CHARACTERIZATION REPORT

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1.0 Project Overview And Background

1.1 Introduction

The *Oatka Creek Watershed Characterization* provides a description of Oatka Creek's watershed and the condition of natural resources and the built environment within that drainage area. This characterization is the first component of a comprehensive watershed management plan for the Oatka Creek watershed. This component includes:

- Description of the watershed and its constituent subwatersheds, land use and land cover, demographics, natural resources, and infrastructure;
- Evaluation of existing water quality data, run-off characteristics and pollutant loadings, including the identification of critical knowledge gaps pertaining to these subject areas; and
- Identification of pollution sources, sources of water quality impairment, and potential threats to water quality and watershed hydrology and ecology.

In addition to the watershed characterization, subsequent project components together comprise an overall strategy to protect and restore water quality and quantity within the Oatka Creek watershed. These components include:

- A community education and outreach program on water quality and quantity and watershed protection issues;
- Identification of management strategies and prioritization of projects and other actions for watershed protection and restoration;
- Identification of land and water use controls for water quality and quantity management and roles and responsibilities of governmental and non-governmental organizations; and
- An implementation strategy, including the identification of watershed-wide and site-specific projects and other actions necessary to protect and restore water quality.

This *Oatka Creek Watershed Characterization* report facilitates these subsequent tasks by establishing a reliable inventory of existing and available information to apply or build upon, as well as to identify any significant knowledge gaps that may be present.

This report is based on existing reports and studies, including the *Oatka Creek Watershed State of the Basin Report* (2002) and other pertinent documents.[1] It is not the intent to duplicate the information that was established through these earlier efforts. Rather, information considered vital or useful to the watershed management planning process is re-organized in a manner that facilitates its application and improves its accuracy and utility.

SECTION 1.0 ENDNOTES

[1] *Oatka Creek Watershed State of the Basin Report*. [Online] In *Oatka Creek Watershed Committee*. Last retrieved 12/8/10 from http://www.oatka.org/Reports/StateofBasin.pdf

2.0 Description of the Study Area

The Oatka Creek watershed lies within the Lower Genesee River Basin – part of the larger Lake Ontario Drainage Basin – and occupies 138,092 acres (215.8 sq. miles) across portions of Wyoming, Genesee, Livingston and Monroe Counties of New York State. Of the 17 watersheds that comprise the Genesee River Basin, the Oatka Creek watershed has the second largest drainage area, constituting approximately 9% of the entire Genesee River Basin.

Section 2.0 of this report is intended to provide the reader with an understanding of the study area as well as how a watershed can be defined and delineated. Subsequent sections of this Characterization report will provide more detailed information on various aspects of the watershed and its condition as well as the extent of our knowledge in these areas.

2.1 Watershed Delineation

A watershed may be described as a geographic area of land that is drained by a river and its tributaries to a single point. Watershed boundaries are typically defined by the highest ridgeline around the stream channels that meet at the lowest point of the land; at this point water flows out of the watershed into a larger river, lake or ocean. Watershed scale is an important consideration, particularly for watershed planning. Watersheds can be small and represent a single tributary within a larger drainage network or be quite large and cover thousands of square miles.

2.1.1 Hydrologic Units

In order to clearly delineate watersheds within the United States, the United States Geologic Survey (USGS) began developing the hydrologic unit system. Originally created in the 1970s and modified several times since then, hydrologic unit boundaries define the aerial extent of surface water drainage to a point (i.e., a watershed). Working in conjunction with the USGS, the National Resource Conservation Service (NRCS – a division of the US Department of Agriculture) has delineated all watersheds in the continental United States based on this standard hierarchical system.[2]

Today, hydrologic units are uniformly classified through six levels. Each hydrologic unit is identified by a unique hydrologic unit code (HUC) number consisting of two to twelve digits based on the six levels of classification. In addition to hydrologic unit codes, each hydrologic unit has been assigned a name corresponding to the principal hydrologic feature(s) within the unit. In the absence of such features, the assigned name will reflect a cultural or political feature within the unit (such as with HUC # 041300030405, “Village of LeRoy”). The intent of this system is to provide a useful framework of hydrologic delineation that facilitates watershed planning and restoration for managers and analysts across a wide geographic area.

The hydrologic unit system of watershed delineation as it applies to the Oatka Creek watershed is illustrated in Table 2.1 and Figures 2.1 and 2.2 on the following pages.

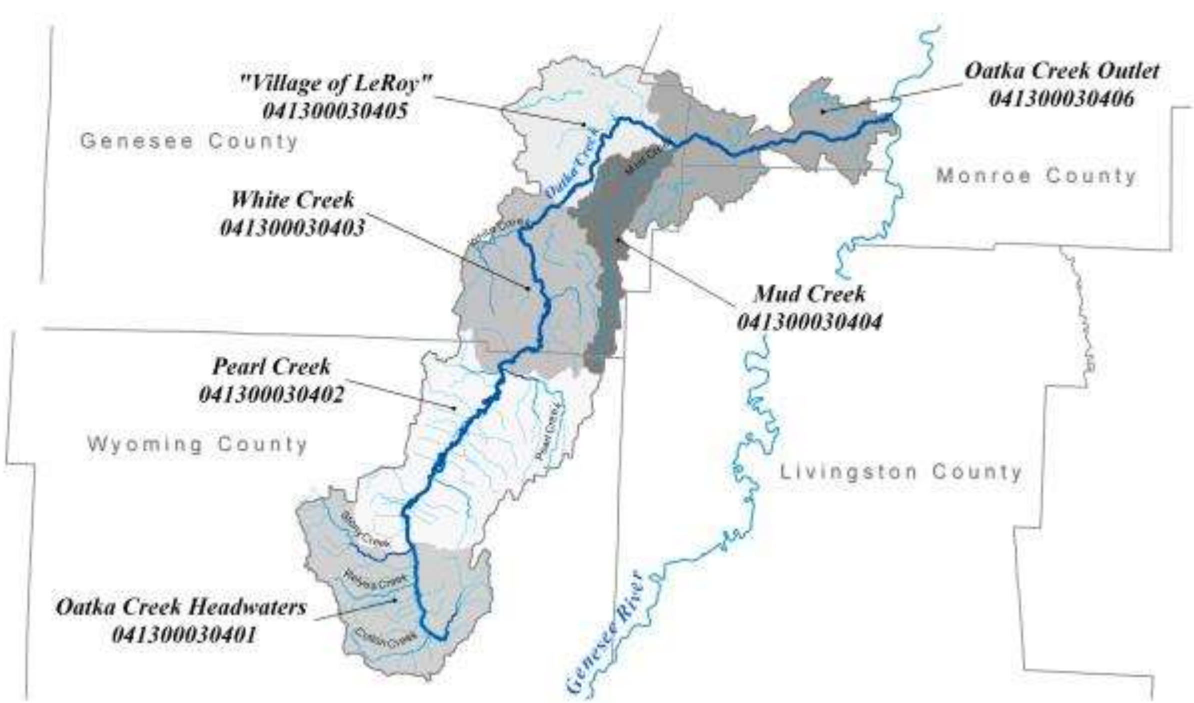
Figure 2.1: The Genesee River Basin and the Oatka Creek Watershed

***Figure 2.1**. The Genesee River Basin is divided into two separate 8-digit hydrologic units – the Upper (HUC No. 04130002) and the Lower (HUC No. 04130003). The Oatka Creek watershed lies within the Lower Genesee River Basin and is identified as a 10-digit hydrologic unit (HUC No. 0413000304).*

Table 2.1: The Hydrologic Unit System of Watershed Delineation Applied to the Oatka Creek Watershed

HUC Classification Level	HUC Name	HUC #
2 digit HUC – First level (Region)	Great Lakes Region of the United States	**04**
4 digit HUC – Second level (Subregion)	Southwestern Lake Ontario	04**13**
6 digit HUC – Third level (Accounting unit)	Southwestern Lake Ontario	0413**00**
8 digit HUC – Fourth level (Cataloguing unit)	Lower Genesee River	041300**03**
10 digit HUC – Fifth level (Watershed)	Oatka Creek Watershed	04130003**04**
12 digit HUC – Sixth level (Subwatershed)	• *Oatka Creek Headwaters Subwatershed*	*0413000304**01***
	• *Pearl Creek Subwatershed*	*0413000304**02***
	• *White Creek Subwatershed*	*0413000304**03***
	• *Mud Creek Subwatershed*	*0413000304**04***
	• *Village of LeRoy Subwatershed*	*0413000304**05***
	• *Oatka Creek Outlet Subwatershed*	*0413000304**06***

Figure 2.2: The Oatka Creek Watershed and Associated "HUC12 Watersheds"



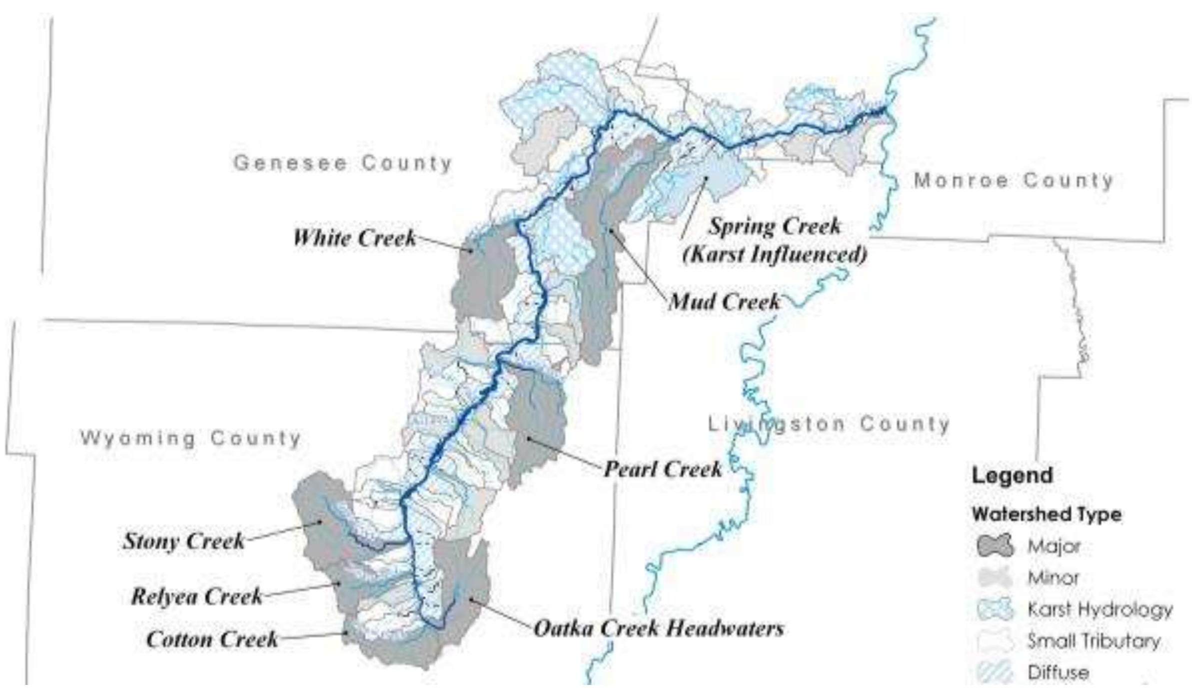
HUC12 subwatersheds may be described more accurately as *hydrologic units*. The term "hydrologic unit" is used to describe a spatial unit that exhibits common characteristics, such as principal hydrologic features, land uses, or topography (for example, HUC#041300030405 is called "Village of LeRoy"). Hydrologic units are not always synonymous with true hydrologic watershed boundaries. This is the case with HUC12 subwatersheds in the Oatka Creek watershed. As can be seen on Figure 2.2, 5 of the 6 HUC12 subwatershed boundaries actually traverse the Oatka Creek and include upland areas on both sides of the creek. While this is somewhat contrary to our understanding of a true hydrologic watershed or subwatershed, the HUC12 subwatershed delineation can nonetheless be useful for planning purposes due to the uniformity of their application across the continental United States.

2.1.2 Hydrologic Subwatersheds

True hydrologic subwatersheds can be delineated by identifying the major and minor hydrologic features in the watershed and selecting their corresponding catchment boundaries. A catchment is the land area that contributes runoff to a drainage area; it is the smallest unit used to measure space in a watershed. GIS analysis identified 256 individual catchments within the Oatka Creek watershed that were used to draw the boundaries shown in Figure 2.3. Once these boundaries are identified, they can be categorized according to hydrologic features, land uses, topography or other units of analysis.

The subwatershed boundaries shown in Figure 2.3 were drawn using flow line features in combination with catchment boundaries. A number of subwatershed boundaries remain obscure due to the presence of karst hydrology throughout the watershed. Karst is a term applied to areas where extensive dissolution of rock has led to the development of subterranean channels through which groundwater flows in conduits. In a number of locations in the Oatka Creek watershed, mapped streams essentially disappear beneath the surface, having no clear confluence with the

Figure 2.3: Hydrologic Subwatersheds of the Oatka Creek Watershed



surrounding hydrologic network. There are at least ten such streams in the Oatka Creek watershed (as identified through topographic maps and corresponding GIS data). In such instances, clear subwatershed boundaries are very difficult to determine given the unknown flow paths of surface waters and their underground flow systems.

Seven major subwatersheds (labeled) and 11 minor subwatersheds were identified, along with a 33 small, relatively narrow tributaries. The watershed also has a significant diffuse drainage area in locations that lie adjacent to the main stem of Oatka Creek; these areas generally have no significant tributaries and often correspond with the flood plain. More information on karst features, subwatershed delineation, and hydrology can be found in Section 4.2 of this report. A larger version of Figures 2.2 and 2.3 can be found in Appendix A of this report.

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2.2 Municipalities

As illustrated on Figure 2.4, the Oatka Creek watershed overlaps portions of four counties and 25 municipalities, 11 of which account for less than 1% of the total watershed area. Table 2.2 lists each municipality that has land area within the Oatka Creek watershed, listed in ascending order.[4]

Table 2.2: Municipal Watershed Acreage[3]

Municipality	County	Watershed Acres	Percent Share of Watershed	Percent of Municipality within Watershed
Town of York	*Livingston*	*0.006*	*0.000004%*	*0.00002%*
Gainesville Village	*Wyoming*	*6.2*	*0.004%*	*0.03%*
Town of Wethersfield	*Wyoming*	*44*	*0.03%*	*0.2%*
*Town of Chili**	*Monroe*	*247*	*0.18%*	*0.97%*
Wyoming Village	Wyoming	431	0.31%	100%
Town of Castile	Wyoming	452	0.33%	2%
Town of Byron*	Genesee	530	0.38%	3%
Scottsville Village	Monroe	538	0.39%	86%
Town of Riga	Monroe	552	0.40%	3%
Town of Bergen*	Genesee	881	0.64%	5%
Caledonia Village	Livingston	957	0.69%	70%
LeRoy Village	Genesee	1,719	1.24%	100%
Warsaw Village	Wyoming	2,647	1.92%	100%
Town of Caledonia	Livingston	2,735	1.98%	10%
Town of Bethany*	Genesee	3,493	2.53%	15%
Town of Perry	Wyoming	4,422	3.20%	20%
Town of Orangeville	Wyoming	4,673	3.38%	20%
Town of Stafford*	Genesee	4,776	3.46%	24%
Town of Gainesville	Wyoming	8,334	6.04%	38%
Town of Middlebury*	Wyoming	10,900	7.89%	49%
Town of Wheatland*	Monroe	12,469	9.03%	65%
Town of Covington	Wyoming	12,812	9.28%	76%
Town of Warsaw	Wyoming	19,514	14%	97%
Town of Pavilion*	Genesee	20,124	15%	88%
Town of LeRoy*	Genesee	24,836	18%	98%
Total Acreage		**138,092**	**100%**	--

***Table 2.2**: Municipalities that have less than 1% of their total land area within the watershed are listed in italics; these will be excluded from detailed analysis in this report. Municipalities marked with an asterisk '*' also have significant land area within the Black Creek watershed and will therefore receive similar focus and analysis in that watershed's respective management plan.*

Figure 2.4: Municipalities of the Oatka Creek Watershed

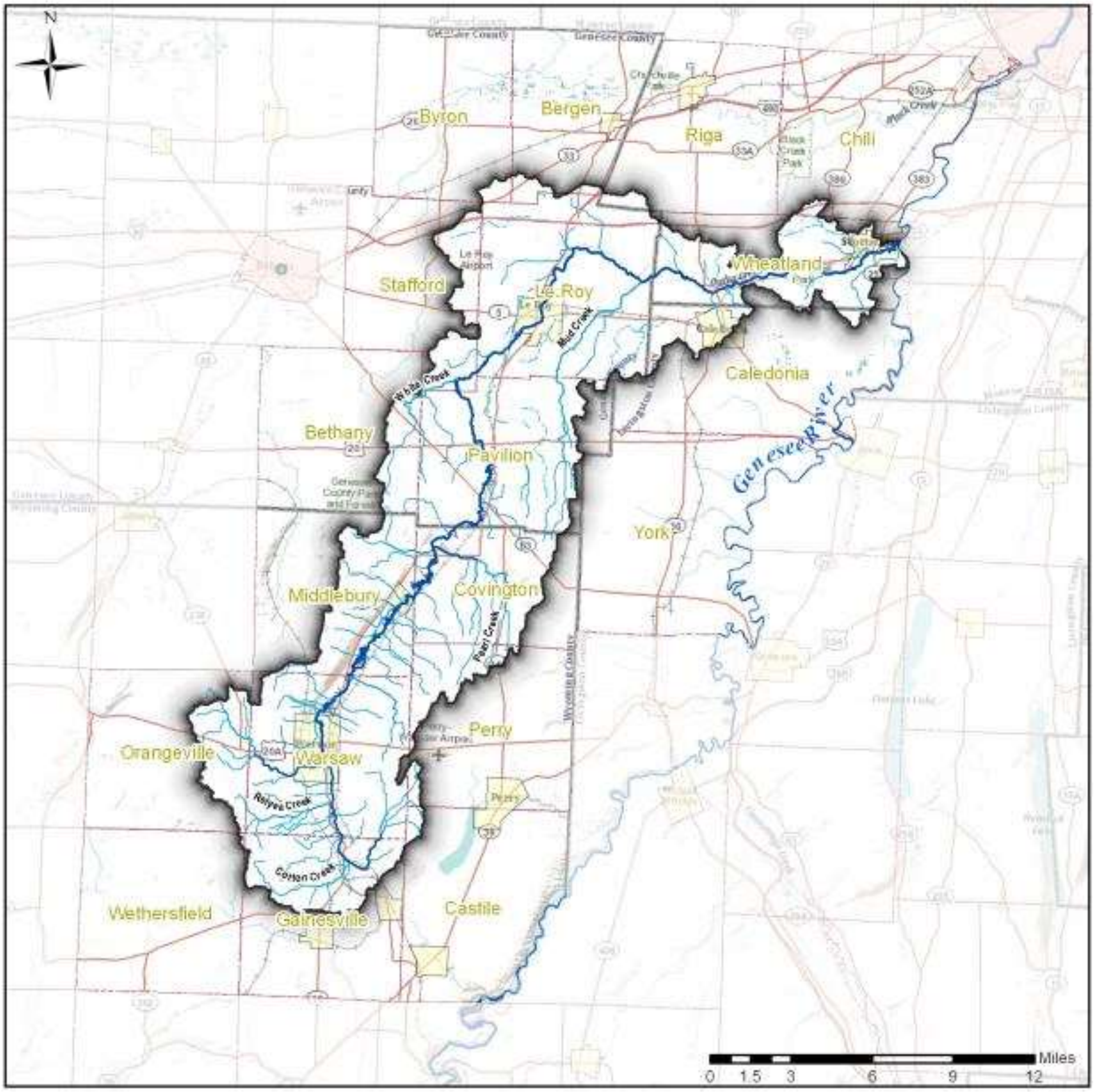


Table 2.3: Spatial Distribution of the Oatka Creek Watershed by County		
	Percentage of the Oatka Creek Watershed in the County	**Percentage of the County Within the Oatka Creek Watershed**
Genesee County	40.8%	26.1%
Livingston County	2.7%	1.3%
Monroe County	10.0%	4.8%
Wyoming County	46.5%	24.7%

2.3 Ecoregion[5]

"Ecoregions" denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources; they are designed to serve as a spatial framework for research, assessment, management, and monitoring of ecosystems and ecosystem components. By recognizing the spatial differences in the capacities and potentials of ecosystems, ecoregions stratify the environment by its probable response to disturbance. These general-purpose ecological regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernmental organizations responsible for different types of resources within the same geographical areas. The approach used to compile these maps was based on the premise that ecological regions can be identified through the analysis of the composition and spatial pattern of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity. These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology.

Levels I and II are the coarsest levels of ecoregions and are not illustrated here. Level I separates North America into a total of 15 ecological regions. The *Eastern Temperate Forests* region is the predominant Level I ecoregion of the eastern United States east of the Mississippi River, stretching to the Atlantic coast and including the entire Great Lakes region. Level II separates the continent into 50 regions; Oatka Creek watershed lies squarely in the *Mixed Wood Plains* Level II region, which includes much of the lowland area of upstate New York as well as similar areas throughout portions of the Great Lakes and the North Eastern regions of the United States.

2.3.1 Level III Ecoregion

New York State contains great ecological diversity in its low coastal plains, large river valleys, rolling plateaus, glacial lakes, forested mountains, and alpine peaks. Nine Level III ecoregions and 42 Level IV ecoregions occur in New York and many continue into ecologically similar parts of adjacent states or provinces. As illustrated in Figure 2.5, Oatka Creek watershed lies primarily in the "Eastern Great Lakes Lowlands" Level III ecoregion with a small portion of its southern tip reaching into the "Northern Alleghany Plateau" Level III ecoregion.

The *Eastern Great Lakes Lowlands* ecoregion surrounds the highland ecoregions of northern New York State. Valleys and lowlands are underlain by interbedded limestone, shale, and sandstone rocks that are more erodible than the more resistant rocks composing the adjacent mountainous areas. The topography and soils of the lowlands have also been shaped by glacial lakes and episodic glacial flooding. Limestone-derived soils are fine-textured, deep, and productive. As a result, much of the region was cleared for agriculture or urban development and less native forest remains than in surrounding ecoregions like the Northeastern Highlands or the Northern Allegheny Plateau. Most agricultural activity is devoted to dairy operations, although orchards, vineyards, and vegetable farming are important locally, particularly near the Great Lakes.

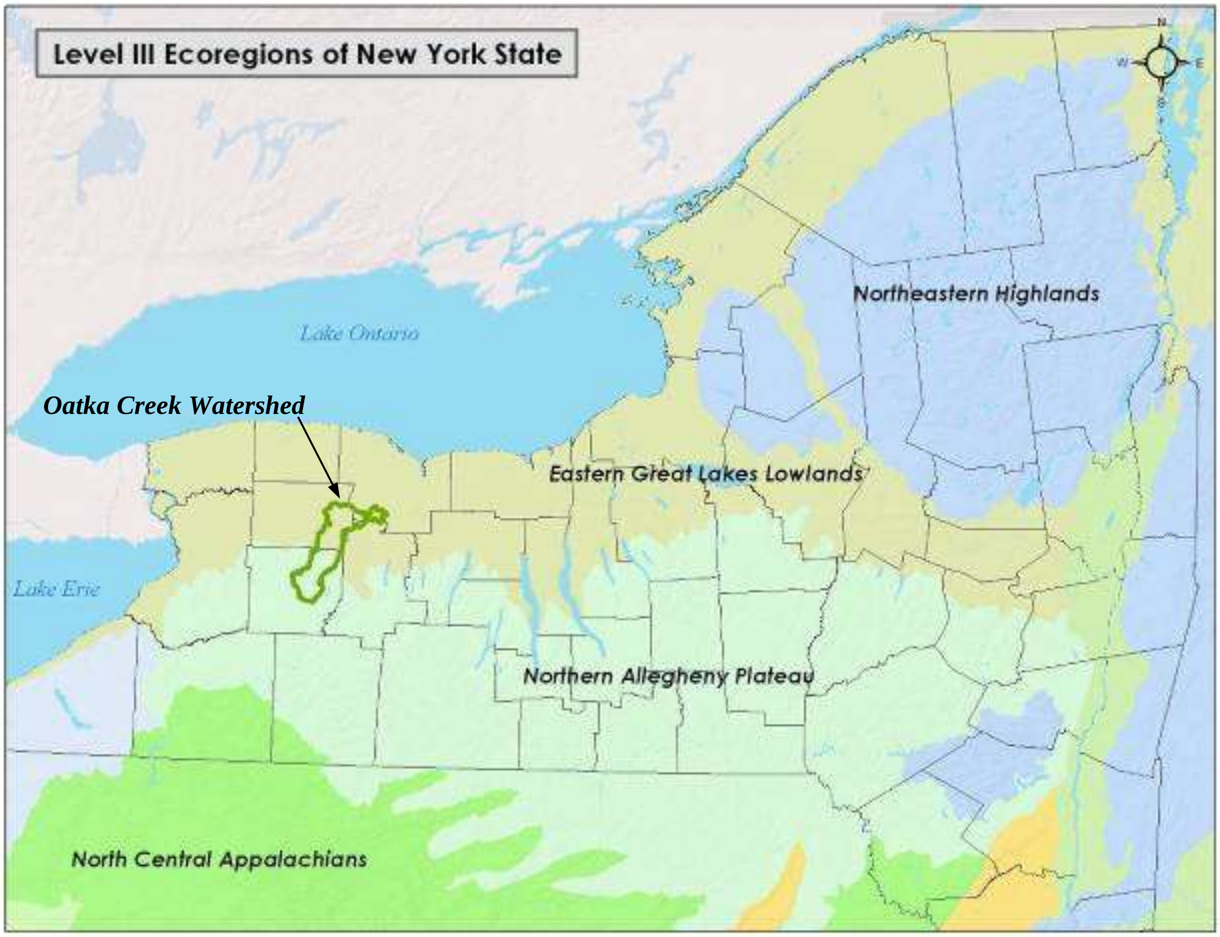


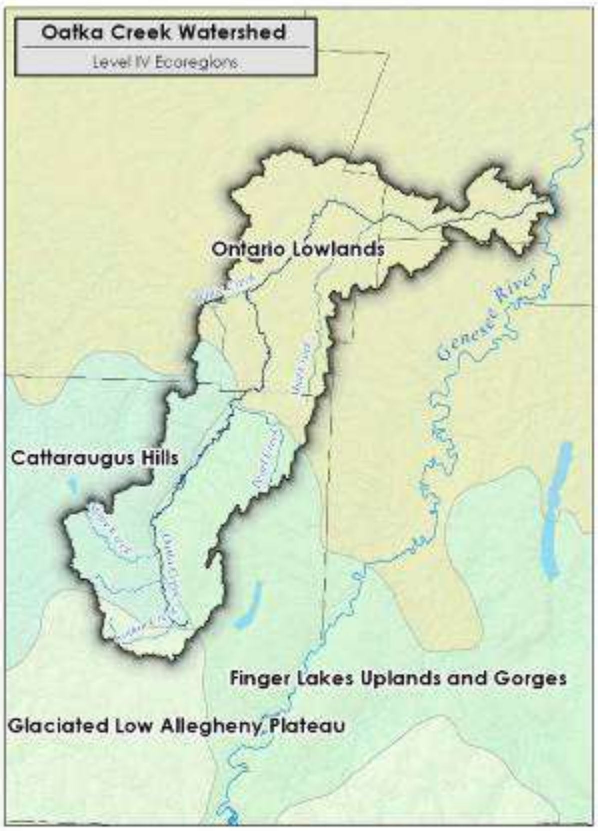
Figure 2.5: Level III Ecoregions of New York State

2.3.2 Level IV Ecoregion

The Oatka Creek watershed lies primarily in the Level IV ecoregion known as the *Ontario Lowlands*. The Ontario Lowlands are defined by the extent of Glacial Lake Iroquois. The relative proximity of the Ontario Lowlands ecoregion to Lake Ontario tempers its climate, meaning that summer heat and winter cold are reduced. Although the influence is strongest within a few miles of the lakeshore in the Erie/Ontario Lake Plain, the lake effect penetrates inland enough to make a noticeable winter temperature difference between the Ontario Lowlands and the north shore of Lake Ontario. The lake effect contributes to clouds in November and December, frequent fog in winter, and high snow amounts. Historically, the forest was dominated by beech and sugar maple with smaller amounts of white oak, basswood, elm, and white ash. Although forests once entirely covered the Ontario Lowlands, only scattered woodlots remain today because of the region's high agricultural capability. The loamy soils of the Ontario Lowlands are derived from limestone and calcareous shale (Alfisols); they are generally deep and finely textured. Although dairy and livestock farming are common, the soils and climate of the Ontario Lowlands are also suitable for growing fruit, vegetables, and other specialty crops.

Very small areas of the southern-most portion of the Oatka Creek watershed straddle the ecoregions of the *Cattaraugus Hills* and the *Finger Lakes Uplands and Gorges*.

Figure 2.6: Level IV Ecoregions of the Oatka Creek Watershed



2.4 Climate[6]

The climate in and around the Oatka Creek watershed is generally defined as humid-continental. Atmospheric flow and weather systems come predominantly from continental sources. Warm, occasionally humid, weather results when the airflow is from the south or southwest; cold, dry weather results when the flow is from the northwest or north. From time to time, well-developed weather systems off the mid- or north-Atlantic coast bring airflow from maritime sources into the region. Cool, cloudy, and often damp weather conditions prevail in this flow coming from the easterly quadrant.

Lake Erie and Lake Ontario have an important influence on the climate of the region. For example, they have a moderating effect on temperature. Summertime heating is less than in areas farther away from these large bodies of water. Consequently, thunderstorms are reduced in number and frequency, and there is less damage from hail and strong winds. The moderating effect of the lakes also reduces cooling at night and thus provides a growing season that is longer than that in areas at a greater distance from the lakes. Also influencing the climate are differences in relief and elevation, but these are secondary to the effect of the Great Lakes.

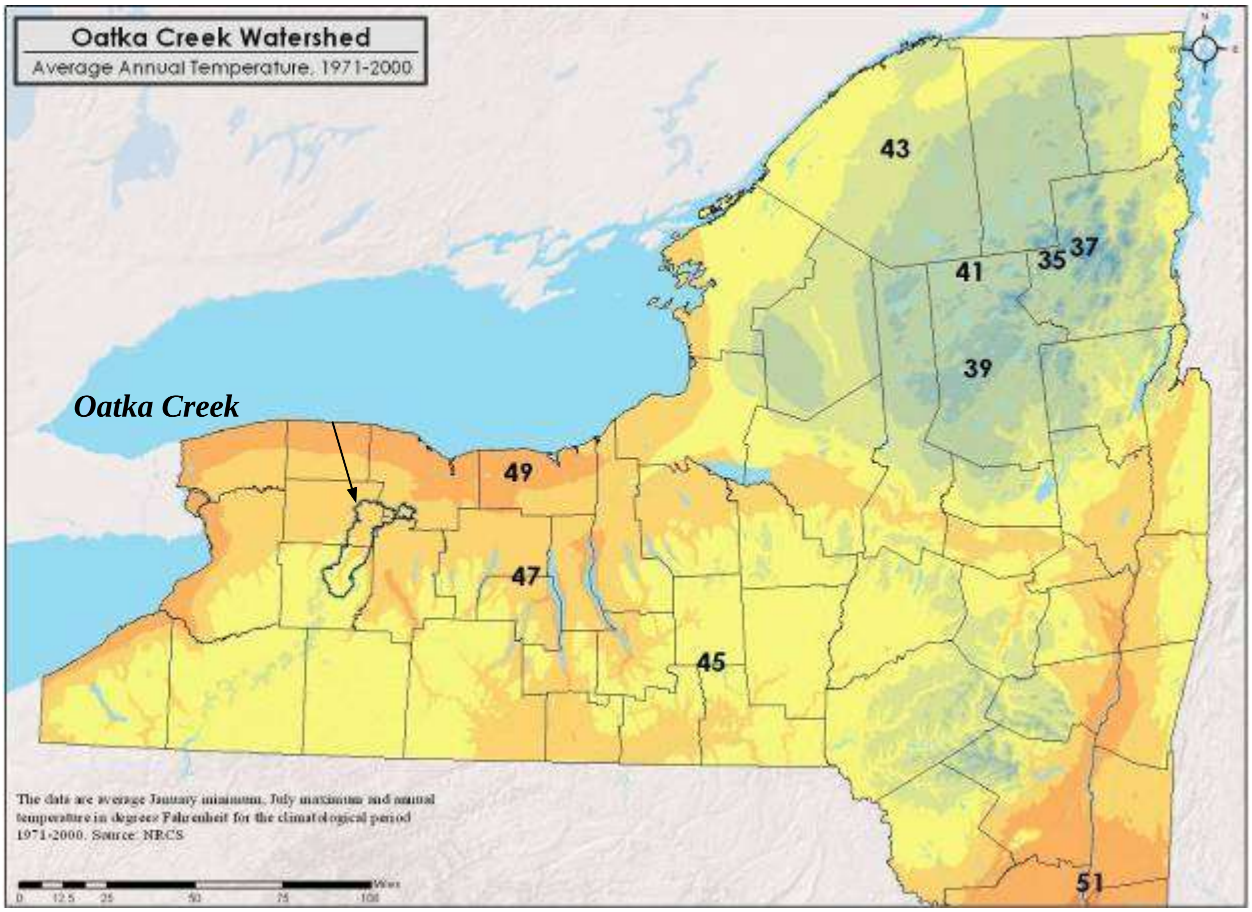
2.4.1 Temperature

Temperature in the Oatka Creek watershed usually varies noticeably, both in extremes and in averages, from day to day and from week to week. Summers are pleasantly warm in the Oatka Creek watershed while winters are generally long and cold and have frequent periods of stormy, unsettled weather. Although climate in the Oatka Creek watershed is chiefly continental, the ranges in temperature are smaller than those in the more centrally located areas of North America.

As the map in Figure 2.7 shows, average annual temperature range from 45 degrees Fahrenheit in the upper reaches of the watershed to 47 degrees near the lower reaches. The temperature reaches 90 degrees Fahrenheit or higher on an average of 7 days per year, almost entirely in June, July, and August. Temperatures of 0 degrees or below can be expected on 5 to 10 days in most winters.

Temperature tends to be slightly lower in the higher elevations of the watershed. There is a corresponding influence on the length of the frost-free growing season, the duration of snow cover, and other factors of climate affected by temperature. Depending on the seasonal conditions, the frost-free growing season can vary between 120 to 180 days in length.

Figure 2.7: Average Annual Temperatures for New York State



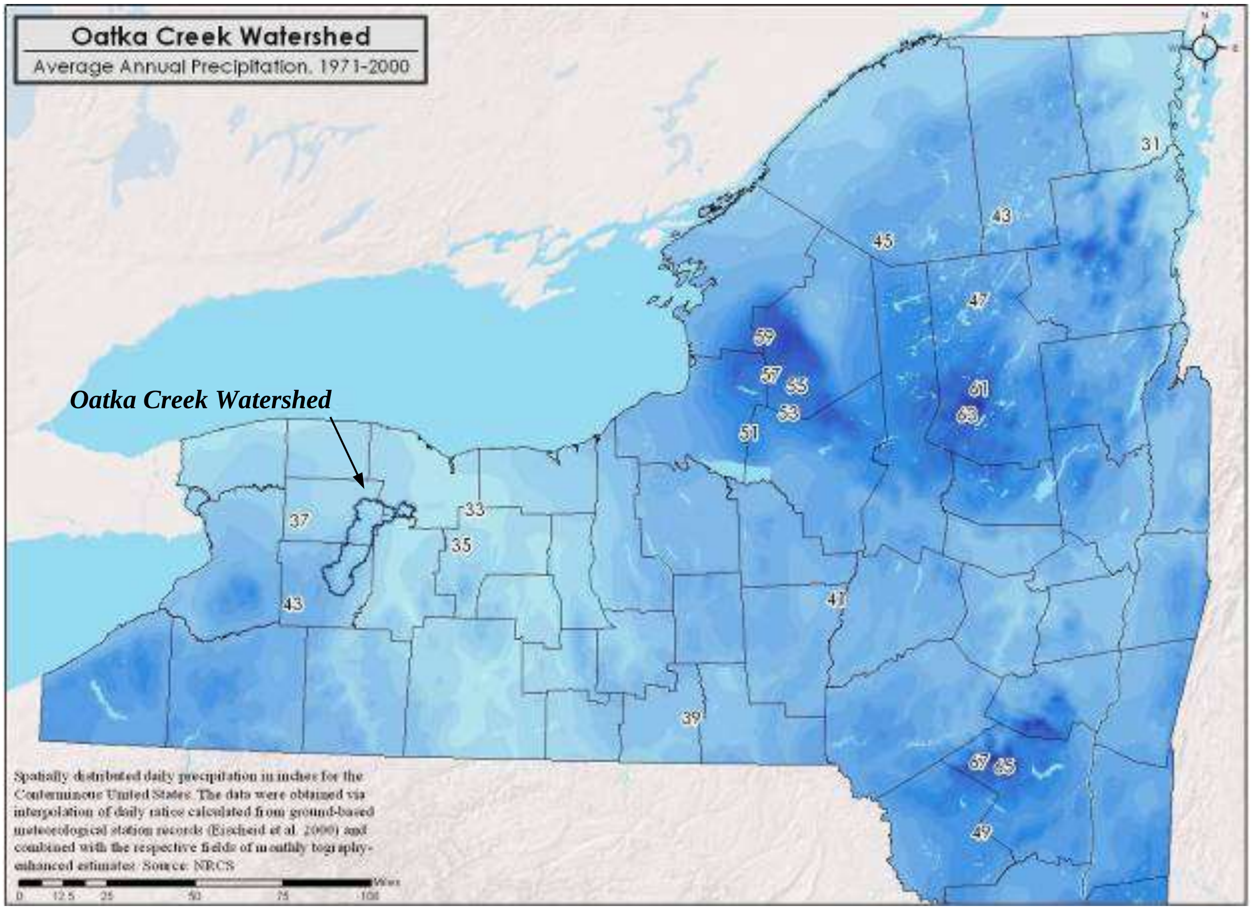
2.4.2 Precipitation

As the map in Figure 2.8 illustrates, average annual precipitation in the Oatka Creek watershed ranges between 33 and 43 inches per year, depending on the location within the watershed.

Monthly precipitation is at a minimum during winter whereas maximum amounts occur late in spring and in summer. The variation of seasonal precipitation is relatively small, even in comparison with other parts of New York State. During the May-September portion of the growing season, the average total precipitation is approximately 14 to 16 inches. These amounts make up to 45 – 50% of the total annual precipitation. Snowfall is frequently heavy, both in terms of individual storms and monthly amounts. The snowfall season usually begins in early or mid-November and continues through the early half of

April. The average winter snowfall is 90 to 100 inches and there is little variation throughout the watershed. Precipitation on the average is evenly distributed in winter.

Figure 2.8: Average Annual Precipitation for NYS



Section 2 Endnotes

[2] Hydrologic Units. [Online] In *United States Geologic Survey*. Retrieved 6/7/11 from http://water.usgs.gov/nawqa/sparrow/wrr97/geograp/geograp.html

[3] 1 acre = 43, 560 sq. ft = 0.0015625 sq. miles; town acreage calculations exclude area of villages & cities within.

[4] Calculations based on NHD HUC 10 watershed boundary. Municipalities that have less than 1% of their total land area within the watershed are listed in italics; these will be excluded from detailed analysis in this report. Municipalities marked with an asterisk '*' also have significant land area within the Black Creek watershed and will therefore receive similar focus and analysis in that watershed's respective management plan.

[5] Adapted from *Ecoregions of New York* map. [Online] In *New York State Department of Environmental Conservation*. Last viewed 1/3/11 at http://www.dec.ny.gov/about/66718.html

[6] Adapted from US Department of Agriculture Soil Surveys for Genesee, Livingston, Monroe, Orleans and Wyoming Counties. 1969 – 1973

3.0 Physical Characteristics Of the Watershed

"Maintenance of aquatic ecological integrity requires that we understand, not only the biological, chemical, and physical condition of water bodies, but also landscape condition and critical watershed attributes and functions, such as hydrology, geomorphology, and natural disturbance patterns."[7]

– An excerpt from *Identifying and Protecting Healthy Watersheds*, a publication of the U.S. Environmental Protection Agency. (Page 2-1)

Section 3.0 includes a selection of existing land cover, hydrologic, and other geo-spatial data sources in an effort to provide an accurate description of the primary physical characteristics of the Oatka Creek watershed. All of this information can be applied in an integrated assessment of watershed health and function at various scales. Opportunities for identifying or developing new data sources and data applications and integrating them with other monitoring and assessment approaches should be sought out as the watershed planning process evolves.

The assessment evaluates the Oatka Creek watershed and its physical components in an effort to provide a more complete understanding of the watershed's landscape and hydrologic conditions. By doing so, planners can begin to establish local protection and restoration priorities that will continue to be refined through the overall watershed management planning process. Specifically, the watershed management process will continue to utilize and refine this information in an effort to evaluate and rank subwatersheds and identify priority subwatersheds and focused management actions for those areas.

3.1 Geology

A brief overview of significant geologic features within the Oatka Creek watershed is provided below. Where deemed applicable, the comprehensive overview of geology that was conducted for the *Black Creek Watershed State of the Basin Report* have been included here for general reference to conditions in the neighboring Oatka Creek watershed.

3.1.1 Bedrock Geology

Bedrock geology in The Oatka Creek State of the Basin Report as follows:

> The bedrock geology of the Oatka Creek watershed is complex and variable…A major distinction in the bedrock geology can be made between the Upper and Lower Oatka. From the headwaters in Wyoming County to LeRoy, the bedrock consists of primarily shales and limestone from several geological groups (e.g. Hamilton, Genesee, Sonyea, West Falls). Downstream of the Village of LeRoy, the stream flows over the Onondaga limestone. In fact, just north of LeRoy, some stream water flows underground from a point upstream of Buttermilk Falls and reemerges from springs located downstream of Buttermilk Falls. The watershed in this region of the Lower Oatka is primarily limestone, Akron dolomite, gypsum, and some shale…The different bedrock types along Oatka Creek affect the water quality along the length of the creek…[8]

Furthermore, a comprehensive account of the bedrock geology for the adjacent Black Creek watershed was provided by SUNY Brockport in the *Black Creek Watershed State of the Basin* report. While the Oatka Creek watershed does have a number of variations and distinctions from its neighbor to the north, the description nonetheless provides valuable insight regarding the ancient geologic history of the area:

> Approximately 360 to 440 million years ago during the Devonian and Silurian periods of the Paleozoic Era, unconsolidated sediments were deposited when the region now containing the Black Creek Watershed was part of a continental sea (Isachsen and others, 1991). At this time the Appalachian Mountains were uplifting to the east, and the Michigan Basin to the northwest was subsiding. Paleozoic sediments, including clay, fine sand, limestone, rock salt and gypsum, were eventually compacted into rock formations.
>
> The bedrock of the Black Creek Watershed originated from this sediment deposition and compaction. Silurian to middle Devonian age bedrock is primarily limestone and dolostone while late Devonian age bedrock consists mostly of shales with some interbedded siltstone and limestone…Paleozoic strata dip to the south at approximately one degree resulting in the exposure of younger bedrock to the south and older bedrock to the north. After deposition, lithification, uplift and erosion, the bedrock was then subjected to a long period of erosion prior to the glaciations that affected the landscape of western New York. Permeable bedrock formations serve as groundwater aquifers and participate in both recharge and discharge between deeper bedrock aquifers and the surface water flow of Black Creek and its tributaries.
>
> The Clarendon-Linden fault zone is a regional compressive fault system that crosses western New York in general north-south direction. This fault zone crosses the western side of the Black Creek Watershed. Three prominent fault segments, known as splinter faults, are identified across the watershed…This fault zone is seismically active and has generated low to moderate scale historic earthquakes with a sporadic and poorly known recurrence level.[9]

Bedrock geology, including many of features described above, can be found in Map 15 in Appendix A.

3.1.2 Surficial Geology

As with bedrock geology, the description of surficial geology prepared by SUNY Brockport in the *Black Creek Watershed State of the Basin* report can be extended to the Oatka Creek watershed:

> Glaciation over the last two million years had a dramatic influence in shaping surface topographic features in the [region]. An ice sheet of greater than one mile in thickness advanced and retreated several times across western New York during the Pleistocene Epoch (Isachsen and others, 1991). Repeated advances and retreats of glaciers were the primary influence on landscape processes in the Black Creek Watershed, however, most landscape features owe their origins to the last glaciation from about 30,000 to 10,000 years ago.
>
> Ice advance scoured bedrock with resistant rock formations persisting as higher areas and less resistant bedrock being carved into landscape lows. A thin blanket of glacial till was spread across most areas and distinct elliptical drumlins pointing to the southwest mark the local ice advance flow direction. Brief pauses in ice retreat resulted in deposition of moraine ridges…Ice stagnation created broad areas of hummocky topography to the north of the moraine ridges. The ice stagnation areas are locally interrupted by kames, eskers and outwash deposits formed by melt water within the glacier or flowing beyond the glacial margin. After glacial ice retreated from the [region], lake deposits, mucklands and stream alluvium partly infilled the lowest topographic areas. Modern streams flow in these low floodplain areas and continue to nourish wetland swamps and deposit alluvial sediments.
>
> Surficial sediments provide the geologic parent material for soil formation, contribute significantly to the infiltration and storage of precipitation, are a source of sediment load to surface waters, comprise a sizable groundwater aquifer system and provide recharge to deeper bedrock aquifers.[10]

Map 10 in Appendix A illustrates these features.

3.1.3 Karst Features and Shallow Soils

In 2010 the U.S. Geological Survey published the scientific investigative paper titled *Hydrogeologic and Geospatial Data for the Assessment of Focused Recharge to the Carbonate-Rock Aquifer in Genesee County, New York*.[11] This study stemmed from concern expressed by local officials regarding chemical and bacteriological contamination in carbonate-rock aquifers present across Genesee County, commonly referred to as the "karst area." The report describes the general characteristics of the carbonate-bedrock aquifer and overlying soils and unconsolidated deposits and presents geospatial information on factors that affect where focused recharge and surface contaminants have the highest potential to enter the carbonate-rock aquifer. Genesee County SWCD is presently using this information to guide its AEM planning activities. In addition, they are coordinating with other agencies and local offices such as the Genesee County Department of Health to assist farmers and landowners in the karst area with problems that have occurred related to fertilizer application and groundwater contamination. A direct result of these efforts is the document *Manure Management Guidelines for Limestone Bedrock/Karst Areas of Genesee County, New York: Practices for Risk Reduction*.[12] The document outlines the manure management practices for the karst area of Genesee County, New York. The paper notes that the risk reduction practices may also be effective in karst and other sensitive areas throughout New York State.

GIS data pertaining to the karst area prepared by the USGS is provided on Map 21in Appendix A of this report.

3.1.4 Mines

Map 18 in Appendix A illustrates a total of 13 active and inactive mines in the Oatka Creek watershed that are identified in the NYSDEC Mined Land Reclamation Program database maintained by the NYS DEC. A summary of information on those facilities is provided in Table 3.1; unabridged information on those facilities can be found online at the referenced source.

Table 3.1: NYS DEC Mined Land Reclamation Program Database Records for the Oatka Creek Watershed[13]

Mine Name (as listed)	County	Status	Commodity	Total acres affected by mining since 1975	Life of mine acres
Reynard's Pit	Wyoming	Reclaimed	Sand and Gravel	1	1
Schillaci Pit	Wyoming	Active	Sand and Gravel	2	2
Johnson Gravel Pit	Wyoming	Active	Sand and Gravel	3	49
Wick Gravel Pit	Wyoming	Reclaimed	Clay	8	8
Herman Gravel Pit	Wyoming	Reclaimed	Sand and Gravel	8	8
Wright Pit	Wyoming	Active	Sand and Gravel	8	8
Trademark Sand And Gravel Pit	Wyoming	Active	Sand and Gravel	10	27
Ewell Gravel Pit	Wyoming	Reclaimed	Sand and Gravel	2	2
Keith Herrmann Gravel Pit	Wyoming	Reclaimed	Sand and Gravel	2	9
Dill Brothers Pit	Wyoming	Active	Sand and Gravel	3	15
Offhaus Gravel Pit	Wyoming	Reclaimed	Sand and Gravel	19	19
Starr Pit	Genesee	Reclaimed	Sand and Gravel	2	2
Marta	Genesee	Active	Sand and Gravel	5	5
Macduffie Pit	Genesee	Active	Sand and Gravel	41	70

Leroy Quarry	Genesee	Active	Limestone	211	454
Leroy Quarry	Genesee	Active	Limestone	109	142
Circular Hill Quarry	Genesee	Active	Sand and Gravel	52	62
Stevens Pit	Genesee	Unknown	Sand and Gravel	13	13
Diehl Sand And Gravel	Genesee	Active	Sand and Gravel	34	60
Route 19 Pit	Genesee	Reclaimed	Sand and Gravel	4	4
North Road #2	Genesee	Reclaimed	Sand and Gravel	5	5
Seldon Road Pit	Genesee	Reclaimed	Sand and Gravel	10	10
Bishoping Mine	Genesee	Reclaimed	Marl	17	17
Clark Marl Mine	Genesee	Active	Marl	12	12

Natural gas has been commercially drilled in New York State since 1821. It has been piped to towns for light, heat, and energy since the 1870s. The first storage facilities were developed in 1916. Hydraulic fracturing of vertical wells was first used in New York to develop low permeability reservoirs in the Medina Group around the 1970s-80s. Six new Trenton-Black River plays (underground reservoir rocks with fossil fuels) were discovered in 2005. There are dozens of plays across the country. Soon New York State may witness its first Marcellus Shale 'play'.

Recent advances in horizontal drilling and hydraulic fracturing have allowed extraction of natural gas from deep gas shale reserves, such as the Marcellus shale, to be economically feasible. The Utica Shale is a deeper and more expansive formation that may also have economic viability for the state. The shale must be below approximately 3,000 ft. of overlying rock before it is a successfully play.

The increased demand for cleaner energy and the proximity of these reserves to the Northeast's population hubs makes these particular 'plays' significant. There are certain financial benefits landowners may receive for leasing their land and certain economic gains a community could reap, but there will be challenges and costs that are associated to these benefits.

The New York State Department of Environmental Conservation is developing the generic environmental impact statement to permit high volume hydraulic fracturing natural gas by horizontal well extraction. Many wells that are not considered high volume hydraulic fracturing wells have already been permitted. The developing horizontal well regulations are designed to ensure that all natural gas extraction is safe, does not significantly disrupt the natural flow of surface (or ground) water to make the hydrofracking fluids, and hydrofracking fluids will be disposed of safely as to not pollute our local water sources. This is vital as the surface and ground water is the source for Class AA drinking water for residents in the watershed.

3.2 Soils[14]

Soil conditions in the Oatka Creek watershed were described as follows on the website of the Oatka Creek Watershed Committee:

> Subsequent to glacial retreat and the formation of north-south hills and valleys, water flowing off the hills carried away topsoil and produced deep fertile valley soils. Underlying much of the watershed soil are shales and sandstone, of varying thickness. Where severe valley wall erosion cuts through these layers, local cascades formed. Valleys and northern slopes are a mixture of alluvial deposits and glacial gravel, producing well-drained, fertile and highly productive soils. In some locations, soils containing small particles produce heavy clay…Below Buttermilk Falls…overlying soils are mainly limestone-derived loams to the west, tending towards sandy

> loams to the east, interspersed with areas of muck. The buffering action of the limestone underlying the stream and its major tributary, Spring Creek, and surrounding lands, contributes greatly to the water quality of the lower stream.[15]

Maps illustrating soils can be found in Appendix A of this report.

3.2.1 Hydrologic Soils

According to the NRCS, a hydrologic group is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are: depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover should be treated independently.

Hydrologic soil groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for planning or designing structures for the use, control, and disposal of water.

Assignment of soils to hydrologic groups is based on the relationship between soil properties and hydrologic groups. Wetness characteristics, water transmission after prolonged wetting, and depth to very slowly permeable layers are properties used in estimating hydrologic groups.[16]

This report defines four hydrologic soil groups: A, B, C, and D. An analysis of the four soil categories in the Oatka Creek watershed yielded the following results:

Table 3.2: Hydrologic Soil Groups in the Oatka Creek Watershed

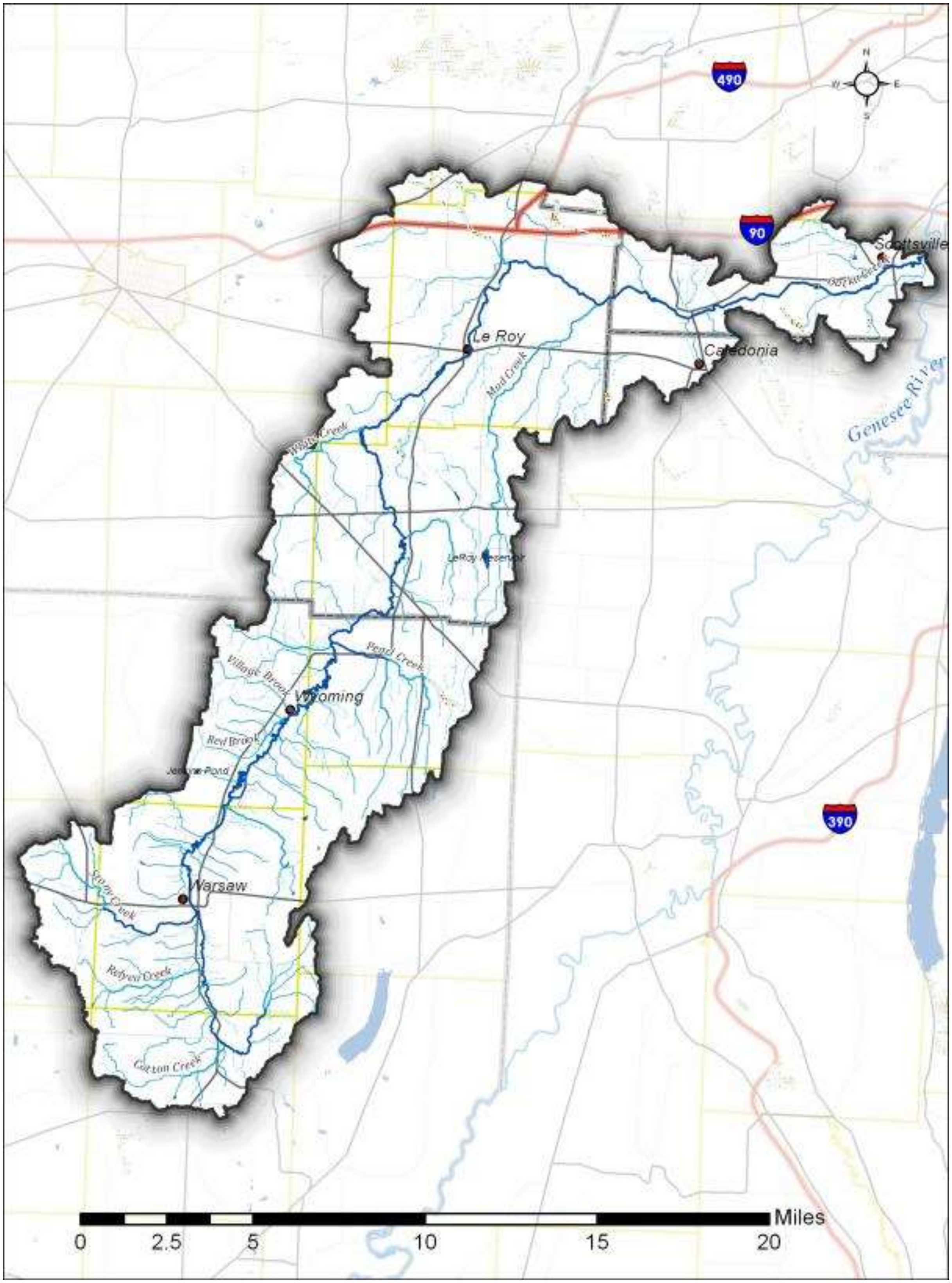
Hydrologic Soil Groups (HSGs)	Total Acres	% of Watershed Cover
HSG A: Low runoff potential when thoroughly wet; water is transmitted thoroughly through the soil. Group A soils typically have less than 10% clay and more than 90% sand or gravel and have gravel or sand textures.	7,154.4	5.2%
HSG B: Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10% and 20% clay and 50% to 90% sand and have loamy sand or sandy loam textures	61,039.3	44.2%
HSG C: Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20% and 40% clay and less than 50% sand and have loam, silt loam, sandy clay loam, and silty clay loam textures	51,520.3	37.3%
HSG D: Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have layer textures. In some areas, they also have high shrink-swell potential.	18,380.2	13.3%

3.3 Hydrology[17]

Hydrology is determined by a complex interaction between geology, groundwater, climate, physiography, and land cover. Perhaps the most distinctive trait that characterizes the topography and, in turn, hydrology of the Oatka Creek watershed is that it lies within an area of North America that has been largely influenced by prolonged periods of glaciation. As a general rule, groundwater flow beneath western New York is northward from the Allegheny Plateau through the Eastern Great Lakes Lowlands with ultimate discharge into Lakes Erie and Ontario [refer to Ecoregions map under Section 2.3]. Local deviations from this regional northward flow pattern may occur in response to small changes in topography caused by drumlins, beach ridges, recessional moraines, or bedrock escarpments. In addition, shallow groundwater flow paths may locally be affected by discharges into surface waters or withdrawal from surface waters.

The following sections describe the hydrologic features and properties of the Oatka Creek watershed and how their function relates to watershed management.

Figure 3.1: Streams and Primary Waterbodies in the Oatka Creek Watershed



3.3.1 Hydrologic Overview

An excellent overview of the hydrology of the Oatka Creek watershed is provided on the website of the Oatka Creek Watershed Committee [note: elevation figures referenced herein have been revised for accuracy; emphasis added to indicate features shown on Figure 3.1]:

> Tributaries in central Wyoming County, the eastward trending ***Cotton Creek*** in Gainesville, and ***Relyea*** and ***Stony Creeks*** in Warsaw drain the western highlands; small streams drain the eastern highlands, and the junction of this drainage creates ***Oatka Creek***. As the Oatka progresses north through the Wyoming Valley, several unnamed seasonal tributaries drain west and east valley walls, bringing water from the hilltops at [approximately 1,900] feet elevation to 950 feet in the valley. The Oatka Creek itself falls only about five feet as it winds its way from Warsaw to Wyoming. ***Pearl Creek***, originating in Covington at an elevation of [1,400] feet, joins the Oatka Creek a short distance south of the Genesee County line. ***White Creek*** drains the towns of Bethany (elevation 1,020 feet) and Pavilion (elevation 910 feet). ***Mud Creek***, rising southeast of the LeRoy Reservoir (elevation 1,058 feet), drains in a NE direction before joining Oatka Creek 2 1/2 miles east of Buttermilk Falls [elevation 775 feet at crest] at an elevation of 630 feet. Few significant tributaries enter the Oatka between ***Mud Creek*** and the Hamlet of Mumford, where ***Spring Creek*** and some smaller limestone spring-fed streams that rise in the Onondaga limestone in Caledonia enter from the south, infusing the stream with high purity water and moderating both winter and summer water temperatures in the downstream reaches. Oatka Creek joins the ***Genesee River*** east of Scottsville at an elevation of [512] feet.[18]

Further valuable information on the LeRoy Reservoir was noted in *The Oatka Creek Watershed State of the Basin Report*:

> The Village of LeRoy use[d] a small reservoir, [***LeRoy Reservoir***], located on Mud Creek….The reservoir was built in 1915 and…has a surface area of approximately 59 acres, a maximum depth of 25 feet and an average depth of 10.5 feet. Daily water use range[d] seasonally from approximately 700,000 gallons per day to occasionally over 1,300,000 gallons per day in summer months... [***LeRoy Reservoir***] serves as a settling basin for nutrients and sediment that enter it from the headwaters of Mud Creek. These materials probably remain in Lake LeRoy and do not flow downstream toward Oatka Creek. The water level in the reservoir is usually below the top of the spillway except in the late winter and spring months. At those times, water from the headwater regions of Mud Creek and from [***LeRoy Reservoir***] will flow downstream in Mud Creek and, ultimately, to Oatka Creek.[19]

LeRoy Reservoir is no longer used as a public drinking supply and was sold to Noblehurst Farms in 2009. Further information on specific hydrologic characteristics of the Oatka Creek watershed are provided under Section 3.1; information on water quality is provided in Section 5 of this report.

3.3.2 Oatka Creek Watershed Stream Network and General Flow Statistics

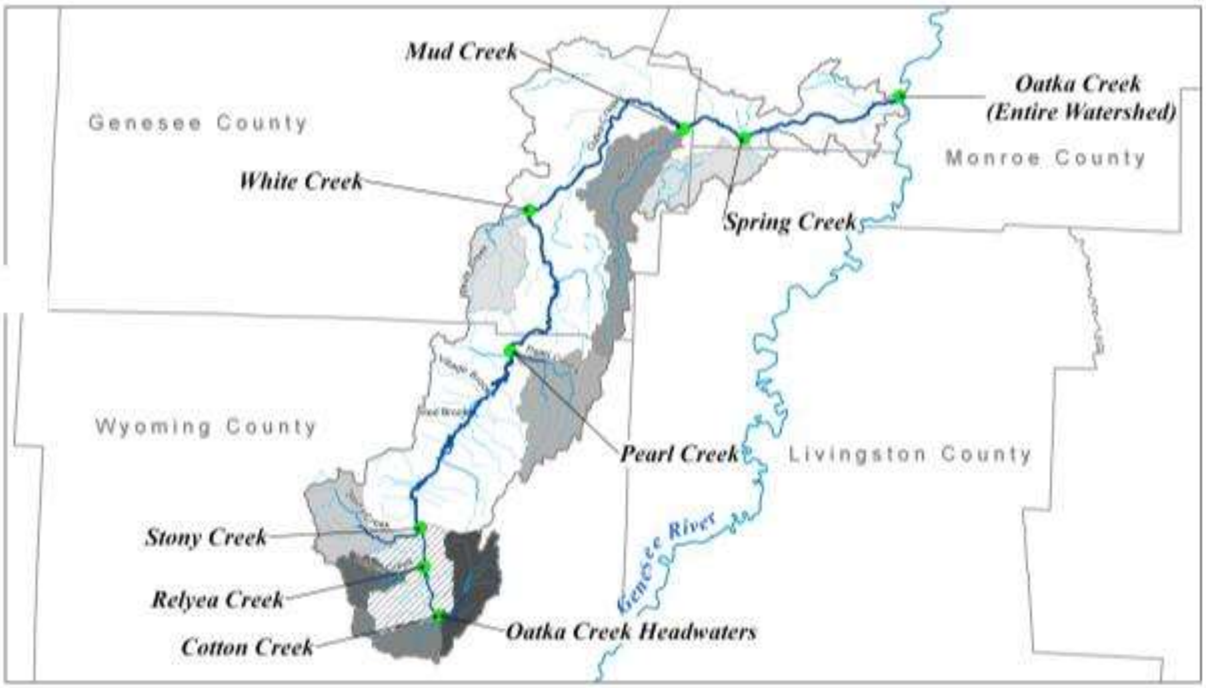
General flow statistics and other fundamental characteristics of the hydrologic network in the Oatka Creek have been summarized in Table 3.3. These data were derived from two primary sources – GIS analysis of the National Hydrography Dataset (NHD) and through the web-based USGS New York StreamStats GIS application. StreamStats allows users to obtain streamflow statistics, basin characteristics, and descriptive information for USGS data-collection stations and user-selected ungauged sites.[20] The program can estimate streamflow statistics for ungauged sites either on the basis of regional regression equations or on the basis of the known flows for nearby stream-gauging stations. All of the flow statistics provided in Table 3.3 are estimates that were derived through a combination of these approaches.

Table 3.3: Characteristics of Streams and Associated Subwatersheds in the Oatka Creek Watershed

	Oatka Creek Watershed	Spring Creek	Mud Creek	White Creek	Pearl Creek	Upstream of Warsaw (including Stony Creek)	Stony Creek	Relyea Creek	Cotton Creek	Headwaters (above Cotton Creek)
Drainage Area (Miles^2)	**216**	8.62	16.3	9.2	13.7	39	9.3	4.06	5.1	8.6
Main Channel Stream Length (Miles)*	**62.5**	9.68	14	7.9	8.6	11.5	7.8	5.31	5.85	6.4
Total Stream Network Length (Miles)	**430.2**	17.2	25.1	16.3	37.2	102	22	13.1	25	55.9
Mean Annual Precipitation (inches)	**33.7**	30.4	31.6	34.7	33.1	37.3	38.6	39.1	37.9	35.2
Mean Annual Runoff (inches)	**14.2**	10.4	12	15	14.1	18.2	19.4	19.9	18.8	15.9
Basin Lag Factor (hours)	**3.42**	.33	.36	.24	.2	.22	.07	.04	.09	.19
Basin Storage**	**.62**	.26	.68	.27	.35	.54	.4	.81	.61	.95
Average basin slope (feet per mi.)	**277**	101	161	238	394	335	320	300	305	264
Minimum daily flow (cfs)	**13**	--	--	--	--	--	--	--	--	--
Maximum daily flow (cfs)	**6,500**	--	--	--	--	--	--	--	--	--
Average daily stream flow (cfs)	**215.386**	--	--	--	--	--	--	--	--	--
Mean Annual Flow (cfs)	**213**	--	--	--	--	--	--	--	--	--

*Stream lengths vary here from those listed in Section 3.3.1 due to variations in calculation method. StreamStats includes braided channels and other intermittent stream reaches, creating greater stream lengths in some cases
**Defined as the percentage of total drainage area of identified lakes, ponds and swamps

Figure 3.2: Streams and Associated Watersheds Assessed Using StreamStats



Recent work by Prof. Paul Richards and his students in the Dept. of Earth Sciences at SUNY Brockport indicates how important the karst geology of the region is to its hydrology. Sinkholes and fissures in the bedrock redirect surface flows into groundwater conduits that may appear far downstream in seeps and springs. Mud Creek, for example, which appears to be an important tributary of Oatka Creek, apparently loses much of its flow to a large sinkhole such that surface flow in the creek makes it past this sinkhole only under high-water conditions, and Mud Creek's contribution to the discharge of Oatka Creek is unimportant. The flow of Spring Creek, which joins Oatka Creek near the Village of Mumford downstream from the mouth of Mud Creek, is largely groundwater-fed from springs and seeps and is not very affected by meteorological events. The source of this groundwater is probably sinkholes along NYS Route 5 and Mud Creek. A large sinkhole in the main channel of Oatka Creek above Buttermilk Falls, where the Onondaga Limestone Formation surfaces, diverts much of the surface flow into sub-surface flow, some of which rejoins the creek below the falls. Measurements of flow along the creek indicate that not all of this flow rejoins the creek here, however, and discharge of Oatka Creek downstream from the sink hole remains lower than that above all the way to the creek's convergence with the Genesee River near Garbutt.[21] (*Using a Mixing Model to Estimate Complex Mixtures within Conduits of Dissolution Karst: A Case Study near Le Roy, NY*, by Jill Libby).

3.3.3 Flood Recurrence Intervals[22]

Flood recurrence refers to the probability that a river will reach flood stage – maximum instantaneous flow – in a given period of time. These estimates are based on regional historical data about rainfall volumes and stream stage. In other words, a 100-year flood has a 1 percent chance of happening in any given year. The USGS StreamStats application was used to generate estimates of peak flows for the Oatka Creek watershed and subwatersheds; these results are provided in Table 3.4.

Table 3.4: Estimated Peak Flow Statistics for Selected Recurrence Intervals (all flow levels measured in cubic feet per second)										
	Oatka Creek	Spring Creek	Mud Creek	White Creek	Pearl Creek	Upstream of Warsaw (including Stony Creek)	Stony Creek	Relyea Creek	Cotton Creek	Headwaters (above Cotton Creek)
2 Year Peak Flood (50% chance)	**3.320**	241	388	348	543	1,520	602	305	331	371
5 Year (20% chance)	**4,780**	349	561	505	832	2,330	936	484	515	578
10 Year (10% chance)	**5,780**	420	676	606	1,030	2,890	1,170	607	641	720
25 Year (4% chance)	**7,110**	508	822	736	1,290	3,640	1,470	775	810	913
50 Year (2% chance)	**8,080**	572	929	829	1,480	4,210	1,710	902	936	1,060
100 Year (1% Chance)	**9,070**	633	1,030	921	1,680	4,800	1,940	1,030	1,060	1,200
200 (.5% chance)	**10,100**	697	1,140	1,020	1,890	5,420	2,190	1,170	1,200	1,360
500 Year (.2% chance)	**11,500**	775	1,280	1,140	2,160	6,260	2,530	1,350	1,380	1,560

3.3.4 Floodplains[23]

The National Flood Insurance Program (NFIP) is a federal program that enables property owners to purchase affordable flood insurance. Before the NFIP, flood insurance was generally unavailable. The program is based on a partnership between communities and the federal government in which the community adopts floodplain management regulations to reduce flood risks and the federal government makes flood insurance available within the community.

The National Flood Insurance Program uses the 100-year flood as the standard on which to base its regulations. This is a national standard used by virtually every Federal and most state agencies, including New York State agencies, in the administration of their programs as they relate to floodplains. The technical and engineering methods involved in determining the magnitude of these floods are well established. Although the 100-year flood is the event that is estimated to have a one percent chance of being equaled or exceeded each year, there is no guarantee that a flood of this magnitude could not occur in fewer than 100 years or that one will necessarily occur in each 100 year period at a precise location.

Flood Insurance Rate Maps (FIRM) are produced by the Federal Emergency Management Agency and provide the official record of special flood hazard areas. While paper or flat FIRM maps are generally available online for every community in the Oatka Creek watershed, corresponding digital GIS data pertaining to the flood boundary is not available for every Oatka Creek watershed community through state or federal agencies. Furthermore, some portions of watershed communities have never been mapped by FEMA at all, creating significant and sometimes perplexing gaps in the floodplain record. (In order to create efficiencies in the mapping process, FEMA likely elected to skip certain areas that were not prone to frequent flooding or had low population density). Information provided by FEMA has been combined with information created by local offices and agencies in an effort to provide comprehensive picture of the 100-year flood zone across the entire Oatka Creek watershed.

Map 7 in Appendix A illustrates those areas identified as within the 100-year flood zone. While these boundaries are generally very close to the actual boundaries as indicated on official FIRM maps, some variation is evident from place to place. Maps and associated data are therefore for planning purposes only and should not be used to determine the level of flood hazard in any particular area.

Table 3.5: Analysis of 100-Year Flood Zone in the Oatka Creek Watershed

Subwatershed	Acres at or below 100-year flood elevation	% of Subwatershed Area	% of Oatka Creek Watershed Area
Oatka Creek Headwaters	289.56	1.2%	0.2%
Pearl Creek	1,818.05	5.0%	1.3%
White Creek	1,045.58	4.1%	0.8%
Mud Creek	316.07	3.0%	0.2%
Village of LeRoy	934.74	5.1%	0.7%
Oatka Creek Outlet	1,655.14	7.4%	1.2%
Oatka Creek	**6,059.14**	**4.4%**	--

Analysis of the 100-year base flood elevation (1% flood risk) indicated that 4.4% of the total land area within the Oatka Creek watershed is within this zone. The Oatka Creek Outlet subwatershed has the highest concentration of lands in the 100-year floodplain, with 1,655 acres accounting for 1.2% of total watershed area. Full results of this analysis are provided in Table 3.5:

3.3.5 Water Withdrawals

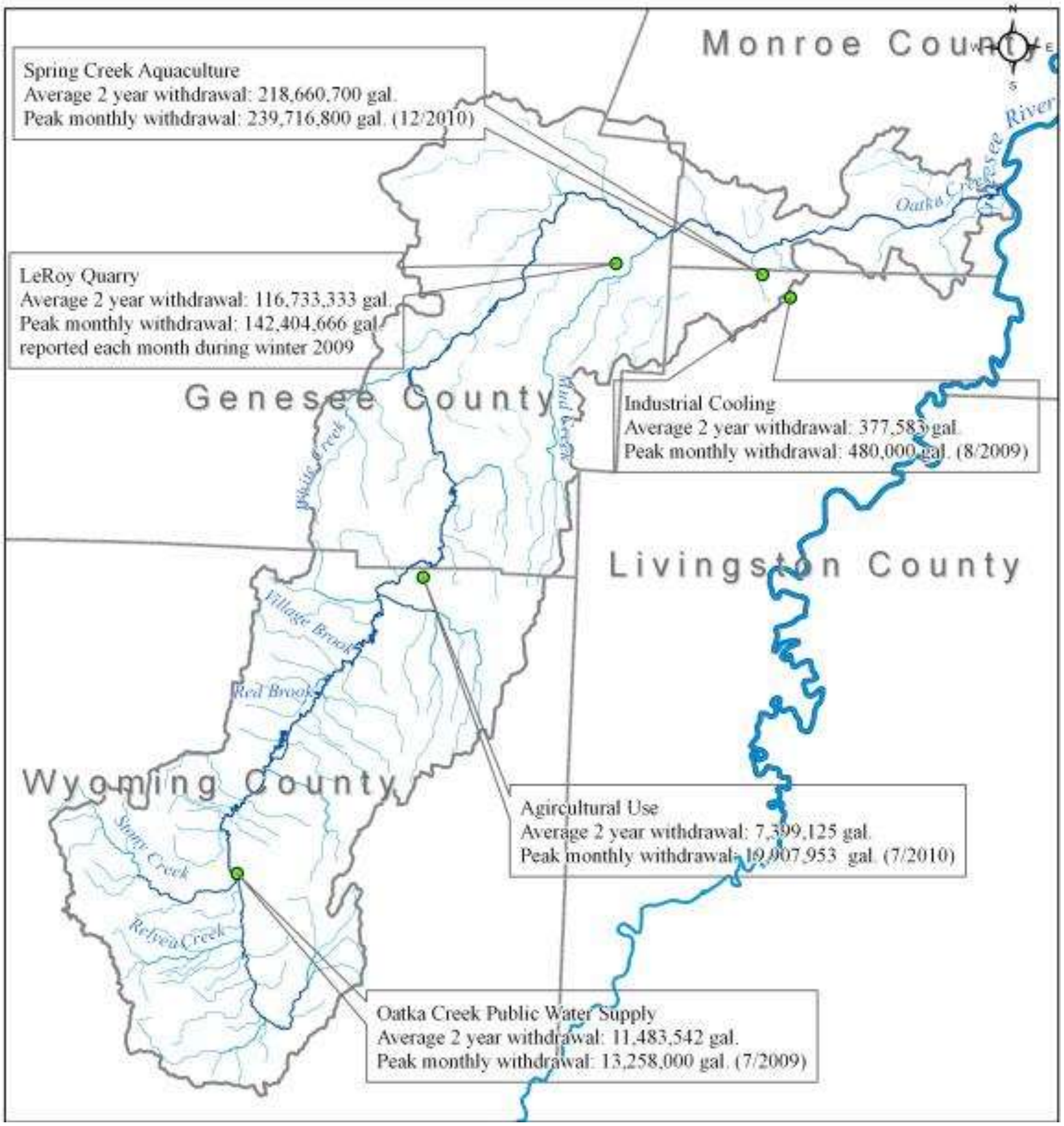
In accordance with ECL Article 15 Title 33 (Water Withdrawal Reporting), NYSDEC maintains records on water withdrawals in excess of 100,000 gallons of water per day.[24] Figures for the Oatka Creek watershed were requested for the Oatka Creek watershed and provided for a 2-year time period during the years 2009 and 2010. The results of those figures have been summarized on Figure 3.3:

Data provided are only the facilities that voluntarily provided the data to DEC; the Department notes that there may be others that they are not aware of. DEC reports the type of facility (Use Sector) and listed what that facility reported as their water supply source; latitude and longitude coordinates were also provided which were used to generate points on the map. None of the facilities that provided data indicated that water is diverted out of their basin. It can therefore be assumed that the water is returned to its source.

3.3.6 Strahler Stream Order

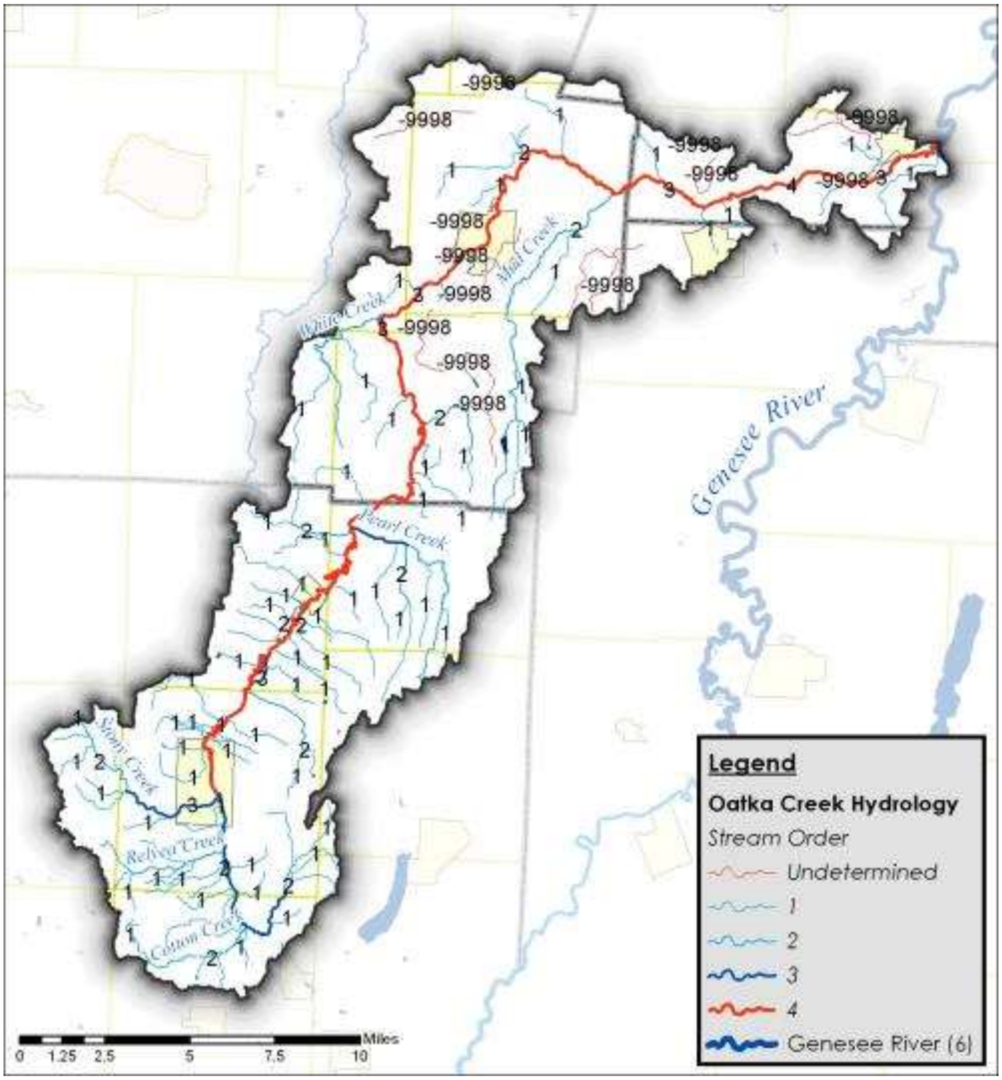
The Oatka Creek watershed has streams that range in order from 1 (first order/smallest streams) to 4. As shown in the map below, Oatka Creek becomes a fourth order stream very high up within the watershed in the Village of Warsaw and remains so until its confluence with the Genesee River.

Figure 3.3: Water Withdrawals Reported to NYSDEC in Excess of 100,000 gal, 2009 – 2010



The method by which stream order is derived for the NHD is not perfect; the technique does at times yield erroneous results. One will note, for example, the presence of a number of disconnected stream segments found throughout the watershed. The GIS logarithm used to calculate stream order is unable to determine values for disconnected flow lines. These segments are labeled by the GIS as "-9998" which indicates that the stream order value for the flow line is missing or undetermined. Some of these isolated flow lines are indeed mapping errors, while many others are actually streams that are influenced by the Karst region of the watershed and effectively disappear underground (see Section 3.1.3 for an explanation of Karst topography in this watershed). A number of these streams, however, do in fact connect to the stream network throughout most of the year and require field verification. This does not affect the output of the stream order classification for the major tributaries in the watershed and helps to identify those areas that may be under the influence of unique geologic conditions.

Figure 3.4: Strahler Stream Order Derived from the National Hydrologic Dataset



3.3.7 Wetlands

Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface.[25] Wetlands serve a number of important functions within a watershed, including sediment trapping, chemical detoxification, nutrient removal, flood protection, shoreline stabilization, ground water recharge, stream flow maintenance, and wildlife and fisheries habitat. Numerous federal and state laws affect the use and protection of wetlands. Because no single one of these laws was specifically designed as a comprehensive policy for wetlands management, understanding how and when the various laws and levels of regulation apply can be confusing.

The principal federal laws that regulate activities in wetlands are Sections 404 and 401 of the Clean Water Act, and Section 10 of the Rivers and Harbors Act. Wetlands, as defined under the Federal Clean Water Act, are: "…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."[26]

In 1986, the Emergency Wetlands Resources Act mandated that the US Fish and Wildlife Service complete the mapping and digitizing of the nation's wetlands. The result is the Wetlands Geospatial Data Layer of the National Spatial Data Infrastructure. This digital data provides highly detailed information on freshwater wetlands and ponds with numerous classifications and sub-classifications. Federal wetlands (referred to as the National Wetlands Inventory (NWI)) in the Oatka Creek watershed are illustrated on Map 6 in Appendix A. A subwatershed analysis of the NWI geospatial information is provided in Table 3.6:

Table 3.6. US Fish and Wildlife Service National Wetlands Inventory for Oatka Creek Watershed

Subwatershed	Total Acreage	*Freshwater Emergent Wetland*	*Freshwater Forested/Shrub Wetland*	*Freshwater Pond*	*Lake*	*Other*	*Riverine*
Oatka Creek Headwaters	1,612.5	264.5	1,183.5	164.4	*0*	0.1	*0*
Pearl Creek	2,809.1	766.2	1,808.5	198.0	*0*	*0*	36.5
White Creek	2,689.3	259.7	2,264.1	56.0	*0*	0.3	109.2
Mud Creek	715.2	16.8	581.8	61.8	47.8	7.0	
Village of LeRoy	1,515.3	231.1	1,163.7	51.0	23.4	1.5	44.6
Oatka Creek Outlet	1,769.6	202.7	1,311.8	65.0	*0*	107.7	82.4
Oatka Creek Watershed	11,111.0	1,741.1	8,313.3	596.2	71.2	116.7	272.6

The principal New York State regulation affecting development activities in and near wetlands in the Oatka Creek watershed is the Freshwater Wetlands Act, Article 24 and Title 23 of Article 71 of the NYS Environmental Conservation Law. The NYSDEC has mapped the approximate boundaries of all freshwater wetlands of 12.4 acres or more in New York. In some cases, these maps include smaller wetlands of unusual local importance. An adjacent area of 100 feet is also protected to provide a buffer zone to the wetland.

New York State regulated freshwater wetlands in the Oatka Creek watershed are illustrated on Map 5 in Appendix A. The largest continuous wetland is located along a segment of Oatka Creek in the vicinity north of the Village of Wyoming. Fragmented wetlands are dispersed throughout the watershed but the highest concentrations of wetlands are within the Pearl Creek and White Creek watersheds.

Table 3.7. NYS Regulated Wetland Acreage by Subwatershed

Subwatershed	NYS Regulated Wetland Acreage
Oatka Creek Headwaters	521.6
Pearl Creek	1,862.9
White Creek	1,522.1
Mud Creek	274.5
Village of LeRoy	987.5
Oatka Creek Outlet	881.1

Oatka Creek Watershed	6,049.7

Results of a geographic analysis of the NYS regulated wetland areas by subwatershed is provided in Table 3.7.

3.3.8 Understanding the Active River Area

The Nature Conservancy recently developed an approach to address river health in areas directly adjacent to streams. This "active river area" framework can be used as a tool to inform conservation, restoration and management of riparian areas and entire watersheds. This approach to riparian planning and protection is described in the TNC manual, *The Active River Area: A Conservation Framework for Protecting Rivers and Streams*:

> River health depends on a wide array of processes that require dynamic interaction between the water and land through which it flows. The areas of dynamic connection and interaction provide a frame of reference from which to conserve, restore and manage river systems. We choose the term active river area to define this framework. "Active" indicates the dynamic and disturbance-driven processes that form and maintain river and riparian systems and their associated habitats and habitat conditions. "River area" represents the lands that contain both of aquatic and riparian habitats and those that contain processes that interact with and contribute to a stream or river channel. The *active river area* framework offers a more holistic vision of a river than solely considering the river channel as it exists in one place at one particular point in time. Rather, the river becomes those lands within which the river interacts both frequently and occasionally.[27]

The active river area, therefore, is a critical area in which watershed restoration and protection efforts should be focused. Defining the active river area on a watershed-wide scale, however, can be challenging, as the characteristics of the active river area evolve from headwaters to outlet and are dependent on a number of variables. In the headwaters of a watershed, which typically have steeper slopes, deep "V"-shaped channels, and fewer meanders, the active river area will be relatively smaller in size as compared to downstream locations. As streams converge in these downstream areas, the active river area will tend to widen and become more dynamic, encompassing larger areas of land and generally will be subject to a larger variety of natural processes (erosion, flooding, sediment transport, debris accumulation, etc.) at varying levels of intensity.

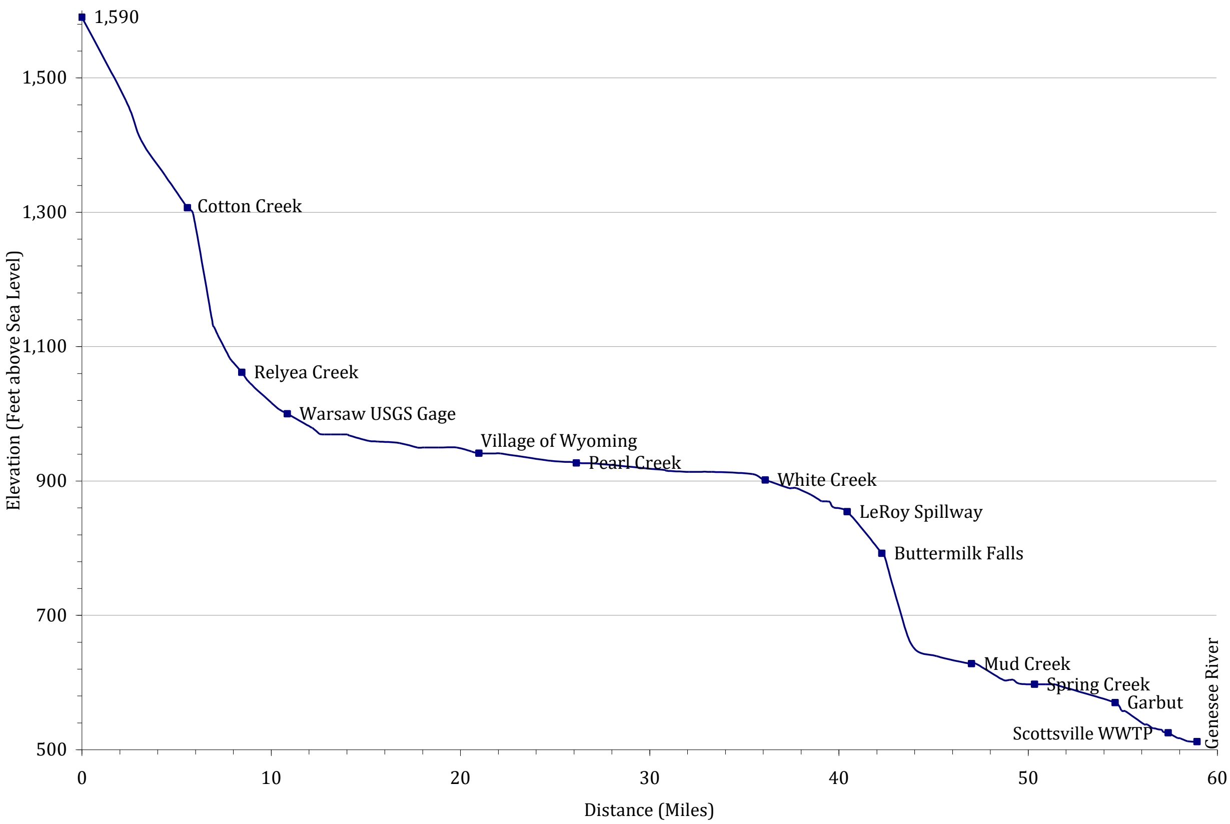
The 150 foot buffer area used for the riparian analysis above is a broad generalization and should not be construed as representative of the active river area. The active river area is comprised of five components: material contribution areas; the meander belt; floodplains; terraces; and riparian wetlands. Map 8 in Appendix A illustrates the location of these areas in the Oatka Creek watershed.

3.4 Elevation and Steep Slopes

Elevation is the vertical distance from mean sea level to a point on the earth's surface. Elevation influences the genesis of natural soil bodies and soil drainage within a landscape. Elevation in the Oatka Creek watershed was analyzed using 10 meter resolution Digital Elevation Model (DEMs) raster quads and authenticated against U.S. Geological Survey topographic maps.

Figure 3.5: Elevation Profile of Oatka Creek

The geography in the Wyoming County portion of the watershed is characterized by relatively high ridgelines and plateaus that drop steeply down into the valley in and around the Village of Warsaw. The elevation changes by as much as 1,000 feet from lowest to highest points in this portion of the watershed. The relief is partly the result of the action of the ice that entirely covered Wyoming County during the last continental glaciation and to postglacial stream cutting. As the Oatka Creek flows through Genesee and into Monroe County, relief begins to decrease, giving way to a gently rolling, hummocky landscape. Although the elevation ranges from 900 to about 1,000 feet when considering areas in the Town of Pavilion, the difference in elevation overall is generally 30 feet or less in any given part of the area,



though it is as much as 50 feet in some places. Total relief (highest to lowest points) in the Oatka Creek watershed is 435.4 meters or 1,428 feet. The maximum elevation in the watershed was determined to be 591.5 meters or 1,941 feet above sea level (located in the Town of Orangeville in the Oatka Creek Headwaters subwatershed just north of the Quaker Settlement Cemetery off of Quakertown Road). The lowest point in the watershed is at the outlet of Oatka Creek where it converges with the Genesee River; the elevation at this junction is 156.1 meters or 512 feet above sea level.

Map 14 in Appendix A illustrates the total relief and slopes greater than 15% in the Oatka Creek watershed. In addition, data included in the National Hydrography Dataset was used to produce a stream elevation profile of the main stem of the Oatka Creek, as illustrated in Figure 3.5. Elevations used in this profile are also based on the 10-meter resolution Digital Elevation Model (DEM) terrain data and represent the estimated stream elevation at the base of the stream bed (as opposed to the mean water level).

3.5 Land Use and Land Cover

Land activities and water quality are inherently linked. The types of activities that take place on the land directly influence the quality and characteristics of the water that runs off it. Understanding the characteristics of the land within a watershed area is therefore a central aspect of watershed planning. A variety of GIS data sources can be used to provide a clear understanding of how land within the watershed has been adapted to human uses, such as agriculture, residential, or commercial use. Landscape conditions can further be analyzed in order to assess elements of the watershed including natural land cover patterns, land disturbance regimes, and ecological connectivity, and how these conditions are changing over time. This information can be manipulated in a variety of ways (adjusting spatial and temporal scales, for example) to provide users with multiple applications for the management and restoration of land and water resources.

3.5.1 Land Use

Land use refers to the human purposes ascribed to the land, such as "industrial" or "residential" use. Land use can be analyzed utilizing Geographic Information System data derived from county Real Property System (RPS) tax parcel records. As explained on the New York State Department of Taxation and Finance Office of Real Property Tax Services website:

> The Assessment Improvement Law (Laws of 1970, Chapter 957) required local governments to prepare and maintain tax maps in accordance with standards established by the State Board of Equalization and Assessment (currently Office of Real Property Services). For the most part, this requirement is a county responsibility…Perhaps the most essential of all assessment tools is an adequate tax map reflecting the size, shape and geographical characteristics of each parcel of land in the assessing unit. The tax map is a graphic display of each assessing unit's land inventory and as such is the major source to the real property assessment roll. The working copy of the tax map used by the assessor can be utilized to record and analyze property transfers, to record other features pertinent to the valuation of land and in the development of a Geographic Information System (GIS). [The GIS] allows us to analyze and map the wealth of parcel level assessment information to solve problems related to: property valuation, local government reassessments, land use, environmental assessment, facility siting and economic development, public health, emergency services and disaster planning.[28]

Tax parcel information is available in GIS format from each county within the study area. Each GIS utilizes the same uniform classification system developed by the New York State Office of Real Property Services that is used in assessment administration in New York State. The system of classification consists of numeric codes in nine categories. An analysis of land use classification within the Oatka Creek watershed is shown in Table 3.8.

It is important to note that property classification and tax map maintenance is a responsibility of the county assessor's office (or equivalent). While the classification system standards are intended to create uniform results, human error and subjectivity can sometimes lead to different interpretations of property types from place to place. Some level of inaccuracy with the results in Table 3.8 should therefore be assumed. Furthermore, properties are classified primarily for the purposes of taxation and public finance, not environmental analysis. While the information aids environmental assessment, the application of these results to watershed planning has its limitations. The information is therefore presented simply to provide a snapshot of the land use within the Oatka Creek watershed and subwatersheds and to facilitate rapid assessment of watershed and subwatershed site conditions.

Table 3.8: Land Use within the Oatka Creek Watershed[29]		
Property Classification Category	**Acres**	**% of Oatka Creek Watershed Area**
Agricultural Property used for the production of crops or livestock	72,042.50	53.67%
Residential Property used for human habitation	31,312.95	23.33%
Vacant Land Property that is not in use, is in temporary use, or lacks permanent improvement	15,910.77	11.85%
Commercial Property used for the sale of goods and/or services	1,511.65	1.13%
Recreation and Entertainment Property used by groups for recreation, amusement, or entertainment	1,048.24	0.78%
Community Services Property used for the well being of the community	1,639.84	1.22%
Industrial Property used for the production and fabrication of durable and nondurable man-made goods	3,701.38	2.76%
Public Services Property used to provide services to the general public	1,328.88	0.99%
Wild, Forested, Cons. Lands & Public Parks Reforested lands, preserves, and private hunting and fishing clubs	1,853.28	1.38%
Unclassified *Property or land that has not been or is unable to be classified*	*3,880.07*	*2.89%*

3.5.2 Land Cover

Land cover refers to the type of features present on the surface of the earth. For example, agricultural fields, water, pine forests, and parking lots are all land cover types. Land cover may refer to a biological categorization of the surface, such as grassland or forest, or to a physical or chemical categorization such as concrete.

Land cover was assessed in the Oatka Creek watershed utilizing imagery associated with the National Land Cover Dataset. This dataset was developed by the Multi-Resolution Land Characteristics (MRLC) Consortium, a group of federal agencies who first joined together in 1993 to purchase satellite imagery for the conterminous U.S. to develop the NLCD. In 1999, a second-generation MRLC consortium was formed to purchase three dates of satellite imagery for the entire United States (MRLC 2001) and to coordinate the production of a comprehensive land cover database for the nation called the National Land Cover Database (NLCD 2001).[30] The latest NLCD version available was completed in 2006 and is used throughout this report.

GIS analysis of the 2006 NLCD provided the following information:

Table 3.9: 2006 NLCD Land Cover within the Oatka Creek Watershed

NLCD Category	Acres	% Cover
11 - Open Water	263.54	0.2%
21 - Developed, Open Space	6,233.06	4.5%
22 - Developed, Low Intensity	2,194.81	1.6%
23 - Developed, Medium Intensity	553.99	0.4%
24 - Developed, High Intensity	130.77	0.1%
31 - Barren Land	521.52	0.4%
41 - Deciduous Forest	23,331.22	16.9%
42 - Evergreen Forest	819.75	0.6%
43 - Mixed Forest	4,733.67	3.4%
52 - Shrub/Scrub	5,663.28	4.1%
71 - Grassland/Herbaceous	479.71	0.3%
81 - Pasture Hay	43,436.60	31.5%
82 - Cultivated Crops	43,042.30	31.2%
90 - Woody Wetlands	6,221.27	4.5%
95 - Emergent Herbaceous Wetlands	407.65	0.3%
Total	138,033.14	

As Table 3.9 shows, the Oatka Creek watershed is dominated by agricultural land cover, with 31.2% devoted to "Cultivated Crops" and 31.3% of lands devoted to "Pasture/Hay." This is a larger amount of land area than is indicated by the land use analysis provided in Table 3.8. This discrepancy is likely due to the reporting methodology used by local Offices of the Assessor. It is likely that large tracts of lands identified as "residential" in real property records may also have some significant amount of pasture or other agricultural use. Forest cover accounts for approximately 21% of total land cover, while "developed" land accounts for a total of 6.8% of land cover within the Oatka Creek watershed.

Natural land cover – defined here by NLCD categories 41 (Deciduous Forest), 42 (Evergreen Forest), 43 (Mixed Forest), 90 (Woody Wetlands) and 95 (Emergent Herbaceous Wetlands) – are important components of a healthy watershed. As stated in the EPA manual, *Identifying and Protecting Healthy Watersheds:*

> Natural vegetative cover stabilizes soil, regulated watershed hydrology, and provides habitat to terrestrial and riparian species. The type, quantity, and structure of the natural vegetation within a watershed have important influences on aquatic habitats…Conversely, agricultural and urban landscapes serve as net exporters of sediment and nutrients, while increasing surface runoff and decreasing infiltration to ground water stores.[31]

A summary of 2006 NLCD data focusing on natural land cover categories is shown in Table 3.10:

Table 3.10: 2006 NLCD Natural Land Cover within the Oatka Creek Watershed

HUC 12 Subwatershed	Subwatershed Area (Acres)	*% Forest*	*% Wetland*	Natural Cover Total
Oatka Creek Headwaters	24,945.36	*35.7%*	*2.7%*	38.4%
Pearl Creek	36,308.63	*21.6%*	*2.7%*	24.3%

White Creek	25,435.30	*16.6%*	*5.8%*	22.4%
Mud Creek	10,442.77	*15.9%*	*6.5%*	22.3%
Village of LeRoy	18,462.55	*15.2%*	*6.4%*	21.6%
Oatka Creek Outlet	22,445.64	*15.5%*	*7.3%*	22.8%
Oatka Creek Watershed	**138,033.14**	***20.9%***	***4.8%***	**25.7%**

As the figures indicate, natural cover is relatively low throughout the watershed, with the highest percent natural cover found in the headwaters in Wyoming County. This is another indication of the watershed's intensive agricultural character.

A full explanation of 2006 NLCD categories and results by subwatershed are provided in Appendix D of this report.

3.5.3 Land Cover in the Riparian Zone

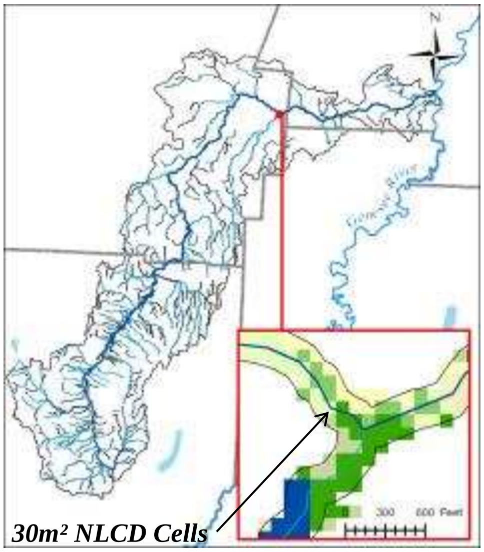
The land area directly adjacent to streams is considered to be among the most dynamic and sensitive components of a watershed and has a significant influence on water quality. A stream surrounded by tree cover and vegetation, for example, will benefit from the cooling effects of shade from the tree canopy above and bank stabilization from tree roots and other types of plant cover below. Detritus from surrounding plants will also be contributed to the stream as a source of nutrition and habitat for a variety of animals and organisms. Conversely, streams surrounded by impervious, hard, non-vegetative cover or agricultural cover will likely experience greater soil loss and more impacts from nonpoint source pollution.

Table 3.11: Analysis of Natural Land Cover within a 300' Buffer of All Streams, by Subwatershed

HUC 12 Subwatershed	Riparian Buffer Area (Acres)	*% Forest*	*% Wetland*	Natural Cover Total	*% Impervious*
Oatka Creek Headwaters	4,034.2	42.4%	7.5%	50%	<1%
Pearl Creek	6,345.1	32.4%	5.3%	37.7%	<1%
White Creek	3,198.9	26.4%	18.8%	45.2%	<1%
Mud Creek	1,368.8	19.2%	21.0%	40.2%	<1%
Village of LeRoy	1,511.2	18.5%	26.2%	44.7%	2.3%
Oatka Creek Outlet	1,960.2	27.5%	27.4%	54.9%	<1%
Oatka Creek Watershed	**18,389.61**	**30.9%**	**13.4%**	**44.3%**	**<1%**

In an effort to ascertain the level of natural cover within areas surrounding streams, a 300' buffer was created around each tributary within the watershed (150' linear distance perpendicular from the stream on both sides of the stream). The riparian buffer linear distance of 150' (45.7m) was selected in an effort to accommodate $30m^2$ cells used by the NLCD raster grid. While correlations exist between various riparian buffer widths and specific ecological, chemical and stream morphological conditions, no such

Figure 3.6: Illustration of 300' Riparian Buffer Applied to the Oatka Creek Watershed



implications are made here with this selection of the 150' linear distance. Rather, the goal is simply to provide a snapshot of land cover in and around the riparian zone throughout the watershed.[32]

It is again important to emphasize that NLCD land cover classification is generalized on a 30x30 meter scale (.22 acres). Random ground-truthing of NLCD land cover pixels against aerial photography generally reveals a diverse array of actual land cover types within a given NLCD 30x30 meter pixel area. Results of this analysis should therefore be viewed with a degree of caution. Full results by subwatershed are provided in Appendix D.

As Table 3.11 illustrates, the lands adjacent to stream corridors within the Oatka Creek watershed have a modest percentage of natural cover within them, ranging from 40.2% natural cover in the Mud Creek subwatershed to 54.9% natural cover in the Oatka Creek Outlet subwatershed, with an overall total average of 44.3% natural cover throughout the entire Oatka Creek watershed. In the absence of natural cover, agricultural land cover – mainly pasture hay and cultivated crops – is often found to be the predominant land cover type (refer to full figures in Appendix D).

Table 3.11 also includes the percentage of impervious cover, which is a good indicator of aquatic system health.[33] This particular measure of impervious cover is a statistical average of the four "development" subcategories of the NLCD. Impervious cover is very low throughout the riparian area across the entire Oatka Creek watershed, with the highest level of riparian area impervious cover found in the 'Village of LeRoy' subwatershed at 2.3%.

3.5.4 Impervious Cover

The Center for Watershed Protection (CWP) defines impervious cover as "any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall."[34] It is the sum of roads, parking lots, sidewalks, rooftops, and other impermeable surfaces of the urban landscape. The impacts of impervious cover on aquatic systems are well documented.[35] In 1994, CWP published the paper *The Importance of Imperviousness*, which outlined the empirical evidence showing the relationship between impervious cover and stream quality. Among the conclusions drawn from that paper:

- Impervious surfaces reduce infiltration of stormwater and increase stormwater runoff volumes and velocities;
- Impervious surfaces increase stream channel instability which, in turn, triggers a cycle of streambank erosion and habitat degradation;
- Impervious surfaces collect and accumulate pollutants deposited from the atmosphere, leaked from vehicles or derived from other sources and quickly directs those pollutants into receiving waterbodies in a concentrated fashion;
- Impervious surfaces along with other associated factors (such as decreased tree cover) amplify stream warming;
- Increases in impervious surfaces are associated with a decrease in the diversity, richness and composition of the aquatic insect community, such as macroinvertebrates; and

- Levels of subwatershed imperviousness in excess of 10 to 15% can have a negative impact on the abundance and diversity of fish communities as well as the richness of both the wetland plant and amphibian community. (pages 1-8)

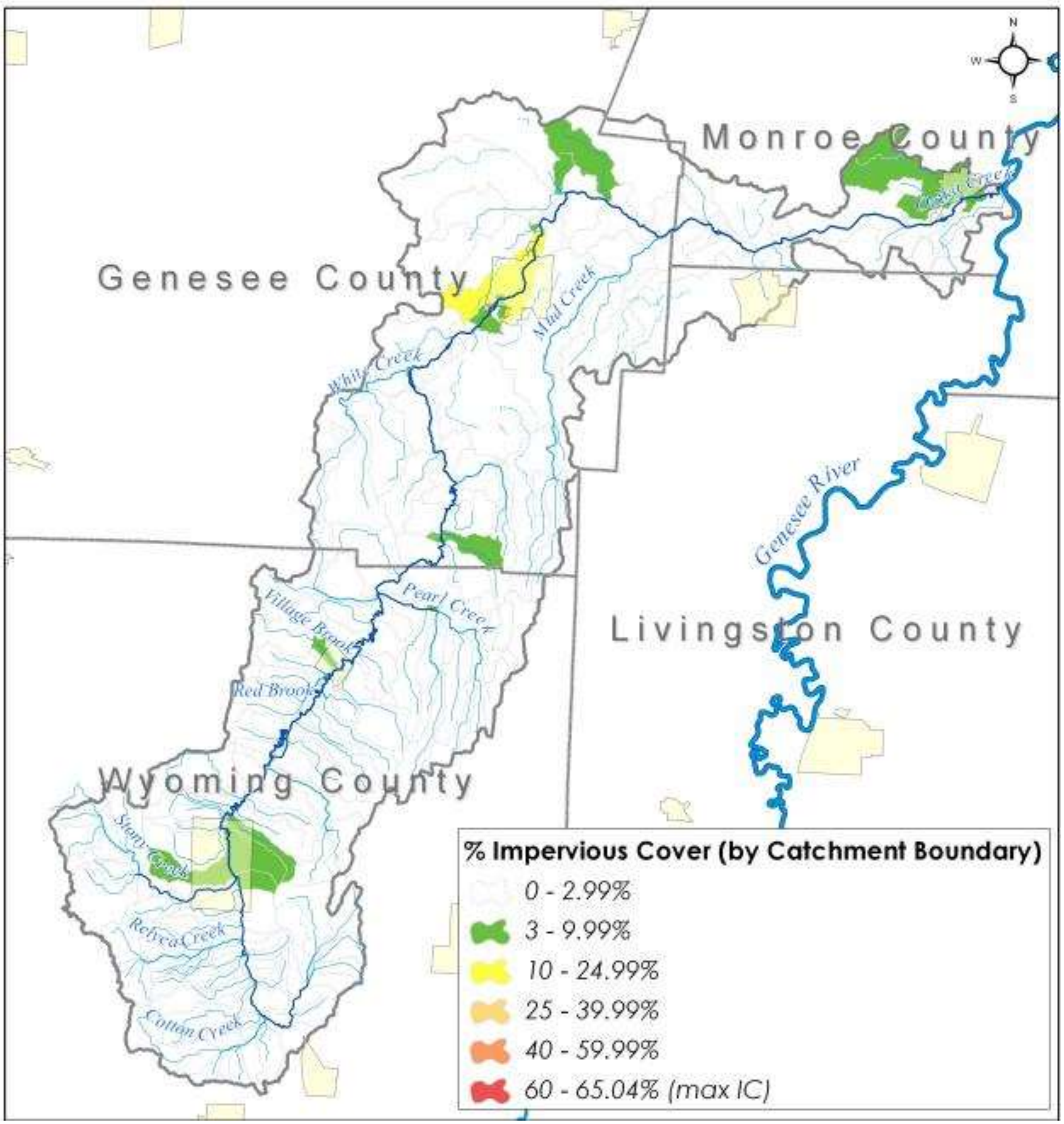
Impervious cover (IC) is therefore a key indicator of stream quality and watershed health. The CWP has integrated these research findings into a general watershed-planning model, known as the Impervious Cover Model (ICM). The ICM predicts that most stream quality indicators decline when watershed IC exceeds 10%, with severe degradation expected beyond 25% IC. While the actual stream response to the level of IC will vary based on a variety of conditions (local topography and physiology, other prevailing land cover characteristics, stormwater practices, watershed history), IC has nonetheless been identified as a significant contributor to aquatic system decline and therefore a reliable indicator of urban hydrologic stress.[36]

Table 3.12 illustrates the basic three-tiered threshold classification scheme of urban stream-quality potential based on watershed imperviousness levels.

Table 3.12: Relationship between Urban Stream Quality and Impervious Cover

Urban Stream Quality	Level of Imperviousness
Stressed	*1 – 10% Imperviousness*
Impacted	*11 – 25% Imperviousness*
Degraded	*>26% Imperviousness*

Figure 3.7: **% Impervious Cover by Catchment for Oatka Creek Watershed**



Impervious cover is obviously highest in urbanized areas within the watershed, such as the Villages of Warsaw, LeRoy, Caledonia and Scottsville. The density of buildings and streets creates a high degree of impervious cover in these areas. Because the catchment boundary in the Caledonia area is large, the ratio of impervious cover to open space is reduced, creating a low IC value. Overall, IC is not a major concern across the Oatka Creek watershed when measured by this standard, even in most villages. The Village of

LeRoy does have several small catchments with a high %IC. The ICM therefore provides a starting point for further research into how these areas affect local aquatic health.

Additional research might include the identification of *effective IC* within these catchments – that is, the specific locations where impervious surfaces are contiguous and directly tied to adjacent waterbodies. These particular areas could then be targeted for stormwater retrofit and mitigation projects in order to eliminate or reduce the negative impacts that they have on local aquatic health.

SECTION 3 ENDNOTES

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4.0 Planning Considerations

"Ecology involves the study of the reciprocal relationships of all organisms to each other and to their biological and physical environments. Landscapes comprise the sum of natural and cultural elements seen in a single view. When we add "planning" to each of these terms, the combined term refers to developing future options for our surroundings, for the interrelationships among biological and physical processes, and for the visual manifestation of those relationships. Because our surroundings contain physical, biological, and built elements, environmental planning involves using knowledge about those elements to provide options for decision making."[37]

> – "Environmental Planning Considerations." An excerpt from *Planning and Urban Design Standards*, a publication of the American Planning Association.

Section 4 of this report provides an overview of the various organizational structures, land uses, and regulatory measures relevant to environmental planning in the Oatka Creek watershed. Information pertaining to recent planning and organizational history, demographics, development trends, agricultural and other land use activities is provided herein.

4.1 Planning History[38]

A wide variety of planning, monitoring and restoration initiatives have been accomplished or are presently underway within the Oatka Creek watershed. These include activities being undertaken by academic institutions, county Soil and Water Conservation Districts, state and local government agencies, and a variety of other public and nonprofit entities.

While independent environmental research, planning and assessment has been taking place within the Oatka Creek watershed for decades, organized intermunicipal watershed planning activities within the watershed did not begin to emerge until the late 1980s and early 1990s. One of the more significant regional watershed planning efforts to take place in and around the Oatka Creek watershed was the Rochester Embayment Remedial Action Plan (RAP), a response to the 1987 US-Canada Great lakes Water Quality Agreement that required "Areas of Concern" to prepare RAPs.[39] The Rochester Embayment was named as an "Area of Concern" and its RAP, completed in 1997 (with updates as recent as 2011), was developed by representatives of the six counties that share the Genesee River Basin and the Rochester Embayment drainage. This report recognized the value of using a Basin-wide approach to addressing localized water quality issues that in some cases result from upstream activities, which would include the area of the Oatka Creek watershed.

An overarching goal of the watershed management planning process is the integration of these various initiatives and disciplinary perspectives into a more cohesive and holistic framework for natural resource management. The "Regulatory and Programmatic Environment" report builds upon information provided in the sections below.

4.1.1 Federal and State Agencies

Various Federal and State agencies have also been active for several decades in the management of Oatka Creek watershed resources. These actions have arisen both through cooperative agreements among county and local governments and specific agencies as well as through direct initiative by responsible agencies. These agencies include (but are likely not limited to) the following:

Table 4.1: Federal and State Agencies Active in the Oatka Creek Watershed

Agency	Relevant Roles and Responsibilities
United States Army Corps of Engineers (USACE)	The US ACE's stated vision is to "Provide vital public engineering services in peace and war to strengthen our Nation's security, energize the economy, and reduce risks from disasters." In doing so, the USACE plays a significant role in planning and building water resource improvements. The Corps of Engineers regulates construction and other work in navigable waterways under Section 10 of the Rivers and Harbors Act of 1899, and has authority over the discharge of dredged or fill material into the "waters of the United States" (a term which includes wetlands and all other aquatic areas) under Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500, the "Clean Water Act"). Under these laws, those who seek to carry out such work must first receive a permit from the Corps. Other significant areas regarding the Corp's role in planning and building water resource improvements include recreation, emergency response and recovery, flood control and floodplain management, navigation, erosion and shore protection, hydrologic modeling, hydropower and water supply management.
United States Geologic Survey (USGS)	A division of the US Department of the Interior, the USGS focuses on research in the natural sciences with emphasis on subjects such as climate and land use change, core science systems, ecosystems, energy, minerals and environmental health, natural hazards, science quality and integrity and water
Federal Emergency Management Agency	A division of the US Dept. of Homeland Security, FEMA's mission is to support citizens and first responders to build, sustain, and improve capability to prepare for, protect against, respond to, recover from, and mitigate all hazards. Responsibilities includes floodplain management, flood hazard mapping and administration of the National Flood Insurance Program.
Environmental Protection Agency	Primary mission is to protect human health and the environment. EPA's FY 2011-2015 Strategic Plan identifies five strategic goals to guide the Agency's work: Goal 1: Taking Action on Climate Change and Improving Air Quality; Goal 2: Protecting America's Waters; Goal 3: Cleaning Up Communities and Advancing Sustainable Development; Goal 4: Ensuring the Safety of Chemicals and Preventing Pollution; and Goal 5: Enforcing Environmental Laws. The EPA enforces the Clean Water Act, the Safe Drinking Water Act, and a number of other important environmental regulations.
Natural Resources Conservation Service	A division of the US Department of Agriculture, the NRCS works with landowners through conservation planning and assistance designed to benefit the soil, water, air, plants, and animals that result in productive lands and healthy ecosystems.
US Fish and Wildlife Service	The U.S. Fish and Wildlife Service is a bureau within the Department of the Interior. Its mission is working with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people. Among its key functions, the Service enforces Federal wildlife laws, protects endangered species, manages migratory birds, restores nationally significant fisheries, and conserves and restores wildlife habitat such as wetlands.
NYS Dept. of Environmental Conservation	The NYSDEC plays a major role in a diverse array of watershed planning and management issues, including regulatory, chemical and pollution control, dam safety, management of public lands and waters, wetlands protection, stormwater management, mining and reclamation, and the protection and management of animals, plants, aquatic life and associated habitats.
NYS Dept. of Health	NYSDOH tracks environmental health data and trends; oversees the delivery of drinking water in coordination with the EPA, addresses pathogens and other sources of contamination in public sources of drinking water; coordinates emergency preparedness and response for water systems; and provides financing mechanisms such as the NYS Drinking Water State Revolving Fund to help protect and expand public water systems.

NYS Dept. of State	Includes the Division of Coastal Resources, which is involved in a wide variety of programs and initiatives that help revitalize, promote and protect New York's communities and waterfronts. Functions include implementing the State's *Waterfront Revitalization of Coastal Areas and Inland Waterways Act*, planning and technical assistance for redevelopment of brownfields, abandoned buildings and deteriorated urban waterfronts, protecting water quality through intermunicipal watershed planning, as well as investing in improvements to waterfront areas through state and federal grant programs.
NYS Dept. of Agriculture and Markets	Relevant Divisions include Soil and Water Conservation and Agriculture Protection and Development which in conjunction with other divisions administer programs such as Agricultural Environmental Management, Agricultural Districts and Farmland Protection.
Great Lakes Commission	The Great Lakes Commission is a public agency established by the Great Lakes Basin Compact in 1955 to help its Member states and provinces speak with a unified voice and collectively fulfill their vision for a healthy, vibrant Great Lakes - St. Lawrence River region. Houses a wide variety of action-oriented programs intended to address specific concerns related to regional coordination and management of natural resources.

4.1.2 County and Local Government

Many local, state and federal offices and agencies are acting both independently and cooperatively in an effort to monitor and manage the natural resources in the Oatka Creek watershed.

County governments have a large stake in the pragmatic management of watershed resources. Protecting the public's health and safety through flood and hazard management and the maintenance or monitoring of regional water quality are important responsibilities that a number of county departments and divisions share. Flood monitoring and control also have direct implications for the protection of public infrastructure, such as roads, bridges and other forms of public property that may cross or lie within a floodway. Since 2000, stormwater management efforts associated with state and federal stormwater regulations have been administered cooperatively by the Stormwater Coalition of Monroe County. The Coalition consists of 28 regulated municipal entities throughout Monroe County. The Coalition implements a wide range of projects and programs that reduce stormwater pollution, including public education, training for municipal employees, and assistance with stormwater system mapping.

A number of counties in the Oatka Creek watershed manage a significant amount of public parkland in the watershed. These spaces serve multiple functions, including recreation and habitat protection. A review of existing reports and studies included in Appendix E illustrates some of the efforts undertaken to inventory and maintain those spaces. Similarly, local citizens have over time made their towns, cities and villages responsible for providing a variety of public services to varying extents. Parks, wastewater treatment plants, and departments of public works are among the important services that local municipalities provide that can play a role in maintaining watershed integrity.

4.1.3 Regional Planning

The Finger Lakes-Lake Ontario Watershed Protection Alliance (FL-LOWPA) is comprised of county representatives from multiple disciplines and agencies, including Soil and Water Conservation Districts, Planning and Health Departments, and Water Quality Management Agencies. Governed by a Water Resources Board made up of appointees from its member counties, FL-LOWPA's purpose is to protect and enhance water resources by promoting the sharing of information, data, ideas, and resources pertaining to the management of watersheds in New York's Lake Ontario Basin; fostering dynamic and collaborative watershed management programs and partnerships; and emphasizing a holistic, ecosystem-based approach to water quality improvement and protection.[40]

A major tenet of FL-LOWPA is grassroots programming. Water quality problems are defined and solutions are developed and implemented at the local level. Through participation in the Alliance, member counties develop a more regional perspective that informs local programming and encourages cooperation. To date, FL-LOWPA has helped to provide significant funding for Oatka Creek watershed planning and restoration projects.

The Genesee Transportation Council (GTC) is the designated Metropolitan Planning Organization (MPO) responsible for transportation policy, planning, and investment decision making in the Genesee-Finger Lakes Region. The U.S. Department of Transportation (USDOT) requires every metropolitan area with a population of over 50,000 to have a designated MPO to qualify for the receipt of federal highway and transit funds. These highway funds can be a significant share of funding for transportation improvement projects in the Oatka Creek watershed, such as road and bridge maintenance or construction. All GTC activities are responsive to mandates and guidelines, including, but not limited to, the Americans with Disabilities Act, Clean Air Act Amendments of 1990, Title VI of the Civil Rights Act of 1964, and environmental justice considerations.

Genesee/Finger Lakes Regional Planning Council (G/FLRPC) supports watershed planning in the Oatka Creek watershed directly through the acquisition of funding for specific projects as well as indirectly through its ongoing land use and water resources planning projects that are active across its nine-county region. These programs and projects encompass a variety of services that advance the overall goal of protecting and improving water quality and quantity. As a regional agency, G/FLRPC is able to examine and coordinate water resource issues effectively at a watershed scale.

4.1.4 County Soil and Water Conservation Districts (SWCDs)

Soil and Water Conservation Districts (SWCDs) within each watershed county play a critical role in the management of natural resources and agricultural activities in the watershed. SWCD activities are guided through the leadership of the New York State Soil and Water Conservation Committee, which works closely with the New York State Department of Agriculture and Markets. The mission of the New York State Soil and Water Conservation Committee is to develop an effective program to conserve soil and water, to maintain water quality, and to manage agricultural nonpoint-source water pollution for the State of New York. These programs are implemented primarily through county Soil and Water Conservation Districts.[41] SWCDs in the Oatka Creek watershed have played an instrumental role in the implementation of agricultural Best Management Practices (BMPs) on local farms, as well as applying for funding and implementing projects that address erosion and sediment reduction, streambank remediation, and nonpoint-source pollution control.

4.1.5 Academic Institutions

Regional academic institutions have played an important role in watershed planning and management in the Oatka Creek watershed. Independent research conducted by environmental science, geology, biology and other similar departments at regional colleges and universities has significantly advanced the knowledge base within the watershed. This is evidenced by the extensive list of research papers cited in

Appendix E. SUNY Brockport is presently active in the watershed conducting various water quality and quantity monitoring studies in support of a variety of short- and long-term projects and programs. In addition, SUNY Geneseo, Genesee Community College, the State University at Buffalo, Rochester Institute of Technology, University of Rochester, and Cornell University have each focused research and expertise specifically on the Oatka Creek watershed. Academic institutions will continue to be important watershed stakeholders that play a vital role in information gathering and analysis.

4.1.6 Not-for-Profit Organizations

The list of not-for-profit organizations that have initiated or assisted watershed planning, protection and restoration efforts in the Oatka Creek watershed is long and diverse.

The Oatka Creek Watershed Committee (OCWC) is a not-for-profit organization whose mission in part is to "facilitate the development of a watershed management plan for use by municipalities, stakeholders and individuals for the conservation and protection of the Oatka Creek watershed."[42] The Committee was formed in 1998 with the support and direction of the Rochester Area Community Foundation (RACF), and was established as a stand-alone organization consisting of a wide variety of stakeholders and agency members. It was incorporated in January of 2002, and remains an active participant in planning efforts for the watershed. In addition, the OCWC website is used as a repository for information related to watershed planning activities taking place in and around the watershed. The website also serves as an important tool for information dissemination and tracking progress. The website address is http://www.oatka.org/.

As indicated above, the Rochester Area Community Foundation has provided important financial support for a number of organizational and educational and outreach activities, such as the *Guide to Oatka Creek* brochure. In addition, local and international organizations such as Trout Unlimited and the Genesee Land Trust are a sample of the organizations that have supported important research, mitigation and preservation actions in the Oatka Creek watershed.

4.2 Existing Watershed Reports and Studies

An annotated bibliography of existing reports and studies pertaining to water quality and natural resource protection has been compiled and posted online at the project website; a summary bibliography has been included in Appendix E of this report.[43]

4.3 Inventory of Local Regulations

The Constitution of the State of New York specifies that the primary authority for guiding community planning and development is vested in cities, towns and villages. This authority is commonly referred to as "home rule" and is implemented locally through the creation of comprehensive plans, zoning, subdivision, site plan and other regulatory mechanisms. From time to time, when devising or administering these documents, local government agencies may voluntarily turn to certain entities for consultation or support, such county or regional planning departments, municipal associations, and state agencies such as the Departments of Transportation, Environmental Conservation, or State.

Table 4.2: Summary of Local Land Use Regulations Among Primary Municipalities in the Oatka Creek Watershed44

	Comprehensive Plan	Zoning	Site Plan Review	Subdivision Law	Provisions for Planned Unit or Cluster Dev't	Erosion/ Sediment Control Law	Flood Damage Prevention
Town of Bergen*	1996	1983 (e-code)	Yes	Yes	Yes	Yes	Yes
Town of Bethany*	2007	2008	Yes	Yes	Yes	Yes	Yes
Town of Byron*	1993 (under revision)	1997 (under revision)	Yes	Yes	Yes	Yes (see General Provisions)	Yes
Town of Caledonia	1964	1994 (e-code)	Yes	Yes	Yes	No	Yes
Village of Caledonia	2003	1999	Yes	Yes	Yes	unk	unk
Town of Castile	1967	1993	Yes	No (section reserved)	Yes	No (section reserved)	unk
Town of Covington	2006	2001	Yes	Yes	Yes	No (plat review by SWCD)	Yes
Town of Gainesville	1995 (within zoning)	2004	No	No	No	No	Yes
Town of LeRoy	2002	1989	Yes	Yes	Yes	No	Yes
Village of LeRoy	2001	1990	Yes	Yes	Yes	No	Yes
Town of Middlebury*	2009 (within zoning)	2009	Yes	No	Yes	No	Yes
Town of Orangeville	2009	2009 (online)	Yes	No	Yes	Yes	Yes
Town of Pavilion	2003	2006	Yes	Yes	Yes	No	Yes
Town of Perry	1969	2000	Yes	Yes	Yes	No	Yes
Town of Riga	2008	2008 (e-code)	Yes	Yes	Yes	Yes	Yes
Village of Scottsville	2004	2005	Yes	Yes	No	No	Yes
Town of Stafford*	2009	2009 (e-code)	Yes	Yes	Yes	No	Yes
Town of Warsaw	2004 (within zoning)	2004	Yes	Yes	Yes	No	Yes
Village of Warsaw	1994	1995	Yes	Yes	Yes	No	Yes
Town of Wheatland*	2004	1980 (e-code)	Yes	Yes	Yes	Yes	Yes
Village of Wyoming	None	1994	Yes	No	Yes	No	Yes

4.3.1 Municipal Plans and Regulations

An inventory of the local regulatory environment indicated that each municipality within the watershed has zoning and some form of comprehensive plan in place. The majority of municipalities have a host of additional supplemental regulations in place that are intended to decrease risks to the health and safety of the public and in some cases lessen the impacts of land development on the natural environment. A more in-depth review and analysis of the local regulatory environment will take place under subsequent tasks associated with this watershed planning project in an effort to identify and elucidate the effectiveness of these local laws with respect to water quality and natural resource protection.[45]

4.3.2 County Plans and Regulations

According to the *New York State Local Government Handbook*, counties in New York State function as a municipal corporation with geographical jurisdiction, home rule powers and the fiscal capacity to provide a wide range of services to its residents.[46] To some extent, counties have evolved into a form of "regional" government that performs specified functions and that encompasses, but does not necessarily supercede, the jurisdiction of the cities, towns and villages within their borders. Counties therefore have the authority to implement a range of environmental and public health plans, studies and initiatives.

Table 4.3: Description of County Legislatures

County	Chief Administrative Official	Legislative Body	Number of Members*
Genesee County	Manager	Legislature	9
Livingston County	Administrator	Supervisors	17
Monroe County	Executive	Legislature	29*
Wyoming County	Administrator	Supervisors	16

**Updated population figures from the 2010 Census may result in redistricting and associated changes to the number of members in 2011.*

As summarized in Table 3.4, each county has its own farmland and agricultural protection plan in place. Farmland and agricultural protection plans are created pursuant to 1NYCRR Part 372 of the New York State Agriculture and Markets Law.[47] Such plans are required to include a statement of the county's goals with respect to agricultural and farmland protection, identification of any lands or areas that are proposed to be protected, and a description of the strategies intended to be used by the county to promote the maintenance of lands in active agricultural use. In addition, Livingston County has aggressively pursued a farmland purchase of development rights (PDR) program, leveraging funds from the New York State Department of Agriculture & Markets to protect over 3,000 acres of farmland in the county to date.[48]

Table 4.4. Summary of Selected County Plans and Regulations

	Farmland and Agricultural Protection Plan	Dept. of Health Onsite Wastewater Treatment System Inspection		Hazard Mitigation Plan
		Inspection for new construction	*Inspection at time of refinance or property transfer*	
Genesee County	2002	Yes	Yes*	Yes
Livingston County	2006	Yes	Yes	Yes
Monroe County	1999	Yes	Recommended[49]	Yes
Wyoming County	2005	Yes	Yes	Yes

**For refinancing, inspections are typically performed upon request from the lending institution.*

Information on how county health departments approach the management of septic systems is also provided in Table 4.4. Sections 347 and 308 of NYS Public Health Law give county boards of health the authority to enact regulations for protection of public health. Each county within the study area has a department of health that performs or requires new onsite wastewater treatment system inspections at the time of new construction; Genesee, Livingston and Wyoming Counties require inspections at the time of property transfer as well. It is important to note, however, that the specific requirements associated with individual inspection of on-site septic systems vary significantly from county to county. Sewage disposal system failures can manifest in a number of ways over time, and those failures can be very difficult to detect because the system is buried. Standard inspections, which are typically non-invasive, are not necessarily thorough enough to ensure that the system is functioning properly. A full review and comparison of county inspection procedures will be included in the subsequent *Evaluation of the Regulatory and Programmatic Environment* associated with this project.

Each county has developed a multi-jurisdictional "all-hazard" mitigation plan that operates under a five-year mandatory review cycle. [50] These plans typically include a detailed characterization of natural and man-made hazards in the county (such as flooding risk or hazard materials risk); a risk assessment that describes potential losses associated with the hazards; a set of goals, objectives, strategies and actions that will guide the county's hazard mitigation activities; and a detailed plan for implementing and monitoring the plan.

Table 4.5. Summary of Hazards Rated as "High" or "Moderately High" within County Hazard Mitigation Plans[51]

County	Genesee County	Livingston County	Monroe County	Wyoming County
Blight				
Civil Unrest			MH	
Dam Failure			MH	
Earthquake				
Energy Crisis			MH	
Explosion			MH	
Extreme Temperatures				
Flood	MH	MH	MH	MH
Fire	MH	MH	MH	MH
Hazardous Materials (Fixed Site)	MH	MH	MH	
Hazardous Materials (in transit)	MH	H	MH	MH
Ice Storm	MH	MH	MH	MH
Infestation				
Landslide			MH	
Oil Spill		MH		
Radiological (Fixed Site)			MH	
Severe Storm			MH	MH
Structural Collapse			MH	
Terrorism		MH	MH	MH
Tornado		MH	MH	
Transportation Accident	MH		MH	
Utility Failure			MH	
Water Supply Contamination	MH		MH	MH
Winter Storm (Severe)			MH	MH

"H" – High Hazard; "MH" – Moderately High Hazard

In addition to the plans listed above, Genesee County has developed an innovative regional planning tool called the Genesee County Smart Growth Plan. Implemented in 2001, the Plan is described as "a mitigating action of potential significant environmental impacts of the Genesee County Water Supply Project upon the viability of agriculture in Genesee County."[52] The Plan is intended to encourage the revitalization of villages and hamlet areas and protect valuable agricultural resources by focusing new industrial, commercial, and residential development opportunities in those areas presently served by public water.

As with municipal plans and regulations, a more in-depth review and analysis of the county and regional regulatory environment will take place under subsequent tasks associated with this watershed planning project.[53]

4.4 Population

Population and the environment are inherently connected. Local economic prosperity is closely tied to residential and commercial growth and development, which in turn are influenced by population growth. Population growth – rapid population growth in particular – can sometimes occur at the expense of the natural environment, putting strains on the carrying capacity of terrestrial and aquatic ecological communities. It is therefore important that we understand where population growth is occurring and at what rate.

In the simplest of terms, local population is determined by net mortality and fertility rates along with net migration either into or out of the geographic unit of observation (in our case a watershed, or a community within a watershed). Our understanding of population figures and trends is largely based on information provided through the decennial census of population conducted by the US Census Bureau. During years between decennial censuses, measuring migration in areas of interest can be challenging and is typically based on estimates and extrapolation. The following sections provide a brief overview of our understanding of current population statistics and trends in the Oatka Creek watershed.

4.4.1 Census Block Analysis

The smallest geographic unit of observation (or land area) that the US Census Bureau reports population figures for is called the *census block*. Census blocks generally conform to municipal or neighborhood boundaries, not natural boundaries (such as a watershed). Therefore, it is not possible to ascertain specific population figures for a watershed boundary utilizing decennial data from the US Census. Furthermore, the census block boundaries sometimes change between decennial census years, making 10-year trend analysis at the block level a difficult endeavor. A number of methods do exist, however, that can be used to provide insight and estimates for population figures within a watershed area.

Typical towns and villages within the Oatka Creek watershed consist of multiple census blocks; by identifying those blocks that are completely within the watershed boundary and those that overlap the watershed boundary, we are provided with a reliable population range. An analysis of census block figures within the Oatka Creek watershed from figures reported in Census 2000 showed a population range between 21,054 and 28,780 persons, a difference of over 7,700 persons. While this range is significant, it can be assumed that the actual population of the Oatka Creek watershed is closer to the high end and is likely approximately 28,000 persons. This assumption is based on close observation of population density maps in combination with the census block boundaries themselves.

Table 4.6. Population Estimates for Subwatersheds	
Subwatershed Name	**Estimated Subwatershed Population (Census 2000)**
Oatka Creek Headwaters	<3,585
Pearl Creek	<6,707
White Brook	<3,713
Mud Creek	<3,733
Village of LeRoy	<7,103
Oatka Creek Outlet	<8,453

A similar method was used to identify census blocks that intersect subwatersheds, the results of which are illustrated in Table 4.6. This process yields very rough figures; in some cases census blocks and the population figures within them are counted for more than one subwatershed because they overlap subwatershed boundaries. While these figures therefore are not exclusive, they nonetheless provide a general estimate of the concentration of population in the general vicinity of the subwatershed. Furthermore, the estimate also provides a basic figure of the population that have a direct influence on the watershed.

4.4.2 Population Density

Population density maps (Maps 22 and 23 in Appendix A) provide insight to the locations with the highest concentrations of population in the watershed. Population densities are generally highest within villages and hamlets. In many instances, population densities are also high directly outside of village boundaries following major highways.

4.4.3 Population Change[54]

Population figures for the Census years 1980 – 2010 are shown for the Towns in the Oatka Creek watershed in Table 4.7. Overall, population has been relatively stable across the Oatka Creek watershed since 1980 and population trends are generally in line with those across Upstate New York and throughout the Great Lakes region of the United States for this same time period. The most significant population increases since 1980 have been in the Towns of Riga, Bergen, Orangeville, and Covington, although it should be noted that the population gains made in Orangeville have very likely occurred in areas outside of the Oatka Creek watershed. Five municipalities showed a population decline during this same time period : Perry, Bethany, LeRoy, Stafford and Wheatland. Overall, the total population increase for all towns listed in Table 4.7 was 3%.

Table 4.7. Population Change of Towns in the Oatka Creek Watershed, 1980 – 2010 (total town population; figures include population of villages and cities within)

Municipality	Population 1980[55]	Population 1990[56]	Population 2000[57]	Population 2010[58]	*Percent Change*			
					1980-1990	*1990-2000*	*2000-2009*	***1980-2009***
Town of Bergen	2,568	2,794	3,182	3,120	9%	14%	-2%	**21%**
Town of Bethany	1,876	1,808	1,760	1,765	-4%	-3%	0.3%	**-6%**
Town of Byron	2,242	2,345	2,493	2,369	5%	6%	-5%	**6%**
Town of Caledonia	4,034	4,441	4,567	4,255	10%	3%	-7%	**5%**
Town of Castile	2,865	3,042	2,873	2,906	6%	-6%	1%	**1%**
Town of Covington	1,075	1,266	1,357	1,232	18%	7%	-9%	**15%**
Town of Gainesville	2,133	2,288	2,333	2,182	7%	2%	-6%	**2%**
Town of LeRoy	8,019	8,176	7,790	7,641	2%	-5%	-2%	**-5%**
Town of Middlebury	1,561	1,532	1,508	1,441	-2%	-2%	6%	**2%**
Town of Orangeville	1,103	1,115	1,301	1,355	1%	17%	4%	**23%**
Town of Pavilion	2,375	2,327	2,467	2,495	-2%	6%	1%	**5%**
Town of Perry	5,437	5,353	6,654	4,616	-2%	24%	-31%	**-15%**
Town of Riga	4,309	5,114	5,437	5,590	19%	6%	3%	**30%**
Town of Stafford	2,508	2,593	2,409	2,459	3%	-7%	2%	**-2%**
Town of Warsaw	5,074	5,342	5,423	5,064	5%	2%	-7%	**-0.2%**
Town of Wheatland	4,897	5,093	5,149	4,775	4%	1%	-7%	**-2%**

4.4.4 Population Projections

Population projections to the year 2040 were prepared by G/FLRPC in 2003. While these projections do not incorporate actual figures from the 2010 Census, the relatively minor variances between actual and projected population figures for 2010 do not result in significant changes in the numbers. Results of these projections for the towns in the Oatka Creek watershed are provided in Table 4.8 on the following page.

Table 4.8. Population Projections, 2000 – 2040

	2000 (actual)	*2010 (projected)*	*2020*	*2030*	*2040*	% Change 2000 – 2040
Town of Bergen	3,182	*3,272*	*3,296*	*3,324*	*3,345*	**5.1%**
Town of Bethany	1,760	*1,772*	*1,782*	*1,791*	*1,798*	**2.2%**
Town of Byron	2,493	*2,547*	*2,591*	*2,629*	*2,661*	**6.7%**
Town of Caledonia	4,567	*4,698*	*4,817*	*4,912*	*4,994*	**9.3%**
Town of Castile	2,873	*2,923*	*2,927*	*2,927*	*2,926*	**1.8%**
Town of Covington	1,357	*1,388*	*1,414*	*1,436*	*1,454*	**7.1%**
Town of Gainesville	2,333	*2,377*	*2,353*	*2,326*	*2,296*	**-1.6%**
Town of Le Roy	7,790	*7,792*	*7,767*	*7,743*	*,7716*	**.9%**
Town of Middlebury	1,508	*1,525*	*1,505*	*1,481*	*1,458*	**-3.3%**
Town of Orangeville	1,301	*1,340*	*1,372*	*1,399*	*1,423*	**9.4%**
Town of Pavilion	2,467	*2,512*	*2,549*	*2,581*	*2,608*	**5.7%**
Town of Perry	4876	*4,811*	*4,761*	*4718*	*4682*	**-4.0%**
Town of Riga	5437	*5549*	*5636*	*5710*	*5767*	**6.1%**
Town of Stafford	2,409	*2,441*	*2,466*	*2,488*	*2,507*	**4.1%**
Town of Warsaw	5423	*5503*	*5426*	*5348*	*5269*	**-2.8%**
Town of Wheatland	5149	*5240*	*5311*	*5369*	*5414*	**5.1%**

4.5 Development

Communities depend on new development to help broaden the local tax base and alleviate the costs of public services. New development, however – if left unchecked – can have a cumulative, detrimental effect on the stability of a community's ability to provide cost-efficient public services and protect the natural environment. Even when faced with declining population trends, communities across the region continue, actively or passively, to encourage development outside of traditional population centers. The result is "sprawl without growth," a phrase coined by Rolf Pendall of Cornell University to describe the disproportionate rate of new green-field land development in the face of slow population growth or outright population decline.[59]

While most indicators seem to imply that sprawl is not presently a major concern throughout the entire Oatka Creek watershed, it is nonetheless a potential concern of significance. New home construction has been relatively flat across Upstate New York for several decades; with isolated exceptions, this trend holds true for most municipalities within the watershed. Anemic regional growth rates are largely a product of external forces such as global and regional economic trends, state finance and taxation policies, and national migration patterns. Oatka Creek watershed communities are in fact capable of accommodating significant residential and commercial development given the presence of ample available land and a well-maintained infrastructure that could support and enable growth if market conditions allow. If external forces happen to shift and begin to favor new development once again in Upstate New York, it remains to be seen how prepared communities in the Oatka Creek watershed will be to address rapid residential or commercial development.[60]

4.5.1 Roads and Bridges

As shown in Table 4.9, there are over 520 center-line miles of roads and 55 major bridges that cross a hydrologic feature in the Oatka Creek watershed (a major bridge is considered any road/stream crossing structure other than a culvert).

Table 4.9: Center Line Road Miles and Associated Bridges in the Oatka Creek Watershed[61]

	Federal	State	County	Local (Town/City/Village)	Private	Total
Road Miles	38.63	73.37	128.48	277.34	2.43	520.25
Bridges	3	16	14	22	-	55

Roads and highways have the potential to generate or contribute substantial amounts of eroded material and other pollutants into local waterbodies. Specific contaminants associated with road runoff include sediment, oils and grease, heavy metals, garbage/debris, and road salts, as well as fertilizers, pesticides and herbicides applied to roadside facilities or spilled on or near roads. Hydrologically-connected roads – roads designed to contribute surface flow directly to a drainage channel – have the greatest potential to deliver road-derived contaminants to streams.

Bridges present a number of additional risks to hydrologic function. In some cases, the bridge itself creates a direct connection between the roadway and stream if the bridge drain is not diverted to an on-land treatment facility (generally ground infiltration or retention). Bridges and culverts, if built too small, can restrict and concentrate stream flow, thereby creating or accelerating stream bank erosion and stream incision. When not properly maintained or designed, bridges and culverts will cause debris accumulation and contribute to upstream flooding and possible property damage. Bridges and culverts can also restrict wildlife passage and fish movement, if not properly designed and maintained. Conversely, bridge crossings also offer excellent opportunities for recreational access to rivers and streams, a possibility that should be considered during any necessary construction or repair of such facilities.

Table 4.10: Major Bridge Crossings by Waterbody

	Federal	*State*	*County*	*Local*
Oatka Creek	2	11	9	13
Mud Creek		1		2
Pearl Creek		1	1	1
Relyea Creek		1		
Spring			1	
Stony Creek	1	1	1	3
White Creek				2
Unnamed Tributary		1	2	1

Map 12 in Appendix A illustrates the various categories of roads as described above and provides locations of each of the 55 bridges identified. In addition, a more comprehensive discussion of the impacts of impervious surfaces on waterbodies is provided under Section 3.5.4.

4.5.2 Water and Sewer Infrastructure

A basic indicator of residential and commercial growth and development is the presence of infrastructure – in particular, public water and sewer supply. Maps in Appendix A illustrate the location of water lines and sewer lines in the Oatka Creek watershed as of December 2008. As the maps illustrate, centralized sewer systems are located in the Villages of Warsaw, Churchville, Scottsville, and the hamlet of Pavilion. (Note that while no line data are available for the Village of Scottsville, it is also serviced by a central wastewater treatment facility). The Villages of Wyoming and Caledonia do not have centralized wastewater treatment facilities; homes in these population centers rely on onsite wastewater treatment systems.

Centralized water systems are spread throughout the northern half of the Oatka Creek watershed, but become less prevalent in Wyoming County.

4.5.3 Land Use Monitoring Report[62]

The Genesee Transportation Council (GTC) provides funding annually to G/FLRPC in order to conduct the Regional Land Use Monitoring Report (LUMR). This report provides information on the issuance of building permits within each municipality dating back to 1999. The primary purpose for collecting these data is to identify areas of growth within the region that might require transportation planning and service modifications. These data can also help to draw very general conclusions pertaining to threats to watershed integrity that may be posed by high rates of growth and development.

LUMR figures for towns that issued an average of 4 or more residential building permits per year between the years 2005 through 2010 are summarized below:

Table 4.11: Municipalities Averaging 4 or more Residential Building Permits per Year (entire town)[63]

	2005	2006	2007	2008	2009	2010	6 Year Average
Town of Riga	13	7	5	3	5	3	**6.0**
Town of Castile	5	6	3	4	6	5	**4.8**
Town of Wheatland*	12	4	3	5	4	1	**4.8**
Town of Perry	8	3	4	6	3	0	**4.0**

As stated above, these figures are for residential building permits only; they include only permits issued for the construction of buildings. Furthermore, permit issuance does not imply actual construction. Results for all municipalities are available in Appendix C.

4.5.4 Projected Build Out

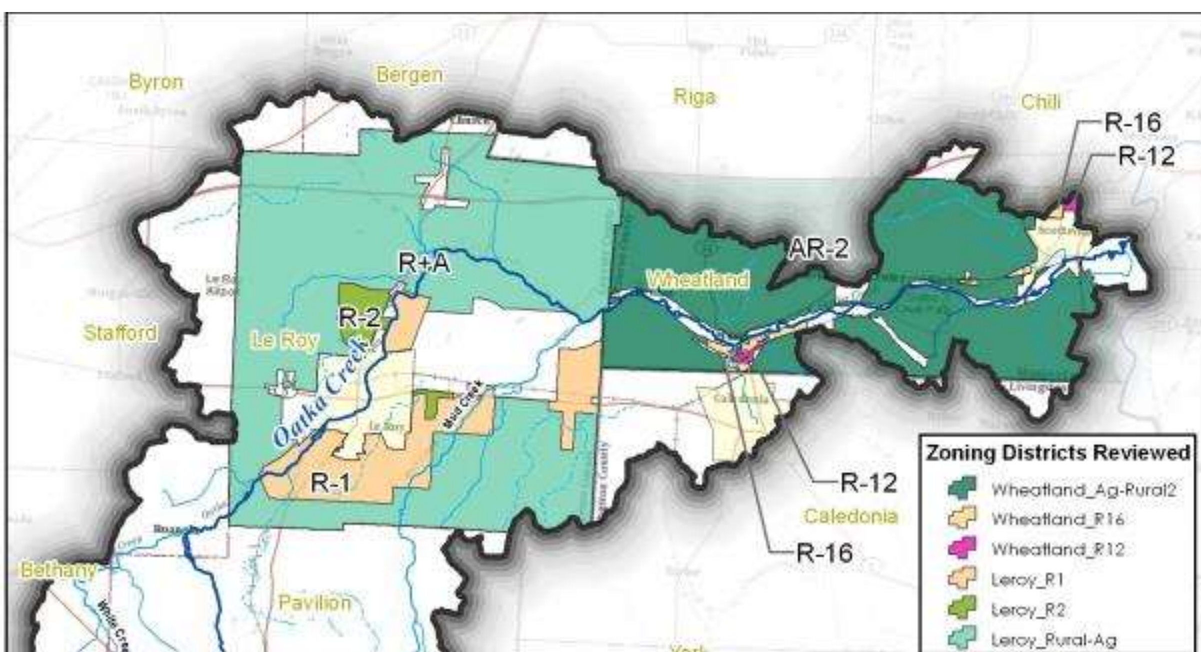
"Build out" refers to a hypothetical time when a municipality (or, more specifically, a zoning district within a municipality) cannot accommodate any more development due to the lack of additional space as dictated by local land use regulations. Build out scenarios are typically mathematical exercises that attempt to calculate the time when build out is likely to occur given a projected rate of growth and development. In order to calculate build out, a number of basic assumptions are made. First, the model assumes that zoning laws regarding allowable lot densities will remain the same over time. Second, the model requires a projected rate of growth to be assumed over time; these are typically based on standard population projections. Finally, the model attempts to calculate or predict standardized "restraints" to development within a given area. Restraints comprise an estimate of gross land that would not be open to new home construction due to environmental restrictions or other physical constraints. Restraints might include areas of standing water, regulated floodplains, regulated/protected wetlands, steep slopes, or simply the area of land required for roads, parks, and other public services.

Even in situations where land use, zoning, and population information is accurate and readily available, build out scenarios have limited application when generalized across a large land area or multiple zoning districts. Furthermore, given that the scenarios are based on population projections, any projected decreases in population will render the build out model null and void. In light of these challenges, a focused approach to build out was conducted in the Oatka Creek watershed, one that limited the scope strictly to those municipalities known to have relatively high rates of growth occurring in them.

The build out analysis was based on the following criteria:

- Exclude villages (most villages are at or near buildable capacity or have strict limits to growth governed by their municipal boundaries)
- Focus only on towns with high rates of growth relative to other towns in the watershed by reviewing:
  - Rate of residential building permit issuance over a 5-year period
  - Rate of population change between the years 2000 and 2010, recognizing only those towns with an increase in population during that time period
  - Any municipalities that show tepid growth rates or population decline will be excluded from analysis
- Within selected towns, analyze only those zoning districts presently zoned 'residential' or 'agricultural'
  - While many agricultural areas in the watershed are deliberately zoned as such in order to protect and maintain agricultural uses, the model assumes that those protections may be waived by the land owner or municipality in lieu of residential development

Figure 4.1: Zoning Districts Reviewed for Build Out Analysis



- Zoning districts must have adequate vacant land within them to accommodate new lots or subdivisions
- Focus only on those zoning districts that have public water available in or very near to them
    - Public water has the potential to induce residential growth and development

Full methodology of the build out analysis can be found in Appendix B: Data Sources and Notes. Based on the assumptions above, the build out analysis produced the following results for these selected zoning districts:

Table 4.12: Estimated Build Out for Selected Zoning Districts in High-Growth Municipalities

Municipality/ Zoning District	Net acres available for development within watershed portion of district (adjusted for all constraints)	Minimum lot size (sq. feet) as stipulated by code	Estimated number of units that could be built in the zone**	Annual residential building permits – 5 year average	Years Until "Build-Out" Occurs (# of units/av. # of permits per year)
Wheatland					
AR2	7,181.3	50,000	6,033	1.7	>50 years
R12	24.8	12,000	80		47 years
R16	106	16,000	264		>50 years
LeRoy					
R1	1,629.9	25,000	2,825	3.5	>50 years
R2	316.0	21,780	629		>50 years
RA	9,617.2	28,125	14,859		>50 years

1 acre = 43,560 square feet
* Adjusted for open space requirements
** For most zoning districts, the # of units was adjusted down to account for existing homes on large lots 10 acres or greater in size

Some weaknesses are apparent with this model. The final column – *Years Until Build-Out" Occurs* – is a very general estimation that applies the town-wide 6 year average permit rate to a specific zoning district. In fact, the building permit rate figure used represents the issuance of permits throughout the entire town, not the number of permits issued for a specific zoning district. Furthermore, if an increase in building permit issuance were to occur, this could significantly alter the figures in the *Years until Build-out" Occurs* column.

Furthermore, build out models operate under the presumption that residential and commercial development are the primary forces behind market-based land use. In fact, many other market demands influence local land use consumption patterns. Large portions of Genesee and Wyoming Counties, for example, consist of some of the most productive and profitable agricultural lands in New York State. Demand for land in these areas of the watershed is largely driven by the desire to farm and the need for more arable land, not for the construction of residential subdivisions.

Nonetheless, the model provides several useful insights. The first is the result of the calculation of "net acres available for development." These are reliable figures that can provide local officials with a very rapid assessment of a zoning district's potential for further development. The other is the "estimated number of units" figure, which similarly provides local officials with a rough idea of what the district might look like in the future if growth were to occur. Municipalities should use these figures and apply serious consideration regarding the type of future growth and development that should take place in their communities, regardless of whether they have "a lot" or "a little" land left for future development.

Establishing better site planning and design standards and creating incentives for developers to conserve natural areas can help to meet a community's demand for future growth without sacrificing environmental quality. Decreasing minimum lot sizes and increasing density, mandating cluster subdivisions, conserving sensitive lands, and buffering water resources are among the tools and practices that can be incorporated directly into local law. By doing so, communities can make strides toward creating economically viable, yet environmentally sensitive development decisions. Such principles – often referred to as Better Site Design standards – will be addressed under Task 13 – *Evaluation of the Regulatory and Programmatic Environment*. As explained in the NYSDEC publication *Better Site Design* (2008), "The aim of better site design is to reduce the environmental impact "footprint" of the site while retaining and enhancing the owner/developer's purpose and vision for the site. Many of the better site design concepts employ non-structural on-site treatment that can reduce the cost of infrastructure while maintaining or even increasing the value of the property relative to conventional designed developments."[64]

4.6 Public Lands and Trails

Public lands can be classified into a number of different categories. In fact, the "parks" that exist in the study area vary tremendously in terms of size, ownership, operation and maintenance, and designated and permitted uses. Public land uses range from local municipal ball fields and cemeteries to significant holdings of public fishing access areas along the Oatka Creek itself.

Refer to Map 11 in Appendix A for an illustration of these lands and trail corridors.

4.6.1 Public Lands

An analysis of public lands using county data and other GIS data sources yielded the following results:

Table 4.13: Identified Public Park, Recreation and Conservation Lands in the Oatka Creek Watershed

Public Land Category	Acreage
NYSDEC Lands	209
Other State Park/Recreation Lands (Includes the Genesee Valley Greenway)	55
Land Trust or Easement (Includes the Genesee Country Village & Museum)	725
County Parkland	458
Municipal Park or Similar Local Public Space	416
Cemetery	108
Watershed Total	*1,974*

Lands owned and maintained by the NYSDEC within the watershed include a portion of Carlton Hill State Recreation Area (170 acres) as well as the historic Caledonia State Fish Hatchery, recognized as the oldest fish hatchery in the United States and Western Hemisphere. A portion of the Genesee Valley Greenway is present in the Town Wheatland near Scottsville, accounting for 50 acres of right-of-way; a small 5-acre tract of land/trail right-of-way was also identified in the Town of Pavilion. The greenway is owned and maintained through cooperative agreement between the NYS DEC, NYS Office of Parks, Recreation, and Historic Preservation and the Friends of the Genesee Valley Greenway, Inc.

Fifteen small municipal parks were identified throughout the watershed accounting for approximately 60 acres of total land area. In addition, the Village of Warsaw owns and maintains 354 acres of land in the Oatka Creek headwaters as part of its municipal water supply system. Various cemeteries scattered throughout the watershed account for a total of approximately 108 acres of land. The largest contiguous portion of public land is Oatka Creek Park in the Town of Wheatland. The park comprises 458 acres and is owned and maintained by Monroe County.

Genesee Country Village and Museum complex – a not-for-profit living history museum chartered by the NYS Department of Education – comprises 672 acres in the Towns of Wheatland and Caledonia. While not a public park, the Museum's mix of grounds and facilities, including the Genesee Country Nature Center, represent a significant public asset of regional importance. Two conservation easements were identified in the Wyoming County town of Warsaw that account for nearly 53 acres of land. County real property information does not always clearly identify private lands that are held in permanent conservation easement, making it difficult to identify all such properties in the watershed. While these the two properties identified here are important pieces of the spectrum of open space, they very likely represent a small fraction of the private lands that are protected under permanent conservation easement within the watershed.

4.6.2 New York State Open Space Conservation Plan

The *2009 New York State Open Space Conservation Plan* includes lists of regional priority conservation projects that have been identified by Regional Advisory Committees and through public comments received through the Plan's review process. Priority projects included on this list are eligible for funding from the State's Environmental Protection Fund, and other State, federal and local funding sources. For most of the project areas identified, a combination of State and local acquisition, land use regulation, smart development decisions, land owner incentives and other conservation tools used in various combinations, will be needed to succeed in conserving these open space resources for the long term. In addition to the Priority Projects listed in the body of the report, the Region 8 Advisory Committee also identified "additional priority projects" warranting attention and focus for preservation and enhancement if resources allow.

Priority Projects

> **Genesee River Corridor** - This project will protect the variety of habitats and landscapes found along the Genesee River as it flows north from Pennsylvania to Lake Ontario… (page 108)
>
> **Genesee Greenway/Recreationway** - The Genesee Valley Greenway (GVG) is a 90-mile long corridor that extends from the city of Rochester in Monroe County through to the Village of Hinsdale in Cattaraugus

> County. It passes through woodlands, wetlands, river and stream valleys and rolling farmlands providing connections to Letchworth State Park, local parks, major trail systems and historic villages and towns in Monroe, Livingston, Wyoming, Allegany and Cattaraugus Counties… (page 110)

In addition, Ecological Corridors, Exceptional Forest Communities, Grassland Preservation and Restoration (specifically in the Towns of Covington and Middlebury in Wyoming County), Trails and Trailways, and Significant Wetlands are identified as general Priority Project areas (pages 112 – 113).

Additional Priority Projects

> **Caledonia Springs** - This project is to provide protection to the high-quality water source that supplies the Caledonia Fish Hatchery in Livingston County, the oldest in the nation. Locally known as Spring Creek, this resource and the associated wetlands are surrounded by development. It also provides a significant wintering habitat for thousands of waterfowl.

> **Fossil Coral Reef** - This 100 plus-acre property located in the Town of LeRoy, Genesee County has been on the US Department of Interior, National Park Service's Registry of National Natural Landmarks since 1967. It is known locally as the "Bradbury Quarry" [and is located near the north side "right angle bend" of Britt Road]. It contains an abandoned limestone quarry and woodlands. It is abundant with ancient fossils, wildlife and trails. Specimens of fossils date back 350 to 400 million years ago. Geologically, the quarry contains the only preserved and well-exposed Middle Devonian Onondaga Coral Reef in Western New York. Rare fossil and flank deposits are abundant in the reef and include numerous tabulate and rugose corals, crinoids, gastropods and trilobites. The site is visited on a regular basis by paleontology groups from local colleges. (page A-123)

> **Buttermilk Falls on Oatka Creek** - Buttermilk Falls is an approximately 70-foot waterfall in Oatka Creek. It is the point where the creek drops over the Akron-Bertie Onondaga Dolomite and Limestone Formation in the Town of LeRoy, Genesee County. During periods of low rainfall (perhaps several weeks during the summer) the creek disappears into the bedrock upstream of the falls and reappears either at the base of the falls or at points on the rock face. It is a very scenic area, but currently unavailable for public viewing. (page A-123)

Unabridged versions of the reports containing the regional priority project narratives and information on the identification process of the priority projects can be found in the Plan's appendices.[65]

4.6.3 Trails

Regional recreational trails that cross through the Oatka Creek watershed include the Genesee Valley Greenway, which crosses through the watershed near the Village of Scottsville. The trail weaves through Canawaugus Park directly adjacent to the Oatka Creek and is a well-known stop among frequent users of the Greenway. In addition to the Genesee Valley Greenway, the New York State Office of Parks, Recreation and Historic Preservation identifies over 102 miles of officially designated snowmobile trails within the watershed.[66]

A Triple Divide Trail System Strategic Plan was developed in 2011.[67] It indicates that the Triple Divide Trail System will be a unified conservation and recreational system stretching ca. 230 miles along the Genesee River and Pine Creek from Lake Ontario in Rochester, NY, to the Susquehanna River in Williamsport, PA. The name derives from its passage over a triple continental divide separating the headwaters of three national watersheds: the Allegheny River, the Genesee River, and the Susquehanna River (West Branch and Pine Creek). This recreational system is being created by connecting existing rail-trails (greenways), water trails (blueways), and nature park areas, including

Letchworth State Park (NY) and Pine Creek Gorge (PA). It combines water conservation, natural flood control, outdoor recreation, environmental education, and sustainable economic development, including new jobs in construction and eco-tourism.

4.6.4 Public Fishing Access

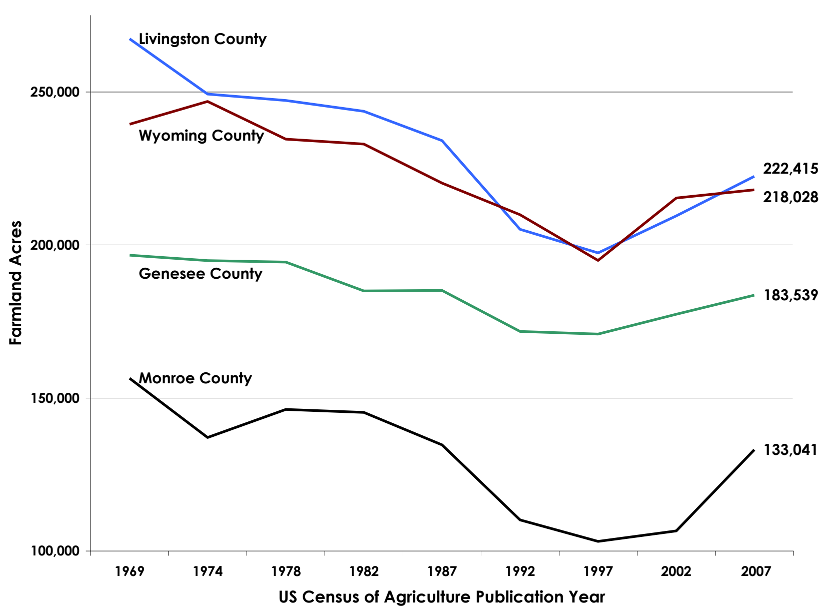
The Oatka Creek watershed is well known for excellent fishing opportunities throughout its extent. Oatka Creek Park in Wheatland offers ample access to Oatka Creek and is prized for its wild brown trout fishing. The NYS DEC also maintains a number of public fishing access areas in the watershed. One access point with parking is located directly on Oatka Creek along Main Street north of the hamlet of Mumford. Another popular DEC fishing access site is located in the Town of LeRoy along Oatka Trail Road. This location offers the public approximately 2 miles of linear stream bank fishing access. Public access is also available at the Caledonia State Fish Hatchery in the Village of Caledonia and in the Village of Scottsville at Canawaugus Park.

More information on NYSDEC Public Fishing Rights along Oatka Creek can be found on the DEC's website at http://www.dec.ny.gov/outdoor/7749.html

4.7 Agriculture

As noted under Section 3.5, real property records indicate that land use within the Oatka Creek watershed is devoted principally to agriculture uses, with 55% of properties classified as "agricultural" under the NYS real property classification system. This is over twice the land area of the next highest land use type ("residential" properties account for 23% of total properties in the watershed). There is therefore no doubt that agriculture is a significant factor when considering land use activities in the Oatka Creek watershed.

Figure 4.2: Change in County Farmland Acreage, 1969 – 2007



Public agencies such as the New York State Department of Agriculture and Markets, county Soil and Water Conservation Districts and the National Resources Conservation Service (a division of the USDA) provide a number of beneficial services to regional agribusinesses. Outreach services provided by these agencies include crop and nutrient management, flood and erosion control, and agricultural environmental Best Management Practice implementation. In providing these services, these agencies compile information on a variety of agricultural- and environmental-related subjects that, in turn, are intended to help measure the effectiveness of and scope of their work. This information can provide us with important insight regarding the state of agricultural activities within the watershed, how those activities impact the natural environment, and how they are changing over time.

As with population statistics, data on agricultural operations can be difficult to ascertain at the watershed level. The lands that belong to a single agribusiness in some cases will cross more than one watershed boundary. Considering that the uses of a farmer's land will often change over time due to necessary crop rotation schedules or changes in a farm's business plan or operational focus, identifying specific land uses or production statistics over time can be challenging. Nonetheless, a selection of basic agricultural indicators has been included herein in an effort to begin describing the state of agriculture in the Oatka Creek watershed. As the watershed management planning process continues, developing a more accurate and complete assessment of the activities occurring on the land will be a critical component of watershed planning and water quality restoration. Furthermore, this will require close coordination with relevant farm service agencies and land owners.

4.7.1 Local Agricultural Districts

Local agricultural districts are described in detail on the New York State Department of Agriculture and Markets website:

> Article 25-AA of the Agriculture and Markets Law authorizes the creation of local agricultural districts pursuant to landowner initiative, preliminary county review, state certification, and county adoption…The purpose of agricultural districting is to encourage the continued use of farmland for agricultural production. The Program is based on a combination of landowner incentives and protections, all of which are designed to forestall the conversion of farmland to non-agricultural uses. Included in these benefits are…protections against overly restrictive local laws, government funded acquisition or construction projects, and private nuisance suits involving agricultural practices.
>
> The [Division of Agricultural Protection & Development] manages the certification of new districts and the review and recertification of existing districts. State certification confirms that a district meets the purposes and intent of the Agricultural Districts Law and all eligibility criteria described therein… The Division administers the Land Classification System, including maintenance of the statewide master list of agricultural soils.[68]

Map 27 in Appendix A illustrates those lands presently enrolled in a local agricultural district within Genesee, Livingston, Monroe and Wyoming Counties. Within the Oatka Creek watershed, 98,980 acres of land fall within a local agricultural district, which accounts for 72% of the total land area within the watershed.

Table 4.14: Lands within the Oatka Creek Watershed Enrolled in a Local Agricultural District

	Acreage within the Oatka Creek Watershed	County Watershed Share within an Ag. District	Percent of County Watershed Share within an Ag. District
Genesee County	56,359	40,314	72%

Livingston County	13,805	11,483	83%
Monroe County	3,693	1,776	48%
Wyoming County	64,234	45,407	71%
Total	138,091	98,980	72%

4.7.2 Agricultural Environmental Management (AEM)

As stated on the program's website: "AEM is a voluntary, incentive-based program that helps farmers make common-sense, cost-effective and science-based decisions to help meet business objectives while protecting and conserving the State's natural resources. Farmers work with local AEM resource professionals to develop comprehensive farm plans using a tiered process…"[69] The result is a coordinated approach to implementing agricultural conservation practices that make a meaningful improvement to the health and stability of the natural environment.

AEM is coordinated by county Soil and Water Conservation Districts in each of the four Oatka Creek watershed counties. AEM priorities are detailed in county AEM strategic plans, which are updated on a five-year cycle. The plans prioritize actions by specific watersheds within the county based on local water quality concerns and input from a local advisory committee.

Table 4.15: Summary of County AEM Statistics – Oatka Creek Watershed[70]

	Approx. Acres of Ag. Land Reported in AEM Surveys	AEM Farms	CAFOs	Types of Farms							
				Crop	*Equine*	*Dairy*	*Beef*	*Veg.*	*Deer*	*Sheep*	*Orchard/ Tree*
Genesee County	37,410	54	6	23	1	19	4	5	-	-	2
Monroe County	10,931	11	1	7	-	4*	-	-	-	-	-
Wyoming County	13,281	-	-	4	2	23	1	-	-	-	1

No AEM statistics provided for Livingston County
**2 of these 4 farms are based outside of Monroe County*

It is important to note that, as stated above, many farms and their operations cross watershed boundaries. In many cases, manure spreading and/or the location of other farm-related facilities might be spread across one of more watersheds. The information above reflects statistics of the general principal location of the farm operation.

In addition, SWCDs have provided estimates of the percentage of AEM farms ***in both*** the Black Creek and Oatka Creek watersheds using the following Best Management Practices:

Table 4.16: Summary of County AEM Statistics – Oatka Creek Watershed[71]

BMPs	Genesee	Monroe
Conservation Tillage	30%	70%
Stripcropping	15%	45%
Ag-to-Forest Land Conversion	1%	10%

Ag-to-Wetland Conversion	5%	10%
Nutrient Management	45%	65%
Grazing Land Management	10%	35%
Terraces/Diversions	5%	55%
Streambank Protection	48%	40%
Barnyard Management	43%	50%
Cropland Management*	50%	75%

Specific data not available for Wyoming and Livingston Counties

4.7.3 Concentrated Animal Feeding Operations (CAFOs)

The general trend occurring in United States agriculture over the past half century has been a reduction in the number of small, family-operated farms and consolidation into larger, more centralized operations. The Concentrated Animal Feeding Operation (CAFO) is a direct reflection of that trend and represents an economy of scale in agricultural commodity production. CAFOs are defined as lots or facilities where animals are stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period; they are categorized as either "large" or "medium" based on the numbers of animals confined.[72] However, there are many small facilities where animals are stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period (see Appendix E) that may fall below the CAFO threshold. CAFOs that discharge to waters of New York State are regulated by the NYS DEC under the authority of the Clean Water Act through the New York State Pollution Discharge Elimination System (SPDES) (refer to Section 3.8 for more information on the NYS SPDES program.[73]

A total of 17 Concentrated Animal Feeding Operations (CAFOs) were found to be located directly within the boundary of the Oatka Creek watershed – five medium size and 3 large sized. In addition, 12 CAFOs (eight medium and four large) were found to be within 2 miles of the Oatka Creek watershed boundary. Identification of CAFOs near the watershed border is an important consideration, as manure spreading often takes place across large areas that are associated with the farm operation. Information on each of these facilities is summarized in Table 4.17; a corresponding map illustrating the location of these farms is included in Appendix A of this report.

Table 4.17: NYSDEC Medium and Large CAFOs in Oatka Creek								
FACILITY Name	**Location** (business address)	**County**	**DEC Region**	**CAFO Size**	**CAFO Type**			CAFO Area
					Mature Dairy	Heifers	Other	
Broughton Farm Operation LLC	Silver Springs	Wyoming	9	Large	2165	510		8 Acres
Double B Farms	Silver Springs	Wyoming	9	Medium	0	400	20	6 Acres
Swiss Valley Farms	Warsaw	Wyoming	9	Large	850	400	400 Calves	10 Acres
East Hill Farm LLC	Warsaw	Wyoming	9	Medium	648	0		14,250 SF
Flint Farm	Warsaw	Wyoming	9	Medium	580	0		4 Acres
Bowhill Farm	Wyoming	Wyoming	9	Medium	285	0	50 Calves	25,720 SF
Highland Farms	Wyoming	Wyoming	9	Medium	428	0	158 Dairy Replacements	47,080 SF
Synergy LLC	Pavilion	Wyoming	9	Large	1350	0		<1 Acres
Logwell Acres INC	Pavilion	Wyoming	9	Medium	300	150	60 Calves	8.5 Acres
Craig T. Harkins	Wyoming	Wyoming	9	Medium	183	100		28,755 SF
Hildene Farms, Inc.	Wyoming	Genesee	8	Large	873	250		2.5 Acres
Cottonwood Farms	Pavilion	Genesee	8	Medium	350	0		40,000 SF
Mowacres Farm II, LLC	LeRoy	Genesee	8	Large	510	250	170 Calves	10 Acres
D & D Dairy	Scottsville	Monroe	8	Medium	375	0		1 Acres
Pagen Farms, Inc.	LeRoy	Genesee	8	Medium	657	640		2 Acres
Stein Farms LLC	LeRoy	Genesee	8	Large	630	0	550 Young Stock	66,793 SF
Udderly Better Acres	LeRoy	Genesee	8	Medium	330	0		0
CAFOs within a 2mi Buffer of Oatka Creek Watershed								
SUNNY KNOLL FARMS	Perry	Wyoming	9	Large	840			93,060 SF
WOODVALE FARMS	Perry	Wyoming	9	Medium	325			140,000 SF
VICTORY ACRES	Perry	Wyoming	9	Medium	240	200		1.1 Acres
MCCORMICK FARMS, INC. - DAIRY	Bliss	Wyoming	9	Large	1250	700		4 Acres
PINGREY FARM 2	Silver Springs	Wyoming	9	Medium	250			2 Acres
ARMSON FARMS LLC	Pavilion	Wyoming	9	Medium	200		100 feeder cattle; 2 horse; 75 calves	
BARNIAK FARMS	Pavilion	Genesee	8	Medium	498			6 Acres
NOBLEHURST FARMS INC.	Pavilion	Livingston	8	Large	1150	900		4.84 Acres
LOR-ROB DAIRY FARM	EAST BETHANY	Genesee	8	Large	1700		2,000 heifers/calves	25 Acres
HY HOPE FARMS, INC.	STAFFORD	Genesee		Medium	491		216 (UNREADABLE), 97 heifers, 122 Steers	6 Acres
ERNEST/TOM GATES	Pavilion	Livingston		Medium	450	200		
HUBERT W. STEIN & SONS				Medium	430	240	23 swine; 75 calves	

4.7.4 NRCS Crop Cover

The USDA National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) is a raster, geo-referenced, crop-specific land cover data layer with a ground resolution of 30 meters. The data layer is aggregated to a possible 85 standardized categories for display purposes, with the emphasis being agricultural land cover (a total of 50 are identified in the Oatka Creek watershed). The purpose of the Cropland Data Layer Program is to use satellite imagery to (1) provide acreage estimates to the Agricultural Statistics Board for the state's major commodities and (2) produce digital, crop-specific, categorized geo-referenced output products. Classification accuracy is generally 85% to 95% correct for the major crop-specific land cover categories. The accuracy of the CDL non-agricultural land cover classes is entirely dependent upon the USGS National Land Cover Dataset (NLCD 2001). Thus, the NASS recommends that users consider the NLCD for studies involving non-agricultural land cover.[74] To that end, results of the NLCD are included in Section 4 of this report and should be used for land use comparison and analysis.

GIS analysis of the 2010 data layer yielded the following results:

Table 4.18: 2010 Cropland Data Layer Analysis for the Oatka Creek Watershed

Crop/Land Cover Category	Acres	% Share of Watershed
Forest Categories Combined*	40,738.29	28.9%
Corn	28,376.25	20.1%
Alfalfa	22,335.78	15.8%
Other Hay	10,836.19	7.7%
Developed Space Categories Combined*	8,940.72	6.3%
Pasture/Grass	5,562.32	3.9%
Wetland Categories Combined*	5,139.77	3.6%
Other Cash Crops Combined*	5,099.51	3.6%
Soybeans	5,097.51	3.6%
Shrub/Fallow/Idle Lands Combined*	4,808.18	3.4%
Winter Wheat	4,056.48	2.9%
Barren	209.72	0.1%

*Tabular results for all land cover categories provided in Appendix D.

4.8 Pollution Control

The US EPA divides water pollution sources into two categories: point and non-point. Point sources of water pollution originate from a defined location such as sewage treatment plants and factories. Under the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. In New York State this program is administered by the NYSDEC and is referred to as the State Pollutant Discharge Elimination System (SPDES).

Water pollution and potential adverse environmental and public health effects associated therein can result from sources other than traditional point sources; these are referred to as non-point sources of pollution. Non-point sources are more diffuse and include sources such as agricultural runoff, construction site runoff, and pollutants collecting and running off of impervious surfaces.

Understanding the sources of pollution in the Oatka Creek watershed and the degree to which they are monitored and managed is an important element of watershed management. The US EPA, in conjunction with state and local authorities, monitors pollution levels in the nation's water and provide status and trend information on compliance and other issues. A selection of pollution control metrics are provided here under Section 4.8.

4.8.1 State Pollution Discharge Elimination System (SPDES)

As stated above, New York State has a state program that has been approved by the United States Environmental Protection Agency for the control of wastewater and stormwater discharges in accordance with the Clean Water Act. Under New York State law the program is known as the State Pollutant Discharge Elimination System (SPDES) and is broader in scope than that required by the Clean Water Act in that it controls point source discharges to groundwater as well as surface waters. A list of permitted SPDES discharge points that are present in the Oatka Creek watershed is provided in Table 3.18.

Table 4.19: New York State Pollution Discharge Elimination System Permittees within the Oatka Creek Watershed

Facility Name	SPDES No.	Municipality	Owner
Warsaw Sewage Treatment Plan	NY0021504	Village of Warsaw	Village of Warsaw
Markin Tubing	NY0084689	Town of Covington	Markin Tubing LP
Pavilion (Hamlet) Sanitary Sewage Disposal System	NY0247197	Pavilion	Town of Pavilion
PCore Electric Company, Inc.	NY0247308	Village of LeRoy	Hubbell Incorporated (of Delaware)
Lapp Insulator	NY0000779	Village of LeRoy	Lapp Insulators LLC
Caledonia Fish Hatchery	NY0035432	Village of Caledonia	NYSDEC
Leroy Village Waste Water Treatment Plant & Sludge Fac.	NY0030546	Village of LeRoy	Village of LeRoy
Scottsville Village Sewage Treatment Plant	NY0020133	Village of Scottsville	Village of Scottsville

A review of Enforcement and Compliance History records through the USEPA Enforcement & Compliance History Online (ECHO) database yielded the following information for each facility:

Effluent Violations refers to the number of times a monitored value at a facility exceeds the effluent limit set in the facility's permit. Effluent violations at every pipe and parameter may be counted once over each reporting period. For example, if a facility had one pipe with two parameters reported every month, the maximum number of effluent violations would be 1(pipe)x2(parameters)x12(months)x3(years)=72 effluent violations.

Notices of Violation are activities taken by EPA or the state that often precede a formal administrative or civil/judicial enforcement action. Not all notices of violation are escalated to formal enforcement action for a variety of reasons, including the following: the facility quickly corrects the problem(s) indicated in the notice, the violation is determined to be less severe than originally thought, or consultation between the facility and EPA or the state indicates that a violation has not occurred.

USEPA Enforcement & Compliance History Online (ECHO) database can be accessed online at http://www.epa-echo.gov/echo/index.html.

Table 4.20: USEPA Enforcement & Compliance History Online (ECHO) of Oatka Creek SPDES Permitees

Facility Name/Desc.	Discharge Point/Waterbody	Effluent Exceedances (9/08 – 9/11)	Description	Notices of Violation (NOV) or Informal Enforcement (9/06 – 9/11)
Warsaw Sewage Treatment Plant (Public Sewage Treatment Fac.)	Oatka Creek		None reported	
Markin Tubing (small manufacturing fac.)	Oatka Creek		Combination of non-compliance factors were recorded over the five year period including: pH; Iron; Lead; Oil & Grease; and TSS	1 Clean Water Act NOVs 01/15/2009
Pavilion (Hamlet) Sanitary Sewage Disposal System (Public Sewage Treatment Fac.)	Oatka Creek	4	Combination of non-compliance factors were recorded over the five year period including: pH and BOD	None reported
PCore Electric Company, Inc. (Elec. Indust. Apparatus)	Oatka Creek		None reported	
Lapp Insulator (Porcelain Elec. Supplies)		3	Combination of non-compliance factors were recorded over the five year period including: pH; Cobalt exceeded by 4% , Oil/Grease exceeded by 137%	1 Clean Water Act NOV 05/18/2010
Caledonia Fish Hatchery	Spring Creek		None reported	1 Clean Water Act NOV 01/15/2009
Leroy Village Waste Water Treatment Plant & Sludge Fac. (Public Sewage Treatment Fac.)	Oatka Creek	5	Combination of non-compliance factors were recorded over the five year period including: BOD and Flow	Violation Of CWA / §405 Sludge Disposal Requirements resulting in formal administrative procedures and $1,000 fine 1/15/2009
Scottsville Village Sewage Treatment Plant (Public Sewage Treatment Fac.)	Oatka Creek	7	Combination of non-compliance factors were recorded over the five year period including: Solids and Flow	None reported

The above charts exclude Dolomite Products Co. Inc. (LeRoy Quarry – 250 Gulf Road, LeRoy) and Hanson Aggregates (6895 Ellicott St (ST RTE 63), Pavilion), both listed by the USEPA as a Minor;

General Permit Covered Facility under NPDES. No record of this facility is included in NYSDEC SPDES GIS records. No violations were reported for either of these facilities by the EPA.

Descriptive data obtained from the NYSDEC on municipally owned waste water treatment plants (WWTPs) is provided in the table below.

Table 4.21: Descriptive Data of Municipal WWTPs in Oatka Creek Watershed[75]

Facility Name	SPDES No.	Discharge Waterbody/Stream Classification	Year Built	Last Update	Plant Class	Collection	Additional Treatment
Leroy Village Waste Water Treatment Plant & Sludge Fac.	NY0030546	Oatka Creek, Class C	1962	1993	3A	Separated System	--
Pavilion (Hamlet) Sanitary Sewage Disposal System	NY0247197	No information provided due to age of plant (recently constructed)					
Scottsville Village Sewage Treatment Plant	NY0020133	Oatka Creek, Class B	1968	1999	2A	Separated System	--
Warsaw Sewage Treatment Plant	NY0021504	Oatka Creek, Class C	1939	1998	2	Separated System	One stage biological nitrification and phosphorus removal

Plant Class explanation:
Plant Class - Refers to the certification required for the chief operator based on scoring of the plant's treatment train: Activated Sludge Treatment, with a definition of a biological treatment process in which a mixture of wastewater and activated sludge is agitated and aerated. The activated sludge is subsequently separated from the treated wastewater by sedimentation and wasted or returned to the process as needed.

- 4A plant score greater than 75 points
- 3A plant score between 56 and 75 points
- 2A plant score between 31 and 55 points
- 1A plant score or less than 30 points

Any biological oxidation process other than activated sludge.

- 4 plant score greater than 75 points
- 3 plant score between 56 and 75 points
- 2 plant score between 31 and 55 points
- 1 plant score or less than 30 points

Generally speaking, the higher the plant class the more sophisticated the system and hence a higher level of technical training is required.

4.8.2 NYS Construction Permit

The NYS General Permit for Construction Activities (Permit No. GP-0-10-001) is required for any construction activity that will disturb more than 1 acre of land.[76] Before commencing construction activity, the owner or operator of a construction project that will involve soil disturbance of one or more acres must obtain coverage under the Permit for Stormwater Discharges from Construction Activity. The permit is intended to reduce impacts to area waterbodies from sediment runoff. This is achieved in part through the development of a Stormwater Pollution Prevention Plan (SWPPP) as well as strict enforcement standards.

A review of General Permit issuances in the Oatka Creek watershed during the period 2003 and 2010 resulted in the following information:

Table 4.22: NYS General Permit for Construction Activities – Permits Issued in the Oatka Creek Watershed, 2003 – 2010

	2003	2004	2005	2006	2007	2008	2009	2010
No. of Permits Issued	5	1	2	7	5	6	5	3
Average Disturbed Area (Acres)	11.8	16.8	2.0	6.2	3.9	9.4	13.6	2.0

Source: NYSDEC

The majority of permits issued in the Oatka Creek watershed were in the Town of Warsaw (10) followed by Caledonia and LeRoy (7, respectively), and Wheatland (4).

4.8.3 EPA Regulated Facilities

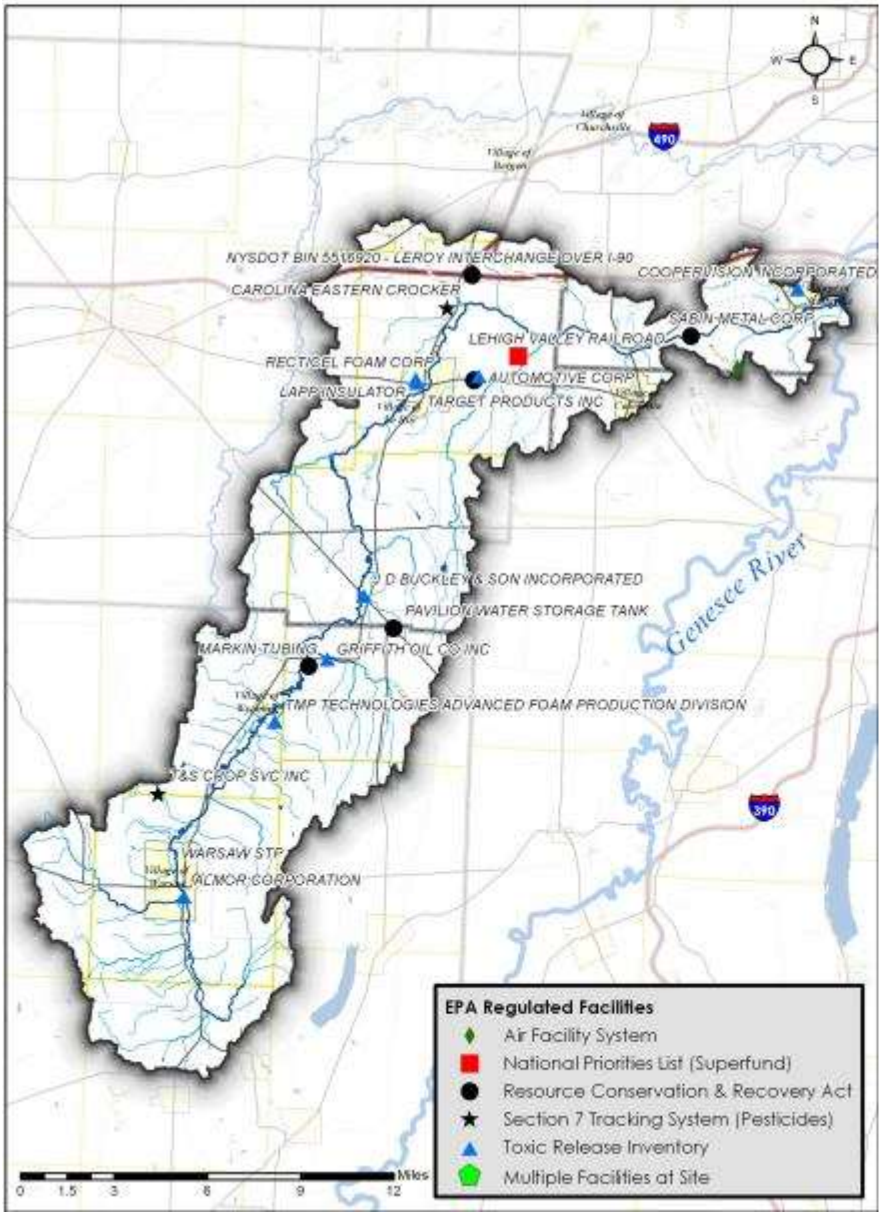
To improve public health and the environment, the EPA collects information about facilities or sites subject to environmental regulation. A query of this database identified 15 facilities present in the Oatka Creek watershed, as listed in Table 4.22 and illustrated on Figure 4.3.

The public is able to conduct research on facilities within their neighborhoods or areas of interest through the US EPA *Envirofacts* database, an online database and retrieval system for regulated facilities in the United States. Information on the facilities listed in Table 4.22 as well as other facilities can be found therein by visiting http://www.epa.gov/enviro/index.html.

The regulatory programs and authorities covered through this database and reported for the Oatka Creek watershed are as follows:

- **Toxic Release Inventory**: EPCRA Section 313 requires EPA and the States to collect data annually on releases and transfers of certain toxic chemicals from industrial facilities and make the data available to the public through the Toxics Release Inventory (TRI).
- **Resource Conservation & Recovery Act (RCRA):** Through RCRA, Congress directed EPA to regulate all aspects of hazardous waste. As a result, EPA developed strict regulations for the treatment, storage, and disposal of hazardous waste. States may implement stricter requirements than the Federal regulations as needed. Facilities listed here may be assumed to be required to perform one or more of the following procedures: treatment and disposal of hazardous materials; storage of hazardous materials, record keeping and reporting of activities associated with hazardous materials; and other requirements as stipulated by Federal law.

Figure 4.3: EPA Regulated Facilities



- **Risk Management Plan**: Under the authority of section 112(r) of the Clean Air Act, the Chemical Accident Prevention Provisions require facilities that produce, handle, process, distribute, or store certain chemicals to develop a Risk Management Program, prepare a Risk Management Plan (RMP), and submit the RMP to EPA.
- **Air Facility System**: Required by Title V of the Clean Air Act, the System consists of legally-enforceable documents designed to improve compliance by clarifying what facilities (i.e. Air pollution sources) must do to control air pollution. Issued to all large sources (“major” sources) and a limited number of smaller sources (called “area” sources, “minor” sources, or “non-major” sources).

Table 4.23: Oatka Creek EPA Regulated Facilities

Facility Name	Location	Facility Type
Almor Corporation	Warsaw	Toxic Release Inventory
T&S Crop Svc, Inc.	Warsaw	Section 7 Tracking System (Pesticides)
TMP Technologies Advanced Foam Production Div.	Wyoming	Toxic Release Inventory
Markin Tubing	Wyoming	Resource Conservation and Recovery Act
Griffith Oil Co., Inc.	Wyoming	Toxic Release Inventory
Pavilion Water Storage Tank	Pavilion	Resource Conservation and Recovery Act
J D Buckley & Son, Inc.	Pavilion	Toxic Release Inventory
Lapp Insulator	LeRoy	Multiple Facilities on Site
Target Products, Inc.	LeRoy	Toxic Release Inventory
Recticel Foam Corp.	LeRoy	Toxic Release Inventory
Hanson Aggregates – LeRoy Quarry	LeRoy	Resource Conservation and Recovery Act
Automotive Corp	LeRoy	Toxic Release Inventory
Monroe Livingston Sanitary Landfill	Scottsville	Air Facility System
Lehigh Valley Railroad	LeRoy	National Priorities List (Superfund)
Sabin Metal Corp	Scottsville	Resource Conservation and Recovery Act
Carolina Eastern Crocker	LeRoy	Section 7 Tracking System (Pesticides)
Coopervision Inc.	Scottsville	Toxic Release Inventory
NYSDOT BIN 5516920 – LeRoy Interchange over I-90	LeRoy	Resource Conservation and Recovery Act

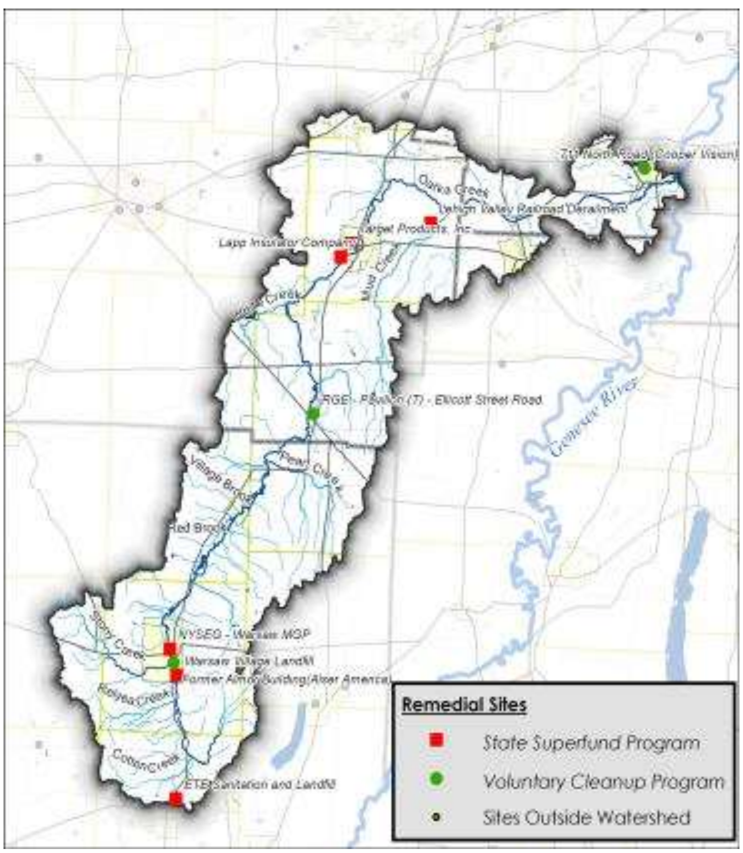


Figure 4.4: NYSDEC Hazardous Waste Sites

4.8.4 NYSDEC Hazardous Waste Sites

The NYS DEC Division of Environmental Remediation maintains a database of sites being addressed under one of the Division's remedial programs – *State Superfund*, *Brownfield Cleanup*, *Environmental Restoration* and *Voluntary Cleanup*. This database also includes the Registry of Inactive Hazardous Waste Disposal Sites and information on Institutional and Engineering Controls in New York State. A query of this database identified four facilities present in the Oatka Creek watershed. The locations of those facilities are shown in the map below; a description of the facility and facility status is provided in Table 4.24 on the following page.

Table 4.24: Oatka Creek DEC Hazardous Waste Sites			
Site Name	Site Location	Site Program	Site Priority Classifications
Target Products, Inc.	9 Lent Avenue, LeRoy	State Superfund Program	C
Lehigh Valley Railroad Derailment	Gulf Road and Lehigh Valley Railroad Crossing, LeRoy	State Superfund Program	02
Lapp Insulator Company	130 Gilbert Street, LeRoy	State Superfund Program	02
RGE - Pavilion (T) - Ellicott Street Road.	6903 Ellicott Street Road, Pavilion	Voluntary Cleanup Program	A
711 North Road (Cooper Vision)	711 North Road, Scottsville	Voluntary Cleanup Program	C
NYSEG - Warsaw MGP	Court and Mechanic Streets, Warsaw	State Superfund Program	C
ETE Sanitation and Landfill	Broughton Road, Gainesville	State Superfund Program	02
Warsaw Village Landfill	Industrial Street, Warsaw	State Superfund Program	03
Former Almor Building (Alser America)	220 South Main Street, Warsaw	Voluntary Cleanup Program	C

Explanation of remediation site priority classifications:[77]

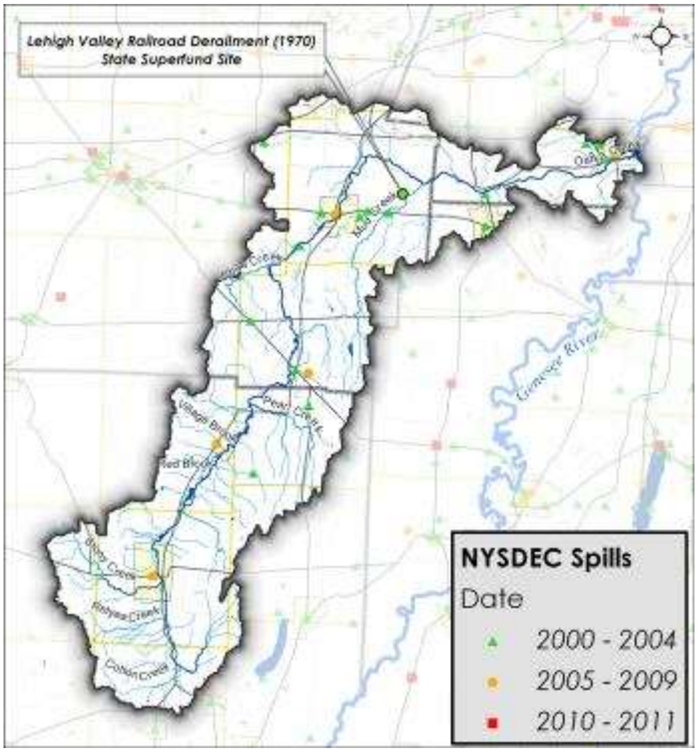
Classification Code: 2
The classification assigned to a site at which:
the disposal of hazardous waste has been confirmed and the presence of such hazardous waste or its components or breakdown products represent a significant threat to the environment or to health as described in subdivision (a) above; or hazardous waste disposal has not been confirmed, but the site has been listed on the Federal National Priorities List (NPL).

Classification Code: 3
The classification assigned to a site at which:
contamination does not presently constitute a significant threat to public health or the environment, as described in subdivision (a) above. This classification is used only when there is sufficient information available to conclude that the site does not pose a significant threat. This classification is not used for sites where the information is insufficient to make a definitive decision concerning significant threat.

Classification Code: A
The classification assigned to a non-registry site in any remedial program where work is underway and not yet completed (i.e., Brownfield Cleanup Program, Environmental Restoration Program, and Voluntary Cleanup Program sites).

Classification Code: C
The classification used for sites where the Department has determined that remediation has been satisfactorily completed under a remedial program (i.e., State Superfund, Brownfield Cleanup Program, Environmental Restoration Program, Voluntary Cleanup Program).

Figure 4.5: NYSDEC Spills, 2000 – 2011



4.8.5 Spills

The NYSDEC maintains a database of chemical and petroleum spills that have been reported to the Department since 1978. GIS analysis of the information was performed to illustrate the degree to which spills have occurred in and around the Oatka Creek watershed over time. An initial query of spills data identified over 10,000 spill incidences across NYSDEC Region's 8 and 9 dating back to 1978. These data were sorted to include only spills dating back to January 1, 2000 in order to narrow down the number of records and to allow a limited GIS analysis. The records were then geo-coded, a process in which an x-y point location is generated based on address data provided in the database, allowing the user to assign a point location on a map for each reported incident. In some cases, these locations are generalized due to limited information on the actual location.

A total of 37 spills were identified within the Oatka Creek watershed during the period 2000 to 2011. Those incidences were classified as follows:

- Commercial Vehicle (16)
- Commercial/Industrial (6)
- Unknown (5)
- Institutional (4)
- Private Residence (3)
- Passenger Vehicle (2)
- Gas Station (1)

Specific materials and volumes are not available through this particular query mechanism but can be obtained for specific incidences utilizing the NYSDEC Spill Incidences Database online search tool at http://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=2.

Also noted on Figures 4.3, 4.4 and 4.5 is the location of the Lehigh Valley Railroad Derailment Site, a spill of significance within this watershed. A December 1970 railroad derailment in the Town of LeRoy spilled 30,000 gallons of trichloroethene, which caused extensive groundwater contamination. Little remediation was conducted at the time of the spill and there was no follow-up regarding the spill until January 1991. An investigation conducted in 1991 found that the spill had migrated at least 3.5 miles from the spill site and contaminated over 35 private water supply wells. The site currently presents no apparent public health hazard due to treatment systems installed to reduce exposures.[78] The site continues to be monitored by state and federal agencies.

SECTION 4 ENDNOTES

[37] American Planning Association. Planning and Urban Design Standards. (Hoboken: John Wiley & Sons, 2006. 99

[38] Portions of this section adapted from USGS & Monroe County DOH article "The Black Creek Watershed Coalition," printed in the Improving Water Quality in Monroe County newsletter. Fall 2002, Issue 8.

[39] USEPA. Rochester Embayment Area of Concern. http://epa.gov/greatlakes/aoc/rochester.html#Background. Last visited online 12/2/10.

[40] *About Us*. [Online] In *Finger Lakes-Lake Ontario Watershed Protection Alliance*. Retrieved 2/3/11 from http://www.fllowpa.org/about.html

[41] *What We Do*. [Online] In *New York State Soil and Water Conservation Committe*e. Retrieved 12/14/10 from http://www.nys-soilandwater.org/about_us/what_we_do.html

[42] *About Us*. [Online] In *Black Creek Watershed Committe*e. Retrieved 12/23/10 from www.oatka.org/aboutus.php

[43] *Related Materials*. [Online] In *Intermunicipal Planning for the Black & Oatka Creek Watersheds*. Retrieved 1/2/11from http://gflrpc.org/Publications/BlackOatka/Summary%20of%20Reports.pdf

[44] Year indicates the year that the law was originally adopted; amendments have often been made since this date. "E-codes" are those made available online through the General Code website. General Code is an independent, for-profit service; it is assumed that the municipality provides the company with appropriate updates to their code on a regular basis. An entry of 'unk' indicates that the municipality's code was not available in its entirety at the time of review; it is therefore unknown whether the component exists. Municipalities listed as a "Regulated MS4" are required to have an erosion and sediment control law in place as per State and Federal law.

[45] Refer to Task 15 (as described above).

[46] New York State Department of State Division of Local Government Services. New York State Local Government Handbook, p. 39. Online at http://www.dos.state.ny.us/LG/publications/Local_Government_Handbook.pdf.

[47] *Farmland Protection Program.* [Online] In *New York State Department of Agriculture and Markets*. Retrieved 1/2/11from http://www.agmkt.state.ny.us/AP/agservices/farmprotect.html#county .

[48] *Livingston County Purchase of Development Rights Program*. [Online] In *Livingston County*. Retrieved online 12/2/10 from http://www.co.livingston.state.ny.us/planning.htm.

[49] Monroe County DOH recommends an 8-part series of checks at time of property transfer and further emphasizes the need to apply strict scrutiny on a case-by-case basis.

[50] Federal authorization to prepare a countywide all-hazard mitigation plan comes from the Disaster Mitigation Act of 2000 and 44 CFR (Code of Federal Regulations, Title 44). These regulations provide a mandate directing local governments to assess the potential dangers posed by natural hazards to their communities and propose cost effective means of reducing/eliminating the threats posed by those hazards. Hazard mitigation planning programs are strongly encouraged and supported by the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974, known as the Stafford Act (PL 93-288, as amended) and New York State Executive Law Article 2B: State and Local Natural and Man-Made Disaster Preparedness.

[51] Genesee County Multi-Jurisdictional All-Hazard Mitigation Plan (2007); Livingston County Multi-Jurisdictional All-Hazard Mitigation Plan (2007); Wyoming County Multi-Jurisdictional All-Hazard Mitigation Plan (2008);

[52] *Genesee County Smart Growth Plan*. [Online] In *Genesee County New York State*. Retrieved 1/2/11 from http://www.co.genesee.ny.us/dpt/planning/smartgrowth.html.

[53] Refer to Task 15 (as described above).

[54] Due to difficulties associated with analyzing population change at the census block level, analysis in this section relies on total population figures for the entire municipality.

[55] US Census Bureau. 1980 Census of Population, Detailed Population Characteristics of New York

[56] US Census Bureau. American FactfFinder. Data Set: 1990 Summary Tape File 1 - 100% data, Total Population.

[57] US Census Bureau. American FactfFinder. Data Set: 2000 Summary File 1100% data, Total Population.

[58] US Census Bureau. Census 2010, Summary File 1 General Profile 1: Persons by Race, Age, and Sex, Urban and Rural

[59] *Sprawl Without Growth: The Upstate Paradox*. [Online] In *The Brookings Institution*. Retrieved 1/2/11 from http://www.brookings.edu/reports/2003/10demographics_pendall.aspx

[60] Subsequent project tasks associated with this watershed management planning process will provide a comprehensive review and evaluation of the regulatory and programmatic environment.

[61] Table 3.10. "Federal" includes all undivided Federal routes, 2 to 4 lane routes, interstate routes and associated ramps; center-line miles are accounted for in both directions for divided highways. "Local" includes all town, city, and village roads named or unnamed on official county base maps. Only bridges that cross a hydrologic feature, such as a stream, lake or wetland, are considered. Bridges are categorized according to the road/highway they are located on; column does not assume ownership or maintenance responsibilities. Bridge features counted exclude culverts and railroad bridges.

[62] *Regional Land Use Monitoring*. [Online] In *Genesee/Finger Lakes Regional Planning Council*. Retrieved 1/2/11 from http://gflrpc.org/Publications/LandUseMonitoring.htm

[63] Figures are for permits issued for the construction of residential buildings (single – five family including mobile/mnfctd homes) in respective year. Permitted construction does not guarantee actual construction.

[64] *Better Site Design*. [Online] In New York State Department of Environmental Conservation. Page 1. Retrieved 7/22/11 from http://www.dec.ny.gov/docs/water_pdf/bsdcomplete.pdf

[65] *2009 New York State Open Space Conservation Plan*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/lands/47990.html

[66] Includes trails that are funded through the NYS Snowmobile Trail Fund. This fund, using snowmobile registration fees, provides grants to local governments, park regions, and the DEC to improve snowmobile trail systems.

[67] *Triple Divide Trail System Strategic Plan* [Online]. Retrieved 3/12/12 from http://www.geneseeriverwilds.org/tripledividetrail-plan2011.pdf

[68] *Agricultural Districts*. [Online] In *New York State Department of Agriculture and Markets*. Retrieved 1/2/11from http://www.agmkt.state.ny.us/AP/agservices/agdistricts.html

[69] *Agriculture Environmental Management*. [Online] In *New York State Soil and Water Conservation Committee*. Retrieved 1/2/11 from http://www.agmkt.state.ny.us/soilwater/aem/.

[70] Statistics provided by Genesee, Monroe and Livingston County Soil and Water Conservation Districts.

[71] Statistics provided by Monroe and Genesee Soil and Water Conservation Districts.

[72] See *§ 122.23.b* under *Part 122—EPA Administered Permit Programs*. [Online] In *US EPA*. Retrieved 8/3/11 from http://www.epa.gov/npdes/regulations/cafo_final_rule2008_comp.pdf.

[73] *Concentrated Animal Feeding Operations (CAFO) - Final Rule.* [Online] In *US EPA*. Retrieved 8/3/11 from http://cfpub.epa.gov/npdes/afo/cafofinalrule.cfm. See also *Permits for Concentrated Animal Feeding Operations (CAFOs)*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/permits/6285.html

[74] *Land Use/Land Cover: Cropland Data Layer by State*. [Online] In *USDA NRCS GeoSpatial Data Gateway*. Metadata retrieved 6/3/11 from http://datagateway.nrcs.usda.gov/Catalog/ProductDescription/NASS_CDL.html

[75] *Descriptive Data of Municipal Wastewater Treatment Facilities* (Jan 2004). [Online] In *NYSDEC Division of Water*. Retrieved 7/7/11 from http://www.dec.ny.gov/chemical/8721.html

[76] *Stormwater Permit for Construction Activity*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/chemical/43133.html

[77] Site Priority Classifications. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/chemical/8663.html

[78] NYS Department of Health. Public *Health Assessment: Lehigh Valley Railroad Derailment Site*. NYD086950251: July 6, 2000.

5.0 Surface Water Chemical Characteristics

The chemistry of surface waters, including those in streams, is affected by the nature of the underlying bedrock geology and the soil in the watershed, by the biota, especially the vegetation, and by the nature of the precipitation that falls on the watershed. Limestone bedrock and soils containing other carbonates, for example, buffer the pH of acid precipitation before it reaches the stream. The bedrock and, especially, the soils add other substances to the water as well—organic debris, inorganic sediment and various dissolved substances. Inasmuch as human activities alter the nature of the watershed's soil and overlying vegetation, they too have important impacts on the chemistry of water in the stream.

Because of their importance to living organisms or because they serve as indicators of human impact, certain chemical attributes of the water are of special interest. Forms of phosphorus and nitrogen—typically phosphate and nitrate—are of particular importance, because they tend to limit or promote the growth of plants and algae. Where these limiting nutrients are abundant, plant and algal growth flourishes. Such excess growth may be unsightly or otherwise troublesome in its own right, but, as it senesces and decays, it may also consume much of the oxygen dissolved in the water, leading to other chemical and biological problems. This process of excess fertilization of plant and algal growth is frequently referred to as cultural eutrophication. Other chemicals, often those of anthropogenic origin, are essentially toxic to the biota: heavy metals—e.g., mercury and lead—and certain synthetic organic compounds—e.g., some pesticides and PCBs—accumulate in biological tissues ("bioaccumulation") and become concentrated at higher levels of the food web ("biomagnification"). Sediment eroding from the watershed makes the water turbid, blocking sunlight from reaching the algae that coat the bottom of the stream and that, along with organic debris washed in from the riparian area around the stream, serve as the base of the foodchain. Sediment also smothers microhabitats that harbor animals that live on the bottom of the stream. Turbidity may also interfere with many human uses of the waterbody.

5.1 Water Quality Criteria and Standards

5.1.1 Ambient Water Quality Standards (AWQS) Screening

New York State DEC classifications for surface waters in the state range from A (or AA) to D, depending on the current of expected best use of the water:

A or AA:	Suitable as a source of drinking water
B:	Suitable for swimming or other contact recreation
C:	Supporting fisheries; suitable for non-contact recreation
D:	Unsuitable for any of the uses above

In addition, classification of B or C waters may be designated "T", supporting a trout population, or "TS" supporting trout spawning. Currently, all of the upper portion of Oatka Creek and its tributaries are classified "C", but the lower portions of the creek, from just above its confluence with Mud Creek to its confluence with the Genesee River near Scottsville are classified "B". Some sections of this lower portion are further classified "T" or "TS", indicating they support trout fisheries. Segments of an Oatka

Creek tributary flowing from the Village of Caledonia is classified C(T) or C(TS). These trout fisheries from the lower portions of the Oatka Creek Watershed are recognized as important regional natural resources.

We have surveyed the available data to assess Oatka Creek's compliance with NYSDEC ambient water quality standards, principally originating from studies completed in 2005, to identify areas of potential concern. Identification of temporal trends and comparison of water quality from place to place within the watershed are inhibited by important data gaps, and it is important to note when and where these water-quality parameters were measured and by whom. Some parameters of water quality have only "narrative" standards. These include the important nutrients phosphorus and nitrogen as well as total and suspended solids.

The data selected were the most recent sample dates within the past 10 years from three datasets:

- USGS 04230500 OATKA CREEK AT GARBUTT NY – Data available from this station range from 1954 to 2009. For the purposes of this screening, data from 2005 through 2009 were used.
- RIBS OATKA CREEK IN SCOTTSVILLE @ STATE ROUTE 251 – Rotating Intensive Basin Study, conducted in 2005 by the New York State DEC; these data appear to be—at least in part—replicated in the USEPA Storet database.
- SUNY Brockport – Data collected by for the Genesee River Project by Dr. Joseph C. Makarewicz (SUNY Brockport) during 2010 on Oatka Creek from a sample location described as "Garbutt", which is presumably comparable to the USGS Garbutt station.

Dr. Makarewicz's group from SUNY Brockport is conducting an ongoing study of Oatka Creek Watershed and a number of other watersheds in the Genesee River Basin. Additional data from a number of sites in the Oatka Creek Watershed will be available soon. These data can be added to t his characterization and used to set priorities for restoration and protection of Oatka Creek and its tributaries.

Analytical results from the datasets currently available that meet the AWQS are shown in Table 5-1, while parameters that exceeded the AWQS are shown in Table 5-2. The parameters listed in Table 5-3 are those with narrative standards; the data available pertaining to these narrative standards do not allow a determination of compliance or non-compliance.
In summary:

- The majority of measurements of nitrite nitrogen, dissolved oxygen and pH meet the NYSDEC ambient water quality standards for Class B waters at Scottsville, where measurements have been made for a number of years. Although the minimum dissolved oxygen measured in the RIBS program on one occasion was very low, other values and all the averages fall well within the standard. Nitrite N was measured in excess of the ambient water quality standard to protect a cold water fish community, but within the warm water standard, on one occasion in June, 2005.
- Levels of aluminum, mercury and total solids in Scottsville, near the confluence of Oatka Creek with the Genesee River, all exceed the NYS ambient water quality standards, and, in the case of mercury, by a factor of 20 or more.

- There is no indication from these data that the narrative standards have been exceeded, and the quality of the water in Oatka Creek and its tributaries appears to be suitable for its designated best use with regard to these nutrients.

Table 5.1: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled in recent years which met the standards.

Parameter	AWQS for Class B and C Waters	Data Source/Location	Meets Standards?
Ammonia	Varies with pH and temperature. *For this data set, standards range from 1.1 to 1.4 mg/l*	RIBS – Scottsville @ State Route 251 (2005)	Standards met.
Cadmium	0.85 exp (0.7852 [ln (ppm hardness)] - 2.715) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 4.22 to 9.32 ug/l.*	RIBS – Scottsville @ State Route 251 (2005)	Standards met.
Coliforms, Fecal	The monthly geometric mean, from a minimum of five examinations, shall not exceed 200 cfu/100ml. *Applicable when disinfection is required for SPDES permitted discharges directly into, or affecting the best usage of, the water; or when the department determines it necessary to protect human health.*	RIBS – Scottsville @ State Route 251 (2005)	Insufficient data to assess compliance. *Period:* Apr-Nov *N samples:* 9 *Geometric mean* = 98 cfu/100ml.
Copper	(0.96) exp(0.8545 [ln (ppm hardness)] - 1.702) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 19.3 to 45.5 ug/l.*	RIBS – Scottsville @ State Route 251 (2005)	Standards met.
Fluoride	(0.02) exp(0.907 [ln (ppm hardness)] + 7.394) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 4,777 to 11,897 ug/l.*	RIBS – Scottsville @ State Route 251 (2005)	Standards met.
Lead	(1.46203 - [ln (hardness) 0.145712]) exp (1.273 [ln (hardness)] - 4.297) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 9.89 to 28 ug/l.*	RIBS – Scottsville @ State Route 251 (2005)	Standards met.
Nickel	0.997 exp (0.846 [ln (ppm hardness)] + 0.0584) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 111 to 260 ug/l.*	RIBS – Scottsville @ State Route 251 (2005)	Standards met.
pH	Shall not be less than 6.5 nor more than 8.5	RIBS – Scottsville @ State Route 251 (2005)	Standards met.
Zinc	exp (0.85 [ln (ppm hardness)] + 0.50) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 177 to 416 ug/l.*	RIBS – Scottsville @ State Route 251 (2005)	Standards met.

A[C] – Standard for aquatic life, chronic exposure.

Table 5.2: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled in recent years that did not meet the standards.

Parameter	AWQS for Class B and C Waters	Data Source/Location (Year)	Meets Criteria?
Aluminum	100 ug/l (A[C])	RIBS – Scottsville @ State Route 251 (2005)	30% of measurements exceeded standard
Coliforms, Fecal	The monthly geometric mean, from a minimum of five examinations, shall not exceed 200 cfu/100ml. *Applicable when disinfection is required for SPDES permitted discharges directly into, or affecting the best usage of, the water; or when the department determines it necessary to protect human health.*	RIBS – Scottsville @ State Route 251 (2005)	Insufficient data to assess compliance. Geometric mean of 9 samples collected Apr-Nov = 98 cfu/100ml.
Coliforms, Total	• The monthly median value of the samples, from a minimum of five examinations, shall not exceed 2,400 cfu/100 ml, and; • more than 20 percent of the samples, from a minimum of five examinations, shall not exceed 5,000 cfu/100ml *Applicable when disinfection is required for SPDES permitted discharges directly into, or affecting the best usage of, the water; or when the department determines it necessary to protect human health.*	SUNY Brockport – Garbutt (2010)	No monthly medians exceeded the standard of 2,400 cfu/100ml. 25% of September and October samples exceeded the percent standard of 5,000 cfu/100ml.
		RIBS – Scottsville @ State Route 251 (2005)	Insufficient data to assess compliance. Median of 9 samples collected Apr-Nov = 190 cfu/100ml. 11% of 9 samples exceeded 5,000 cfu/100ml.
Dissolved Oxygen	For trout spawning waters (TS), the DO concentration shall not be less than 7.0 mg/L from other than natural conditions. For trout waters (T), the minimum daily average shall not be less than 6.0 mg/L, and at no time shall the concentration be less than 5.0 mg/L.	RIBS – Scottsville @ State Route 251 (2005)	20% of samples were less than 7 mg/l 10% of samples were less than 5.0 mg/l.
Mercury	0.0007 µg/l (H[FC])	RIBS – Scottsville @ State Route 251 (2005)	Measurements reported with detectable concentrations exceeded standard.
Nitrite Nitrogen	100 ug/L except 20 ug/L for trout waters (T or TS) (A[C])	RIBS – Scottsville @ State Route 251 (2005)	Standard not met for trout waters; 10% of samples exceeded 20 ug/l.
Solids, Total Dissolved	Shall be kept as low as practicable to maintain the best usage of waters but in no case shall it exceed 500 mg/L.	RIBS – Scottsville @ State Route 251 (2005)	80% of samples exceeded standard.

A[C] – Standard for aquatic life, chronic exposure.
H[FC] – Standard for human exposure via fish consumption

Table 5.3: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled in recent years with narrative standards difficult to evaluate against numerical data.

Parameter	AWQS for Class B and C Waters	Data Sources/Location
Nitrogen, Total	None in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages.	USGS – Garbutt (2005-2009) SUNY Brockport – Garbutt (2010)
Phosphorus, Total	None in amounts that will result in growths of algae, weeds, and slimes that will impair the waters for their best usages.	RIBS – Scottsville@ STATE ROUTE 251 (2005) USGS – Garbutt (2005-2009) SUNY Brockport – Garbutt (2010)
Solids, Total Suspended	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	RIBS – Scottsville @ State Route 251 (2005) USGS – Garbutt (2005-2009) SUNY Brockport – Garbutt (2010)
Solids, Total	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	RIBS – Scottsville @ State Route 251 (2005)
Turbidity	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	RIBS – Scottsville @ State Route 251 (2005)

5.1.2 Priority Waterbodies List (PWL)

States must complete periodic assessments of water quality and habitat conditions in order to evaluate whether standards are met, and whether the designated uses are supported. In New York, surface waters exhibiting symptoms of degradation are placed on a Priority Waterbodies List (PWL), and categorized based on the severity of water quality and/or habitat degradation (Table 5-4).

Table 5-4: Categories of water quality, based on the severity of water quality and/or habitat degradation

Severity	Criteria
Precluded	*Frequent/persistent* water quality, or quantity conditions and/or associated habitat degradation *prevents all aspects* of the waterbody use.
Impaired	Occasional water quality, or quantity conditions and/or habitat characteristics *periodically prevent* the use of the waterbody, or; Waterbody uses are not precluded, but some aspects of the use are *limited* or *restricted*, or; Waterbody uses are not precluded, but *frequent/persistent* water quality, or quantity conditions and/or associated habitat degradation *discourage* the use of the waterbody, or; Support of the waterbody use *requires additional/advanced* measures or treatment.
Stressed	Waterbody uses are not significantly limited or restricted, but occasional water quality, or quantity conditions and/or associated habitat degradation *periodically discourage* the use of the waterbody.

Threatened	Water quality currently supports waterbody uses and the ecosystem exhibits no obvious signs of stress, however *existing or changing land use patterns* may result in restricted use or ecosystem disruption, or; Monitoring *data reveal increasing contamination* or the presence of toxics below the level of concern, or; Waterbody uses are not restricted and no water quality problems exist, but the waterbody is a *highly valued resource* deemed worthy of special protection and consideration.

The most recently published Priority Waterbodies List (2003) evaluates 5 segments of Oatka Creek: upper, middle (Genesee Co.), middle (Wyoming Co.), lower Oatka Creek, each with its associated minor tributaries, and the LeRoy Reservoir (Table 5-5). [79]

Table 5-5: Priority waterbody listings (PWL) for segments of Oatka Creek and its tributaries (NYSDEC PWL 2003).

Oatka Creek Segment	Use Impairment	Cause Source	Class	W B Category
Lower Oatka Ck & Minor Tribs.	Aquatic Life suspected of being **stressed** Aesthetics suspected of being **stressed** Public bathing suspected of being **stressed**	algal/weed growth; silt/sediments agriculture; stream-bank erosion	B	minor impacts
Middle Oatka Ck & Minor Tribs. (Wyoming Co.)	Recreation suspected of being **stressed** Aesthetics suspected of being **stressed**	algal/weed growth; nutrients; silt/sediment agriculture; stream-bank erosion	C	Minor Impacts
Middle Oatka Ck & Minor Tribs. (Genesee Co.)	Recreation suspected of being **stressed** Aesthetics suspected of being **stressed**	algal/weed growth; nutrients; silt/sediment agriculture; stream-bank erosion	C	minor impacts
Upper Oatka Ck & Minor Tribs.	Recreation suspected of being **stressed** Aesthetics suspected of being **stressed**	algal/weed growth; nutrients; silt/sediment agriculture; stream-bank erosion	C	minor impacts
LeRoy Reservoir (Sect. 303(d) listed waterbody)	Water supply known to be **stressed**. Aesthetics known to be **stressed**.	water level/flow, nutrients, pathogens hydro modification; failing on-site systems		minor impacts

5.1.3 Section 303(d) Listing

In New York, waterbodies with designated uses considered precluded or impaired are eligible for placement on the 303(d) list. This list is named for the section of the Clean Water Act requiring states, territories, and authorized tribes to assess water-quality conditions within their jurisdictions and compare the data to promulgated standards. The 303(d) list is a product of this assessment; water bodies are placed on the list when additional controls are needed to bring water quality into compliance with standards and criteria.

The Final New York State (June 2010) Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy (http://www.dec.ny.gov/docs/water_pdf/303dlistfinal10.pdf) lists no segments of Oatka Creek with impairments significant enough to require TMDL development or other controls.

5.2 Water Quality Data Summary

The water chemistry of Oatka Creek (and its tributaries) was characterized in the Oatka Creek Watershed State of the Basin Report (2002) using principally data from the DEC-RIBS Program for 1989 & 1990, a similar study by Sutton (1995), and water-flow and water-chemistry data from the USGS gauging station at Garbutt. There are also very recent data for some chemical parameters (Fall 2010) from a site near the Garbutt gauging station (Makarewicz, unpublished[80]). These data suggest that the water quality of Oatka Creek and its tributaries is generally good with only minor impairments and does not appear to be deteriorating.

Table 5.6: Comparison of selected analytical results from three data sets

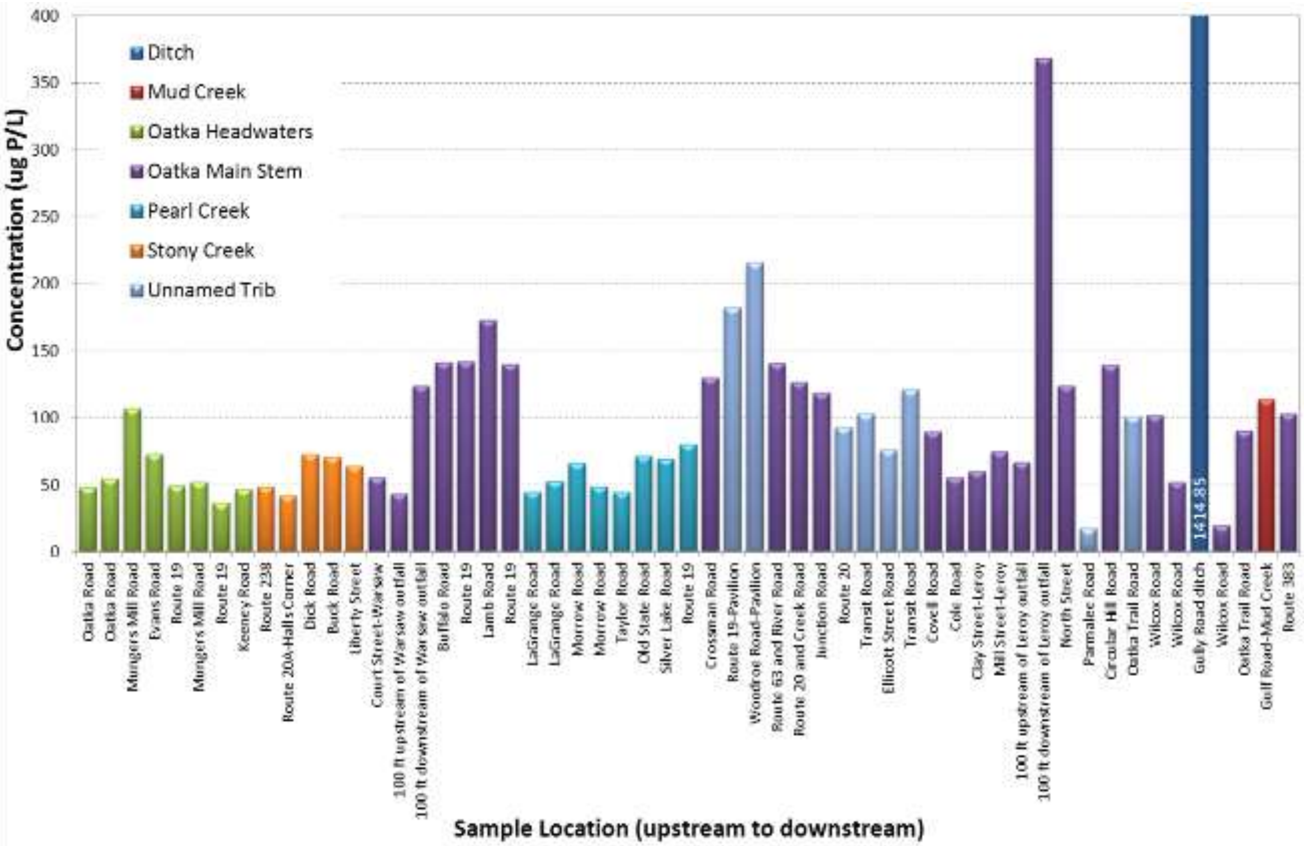
Parameter (units)	RIBS at Scottsville Route 237 2000 & 2005 (N = 20)	USGS at Garbutt 2005-2009 (N = 48)	SUNY Brockport 2010 (N = 15)
Phosphorus (mg/l)			
Min	0.011	0.022	0.008
Max	0.247	0.482	0.036
Average	0.034	0.099	0.020
Median	0.019	0.077	0.019
Nitrogen (mg/l)			
Min	1.39[a]	1.4	1.61
Max	4.11[a]	6.8	1.94
Average	2.28[a]	2.6	1.80
Median	2.26[a]	2.7	1.79
TSS (mg/l)			
Min	1.0	6.0	0.10
Max	114	171	7.5
Average	9.4	40	2.6
Median	2.85	31	2.4

[a]Total nitrogen calculated as the sum of ammonia, TKN and nitrate/nitrite.

5.2.1 Water chemistry 2002-2004

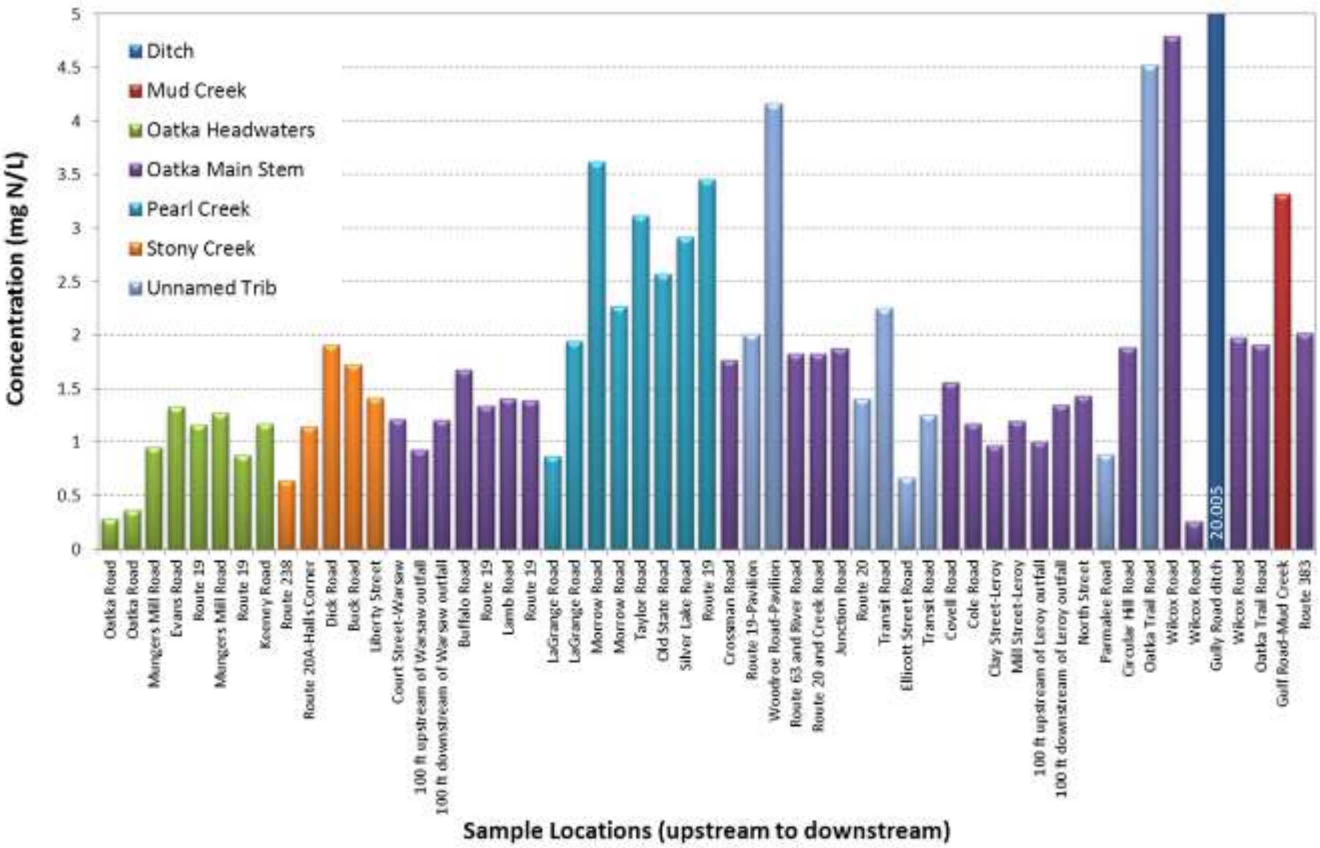
The State of the Basin Report (2002) noted few, if any, water quality parameters that fall outside ambient water quality standards or guidance values. However, concentrations of phosphorus, an important nutrient, and of suspended solids that contribute to turbidity, are especially high at times of high flow. The report recommends regular monitoring of these parameters of potential concern.

Figure 5.1: Total Phosphorus average concentrations, 2003-2004, from upstream (left) to downstream (right) on Oatka Creek. (Source: Makarewicz and Lewis, 2004).



As a follow-up to this recommendation, Makarewicz and Lewis (2004) collected grab samples at multiple sites along the main stream and a number of tributaries on eight dates between Sept. 2003 and May 2004, measuring total and soluble reactive phosphorus (TP (Figure 5-1) and SRP), nitrate and total Kjeldahl nitrogen (NO3-N (Figure 5-2) and TKN), sodium and total suspended solids (TSS) in order to locate sources of point and non-point pollution. This study identified seven areas affected by non-point sources of pollution on tributaries or the main stream. In each case, the sites were in proximity to agricultural lands. In addition, the study was able to discern the effects of the wastewater treatment plants at Warsaw and at LeRoy on in-stream concentrations of phosphorus and nitrogen. Makarewicz and Lewis (2004) recommend that landowners and managers in the watershed work together to implement best management practices (BMP) on agricultural lands in the watershed, especially at the sites they note as “stressed”. The two wastewater treatment plants were operating within their current State Pollution Discharge Elimination System (SPDES) permits during the study period. The investigators recommended stakeholder discussions to consider the potential for the effects of increased population growth and associated increased point source loading on Oatka Creek.

Figure 5.2: Nitrate average concentrations, from upstream (left) to downstream (right) on Oatka Creek.
(Source: Makarewicz and Lewis, 2004).

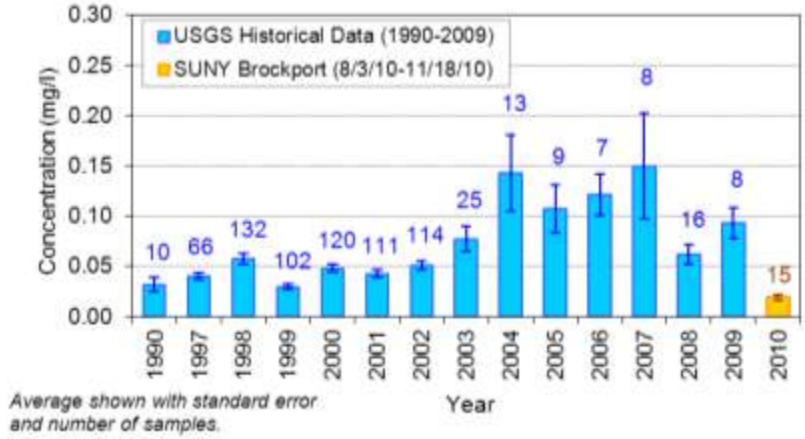


5.2.2 Water chemistry since 2004

The USGS data displayed in Figure 5.3 reflect an increasing trend or at least higher levels of total phosphorus (TP) for the years 2004-2007 and 2009. The averages for these years, however, are based on relatively fewer samples (7-13) and have more variability than those for the years 1990-2003 (up to 132 measurements). This change in the sampling program was designed to maintain the integrity of the long-term monitoring record despite reduced funding allocations; samples are collected during baseflow and runoff events, distributed throughout the annual cycle. While New York State has not yet proposed nutrient criteria for flowing waters, recent total P concentrations in Oatka Creek (with the exception of 2008) approach the 0.1 mg/L threshold cited as the EPA's goal for controlling eutrophication.

The values reported by Makarewicz from his 2010 sampling program are among the lowest reported for this site. Most of the 15 samples were collected during low flow conditions (refer to Figure 5.5), which likely contributes to the low variability in the measured concentrations as well.

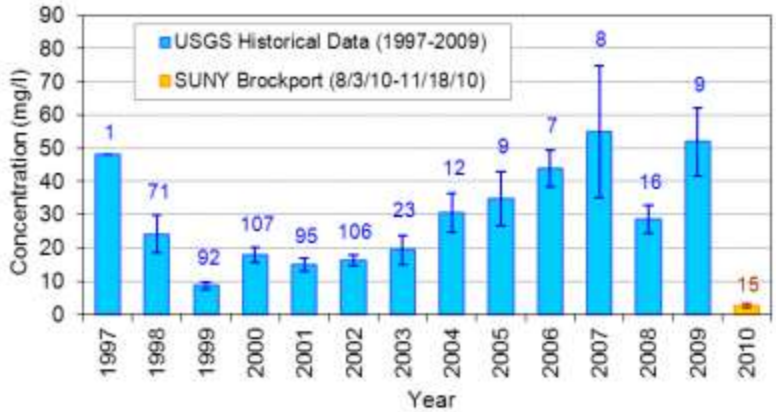
Figure 5.3: Annual statistics for phosphorus in Oatka Creek at Garbutt.



The same pattern holds for total suspended solids (TSS – Figure 5.4): values for 2004-2007 and for 2009 are high, with the reduced sampling regime likely contributing to the higher standard error of the mean. Once again, Makarewicz's results, collected during low flow conditions, are much lower than the USGS dataset. The TP and TSS results are highly correlated, and both are higher during high flow conditions. Ongoing investigations by the Brockport group in the upper reaches of the watershed have determined that farm-animal waste, especially from confined animal feeding operations (CAFOs) present significant loads of nitrogen and phosphorus, at least to the Evans Creek subwatershed, although wetlands along the stream serve as sinks for phosphorus and mitigate concentrations to some extent (D. Pettenski, pers. comm., Scholars' Day Presentation, SUNY Brockport, March 2011)

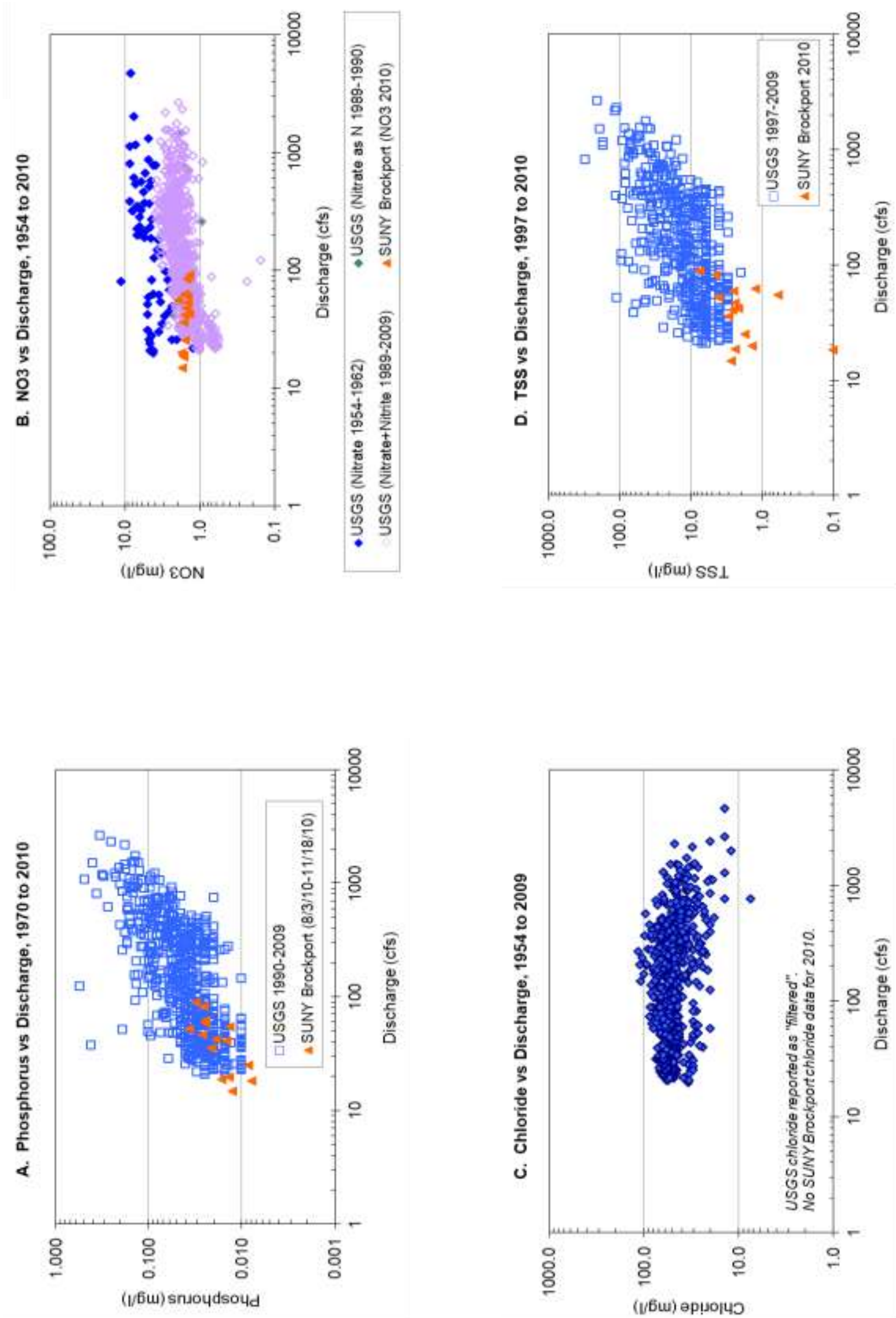
The same pattern holds for total suspended solids (TSS – Figure 5.4)): values for 2004-2007 and for 2009 are high, but represent small sample sizes. Once again, Makarewicz's values are much lower. Since the years for which the average concentrations of TP and TSS represent relatively few samples, since both TP and TSS concentrations in the creek depend strongly on the discharge rate (Figure 5.5), and since Makarewicz recently reported much lower concentrations, there is no clear trend of increase in either of these.

Figure 5.4: Annual statistics for Total Suspended Solids in Oatka Creek at Garbutt



Average with standard error and number of samples.

Figure 5.5. Comparison of parameter concentrations with stream discharge, Oatka Creek at Garbutt



SECTION 5.0 ENDNOTES

[79] Summary Listing of Priority Waters, [Online], NYSDEC, http://www.dec.ny.gov/docs/water_pdf/pwlgeneslist.pdf. Ont 117-25 and Ont 117- 25- 7-4-P24a

[80] The Genesee River Project, Joseph Makarewicz, SUNY College at Brockport, Brockport, NY

6.0 Biological Characteristics of the Watershed

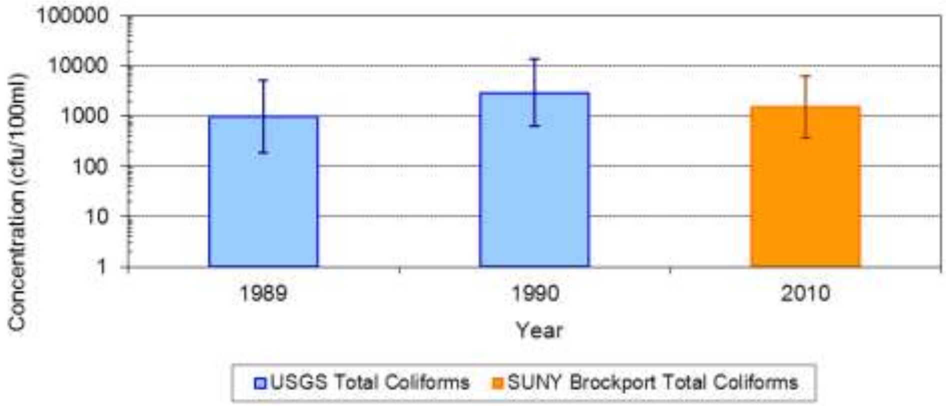
6.1 Coliform Bacteria

Coliform bacteria that originate in the intestinal tracts of birds and mammals, including humans, are reported as "fecal coliforms", and are used to indicate the potential presence of pathogenic (disease-causing) microorganisms in water. Although these bacteria themselves may not be pathogenic, because they are specific to the intestinal tracts of animals, however, they indicate that animal feces, perhaps containing pathogens, have entered the water. Other coliform bacteria are naturally present in the soil and may reach the waterway through erosion and runoff. Measurements reported as "total coliforms" include these soil organisms as well as the "fecal coliforms". Because erosion and runoff are greater during periods of high-flow storm events, counts of "total coliforms" can vary greatly with stream discharge rates.

Individual on-site wastewater disposal systems (septic systems), wastewater treatment facilities and animal feeding operations, including pastured animals with access to streams, confined animal feeding operations (CAFOs), or run-off from manured fields are likely sources of fecal coliform bacteria in waterways. Waterfowl, including Canada geese, can also contribute fecal coliform bacteria to waterways.

The State of the Basin Report (2002) cites the 1989-1990 RIBS program's findings for total coliform and fecal coliform bacteria in Oatka Creek at Garbutt. Among the monthly samples taken at that time, total coliform counts ranged from 96-8200 cfu (colony-forming units)/100 ml, and fecal coliform bacteria counts ranged from 10 to 1600 cfu/100 ml, and all of these levels are below criteria for secondary contact recreation (Class C Waterbody). The RIBS study was repeated in 2005 (9 samples from April to November). Total coliform ranged from 55 to 22,000 cfu/100 ml (median of 300 cfu/ 100 ml), and fecal coliform ranged from 15 to 7800 cfu/ 100 ml (median of 50 cfu/100 ml).

Figure 6.1: Annual statistics (geometric mean +/- standard deviation) for total coliforms in Oatka Creek at Garbutt. USGS data for 1989 and 1990; SUNY Brockport data from 2010



Recent studies by the SUNY Brockport group (Makarewicz. pers. comm[1].), however, report much higher levels of total coliforms ranging from 0 to 92,000 cfu/100 ml with a median of 900 cfu/100 ml at the Garbutt site (Figure 6-1).

The SUNY Brockport 2010 total coliform data were evaluated for compliance with the NY State Ambient Water Quality Standard (AWQS) (Table 6-1). The AWQS for total coliforms consists of two standards, based on a minimum of 5 examinations:

- The monthly median value shall not exceed 2,400 cfu/100ml, and
- more than 20 percent of the samples shall not exceed 5,000 cfu/100ml

Table 6.1: Evaluation of 2010 SUNY Brockport total coliforms data with AWQS

Month 2010	N samples	The monthly median value shall not exceed 2,400 cfu/100ml		more than 20 percent of the samples shall not exceed 5,000 cfu/100ml	
		Monthly Median	*Exceeds Criterion?*	*% of Samples >5000 cfu/100ml*	*Exceeds Criterion?*
August	5	1,500	No	0%	No
September	4	900*	No*	25%*	Yes*
October	4	2,200*	No*	25%*	Yes*
November	2	na	--	na	--

* - Number of samples less than 5 (4).
na – indicates insufficient number of samples (2) for evaluation with AWQS

[1] The Genesee River Project, Joseph Makarewicz, SUNY College at Brockport, Brockport, NY, pers. comm..

6.2 Benthic Macroinvertebrates

The community of animals living in a waterbody is a good indicator of the qualities of the water, especially the qualities important for supporting life. In particular, evaluation of the community of invertebrate animals—largely insects—living on the bottom of a stream has been widely used as an indicator of water quality. These bottom-dwelling invertebrate animals are large enough to be seen without the aid of a microscope and are referred to as benthic macroinvertebrates. Some of these animals are sensitive to pollution, and since many of them live in the stream for a year or more, they integrate the condition of the water over time, unlike so-called "grab samples" for chemical analysis that represent only a snapshot of conditions. The NYSDEC, the US-EPA and other agencies apply standard methods to the analysis of these communities to arrive at statements of overall water quality.

Based on an analysis of the community of benthic macroinvertebrates in Oatka Creek, the 1989-1990 DEC-RIBS study classified the water in the creek as "slightly impacted". This finding was confirmed by Sutton (1997), who carried out a series of similar assessments during the 1990s, and the State of the Basin Report (2002) lists the creek as "slightly impacted" and notes that these conditions did not change from the 1989-90 study to the 1997 study of Sutton (1997). An intensive RIBS study was repeated at the Scottville site in 2005, and evaluation of the benthic macroinvertebrate community once again led to a "slightly impacted" designation.

Freshwater mussels also reside in Oatka Creek and its tributaries, but Region 8 (Avon) NYSDEC biologists searched 13 sites from upstream of Warsaw to Scottsville and found live mussels representing 2 common species only at a site at Mumford (Table 6.2) (pers. com. DEC Region 8).

Table 6.2: Freshwater Mussels of the Oatka Creek Watershed (data provided by Jenny Landry, NYSDEC Bureau of Wildlife, Region 8, February 2011)

Scientific Name	Common Name
Oatka Creek	
Anodontoides ferussacianus (Lea)	Cylindrical papershell
Pyganodon grandis (Say)	Floater / Giant floater

6.3 Fish

The most recent general surveys of fish in the Oatka Creek Watershed were done by the NYSDEC Regions 8 and 9 between 1990 and 2003. Although the species lists from those surveys cannot be used reliably to detect changes in the fish community in the watershed, they may serve as baseline data for future program of surveys. A total of 30 species of fish were recorded among the surveys, as listed below (pers. com. DEC Region 8).

Brown trout	Sand shiner	Northern pike
Rainbow trout	Mimic shiner	Banded killifish
White sucker	Bluntnose minnow	Rock bass
Northern hog sucker	Fathead minnow	Pumpkinseed
Smallmouth bass	Cutlip minnow	Bluegill
Largemouth bass	Longnose dace	Greenside darter
Northern pike	Eastern Blacknose dace	Fantail darter
Central stoneroller	Shorthead redhorse	Johnny darter
Common shiner	Creek chub	Tessellated darter
Spottail shiner	Hornyhead chub	Logperch
Brook trout		

There is a productive trout fishery in Oatka Creek based mainly on brown trout introduced by the DEC with the help of local anglers. In 2009, the DEC stocked approximately 15,000 brown trout at Wheatland in Monroe Co., LeRoy in Genesee Co. and Warsaw in Wyoming Co. Stocking of a similar number in 2010 was planned, but the numbers stocked have not yet been posted by the DEC. This fishery, especially the lower reaches of the creek constitute an important regional natural resource worthy of protection and dependent on the maintenance of excellent water quality. Beginning in October 2001, the NYSDEC imposed a no-kill regulation for trout on the section of Oatka Creek managed for wild brown trout. After the imposition of the regulation, no-kill sections of the creek were compared with pre-regulation surveys conducted in the section (1998-2010) and with control sites outside the no-kill section. This study of the effects of the regulation indicated that overall trout biomass and growth was unchanged by the regulation, but that it resulted in a population shift toward larger, age-4 trout and, therefore, greater angler satisfaction. The no-kill regulation has remained in effect on this section of the creek (Sanderson, M, 2007. *The effect of a no-kill regulation on biomass, abundance, and growth of brown trout (Salmo trutta) in Oatka Creek*. NYSDEC Region 8). According to Matt Sanderson, NYSDEC Region 8, Wild brook trout are found in Oatka and Spring Creeks.

6.4 Other Animals

The Second Atlas of Breeding Birds in New York State (McGowan, KJ and K Corwin, Eds., 2008, Cornell Univ. Pr.) is available through NY DEC website. The Atlas lists bird species likely or confirmed to be breeding during the 2000-2005 survey period in each of 5,333, 5 km by 5 km, survey blocks statewide. Since the survey blocks do not correspond to watershed boundaries and since many survey blocks lie within the Oatka Creek Watershed, it would be difficult and time consuming to extract a species list for the entire watershed. If one wished to find if a particular bird had been noted as breeding in some small section of the watershed, however, one could locate the data here.

6.5 Biological Elements of Special Concern

A number of animals, plants and ecological communities rare either nationally or in the state of New York are listed with the NY Natural Heritage Program (Table 6.3), and some are listed or are candidates for listing in the US Fish and Wildlife Service's threatened and endangered species program (Table 6.4). Special permitting policies pertain in locations where these elements may occur.

Table 6.3: Rare, Threatened and Endangered Species and Significant Habitats within Oatka Creek Watershed (NY Natural Heritage Program database)

Common Name[1]	Scientific Name	NY Protection Status[2] E	T	R	U	Conservation Ranking[3]
Birds						
Short-eared Owl	*Asio flammeus* (nonbreeding)	x				S2; G5
Other						
Waterfowl Winter Concentration Area					x	S3S4; GNR
Vascular Plants						
Golden-seal	*Hydrastis canadensis*		x			S2; G4
Goosefoot Corn-salad	*Valerianella chenopodiifolia*	x				S1; G5
Green Gentian	*Frasera caroliniensis*		x			S2; G5
James' Sedge	*Carex jamesii*		x			S2; G5
Little-leaf Tick-trefoil	*Desmodium ciliare*		x			S2S3; G5
Log fern*	*Dryopteris celsa*	x				S1; G4
Marsh Arrow-grass	*Triglochin palustre*		x			S2; G5
Spreading Globeflower	*Trollius laxus*			x		S3; G4T3
Twin-leaf	*Jeffersonia diphylla*		x			S2; G5
Wild Hydrangea	*Hydrangea arborescens*	x				S2; G5
Willdenow's Sedge	*Carex willdenowii*		x			S2S3; G5
Woodland Agrimony	*Agrimonia rostellata*		x			S2; G5
Yellow Giant-hyssop	*Agastache nepetoides*		x			S2S3; G5
Communities						
Calcareous cliff community					x	S3; G4
Floodplain forest					x	S2S3; G3G4
Hemlock-northern hardwood forest					x	S4; G4G5
Limestone woodland					x	S2S3; G3G4
Maple-basswood rich mesic forest					x	S3; G4
Rich sloping fen					x	S1S2; G3
Rocky summit grassland					x	S3; G3G4

[1]Rare plants, rare animals and significant communities documented in the Oatka Creek watershed since 1980, unless marked with an asterisk (*), which indicates last documented in vicinity of the project site before 1980.
[2]NY Protection Status: E = Endangered; T = Threatened; R = Rare; U = Unlisted.
[3]Conservation rankings:

- State Ranking – Rarity in New York as ranked by NY Natural Heritage Program on a 1 to 5 scale.
  S1 = Critically imperiled S2 = Imperiled S3 = Vulnerable
  S4 = Apparently secure S5 = Abundant and secure
- Global Ranking – Global rarity as ranked by Nature Serve on a 1 to 5 scale.
  G1 = Critically imperiled G2 = Imperiled G3 = Vulnerable
  G4 = Apparently secure G5 = Secure GNR = Not ranked;
- T-ranks (T1-T5) are defined the same as the G-ranks (G1-G5), but T-rank refers only to the rarity of the subspecies or variety.

Table 6.4: Federally Listed Endangered, Threatened and Candidate Species within counties of the Oatka Creek Watershed (US Fish and Wildlife Service)

Common Name	Scientific Name	NY County[1]	Federal Status[2] E	T	P	C	D
Birds							
Bald eagle[3]	*Haliaeetus leucocephalus*	*GLW*					x
Reptiles							
Bog turtle[4,5]	*Clemmys [=Glyptemys] muhlenbergii*	*GM*		x			
Eastern massasauga	*Sistrurus catenatus catenatus*	*G*				x	
Vascular Plants							
Eastern prairie fringed orchid[4]	*Platanthera leucophea*	*G*		x			
Houghton's goldenrod	*Solidago houghtonii*	*G*		x			

[1]Counties in NY: G = Genesee; L = Livingston; M = Monroe; W = Wyoming
[2]Federal Status: E = Endangered; T = Threatened; P = Proposed; C = Candidate; D = Delisted.
[3]"The bald eagle was delisted on August 8, 2007. While there are no ESA requirements for bald eagles after this date, the eagles continue to receive protection under the Bald and Golden Eagle Act (BGEPA). Please follow the Service's May 2007 Bald Eagle Management Guidelines to determine whether you can avoid impacts under the BGEPA for your projects." (USFWS)
[4]Historic
[5]Riga and Sweden Townships in Monroe County

The NYSDEC's Statewide Wildlife Conservation Strategy for the Southwest Lake Ontario Basin, which includes the Oatka Creek Watershed, lists many of these elements as of concern regionally. Habitat destruction and fragmentation associated with development poses a high-order threat to wildlife in the region in general, although invasive exotic species of animals and plants also pose threats.

7.0 Watershed Runoff Export Coefficients

The following approach utilizes an export coefficient model to estimate annual loss of water and materials from the landscape. Because limited data are available to calibrate or verify a model of chemical and sediment loss from the landscape (i.e., pollutant load) in Oatka Creek, a simple landscape approach was used with regionally-appropriate export coefficients based on land cover and soil hydrologic class. The export coefficient modeling approach is typically used to characterize rural landscapes, with nonpoint sources of pollution and limited - if any - stormwater collection and point source discharges.

This is an empirical modeling approach; the export coefficients were derived from field investigations of watersheds with a range of land cover and soil hydrologic class conditions. We endeavored to select export coefficients from areas with physiographic, climatic and soil conditions comparable to those found in the Oatka Creek watershed. The analysis estimates the annual export of material, and results are reported in units of mass per area per time (kg/ha/yr). For the purposes of this analysis, we focused on export of phosphorus from the landscape. Analysis of export for other parameters may be conducted in the future as needed.

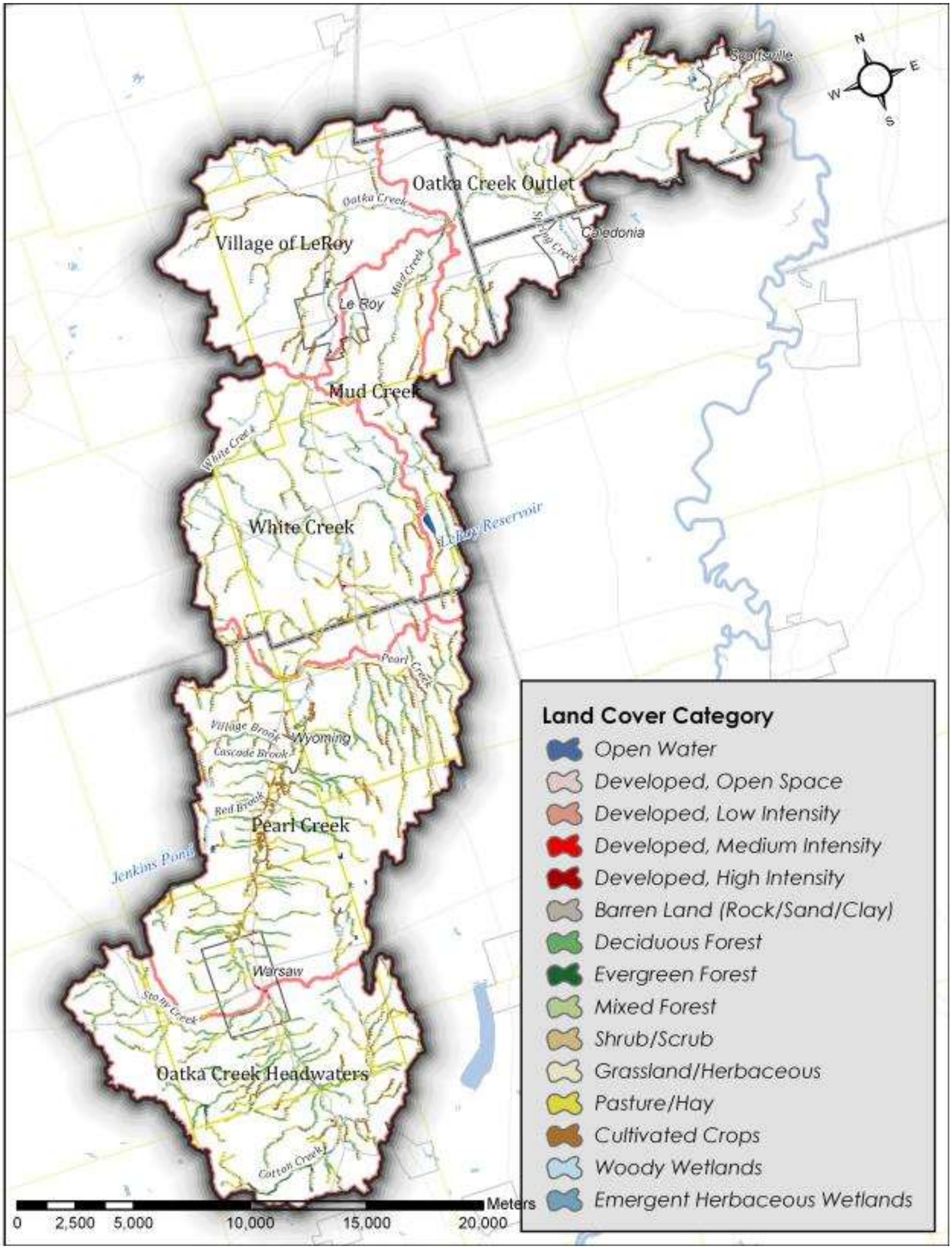
7.1 Method

Phosphorus export calculations were developed using two data sets: land cover and municipal/industrial discharges. Land cover data were obtained from the G/FLRPC GIS files prepared for the Characterization Report. Given that areas closer to streams are more likely to contribute pollutant load than areas farther away, land cover data within 100m of streams (Figure 7.1) were weighted for proximity. This weighting was accomplished by applying less than the full value of the phosphorus

Table 7.1: Land Cover within 100m of streams, Oatka Creek (2006 NLCD)

Land Cover (NLCD 2006)	Acres	%
Open Water	139.4	0.5%
Developed, Open Space	1189.1	3.9%
Developed, Low Intensity	292.0	1.0%
Developed, Medium Intensity	81.0	0.3%
Developed, High Intensity	14.9	0.049%
Barren Land	24.5	0.1%
Deciduous Forest	7008.6	22.8%
Evergreen Forest	234.6	0.8%
Mixed Forest	1815.4	5.9%
Shrub/Scrub	1475.1	4.8%
Grassland/Herbaceous	90.3	0.3%
Pasture /Hay	8803.9	28.7%
Cultivated Crops	6641.4	21.6%
Woody Wetlands	2702.1	8.8%
Emergent Herbaceous Wetlands	198.8	0.6%

Figure 7.1: Land Cover within 100m of Streams - Oatka Creek Watershed



export coefficient for the land cover areas more than 100m from streams. The actual proportion of the value for areas more than 100m was selected through an iterative process.

Phosphorus export coefficients, derived from literature and representing unit losses for a given land cover class, were assigned. Total annual load was derived by multiplying area (ha) by unit export (kg/ha/yr) for the annual load (kg/yr) for each land cover type.

In addition to land cover, municipal and industrial discharges are potential sources of phosphorus loading to Oatka Creek. Five wastewater discharge points were identified in the Oatka State of the Basin 2002 report (Table 7.2). Potential phosphorus loading from these points were derived by using design flow volume (mgd) and concentration limits for phosphorus based on SPDES permits (http://www.epa.gov/enviro/facts/pcs/search.html). Where there was no limit on phosphorus for a particular facility, no loading was estimated.

Table 7.2: Municipal/industrial discharges in Oatka Creek basin.

Permitted Discharges	Receiving Waters	Design Flow	SPDES TP limit
Warsaw STP	Oatka Headwaters	0.65 mgd	1.0 mg/l (average)
LeRoy (Village) WWTP	Village of LeRoy	1.0 mgd	1.0 mg/l (maximum)
Scottsville (Village) STP	Oatka Outlet	0.65 mgd	n/a
Caledonia Fish Hatchery	Spring Creek (Oatka Outlet)	3.15 mgd	n/a
Lapp Insulator Div.	Village of LeRoy	1.4 mgd	n/a
Pavilion SSDS	White Creek	0.08 mgd1	5.7 mg/l2 (median)
PCore Electric Company	Village of LeRoy	n/a	n/a
Markin Tubing	GW	n/a	n/a

Sources:
Oatka State of the Basin 2002 report
USEPA Envirofacts web site, Permit Compliance System database
Notes:
1Pavilion (Hamlet) Sanitary Sewage Disposal System flow based on SPDES permitted flow of 80,000 gd.
2PCS database indicated TP was regulated, but no limit was published. Some effluent measurements were provided; from these data, the median is shown.
n/a – no data available

The predictions of phosphorus loading in the Oatka Creek watershed (the sum of land cover and discharge loading) were compared with recent USGS data from the Oatka Creek at Garbutt monitoring site. Measurements of mean annual stream flow, unit discharge, water chemistry, and materials loading at this site for water years 2003 – 2008 were published in December 2010. By comparing predicted and observed data, the selection of export coefficients within the published range was refined; adjustments were made in an iterative manner.

Once reasonable comparisons of predicted and observed conditions were achieved, the model can be used to test scenarios of changes in land use, predicting the water quality (i.e., load) consequences of actions such as increased residential development or intensification of agricultural use.

7.2 Results

The USGS estimated the phosphorus yield of the Oatka Creek watershed from the median concentrations for a six-year period (2003-2008). The yields were not available on a sub-watershed basis, so the yield for the entire Oatka Creek watershed was used. Annual yields ranged from 0.32 to 0.42 kg/ha, and averaged 0.36 kg/ha. The average annual load of phosphorus, based on a 200 square mile watershed area, was 18,446 kg.

Phosphorus loading estimated from land cover types incorporated export coefficients with land cover area to derive total loading for the subwatersheds (Table 7.3), as described above. Areas within 100m of streams were weighted. The dominant land cover type related to agricultural uses – Cultivated Crops and Hay/Pasture account for 63% of total watershed land cover, and 50% of land cover within 100m of streams. The second most-common land cover type is Deciduous Forest, which accounts for 17% of the total watershed land cover, and 23% of land cover within 100m of streams.

Table 7.3: Summary of P load estimate for land cover, by subwatershed (weighted to 0.25 for area >100m)

Subwatershed	Land Cover TP Load Estimate (kg/yr)	Percent of Total
Oatka Headwaters	2,860	16%
Pearl Creek	5,419	30%
White Creek	3,245	18%
Mud Creek	1,585	9%
Village of LeRoy	2,186	12%
Oatka Outlet	2,951	16%
Oatka Creek Total	18,248	

Estimates of phosphorus loading were made for two of the five municipal and industrial dischargers to Oatka Creek, based on data availability (Table 7.4).

Table 7.4: Summary of P load estimate for dischargers, by subwatershed.

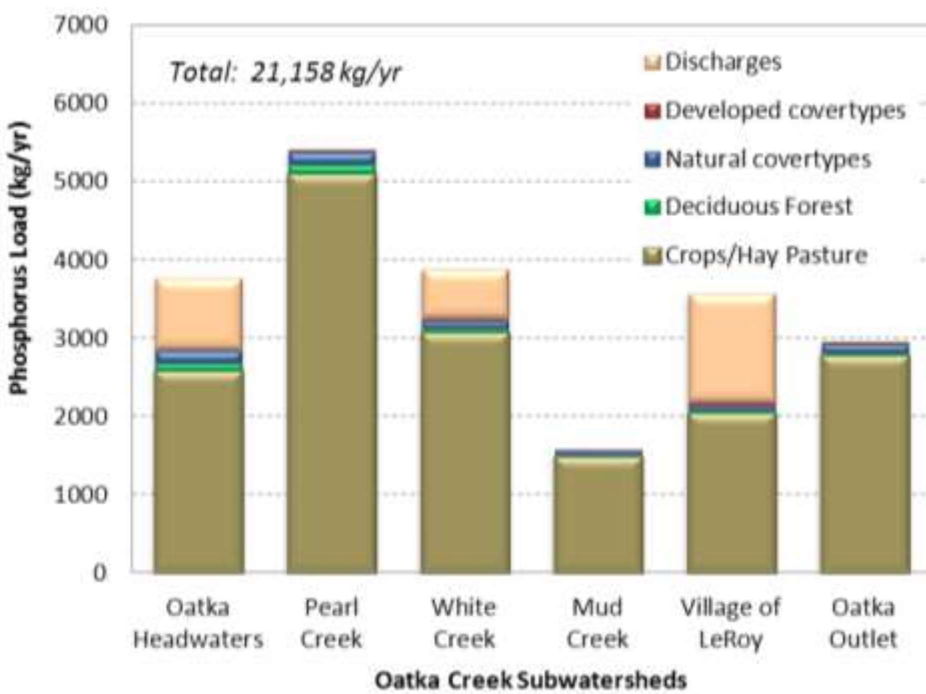
Subwatershed	Point Source TP Load Estimate (kg/yr)	Percent of Total
Oatka Headwaters	898	39%
Pearl Creek		
White Creek		
Mud Creek		
Village of LeRoy	1,382	61%
Oatka Outlet		
Oatka Creek Total	2,280	

Finally, these phosphorus loading estimates were compared with the USGS yields data. The initial analysis, using export coefficients representing average values from several sources, estimated the TP load substantially higher than that reported by the USGS. Weighting the land cover types farther than 100m from streams was conducted iteratively, until the phosphorus estimate calculated in this model approached the value obtained from the USGS yields. Ultimately, the weighting of one-quarter (0.25) of the export coefficient was applied for the land cover more than 100m from streams, which may be thought of as a quarter of the export from those areas actually reaches the stream (Table 7.5).

Table 7.5: Phosphorus Load Yield Estimates Compared to USGS Yield Data

Subwatershed	Phosphorus Load From USGS (2003-2008) Tributary Yields (kg/year)	Estimated Non-Point Phosphorus Load From Land Use (kg/year)	Estimated Point Source Loading From SPDES Permits (kg/year)	Estimated Total (kg/year)	Difference in Measured vs. Estimated
Oatka Headwaters	--	2,862	898	3,760	--
Pearl Creek	--	5,419	--	5,419	--
White Creek	--	3,245	630	3,875	--
Mud Creek	--	1,585	--	1,585	--
Village of LeRoy	--	2,186	1,382	3,567	--
Oatka Outlet	--	2,951	--	2,951	--
Oatka Creek	18,446	18.248	2,910	21,158	2,712

Figure 7.2: Estimated P Loading, Oatka Creek Watershed



SECTION 7 REFERENCES

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WiLMS Precipitation loading rate calculated for Onondaga Lake by Dr. William Walker as part of Mass Balance calculations for the Onondaga Lake monitoring program

Source for municipal/industrial discharges:
USEPA EnviroFacts Permit Compliance System (PCS) (http://www.epa.gov/enviro/facts/pcs/)

8.0 Identification of Impairments and Threats

8.1 The Environmental Risk Assessment Process

The purpose of this summary of impairments and threats is to aid the preparation of a watershed management strategy that will describe and illustrate various impairments and threats in the watershed and evaluate approaches to addressing them. This strategy will enable watershed managers to make informed environmental decisions into the future.

What follows is a general representation of a complex and varied group of watershed "issues" organized into specific categories. This represents the beginning of an assessment process that will aid in the formulation of watershed goals, objectives, and final management strategies. The identification of data gaps is an important component of this process. The entire process is frequently an iterative one in which factual information learned during the analysis, characterization or discussion phases can lead to a reevaluation of the problem formulation or to new data collection and analysis.

Identification of threats and impairments is one of the first steps in the development of a watershed management strategy. The completed strategy will include an implementation program which will likely contain several basic elements, including

- Education and outreach to inform the public and encourage participation
- Implementation schedule
- Benchmarks and criteria for measuring progress
- Ongoing monitoring and research component to continue evaluation of the resource(s) and the effectiveness of any implementation (i.e. mitigation/restoration) efforts
- Financial estimates
- Responsible parties
- Formal framework for implementation and evaluation[81]

It will be important that the watershed management process allow for the incorporation of new information into watershed assessment on a continuing basis, which can then be used to improve the decision making process in an iterative fashion. This will be an ongoing process of analysis and deliberation assigned to a coordinated organization and associated technical advisory group to drive progress.[82] This watershed management planning process will make recommendations regarding this organization structure near the completion of the process.

These are the primary products of watershed planning: (1) clearly established and articulated management goals, (2) characterization of decisions to be made within the context of the management goals, and (3) agreement on the scope, complexity, and focus of the assessment, including the expected output and the technical and financial support available to complete it.

To begin the process of developing these planning products, we must first begin to identify the problems as they are known to exist. As stated in the USEPA document *Guidelines for Ecological Risk Assessment*:

> Descriptions of the likelihood of adverse effects may range from qualitative judgments to quantitative probabilities. Although risk assessments may include quantitative risk estimates, quantitation of risks is not always possible. It is better to convey conclusions (and associated uncertainties) qualitatively than to ignore them because they are not easily understood or estimated.[83]

After the problems are identified and agreed upon in a public format the process of systematic assessment and prioritization may commence. These steps will proceed in subsequent project components during 2012.

8.2 Resource Management and Risk Assessment in Perspective

The Oatka Creek watershed has been in a state of fluctuation. The rate of change has increased significantly since European-American settlement and activity began to grow during the late 18th and early 19th Centuries. Since then, the watershed has experienced a gradual transformation in the types of uses and their intensity. Land conversion from forest cover to agricultural cover was one of the most dramatic changes in the watershed in the past 12,000 years, since the last glaciation. Today, in some locations in the watershed, marginal land that was cleared for agricultural use has reverted back to shrub and forest cover. Farming continues to be the predominant use of the land throughout most of the watershed, however, and has a significant influence on local water quality. Agricultural practices continue to evolve as farmers look for ways to make more efficient use of the land and reduce the negative impacts of agricultural production.

Population density has also gradually increased in the watershed over time. Communities began to grow and prosper during the 19th Century as businesses and industry expanded to serve local and regional needs. While population density was largely concentrated in villages before WWII, patterns of suburban development in the post-war period have become more prevalent throughout the watershed. The rate of suburban growth has slowed significantly in the past 25 years, but some of the consequences of sprawl are evident. Those include increased stormwater runoff from construction sites and other sources, increased impervious surfaces, increased residential fertilizer application and runoff, the occurrence of failing onsite wastewater treatment systems, and increasing habitat fragmentation.

Habitat fragmentation resulting from land conversion for agriculture and human settlement has the potential to cause significant disruption to biological communities. Habitat fragmentation has occurred for thousands of years as a result of glaciation and other natural events, although this has generally occurred at a geologic pace and scale, allowing natural communities to adapt to changes gradually. The alteration of land cover across the watershed over the course of decades (as opposed to centuries) raises the likelihood of a reduction in species richness in the watershed. While nature resilient and adaptable to changes in the environment, decline in regional biodiversity is nonetheless a primary concern, particularly in light of other external threats, such as climate change and the influx of invasive and exotic species.

Pollution resulting from industry and municipal sources have gradually changed over time, particularly over the course of the 20th Century. Industrial and municipal discharges of wastewater into receiving water bodies in most instances went unchecked prior to Congressional approval of the Federal Clean Water Act in 1972. Point sources have been given strict oversight by the NYS DEC under approval and guidance from the US EPA. While point source emissions continue to require close monitoring, the regulatory mechanisms to control them are in place and can be effective when applied. More recently, consolidation of municipal wastewater treatment plants into the Monroe County Pure Waters system has helped to alleviate costs to consumers by transferring wastewater to the Frank E. VanLare plant in Rochester, NY, for treatment and ultimate discharge into Lake Ontario. As a result, point sources have become less of a concern for watershed managers, although close monitoring of existing point source discharges remain an important priority in the watershed. Meanwhile, nonpoint sources have grown in their complexity and continue to be a difficult problem to address due to their diffuse and varying sources. Amendments to the Clean Water Act in 1987 have played an important role in expanding the research and development of nonpoint regulatory controls and management practices.

Management of the natural resources within the Oatka Creek watershed therefore presents a host of challenges. The process of problem formulation, analysis and risk characterization requires managers to frame the issues in their appropriate temporal, spatial and programmatic contexts. Furthermore, many of these issues are likely to be interrelated and new information is continually being developed – often by different entities – thereby further complicating the assessment and planning process. It is therefore critical that a singular process be established to systematically evaluate and organize data, information, assumptions, and uncertainties in an effort to better understand the challenges in a way that is useful to environmental decision making.[84]

8.3 Identification of Threats and Impairments

The following summary of threats and impairments is based on a review of existing literature (as cited in the appendix of this report) as well as consideration of significant national and regional trends in environmental assessment. Subsequent components of this watershed management planning process will seek to further explore the facts surrounding these issues, including levels of risk that they may impose on watershed resources. The development of a conceptual model (sometimes referred to as a *logic model*) may be a preferable approach.

Uncertainty should not be an excuse for inaction…the process of reducing uncertainty must become a guide for action.

P. 4 WWF series on adapting water management

8.3.1 Water Quality Impairments

In general, water quality and aquatic habitat conditions in Oatka Creek are considered to be good, and there is no evidence of trends toward degradation, based on long-term monitoring data. Despite this general conclusion, there are specific segments of Oatka Creek where the waters are considered to be at risk of failing to fully support their designated use.

Oatka Creek includes both Class B and Class C segments (Appendix A, Map 5). As set forth in NYCRR Part 701.7, *"The best usages of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival."* As set forth in NYCRR Part 701.8, *"The best usage of Class C waters is fishing; these waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes."*

In addition, certain segments of Oatka Creek are further classified as trout waters, designated with a T or TS. More stringent ambient water quality standards for certain parameters, including dissolved oxygen, ammonia and nitrite, are in place to protect these sensitive cold water fishes.

States must complete periodic assessments of water quality and habitat conditions in order to evaluate whether standards are met, and whether the designated uses are supported. In New York, the results of this evaluation are published in the 305(b) list, also known as the Priority Waterbodies List (PWL); surface waters exhibiting symptoms of degradation are categorized on the PWL based on the severity of water quality and/or habitat degradation. The most recent PWL for the Genesee Basin was issued in 2003. Several segments of Oatka Creek were included on the 2003 PWL. The pollutants of concern were nutrients and silt/sediments; these pollutants were stated to cause excessive growth of weeds and algae in the stream. Streambank erosion and agriculture were cited as the suspected sources of the excessive nutrients and sediments. Failing on-site wastewater disposal systems were cited as an additional source in one segment.

NYS regulations (NYSCRR 6 Part 703.2) include a narrative standard for phosphorus that specifies: “none in amounts that will result in growth of algae, weeds, and slimes that will impair the waters from their best use.” The NYSDEC is developing nutrient criteria that would provide a benchmark for acceptable phosphorus levels in Oatka Creek; that is, concentrations that would mitigate the cited impairment. Progress has been slow, and it appears that nutrient criteria for flowing waters will not be released for comment before 2012.

In addition to or in lieu of specific nutrient criteria, the premise of adopting a method for using invertebrate sampling as a method of determining aquatic health could be considered and developed for the watershed by local watershed managers.[85] Physical, chemical and other biological measures could be used as well as macroinvertebrates to describe comprehensively the water and habitat quality of aquatic environments. However, with the ultimate goal being to provide water quality that will support a diversity of aquatic life, the assessment of water quality that utilizes the assemblages of aquatic organisms living in the stream would seem to be of primary importance in determining if improvements in water quality are meeting the desired goal.

With the exception of phosphorus, governed by the narrative standard, our data analysis indicates that the water quality of Oatka Creek is generally in compliance with ambient water quality standards. There are a few exceptions. Aluminum has been measured at concentrations exceeding the ambient water quality standard for this parameter; natural geologic conditions are considered to be the cause. Abundance of total coliform bacteria in the stream is elevated following storm events, particularly downstream of active agricultural areas. Total dissolved solids concentrations are elevated; again, this is attributed to background surficial geology. Mercury, whole not routinely detected in the stream waters, has been confirmed present at the NYSDEC Scottsville monitoring site. Assessing compliance with mercury standards is complicated by the fact that the analytical limit of detection is well above the ambient water quality standard for this metal. One exceedances of the nitrite standard to protect a cold water fish community was reported in June, 2005 at Scottsville.

8.3.2 Known or Suspected Threats

The following threats to water quality and living resources have been compiled based on the information gathered and analyzed in this report and through a review of literature germane to water and natural resource planning and protection in New York State. These issues are listed alphabetically and are not prioritized. Prioritization of issues based on magnitude and location will occur in subsequent project components.

8.3.2.1 Agriculture

The Oatka Creek watershed is largely agricultural in character with approximately 60% of its land area devoted specifically to cultivation of agricultural crops. A total of 17 Concentrated Animal Feeding Operations (CAFOs) are located directly within the boundary of the Oatka Creek watershed – 11 medium sizes and 6 large sized. In addition, 7 other CAFOs lie within 1 mile of the watershed boundary. The *2001 Genesee River Basin Waterbody Inventory and Priority Waterbodies List* (PWL) cited agriculture as a known source of pollution in each of the waterbodies that were assessed during that assessment period, including the primary sections of the main stem of the Oatka Creek (Upper, Middle and Lower). Water quality monitoring data and/or studies have been completed by the NYS DEC or partner organizations and have concluded that the uses of the waterbody are effected by agricultural sources. These uses include aquatic life, recreation, and aesthetics. The types of pollutants cited as likely to result from agricultural sources include nutrient enrichment, algal/weed growth, and silt/sedimentation each of which impact the waterbody to varying levels of severity.

In most cases, adverse water quality impacts resulting from agriculture are likely a result of poor agricultural practices. However, the character of the watershed – particularly its landscape and geology – lends itself to contaminant risk to surface and ground water supplies, complicating the Best Management Practice implementation. Poor agricultural practices may result in the following:

- Silt/sedimentation and associated nutrient loading/runoff
- Livestock access to stream banks and stream beds
- Excessive manure and other fertilizer application
- Destruction, removal or failure to maintain an adequate vegetated stream buffer strip/area adjacent to streams
- Excessive pesticide and herbicide use and contamination resulting from misapplication or improper mixing

In addition, the karst area of the watershed where cracks, fractures, and other solution channel irregularities are present provide a direct connection between surface water and ground water. As documented in the publication *Manure Management Guidelines for Limestone Bedrock/Karst Area of Genesee County, New York: Practices for Risk Reduction*, these areas present increased risk to contaminating groundwater due to rapid infiltration. USGS scientific investigations in conjunction with Cornell University and SWCD planning efforts will aid in the mitigation of nutrient management within these highly-sensitive areas of the watershed. While USGS scientific investigations have begun to map the specific locations of karst geology in Genesee County, further detailed analysis in other locations in the watershed are warranted.

8.3.2.2 Climate Change

The impact of climate change on freshwater ecosystems is explored in the document *Adapting Water Management: A primer on coping with climate change*.

> The impacts of climate change on freshwater ecosystems can be characterized by shifts in water quality (e.g., pollutants, temperature, dissolved oxygen), water quantity, and water timing (normal flood and dry periods)…Across the planet, numerous aspects of precipitation are changing, such as the amount of annual or seasonal precipitation; the seasonal timing of precipitation (such as snow versus rain); the intensity of precipitation events (how much per unit of time); the frequency and severity of extreme events like droughts and floods; and the net accumulation or loss of water in places like glaciers and the poles. Moreover, all of these aspects of precipitation are expected to continue to shift over the coming century.[86]

According to a fact sheet produced by the Union of Concerned Scientists summarizing findings from *Confronting Climate Change in the Great Lakes Region*, the impacts of climate change on New York communities and ecosystems can be summarized as follows:

> In the Great Lakes region, the impacts of climate change will likely be manifested by average annual temperatures increasing; frequency and severity of rainstorms both increasing; winters becoming shorter; and the duration of lake ice decreasing (thereby influencing regional precipitation). More specifically, by the end of the 21st century, temperatures are projected to rise 7 – 13° F in winter and 7 – 14° F in summer. Overall, extreme heat will be more common. While annual average precipitation may not change much, precipitation is likely to increase in winter and decrease in summer. This may equate to drier soils and perhaps more droughts in NYS. The frequency of heavy rainstorms, both 24-hour and multi-day, will continue to increase. Declines in ice cover on the Great Lakes and inland lakes have been recorded during the past 100 – 150 years, although this trend has been moderated in areas of lake-effect snow. Ice cover declines are expected to continue.

Additional potential impacts from climate change include:

Water Supply and Pollution

- Lake levels are expected to decline in both inland lakes and the Great lakes, as more moisture evaporates due to warmer temperatures and less ice cover.
- Reduced summer water levels are likely to diminish the recharge of groundwater, cause small streams to dry up, and reduce the area of wetlands, resulting in poorer water quality and less habitat for wildlife.
- Pressure to increase water extraction…will grow…
- Development and climate change will degrade the flood-absorbing capacities of wetlands and floodplains, resulting in increased erosion, flooding, and runoff polluted with nutrients, pesticides, and other toxins.

Human Health

- Of particular concern is the large projected increase in extreme heat days (exceeding 97° F) by 2080 – 2100.
- Some waterborne infectious diseases such as cryptosporidiosis or giardiasis may become more frequent.
- Changes in transmission occurrence of many infectious diseases, such as Lyme disease and West Nile encephalitis may occur.

Property and Infrastructure

- More frequent extreme rainstorms and floods, exacerbated by stream channeling and more paved surfaces, may result in greater property damage.

- Municipalities will have to upgrade water-related infrastructure including levees, sewer pipes, and wastewater treatment plants in anticipation of more frequent extreme downpours.

Agriculture
- Increased atmospheric CO2 and nitrogen as well as a longer growing season could boost yields of some crops, although severe rainstorms and flooding will likely depress productivity.
- Several climate changes will likely combine to create more favorable conditions for a number of pests and pathogens.

Recreation and Tourism
- Populations of cold water fish species and even some cool water fish may decline while warm water species may increase.
- The summer recreation season will likely expand as temperatures warm, although mal effects of extreme heat heavy rains and possible risks from insect and waterborne diseases may dampen outdoor enthusiasm.
- Continued stress on wetlands, thereby reducing habitat and food resources for migratory birds and waterfowl.[87]

Natural Resource and Habitat Protection
- Increased incursion on non-native, exotic species into natural habitats

8.3.2.3 Failing Onsite Wastewater Treatment Systems

The NYSDEC publication "Top Ten Water Quality Issues in NYS" cites failing onsite wastewater treatment systems (septic systems) as a prevalent causes/source of water quality impact in the assessed waters of New York State.[88] In a sense, failing onsite wastewater treatment systems can be considered as an externality of suburban sprawl. The problem is described as follows:

> While most residences are connected to sewer systems and larger centralized wastewater treatment plants, about one-quarter of New Yorkers and a comparable number of businesses and institutions are served by onsite wastewater treatment systems (OWTS). Onsite systems are effective and economical when properly designed, installed and maintained. However the lack of an adequate onsite system, poor routine maintenance, increased density of homes served by onsite systems, undersized and overused systems (particularly due to conversion of vacation cottages and camps into year-round residences), and the installation of systems on sites with unacceptable conditions can all lead to onsite system failure and water quality impacts.
>
> Acute failures resulting in wastewater pooling on the ground, impacts to beaches or backups into buildings are potential health problems. Chronic problems can result in bacteria contamination of groundwater and nutrient loadings to nearby lakes and other recreational waters that spur excessive aquatic weed and algal growth (see also Aquatic Weeds and Invasive Species).[89]

The *2001 Genesee River Basin Waterbody Inventory and Priority Waterbodies List* (PWL) cites failing OWTS as either a known or suspected source of pollution in portions of the Oatka Creek and its surrounding tributaries, particularly the middle section between Mud Creek and Pearl Creek. Real property information in combination with other GIS data sources (such as public sewer lines) can begin to identify the locations of populations served by onsite wastewater treatment systems. Once identified, a more detailed assessment as to the age and operation and maintenance needs of those facilities can occur.

8.3.2.4 Habitat Fragmentation/Degradation and Reduction of Open Spaces

Habitat fragmentation is the disruption of once large continuous blocks of habitat into less continuous habitat, primarily by human disturbances such as land clearing and conversion of vegetation from one type to another.[90] *Habitat quality* is defined as the ability of the environment to provide conditions appropriate for individual and population persistence.[91] The negative consequences of habitat degradation are manifested in the reduction of species diversity and the production or survival of a species is negatively affected. Fragmentation therefore reduces the extent and connectivity of remaining habitats, and species may or may not be able to persist as a result of those changes.

Given that habitat is defined with reference to a particular species, planning for habitat at the regional level is an extraordinarily complex process. Poor habitat quality can be the result of the combination of a number of complex interrelationships. Of significant concern is that the detrimental effects of habitat degradation are often not noticed until well after the destruction has occurred. Identifying and protecting those areas critical to the survival of sensitive or rare species before they are impacted by development is therefore an important aspect of watershed planning in the Oatka Creek watershed.

In the absence of a comprehensive regional approach to habitat and open space protection, uniform enforcement of existing regulations that are already in place that complement these goals is an important step forward. These include:

- Article 15 NYS Env. Conservation Law – Protection of Waters
- Article 24 NYS Env. Conservation Law – Freshwater Wetlands
- Section 404 of the Federal Clean Water Act regulating discharges to waters of the US, including the filling of wetlands

In addition, the creation of or enforcement of local laws which prevent development from occurring within floodplains and the active river area can help to protect critical aquatic and terrestrial habitats.

A review of existing approaches to the acquisition and permanent protection of sensitive lands within and around the watershed will also be an important consideration. Currently, the NYS Open Space Conservation Plan identifies *Ecological Corridors*, *Exceptional Forest Communities*, *Grassland Preservation and Restoration*, and *Significant Wetlands* as conservation priorities in and around the region of the Oatka Creek watershed. Further defining how those priorities can be achieved within the watershed will be an important step forward.

8.3.2.5 Industrial and Municipal Discharges

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. In New York State, the NPDES program is administered by the NYS DEC and referred to as the State Pollution Discharge Elimination System (SPDES).

SPDES permit for Private, Commercial or Institutional (P/C/I) Facilities program is designed to eliminate the pollution of New York waters and to maintain the highest quality of water possible – consistent with public health, public enjoyment of the resource, protection and propagation of fish and wildlife, and industrial development in the state.

SPDES permits for Concentrated Animal Feeding Operations, Construction Site Discharges and Municipal Separate Storm Sewer Systems are discussed under sections 7.3.1 and 7.3.4 respectively. Information pertaining to the regulation and monitoring of these facilities throughout the watershed is included in Section 3.0.

8.3.2.6 Nuisance and Invasive Species

As described on the website of the Invasive Species Taskforce NYSDEC website:

> **The Problem**
> Invasive species are non-native species that can cause harm to the environment or to human health. As a threat to our biodiversity, they have been judged second only to habitat loss. Invasives come from all around the world; the rate of invasion is increasing along with the increase in international trade that accompanies globalization.
>
> Invasive species have caused many problems in the past, are causing problems now, and pose threats to our future. A wide variety of species are problematic for many sectors of our world: our ecosystems, including both all natural systems and also managed forests; our food supply, including not only agriculture but also harvested wildlife, fish and shellfish; our built environments, including landscaping, infrastructure, industry, gardens, and pets. Invasive species have implications, too, for recreation and for human health.
>
> **Strategic Need**
> Existing management efforts are limited. Although the invasive species issue is recognized by professionals as a major threat to our natural resources, few resources have been allocated toward solutions. The National Invasive Species Council has been established by executive order to coordinate efforts among federal agencies, but there is no overarching federal legislation that recognizes the magnitude of invasive species as an issue. Thus, there is no dedicated funding stream available for their management.[92]

In response to this need to coordinate management efforts, the New York State Invasive Species Task Force (ISTF) was formed. The ISTF is described below:

> New legislation was passed in 2003 that called for a team to explore the invasive species issue and to provide recommendations to the Governor and the Legislature by November 2005. The statute describes the intended membership of the Task Force and directs that it be co-led by two New York State agencies: the Department of Environment Conservation and the Department of Agriculture and Markets. Other members of the Task Force include:
> - NYS Department of Transportation
> - NYS Thruway Authority (and Canals Corporation)
> - NYS Museum (and Biodiversity Research Institute)
> - NYS Office of Parks, Recreation and Historical Preservation
> - NYS Department of State
> - Adirondack Park Agency
> - New York Sea Grant

- Cornell University
- Invasive Plant Council
- The Nature Conservancy
- NYS Farm Bureau
- Empire State Marine Trades Association
- NYS Nursery and Landscape Association

The Task Force has taken numerous steps toward accomplishing its task. It first established a Steering Committee to oversee the day-to-day work of the Task Force. Early on, it arranged for the whole Task Force to consult with the leader of our federal counterpart, the National Invasive Species Council. The next big task was to design and conduct an in-depth survey of all Task Force member organizations. Then, they established several smaller teams to investigate in depth, to analyze existing efforts, to identify needs, and to develop recommendations. Each team has been designed to pull together organizations that share a common area of interest or expertise. The Task Force has reached out to numerous stakeholders to invite them to participate as members of these teams.

The Task Force has been meeting at various locations around New York. These meetings are open to the public and dates, times and locations are announced in the Environmental Notice Bulletin. Formal public review of the Draft Report of the Invasive Species Task Force will be accomplished through a combination of both in-person public meetings and internet communication. It is planned for the summer of 2005.[93]

The Final Report of the New York State Invasive Species Task Force is available online at http://www.dec.ny.gov/docs/wildlife_pdf/istfreport1105.pdf . The report outlines the nature and extent of the invasive species problem in specific regions of New York State, identifies existing efforts to manage invasive species, and provides specific recommendations.

A summary of report findings is included in Table 8.1.

Table 8.1. Summary of Findings of the Final Report of the New York State Invasive Species Task Force

Aquatic and Terrestrial Species and Issues of Concern in the Great Lakes Region of NYS (list identifies significant regional concerns and is not a comprehensive assessment of species present in or threatening the watershed)

- Mussels, Gobies, and Botulism
- Didymosphenia geminata, commonly known as didymo or "rock snot"
- Emerald Ash Borer
- Sudden Oak Death
- European Starling
- Purple Loosestrife
- Eurasian Watermilfoil
- Captive and ornamental wildlife
- Pet trade
- Live food trade
- Live bait
- Hemlock Woolly Adelgid
- Norway Maple
- Common Reed (Phragmites)
- Giant Hogweed
- Kudzu
- Oriental Bittersweet
- Japanese Knotweed

Existing Efforts to Manage Invasive Species

- USDA Food Safety and Inspection Service and Animal and Plant health Inspection Service
- Early detection and rapid response
- Cooperative Agricultural Pest Survey Program
- Taxonomic and Diagnostic support
- Pest databases
- Regional Coordination and Outreach
- Effective monitoring
- Sustained funding and Meaningful restoration

Recommendations

1. Establish a permanent leadership structure to coordinate invasive species efforts
2. Prepare and implement a comprehensive invasive species management plan
3. Allocate appropriate resources for invasive species efforts
4. Establish a comprehensive education and outreach effort
5. Integrate databases and information clearinghouses
6. Convene a regular invasive species conference
7. Formalize New York State policy and practices on invasive species
8. Establish a center for invasive species research
9. Coordinate and streamline regulatory processes
10. Encourage non-regulatory approaches to prevention
11. Influence Federal actions to support invasive species prevention, eradication and control

12. Recognize and fund demonstration projects

Given that many species have spread across wide regions of the US, the coordination of invasive species management must occur at the state or national level in order to be effective. Effective coordination of outreach efforts within the watershed can be an effective regional strategy to implementing the statewide effort to control and eradicate invasive species of concern.

Detailed information on the identification and tracking of invasive species in New York State can be found at the New York Invasive Species Program website http://nyis.info/, a publication of Cornell University Cooperative Extension and NYS Sea Grant. Additional information can also be found at the New York State DEC Nuisance and Invasive Species Resources website, http://www.dec.ny.gov/animals/265.html

8.3.2.7 Spills and Contamination

As described on the NYS DEC website:

> Accidental releases of petroleum, toxic chemicals, gases, and other hazardous materials occur frequently throughout New York State. Even small releases have the potential to endanger public health and contaminate groundwater, surface water, and soils. Every year, the New York State Department of Environmental Conservation receives approximately 16,000 reports of confirmed and suspected releases to the environment. Approximately ninety percent of those releases involve petroleum products. The rest involve various hazardous substances, unknown materials, or other materials such as untreated sewage and cooking grease.
>
> Environmental damage from such releases depends on the material spilled and the extent of contamination. Many of these reports are releases of small quantities, typically a few gallons, that are contained and cleaned up quickly with little damage to the environment. In other instances material releases seep through the soil and eventually into the groundwater, which can make water supplies unsafe to drink. Uncontained spills, especially those that impact surface water, can kill or injure plants, fish, and wildlife, and cause damage to their habitats.[94]

New York State (NYS) responds to reports of petroleum and other hazardous material releases through the Spill Response Program maintained by the NYS Department of Environmental Conservation (DEC). A total of 37 spills were identified within the Oatka Creek watershed during the period 2000 to 2011. An investigation conducted in 1991 into the Lehigh Valley Railroad Derailment Site found that the trichloroethene spill that had occurred there had migrated at least 3.5 miles from the spill site and contaminated over 35 private water supply wells. The site currently presents no apparent public health hazard due to treatment systems installed to reduce exposures.[95] The site will continue to be monitored by state and federal agencies.

8.3.2.8 Stormwater Management

Stormwater and erosion are best understood in the context of the land's interaction with precipitation and runoff. Changes in the character or cover of the land can cause changes in runoff volumes, rates, and velocities, which can lead to sedimentation and nonpoint source pollution. Sedimentation occurs when soil, sand, silt, clay, and minerals eroded from the land surface and are transported to receiving waterbodies. Erosion and sedimentation are natural processes, but these processes can be accelerated when land cover is altered. Nonpoint source pollution includes sediments, as well as any materials that may be present along with sediments, such as litter, oils, chemicals, bacteria from animal fecal matter, pesticides, fertilizers and other nutrients (particularly phosphorus).

Sediment overload causes a number of problems for aquatic organisms. Because fine sediment particulates are suspended in water, the resulting cloudiness decreases the amount of sunlight that can reach aquatic plants that provide food and oxygen for aquatic organisms. As sediment settles, it fills the void between rocks, destroying habitat used by many invertebrates. Sediment also clogs the gills of fish, crayfish, and other underwater organisms. Sediment can bury fish and insect eggs and prevent them from hatching. Sediment particles often pick up other forms of pollution such as toxic substances, nutrients, or bacteria, which are then transferred into receiving waterbodies, which can also have adverse impacts.

In 1987, amendments to the Clean Water Act required states in coordination with the US EPA to develop an approach to addressing stormwater pollution. The primary regulatory mechanism used in New York State today is referred to as Stormwater Phase II as embodied by two main regulatory permits:

1. Multi- Sector General Permit for Stormwater Discharges Associated with Industrial Activities
2. Municipal Separate Storm Sewer Systems Permit, GP-0-10-002
3. SPDES General Permit for Stormwater Discharges from Construction Activity, GP-0-10-001[96]

Of these three rules, the third rule has primary relevance to the municipalities in the Oatka Creek watershed. The second rule listed which pertains to the Municipal Separate Storm Sewer Systems Permit requires operators of municipal separate storm sewer systems (MS4s) to develop Stormwater Management Program (SWMP) and submit annual reports to the NYSDEC. There are presently no municipalities regulated under GP-0-10-002 in the Oatka Creek watershed.

The SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-10-001) requires operators of small construction sites (greater than one acre) to obtain SPDES permits that implement programs and practices to control polluted stormwater runoff. All municipalities in NYS are regulated under GP-0-10-001 which is enforced by NYSDEC regional offices. Construction site operators are required to file a Notice of Intent (NOI) with the DEC in advance of land disturbance activities and develop a Stormwater Pollution Prevention Plan (SWPPP) to be kept on-site during the construction period.

State and federal stormwater regulations as described above went into effect in 2003 and since that time municipalities have been working in close coordination with SWCD offices and regional planning entities to meet the new requirements in an efficient and effective manner. These efforts have largely been focused on the urbanized/regulated areas in NYS, however, which excludes all areas of the Oatka Creek watershed (as of 2011). It will be important that Oatka Creek watershed communities remain vigilant and ensure that uniform enforcement of the construction permit take place throughout the watershed in the future.

The regulatory permits were revised by the NYSDEC in 2010 to reflect the evolution of the stormwater program. The 2010 updates to the *NYS Stormwater Management Design Manual* also reflect these changes.[97] The latest additions to the Design Manual are intended to address runoff reduction and planning and design of green infrastructure. Incorporation of stormwater mitigation and other green infrastructure measures early on during the design phase of new developments and minimizing land disturbance by preserving natural features and reducing the construction of impervious surfaces are major steps forward. It will be important for local municipalities to update their local regulatory framework to aid in the implementation of these guidelines.

8.3.2.9 Streambank Erosion

G/FLRPC, in consultation with LU Engineers, utilizing funds from the Great Lakes Commission Program on Erosion and Sediment Control completed a study in 2005 entitled *Controlling Sediment in Black and Oatka Creeks*. The purpose of the project was to identify areas experiencing significant stream bank erosion and plan for the restoration or remediation of the most severely-eroded sites. Site inventory data were reviewed from previous stream inventories and assessments completed by Wyoming, Genesee and Monroe County SWCD staff for both the Black and Oatka Creeks. Previous inventories rated sites along the stream channels for bank condition, stream condition, erosion and sedimentation potential. An initial list of high-erosion potential sites was generated from these previous inventories. Additional sites were suggested by SWCD staff.

An initial list of 41 candidate sites was developed from SWCD staff suggestions and from the stream inventories and further refined in subsequent meetings. To date, these inventories have been used to conduct mitigation projects in at least 1 location (Kennedy site – Wyoming County) identified in this study. The complete list of sites is included in the report *Identification and Analysis of the Riparian Corridor in the Black & Oatka Creek Watersheds*.[98]

Review and update of this initial assessment of locations with specific erosion and sedimentation should occur. Sites which were prioritized for remediation should continue to be monitored and addressed if and when funds become available. Furthermore, stream segments should be reviewed in order to ascertain the degree to which streambank erosion and sedimentation continues to occur in the watershed.

8.3.2.10 Water Quantity, Flow and Channel Maintenance

Flooding in the Oatka Creek watershed was well-documented in the 2002 G/FLRPC report Genesee & Wyoming Counties Joint Flood Mitigation Plan as follows:

> The Oatka Watershed has a history of annual flooding where the Oatka Creek flows through regions of Genesee County and Wyoming County. Floods can be expected yearly between late winter and throughout the spring. Severe flooding during this season is commonly the result of heavy rains.
>
> In addition to climate conditions, geographic factors of the watershed create interconnected weather patterns along the Creek. Flooding frequently begins where the Oatka Creek flows through Warsaw, which lies on lowland especially susceptible to flooding due to runoff waters from the nearby East Hills. As the Creek continues north and then east through Genesee County, there is potential for flooding along its banks in the Towns of Pavilion and LeRoy.

The most severe recorded Oatka Creek floods have occurred in July 1902, throughout the spring of 1916, June 1928, March 1942, March 1955, March 1973, February 1984, and July 1998.

Newspapers reported the flood of July 1902 at biblical proportions, alluding to the story of Noah. Damage was extreme; "nearly every bridge… all along the Oatka and its tributaries was either carried away or damaged to such an extent that they are unsafe." (The Western New-Yorker, July 11, 1902). The flood was caused by the combination of heavy rain with the bursting of three local reservoirs located north of Warsaw. Flooding may have been worsened by the loss of vegetation on the surrounding hills due to salt mining activities in the previous decades.

There would be two instances of especially severe Oatka Creek flooding during spring of 1916. The first instance occurred in April of 1916. Conditions in Warsaw were especially extreme because of a threefold combination of heavy rain, the Buffalo Street bridge acting as an inadvertent dam, and the improper drainage of rainwater into lower areas of Warsaw from nearby East Hill. Warsaw's water ran downstream, creating a severe region-wide flood. The flood initiated proposals to get rid of the Buffalo Street Bridge and to re-route the gully on East Hill.

May of 1916 was the date of the second occurrence of severe floods within the year. A brief, but intense rainfall was cited as the worst that Pavilion had ever recorded, and was severe enough to close all BR&P trains into LeRoy (The Western New Yorker, May 18, 1972). Severe floods resulted in water build-ups a much as eight feet deep. The intensity of the flood was due to heavy rainfall in Covington coupled with East Hill run-off water of heavy rains into Warsaw.

In March of 1955, the combination of melting snow with heavy rain led to flooding so severe that the Red Cross was called in to help with damages. Warsaw was hit especially hard; Buffalo Street was again inundated. In 1966, the Buffalo District's ACE initiated a public project to enlarge the Oatka Creek to maximize flood protection. The project was completed in 1968. A 1972 estimate by the ACE reported that the project had prevented an estimated $1 million in damages since its completion. (The Batavian Daily News, July 11, 1972)

1972's flood season was impacted by Hurricane Agnes and was one of the worst incidents of Oatka Creek flooding. As weather conditions worsened due to heavy rainfall, the Mt. Morris Dam (southwest of Warsaw) threatened to burst. Residents in low areas between Mt. Morris and as far north as Rochester were evacuated as a precaution. Luckily, water was systematically released from the dam, and calamity was avoided (The Western New-Yorker, June 27, 1972). However, more than twenty bridges within the watershed were washed away, and the area between Warsaw and Wyoming were especially flooded. East Hill run-off water resulted in excessive flooding in Warsaw. Among groups that assisted with repercussions of the rain included the Civil Defense and the National Guard watching water levels around the area, the Attica Correctional Institute gathering 200 volunteers to assist with cleanup, and the Red Cross assisted individuals with personal losses sustained from the flood.

In 1998, heavy rains caused severe floods in January and again in mid-July. January's floods were additionally complicated by an ice storm. Conditions in July were so severe that a state of emergency was declared for five days, and roads were closed throughout a range of areas along the watershed due to flooding.

8.4 Next Steps in the Watershed Planning Process

Watershed planning begins with *Problem Formulation*. Problem formulation is defined as the process for generating and evaluating preliminary hypotheses about why ecological effects have occurred, or may occur, from human activities. Section 8.3 is the first step toward problem formulation in the Oatka Creek watershed. These problems will be reviewed, deliberated and revised by the Project Advisory Committee and then be released to the public for similar review in a public setting.

Problem formulation results in three products: (1) assessment endpoints that adequately reflect management goals and the ecosystem [or watershed] they represent, (2) conceptual models that describe key relationships between a stressor and assessment endpoint or between several stressors and assessment endpoints, and (3) an analysis plan.

The first two products – assessment endpoints and conceptual models – will be developed in subsequent phases that follow the completion of this Characterization report. Together with other project components (such as the evaluation of the regulatory and programmatic environment), each of these tasks will contribute to and ultimately comprise the final watershed management plan for the Oatka Creek watershed.

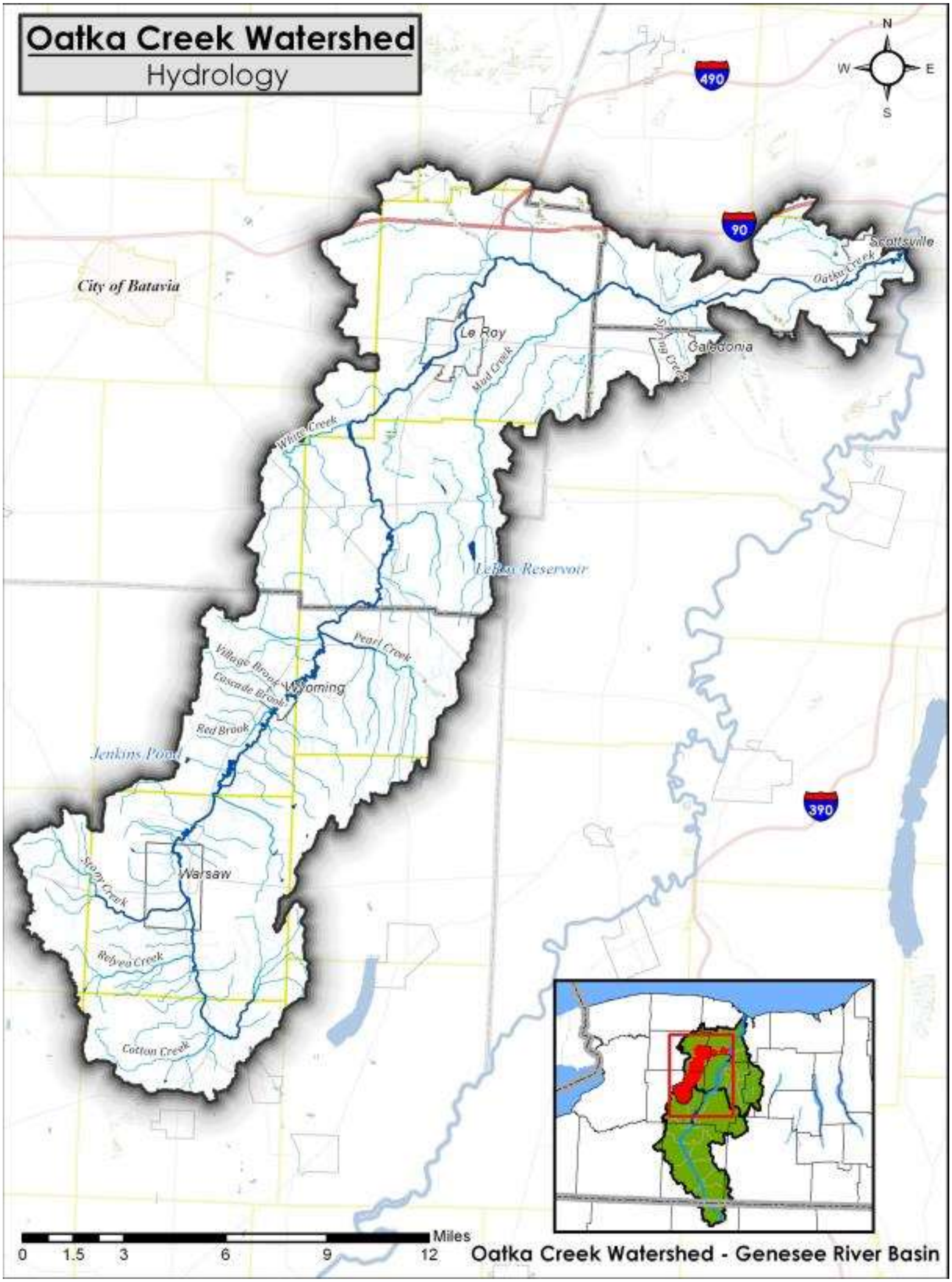
Section 8 Endnotes

[81] Adapted from Chapter 12 of the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. USEPA.
[82] *Guidelines for Ecological Risk Assessment*. [Online] In *US EPA*. Retrieved 2/2/11 from oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=36512 (page 12)
[83] *Guidelines for Ecological Risk Assessment*. (page 1)
[84] *Guidelines for Ecological Risk Assessment*. (page 1)
[85] *Invertebrates as Indicators*. [Online] In *USEPA*. Retrieved 8/8/11 from http://www.epa.gov/bioiweb1/html/invertebrate.html
[86] *Adapting Water Management: A primer on coping with climate change*. [Online] In *World Wildlife Foundation*. Retrieved 3/1/11 from http://www.worldwildlife.org/climate/Publications/WWFBinaryitem12534.pdf
[87] *Great Lakes Communities and Ecosystems at Risk*. [Online] In *Union of Concerned Scientists*. Retrieved 3/1/11 from http://www.ucsusa.org/greatlakes/
[88] *Top Ten Water Quality Issues in NYS: Onsite Wastewater Treatment*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 3/1/11 from http://www.dec.ny.gov/docs/water_pdf/top10inadqtonsite.pdf
[89] *Ibid.*
[90] Franklin, Alan B, Barry R. Noon, and T. Luke George. *What is Habitat Fragmentation?* [Online] In Global Restoration Network. Retrieved 3/1/11 from http://www.globalrestorationnetwork.org/uploads/files/LiteratureAttachments/368_what-is-habitat-fragmentation.pdf
[91] Franklin, Alan B, Barry R. Noon, and T. Luke George.
[92] *Invasive Species Task Force*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 3/1/11 from http://www.dec.ny.gov/animals/6989.html
[93] *Invasive Species Task Force*. [Online]
[94] *Chemical and Petroleum Spills*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 3/1/11 from http://www.dec.ny.gov/chemical/8428.html
[95] NYS Department of Health. Public *Health Assessment: Lehigh Valley Railroad Derailment Site*. NYD086950251: July 6, 2000.
[96] *Stormwater.* [Online] In *New York State Department of Environmental Conservation*. Retrieved 3/1/11 from http://www.dec.ny.gov/chemical/8468.html

[97] *NYS Stormwater Management Design Manual (August 2010)*. [Online] In. *New York State Department of Environmental Conservation*. Retrieved 3/1/11 from http://www.dec.ny.gov/chemical/29072.html
[98] *Identification and Analysis of the Riparian Corridor in the Black & Oatka Creek Watersheds*. [Online] In *G/FLRPC*. Retrieved 3/1/11 from http://gflrpc.org/Publications/RiparianCorridor.htm

Appendices

Map 1


Oatka Creek Watershed
Hydrology
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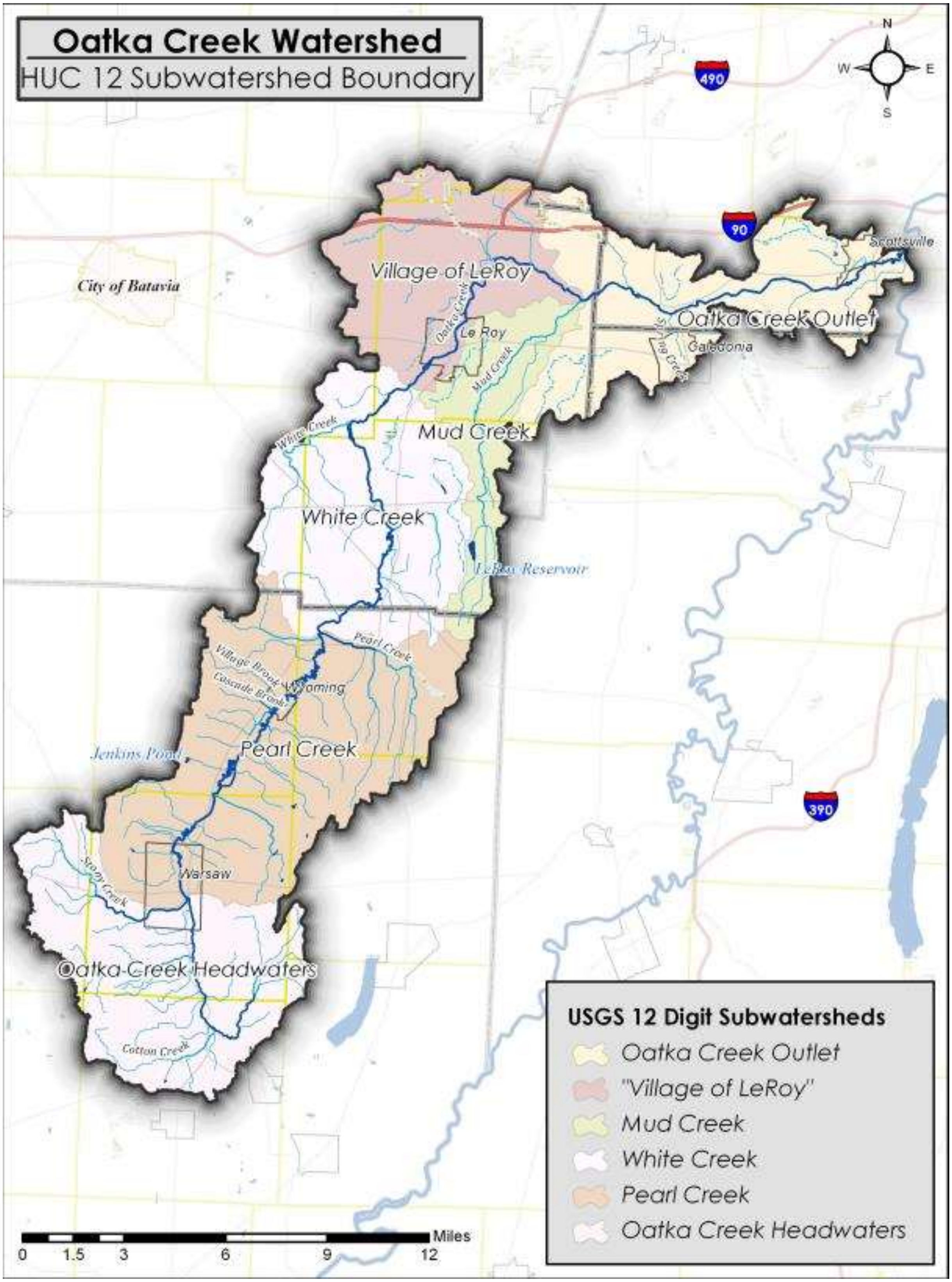
390
City of Batavia
Scottsville
Oatka Creek
Le Roy
Caledonia
Mud Creek
Spring Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
Miles
0 1.5 3 6 9 12
Oatka Creek Watershed - Genesee River Basin

Map 2


Oatka Creek Watershed
HUC 12 Subwatershed Boundary
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City of Batavia
Village of LeRoy
Le Roy
Oatka Creek
Mud Creek
Scottsville
Oatka Creek Outlet
Caledonia
Spring Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Jenkins Pond
Warsaw
Stony Creek
Oatka Creek Headwaters
Cotton Creek
Miles
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1.5
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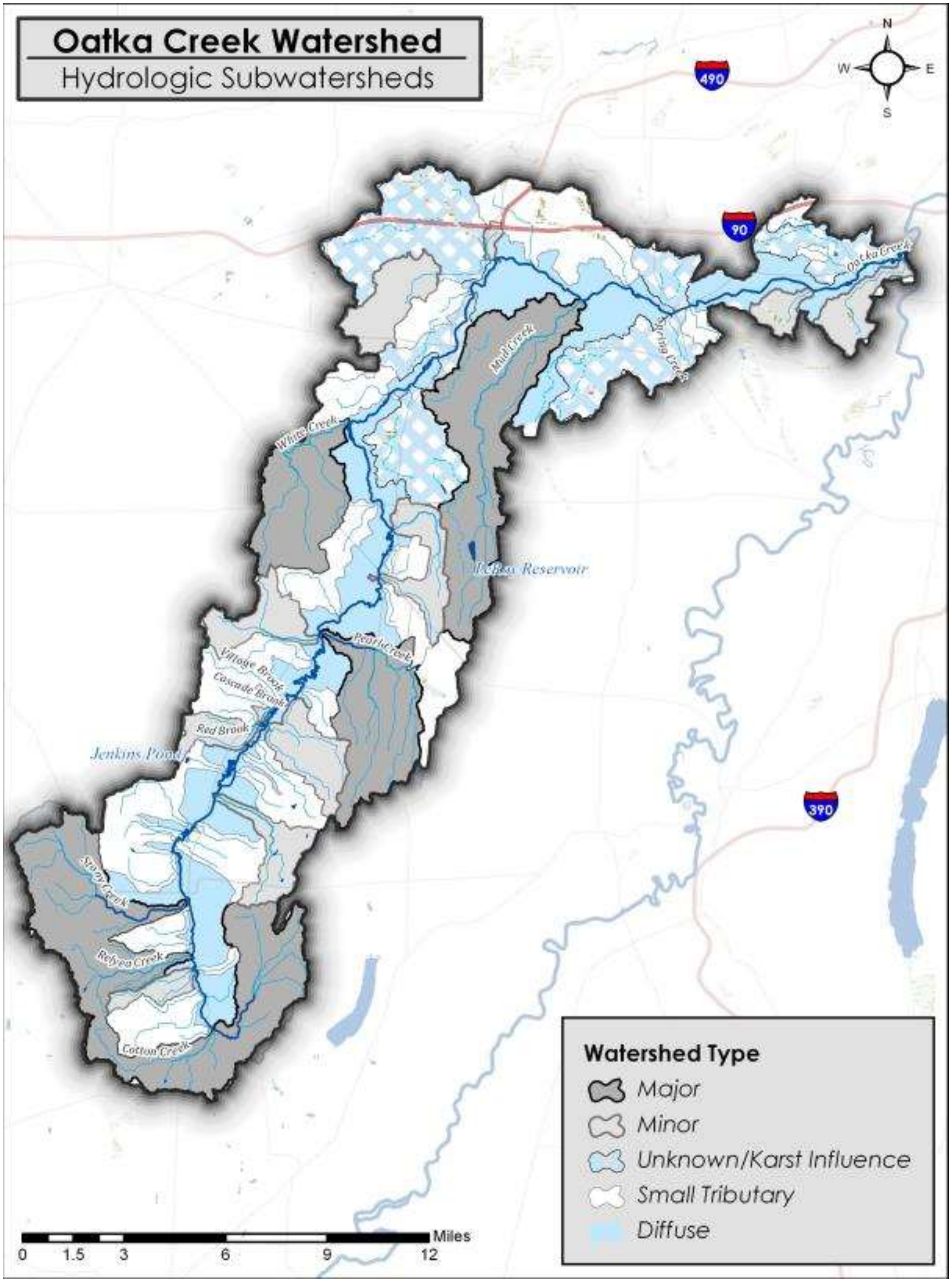
12
USGS 12 Digit Subwatersheds
Oatka Creek Outlet
"Village of LeRoy"
Mud Creek
White Creek
Pearl Creek
Oatka Creek Headwaters

Map 3


Oatka Creek Watershed
Hydrologic Subwatersheds
490
90
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Oatka Creek
Spring Creek
Mud Creek
White Creek
Reservoir
Pearl Creek
Village Brook
Cascade Brook
Red Brook
Jenkins Pond
Stony Creek
Relyea Creek
Cotton Creek
Watershed Type
Major
Minor
Unknown/Karst Influence
Small Tributary
Diffuse
Miles
0
1.5
3
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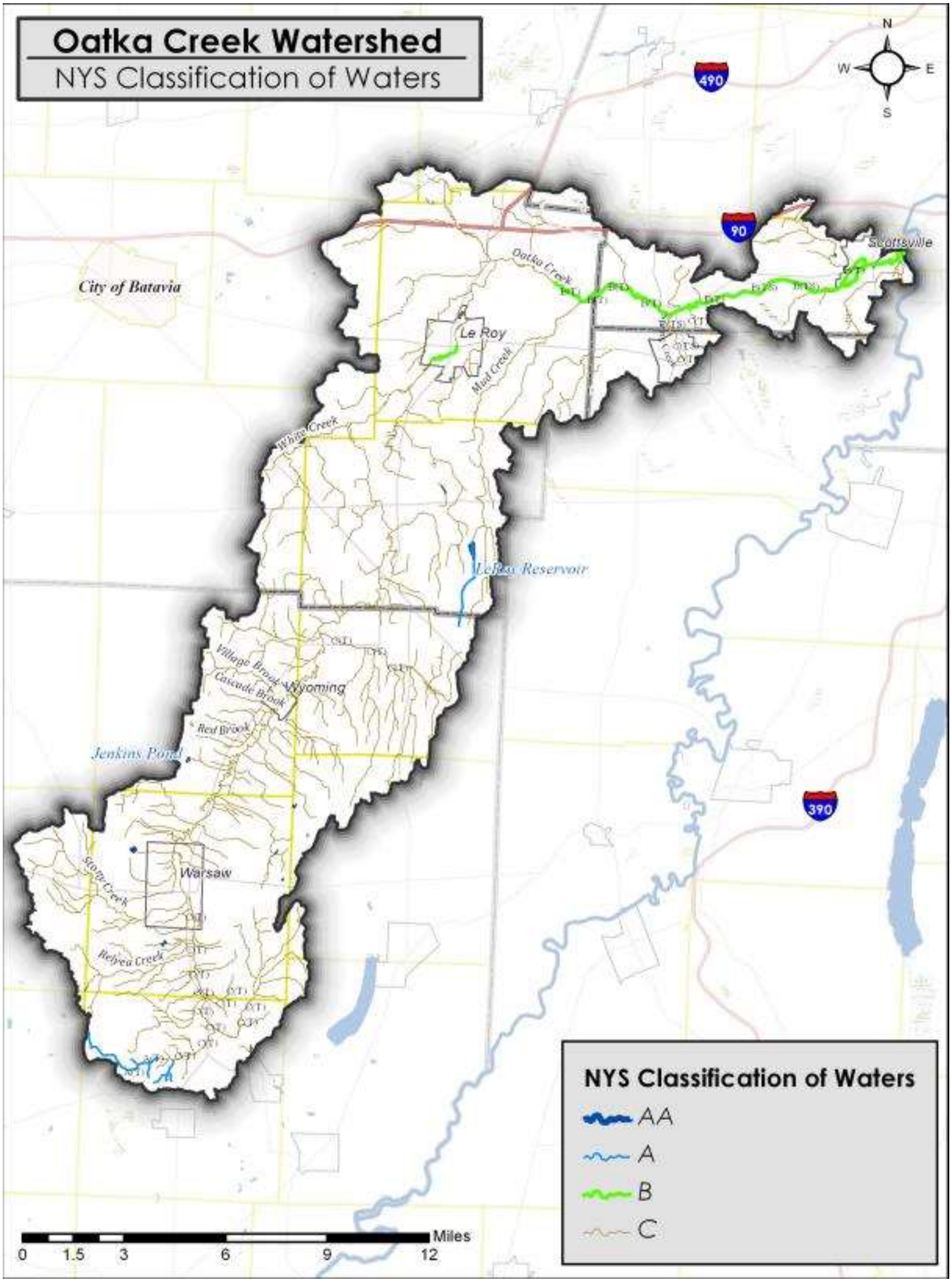
Map 4


Oatka Creek Watershed
NYS Classification of Waters
N
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490
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Scottsville
City of Batavia
Oatka Creek
Le Roy
Mud Creek
White Creek
LeRoy Reservoir
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
NYS Classification of Waters
AA
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Miles
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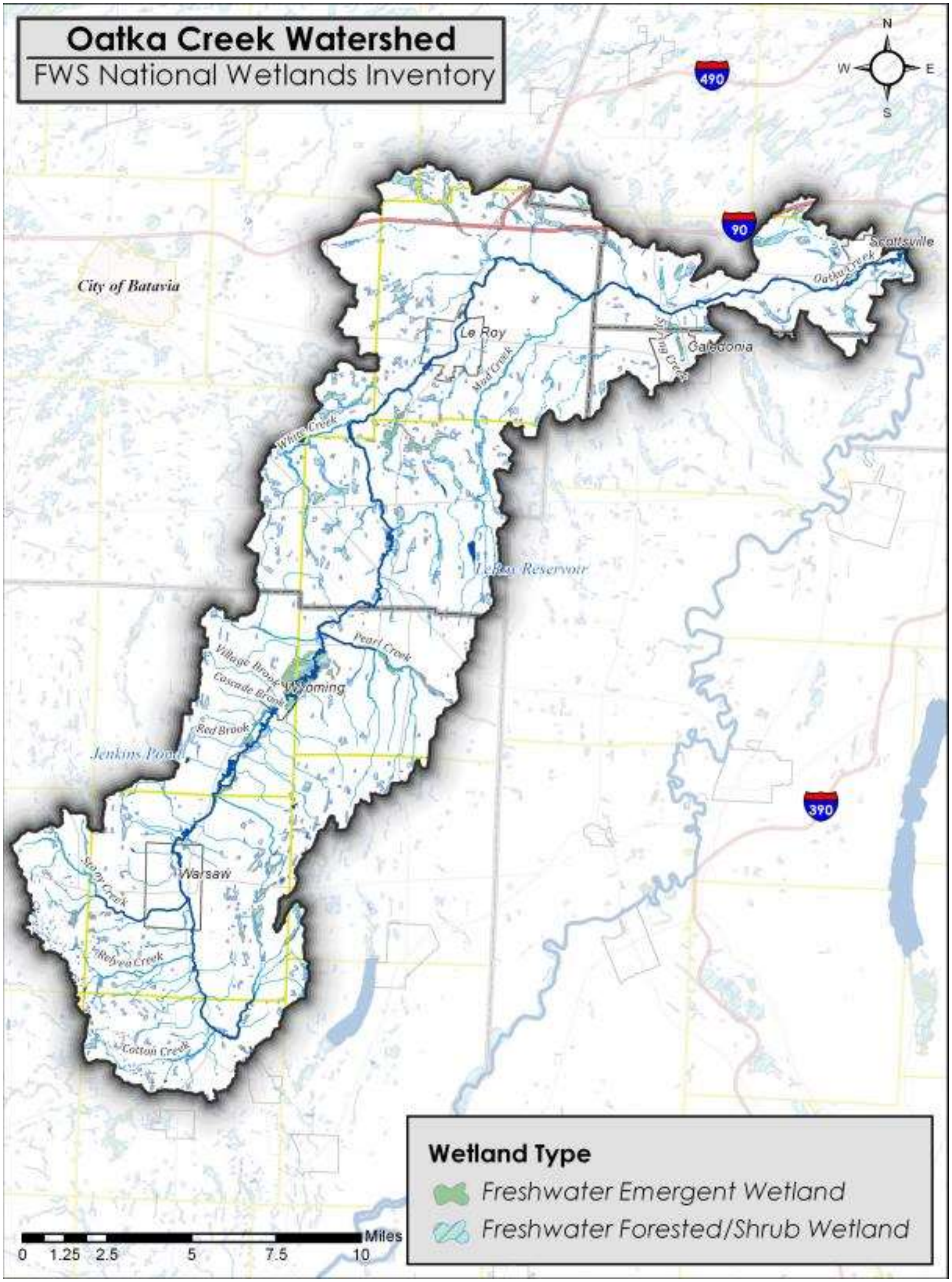
Map 5


Oatka Creek Watershed
FWS National Wetlands Inventory
N
W
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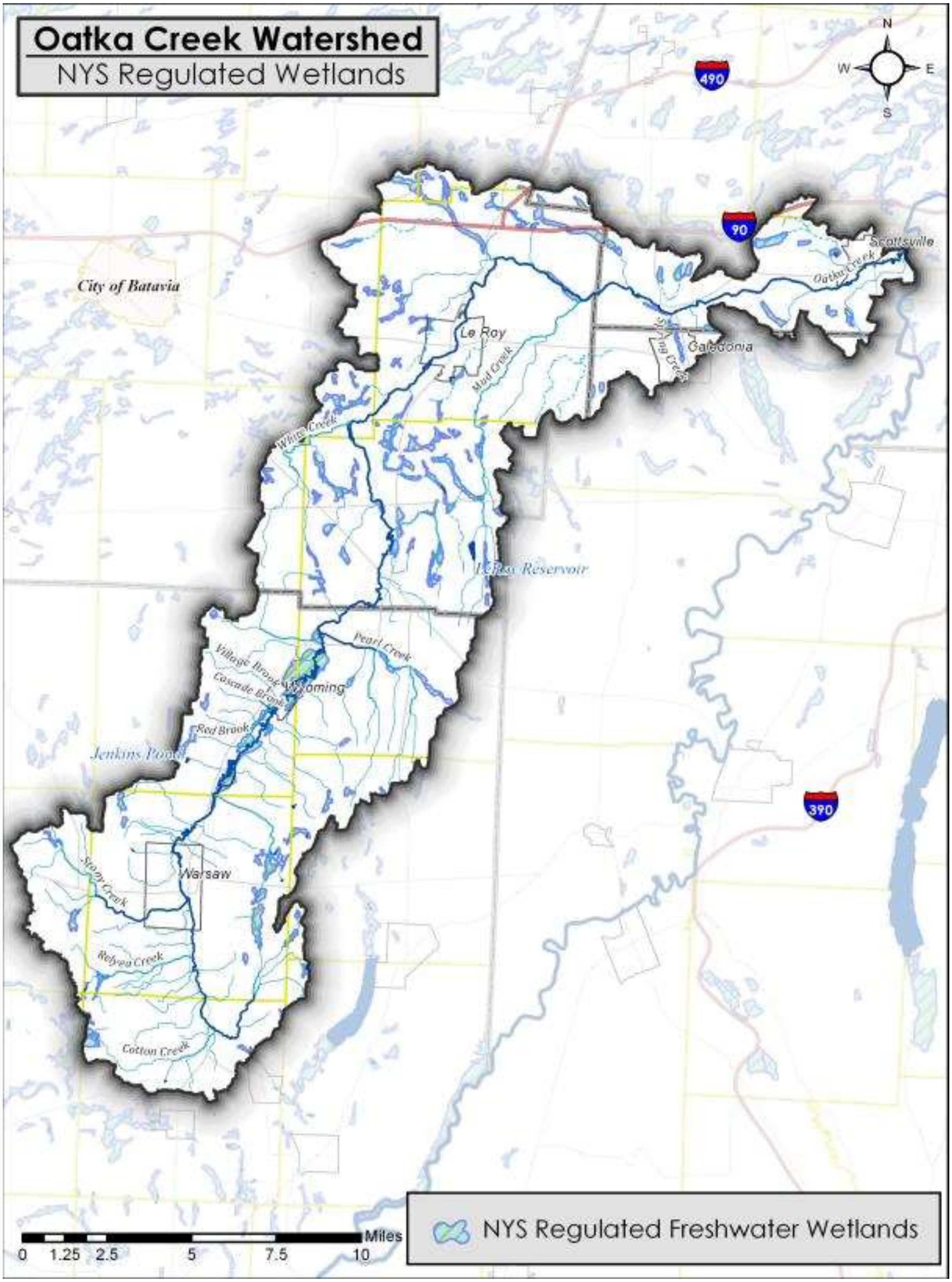
490
90
390
Scottsville
Oatka Creek
City of Batavia
Le Roy
Caledonia
Spring Creek
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
Wetland Type
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Miles
0 1.25 2.5 5 7.5 10

Map 6


Oatka Creek Watershed
NYS Regulated Wetlands
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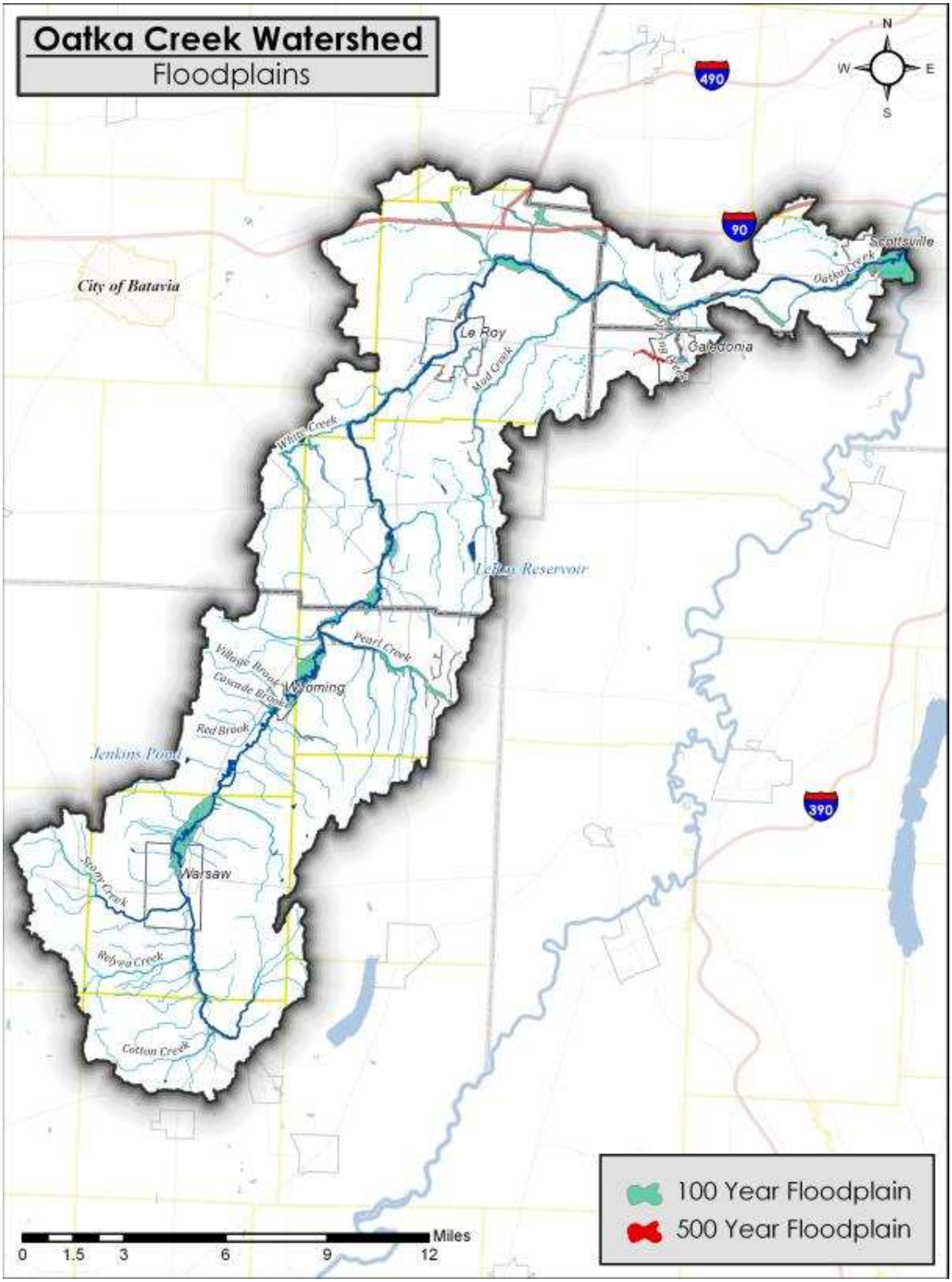
Scottsville
Oatka Creek
City of Batavia
Le Roy
Caledonia
Spring Creek
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
0 1.25 2.5 5 7.5 10
Miles
NYS Regulated Freshwater Wetlands


Oatka Creek Watershed
Floodplains
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City of Batavia
Scottsville
Oatka Creek
Le Roy
Caledonia
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
100 Year Floodplain
500 Year Floodplain
Miles
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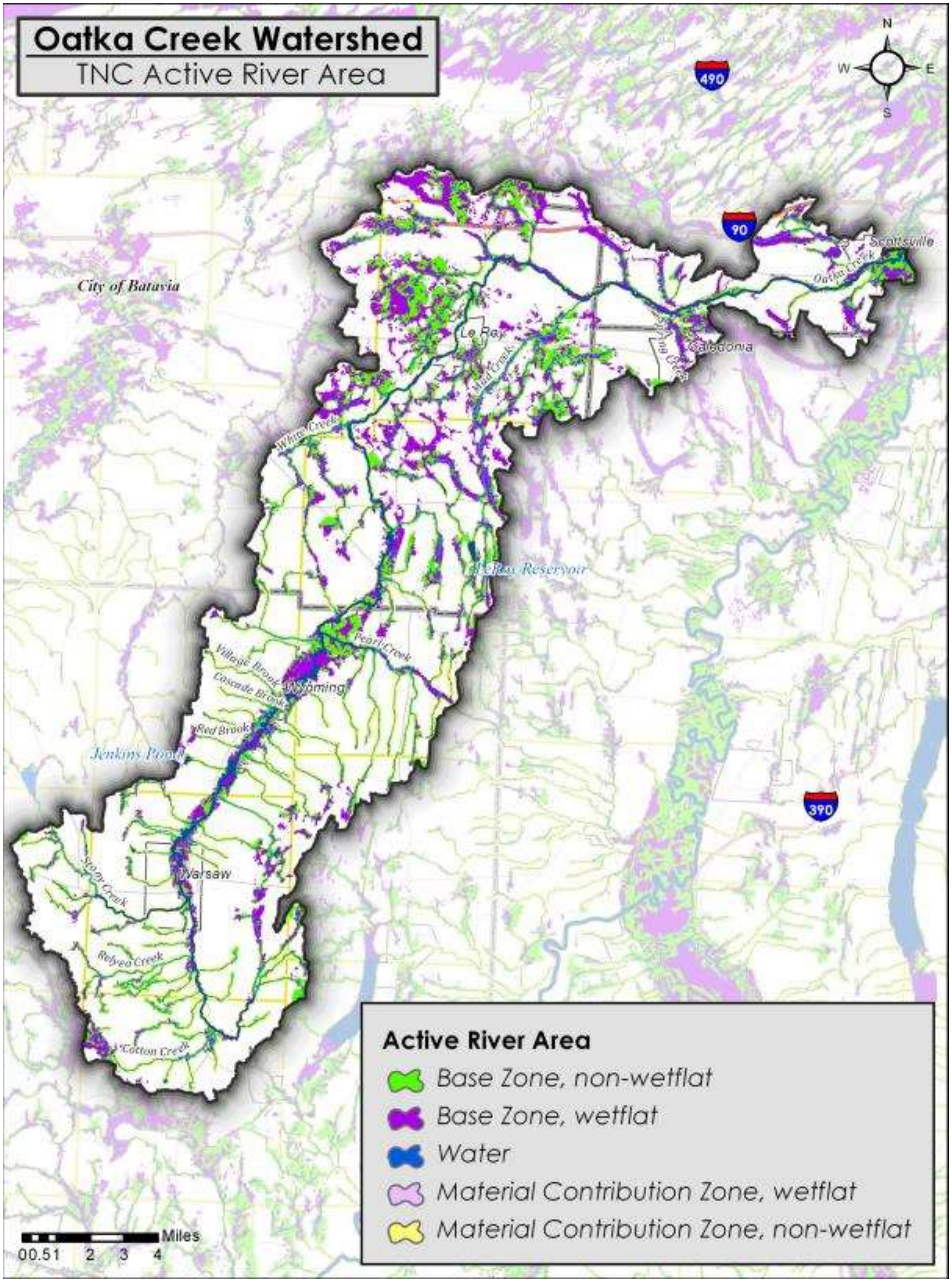
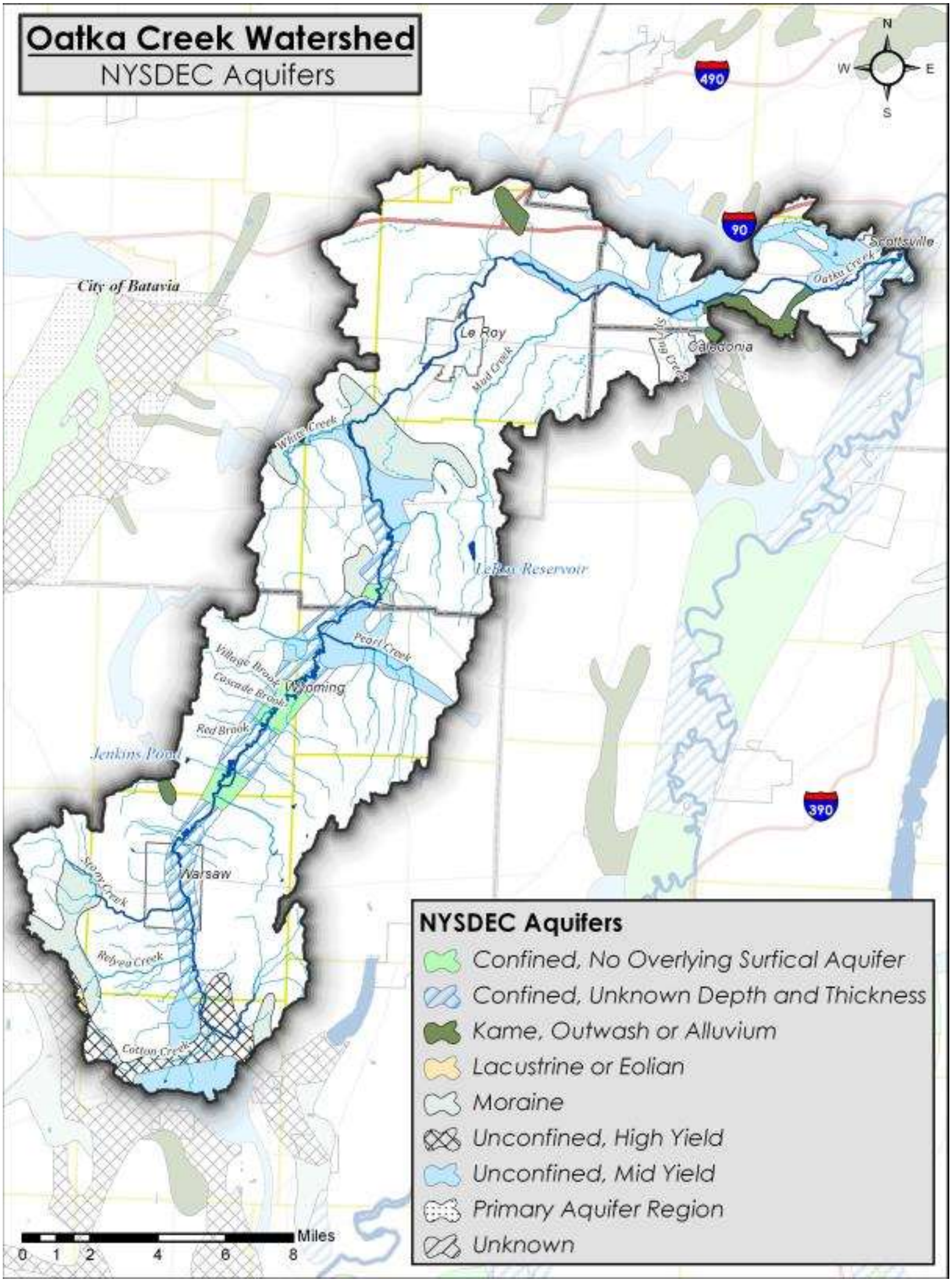
Map 8


Oatka Creek Watershed
TNC Active River Area
City of Batavia
Le Roy
Caledonia
Scottsville
Oatka Creek
Spring Creek
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
490
90
390
N
S
E
W
Active River Area
Base Zone, non-wetflat
Base Zone, wetflat
Water
Material Contribution Zone, wetflat
Material Contribution Zone, non-wetflat
Miles
0 0.5 1 2 3 4

Map 9

Oatka Creek Watershed
NYSDEC Dam Inventory
N
W
E
S
490
90
390
City of Batavia
Scottsville
Le Roy
Caledonia
Wyoming
Warsaw
LeRoy Reservoir
Jenkins Pond
Oatka Creek
Mud Creek
White Creek
Pearl Creek
Cascade Brook
Stony Creek
Relyea Creek
Cotton Creek
EDDY ROBERTSON DAM
COLEMAN DAM
GARBUTT DAM
DONALD WOODWARD DAM
JOHN WEHLE DAM
L H GARDNER PAPER CO DAM
OATKA CREEK DAM
OATKA CREEK DAM
CHARLES O'MILLER MARSH DAM
ROANOKE MILL DAM
BRADLEYS DAM
PIXLEY & SONS DAM
O PIXLEY & CO POND DAM
PAVILION CENTER DAM
LEROY RESERVOIR DAM
GILL MARSH DAM
LAWRENCE MOREHOUSE DAM
JENKINS DAM
RALPH C EPSTEIN DAM
HAWLEY-COBURN MARSH DAM
FLOWERS-COBURN MARSH DAM
CLIFFORD COFFIELD DAM
BAUER MARSH DAM
CARPENTER & BAUER WILDLIFE MARSH DAM
EMMA COOK MARSH DAM
RICHARD BANNISTER DAM
WARSAW RESERVOIR DAM
WILLIAM MILLIGAN DAM
Miles
0
1.5
3
6
9
12
NYSDEC Identified Dams

Map 10



Oatka Creek Watershed
NYSDEC Aquifers
N
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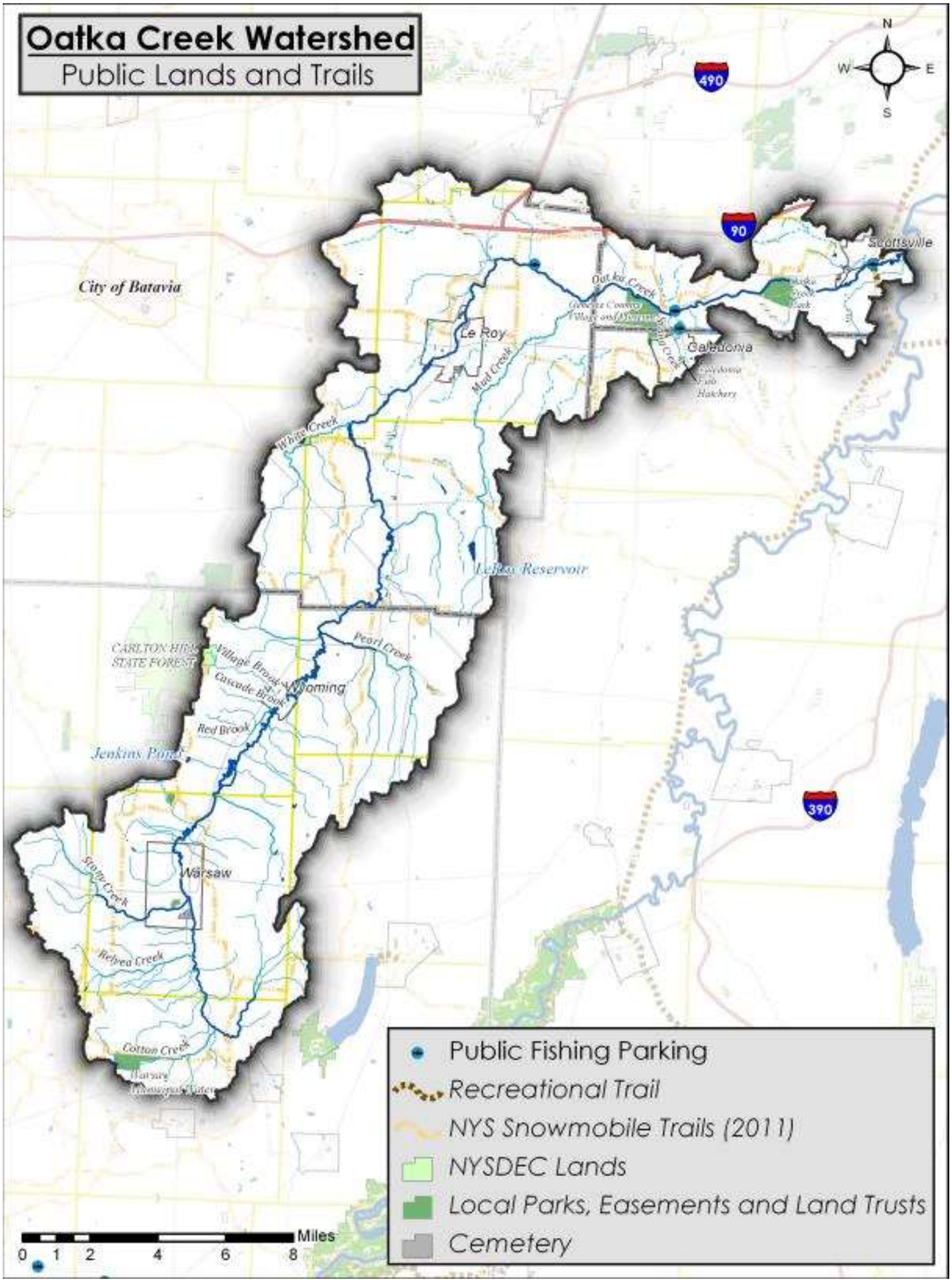
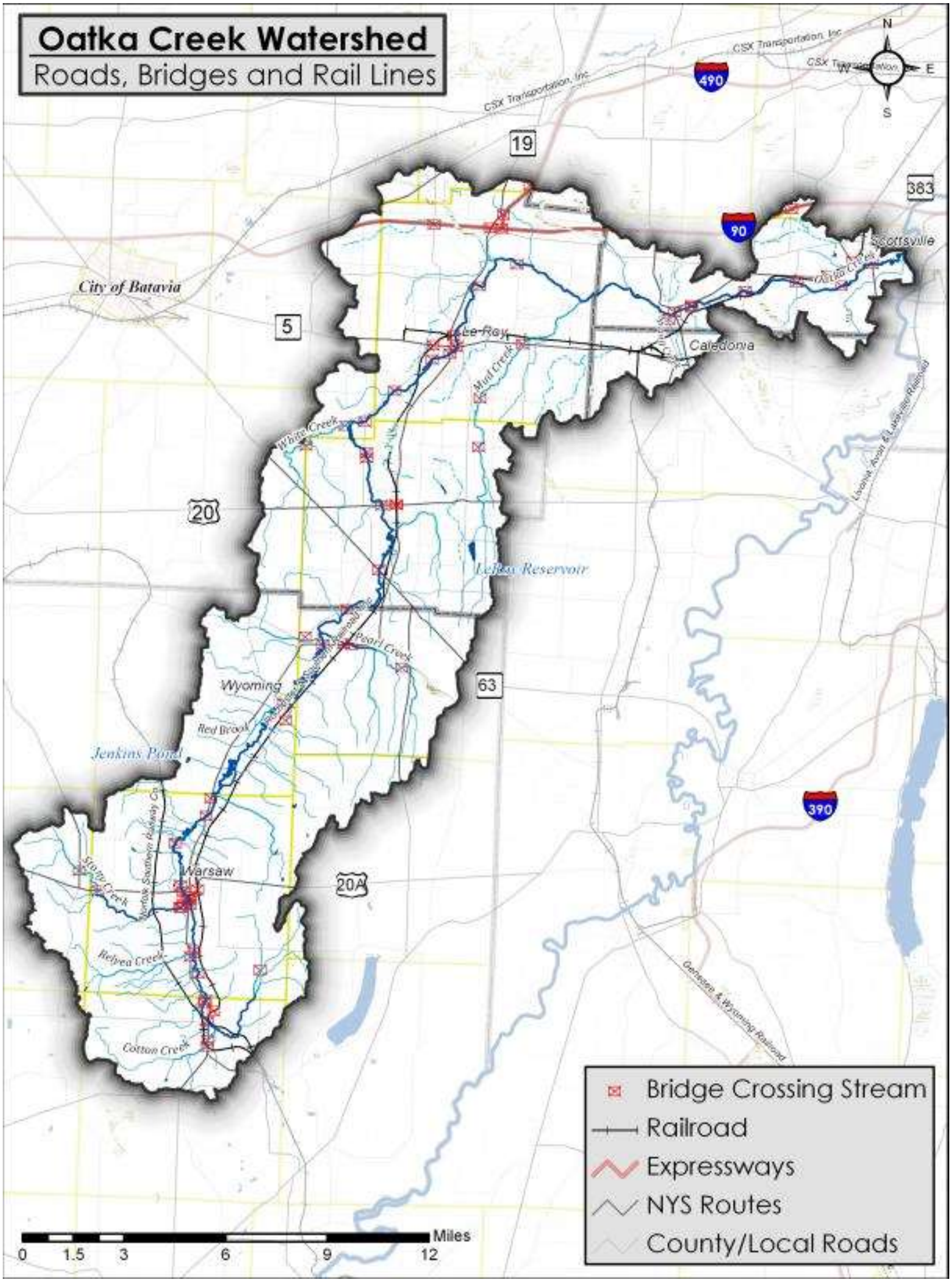
490
90
390
City of Batavia
Le Roy
Mud Creek
Spring Creek
Caledonia
Scottsville
Oatka Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
NYSDEC Aquifers
Confined, No Overlying Surfical Aquifer
Confined, Unknown Depth and Thickness
Kame, Outwash or Alluvium
Lacustrine or Eolian
Moraine
Unconfined, High Yield
Unconfined, Mid Yield
Primary Aquifer Region
Unknown
Miles
0
1
2
4
6
8

Map 11

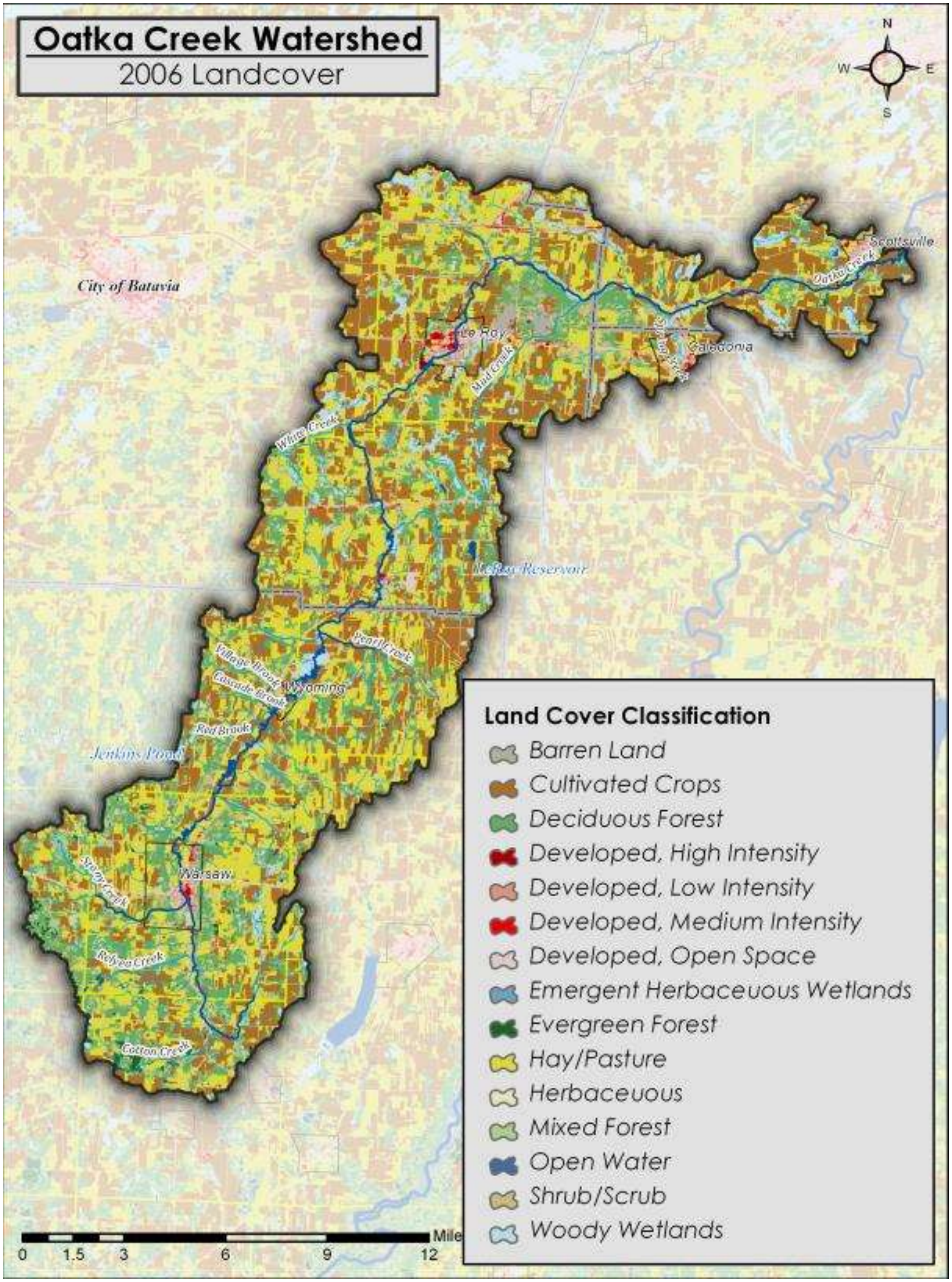


Oatka Creek Watershed
Public Lands and Trails
N
W
E
S
490
90
390
Scottsville
City of Batavia
Oatka Creek
Le Roy
Mud Creek
Caledonia
White Creek
LeRoy Reservoir
Pearl Creek
CARLTON HILL STATE FOREST
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
Public Fishing Parking
Recreational Trail
NYS Snowmobile Trails (2011)
NYSDEC Lands
Local Parks, Easements and Land Trusts
Cemetery
Miles
0
1
2
4
6
8

Map 12

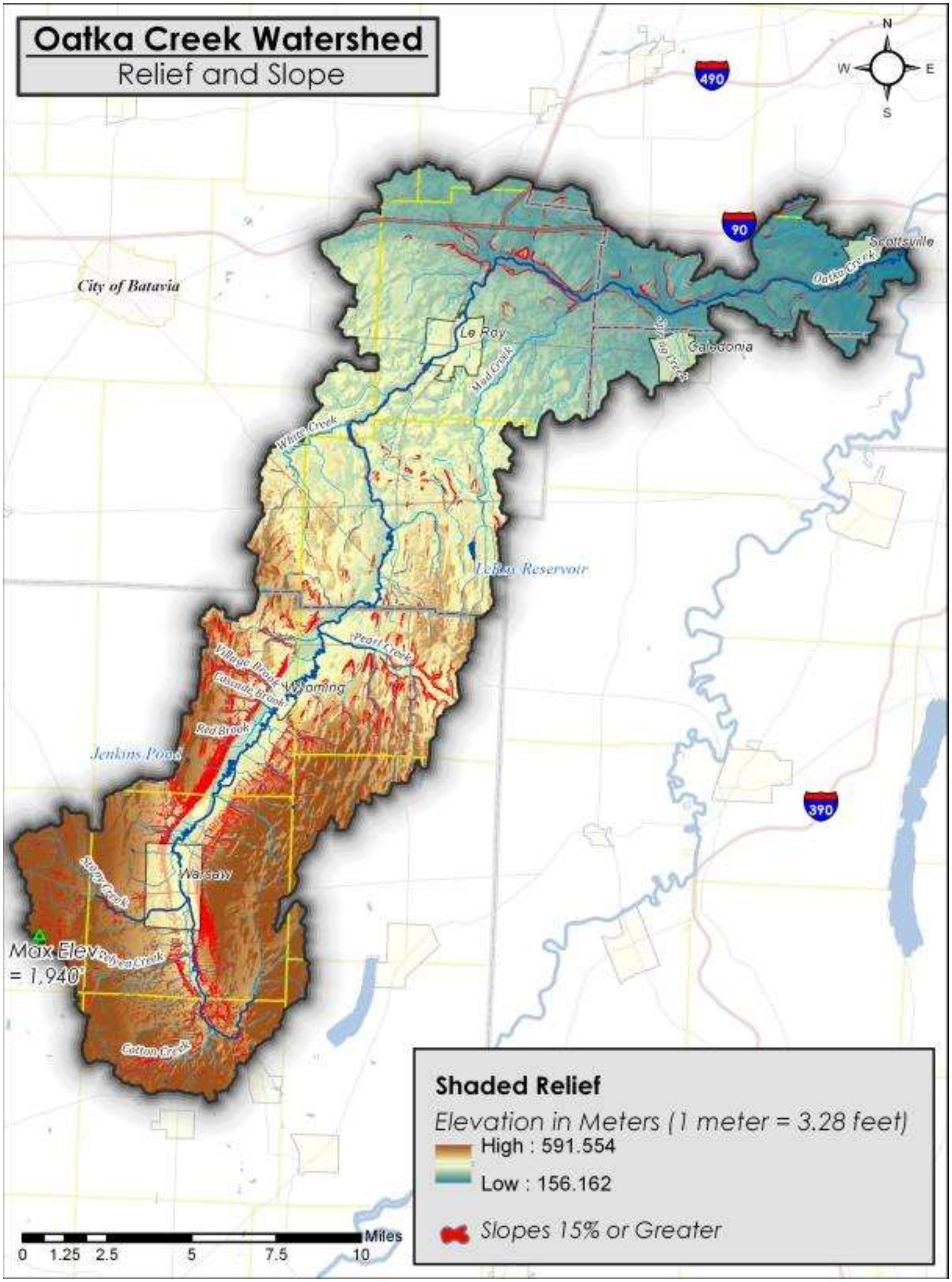

Oatka Creek Watershed
Roads, Bridges and Rail Lines
N
E
W
S
CSX Transportation, Inc
490
19
383
90
Scottsville
Oatka Creek
City of Batavia
5
Le Roy
Caledonia
Mud Creek
White Creek
20
LeRoy Reservoir
Pearl Creek
63
Wyoming
Red Brook
Jenkins Pond
390
Warsaw
20A
Stony Creek
Relyea Creek
Cotton Creek
Genesee & Wyoming Railroad
Livonia, Avon & Lakeville Railroad
Bridge Crossing Stream
Railroad
Expressways
NYS Routes
County/Local Roads
Miles
0
1.5
3
6
9
12

Map 13

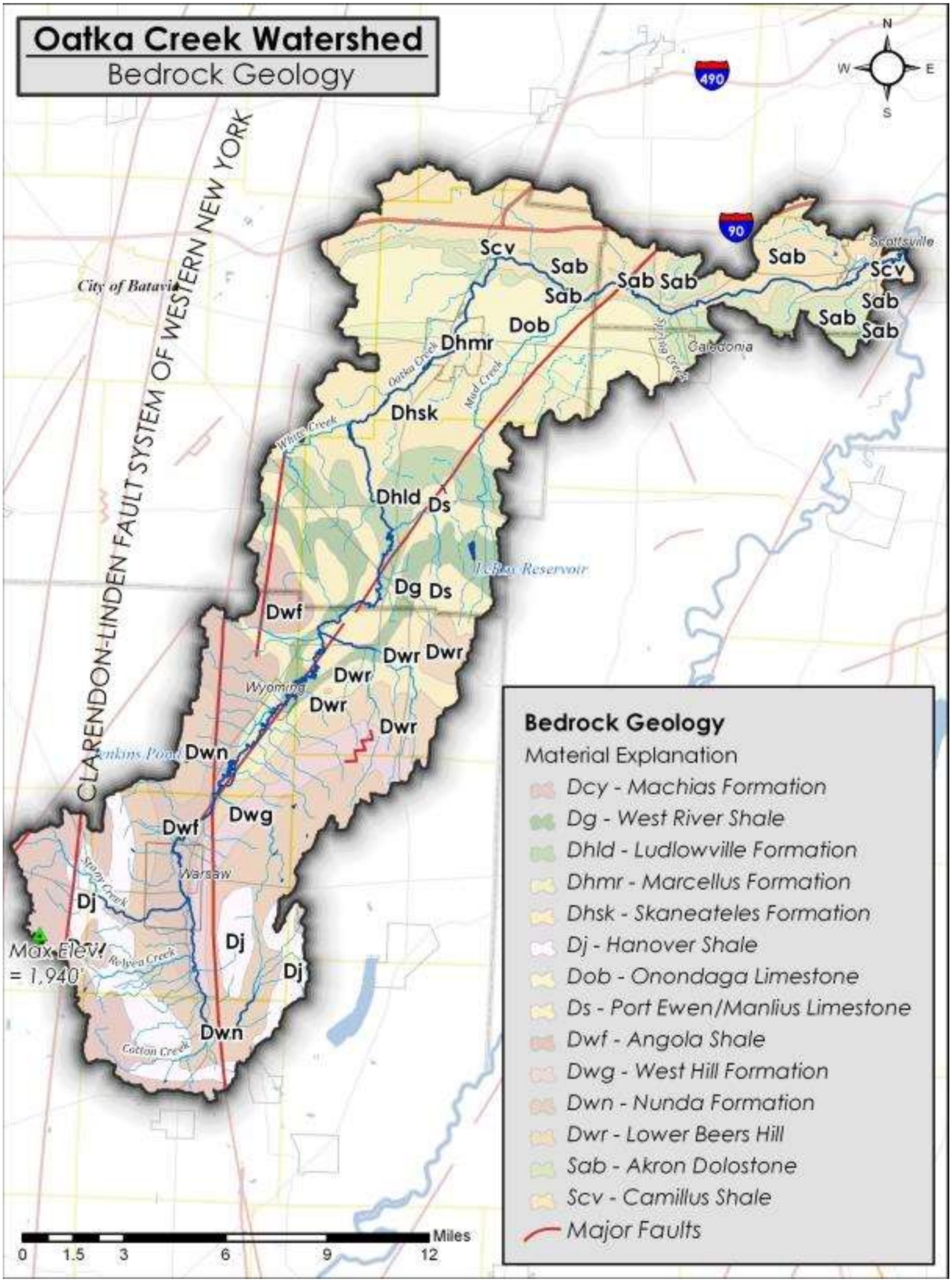

Oatka Creek Watershed
2006 Landcover
N
W
E
S
City of Batavia
Scottsville
Oatka Creek
Le Roy
Mud Creek
Caledonia
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
Land Cover Classification
Barren Land
Cultivated Crops
Deciduous Forest
Developed, High Intensity
Developed, Low Intensity
Developed, Medium Intensity
Developed, Open Space
Emergent Herbaceuous Wetlands
Evergreen Forest
Hay/Pasture
Herbaceuous
Mixed Forest
Open Water
Shrub/Scrub
Woody Wetlands
0 1.5 3 6 9 12
Mile

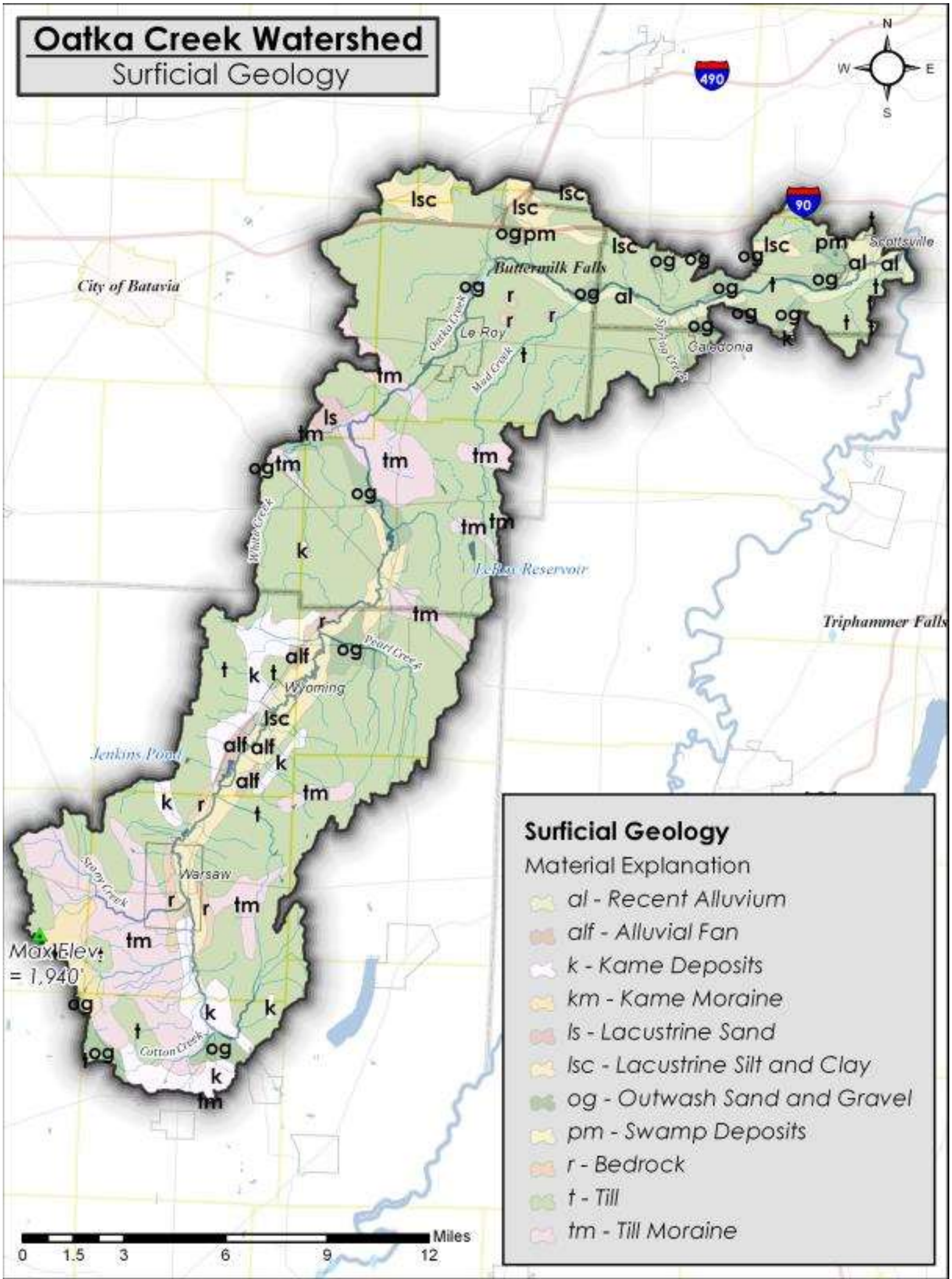
]

Map 14

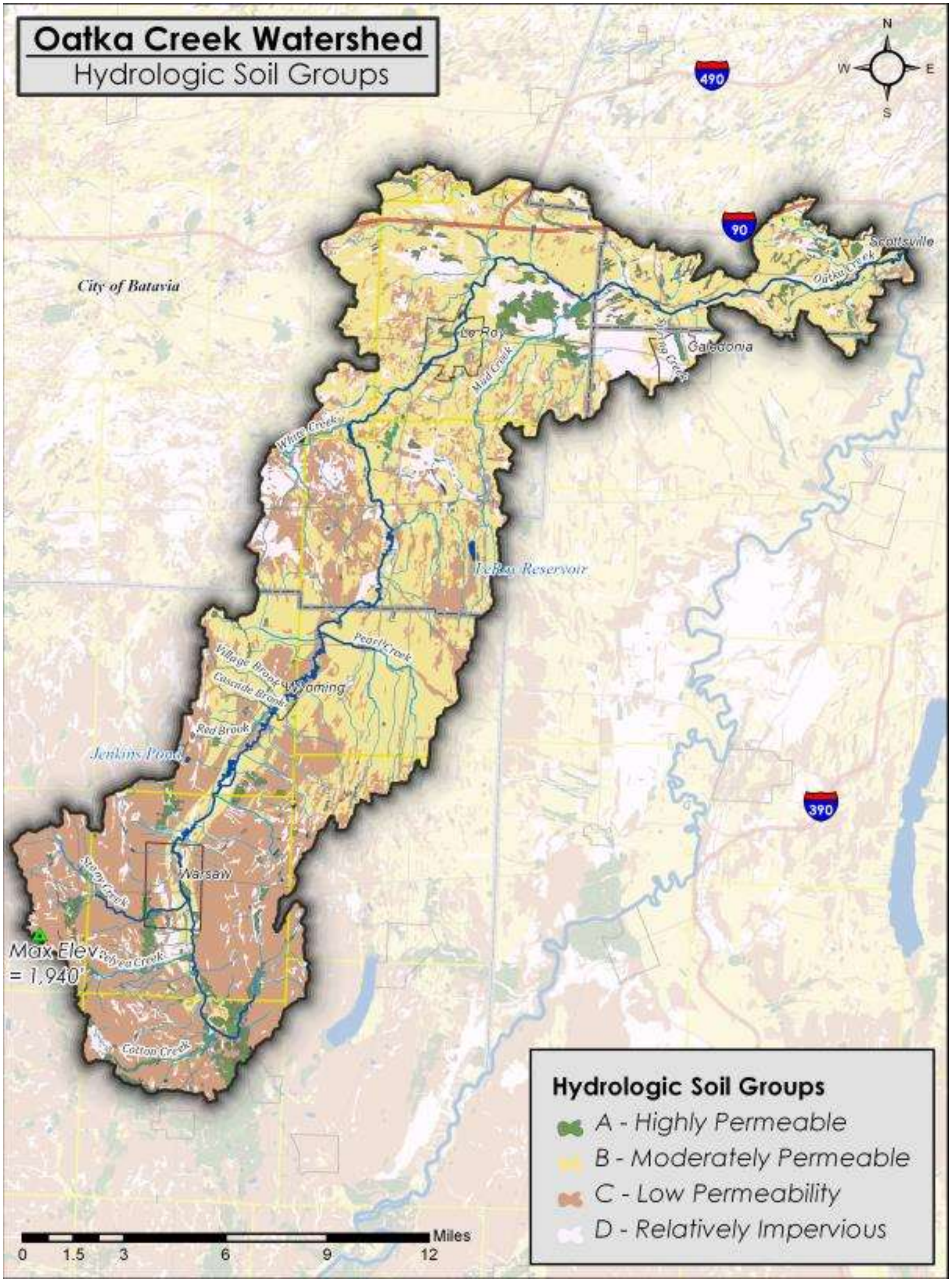

Oatka Creek Watershed
Relief and Slope
City of Batavia
Le Roy
Mud Creek
White Creek
Caledonia
Scottsville
Oatka Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Max Elev = 1,940'
Cotton Creek
Shaded Relief
Elevation in Meters (1 meter = 3.28 feet)
High : 591.554
Low : 156.162
Slopes 15% or Greater
Miles
0 1.25 2.5 5 7.5 10
N
S
E
W
490
90
390

Map 15

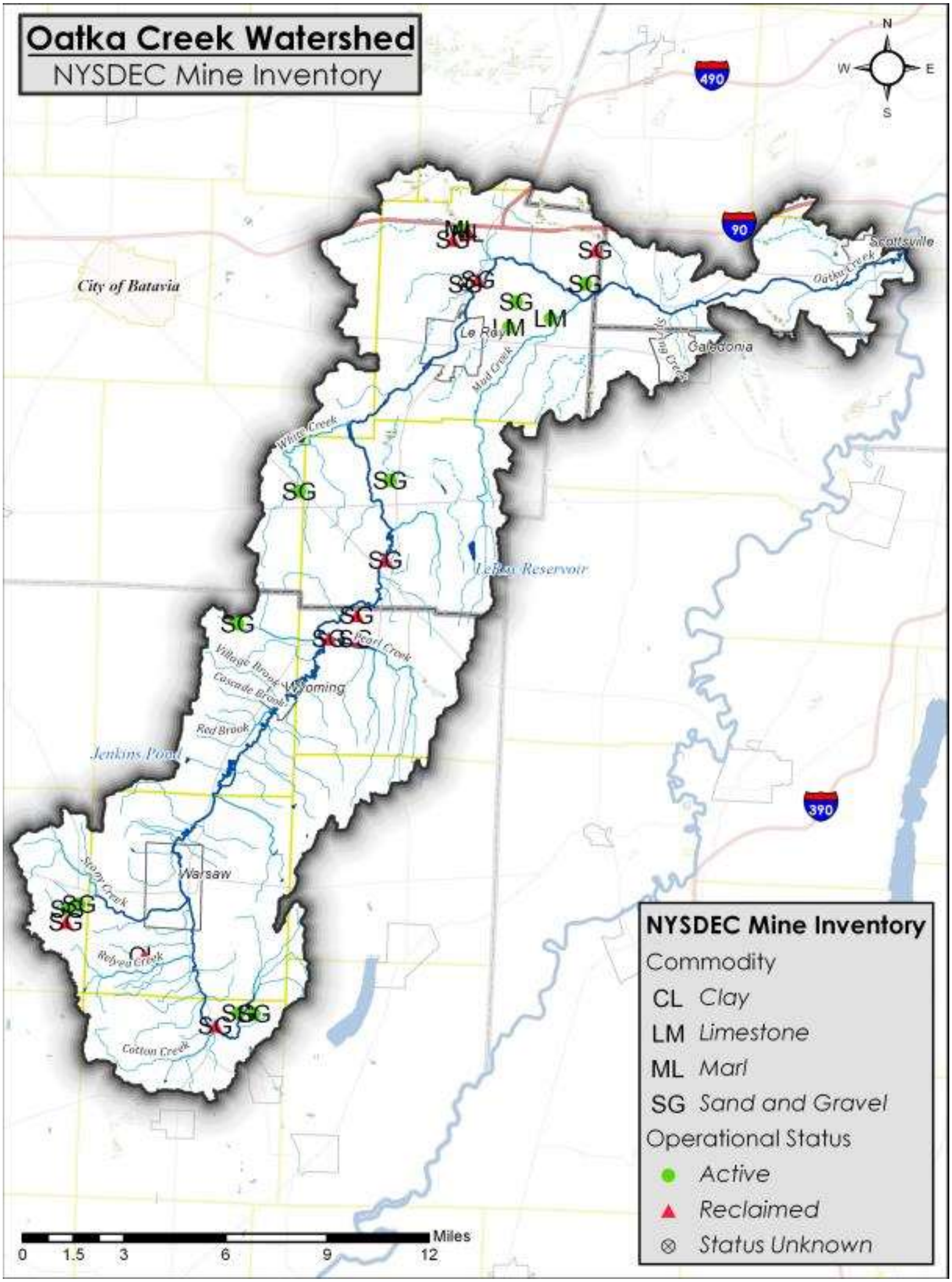

Oatka Creek Watershed
Bedrock Geology
CLARENDON-LINDEN FAULT SYSTEM OF WESTERN NEW YORK
City of Batavia
Scottsville
Caledonia
Wyoming
Warsaw
Jenkins Pond
White Creek
Oatka Creek
Mud Creek
Spring Creek
Stony Creek
Relyea Creek
Cotton Creek
Max Elev. = 1,940'
490
90
N
S
E
W
Scv
Sab
Dob
Dhmr
Dhsk
Dhld
Ds
Dg
Dwf
Dwr
Dwn
Dwg
Dj
Bedrock Geology
Material Explanation
Dcy - Machias Formation
Dg - West River Shale
Dhld - Ludlowville Formation
Dhmr - Marcellus Formation
Dhsk - Skaneateles Formation
Dj - Hanover Shale
Dob - Onondaga Limestone
Ds - Port Ewen/Manlius Limestone
Dwf - Angola Shale
Dwg - West Hill Formation
Dwn - Nunda Formation
Dwr - Lower Beers Hill
Sab - Akron Dolostone
Scv - Camillus Shale
Major Faults
Miles
0
1.5
3
6
9
12


Oatka Creek Watershed
Surficial Geology
N
S
W
E
490
90
City of Batavia
Buttermilk Falls
Le Roy
Oatka Creek
Mud Creek
Spring Creek
Caledonia
Scottsville
White Creek
LeRoy Reservoir
Triphammer Falls
Pearl Creek
Wyoming
Jenkins Pond
Warsaw
Stony Creek
Cotton Creek
Max Elev.
= 1,940'
lsc
ogpm
og
al
pm
t
r
k
tm
ls
alf
Miles
0
1.5
3
6
9
12
Surficial Geology
Material Explanation
al - Recent Alluvium
alf - Alluvial Fan
k - Kame Deposits
km - Kame Moraine
ls - Lacustrine Sand
lsc - Lacustrine Silt and Clay
og - Outwash Sand and Gravel
pm - Swamp Deposits
r - Bedrock
t - Till
tm - Till Moraine

Map 17


Oatka Creek Watershed
Hydrologic Soil Groups
N
W
E
S
490
90
390
City of Batavia
Scottsville
Oatka Creek
Le Roy
Caledonia
Spring Creek
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Wyoming
Cascade Brook
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Max Elev = 1,940'
Cotton Creek
Hydrologic Soil Groups
A - Highly Permeable
B - Moderately Permeable
C - Low Permeability
D - Relatively Impervious
Miles
0
1.5
3
6
9
12

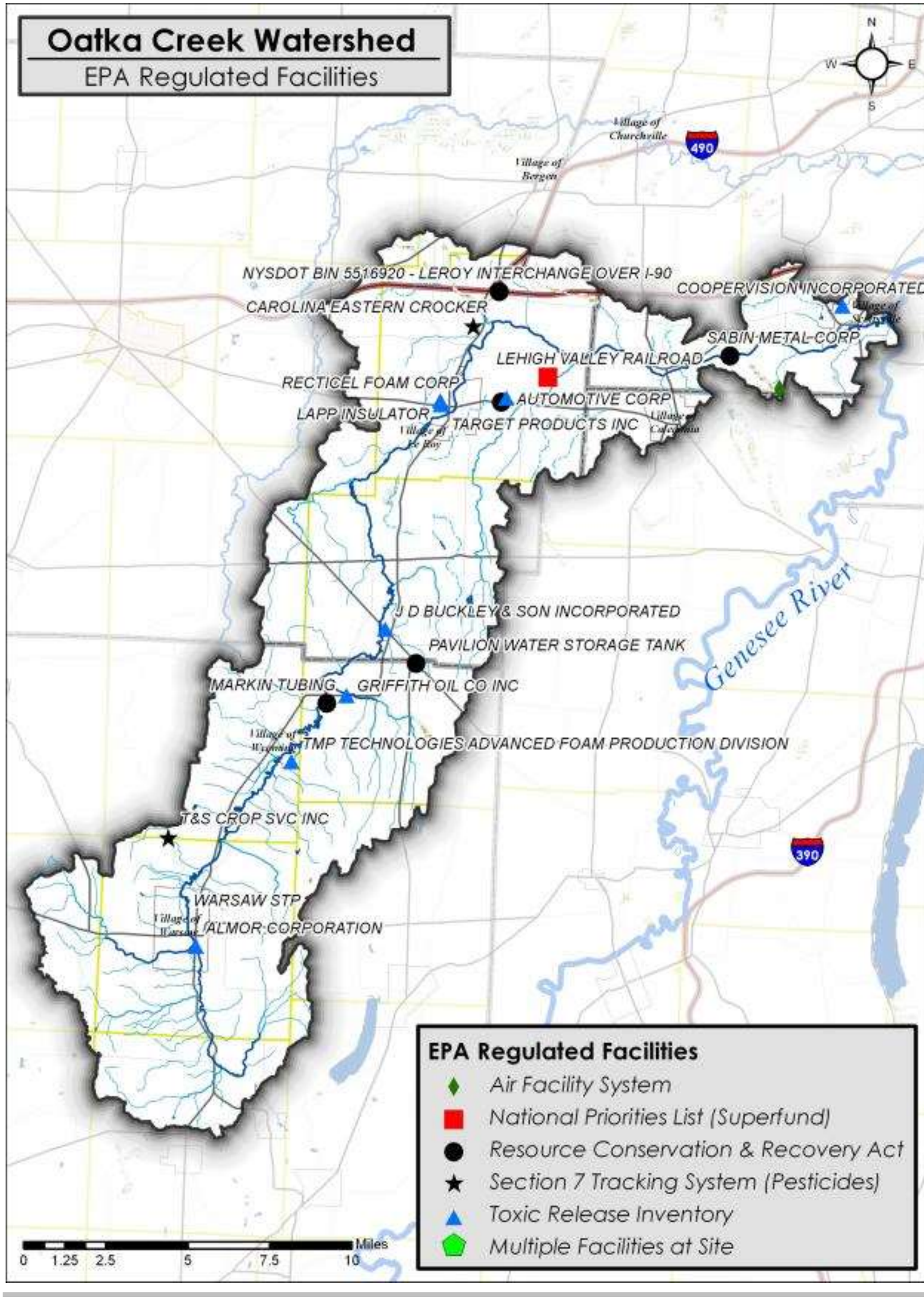
Map 18


Oatka Creek Watershed
NYSDEC Mine Inventory
City of Batavia
Le Roy
Caledonia
Scottsville
Oatka Creek
Mud Creek
Spring Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
490
90
390
N
S
E
W
Miles
0
1.5
3
6
9
12
NYSDEC Mine Inventory
Commodity
CL Clay
LM Limestone
ML Marl
SG Sand and Gravel
Operational Status
Active
Reclaimed
Status Unknown

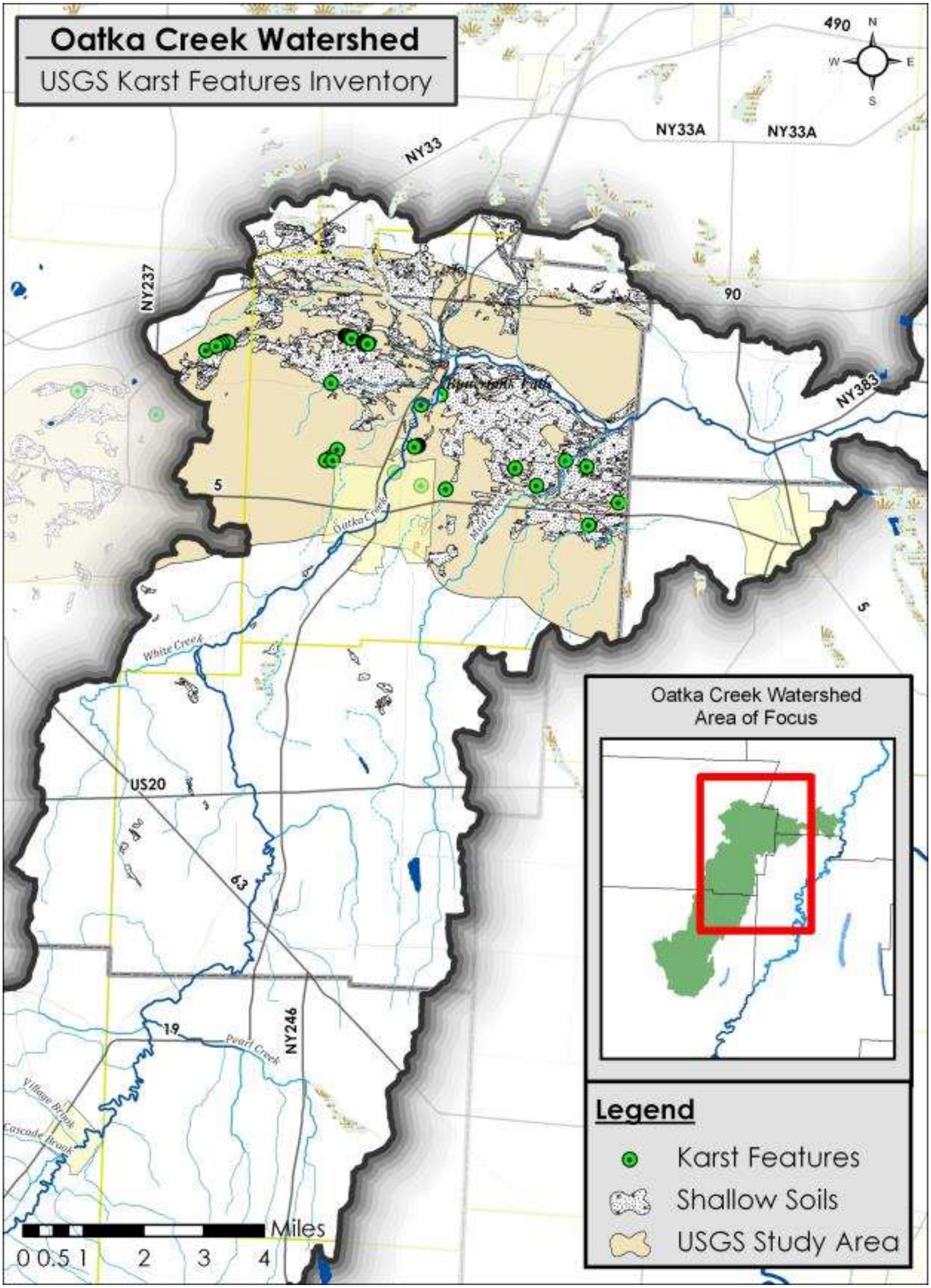
Map 19


Oatka Creek Watershed
NYSDEC SPDES Points
N
W
E
S
490
90
390
City of Batavia
NY0020133
Scottsville
NY0030546
NY0035432
Caledonia
NY0000779
NY0247308
Oatka Creek
White Creek
NY0247197
LeRoy Reservoir
NY0084689
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
NY0021504
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
Refer to Section 3.8.1 for more informatin on these sites and the NY State Pollution Discharge Elimination System.
Miles
0
1.5
3
6
9
12
SPDES Discharge Point

Map 20

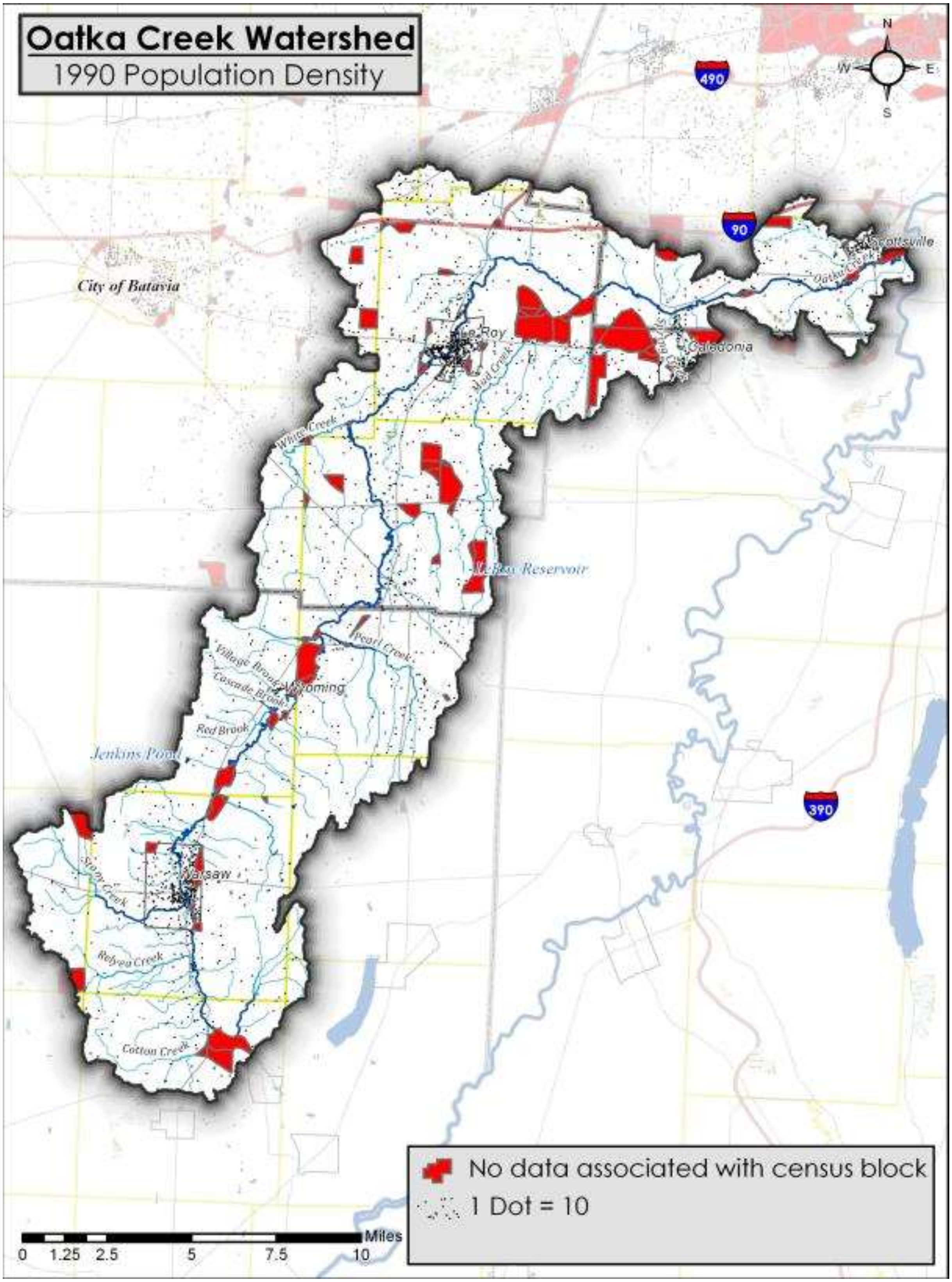

Oatka Creek Watershed
EPA Regulated Facilities
N
W
E
S
Village of Churchville
490
Village of Bergen
NYSDOT BIN 5516920 - LEROY INTERCHANGE OVER I-90
COOPERVISION INCORPORATED
CAROLINA EASTERN CROCKER
SABIN METAL CORP
LEHIGH VALLEY RAILROAD
RECTICEL FOAM CORP
AUTOMOTIVE CORP
LAPP INSULATOR
TARGET PRODUCTS INC
Village of Le Roy
J D BUCKLEY & SON INCORPORATED
PAVILION WATER STORAGE TANK
Genesee River
MARKIN TUBING
GRIFFITH OIL CO INC
TMP TECHNOLOGIES ADVANCED FOAM PRODUCTION DIVISION
T&S CROP SVC INC
390
WARSAW STP
ALMOR CORPORATION
EPA Regulated Facilities
Air Facility System
National Priorities List (Superfund)
Resource Conservation & Recovery Act
Section 7 Tracking System (Pesticides)
Toxic Release Inventory
Multiple Facilities at Site
Miles
0
1.25
2.5
5
7.5
10

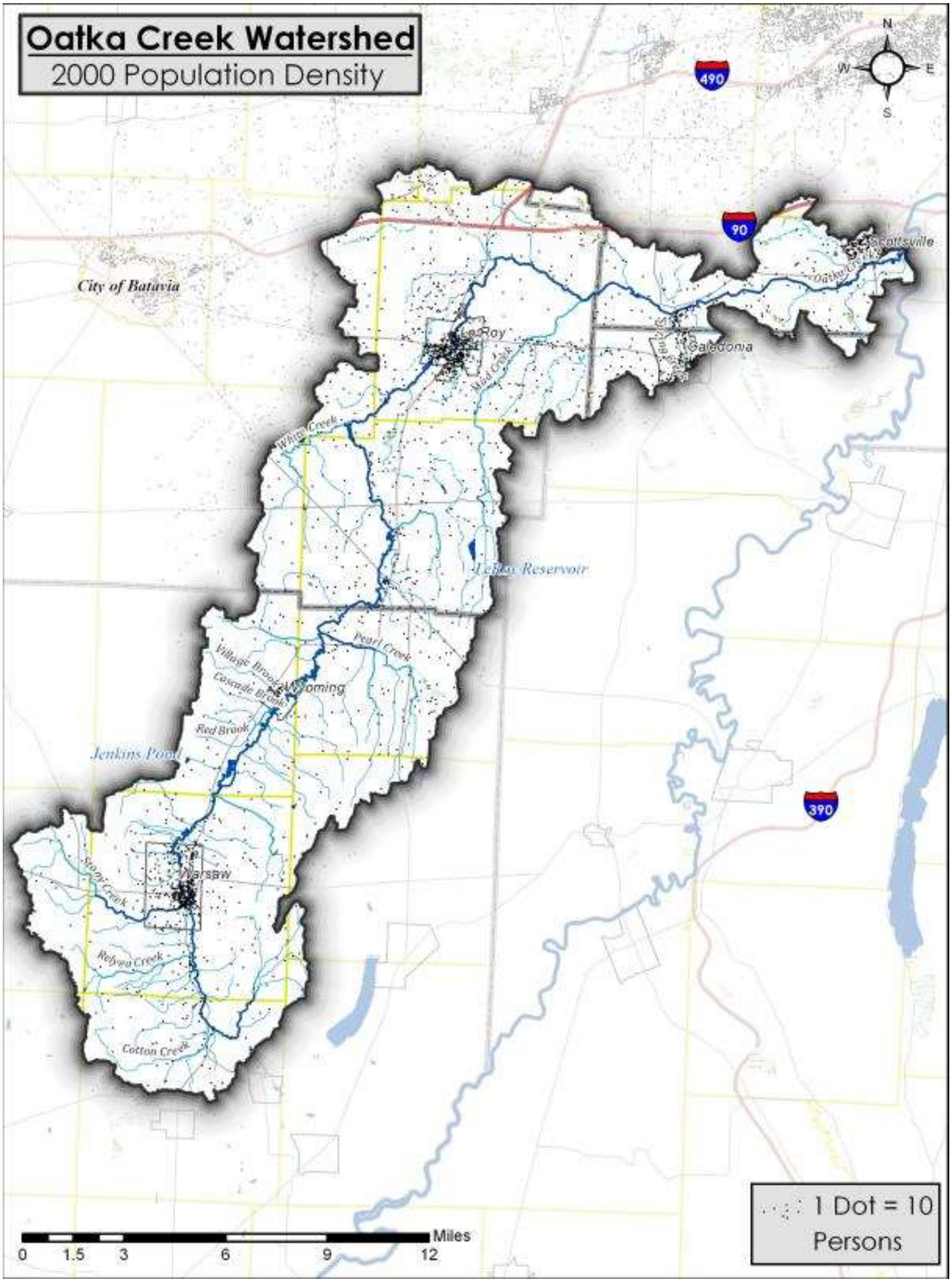
Map 21



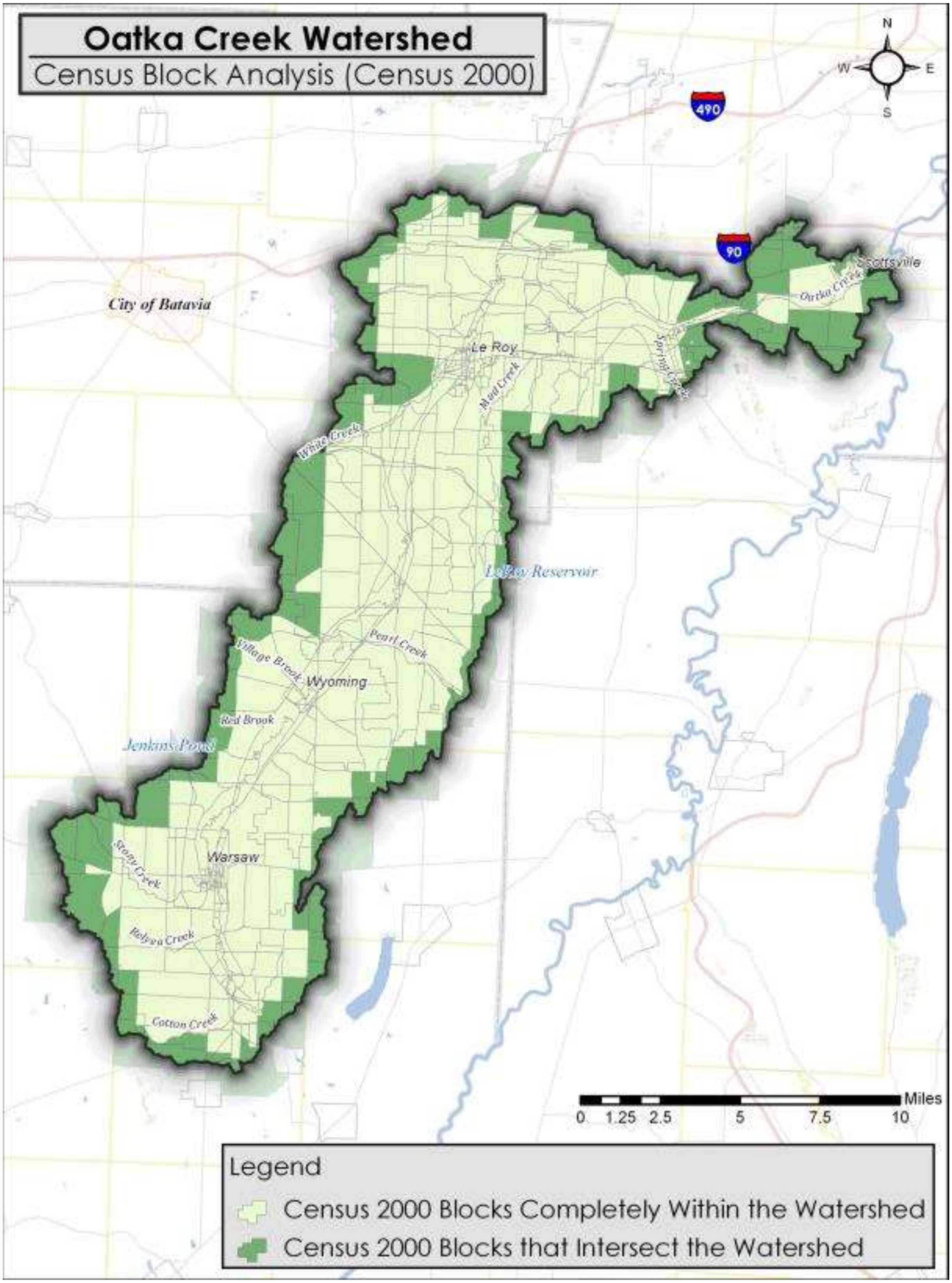
Oatka Creek Watershed
USGS Karst Features Inventory
490
N
W
E
S
NY33A
NY33A
NY33
NY237
90
NY383
5
Oatka Creek
White Creek
US20
63
19
Pearl Creek
NY246
Village Brook
Cascade Brook
5
Oatka Creek Watershed
Area of Focus
Legend
Karst Features
Shallow Soils
USGS Study Area
Miles
0 0.5 1
2
3
4

Map 22

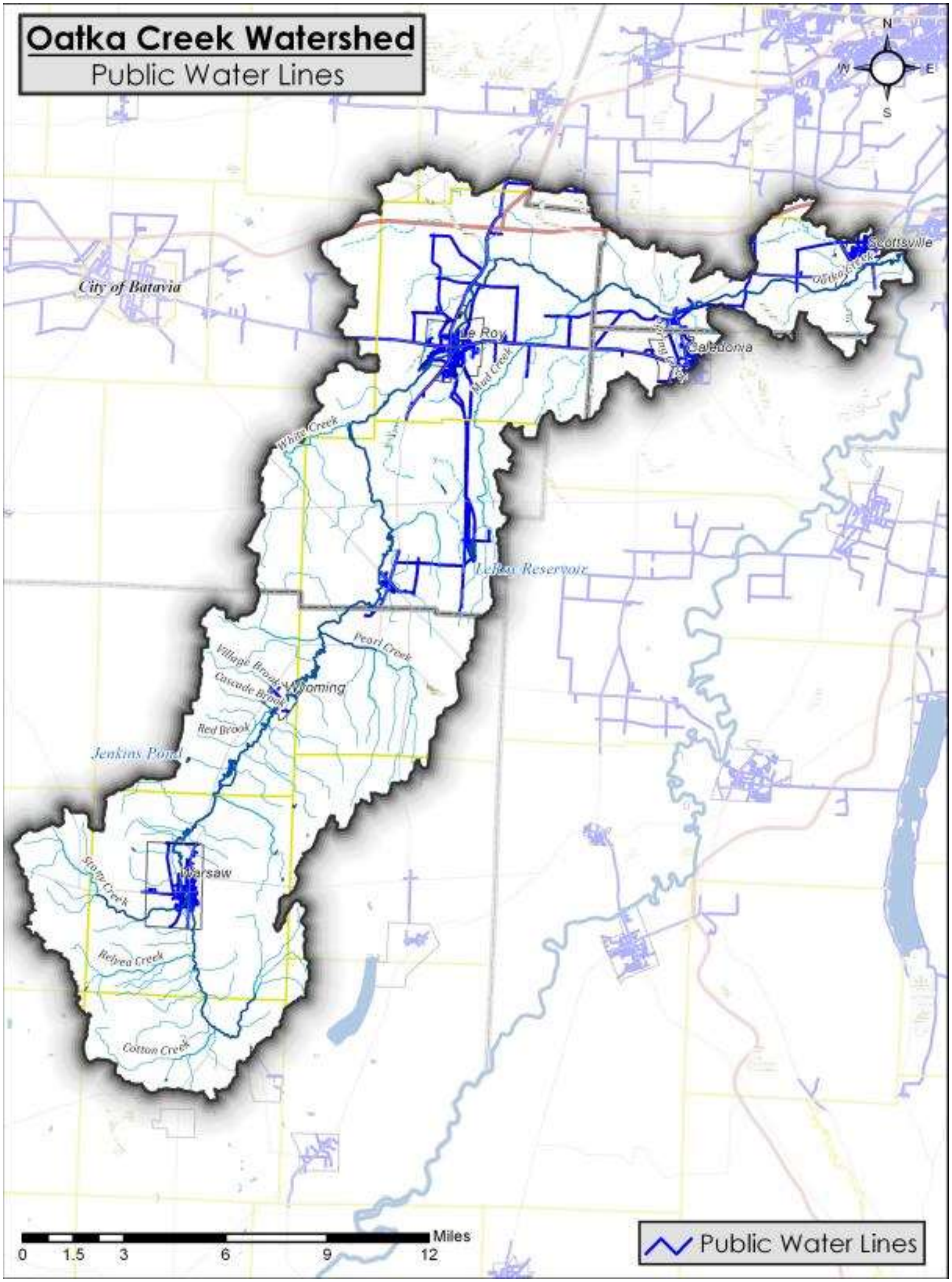

Oatka Creek Watershed
1990 Population Density
City of Batavia
Le Roy
Caledonia
Scottsville
Oatka Creek
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
490
90
390
N
E
S
W
No data associated with census block
1 Dot = 10
Miles
0 1.25 2.5 5 7.5 10


Oatka Creek Watershed
2000 Population Density
490
90
390
N
W
E
S
Scottsville
Oatka Creek
City of Batavia
Le Roy
Caledonia
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
1 Dot = 10 Persons
Miles
0 1.5 3 6 9 12

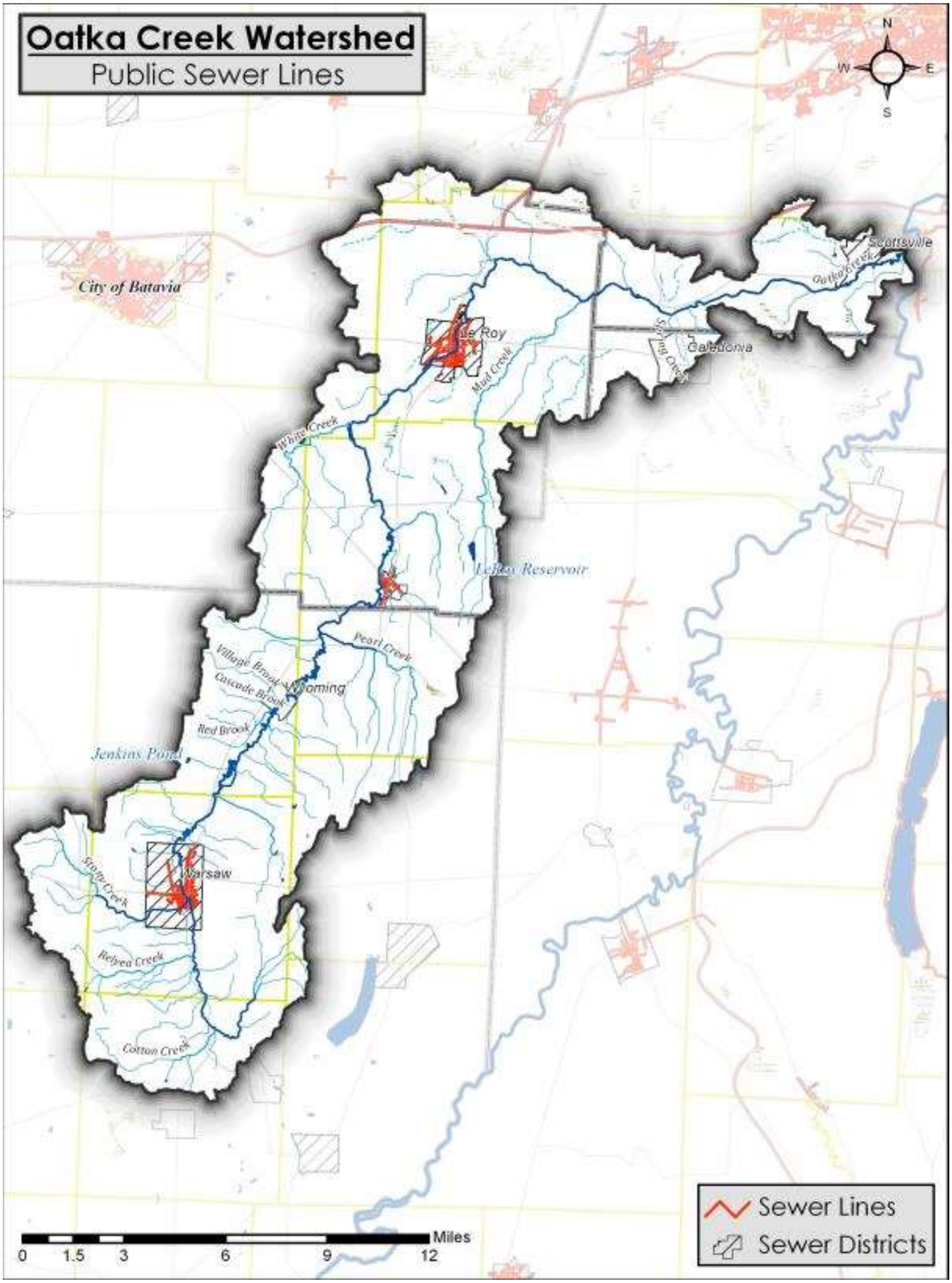
Map 24

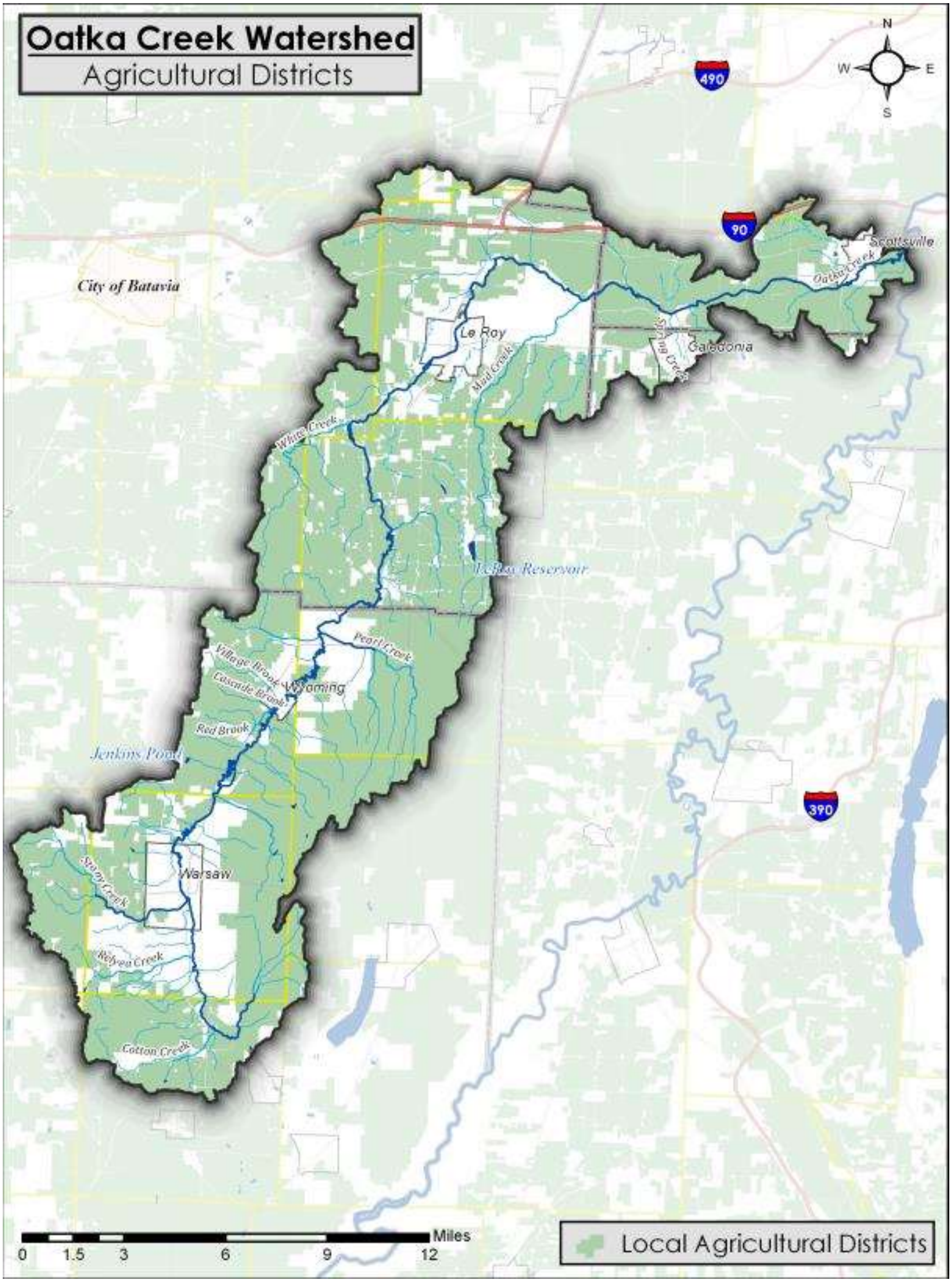

Oatka Creek Watershed
Census Block Analysis (Census 2000)
N
W
E
S
490
90
Scottsville
Oatka Creek
City of Batavia
Le Roy
Spring Creek
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
Miles
0 1.25 2.5 5 7.5 10
Legend
Census 2000 Blocks Completely Within the Watershed
Census 2000 Blocks that Intersect the Watershed

Map 25

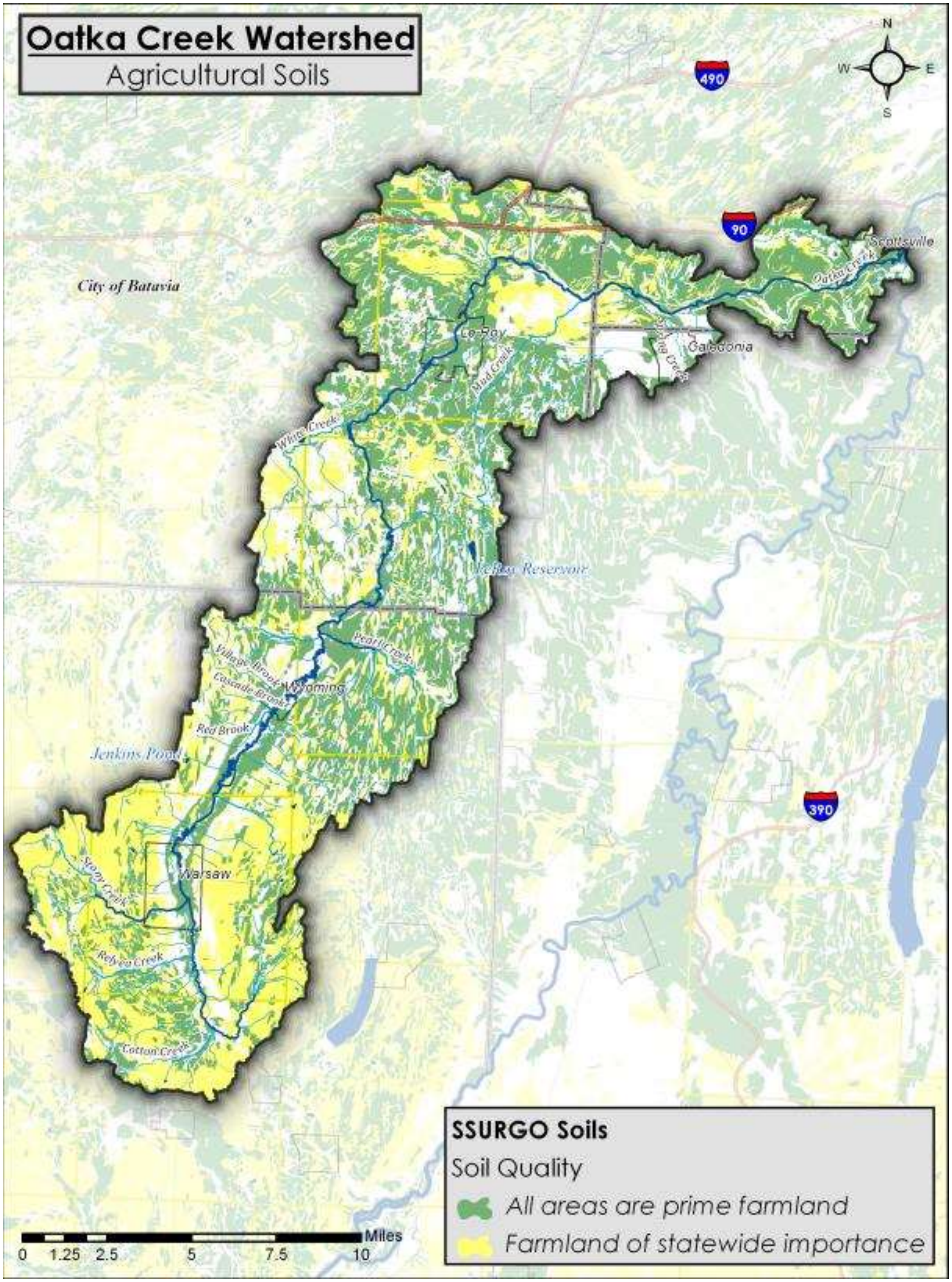

Oatka Creek Watershed
Public Water Lines
N
W
E
S
City of Batavia
Le Roy
Caledonia
Scottsville
Oatka Creek
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
0
1.5
3
6
9
12
Miles
Public Water Lines

Map 26

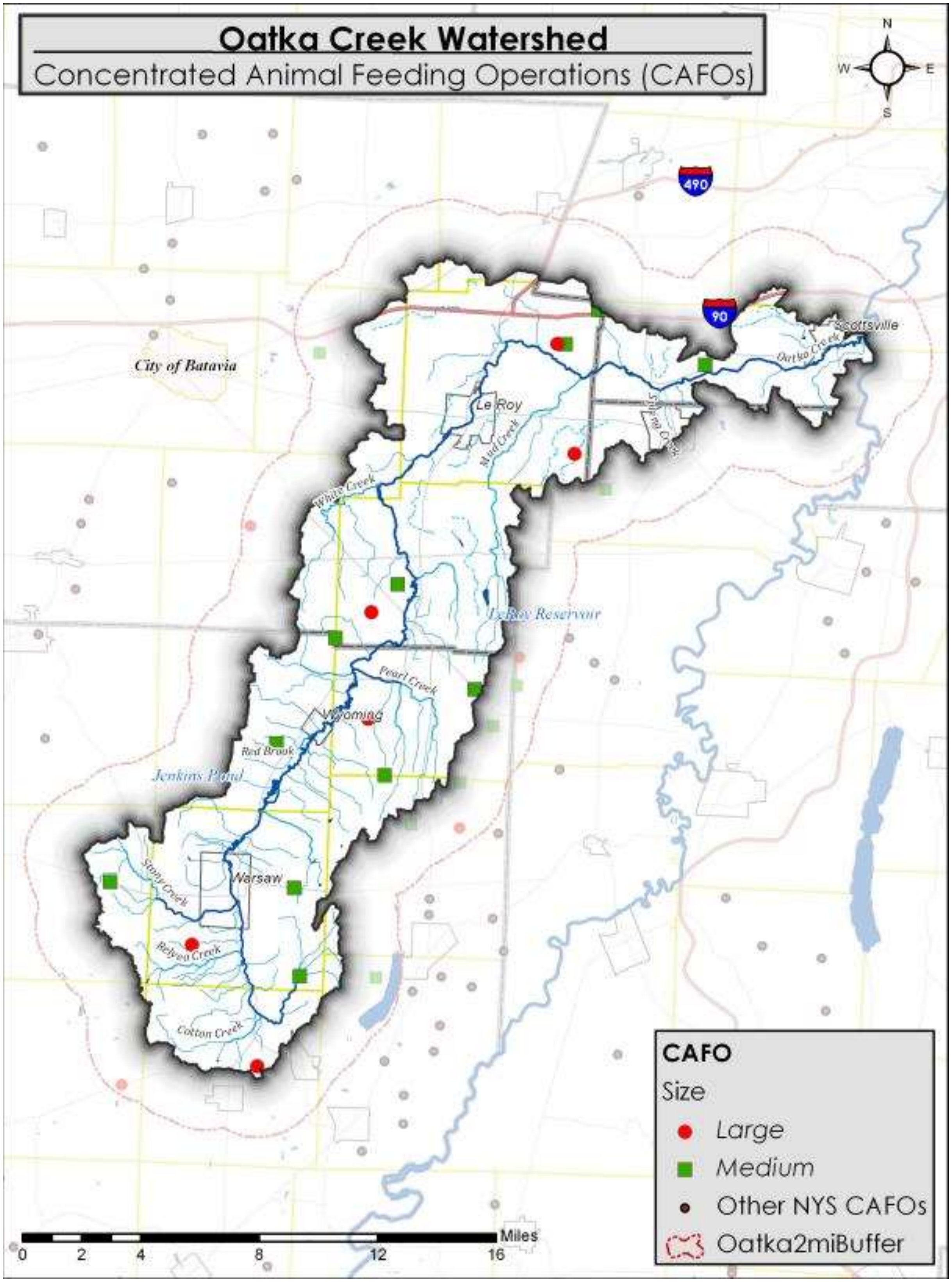

Oatka Creek Watershed
Public Sewer Lines
N
W
E
S
City of Batavia
Le Roy
Mud Creek
Scottsville
Oatka Creek
Spring Creek
Caledonia
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Wyoming
Cascade Brook
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
Miles
0
1.5
3
6
9
12
Sewer Lines
Sewer Districts


Oatka Creek Watershed
Agricultural Districts
N
W
E
S
490
90
390
Scottsville
Oatka Creek
City of Batavia
Le Roy
Caledonia
Spring Creek
Mud Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Stony Creek
Relyea Creek
Cotton Creek
Miles
0
1.5
3
6
9
12
Local Agricultural Districts

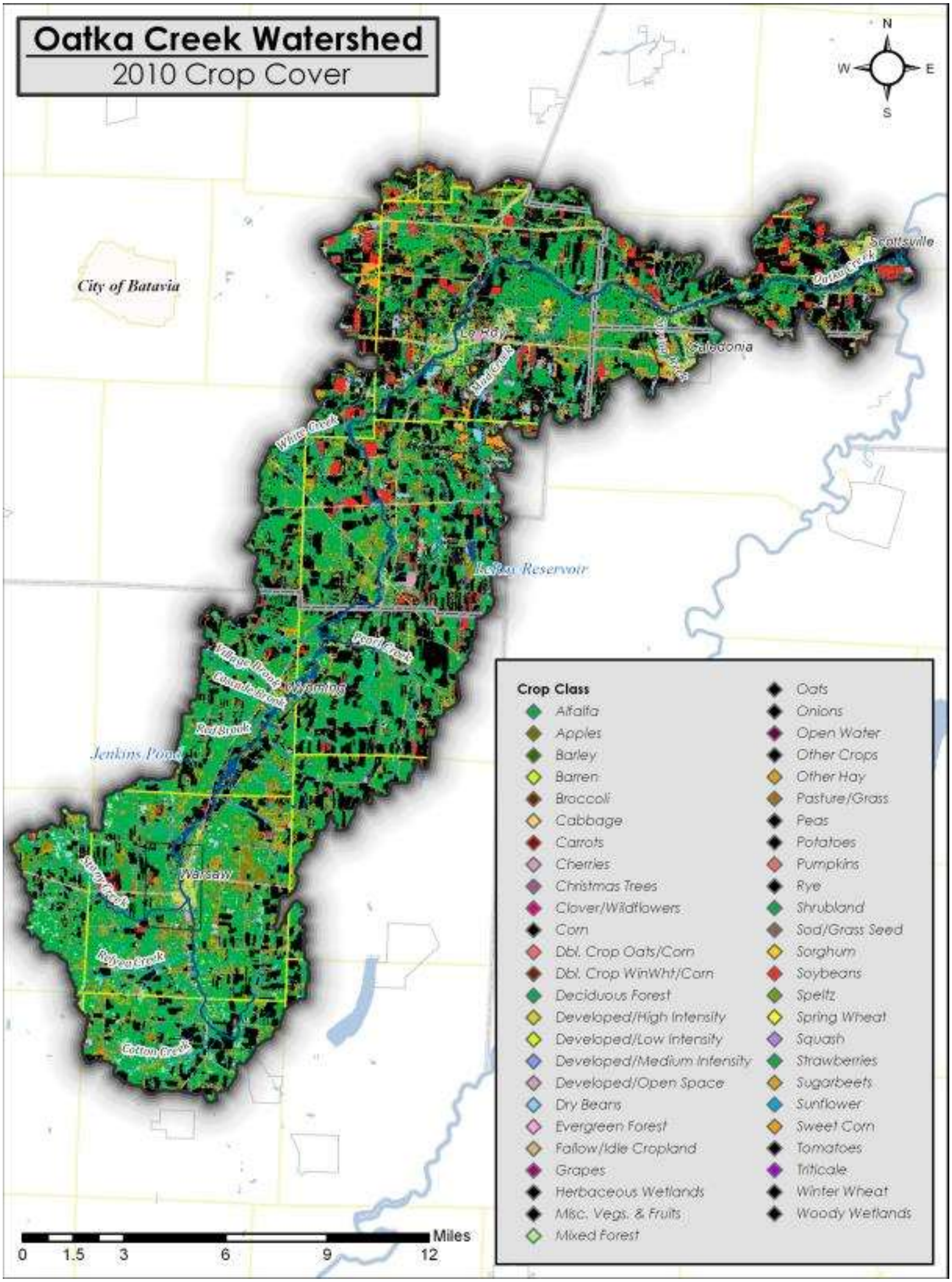
Map 28


Oatka Creek Watershed
Agricultural Soils
N
W
E
S
490
90
390
City of Batavia
Scottsville
Oatka Creek
Le Roy
Mud Creek
Caledonia
Spring Creek
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Cascade Brook
Wyoming
Red Brook
Jenkins Pond
Stony Creek
Warsaw
Relyea Creek
Cotton Creek
SSURGO Soils
Soil Quality
All areas are prime farmland
Farmland of statewide importance
0
1.25
2.5
5
7.5
10
Miles

Map 29


Oatka Creek Watershed
Concentrated Animal Feeding Operations (CAFOs)
N
W
E
S
490
90
Scottsville
Oatka Creek
City of Batavia
Le Roy
Mud Creek
Spring Creek
White Creek
LeRoy Reservoir
Pearl Creek
Wyoming
Red Brook
Jenkins Pond
Stony Creek
Warsaw
Relyea Creek
Cotton Creek
CAFO
Size
Large
Medium
Other NYS CAFOs
Oatka2miBuffer
Miles
0
2
4
8
12
16

Map 30


Oatka Creek Watershed
2010 Crop Cover
N
W
E
S
City of Batavia
Scottsville
Oatka Creek
Le Roy
Caledonia
White Creek
LeRoy Reservoir
Pearl Creek
Village Brook
Wyoming
Red Brook
Jenkins Pond
Warsaw
Relyea Creek
Cotton Creek
Crop Class
Alfalfa
Apples
Barley
Barren
Broccoli
Cabbage
Carrots
Cherries
Christmas Trees
Clover/Wildflowers
Corn
Dbl. Crop Oats/Corn
Dbl. Crop WinWht/Corn
Deciduous Forest
Developed/High Intensity
Developed/Low Intensity
Developed/Medium Intensity
Developed/Open Space
Dry Beans
Evergreen Forest
Fallow/Idle Cropland
Grapes
Herbaceous Wetlands
Misc. Vegs. & Fruits
Mixed Forest
Oats
Onions
Open Water
Other Crops
Other Hay
Pasture/Grass
Peas
Potatoes
Pumpkins
Rye
Shrubland
Sod/Grass Seed
Sorghum
Soybeans
Speltz
Spring Wheat
Squash
Strawberries
Sugarbeets
Sunflower
Sweet Corn
Tomatoes
Triticale
Winter Wheat
Woody Wetlands
Miles
0
1.5
3
6
9
12

Maps and GIS Data Sources

Map 1: Oatka Creek Watershed Hydrology

National Hydrography Dataset. http://nhd.usgs.gov/

Map 2: USGS HUC 12 Watershed Boundaries

National Hydrography Dataset. http://nhd.usgs.gov/

Map 3: Hydrologic Watersheds

Hydrologic subwatershed boundaries were drawn digitically utilizing the catchment boundaries included in the National Hydrography Dataset noted above. Individual catchments were selected and categorized based on their respective subwatershed drainage area. Some subwatershed boundaries may be subject to error due to the presence of isolated flowlines in the NHD (i.e. streams that do not connect to the larger drainage network).

Map 4: NYS Classification of Waters

This data set provides the water quality classifications of New York State's lakes, rivers, streams and ponds, collectively referred to as water bodies. All water bodies in the state are provided a water quality classification based on existing, or expected best usage, of each water body or water body segment. Under New York State's Environmental Conservation Law (ECL), Title 5 of Article 15, certain waters of the state are protected on the basis of their classification. Streams and small water bodies located in the course of a stream that are designated as C (T) or higher (i.e., C (TS), B, or A) are collectively referred to as "protected streams."

Map 5: NYS Regulated Freshwater Wetlands

Freshwater Wetlands (DEC; NAD83) Coverages (wetlands boundary datasets) are published by county, and are updated as amendments occur, or as errors in the data are discovered and corrected. For the most recent updates to coverages by county, visit the Cornell University Geospatial Information Repository at http://cugir.mannlib.cornell.edu/ .

Publication dates of county wetlands coverages are as follows:

Genesee County (November 30, 1998)
Monroe County (September 24, 2008)
Livingston County (November 30, 1998)
Wyoming County (November 30, 1998)

Map 6: US Fish and Wildlife Service National Wetlands Inventory

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information to the public on the extent and status of the Nation's wetlands. The agency has developed a series of topical maps to show wetlands and deepwater habitats. This geospatial information is used by Federal, State, and local agencies, academic institutions, and private industry for management, research, policy development, education and planning activities. Digital GIS data can be viewed and downloaded at http://www.fws.gov/wetlands/

Map 7: Floodplains

Digital Flood Insurance Rate Map for Monroe County obtained from the Federal Emergency Management Agency's (FEMA) Map Service Center http://www.fema.gov/. . All other flood information derived from local sources, including:

- Genesee County Department of Planning.
- Orleans County Soil and Water Conservation District (originally created by G/FLRPC)
- Wyoming County Soil and Water Conservation District

Map 8: Active River Area

Active River Area developed by The Nature Conservancy. ARA GIS data layer provided by and reprinted with permission from The Central and Western New York chapter office.

Map 9: NYS Inventory of Dams

This dataset is used to show the location of dams in New York State's inventory of dams, and lists selected attributes of each dam. GIS data available for download at http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1130

Map 10: Unconsolidated Aquifers

These aquifers are those in upstate NY that consist of sand and gravel and yield large supplies of water to wells. Bedrock aquifers, although significant in some areas, are not addressed here. Source data is 1:250,000, same scale as the NYS Geological Survey surficial and bedrock geology maps on which they were based. Together these maps form a consistent set of geologic and groundwater maps for use in regional management of the groundwater resources of the State. GIS data available for download from http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1141

Map 11: Public Lands and Recreation Trails

Public lands data compiled from multiple sources under the Genesee/Finger Lakes Regional Planning Council Finger Lakes Open Lands Conservation Project (2010). Project overview available online from http://gflrpc.org/Publications/FLOLCP/index.htm.

Sources include:

Genesee County Planning Department
- Genesee County Tax Parcel Boundaries (2010)

Livingston County Planning Department
- Livingston County Tax Parcel Boundaries (2010)

Monroe County
- Monroe County Tax Parcel Boundaries (2010)

Wyoming County Assessor's Office
- Wyoming County Tax Parcel Boundaries (2010)

NYS Department of Environmental Conservation:
- DEC Lands (2010)
- Public Fishing Rights (2010)
- Public Fishing Stream Parking Areas

NYS Office of Parks, Recreation & Historic Preservation
- New York State Historic Sites and Park Boundary
- State-funded Snowmobile Trails

Genesee Transportation Council
- Regional Trails Inventory

Map 12: Roads, Bridges and Railways

Bridge data includes vector point file of bridges that carry or cross a public road. Bridge ID Number (BIN) attribute used to identify each bridge. Statewide coverage. UTM NAD 83 Zone 18. Copyright 2001 by NYS Dept of Transportation. Railway lines are a vector line file of active and inactive railroad lines. UTM NAD 83 Zone 18. Copyright 2001 by NYS Dept of Transportation.

Map 13: 2006 National Land Cover Database

Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.

The 2006 National Land Cover Dataset is available through the USGS at http://www.mrlc.gov/nlcd06_data.php

Map 14: Relief and Slope

Information derived from USGS 10 meter resolution Digital Elevation Models (DEMs). DEMs consist of a raster grid of regularly spaced elevation values that have been primarily derived from the USGS topographic map series. Available for download at http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=817

Map 15: Bedrock Geology

NYS Museum. NYS Geological Survey: Bedrock Attributes. GIS data available from http://www.nysgis.state.ny.us/gisdata/inventories/member.cfm?organizationID=558

Map 16: Surficial Geology

NYS Museum. NYS Geological Survey: Surficial Geology. GIS data available from http://www.nysgis.state.ny.us/gisdata/inventories/member.cfm?organizationID=558

Map 17: Hydrologic Soil Groups

Hydrologic Soil Group derrived from NRCS Soil Survey Geographic Database (SSURGO) data for each county in the study area. GIS data available by county from http://datagateway.nrcs.usda.gov/. Hydrologic soil group attributes were generated utilizing the ssurgoImport.xls utility.

Map 18: Active and Inactive Mines

Downloadable Mining Database. [Online] In New York State Department of Environmental Conservation. Retrieved 2/3/11 from http://www.dec.ny.gov/lands/5374.html

Map 19: NY State Pollution Discharge Elimination System Point Discharge Locations

The purpose of the State Pollutant Discharge Elimination System (SPDES) Program is to protect human Health and the environment. The SPDES permit program in the Department's Division of Water regulates municipal and industrial wastewater treatment facilities that discharge directly into navigable waters. GIS data layer depicted was updated April 2009 and is available at http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1010

Map 20: US EPA Regulated Facilities

To improve public health and the environment, the EPA collects information about facilities or sites subject to environmental regulation. GIS data is available for download from http://www.epa.gov/enviro/geo_data.html Information on the following programs active within the Oatka Creek watershed are illustrated:

- Superfund National Priorities List (NPL)
- RCRAInfo - EPA and State Treatment, Storage, Disposal facilities
- Toxic Release Inventory System - All reported years including the just released 2009 data
- RCRAInfo - Large Quantity Generators (LQG)
- Air Facility System (AFS) - Major discharges of air pollutants
- RCRAInfo - Corrective Actions
- RMP - Risk Management Plan
- SSTS - Section Seven Tracking System (Pesticides)
- ACRES - Brownfields Properties

Map 21: USGS Karst Features Inventory

Shapefiles Associated with the following study:
Reddy, J.E., and Kappel, W.M., 2010, Comiplation of existing hydrogeologic and geospatial data for the assessment of focused recharge to the carbonate-rock aquifer in Genesee County, New York: U.S. Geological Survey Scientific Investigations Map 3132, 17 p., 20 sheets, at http://pubs.usgs.gov/sim/3132/.

Map 22: 1990 Census Population Density

Boundary file: http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm
Population Data: http://data.nhgis.org/nhgis/tables.do. Minnesota Population Center. *National Historical Geographic Information System: Pre-release Version 0.1*. Minneapolis, MN: University of Minnesota 2004.

Map 23 2000 Census Population Density
Boundary and population data obtained from http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm

Map 24: Census Block Analysis
Boundary data obtained from http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm

Map 25: Public Water Lines
Water line data compiled from multiple sources under the Genesee/Finger Lakes Regional Planning Council *Finger Lakes Open Lands Conservation Project* (2010). Project overview available online from http://gflrpc.org/Publications/FLOLCP/index.htm.

Map 26: Public Sewer Lines
Sewer line data compiled from multiple sources under the Genesee/Finger Lakes Regional Planning Council Finger Lakes Open Lands Conservation Project (2010). Project overview available online from http://gflrpc.org/Publications/FLOLCP/index.htm.

Map 27: Agricultural Districts
Map illustrates polygon coverages representing generalized geographic boundaries of lands under the protection of NYS Agricultural District Law, as administered by the New York State Department of Agriculture and Markets. Data sets should not be used for legal jurisdictional determinations without consulting associated metadata. 2010. GIS data available from http://cugir.mannlib.cornell.edu/datatheme.jsp?id=2

Publication date of geospatial data depicted in map:

Genesee County:	March 11, 2010
Monroe County:	March 11, 2010
Livingston County:	February 13, 2009
Wyoming County:	February 13, 2009

Map 28: Agricultural Soils
Hydrologic Soil Group derrived from NRCS Soil Survey Geographic Database (SSURGO) data for each county in the study area. GIS data available by county from http://datagateway.nrcs.usda.gov/. Attributes listed under soil quality were sorted according to agricultural suitability listed in the Legend.

Map 29: Concentrated Animal Feeding Operations
Provided by the New York State Department of Environmental Conservation.

Map 30: USDA-NASS 2009 Crop Cover
U.S. Department of Agriculture, National Agricultural Statistics Service (NASS), Research and Development Division, Geospatial Information Branch, Spatial Analysis Research Section (SARS). Available for download through the USDA NRCS Geospatial Gateway: http://datagateway.nrcs.usda.gov/

Note that printing resolution at this scale does not adequately capture raster cell distribution throughout the watershed. A smaller scale is required in order to fully reveal crop distribution of the 30 x 30m raster cells.

Additional GIS Source information:

Climate – Rain
Processed Annual Precipitation. USDA/NRCS - National Cartography & Geospatial Center. Vector dataset provides derived average annual precipitation according to a model using point precipitation and elevation data for the 30-year period of 1971-2000.

Climate – Temperature

Processed Annual Average Temperature. USDA/NRCS - National Cartography & Geospatial Center. Vector dataset provides derived average annual temperature according to a model using point temperature data for the 30-year period of 1971-2000.

Ecozones

Derrived from US EPA Western Ecology Division. http://www.epa.gov/wed/pages/ecoregions.htm

Build Out Analysis Methodology

1. This analysis reviewed the potential for future residential growth only in locations that were pre-determined to have a high potential for future residential growth.

2. Determine "high growth" towns for analysis by reviewing the following data sources and noting salient trends:

A) 5 Year residential permit average
B) Population % change 2000-2009(est.)
C) Availability of public water utilizing the 2008 G/FLRPC public water GIS files
D) Villages were excluded from this analysis

3. Within selected "high growth" towns, determine the zoning districts for further analysis

A) Identify Residential, Agricultural, and Agricultural/Residential zones in selected municipalities that are at least partially within the watershed and have access to public water. Zones that have water lines intersecting them at any point are considered to have access to public water.
B) Excluded Mobile Home Park Zones
C) Excluded Mixed Use/PUD zones; it is extremely difficult to determine how these zones will ultimately be developed if a proposal is submitted.
D) Zones must be at least partially within the watershed for further consideration

4. Determine bulk regulations for identified zoning districts

A) Bulk Regulations refer to the minimum and maximum standards for lot sizes and address geometric and structural issues such as building setbacks and building height.
B) The bulk regulations were reviewed in an effort to establish the typical single family residential lot size in each selected zone.
   a. This study excluded the potential for multi-family buildings/lots given the vast multitude of potential scenarios that these options would create for each zoning district

4. Determine total land area open to potential development

A) Zones that meet all of the aforementioned criteria will be extracted and clipped by watershed boundary for further analysis
   a. This study will only analyze the area of zoning districts that fall within the boundary of the Oatka Creek watershed
B) Among zones remaining for future consideration, consider bulk regulations and RPS parcel data to determine if those zones have adequate vacant property to accommodate new development. "Developable" parcels are those that meet the following criteria:
   a. Parcels identified as "vacant" residential property in RPS records
   b. Large lots were reviewed using aerial photography and included for further analysis if they were either farms or had significant land in open space. Lots with 1, 2, or 3 family structures were considered if they were 10 acres in size or larger because it is assumed that these would be large enough to be subdivided without affecting existing structures or residences
   c. All agricultural properties were considered as "vacant" properties open to future residential development.
      i. While agricultural use is in many cases are protected or specifically zoned "agricultural" in order to preserve such use, the property could feasibly be sold or re-zoned in the future

for the purposes of residential development and are therefore considered for further analysis

d. Zones must have enough vacant property to allow for minimum lot size development in order to qualify for further build out analysis. Minimum lot sizes are determined by reviewing bulk regulations for the zone.

C) Determine the total "developable" land area for each identified zoning district

a. was established for each zoning district. All vacant property determined to qualify for potential future development was summed to arrive at A raw figure of total area in square feet

5. Determine potential constraints to development within each zone

A) Constraints to development were examined only on parcels considered developable, and subtracted from the amount of total developable land.

B) In several instances zones were deleted from further analysis because constraints prevented them from having any parcels large enough to build on.

C) Environmental constraints include:

a. NYS Regulated Freshwater Wetlands (+100ft buffer)

b. Surface water (lakes, ponds, streams, creeks, rivers, + a standard 50ft buffer area)

c. Land area that has a slope great than 15% based on GIS 30 meter Digital Elevation Model analysis

D) In addition, a standard deduction of 25% from the remaining land area open for development would be reduced to accommodate for anticipated infrastructure (such as roads, sidewalks, power lines, stormwater facilities, etc.), natural features (including poor soils), and irregularly-shaped parcel boundaries. (this is in accordance with the Monroe County Department of Transportation study "Ballantyne Corridor Study" (2005)).

E) Land area within the identified 100-year flood zone was not considered to be a constraint. In all towns, 100 year flood zones were considered open to new development with proper precautions and approval. In some instances, towns have identified locations of high flood risk and zoned accordingly; these zoning districts were therefore removed from analysis early on in the build out study.

F) Additional park, recreation or open space requirements. Some towns have provisions that require or "may" require a certain amount of land to be set aside for these purposes. These standards are generally not specific in nature and left to the discretion of the local planning or regulatory body. A percentage in an amount deemed appropriate based on the local regulation would be further deduced from the land area available for development.

G) Lots already developed will be identified through aerial imagery and subtracted

6. Final calculation of potential land available for development.

A) Each zone will have a customized series of calculations performed in order to determine the estimated land area open to potential residential development. This is generally determined by conducting the following steps in Excel.

B) Environmental constraints (see 5.C) are subtracted from the total gross land open to development

C) 25% standard reduction is applied to this figure (see 5.D)

D) If necessary, a specific percentage of land area assumed necessary for parks, recreation or open space is then applied based on language in the code (see 5.F)

E) Lots already developed subtracted

F) A figure estimating the net land area available for development is determined within each zone

7. Assuming a specific rate of growth and development, determine when the zone within the watershed will become "built-out."

A) The minimum lot size for each zone is established under bulk regulations; this figure will be divided into the net land area available for development in order to determine a general estimate of the number of new residential lots that the zone can accommodate.

B) The average number of residential permits issued in the town in a five-year period is used to determine the rate of development

C) The estimated remaining number of years until build out occurs is determined by dividing the estimated number of lots that the zone can accommodate by the number of building permits issued annually (5 year average)

Total Population of Towns in the Oatka Creek Watershed (includes population of villages and cities within)								
Municipality	Population 1980[99]	Population 1990[100]	Population 2000[101]	Population 2010[102]	*Percent Change*			
					1980-1990	*1990-2000*	*2000-2009*	***1980-2009***
Town of Bergen	2,568	2,794	3,182	3,120	9%	14%	-2%	**21%**
Town of Bethany	1,876	1,808	1,760	1,765	-4%	-3%	0.3%	**-6%**
Town of Byron	2,242	2,345	2,493	2,369	5%	6%	-5%	**6%**
Town of Caledonia	4,034	4,441	4,567	4,255	10%	3%	-7%	**5%**
Town of Castile	2,865	3,042	2,873	2,906	6%	-6%	1%	**1%**
Town of Covington	1,075	1,266	1,357	1,232	18%	7%	-9%	**15%**
Town of Gainesville	2,133	2,288	2,333	2,182	7%	2%	-6%	**2%**
Town of LeRoy	8,019	8,176	7,790	7,641	2%	-5%	-2%	**-5%**
Town of Middlebury	1,561	1,532	1,508	1,441	-2%	-2%	6%	**2%**
Town of Pavilion	2,375	2,327	2,467	2,495	-2%	6%	1%	**5%**
Town of Perry	5,437	5,353	6,654	4,616	-2%	24%	-31%	**-15%**
Town of Riga	4,309	5,114	5,437	5,590	19%	6%	3%	**30%**
Town of Stafford	2,508	2,593	2,409	2,459	3%	-7%	2%	**-2%**
Town of Warsaw	5,074	5,342	5,423	5,064	5%	2%	-7%	**0%**
Town of Wheatland	4,897	5,093	5,149	4,775	4%	1%	-7%	**-2%**
County Figures								
Genesee	59,400	60,060	60,370	60,079	1%	1%	-.0.5%	***1%***
Livingston	57,006	62,372	64,328	65,393	9%	3%	2%	***15%***
Monroe	702,238	713,968	735,343	744,344	2%	3%	1%	***6%***
Wyoming	39,895	42,507	43,424	42,155	7%	2%	-3%	***6%***
Totals	**897,035**	**920,753**	**903,465**	**937,191**	3%	*3%*	1%	***6%***

Population Projections, 2000 – 2040						
	2000	2010	2020	2030	2040	% Change 2000 – 2040
Town of Bergen	1,942	1,994	2,037	2,073	2,105	8%
Town of Bethany	1,760	1,772	1,782	1,791	1,798	2%
Town of Byron	2,493	2,547	2,591	2,629	2,661	7%
Town of Caledonia	2,240	2,309	2,366	2,414	2,456	10%
Town of Castile	1,051	1,031	1,015	1,001	989	-6%
Town of Covington	1,357	1,388	1,414	1,436	1,454	7%
Town of Gainesville	304	301	298	295	293	-4%
Town of Le Roy	3,328	3,402	3,463	3,515	3,560	7%
Town of Middlebury	995	1,005	1,012	1,018	1,024	3%
Town of Orangeville	1,301	1,340	1,372	1,399	1,423	9%
Town of Pavilion	2,467	2,512	2,549	2,581	2,608	6%
Town of Perry	3,168	3,240	3,299	3,349	3,392	7%
Town of Riga	3,550	3,655	3,742	3,816	3,880	9%
Town of Stafford	2,409	2,441	2,466	2,488	2,507	4%
Town of Warsaw	3,814	3,825	3,833	3,840	3,846	1%
Town of Wheatland	3021	3109	3181	3242	3295	9%

G/FLRPC Land Use Monitoring Report Figures, 2005 – 2010[103]							
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**6 Year Average**
Bergen	4	4	8	1	1	3	3.5
Bergen (Village)	0	0	0	0	0	0	0.0
Bethany	1	1	DNA	2	0	3	1.4
Byron	5	8	DNA	2	1	2	3.6
Caledonia	5	4	5	3	2	2	3.5
Caledonia (Village)	0	0	0	0	0	1	0.2
Castile	5	6	3	4	6	5	4.8
Covington	5	0	5	5	4	3	3.7
Gainesville	5	3	9	0	1	3	3.5
LeRoy	5	3	9	0	1	3	3.5
LeRoy (Village)	5	3	9	0	1	3	3.5
Middlebury	4	3	1	4	1	0	2.2
Orangeville	7	2	4	2	4	3	3.7
Pavilion	5	DNA	DNA	4	3	1	3.3
Perry	8	3	4	6	3	0	4.0
Riga	13	7	5	3	5	3	6.0
Scottsville (Village)	3	2	2	0	0	1	1.3
Stafford	9	5	5	3	1	0	3.8
Warsaw	10	6	3	0	1	2	3.7
Warsaw (Village)	0	0	0	0	0	0	0.0
Wheatland	12	4	3	5	4	1	4.8
Wyoming (Village)	0	0	0	2	4	1	1.2

DNA = Data Not Available

Figures are for permits issued for the construction of residential buildings (single – five family including mobile/mnfctd homes) in respective year. Permitted construction does not guarantee actual construction.

Data notes

[99] US Census Bureau. 1980 Census of Population, Detailed Population Characteristics of New York

[100] US Census Bureau. American FactfFinder. Data Set: 1990 Summary Tape File 1 - 100% data, Total Population.

[101] US Census Bureau. American FactfFinder. Data Set: 2000 Summary File 1100% data, Total Population.

[102] US Census Bureau. Census 2010, Summary File 1 General Profile 1: Persons by Race, Age, and Sex, Urban and Rural

[103] *Regional Land Use Monitoring*. [Online] In *Genesee/Finger Lakes Regional Planning Council*. Retrieved 1/2/11 from http://gflrpc.org/Publications/LandUseMonitoring.htm

2010 USDA-NASS Cropland Data Layer

Refer to http://www.nass.usda.gov/research/Cropland/SARS1a.htm

Unabridged 2010 Cropland Data Layer Analysis for the Oatka Creek Watershed

Crop/Land Cover	Acres	% Share of Watershed
Forest Categories Combined	**40,738.29**	**28.9%**
Deciduous Forest	*37,401.03*	*26.5%*
Mixed Forest	*2,666.07*	*1.9%*
Evergreen Forest	*671.19*	*0.5%*
Corn	**28,376.25**	**20.1%**
Alfalfa	**22,335.78**	**15.8%**
Other Hay	**10,836.19**	**7.7%**
Open Space Categories Combined	**8,940.72**	**6.3%**
Developed/Open Space	*6,214.82*	*4.4%*
Developed/Low Intensity	*2,082.06*	*1.5%*
Developed/Medium Intensity	*522.63*	*0.4%*
Developed/High Intensity	*121.21*	*0.1%*
Pasture/Grass	**5,562.32**	**3.9%**
Wetland Categories Combined	**5,139.77**	**3.6%**
Woody Wetlands	*4,653.83*	*3.3%*
Open Water	*259.98*	*0.2%*
Herbaceous Wetlands	*225.95*	*0.2%*
Other Cash Crops Combined	**5,099.51**	**3.6%**
Dry Beans	*1,916.15*	*1.4%*
Sweet Corn	*1,136.66*	*0.8%*
Peas	*953.63*	*0.7%*
Oats	*349.83*	*0.2%*
Rye	*259.09*	*0.2%*
Potatoes	*139.89*	*0.1%*
Cabbage	*49.15*	*0.03%*
Apples	*40.92*	*0.03%*
Sugarbeets	*37.36*	*0.03%*
Speltz	*31.58*	*0.02%*
Grapes	*29.36*	*0.02%*
Clover/Wildflowers	*28.47*	*0.02%*
Other Crops	*27.35*	*0.02%*
Barley	*23.35*	*0.02%*
Triticale	*19.35*	*0.01%*
Misc. Vegs. & Fruits	*14.90*	*0.01%*
Squash	*10.01*	*0.01%*
Onions	*9.12*	*0.01%*
Carrots	*5.34*	*0.004%*
Dbl. Crop WinWht/Corn	*5.34*	*0.004%*
Sorghum	*5.12*	*0.004%*
Christmas Trees	*3.56*	*0.003%*
Pumpkins	*2.00*	*0.001%*
Cauliflower	*0.44*	*0.0003%*
Sunflower	*0.22*	*0.0002%*
Sod/Grass Seed	*0.22*	*0.0002%*
Cherries	*0.22*	*0.0002%*
Garlic	*0.22*	*0.0002%*
Plums	*0.22*	*0.0002%*
Dbl. Crop Oats/Corn	*0.22*	*0.0002%*
Lettuce	*0.22*	*0.0002%*
Soybeans	**5,097.51**	**3.6%**
Shrub/Fallow/Idle Lands Combined	**4,808.18**	**3.4%**
Shrubland	*3,891.24*	*2.8%*
Fallow/Idle Cropland	*916.93*	*0.6%*
Winter Wheat	**4,056.48**	**2.9%**
Barren	**209.72**	**0.1%**

The 2001 National Land Cover Dataset is available through the USGS at http://seamless.usgs.gov/data_availability.php?serviceid=Dataset_13

Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.

2001 NLCD Categories:[104]

11 – Open Water: All areas of open water, generally with less than 25% cover of vegetation or soil.

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

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.

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.

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.

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.

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

2006 NLCD Land Cover – Subwatersheds of Oatka Creek Watershed

	Headwaters		Pearl Creek		White Creek		Mud Creek		Village of LeRoy		Outlet	
NLCD Category	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
11 - Open Water	33.58	0.1%	50.93	0.1%	12.23	0.0%	75.61	0.7%	63.38	0.3%	27.13	0.1%
21 - Developed, Open Space	915.82	3.7%	1,481.59	4.1%	1,244.97	4.9%	552.43	5.3%	902.92	4.9%	1,135.77	5.1%
22 - Developed, Low Intensity	135.44	0.5%	374.96	1.0%	305.79	1.2%	179.03	1.7%	703.66	3.8%	495.72	2.2%
23 - Developed, Medium Intensity	22.02	0.1%	89.40	0.2%	56.71	0.2%	38.92	0.4%	213.50	1.2%	133.44	0.6%
24 - Developed, High Intensity	0.89	0.0%	16.68	0.0%	5.12	0.0%	14.23	0.1%	70.28	0.4%	23.57	0.1%
31 - Barren Land	16.90	0.1%	23.57	0.1%	0.00	0.0%	358.95	3.4%	80.73	0.4%	41.37	0.2%
41 - Deciduous Forest	6,576.44	26.4%	6,854.21	18.9%	3,411.09	13.4%	1,459.35	14.0%	2,401.42	13.0%	2,632.27	11.7%
42 - Evergreen Forest	594.68	2.4%	91.63	0.3%	39.14	0.2%	18.24	0.2%	21.35	0.1%	54.71	0.2%
43 - Mixed Forest	1,735.35	7.0%	885.35	2.4%	760.59	3.0%	178.81	1.7%	374.51	2.0%	800.40	3.6%
52 - Shrub/Scrub	1,155.34	4.6%	1,858.33	5.1%	629.82	2.5%	523.52	5.0%	715.89	3.9%	781.27	3.5%
71 - Grass/Herbaceous	56.04	0.2%	123.21	0.3%	57.16	0.2%	54.93	0.5%	79.17	0.4%	109.42	0.5%
81 - Pasture Hay	7,435.10	29.8%	13,039.45	35.9%	9,376.83	36.9%	2,138.55	20.5%	5,593.23	30.3%	5,853.65	26.1%
82 - Cultivated Crops	5,595.68	22.4%	10,432.32	28.7%	8,057.37	31.7%	4,175.24	40.0%	6,060.48	32.8%	8,722.33	38.9%
90 - Woody Wetlands	623.82	2.5%	930.28	2.6%	1,329.25	5.2%	648.50	6.2%	1,122.65	6.1%	1,566.99	7.0%
95 - Emergent Herbaceous Wetlands	48.26	0.2%	56.71	0.2%	149.23	0.6%	26.46	0.3%	59.38	0.3%	67.61	0.3%
Total	24,945.36		36,308.63		25,435.30		10,442.77		18,462.55		22,445.64	

2006 NLCD Land Cover – 300' Riparian Buffer Analysis within Subwatersheds of Oatka Creek Watershed

	Headwaters		Pearl Creek		White Creek		Mud Creek		Village of LeRoy		Outlet	
NLCD Category	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
11 - Open Water	20.0	0.5%	23.1	0.4%	10.0	0.3%	35.4	2.6%	44.3	2.9%	14.2	0.7%
21 - Developed, Open Space	173.2	4.3%	185.9	2.9%	135.4	4.2%	57.2	4.2%	74.1	4.9%	55.2	2.8%
22 - Developed, Low Intensity	28.7	0.7%	52.3	0.8%	30.9	1.0%	8.7	0.6%	50.9	3.4%	21.6	1.1%
23 - Developed, Medium Intensity	8.7	0.2%	16.2	0.3%	10.2	0.3%	1.1	0.1%	17.3	1.1%	5.6	0.3%
24 - Developed, High Intensity	0.2	0.0%	1.1	0.0%	1.8	0.1%		0.0%	2.2	0.1%	1.6	0.1%
31 - Barren Land	3.1	0.1%	8.5	0.1%		0.0%	0.2	0.0%		0.0%	0.2	0.0%
41 - Deciduous Forest	1,224.1	30.3%	1,793.6	28.3%	592.7	18.5%	209.9	15.3%	168.4	11.1%	258.9	13.2%
42 - Evergreen Forest	114.3	2.8%	9.8	0.2%	5.1	0.2%	1.1	0.1%	7.8	0.5%	10.5	0.5%
43 - Mixed Forest	374.1	9.3%	251.8	4.0%	247.7	7.7%	51.8	3.8%	103.0	6.8%	268.9	13.7%
52 - Shrub/Scrub	235.7	5.8%	297.3	4.7%	107.4	3.4%	87.8	6.4%	71.2	4.7%	59.2	3.0%
71 - Grass/Herbaceous	4.4	0.1%	16.0	0.3%	5.1	0.2%	6.2	0.5%	1.1	0.1%	8.9	0.5%
81 - Pasture Hay	1,047.9	26.0%	1,907.9	30.1%	971.6	30.4%	311.1	22.7%	295.1	19.5%	301.1	15.4%
82 - Cultivated Crops	515.3	12.8%	1,466.0	23.1%	490.4	15.3%	346.7	25.3%	324.5	21.5%	430.8	22.0%
90 - Woody Wetlands	260.2	6.4%	299.1	4.7%	518.8	16.2%	250.2	18.3%	326.9	21.6%	499.3	25.5%
95 - Emergent Herbaceous Wetlands	24.2	0.6%	16.5	0.3%	71.6	2.2%	1.3	0.1%	24.5	1.6%	24.5	1.2%
Total	4,034.2		6,345.1		3,198.9		1,368.8		1,511.2		1,960.2	

Data notes

[104] NLCD Class Definitions. [Online] In Multi-Resolution Land Characteristics Consortium. Retrieved 12/13/10 from http://www.mrlc.gov/nlcd_definitions.php

2007 Census of Agriculture

Refer to
http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/New_York/st36_2_008_008.pdf

		Genesee	Livingston	Monroe	Orleans	Wyoming
2007 size of farm:						
1 to 9 acres	Farms	40	47	78	52	50
	Acres	214	227	384	235	214
10 to 49 acres	Farms	159	206	243	159	185
	Acres	4,061	5,865	6,233	4,560	4,985
50 to 69 acres	Farms	69	74	46	70	58
	Acres	4,029	4,208	2,676	4,037	3,354
70 to 99 acres	Farms	60	96	45	48	72
	Acres	5,049	8,095	3,646	4,109	6,082
100 to 139 acres	Farms	38	66	54	44	92
	Acres	4,611	7,593	6,263	5,037	10,563
140 to 179 acres	Farms	21	47	13	32	54
	Acres	3,360	7,524	2,031	5,092	8,649
180 to 219 acres	Farms	30	46	8	36	26
	Acres	5,876	9,110	1,566	7,202	5,180
220 to 259 acres	Farms	12	31	10	18	21
	Acres	2,876	7,210	2,306	4,337	5,107
260 to 499 acres	Farms	53	77	22	47	97
	Acres	18,453	27,711	7,820	16,245	34,639
500 to 999 acres	Farms	28	45	30	18	61
	Acres	20,430	32,361	20,475	13,464	41,865
1,000 to 1,999 acres	Farms	26	34	17	18	29
	Acres	34,350	44,843	23,189	22,698	39,038
2,000 acres or more	Farms	15	23	19	12	16
	Acres	80,230	67,668	56,452	52,748	58,352
2002 size of farm:						
1 to 9 acres	Farms	41	42	98	29	41
	Acres	217	207	469	148	199
10 to 49 acres	Farms	185	218	278	142	177
	Acres	4,542	6,543	6,610	4,184	4,678
50 to 69 acres	Farms	46	86	64	79	62
	Acres	2,638	4,923	3,709	4,561	3,514
70 to 99 acres	Farms	56	75	36	48	53
	Acres	4,829	6,279	3,029	3,927	4,459
100 to 139 acres	Farms	44	101	39	43	78
	Acres	5,136	11,573	4,610	4,923	8,993
140 to 179 acres	Farms	27	38	13	22	50
	Acres	4,262	5,909	2,051	3,434	7,920
180 to 219 acres	Farms	32	40	11	29	36
	Acres	6,373	7,700	2,169	5,785	7,050
220 to 259 acres	Farms	15	20	4	17	41
	Acres	3,640	4,743	925	4,014	9,612
260 to 499 acres	Farms	61	78	28	41	134
	Acres	21,338	28,294	10,923	14,813	45,978
500 to 999 acres	Farms	36	51	34	28	57
	Acres	25,007	35,066	24,490	20,245	38,428
1,000 to 1,999 acres	Farms	25	30	21	14	24
	Acres	33,725	41,982	30,818	18,116	33,197
2,000 acres or more	Farms	12	22	5	12	14
	Acres	65,663	56,277	16,758	48,797	51,289

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