related to the geologic history of the watershed (Dave Larson, Pers. Comm.). The geomorphology of a watershed can be explained by stream morphology, bedrock, quaternary deposits, and factors of soil formation.

Stream Morphology

Clear Creek is a small stream, averaging only about 15 feet wide and approximately 1.5 to 2 feet deep. At the downstream end, Clear Creek flows into Lost Lake, where it is blocked by the dam that impounds Lost Lake (Rivera, 2006 unpublished). It has an unadjusted 10-85 slope of 21,555 ft/mi and an adjusted 10-85 slope of 19.819 ft/mi (USGS, 2010*a*).

Bedrock

Bedrock in the watershed is of Prairie du Chien and Ancell groups (Map 20) with layers above of St. Peter Sandstone and Platteville Group. Bedrock occurs at a maximum depth of 400 feet in the southeastern corner of Ogle County around the watershed area, but appears near the surface elsewhere (FEMA, 2009). Depth to bedrock measured at the Lost Nation Dam is 75_{+} ft. (Finch, 1973). There are no bedrock faults within the watershed, although there are some located just outside of the watershed to the northeast (Map 21). The northeastern and eastern portions of the watershed are in the Prairie du Chien Group, which consist of cherty dolomite and interbedded sandstone. These rocks vary in thickness from 0 (where eroded) to about 280 ft. (0 to 85 m). Deposition of Prairie du Chien, followed by exposure and subsequent erosion, create an irregular surface with several hundred feet of local relief upon which the Ancell Group is deposited (McGarry, 1999). The Ancell Group is found at the southwestern and western portions of the watershed, although data is sparse. It is a predominantly elastic unit consisting of sandstone, argillaceous and sandy limestone, and dolomite formations (Templeton and Willman, 1963). Thickness is highly variable because the base of the Ancell rests on an eroded surface. It is generally 0 (where eroded) to 380 feet thick in this area and fills irregularities in the older Early Ordovician and Late Cambrian surface. The upper 1 to 15 feet (0.3 to 4.6 m) consists of interbedded fine grained, impure dolomite, sandstone and green shale (Willman et al. 1975 *IN* McGarry, 1999). It underlies the Platteville Group in northern Illinois (Willman et al., 1975). The St. Peter Sandstone is the basal formation in the Group, overlain by members of the Glenwood Formation. It is composed mainly of quartz sand that is normally pure and very fine- to coarse-grained (Templeton and Willman, 1963; Buschbach, 1964). It commonly contains less than 2% silt and 1 to 3% disseminated clay. Its heavy mineral suite is limited to the highly resistant minerals, tourmaline and zircon. It fills irregularities on a complex surface which includes both karst and erosional features. The St. Peter is 100 to 200 feet thick over most of northern Illinois. Across central Illinois, the Plateville Group overlies the St. Peter Sandstone. The group is about 135 feet thick in the Dixon area near the watershed (Willman et al., 1975).

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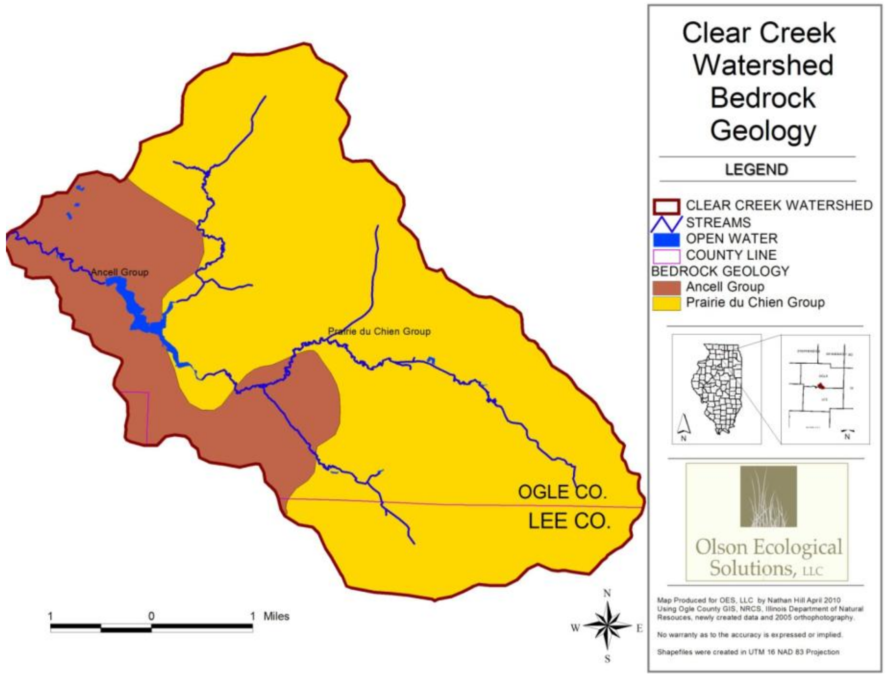
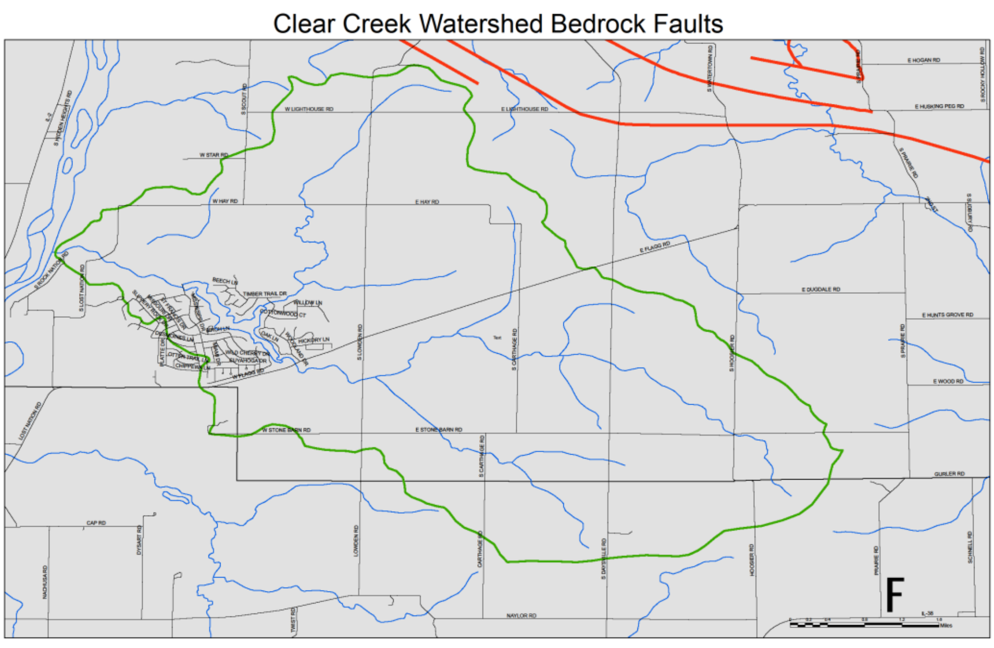
Map 20: Bedrock geology of the Clear Creek Watershed.



Map 21: Bedrock fault locations in relation to the Clear Creek Watershed.



Quaternary Deposits

Quaternary deposits within the watershed include Cahokia/Henry and Glasford formations (Map 22). The Cahokia/Henry Formation follows Clear Creek to the Rock River. It consists of channel and floodplain

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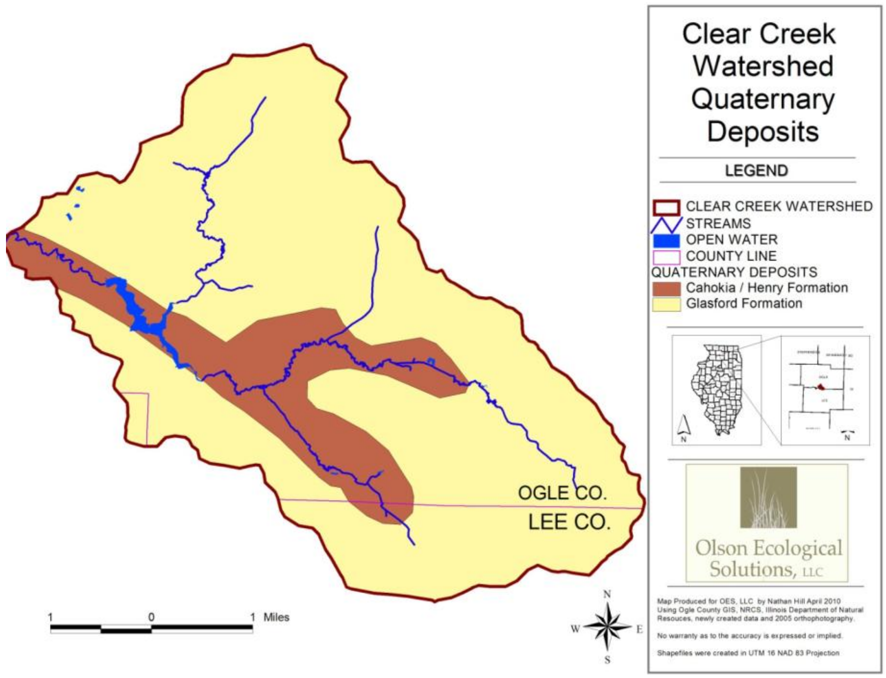
deposits of modern streams and rivers consisting of stratified silt containing sand and clay lenses. Thickness varies greatly, and may be up to 75 feet along the Rock River. The Glasford formation covers the uplands of the watershed and Babbling Brook area. It consists of calcareous, gray to tan gray, loam to clay loam diamicton that may appear yellowish brown when oxidized. Often small clasts of coal (less than 5mm diameter) are present within the diamicton. The silt covering may be up to 30 feet thick in some areas. The unit typically overlies bedrock.

Map 22: Quaternary deposits in the Clear Creek Watershed.



Factors of Soil Formation

Major factors of soil formation are the physical and mineralogical composition of the parent material; living organisms on and in the soil; climate in which the soil formed; topography; and length of time that the forces of soil formation have acted on the parent material (Jenny, 1941). Ogle County's soils have formed from a variety of parent materials, and the most common materials now found are loess, glacial deposits, weathered bedrock, paleosols, and alluvium (FEMA, 2009). Illinois' soils developed on tills or thick loess that are mixtures of crushed bedrock particles. These soil parent materials, formed and homogenized by the grinding action of glaciers, supply abundant nutrients vital to crops. Where glaciers do not cover the terrain, the topography, soils, and vegetation differ significantly. Soils are directly related to the composition of the immediately underlying bedrock from which they are formed by chemical and physical weathering (IDNR, 2002*a*).

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Cultural Resources

Although most of the watershed has not been surveyed for historic and archaeological resources, there are five reported archaeological sites in the western portion from some early archaeological surveys. Near the Rock River, in the floodplain and terrace portions of section 6, there are two prehistoric burial mound sites and one Middle Woodland habitation site. The burial mounds have been identified by staff of the Illinois State Museum in 1959 and at an earlier date. The habitation site has been identified in 1972 by the University of Wisconsin-Milwaukee archaeologists. Further east, in section 5, is a prehistoric habitation site on the bluffcrest above Clear Creek. In section 4, an older Archaic period habitation site is found also overlooking the creek. These two sites were identified during the Historic Sites Survey of the early 1970s conducted by the University of Wisconsin-Milwaukee (Santure, Pers. Comm.).

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Appendix A: GIS Data Documentation

Type: Watershed Boundary file
Source/agency: Illinois State Geological Survey
Date: 2009
Scale: 1:65,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: Border of the Clear Creek Watershed as defined by the US Geological Survey

Type: Water Bodies (polygons and line files)
Source/agency: Illinois State Water Survey,
Date: 2009
Scale: 1:65,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: Open water, including rivers and ponds, as well as creeks and manmade bodies of water.

Type: National Wetlands Inventory
Source/agency: US Fish and Wildlife Service
Date: 2009
Scale: 1:24,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: Areas of known wetlands, http://www.fws.gov/wetlands/Data/DataDownload.html

Type: Township and County Borders
Source/agency: US Census Bureau
Date: 2000
Scale: 1:65,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: Political boundaries within the two county area.

Type: Land Use Land Cover
Source/agency: United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS), Research and Development Division (RDD), Geospatial Information Branch (GIB), Spatial Analysis Research Section (SARS)
Date: 1987
Scale: 1:65,000
Projection: UTM_Zone_Number 16, Transverse_Mercator:
Description: Areas of land cover identified, NLCD 2001 Land Cover Class Definitions
11. Open Water - All areas of open water, generally with less than 25% cover of vegetation or soil.
12. Perennial Ice/Snow - All areas characterized by a perennial cover of ice and/or snow, generally greater than 25% of total cover.
21. Developed, Open Space - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes

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22. Developed, Low Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.
23. Developed, Medium Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.
24. Developed, High Intensity - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.
31. Barren Land (Rock/Sand/Clay) - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
32. Unconsolidated Shore* - Unconsolidated material such as silt, sand, or gravel that is subject to inundation and redistribution due to the action of water. Characterized by substrates lacking vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable. Erosion and deposition by waves and currents produce a number of landforms representing this class.
41. Deciduous Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
42. Evergreen Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.
43. Mixed Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
51. Dwarf Scrub - Alaska only areas dominated by shrubs less than 20 centimeters tall with shrub canopy typically greater than 20% of total vegetation. This type is often co-associated with grasses, sedges, herbs, and non-vascular vegetation.
52. Shrub/Scrub - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
71. Grassland/Herbaceous - Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
72. Sedge/Herbaceous - Alaska only areas dominated by sedges and forbs, generally greater than 80% of total vegetation. This type can occur with significant other grasses or other grass like plants, and includes sedge tundra, and sedge tussock tundra.
73. Lichens - Alaska only areas dominated by fruticose or foliose lichens generally greater than 80% of total vegetation.
74. Moss - Alaska only areas dominated by mosses, generally greater than 80% of total vegetation.
81. Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
82. Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.
90. Woody Wetlands - Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

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91. Palustrine Forested Wetland* -Includes all tidal and non-tidal wetlands dominated by woody vegetation greater than or equal to 5 meters in height and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 0.5 percent. Total vegetation coverage is greater than 20 percent.
92. Palustrine Scrub/Shrub Wetland* - Includes all tidal and non-tidal wetlands dominated by woody vegetation less than 5 meters in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 0.5 percent. Total vegetation coverage is greater than 20 percent. The species present could be true shrubs, young trees and shrubs or trees that are small or stunted due to environmental conditions.
93. Estuarine Forested Wetland* - Includes all tidal wetlands dominated by woody vegetation greater than or equal to 5 meters in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent. Total vegetation coverage is greater than 20 percent.
94. Estuarine Scrub/Shrub Wetland* - Includes all tidal wetlands dominated by woody vegetation less than 5 meters in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent. Total vegetation coverage is greater than 20 percent.
95. Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
96. Palustrine Emergent Wetland (Persistent)* - Includes all tidal and non-tidal wetlands dominated by persistent emergent vascular plants, emergent mosses or lichens, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 0.5 percent. Plants generally remain standing until the next growing season.
97. Estuarine Emergent Wetland* - Includes all tidal wetlands dominated by erect, rooted, herbaceous hydrophytes (excluding mosses and lichens) and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent and that are present for most of the growing season in most years. Perennial plants usually dominate these wetlands.
98. Palustrine Aquatic Bed* - The Palustrine Aquatic Bed class includes tidal and nontidal wetlands and deepwater habitats in which salinity due to ocean-derived salts is below 0.5 percent and which are dominated by plants that grow and form a continuous cover principally on or at the surface of the water. These include algal mats, detached floating mats, and rooted vascular plant assemblages.
99. Estuarine Aquatic Bed* - Includes tidal wetlands and deepwater habitats in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent and which are dominated by plants that grow and form a continuous cover principally on or at the surface of the water. These include algal mats, kelp beds, and rooted vascular plant assemblages.

Type: 100 and 500 Year Flood Zones
Source/agency: Illinois State Geological Survey
Date: 1996
Scale: 1:24,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: This is a statewide polygon feature class of 100 year and 500 year flood zones as of 1986 for the unincorporated areas of Illinois as indicated on Federal Emergency Management Agency (FEMA) National Flood Insurance Program (FIRM) maps and Flood Hazard Boundary maps.

Type: SOILS
Source/agency: U.S. Department of Agriculture, Natural Resources Conservation Service
Date: February 2006
Scale: 1:65,000

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Geographic Coordinate System: UTM 16 NAD 83
Description: Soil Survey Geographic (SSURGO) database for Ogle + Lee Counties, Illinois

Type: HEL (Highly Erodable Land): United States Department of Agriculture
Source/agency: U.S. Department of Agriculture, Natural Resources Conservation Service
Date: February 2006
Scale: 1:65,000
Geographic Coordinate System: UTM 16 NAD 83
Descripion: Soil Survey Geographic (SSURGO) database for Ogle + Lee Counties, Illinois Soil map units having an erodibility index of 8 or greater

Type: Hydric Soils
Source/agency: U.S. Department of Agriculture, Natural Resources Conservation Service
Date: February 2006
Scale: 1:65,000
Geographic Coordinate System: UTM 16 NAD 83
Description: Soil Survey Geographic (SSURGO) database for Ogle + Lee Counties, Illinois

Type: Hydrologic Soil Groups
Source/agency: U.S. Department of Agriculture, Natural Resources Conservation Service
Date: February 2006
Scale: 1:65,000
Geographic Coordinate System: UTM 16 NAD 83
Description: Soil Survey Geographic (SSURGO) database for Ogle + Lee Counties, Illinois

Type: Relief / Topography
Source/agency: USDA, NRCS
Date: December 2000
Scale: 1:65,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: Dataset containing contour elevations of the landscape.

Type: Prime Farmland
Source/agency: US Department of Agriculture
Date: January 2010
Scale: 1:24,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, and few or no rocks. Its soils are permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding. Users of the lists of prime farmland map units should recognize that soil properties are only one of several criteria that are necessary.

Type: Natural Areas (Forest and Grasslands)
Source/agency: OES
Date: February 2010
Scale: 1:24:000
Projection: Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: Using the 1999 land cover created by the IDNR as a base, interpretation of the 2005 orthophotography and site knowledge new shapefiles for forest area and grasslands were created. Forests were defined as >80% canopy deciduous and coniferous trees. Grasslands were defined as cool and warm season grasses and prairie with very few shrubs and no trees.

Type: Publicly Protected Natural Areas
Source/agency: Illinois Natural History Survey Illinois Department of Natural Resources
Publication_Date: April 1994
Scale: 1:24,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: Publicly protected open space including State Parks, State Forests, State, Natural Areas, State Conservation Areas, Illinois Natural Area Inventory Sites, Nature Preserves.

Type: Well Boring Locations
Source/agency: Illinois State Geological Survey
Date: 2008
Scale: 1:62,500
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: This file contains point locations from the ISGS Wells and Borings database. The attribute information include API number (the ID), well or boring type, longitude, and latitude. The spatial reference is geographic coordinates, decimal degrees, NAD83. The data are exported to a shapefile weekly from the Wells and Borings (source) database for Internet distribution.

Type: Leach Sensitivity (Pesticide and NO3)
Source/agency: Illinois State Geological Survey
Date: 1995
Scale: 1:250,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: This data set was created to classify soils and aquifer settings according to predictions of leaching potential. The classifications have not been validated by the results of water quality sampling. In addition, the use of these aquifer sensitivity ratings as predictors of water quality has not been evaluated. Nonuniform use of fertilizers might reduce the reliability of water quality predictions, which can only be validated by careful comparison with water
quality data.

Type: Cultivated Land Cover
Source/agency: US Department of Agriculture
Date: 2007
Scale: 1:65,000
Geographic Coordinate System: GCS_North_American_1983

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Datum: D_North_American_1983
Description: This feature dataset provides the estimated percentages of cultivated cropland.

Type: Bedrock
Source/agency: Illinois State Geological Survey
Date: 2005
Scale: 1:500,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: This feature dataset shows the distribution and extent of the bedrock geologic units within the State of Illinois, as depicted on the map Bedrock Geology of Illinois.

Type: Quarternary Deposits
Source/agency: Illinois State Geological Survey
Date: 1996
Scale: 1:2,500,000
Geographic Coordinate System: GCS_North_American_1983
Datum: D_North_American_1983
Description: This feature dataset is a generalized version of Quaternary Deposits of Illinois. Updated to reflect the areal distribution of the Wedron and Mason Groups (Wisconsin and Hudson Episodes) and deposits of the Illinoian and pre-Illinoian episodes in Illinois as described in ISGS Bulletin 104. Episodes are diachronic temporal units.

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