Mohawk River Watershed Management Plan

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MRWC
MOHAWK RIVER WATERSHED COALITION

NEW YORK STATE DOS DEPARTMENT OF STATE

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The Mohawk River Watershed Management Plan assesses the present state of the Mohawk River Watershed, the changes it is undergoing, and the challenges it is facing. In light of this assessment, the Mohawk River Watershed Management Plan recommends actions needed to restore and protect the watershed. Preparation of the Plan was led by the Mohawk River Watershed Coalition of Conservation Districts (the Coalition) in collaboration with members of the Mohawk River Watershed Advisory Committee. The Coalition, formed in 2009, includes the 14 Soil and Water Conservation Districts (SWCDs) within the Mohawk River Watershed. The Mohawk River Watershed Advisory Committee includes representatives from the New York State Department of State (NYSDOS), the NYS Department of Environmental Conservation (NYSDEC), the U.S. Geological Survey (USGS), the State University of New York, Union College, the U.S. National Park Service, The Nature Conservancy, the NYS Canal Corporation, Cornell Cooperative Extension, Cornell Water Resources Institute, the NYS Department of Agriculture and Markets, the Tug Hill Commission, the Capital District Regional Planning Commission, Herkimer-Oneida Counties Comprehensive Planning Program, USDA's Natural Resources Conservation Service (NRCS), the U.S. Army Corps of Engineers (USACOE), the NYS Department of Transportation (NYSDOT), Empire State Development, the U.S. Fish and Wildlife Service (USFWS), all 14 SWCDs in the Mohawk River Watershed, and watershed municipalities.

Preparation of the Mohawk River Watershed Management Plan was funded in part through a New York State Department of State Title 11 Environmental Protection Fund (EPF) Local Waterfront Revitalization Program (LWRP) grant to Montgomery County, and represents a collaborative effort among local governments, county and state agencies and others, including representatives of government agencies, nonprofit organizations, and academic institutions.

Vision and Goals

The Mohawk River Watershed Advisory Committee worked collaboratively to develop a vision for the future of the watershed in which:

> *The Mohawk River Watershed's natural hydrologic conditions are respected. Diverse fish and wildlife habitats and agriculture are flourishing, and superior water quality is celebrated. Vibrant watershed communities find prosperity in the strong economy where water-based recreation and tourism thrive along the waterfront.*

Guided by this vision, the WAC established seven goals:

1. Protect and restore the quality and ecological function of water resources.
2. Protect and enhance natural hydrologic processes.
3. Promote flood hazard risk reduction and enhanced flood resilience.
4. Protect, restore, and enhance fish and wildlife habitat.
5. Revitalize communities and waterfronts and adopt Smart Growth land use practices.
6. Promote agriculture and other working landscapes.
7. Increase watershed awareness.

Approach

The Mohawk River Watershed covers 3,460 square miles, including 170 municipalities and a population of more than 600,000 people.

The Coalition used the watershed planning approach jointly developed by the NYSDOS and NYSDEC and described in the guidebook *Watershed Plans: Protecting and Restoring Water Quality* to identify practices, actions, and projects that will help meet the seven goals listed above. Addressing these goals will contribute to the restoration and protection of the entire Mohawk River Watershed, which is an important resource for New York State.

To characterize the current state of the Mohawk River Watershed and to identify threats to water quality and opportunities, each of the SWCDs in the Coalition assessed watershed characteristics within its land area, providing information that covered all 116 subwatersheds in the Mohawk River basin. These findings were then summarized into larger subwatershed and basin-wide characterizations of water quality. Furthermore, a review and summary of local land use and development controls and practices affecting water quality led to recommendations to assist municipalities in strengthening their ability to address water quality issues.

Public Input

A Community Outreach/Public Participation Plan directed at interested individuals, organizations and agencies was drafted, made available online, and presented at public meetings to solicit broad public input to the development of the Mohawk River Watershed Management Plan.

This Plan is likely to change as new challenges appear and new opportunities arise. Progress in the implementation of recommended projects and other actions to protect and improve water quality and related watershed resources can be assessed through tracking implementation and correlating this information with ongoing monitoring of water quality.

The Nature of the Mohawk River Watershed

Setting

The Mohawk River Watershed is one of the largest and most important physical features of New York State, encompassing 3,460 square miles within 14 counties between the Adirondack Mountains to the north and the Catskills to the south (see Map 1-1). Over 600,000 New Yorkers live within the watershed's 170 municipalities. For the purpose of analysis, the Mohawk River Watershed was divided into three main regions: Upper Mohawk, Main River, and the Schoharie Watershed. Many streams in the Upper Mohawk and the Schoharie Watershed originate in pristine, wooded areas in the Adirondack or Catskill Parks, while downstream sections flow through agricultural land. The cities of Rome, Utica and Little Falls, and the Village of

Herkimer, and other developed areas lie along the Upper Mohawk. The Main River region includes fertile agricultural land as well as developed areas, including the cities of Amsterdam and Schenectady and the suburbs of Albany.

Significant flooding occurred in the Schoharie Valley after Hurricane Irene in 2011. Climate change may lead to more frequent episodes of heavy precipitation, making the problem worse.

History

With the advent of the Erie Canal in the early 19th century, the Mohawk Valley developed as an important transportation link, a center of manufacturing and other industry, and a productive agricultural region. The growth of industry and agriculture in the 19th and 20th centuries had a significant negative impact on water quality in the Mohawk River and its tributaries. With the passage of the Clean Water Act in the 1970s, water quality began to improve and continues to improve to this day, but many problems remain. Among these are pollution with harmful chemicals, including PCBs, nutrient enrichment from inadequate sewage treatment, and erosion and sedimentation from agricultural practices and development. Even the relatively pristine upper reaches of the watershed in the Adirondack and Catskill Parks continue to be subject to acid precipitation and other forms of atmospheric pollution. Flooding has a long history in the Mohawk River Watershed, and climate change with more frequent episodes of heavy precipitation can be expected to make the problem worse. The watershed experienced severe flooding most recently during Hurricane Irene and Tropical Storm Lee in 2011.

Land Use and Land Cover

The largest cities wholly in the watershed are Utica, Rome, Amsterdam, and Schenectady. The western edge of Albany is also included. Most of the population in the Mohawk River Watershed is located in the lowlands and mid-uplands along the main stem of the river, as are most of the roadways and railways, and the New York State Barge Canal.

Forests are the dominant land cover in the Mohawk River Watershed, and agriculture is the second most common land-cover type. The principal types of land use within the watershed are residential, wild lands, forested conservation lands, agriculture, and vacant land. Land cover and land use follow largely similar patterns, with the forested lands in the Adirondack highlands to the north and the Catskills to the south. Agriculture and human settlement dominate the lowlands near the Mohawk River and the mid-uplands along major tributaries to the north and south.

Pollution Sources

Discharges from municipal sewage treatment plants and stormwater outfalls are regulated under the State Pollution Discharge Elimination System (SPDES). These pollution sources are classified as “point sources” because the discharge enters the water at a defined point (usually a pipe). Combined Sewer Overflows (CSOs), which are present in some older cities and villages in the watershed, are also considered point sources of pollution. Combined sewers use a single piping system to convey wastewater and stormwater to a treatment facility. During times of high rainfall or snowmelt, the capacity of these pipes is exceeded, resulting in overflows of untreated

Riparian buffer zones, which help to protect waterbodies from pollutants transported in runoff, can play an important role in management strategies.

sanitary waste and stormwater to regional waterways. These overflow points are designated as CSOs and regulated by NYSDEC.

Other pollution sources reach the waterways through diffuse sources; they are not conveyed by pipes and are referred to as nonpoint sources. Developed lands and agricultural lands cover significant regions of the Mohawk River Watershed and affect water quality conditions. Densely populated areas have many surfaces where rain and snowmelt cannot seep into the ground (impervious surfaces). Runoff from rooftops, driveways, parking lots and roadways carries various pollutants, and eventually this runoff finds its way into waterways. Suburban sprawl, characteristic of rapidly growing communities in the Mohawk River Watershed, contributes to this problem with a greater proportion of impervious surfaces compared to older, more compact cities and villages. Runoff from agricultural areas containing animal waste, fertilizers, other chemicals, and eroded topsoil constitutes another important nonpoint source of pollution in the Mohawk River Watershed.

The most frequently cited sources of pollution in the watershed are atmospheric deposition, agricultural activities, habitat/hydrologic modification, and streambank erosion. There are areas in the watershed where water quality and/or habitat conditions do not support the designated best use of the waterways—for drinking water, recreation, and aquatic life support. These areas require active measures to reduce pollutant sources and restore the lands and waters. In addition, there are pristine areas in the watershed that require protection to ensure that they remain intact. Some of these pristine areas play an essential role in protecting and maintaining the watershed. For example, wetlands provide a buffer against flooding, woodlands help protect waterbodies from runoff, vegetation stabilizes steep slopes prone to erosion, etc. The role these natural areas play in mitigating the potential for adverse impacts on lands and waters of the Mohawk River Watershed would be costly or impossible to replace.

Regulations

Local laws related to impervious surfaces, site plan reviews, setbacks from waterways, development in floodplains, and erosion and sedimentation controls can have a significant effect on water quality. Local laws governing land use can differ significantly among municipalities, largely because New York municipalities are responsible for formulating their own land use regulations (the “home rule” provision of General Municipal Law).

Opportunities were identified to strengthen municipal controls in the Mohawk River Watershed to enhance overall protection and preservation of water quality. Noteworthy gaps in the regulations include provisions dealing with impervious surfaces, development on steep slopes, floodplains, and protection of lakes and streams.

Recommendations

Defining Priorities

To define priority areas, each of the 116 subwatersheds in the Mohawk River Watershed was assigned a score based on quantitative indicators of current water quality, land use, and habitat conditions (see Chapter 3). The

evaluation, conducted with input from SWCDs throughout the basin, was completed at this relatively detailed scale because it is at this level that efforts for restoration or protection will be implemented. Based on this quantitative assessment, subwatersheds in the forested upland areas of the Adirondacks and Catskills received relatively high scores, indicating healthy conditions and a need for protection, while subwatersheds in highly developed and agricultural areas earned low scores, indicating unhealthy conditions and a need for restoration.

Developing Strategies for the Watershed: Actions, Practices, and Projects

Based on the assessment results, recommendations were developed to restore or protect watershed health throughout the basin, thereby promoting the seven goals of the Mohawk River Watershed Management Plan (see Chapter 4). Actions taken to achieve these goals will not only restore or protect the natural processes of a healthy watershed, but will also bring economic benefits to communities within the watershed. Three strategies are recommended, each of which includes components that will support goals for the watershed:

Strategy 1: Implement best management practices to protect and restore natural hydrology, reduce erosion and sedimentation, minimize pollution, and protect and restore habitats.

Strategy 2: Advance municipal actions to promote sustainability, reduce risk of flood damage, and revitalize communities and waterfronts through the adoption of appropriate zoning and land use policies to encourage cluster development, protect steep slopes, protect and enhance floodplains, reduce impervious surfaces, protect, restore or enhance unique and natural areas, riparian areas, and wetlands.

Strategy 3: Advance collaboration and partnerships to promote sustainable communities, smart growth, economic development, and environmental quality through advancing collaboration and partnerships with the NYSDOS Local Waterfront Revitalization Program (LWRP), Mighty Waters Working Group, NYSDEC Mohawk River Basin Action Agenda, New York Rising Community Reconstruction (NYRCR) Program, and the Cleaner, Greener Communities Program.

Each of the strategies is developed into a set of detailed recommendations for actions and practices that address current conditions of the natural and built environment within the watershed. Since each community and subwatershed faces unique conditions influencing factors such as water quality, hydrology and flooding, waterfront revitalization, and community development, many recommendations are proposed with consideration for their relevance to the three main watershed regions and subwatershed areas within those regions.

Implementation and Monitoring

Launching Projects to Carry Out Recommendations

Members of the Coalition have proposed specific projects based on recommended actions and practices that resulted from the detailed planning effort (see Chapter 5). Each project addresses a specific area or waterbody in one of the three main regions of the Mohawk River Watershed, with a focus on subwatersheds whose low assessment scores indicate the need for restoration. Some of the recommended actions and practices are designed to be protective, and are therefore directed at mid- and high-scoring subwatersheds. Some projects have already been funded but not yet installed, some have been submitted for grant funding, and other projects have been recommended for future funding.

At present, implementation of the recommended actions and practices tends to focus on Strategy 1, BMPs, and their relevance for restoration and protection of watershed health, both basin-wide and with respect to specific

subwatersheds in the three regions. Recommendations for Strategy 2, advancing municipal actions, apply to all three regions of the Mohawk River watershed, and the priority for implementing these actions will focus on HUC-10 subwatersheds with low assessment scores. For Strategy 3, which relates to collaboration and partnerships, ongoing implementation of the Plan will include working with the organizations and initiatives identified.

In addition to the specific projects recommended by members of the Coalition and other watershed stakeholders, other projects will certainly be added in the future as the Plan is implemented. Future actions will be prioritized and initiated to the extent that they address the seven goals for the watershed and the three overarching strategies designed to support these goals. Thus, the Mohawk River Watershed Management Plan remains a work in progress, evolving as conditions in the watershed change.

Tracking Implementation

The Mohawk River Watershed Coalition will track the ongoing implementation of watershed projects and other actions to restore and protect the watershed. Changes over time will be reflected in the Interactive Mapping Tool for the Mohawk River Watershed, where multilayered maps will show how the watershed strategies are being carried out through specific projects and activities at the subwatershed scale. Details will include information regarding goals, timing, estimated cost, funding sources, responsible party, and project status/progress.

Monitoring Water Quality and Watershed Health

The Coalition will also oversee long-term monitoring of water quality and watershed health by periodically repeating the assessment procedure used to determine the current status of water quality in each subwatershed. A comparison of the resulting assessment scores over time will enable the Coalition and others to follow progress toward achieving the goals set out in the Plan. The status of each waterbody is reported on the NYSDEC Waterbody Index/Priority Waterbodies List (WI/PWL) which is updated every five years; this compendium provides important information for calculating the assessment scores. Updating the assessment scores will provide insights into the effectiveness of the actions taken to date, and the need for additional measures to restore and protect the lands and waters of the Mohawk River Watershed.

Looking Ahead

This watershed managementplan is a living document, and will be updated as new projects are undertaken, as the effectiveness of actions is documented, and as new challenges arise. Updates to the Plan will be published on the Mohawk River Watershed Coalition website.

Continuing in their role as natural resource managers at the local level, the Mohawk River Watershed Coalition of Conservation Districts will coordinate implementation of projects with the many state, federal, academic, and nonprofit organizations that joined forces to focus on the Mohawk River Watershed. Ultimately, realizing the vision for a healthy and economically vibrant Mohawk River Watershed will depend on this collaborative approach.

Water-based recreation and tourism are important to the vision for vibrant watershed communities.

Abbreviations and Linked Documents

ABBREVIATIONS

APA	Adirondack Park Agency
AEM	Agricultural Environmental Management
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CSO	Combined Sewer Overflows
CDBG	Community Development Block Grant
CEA	Critical Environmental Area
EPF	Environmental Protection Fund
FEMA	Federal Emergency Management Agency
HOCCPP	Herkimer-Oneida Counties Comprehensive Planning Program
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
LWRP	Local Waterfront Revitalization Program
MCL	Maximum contaminant level
MVREDC	Mohawk Valley Regional Economic Development Council
MS4	Municipal Separate Storm Sewer System
NAI	No Adverse Impacts
NLCD	National Land Cover Database
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NYRCR	New York Rising Community Reconstruction Program
NYSDEC	New York State Department of Environmental Conservation
NYSDOS	New York State Department of State
NYSEFC	New York State Environmental Facilities Corporation
NYSDOT	New York State Department of Transportation
NYS OPHRP	New York State Office of Parks, Recreation and Historic Preservatio
OSWCD	Oneida Soil and Water Conservation District
PWL	Priority Waterbodies List
SDWS	Secondary drinking-water standard
SPDES	State Pollution Discharge Elimination System
SUNY	State University of New York
SWCD	Soil and Water Conservation District
SWMP	Stormwater Management Program
TSS	Total Suspended Solids
USACOE	U.S. Army Corps of Engineers
USDA	U. S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	Volatile organic compound
WWTP	Wastewater treatment plant
WI	Waterbody Inventory
WAC	Watershed Advisory Committee

LINKED DOCUMENTS

Clean Water Act Section 319 — www.epa.gov/nps/319

Combined Sewer Overflow Map — www.dec.ny.gov/maps/nyscsoslink.kmz

Groundwater Quality in the Mohawk River Basin, 2006 — pubs.usgs.gov/of/2008/1086/

Groundwater Quality in the Mohawk River Basin, 2011 — pubs.usgs.gov/of/2013/1021/

Herkimer County New York Rising Countywide Resiliency Plan — www.stormrecovery.ny.gov/sites/default/files/crp/community/documents/herkimer_county_resiliency_plan_final.pdf

Interactive Mapping Tool for the Mohawk River Watershed — mohawkriver.org/mapping-tool

Mohawk River Basin Initiative, 2014-2016 — mohawkriver.org/wp-content/uploads/2015/01/MohawkRiverBasinProgramResearchPriorities2014-2016.pdf

Mohawk River Watershed Coalition Website — www.mohawkriver.org

Mohawk Valley Regional Sustainability Plan — www.sustainablemohawkvalley.com

Mohawk River Watershed Regulatory Review and Analysis:

> ***Executive Summary*** — mohawkriver.org/wp-content/uploads/2015/01/MohawkWatershedRegulatoryReview_Executive-Summary_Jan2014.pdf
>
> ***Full Report*** — mohawkriver.org/wp-content/uploads/2015/01/MohawkWatershedRegulatoryReview_FullReport_Nov2013.pdf

National Water Information System Mapping Tool — maps.waterdata.usgs.gov/mapper

New York Rising — www.stormrecovery.ny.gov

Montgomery County NY Rising Countywide Resiliency Plan — www.stormrecovery.ny.gov/nyrcr/final-plans

Oneida County and Herkimer County NY Rising Countywide Resiliency Plans — www.stormrecovery.ny.gov/nyrcr/final-plans

Protecting Water Quality with Higher Density Development — www.epa.gov/dced/pdf/protect_water_higher_density.pdf

Responding to Climate Change in New York State — www.nyserda.ny.gov/climaid

Small MS4 Stormwater Program Requirements — water.epa.gov/polwaste/npdes/stormwater/Small-MS4-Stormwater-Program-Requirements.cfm

Chapter 1: Introduction

1.1 Evolution of the Mohawk River Watershed Management Plan

The Mohawk River Watershed Management Plan (the Plan) presents the findings of the Mohawk River Watershed Coalition of Conservation Districts and other members of the Mohawk River Watershed Advisory Committee regarding the actions needed to restore and protect the Mohawk River Watershed. The Mohawk River Watershed Coalition of Conservation Districts (the Coalition) was formed in March 2009, and includes the 14 counties of Albany, Delaware, Fulton, Greene, Hamilton, Herkimer, Lewis, Madison, Montgomery, Oneida, Otsego, Saratoga, Schenectady, and Schoharie. The Coalition's mission is "*to implement conservation initiatives that protect, promote, and enhance the resources of the Mohawk River Watershed in partnership with local, state, and federal stakeholders.*" The Watershed Advisory Committee (WAC) was established as an outgrowth of the 2009 Environmental Protection Fund Local Waterfront Revitalization Program grant to Montgomery County to facilitate communication and cooperation among local governments, county and state agencies, and others essential to the preparation and eventual implementation of the Plan.[1] Preparation of this Plan was funded in part through a New York State Department of State (NYSDOS) Title 11 Environmental Protection Fund Local Waterfront Revitalization Program grant to Montgomery County, working in partnership with the Coalition and the WAC.

1.1.1 Vision and Goals for the Watershed

The Mohawk River Watershed Advisory Committee worked collaboratively to develop a vision for the future of the watershed in which:

> *The Mohawk River Watershed's natural hydrologic conditions are respected. Diverse fish and wildlife habitats and agriculture are flourishing, and superior water quality is celebrated. Vibrant watershed communities find prosperity in the strong economy where water-based recreation and tourism thrive along the waterfront.*

Guided by this vision, the WAC established seven goals:

1. Protect and restore the quality and ecological function of water resources.
2. Protect and enhance natural hydrologic processes.
3. Promote flood hazard risk reduction and enhanced flood resilience.
4. Protect, restore, and enhance fish and wildlife habitat.
5. Revitalize communities and waterfronts and adopt smart growth land use practices.
6. Promote agriculture and other working landscapes.
7. Increase watershed awareness.

In 2010, NYSDEC established the Mohawk River Basin Program, which is intended to focus efforts to conserve, preserve, and restore the environmental quality of the Mohawk River and its watershed, and manage the resources of the region for a sustainable future.

[1] WAC members include representatives from NYSDOS, NYSDEC, USGS, SUNY, Union College, U.S. National Park Service, The Nature Conservancy, NYS Canal Corporation, Cornell Cooperative Extension, Cornell Water Resources Institute, NYS Dept. of Agriculture and Markets, Tug Hill Commission, Capital District Regional Planning Commission, Herkimer-Oneida Counties Comprehensive Planning Program, USDA NRCS, USACOE, NYSDOT, Empire State Development, USFWS, all 14 SWCDs in the Mohawk River Watershed, and watershed municipalities.

This broad interest in the Mohawk River Watershed is evidence of both its importance as a resource and its management challenges. By developing this Plan and partnering with other agencies and local stakeholders, the Coalition intends to make significant contributions toward meeting these watershed goals. The Plan may be considered complementary to the NYSDEC Action Agenda; it includes recommended practices, actions, and projects at the subwatershed scale that will address broader and more specific goals.

1.1.2 Related Initiatives

In 2011, a New York State initiative related to community revitalization (but focused on economic development) began when Governor Andrew Cuomo announced the creation of ten Regional Economic Development Councils and tasked each of them with developing strategic plans for their region's economic growth. The Mohawk Valley Regional Economic Development Council (MVREDC) encompasses six counties located in the center of the watershed: Fulton, Oneida, Herkimer, Montgomery, Otsego and Schoharie. These counties encompass the majority of land area within the Mohawk River Watershed. Four watershed counties (Albany, Schenectady, Greene, and Saratoga) are included in the Capital Region Economic Development Council; two counties (Hamilton and Lewis) are within the North County Regional Economic Development Council. Madison County is in the Central New York Regional Economic Development Council, and Delaware County is part of the Southern Tier Regional Economic Development Council.

While each Regional Economic Development Council has a unique strategic plan and set of goals, there are common themes that relate directly to the priorities and approach of the watershed planning process.

- Commitment to a regional approach to identifying challenges and finding solutions;
- Recognition of the need to invest in infrastructure;
- A focus on education and the need to improve scientific literacy and prepare for innovation;
- An embrace of smart growth concepts: recognition of the need to increase spatial efficiency and contribute to energy efficiency and sustainability;
- Support for local agriculture;
- Reclamation of waterfront assets for community and economic development;
- Recognition of the need to strengthen the effectiveness of government and civic institutions in order to improve the quality of life for all.

1.2 Overview of the Watershed: Political Boundaries, Natural Boundaries

A watershed is an area of the landscape that drains into a single body of water. The high ground delimiting a watershed constitutes a natural boundary within which resources, especially water resources, can be effectively managed. At 3,460 square miles, the Mohawk River Watershed is the largest tributary of the Hudson River, comprising 25% of the Hudson's entire watershed. The Mohawk River itself extends over 140 miles as it flows from north of Rome on the Tug Hill Plateau to its confluence with the Hudson River near Albany. The watershed includes some 6,656 miles of freshwater rivers, streams, and canals (**Map 1-1**).

The watershed encompasses portions of 14 counties. Due to the basin's size and the diversity of both landscape (natural conditions) and land uses (human uses) that it exhibits, much of the detail within this Plan is organized in

three regions based on geographic areas within the watershed: Upper Mohawk, Main River, and the Schoharie Watershed.

The Upper Mohawk encompasses parts of Lewis, Hamilton, Oneida, Herkimer, Madison and Otsego Counties. The headwaters of many of the streams in this region lie in heavily wooded, undeveloped areas, some within the Adirondack Park, and this section of the Mohawk River flows through agricultural land and the cities of Rome, Utica, Little Falls, and the Village of Herkimer.

*The Main Rive*r region includes portions of Fulton, Montgomery, Schenectady, Saratoga, and Albany Counties. The upstream parts of this section drain fertile and heavily farmed agricultural land, whereas the downstream, eastern portion of the Mohawk Valley is highly developed, including the cities of Amsterdam and Schenectady and the suburbs of Albany.

The Schoharie Watershed, whose headwaters lie in the Catskill Mountains, primarily in wooded landscapes, includes portions of Schoharie, Greene, and Delaware Counties. Schoharie Creek contributes to the public water supply of New York City water through a pipeline from the Schoharie Reservoir, and strict land use and water quality regulations are in effect for this portion of the Schoharie Watershed.

There are 170 municipalities within the Mohawk River Watershed and a 2010 population of 600,388. The Mohawk Valley constitutes one of the most important transportation corridors in New York State, with the river itself and the New York Barge Canal as well as the New York State Thruway and a major rail route. From the opening of the Erie Canal in the early nineteenth century to the present, this corridor has played an important role in the economy of the state and the nation, as it opened up transportation to the Great Lakes and beyond.

Because of its long history of agricultural and industrial development, the Mohawk River Watershed has suffered from many kinds of pollution and hydrologic modification, the remnants of which still pose environmental challenges. Even the relatively pristine upper reaches of the watershed in the Adirondack and Catskill Parks continue to be subject to acid precipitation and other forms of atmospheric pollution carried from sources far to the west. The watershed has experienced severe flooding, most recently during Hurricane Irene and Tropical Storm Lee in 2011.

An online Interactive Mapping Tool for the Mohawk River Watershed was created to supplement this watershed management plan. This mapping tool provides multilayered information about watershed boundaries, hydrology, soils, residential development, habitat, infrastructure, pollution, floodplains, governance, and much more. Developed by Stone Environmental Inc. for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund, the online map draws on numerous data sources. It can be viewed at various scales, allowing detailed examination of specific areas within the watershed while also facilitating an understanding of patterns and relationships across the watershed as a whole.

1.3 Value of a Watershed Management Plan

A watershed can provide various “services” that benefit the people living within it, as well as support the mosaic of aquatic, terrestrial, and wetland ecosystems of which people are but one component. A well-managed watershed provides flood protection, habitat for fish and wildlife, and recreational and aesthetic benefits. Surface and groundwater resources within the Mohawk River Watershed are a source of potable water. The landscape supports agriculture and forestry, and the river and canals serve as a transportation corridor as well as a destination for recreation and tourism.

One of the largest and most important watersheds in New York State, the Mohawk River basin has suffered past abuses, potentially jeopardizing the services it provides. A well-developed watershed management plan is the beginning of restoring and protecting this important resource. The Mohawk River Watershed Management Plan has been developed as a living document, one that will change as current issues are resolved and new issues are encountered.[2] The Plan is not a mandate; rather, it will serve as a guide to effective actions to protect and restore the quality of the watershed, and enhance quality of life for its residents. The Plan is designed to serve as a roadmap for protecting the vital natural resources the watershed provides while balancing the need for economic growth and development among the watershed's communities.

Implementation of these recommended actions will require commitment at many levels: federal, state, and local government; natural resource and agricultural management agencies; and watershed landowners and residents. The problems affecting the watershed are the cumulative results of many activities and natural conditions within the watershed boundaries, and the responsibility for improvements rests with the entire community.

1.4 Planning Process and Partners

Preparation of the Mohawk River Watershed Management Plan follows the approach jointly developed by the NYS Department of State and NYS Department of Environmental Conservation and described in the guidebook *Watershed Plans: Protecting and Restoring Water Quality*. The Plan will make substantial contributions toward meeting the Watershed Advisory Committee's goals, described in section 1.1.1. Ultimately, a successful watershed management plan will address the following questions:

- **Where are we now?** That is, what is the current status of the natural, cultural, and political environment within the watershed? What are the assets, existing problems, and emerging threats and opportunities?
- **Where are we going?** What processes and programs are in place that will affect the future of the watershed?
- **Where do we want to be?** What is our vision for the future of the watershed? What desirable conditions or attributes of the watershed do we want to maximize, and what undesirable properties do we want to minimize or eliminate?
- **How do we get there?** What strategic actions will enable us to achieve the goals and vision? What specific practices and projects will help restore and protect the watershed, and how do we best leverage funding opportunities?
- **When will we get there?** When will the recommended projects be advanced, and how will the priority actions be decided?
- **How do we measure progress?** What is the plan for tracking improvement and deciding what else needs to be done?

Maximizing the benefits that the Mohawk River Watershed can provide to the basin's communities requires careful cooperative planning and management. Bodies of water—lakes and streams—typically delineate political boundaries rather than being contained within them. Effective management of those waterbodies, therefore,

[2] Changes over time will be reflected in the Interactive Mapping Tool for the Mohawk River Watershed, where multilayered maps will be used to to track implementation of the watershed strategies as specific projects and activities are carried out at the subwatershed scale. Updates to the Plan itself will be published on the Mohawk River Watershed Coalition website.

requires partnerships and cooperation among the municipalities within the watershed, and the inclusion and buy-in of a diverse group of stakeholders beyond the elected and appointed officials of those municipalities.

1.5 Sources of Data and Information

Each of the Soil and Water Conservation Districts in the Coalition assessed watershed characteristics within its land area at the fine-scale, 12-digit Hydrologic Unit Code (HUC-12) level. These assessment reports provide the bulk of information on water quality characteristics within the Mohawk River Watershed and have been summarized into subwatershed and basin-wide characterizations of water quality.

The local regulatory framework affecting water quality in each municipality was reviewed and summarized in order to identify improvements that will allow local municipalities to more effectively address water quality impacts from land development activities, and community-specific recommendations were developed.

Further information, especially with regard to stakeholder concerns, came from implementing a Community Outreach/Public Participation Plan that identified forums and methods to engage interested individuals, organizations, and agencies in the preparation of the Mohawk River Watershed Management Plan. The draft Plan was made available online and was presented at public meetings held in each of the three major regions of the watershed. Public input was solicited at these meetings, recorded, and incorporated in the final document.

1.6 Challenges to be Addressed

A watershed management plan is valuable only insofar as it can be implemented, and implementation always depends on forging cooperation among stakeholders—the public, municipalities, and government agencies at all levels. To achieve this cooperation, it is essential that a viable public outreach and participation plan is in place before the watershed management plan is developed and implemented. Stakeholders whose concerns were heard and included in the Plan are much more likely to participate actively in its implementation.

The goals set out in this Plan represent best practices for smart growth, designed to protect and improve water quality. The Plan recommends that relatively pristine areas within the watershed be protected and that areas that have been degraded be restored. Smart growth preserves hydrologically sensitive areas, limits impervious surfaces by promoting compact community design, and plans for handling storm water and point and nonpoint pollution in a proactive manner. Inasmuch as this Plan can only recommend such actions, implementation will, in many instances, require that the recommendations be incorporated into local laws that take a landscape view of development and growth, consistent with watershed-wide management. This may present a challenge in that New York State's "home rule" policy, granting relative autonomy to local municipalities on land use issues, will demand that local laws be coordinated among municipalities in the watershed.

In the late summer of 2011, the Mohawk River Watershed experienced back-to-back episodes of severe flooding as Hurricane Irene and Tropical Storm Lee, with their heavy rainfall, passed through the area within two weeks of each other. Global climate change means that the Mohawk River Watershed, like other areas of the world, will be increasingly subject to such episodes of extreme weather. There is a tendency to base future actions on past events, but the environment is dynamic—especially under global climate change conditions—and it will be challenging to implement a plan that takes such change into account.

The Mohawk River Watershed Management Plan will be updated as new projects are undertaken, the effectiveness of actions is documented, and new challenges arise (see the Mohawk River Watershed Coalition website and Interactive Mapping Tool for the Mohawk River Watershed for updates). Regular monitoring of water quality and other sensitive elements of the watershed are essential components of adaptive management. Continuing in their role as natural resource managers at the local level, Coalition members will coordinate implementation of projects with the many state, federal, academic, and nonprofit organizations that joined forces to focus on the watershed and contribute to this Plan. Ultimately, realizing the vision for a healthy and economically vibrant watershed depends on this collaborative approach.

Finally, it will be challenging to find funding to implement the many recommendations made in this Plan. Nonetheless, the existence of a well-developed, watershed-wide management plan should make finding such funding less challenging than for individual, uncoordinated projects.

The Mohawk River Watershed Management Plan provides a roadmap from current conditions toward an improved watershed. The vision of the desired future is for a healthy, restored watershed as expressed in the seven goals listed in section 1.1.1. The goals include elements related to human uses of the resource and the sustainability and vitality of the communities within it, as well as maintenance of natural habitats and ecosystem functions. By working together, the Coalition and its many partners in state and local government, the not-for-profit sector, and the academic community can focus their efforts toward restoring and protecting the watershed for future generations.

PROJECT LOCATION

MAP 1-1

Mohawk River Watershed Management Plan

Legend

- Mohawk River Watershed
- County Boundary
- Adirondack Park Boundary

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 5 10 20 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Shaded Relief, ESRI.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

Source: US National Park Service

Chapter 2: Watershed Characterization

2.1 Introduction

By the very nature of a watershed, the quality of the water is inextricably tied to the environmental conditions in the entire watershed—its hydrology (i.e., pattern of water movement), its climate, its soils, and other properties of the landscape. Inasmuch as human activities—settlement patterns, land use, impervious surfaces, waste disposal, and other modifications of the landscape—change the natural state, they too will affect water quality. A watershed management plan must recognize these factors and how they influence the current conditions of the land and waters.

In this chapter, both the natural environmental setting and the cultural (human-influenced) conditions of the Mohawk River Watershed are described. The data and information from the 2013 Mohawk River Watershed Characterization Report are incorporated, along with an analysis of the local laws adopted by the watershed municipalities and how those laws may affect water quality conditions.[1] Understanding the underlying environmental conditions as well as the constraints imposed by existing land use patterns and the regulatory environment provides a rational basis for recommending long-term protection and restoration strategies.

2.2 Watershed and Subwatershed Boundaries

2.2.1 Evolution of the Basin

The Mohawk River Watershed took final shape as a result of the last glaciation approximately 10,000 years ago. Glacial ice and melt water played a major role in forming the Mohawk Valley. Prior to the glaciation, the Mohawk drained south from Schenectady and entered the Hudson River near Coeymans, New York. During glaciation, it flowed north through what is now the Ballston Spa area. Following glaciation, this route was blocked by ice, and as the St. Lawrence lowland was also blocked by ice, a large river called the Iromohawk drained the Great Lakes and the melt water of the eastern Laurentide ice sheet through the area between the mountains of the Adirondacks and Catskills. The Iromohawk cut a wide channel, west to east, to the Hudson, forming the route the Mohawk River follows today. The geological remnants of this river, much larger than the current river, exist within the valley.

2.2.2 Current Basin Configuration

The present day Mohawk River Watershed (basin) is located in central New York State and covers an area of approximately 3,460 square miles. The watershed extends north to south from the southwestern Adirondacks to the northern Catskills, and east to west from Rome, New York, to the Hudson River at Cohoes, as displayed in Map 1-1. The watershed comprises approximately 25% of the total drainage area of the Hudson River. The headwaters of the Mohawk River are at the eastern edge of the Tug Hill Plateau, with the river flowing south towards Rome, and then turning east and continuing to the Hudson, for a total of 140 miles. The watershed is one of the major drainage basins in New York State (Map 2-1).[2]

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[1] Bergmann Associates. 2014 (January). *Mohawk River Watershed Regulatory Review & Analysis*. Prepared for the Mohawk River Watershed Coalition of Conservation Districts. Link to Executive Summary or Full Report.

[2] The Interactive Mapping Tool for the Mohawk River Watershed that was developed to supplement this Plan provides multilayered information about watershed boundaries, hydrology, soils, residential development, habitat, infrastructure, pollution, floodplains, governance, and more.

Major drainage basins throughout the United States are subdivided into drainage units, and are assigned a hydrologic unit code (HUC) based on four levels of classification, including region, subregion, accounting unit, and cataloging unit. Each major drainage basin is further divided into 8-, 10-, and 12-digit HUCs. The Mohawk basin is comprised of two 8-digit HUC subwatersheds (the Mohawk and Schoharie), eighteen 10-digit subwatersheds (**Map 2-2**), and 116 12-digit HUC subwatersheds (**Map 2-3**). The 12-digit HUC is the level at which watershed health is assessed and strategies and action plans for restoration or protection are implemented.

Other than the headwaters of the Mohawk River itself, north of Rome, the major tributaries or subwatersheds of the Mohawk include West Canada Creek, which drains the southwestern Adirondack Mountains and joins the Mohawk near Herkimer, and Schoharie Creek, which drains the northeastern Catskill Mountains and joins the Mohawk west of Amsterdam.

The main topographic features of the watershed are shown in **Map 2-4**, with the Mohawk River lowlands bounded by the Adirondack Mountains to the north and the Catskill Mountains to the south. The range in elevation is approximately 3,500 feet from mountainous areas in the southern Adirondacks to the confluence with the Hudson. The Mohawk lowlands developed due to the erodibility of the shale and siltstone bedrock compared to the harder bedrock types of the Adirondacks.

There are more than 6,600 miles of rivers, canals, and streams and 135 lakes, reservoirs, and ponds greater than 6.4 acres in size within the basin (**Map 2-5**). The main tributaries to the Mohawk represent a large portion of these stream and river miles. Flowing out of the Catskills, Schoharie Creek and its tributaries include 1,650 stream miles, or 25% of the stream miles. Two large tributaries flow from the Adirondacks: West Canada Creek (1,165 miles, 18% of the stream miles) and East Canada Creek (515 miles, comprising 8% of the stream miles). Of the lakes and reservoirs, three of the four largest are constructed reservoirs (Hinckley, Delta, and Schoharie reservoirs) which, along with the naturally formed Peck Lake, represent 42% of total lake acres in the watershed.

The Mohawk River Watershed can be conveniently divided into three geographic regions that reflect the wide-ranging diversity in the watershed: Upper Mohawk, Main River, and Schoharie Watershed (boundaries are shown in Map 2-2). The Upper Mohawk region encompasses portions of Lewis, Hamilton, Oneida, Herkimer, Madison, and Otsego Counties. The headwaters of the Mohawk River originate in this region at the eastern edge of Lewis County on the Tug Hill Plateau, from which the river flows south to Rome. It then turns eastward flowing through Oneida and Herkimer Counties. The subwatersheds in this region include a portion of the Adirondack Park that is heavily wooded and mountainous; this part of the watershed has very little development. In contrast, the Upper Mohawk also encompasses the western segment of the main stem of the river where the cities of Rome, Utica, Herkimer, and Little Falls have a long history as industrial regions and population centers.

The Main River region includes portions of Fulton, Montgomery, Schenectady, Saratoga, and Albany Counties. The majority of this region consists of what has been historically referred to as the Mohawk Valley, the highly fertile lowlands along the main stem of the river with extensive agricultural land use. The eastern segment of the Main River region is highly developed with the cities of Amsterdam and Schenectady and the suburbs of Albany. These cities have also been settled for centuries, and have served as centers of industrial production and commerce as well as an important transportation corridor to the Great Lakes.

The Schoharie Watershed region, which is the drainage basin for Schoharie Creek, includes portions of Schoharie, Greene, and Delaware counties. The Catskill Mountains encompass the uplands of this region, with steep slopes and wooded land cover. A unique feature of this region is that the portion in Greene County is in the New York City watershed because a portion of the water that enters the Schoharie Reservoir, located at the border of Greene and Schoharie Counties, is diverted to New York City for potable water supply. As part of the New York City

watershed, strict watershed rules and regulations are in effect in Greene County. The Schoharie Watershed has less agriculture than the fertile lowlands along the main stem of the Mohawk and a higher percentage of residential land use.

2.3 Environmental Setting

2.3.1 Water Resources

New York State has a humid continental climate. The average annual precipitation within the Mohawk basin ranges from 33 to 71 inches per year, depending largely on elevation (**Map 2-6**). Mean annual temperatures within the basin range from about 40° Fahrenheit in the Adirondacks to about 50°F in lowland areas.

Since the 1970s, annual temperatures in New York State have increased approximately 0.6°F per decade, with the rise in winter temperatures exceeding 1.1°F per decade. Mean annual temperatures may rise by 1.5°F by the 2020s. There has been no discernable trend in annual precipitation, but year-to-year variability has increased and intense precipitation events have become more frequent with the potential for more destructive flooding in flood-prone areas of the Mohawk River Watershed.[3]

Flooding of the Mohawk Valley and along its tributaries has been a long-standing natural phenomenon extending back to its formation 10,000 years ago. There are two main types of flooding events, *free-water* and *break-up*. Free-water events usually occur in the late summer and early fall during hurricane season and are associated with heavy precipitation. Break-up events are associated with the break-up of river ice due to rising temperatures, snow melt, and heavy rains in early spring. Flooding is exacerbated during break-up events when ice jams occur at structures along the river such as bridges and dams.[4]

Major flooding occurred in the Schenectady area during the 1800s and early 1900s when flood stages exceeded 15 feet for eight different flooding events over a period of 45 years, including the great flood of 1914. In recent years, flooding due to a stalled front in 2006 resulted in $200 million in damages. In 2011, Hurricane Irene deposited 4 to 8 inches of rain in the eastern part of the Mohawk watershed and up to 13 inches in the Schoharie Valley, causing severe flooding in that region and along the Mohawk from Amsterdam to Schenectady. Damages from the flood were estimated to be close to $300 million. Hurricane Irene was followed a couple of weeks later by Tropical Storm Lee, which caused further flood damage.

Since many of the developed areas in the watershed lie in floodplains, losses from floods like those of 2011 are likely to be great. The Federal Emergency Management Agency (FEMA) has mapped flood-prone areas in the watershed (**Map 2-7**), and many of these areas were heavily damaged in the 2011 floods.

Stream discharge is monitored at multiple locations along the Mohawk River and its major tributaries. The U.S. Geological Survey (USGS) maintains a network of stream gauges and river gauges, as summarized in **Table 2-1**. An online National Water Information System Mapping Tool displays the locations of the gauging stations and provides links to near real-time data. These monitoring data are an essential tool for managing hydrology and

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[3] Rosenzweig, C., W. Solecki, A. DeGaetano, M. O'Grady, S. Hassol, P. Grabhorn (Eds.). 2011. *Responding to Climate Change in New York State: The ClimAID Integrated Assessment of Effective Climate Change Adaptation*. Technical Report. New York State Energy Research and Development Authority (NYSERDA), Albany, NY. Available at http://www.nyserda.ny.gov/climaid.

[4] Garver, J.I., and Cockburn, J.M.H. 2009. *A Historical Perspective of Ice Jams on the Lower Mohawk River.* Proceedings from the 2009 Mohawk Symposium, Union College, Schenectady, NY, p. 25-29.

forecasting risk of flooding events. In the Schoharie watershed, the gauging network provides information the New York Power Authority requires to manage the Blenheim-Gilboa Pumped Storage Power Project.

TABLE 2-1

List of USGS Surface Water Gauging Sites within the Mohawk River Basin

River Segment	Site Name	Gauge Number
Upper Mohawk	WEST CANADA CREEK AT KAST BRIDGE NY	01346000
	SAUQUOIT CREEK AT WHITESBORO NY	01339060
	MOHAWK RIVER NEAR UTICA NY	01342602
	HINCKLEY RESERVOIR AT HINCKLEY NY	01343900
	WEST CANADA CREEK NEAR WILMURT NY	01343060
	BLACK CREEK NEAR GRAY NY	01343403
	MOHAWK RIVER BELOW DELTA DAM NEAR ROME NY	01336000
	FULMER CREEK NEAR MOHAWK NY	01342743
	MOHAWK RIVER NEAR LITTLE FALLS NY	01347000
	EAST CANADA CREEK AT EAST CREEK NY	01348000
	NORTH CREEK NEAR EPHRATAH NY	01348420
Main River	OTSQUAGO CREEK AT FORT PLAIN NY	01349000
	CANAJOHARIE CREEK NEAR CANAJOHARIE NY	01349150
	MOHAWK RIVER ABOVE STATE HIGHWAY 30A AT FONDA NY	01349527
	MOHAWK RIVER AT LOCK 8 NEAR SCHENECTADY NY	01354330
	Surveillance camera to detect ice jams at the Stockade	None
	MOHAWK RIVER AT FREEMAN'S BRIDGE AT SCHENECTADY NY	01354500
	MOHAWK RIVER AT REXFORD NY	01355475
	MOHAWK RIVER AT COHOES NY	01357500
Schoharie Watershed	WEST KILL BELOW HUNTER BROOK NEAR SPRUCETON NY	01349711
	EAST KILL NEAR JEWETT CENTER NY	01349700
	SCHOHARIE CREEK NEAR LEXINGTON NY	01349705
	WEST KILL NEAR WEST KILL NY	01349810
	BATAVIA KILL AT RED FALLS NEAR PRATTSVILLE NY	01349950
	SCHOHARIE CREEK AT PRATTSVILLE NY	01350000
	BEAR KILL NEAR PRATTSVILLE NY	01350035
	SCHOHARIE RESERVOIR NEAR GRAND GORGE NY	01350100
	MANOR KILL AT WEST CONESVILLE NEAR GILBOA NY	01350080
	SCHOHARIE CREEK AT GILBOA NY	01350101
	PLATTER KILL AT GILBOA NY	01350120
	MINE KILL NEAR NORTH BLENHEIM NY	01350140
	SCHOHARIE CREEK AT NORTH BLENHEIM NY	01350180
	SCHOHARIE CREEK AT BREAKABEEN NY	01350355
	SCHOHARIE CREEK AT BURTONSVILLE NY	01351500

2.3.2 Geology

The surficial material (Map 2-8) throughout the basin was deposited primarily during the last glaciations of the Pleistocene Epoch when the Wisconsin glaciers covered most of the Northeast. Till mantles the uplands, and ice-contact, deltaic, fluvial, and alluvial sand and gravel and lacustrine silt and clay deposits are present in the valleys. Till and lacustrine silt and clay deposits generally have low yields of water, whereas the well-sorted, coarse-grained deposits form important aquifers in the basin. The valley-fill sand-and-gravel aquifers may produce yields as high as 500 gallons per minute.[5]

Bedrock in the Mohawk River basin (Map 2-9) includes shale, sandstone, carbonate, and crystalline rocks. Black shale is present in the Mohawk Valley, with bands of carbonate rock along the edges of the valley. Bedrock in the southern part of the basin consists mainly of shale and sandstone, and bedrock in the northern part of the basin is mainly crystalline metamorphic rock. Of the bedrock aquifers in the basin, carbonate rocks generally produce the highest yields, and the crystalline rocks generally produce the lowest; the clastic rocks generally have low to moderate yields.

2.3.3 Soils

Soils are influenced by five factors: parent material, climate, living organisms, topography, and time. The hydrologic soil groups illustrated in Map 2-10 range from A soils (high infiltration), shown in light to dark green, through D soils (very slow infiltration), shown in light to dark red. Much of the watershed has C soils, which have slow infiltration. The potential for soil erosion, measured by the soil erodibility k-factor, is displayed in Map 2-11. As the k-factor increases—as shown by the darker orange on the map—soil erodibility increases. The online Interactive Mapping Tool for the Mohawk River Watershed provides more detailed information regarding the nature and distribution of soils within the watershed.

2.3.4 Habitat

An abundance of wildlife, both terrestrial and aquatic, thrives within the Mohawk River basin. The river itself supports an exceptional warm-water fishery, known regionally for its smallmouth bass. The abundance of migrating blueback herring in the river has provided a substantial high quality food source for bass.[6] The Mohawk River valley is also home to many important terrestrial habitats such as grasslands, wetlands, and forests. Specifically, grassland habitats act as refuge for many important bird species, while wetland and forest habitats support various important reptile, amphibian, and mammal populations.

The land cover map (Map 2-12), which is based on data from the 2006 National Land Cover Database, illustrates the diversity of habitats in the watershed, with forested areas in the Adirondacks and Catskills and the more open spaces in the Mohawk Valley. These distinct ecological zones are also shown in Map 2-13. Ecological zones are delineated land units of similar ecological and geographic characteristics, based on topography, vegetation types, and land use.

The Mohawk River basin contains many environmentally sensitive areas, including lakes and streams, steep slopes, wetlands, and hydric soils (Map 2-14), as well as floodplains (both 100-year and 500-year) and primary aquifers.

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[5] Nystrom, E. A. 2008. *Groundwater quality in the Mohawk River Basin, New York, 2006.* U.S. Geological Survey Open-File Report 2008-1086, 33. Available at http://pubs.usgs.gov/of/2008/1086/.

[6] McBride, N. D. 1994. *A Fisheries Management Plan for the Lower Mohawk River*. New York State Department of Environmental Conservation, Region 4, Fisheries. Technical Report. 109 pages.

Larger wetlands throughout the watershed are regulated by two state agencies: the Adirondack Park Agency (APA) designates wetlands in the Adirondack Park, and the NYS Department of Environmental Conservation regulates wetlands of 12.4 acres or more in the remainder of the watershed (**Map 2-15**). Additional unmapped wetlands within the watershed are regulated by the U.S. Army Corp of Engineers.

2.4 Cultural Setting

2.4.1 Historical Perspective

Native Americans referred to the Mohawk River as *Te-non-an-che*, the "river flowing through the mountains." The Mohawk River Valley provided Native Americans, and the American settlers who displaced them, a route through the mountains from east to west, which connected the Atlantic Ocean with the interior of North America. The fertile soils of the valley attracted farmers in the 1700s. The Mohawk Valley was strategically important during the French and Indian War and the Revolutionary War, and many important battles were fought in this region.

During the seventeenth and eighteenth centuries, the natural streams and lakes of the Mohawk/Oneida waterway served as an inland corridor for European exploration and military expansion before becoming a vital transportation link between the Hudson River and the Great Lakes for the new nation. Although planning for the Erie Canal was initiated in 1808, construction was delayed until 1817 because of the War of 1812; it was completed in 1825 at a cost of $7 million. The Erie Canal, which paralleled the Mohawk River, was enlarged in 1835, and again in 1891. The canal ceased operation in 1918 following the opening of the larger Barge Canal, which followed the main stem of the Mohawk River from the Hudson to Utica, and then continued west.

With the advent of the Erie Canal, industrialization of the Mohawk Valley increased rapidly. Between 1825 and the end of the Civil War in 1865, the Mohawk Valley saw rapid growth in the number and size of towns, the extent of railroads, and the beginning of manufacturing. From the mid-1800s to the early 1900s, industrial development increased on a large scale. Examples of industrial development along the river include the following: wood pulp and paper at Herkimer; brooms and carpets at Amsterdam; dairy machinery at Little Falls; knitting goods at Little Falls and Herkimer; leather goods at Little Falls, typewriters and firearms at Ilion, felt products at Dolgeville; copper at Rome, packaged food products at Canajoharie, and electric products at Schenectady. By 1912, there were 1,321 factories in the six Mohawk Valley counties.

Due to the fertile soils and transportation infrastructure of roads, railways, and waterways, human settlement and economic development flourished during the nineteenth and into the twentieth century. The population of the six Mohawk Valley counties was 500,000 by 1925. Agricultural and industrial development has had a significant negative impact on water quality in the Mohawk River and its tributaries. With the enactment of the Clean Water Act in the 1970s, water quality began to improve and has continued to improve to the present day. Many problems from the past remain unresolved, however, including PCB contamination and sediment build-up in streams. Pollution from inadequate sewage treatment facilities and the erosion of stream banks are ongoing problems.

2.4.2 Municipalities and Population

There are 170 municipalities—counties, towns, cities and villages—in the watershed (**Map 2-16**). The counties within the Mohawk River watershed include all of Montgomery, most of Schoharie, large parts of Schenectady, Greene, Fulton, Herkimer, and Oneida, and portions of Albany, Saratoga, Delaware, Otsego, Hamilton, Madison, and Lewis. The largest cities wholly in the watershed are Utica, Rome, Amsterdam, and Schenectady. The western edge of Albany is also included. The total watershed population in 2010 was 600,388, with Utica reporting 62,235,

Rome 33,725, Amsterdam 18,620, and Schenectady 66,135. Population density (persons per square mile) is shown in Map 2-17.

2.4.3 Infrastructure

Infrastructure within the watershed—including highways, railways, bridges, dams, and stormwater outfalls—is illustrated in Map 2-18. The built environment can have a significant and direct impact on water quality and hydrology due, for example, to the effects of impervious surfaces on stormwater runoff, potential pollution from vehicles, and outfalls of treated wastewater. In addition, infrastructure affects settlement patterns and land use.

Roads, Highways, and Railways. The greatest concentration of roadways is in the lowlands and mid-uplands of the watershed. The principal east-west highway is the NYS Thruway (Interstate 90), which runs parallel to the main stem of the Mohawk River between Utica and Schenectady, a distance of approximately 75 miles. NY Route 5, which pre-dates the Thruway, also runs along the river for the same distance. The main rail lines follow this same route. In contrast, the portion of the watershed in the Adirondack Park is practically devoid of roads and rail lines, as is the upper part of the Schoharie watershed in the Catskills.

Dams. There are 495 dams in the Mohawk River watershed, ranging from small earthen dams for ponds to large dams for major reservoirs. Of these, there are 37 high hazard dams, designated Class C by NYSDEC, which, if they fail, cause large-scale property damage and possible loss of life. More information about dams can be found at the online Interactive Mapping Tool for the Mohawk River Watershed (view infrastructure maps, then zoom in and click on a dam to get information such as name, location, hazard class, purpose, year built, length, height, maximum discharge, and impoundment storage and surface area). Dams that impound large reservoirs are listed in Table 2-2. All of these dams are Class C.

TABLE 2-2
Dams Impounding Large Reservoirs in the Mohawk River Watershed

Dam Name	Year Built	Length (ft.)	Height (ft.)
Delta	1912	1000	106
Hinckley	1914	3565	48
Peck Lake	1910	920	39
Gilboa	1926	2273	183

Delta Dam on the Mohawk River above Rome was built to supply water to the Erie Canal. Delta Reservoir helps attenuate high flows due to heavy rain events and thus provides a degree of flood protection downstream. Hinckley Reservoir, behind Hinckley Dam on West Canada Creek, provides water to 130,000 people in the greater Utica area. It also supplies the Gregory B. Jarvis hydroelectric plant with its 9,000-kW capacity, which began operation in June of 1986. This reservoir also provides attenuation of high flows. Gilboa Dam impounds the Schoharie Reservoir on Schoharie Creek and supplies water to New York City.

2.4.4 Land Cover and Land Use

Land cover (refer to Map 2-12) and land use (Map 2-19) are interrelated. Land cover documents how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, open water, etc. Land use shows how people use the landscape, whether for development, conservation, or mixed uses. The different types of land cover can be managed or used quite differently. Two land parcels may have similar land cover, but different land use. For instance, an industrial assembly plant may look, from the outside, very much like an office building. The

first is an example of industrial use, the latter an example of commercial use. Similarly, two land parcels that have similar land use may have different land cover. A golf course and an office building are both commercial land uses. The former would have a land cover of grass, while the latter would be considered built up.

Both land cover and land use can significantly affect water quality. Forest cover, particularly along streams, protects against sediment and nutrient pollution and moderates flooding, as do wetlands. Open spaces such as grasslands and shrub/scrub cover can also protect waterbodies. Open spaces used for agriculture or residential and commercial development, however, can have a detrimental impact on nearby waterbodies, unless runoff is managed properly.

The two dominant *land cover* types in the Mohawk River watershed include forest, representing 50% of the total area, and agriculture representing 25%. Other land covers include wetland, developed, herb/shrub/scrub, and water (see Map 2-12; **Figure 2-1**; and **Table 2-3**). These data are from the 2006 USGS National Land Cover Database (NLCD). The Upper Mohawk region includes the heavily wooded northwestern headwaters in the Adirondack Park, and the Mohawk lowlands with the developed areas of Utica and Rome and agricultural land cover extending both north and south of the Mohawk River. Percentages of land cover types in this region are similar to those of the watershed as a whole. The Main River region, however, mainly in the lowlands, has less forest and more agricultural and developed land cover. It also contains more wetlands. The Schoharie Watershed region is significantly different from the watershed as a whole, with a much higher percentage of forest cover and lower percentages of developed and agricultural cover. Not surprisingly, this region has the best water quality compared to the other regions of the watershed.

Residential *land use* (28%) is the most prominent land use type in the watershed, followed by Wild, Forested and Conservation (20%), and Agriculture (20%) (refer to Map 2-19, **Figure 2-2**, and **Table 2-4**). As expected, land uses vary by region. Wild/Forested/Conservation land use is highest in the Upper Mohawk, due in part to the Adirondack Park. In the Schoharie Watershed, forest cover is 71%, whereas the land use for wild/forested/ conservation is only 17%. This is because other land uses such as residential have forest cover. Agricultural land use is highest in the lowlands of the Upper Mohawk and Main River, and lowest in the Schoharie Watershed, which is consistent with land cover.

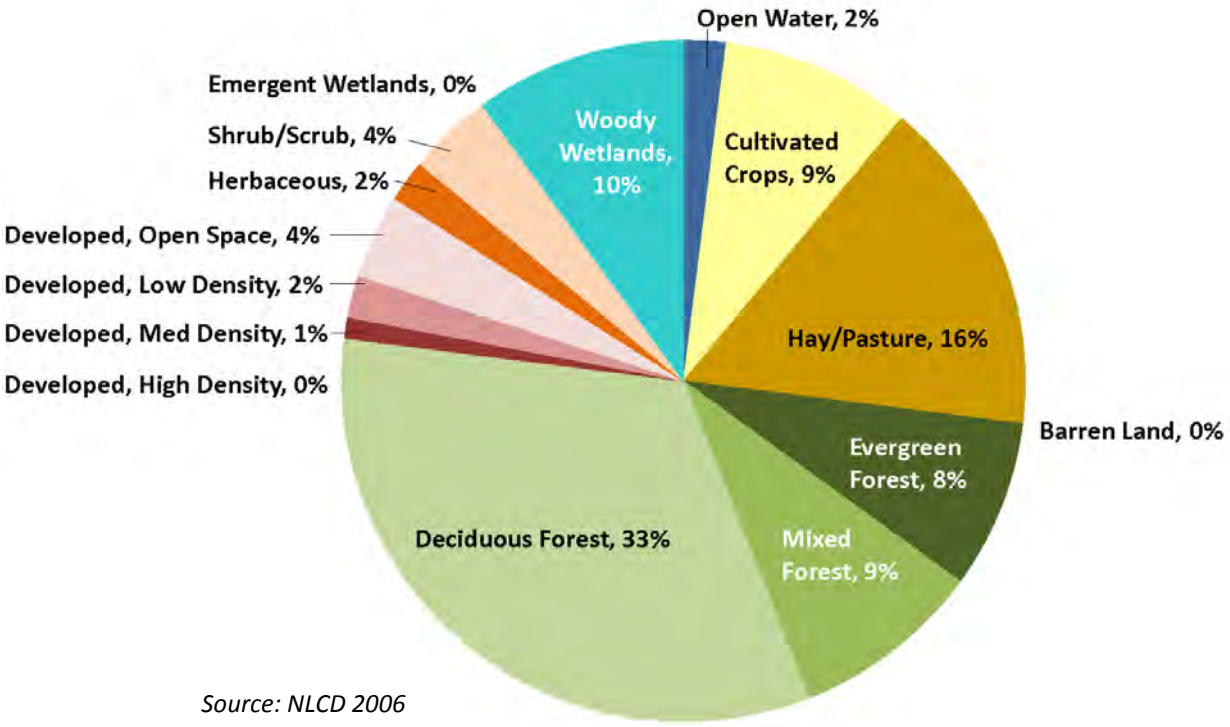
TABLE 2-3

Summary of the Main Land Cover Types for the Entire Watershed, and Comparison by Region (Upper Mohawk, Main River, and Schoharie Watershed)

Land Cover Type	Total Watershed (%)	Upper Mohawk (%)	Main River (%)	Schoharie Watershed (%)
Forest	50	48	41	71
Agriculture	25	24	21	18
Wetland	10	9	16	4
Developed	7	6	10	5
Herb/Shrub/Scrub	6	9	3	1

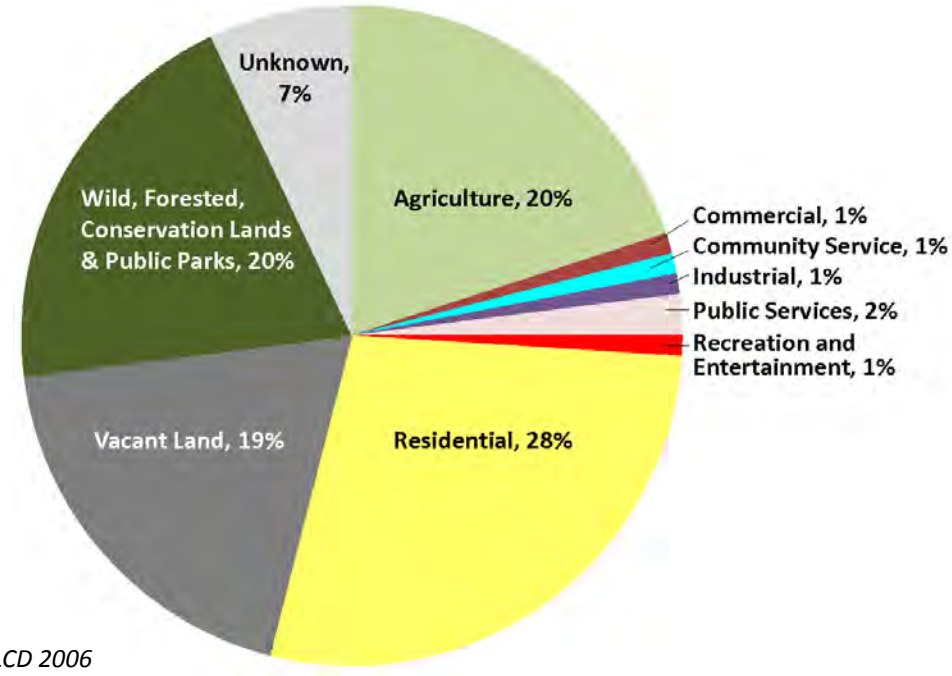
Source: NLCD 2006

Figure 2-1
Distribution of Land Cover, Mohawk River Watershed



Source: NLCD 2006

Figure 2-2
Distribution of Land Use, Mohawk River Watershed



Source: NLCD 2006

TABLE 2-4
Summary of the Main Land Use Types for the Entire Watershed, and Comparison by Region (Upper Mohawk, Main River, and Schoharie Watershed)

Land Use Type	Total Watershed (%)	Upper Mohawk (%)	Main River (%)	Schoharie Watershed (%)
Wild, Forested, Conservation	20	24	18	17
Agriculture	20	23	22	13
Residential	28	24	29	34
Vacant	19	17	17	25
Unknown	7	6	6	7
Misc. (commercial, industrial, recreation)	6	6	5	4

Source: NLCD 2006

2.5 Potential Sources of Pollution

There are many point sources of pollution in the basin (point sources refer to discharges that originate from a single, identifiable sources such as a regulated wastewater discharge). There are also areas of known contamination such as brownfield sites at former manufacturing facilities (Map 2-20). Superfund sites, of which there are a few, are highly contaminated areas that have been identified by USEPA as requiring remediation.

2.5.1 Municipal Wastewater Treatment Plants

Most of the point sources of pollution discharging to waterways within the Mohawk basin are the regulated discharges of municipal wastewater treatment facilities. These facilities operate with a State Pollution Discharge Elimination System (SPDES) permit from NYSDEC. While these are legally permitted discharges of treated effluent, they are not pollutant free. The pollutant discharges have regulatory limits; these limits typically include maximum load and/or concentrations of Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS). These discharges also contain the nutrients nitrogen and phosphorus, which can cause algal blooms; phosphorus is of most concern in impounded waters. There are 82 municipal wastewater treatment facilities in the watershed. The distribution of the facilities by region is as follows: Upper Mohawk, 25; Main River, 37; Schoharie Watershed, 20.

2.5.2 Stormwater Outfalls (MS4s)

Stormwater outfalls included in Municipal Separate Storm Sewer System (MS4) program are displayed in Map 2-18. MS4 stormwater outfalls are managed by municipalities and regulated by NYSDEC SPDES general permits in compliance with federal requirements set forth by USEPA. MS4 operators are required to implement a stormwater management program (SWMP), which includes control measures ("Six Minimum Control Measures")[7] and utilizes Best Management Practices (BMPs).

The two main regions where these are found in the Mohawk River Watershed are the Greater Utica area in the west and the Greater Schenectady area in the east. In addition, there are MS4 communities in Albany and Saratoga Counties and in smaller cities throughout the watershed. Activities underway in Schenectady and Utica to manage stormwater and reduce this nonpoint source of pollution are described below.

[7] USEPA. 2014. Small MS4 Stormwater Program Requirements. Available at http://water.epa.gov/polwaste/npdes/stormwater/Small-MS4-Stormwater-Program-Requirements.cfm

The Schenectady County Water Quality Coordinating Committee manages the MS4 program for the Greater Schenectady area. All the MS4 municipalities have completed outfall mapping and have upgraded local ordinances to address stormwater regulations. In addition, the Schenectady County Soil and Water Conservation District has provided training to DPW crews and local contractors to control erosion and sediment loss due to stormwater runoff from roadways and construction sites.

For the Greater Utica area, the City of Utica and most of the surrounding towns and villages have been designated as MS4s. With support from the Oneida Soil and Water Conservation District (OSWCD) and the Herkimer Oneida Counties Comprehensive Planning Program (HOCCPP), the MS4 municipalities have implemented the Six Minimum Control Measures. Additional support from OSWCD and HOCCPP includes contractor training for Erosion and Sedimentation Control, writing annual reports, system mapping, managing web-based SWMPs, and implementing green infrastructure projects.

2.5.3 Combined Sewer Overflows

There are limited portions of the Mohawk River watershed served by combined (sanitary/storm) sewers. Combined sewers transmit sanitary wastewater from residences and businesses as well as stormwater in a single pipe. Characteristic of older cities, the combined sewers include relief points (combined sewer overflows, CSOs) to direct the mixture of wastewater and stormwater into waterways when the capacity of the pipes is exceeded. Some CSOs will activate more than 50 times each year; the number of overflows varies with the pattern of rainfall and the pipe capacity. This mixture of untreated wastewater and stormwater can contain elevated concentration of contaminants such as bacteria, nutrients, solids, and oxygen-demanding materials. The NYSDEC requires CSO communities to file annual reports on progress toward remediation. Each CSO outfall is marked by signage.

The NYSDEC maintains a Combined Sewer Overflow map on their website showing locations of CSOs within the state. From this map, it is evident that the highest numbers of CSO discharges to the Mohawk are within the City of Utica, with 47 CSOs. Several developed areas served by the Oneida Wastewater Treatment Plant have CSO outfalls to the river, as do Amsterdam, Schenectady, Waterford and Cohoes. There are no CSOs discharging to Schoharie Creek. NYSDEC is actively working with communities to abate CSOs.

2.5.4 Runoff from Developed Areas

Trends in residential and commercial development vary among areas within the watershed, and such development can significantly affect water quality. As indicated by the number of building permits issued over the past 20 years (**Map 2-21**), development appears to be highest in three principal areas: in the east in the Greater Capital District, in the west in the Utica/Rome area, and in the south in the Catskill towns of Windham and Cairo. The watershed municipalities exhibiting the highest growth pressure between 1990 and 2010 are listed in **Table 2-5**.

TABLE 2-5
Mohawk River Watershed Municipalities Exhibiting the Highest Growth Pressure

Sub-basin	High Growth Pressure Communities
Upper Mohawk	New Hartford, Whitestown, Westmoreland, Marcy
Main River	Colonie, Clifton Park, Niskayuna, Halfmoon, Amsterdam
Schoharie Watershed	Windham, Cairo, Durham, Hunter

Developed areas in the watershed typically have many impervious surfaces resulting from roads, sidewalks, driveways, and building rooftops. Because they impede infiltration, impervious surfaces result in increased runoff

to waterbodies, and this runoff carries automotive pollutants from roads and fertilizers and pesticides from lawns. Traveling west to east through the lowlands along the main stem of the river, areas with high percentages of impervious surfaces include the developed areas of Utica/Rome, Ilion/Mohawk/Herkimer, Little Falls, St. Johnsville, Fort Plan/Nelliston, Canajoharie/Palatine Bridge, Fultonville/Fonda, Johnstown/Gloversville, Amsterdam, and Schenectady/Greater Albany (**Map 2-22**). However, the older villages and cities in the watershed were developed in a more compact fashion than the newer developed areas in the suburbs of Schenectady/Greater Albany, and therefore have less impervious surfaces per capita than these newer, more sprawling areas.

2.5.5 Runoff from Agricultural Areas

Not surprisingly, agricultural land use is highest in the lowlands of the Upper Mohawk and Main River regions, where the prime farmland soils are located (**Map 2-23**). Agricultural land use has a high potential for a negative impact on water quality in nearby streams and lakes due to nonpoint source pollution from sediment and nutrient loading. The Water Quality assessment map (**Map 2-24**) reinforces this, with low to medium scores for the 10-digit HUC subwatersheds located in the Mohawk River lowlands.

2.6 Surface Water Quality Conditions and Compliance with Ambient Standards

The NYSDEC assigns water-quality classifications according to their designated best use, as displayed on **Map 2-25**. The current classifications indicate that the majority of streams should be suitable for fishing or fish propagation (displayed as green segments on the map) or for drinking water (displayed as blue segments on the map). Drinking water supplies from wellheads and from lakes and reservoirs are shown in Map 2-25, and the major aquifers in **Map 2-26**. The NYSDEC inventories all NYS waterbodies to evaluate the extent to which water quality and habitat conditions support these designated uses and reports the Waterbody Inventory/Priority Waterbodies List (WI/PWL). When the current water quality and/or habitat conditions are not adequate to support the designated use, the waterbodies are placed on the Priority Waterbodies List portion of the WI/PWL, and NYSDEC and local partners work to identify effective actions to improve these waterways.

2.6.1 Impaired Waterbodies

The status of waterbody assessments from the 2010 WI/PWL is illustrated in **Map 2-27**, with the waterbodies color-coded according to the assessment category. The streams mapped using darker colors are considered to exhibit varying degrees of water quality impairment, while those that are colored yellow or light gray on the map either have “no known impacts” or are unassessed. Using the Interactive Mapping Tool for the Mohawk River Watershed, one can click on an impaired stream segment to see what uses are affected and to what degree. The primary water quality use affected in the Mohawk River lowlands is aquatic life, due primarily to runoff and pollution from agricultural lands. In the Adirondacks, aquatic life in streams is precluded due to acid rain, whereas in the Catskills, the aquatic habitat may be stressed due to changes in hydrology leading to stream bank erosion and silt and sediment deposition.

About one-third (2,340 miles) of the more than 6,600 river miles in the Mohawk River Basin are included on the 2010 PWL as either not supporting uses or having minor impacts or threats to water quality. Most (79%) of these PWL-designated river miles are considered Stressed or Threatened; these waters fully support designated uses but exhibit declining water quality and/or aquatic habitat conditions. Only about 7% of all basin river miles are designated as Impaired, signifying that the waters do not fully support their designated uses.

Twenty-seven (27) of the 136 separate lake segments in the basin are included on the PWL as having either impaired uses or minor impacts/threats to uses. These impaired/impacted lakes represent nearly one-half (47%) of

the total lake acres in the basin. Impairments to two of the four largest reservoirs in the basin (Delta Reservoir and Schoharie Reservoir) account for over 3,500 impaired acres, or 58% of the total impaired lake acres in the basin where fish consumption, recreational uses, and/or aquatic life are not fully supported.

The most frequently cited sources of impacts affecting water quality in the basin are atmospheric deposition, agricultural activities, habitat/hydrologic modification, and streambank erosion. These sources, along with urban/storm runoff, toxic/contaminated sediments, CSOs, and municipal and industrial discharges, are responsible for the water quality impairment that occurs in the basin. The wide range of sources reflects the diverse nature of the basin, which includes older urban centers, extensive farming areas, and remote forested lands.

2.6.2 Sensitive Areas

While one goal of a functional watershed management plan is to restore degraded areas of the watershed to healthy status, another equally important goal is to protect areas that are pristine or nondegraded. The impaired watershed areas, shown in dark colors in Map 2-24, are examples of places that need restoration. Others, shown in light color, may have been assessed and appear not to be degraded, but some of these have not been assessed.

Some areas in the watershed are more vulnerable than others to ecological degradation by poor management (refer to Map 2-14) and require protection by the implementation of management practices appropriate for the nature of their vulnerability. It is important to note that these areas may provide essential ecosystem services—wetlands providing a buffer against flooding, woodlands buffering waterbodies from runoff, vegetative cover stabilizing steep slopes prone to erosion—that may be impossible or costly to replicate.

2.7 Groundwater Quality Conditions and Compliance with Ambient Standards

Just as the NYSDEC is committed to periodically evaluating surface water quality conditions throughout the state, they collaborate with the USGS on a program to evaluate groundwater quality in New York's major river basins on a rotating basis. This program parallels the Rotating Intensive Basin Study program and helps NYSDEC comply with the federal requirement to report on the chemical quality of groundwater. The groundwater quality assessment program began in 2002 with a pilot study in the Mohawk River Basin and has continued throughout upstate New York ever since. The most recent round of testing of groundwater quality in the Mohawk River basin was completed in 2011. The summary of the USGS report on Mohawk River basin conditions in 2011 is excerpted below:

> "Groundwater samples were collected during July 2011 from 21 wells in the Mohawk River Basin to characterize the groundwater quality. Sample collection and analysis followed standard USGS procedures and other documented procedures. Samples were analyzed for physical properties and concentrations of dissolved gases, major ions, nutrients, trace elements, pesticides, volatile organic compounds (VOCs), radionuclides, and bacteria. Many of the 148 constituents analyzed for were not detected in any of the samples.
>
> The depths of sand and gravel wells sampled in the Mohawk River Basin range from 28 to 395 ft. below land surface; the bedrock wells are 120 to 815 ft. deep and typically are completed in shale, sandstone, or carbonate bedrock. Ten of the 21 wells sampled are production wells; 11 are domestic wells. The samples generally indicated good water quality, although properties and concentrations of some constituents—color, pH, sodium, chloride, sulfate, dissolved solids, aluminum, iron, manganese, radon-222, and bacteria—equaled or exceeded primary, secondary, or proposed drinking-water standards. The constituents most frequently detected in concentrations exceeding drinking-water standards were radon-222 (10 samples had

concentrations equal to or greater than the U.S. Environmental Protection Agency (USEPA) proposed maximum contaminant level (MCL) of 300 picocuries per liter (pCi/L)), sodium (9 samples had concentrations greater than the USEPA Drinking Water Taste Advisory of 60 milligrams per liter (mg/L)), iron (8 unfiltered samples had concentrations greater than the New York State Department of Health MCL and USEPA secondary drinking-water standard (SDWS) of 300 micrograms per liter (µg/L)), dissolved solids (7 samples had concentrations greater than the USEPA SDWS of 500 mg/L), manganese (6 unfiltered samples had concentrations greater than the USEPA SDWS of 50 µg/L), and coliform bacteria (5 samples had detections).

Sample pH was typically near neutral or slightly basic. Methane was detected in 15 of the 21 samples; 2 samples had methane concentrations greater than 28 mg/L. The water typically was very hard, and the median dissolved solids concentration was 436 mg/L. The ions detected in the highest median concentrations were bicarbonate, chloride, calcium, and sodium. The dominant nutrient was nitrate; concentrations of nitrate and nitrite did not exceed established drinking-water standards. Strontium was the trace element with the highest median concentrations; some samples had moderately high (greater than 10,000 µg/L) concentrations of strontium or iron. Four pesticides and pesticide degradates were detected in four samples from sand and gravel wells; all were trace-level detections of broadleaf herbicides or their degradates. Three VOCs were detected in four samples, including chloroform, tetrachloroethene, and toluene. Radon-222 activities in 10 samples exceeded a proposed MCL, but none exceeded the proposed AMCL. Coliform bacteria were detected in five samples. Fecal coliform and *Escherichia coli* bacteria were detected in one sample each."[8]

2.8 Regulatory and Programmatic Environment

In response to effective outreach by county and regional planning agencies, NYSDOS, and others, many New York watershed municipalities have reviewed and updated facets of their local laws related to impervious surfaces, site plan reviews, setbacks from waterways, development in floodplains, and erosion and sedimentation controls. These code modifications are designed to help minimize the potential adverse water quality impacts of land development activities. Model codes and ordinances have been drafted to help bring municipal comprehensive plans and zoning and subdivision ordinances into alignment with best practices for controlling nonpoint source pollution. In the Mohawk River basin, there are significant differences among municipalities with respect to local laws that govern land use. Since New York is a "home rule" state, zoning and subdivision laws and other local codes must be revised at the municipal level. This can be an extended process that requires commitment and public support. Moreover, the majority of the municipalities within the watershed are not regulated MS4s and therefore are not compelled to implement the same programmatic and regulatory standards as those falling under the MS4 regulations.

2.8.1 Approach to Reviewing Local Laws, Plans, and Programs

For the Mohawk River Watershed Management Plan, the Coalition worked with a consultant (Bergmann Associates) to compile and review the local laws of the watershed municipalities and evaluate their effectiveness in protecting water quality and habitat from point- and nonpoint-source pollution. The NYSDOS assessment tool was used as a foundation for this analysis, although, because of the large number of municipalities in the watershed and because of time constraints, the assessment tool was rigorously applied to only ten of the most

[8] Nystrom, E.A., and Scott, T. 2013. *Groundwater Quality in the Mohawk River Basin, New York, 2011.* U.S. Geological Survey Open-File Report 2013-1021, 43 p. Available at http://pubs.usgs.gov/of/2013/1021/.

developed municipalities in the watershed. The resulting product is the *Mohawk River Watershed Regulatory Review & Analysis,*[9] which evaluates the current regulatory environment in watershed municipalities with respect to water quality and identifies improvements to local codes that would address water quality impacts from land development activities more effectively.

A wide range of municipal documents and programs were included in the regulatory review. These documents can generally be grouped into one of the following three categories:

- Comprehensive Plans/Land Use Plans/Rural Development Plans;
- Zoning, Site Plan Review and Subdivision Regulations; and
- Stormwater and Erosion Control Programs.

The report also includes a review of state and federal legislation, focusing on the existing roles and responsibilities of state and federal agencies, regulations, and programs as they affect point and nonpoint source pollution.

2.8.2 Findings: Comprehensive Plans

Comprehensive plans and other area-wide land use planning documents provide an overall framework for future public and private investment and decision making in a given municipality. By articulating an overall vision and the means to achieve the objectives identified by the community, comprehensive plans help to shape the physical, social, and economic character of the community. Where communities have adopted zoning regulations, the comprehensive plan forms the basis for those regulations. As such, comprehensive plans and other area-wide land use planning documents can play a pivotal role in protecting and preserving water quality.

Based on the results of the regulatory review and analysis, 76% of municipalities in the Mohawk River watershed have, or are currently preparing a Comprehensive Plan or other area-wide land use planning document.

2.8.3 Findings: Zoning, Subdivision Regulations, and Site Plan Review

Zoning, subdivision regulations, and site plan review are three of the primary means by which communities implement their comprehensive plans and ensure that development occurs in the desired manner. As such, communities often use various combinations of these regulatory tools to address the environmental and ecological impacts of land development, including impacts to water quality.

Based on the review of available regulatory documents, 81% of all watershed municipalities have enacted zoning legislation, 77% have enacted subdivision regulations, and 65% have enacted site plan review legislation. Ten percent of the watershed municipalities have enacted none of the aforementioned ordinances.

It is important to note that even though most communities in the watershed have adopted land use codes, many of these codes (and the comprehensive plans on which they are based) are outdated and do not adequately address water quality issues. For example, most codes require overly wide standards for residential streets in new subdivisions and oversized parking requirements for commercial development. Moreover, the majority of watershed zoning codes allows low-density, large-lot residential development throughout wide areas of these communities.

[9] Bergmann Associates. 2014 (January). *Mohawk River Watershed Regulatory Review & Analysis*. Prepared for the Mohawk River Watershed Coalition of Conservation Districts. Link to Executive Summary or Full Report.

2.8.4 Findings: Stormwater and Erosion Control Programs

The purpose of stormwater and erosion control programs is to ensure that increased runoff, erosion and sedimentation that typically results from land development activities does not negatively affect surrounding land uses and impact water quality. As part of the National Pollutant Discharge Elimination System (NPDES) Stormwater Phase II Program, permits are now required for stormwater discharges from Municipal Separate Storm Sewer Systems in urbanized areas and for construction activities disturbing one or more acres. The MS4 classification includes municipally owned storm sewer systems (e.g., underground pipes, roads with drainage systems, gutters and ditches), state departments of transportation, public universities, local sewer districts, public hospitals, military bases and prisons. In the Mohawk River Watershed, 35 municipalities have been designated as MS4s (see section 5.1.2 of the full *Mohawk River Watershed Regulatory Review & Analysis* for the complete list of MS4 communities in the watershed).

As part of this program, MS4s are required to develop, implement, and enforce a stormwater management program that includes six minimum control measures and identifies measurable goals and the implement management practices to achieve those measurable goals. The six minimum measures include

1. Public Education and Outreach
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Runoff Control
5. Post-Construction Runoff Control
6. Pollution Prevention and Good Housekeeping

As noted above, only 21% of communities in the watershed are required to develop comprehensive stormwater management programs. However, 76% of all watershed municipalities include stormwater management in their regulatory program, with 39% addressing the issue at a level somewhat consistent with accepted best management practices.

2.8.5 Gap Assessment as Related to the the Desired State

Based on the results of the evaluation, most municipalities in the Mohawk River Watershed do not adequately address the comprehensive protection and preservation of water quality in their regulatory programs.

Two factors crucial to the protection and improvement of water quality that are often unaddressed by watershed communities are Impervious Surfaces and Lake/Stream Protection. Across the entire watershed, 75% of municipalities do not address impervious surfaces at any level and only 8% are consistent with best management practices. Lake/Stream Protection does not fare much better—71% of watershed municipalities do not address the issue at a level at least somewhat consistent with BMPs.

The two factors most consistently addressed in the watershed are Junkyards and Stormwater Management and Erosion Control—38% of the municipal entities address Junkyards and 39% of them address Stormwater Management and Erosion Control at levels at least somewhat consistent with BMPs.

Additional key findings from the municipal evaluations include

- 67% of municipal regulatory programs do not address development on steep slopes. Of those that do allow cluster development, only 12% are consistent with BMPs.

- 65% of municipal regulatory programs do not have provisions for cluster development. Of those that do allow cluster development, only 4% are consistent with BMPs. However, 29% of municipalities do include cluster development in their comprehensive plans.
- 65% of municipal regulatory programs do not address the environmental impacts of timber harvesting; however, 24% of watershed municipalities lack large forest stands available for harvesting.
- 58% of municipal regulatory programs do not address the environmental impacts of marinas; however, 40% of watershed municipalities do not have navigable waterways within their boundaries.
- 37% of municipal regulatory programs address the environmental impacts of junkyards at a level consistent with BMPs.
- Only 24% of municipal regulatory programs do not address stormwater management and erosion control, with 39% being at least somewhat consistent with BMPs.

The results of this analysis have been summarized for the watershed as a whole (**Table 2-6**) and for its three main regions (**Table 2-7**, **Table 2-8**, and **Table 2-9**).

TABLE 2-6
Nonpoint Sources of Pollution Addressed by Local Municipalities, Mohawk River Watershed

Factors	Percent of Municipalities in Mohawk River Watershed Addressing a Given Factor at a Particular Level					
	N	1	2	3	C	NA
Cluster Development	65%	21%	12%	4%	29%	0%
Development on Steep Slopes	67%	12%	9%	12%	20%	0%
Environmental Impacts Identified as Overarching Issue	62%	16%	10%	10%	34%	0%
Floodplain Protection	35%	50%	9%	5%	25%	0%
Impervious Surfaces	75%	11%	6%	8%	9%	0%
Junkyards	55%	6%	1%	37%	4%	0%
Lake/Stream Protection	46%	25%	9%	20%	36%	0%
Lot Coverage Requirements	31%	54%	10%	5%	1%	0%
Lot Development Standards in Agricultural or Open Space Districts	30%	36%	12%	8%	20%	15%
Marinas	58%	1%	1%	1%	0%	40%
Mining Operations	63%	5%	6%	10%	4%	14%
On-Site Wastewater	50%	22%	9%	19%	9%	0%
Stormwater Management & Erosion Control	24%	37%	14%	25%	20%	0%
Timber Harvesting	65%	5%	1%	5%	4%	24%
Unique and Other Natural Areas Protection	47%	41%	6%	4%	28%	1%
Waterfront Development Standards	51%	1%	0%	3%	3%	44%
Wetland Protection	49%	31%	10%	9%	27%	0%

*The calculation of these statistics only included those municipalities for which documents were available at the time of the review.

NA: Not applicable (e.g., a municipality with no navigable waterways would receive a "NA" score for Marinas).

N: No document or ordinance addresses this issue within a given municipality.

C: This issue is addressed in a Comprehensive Plan or other relevant planning documents. Note that communities can receive a "C," as well as a second score (e.g., "2,C") if a given topic is addressed in both the comprehensive plan and a municipal regulation.

1: This issue is addressed in an ordinance, but local guidelines are generic and/or optional; or the ordinance defers to Federal/State/County regulations.

2: This issue is addressed in an ordinance, with general local guidelines provided.

3: This issue is addressed in an ordinance, with local guidelines that are consistent with accepted Best Management Practices.

TABLE 2-7
Nonpoint Sources of Pollution Addressed by Local Municipalities, Main River Region

Factors	Percent of Municipalities in the Main River Region Addressing a Given Factor at a Particular Level					
	N	1	2	3	C	NA
Cluster Development	52%	33%	12%	6%	45%	0%
Development on Steep Slopes	64%	15%	6%	15%	24%	0%
Environmental Impacts Identified as Overarching Issue	55%	21%	15%	9%	42%	0%
Floodplain Protection	33%	52%	9%	6%	21%	0%
Impervious Surfaces	67%	18%	6%	9%	6%	0%
Junkyards	52%	9%	0%	39%	0%	0%
Lake/Stream Protection	36%	27%	9%	27%	39%	0%
Lot Coverage Requirements	30%	52%	9%	9%	0%	0%
Lot Development Standards in Agricultural or Open Space Districts	48%	27%	6%	12%	18%	9%
Marinas	91%	3%	3%	0%	0%	3%
Mining Operations	73%	0%	6%	18%	9%	3%
On-Site Wastewater	42%	18%	3%	39%	3%	0%
Stormwater Management & Erosion Control	24%	27%	15%	33%	18%	0%
Timber Harvesting	70%	0%	3%	6%	6%	21%
Unique and Other Natural Areas Protection	48%	42%	3%	6%	27%	0%
Waterfront Development Standards	64%	6%	0%	9%	3%	21%
Wetland Protection	48%	24%	9%	12%	36%	0%

*The calculation of these statistics only included those municipalities for which documents were available at the time of the review.

NA: Not applicable (e.g., a municipality with no navigable waterways would receive a "NA" score for Marinas).

N: No document or ordinance addresses this issue within a given municipality.

C: This issue is addressed in a Comprehensive Plan or other relevant planning documents. Note that communities can receive a "C," as well as a second score (e.g., "2,C") if a given topic is addressed in both the comprehensive plan and a municipal regulation.

1: This issue is addressed in an ordinance, but local guidelines are generic and/or optional; or the ordinance defers to Federal/State/County regulations.

2: This issue is addressed in an ordinance, with general local guidelines provided.

3: This issue is addressed in an ordinance, with local guidelines that are consistent with accepted Best Management Practices.

TABLE 2-8
Nonpoint Sources of Pollution Addressed by Local Municipalities, Upper Mohawk Region

Factors	Percent of Municipalities in the Upper Mohawk Region Addressing a Given Factor at a Particular Level					
	N	1	2	3	C	NA
Cluster Development	75%	16%	7%	1%	10%	0%
Development on Steep Slopes	75%	12%	9%	4%	16%	0%
Environmental Impacts Identified as Overarching Issue	67%	19%	6%	6%	28%	0%
Floodplain Protection	48%	41%	9%	3%	23%	0%
Impervious Surfaces	81%	3%	7%	7%	10%	0%
Junkyards	58%	3%	3%	36%	1%	0%
Lake/Stream Protection	48%	25%	9%	19%	32%	0%
Lot Coverage Requirements	29%	62%	7%	1%	3%	0%
Lot Development Standards in Agricultural or Open Space Districts	28%	41%	9%	4%	20%	17%
Marinas	57%	0%	0%	1%	0%	42%
Mining Operations	61%	4%	6%	7%	3%	20%
On-Site Wastewater	55%	23%	9%	13%	10%	0%
Stormwater Management & Erosion Control	30%	32%	12%	26%	13%	0%
Timber Harvesting	59%	10%	1%	1%	3%	28%
Unique and Other Natural Areas Protection	59%	30%	7%	1%	23%	1%
Waterfront Development Standards	54%	0%	0%	1%	1%	45%
Wetland Protection	59%	22%	14%	4%	23%	0%

*The calculation of these statistics only included those municipalities for which documents were available at the time of the review.

NA: Not applicable (e.g., a municipality with no navigable waterways would receive a "NA" score for Marinas).

N: No document or ordinance addresses this issue within a given municipality.

C: This issue is addressed in a Comprehensive Plan or other relevant planning documents. Note that communities can receive a "C," as well as a second score (e.g., "2,C") if a given topic is addressed in both the comprehensive plan and a municipal regulation.

1: This issue is addressed in an ordinance, but local guidelines are generic and/or optional; or the ordinance defers to Federal/State/County regulations.

2: This issue is addressed in an ordinance, with general local guidelines provided.

3: This issue is addressed in an ordinance, with local guidelines that are consistent with accepted Best Management Practices.

TABLE 2-9
Nonpoint Sources of Pollution Addressed by Local Municipalities,
Schoharie Watershed Region

Factors	Percent of Municipalities in the Schoharie Watershed Region Addressing a Given Factor at a Particular Level					
	N	1	2	3	C	NA
Cluster Development	57%	19%	19%	8%	49%	0%
Development on Steep Slopes	54%	11%	11%	24%	24%	0%
Environmental Impacts Identified as Overarching Issue	59%	5%	14%	19%	38%	0%
Floodplain Protection	14%	65%	11%	8%	32%	0%
Impervious Surfaces	70%	19%	3%	8%	8%	0%
Junkyards	54%	8%	0%	35%	14%	0%
Lake/Stream Protection	51%	24%	8%	16%	41%	0%
Lot Coverage Requirements	35%	41%	16%	8%	0%	0%
Lot Development Standards in Agricultural or Open Space Districts	19%	35%	22%	11%	22%	16%
Marinas	30%	0%	0%	0%	0%	70%
Mining Operations	59%	11%	8%	8%	3%	14%
On-Site Wastewater	46%	24%	16%	14%	11%	0%
Stormwater Management & Erosion Control	11%	57%	16%	16%	35%	0%
Timber Harvesting	70%	0%	0%	11%	5%	22%
Unique and Other Natural Areas Protection	24%	59%	8%	8%	38%	0%
Waterfront Development Standards	35%	0%	0%	0%	5%	62%
Wetland Protection	30%	54%	3%	14%	27%	0%

*The calculation of these statistics only included those municipalities for which documents were available at the time of the review.

NA: Not applicable (e.g., a municipality with no navigable waterways would receive a "NA" score for Marinas).

N: No document or ordinance addresses this issue within a given municipality.

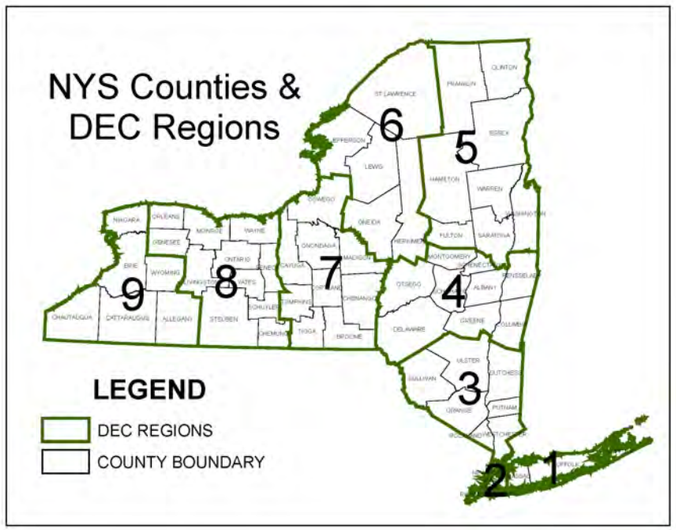
C: This issue is addressed in a Comprehensive Plan or other relevant planning documents. Note that communities can receive a "C," as well as a second score (e.g., "2,C") if a given topic is addressed in both the comprehensive plan and a municipal regulation.

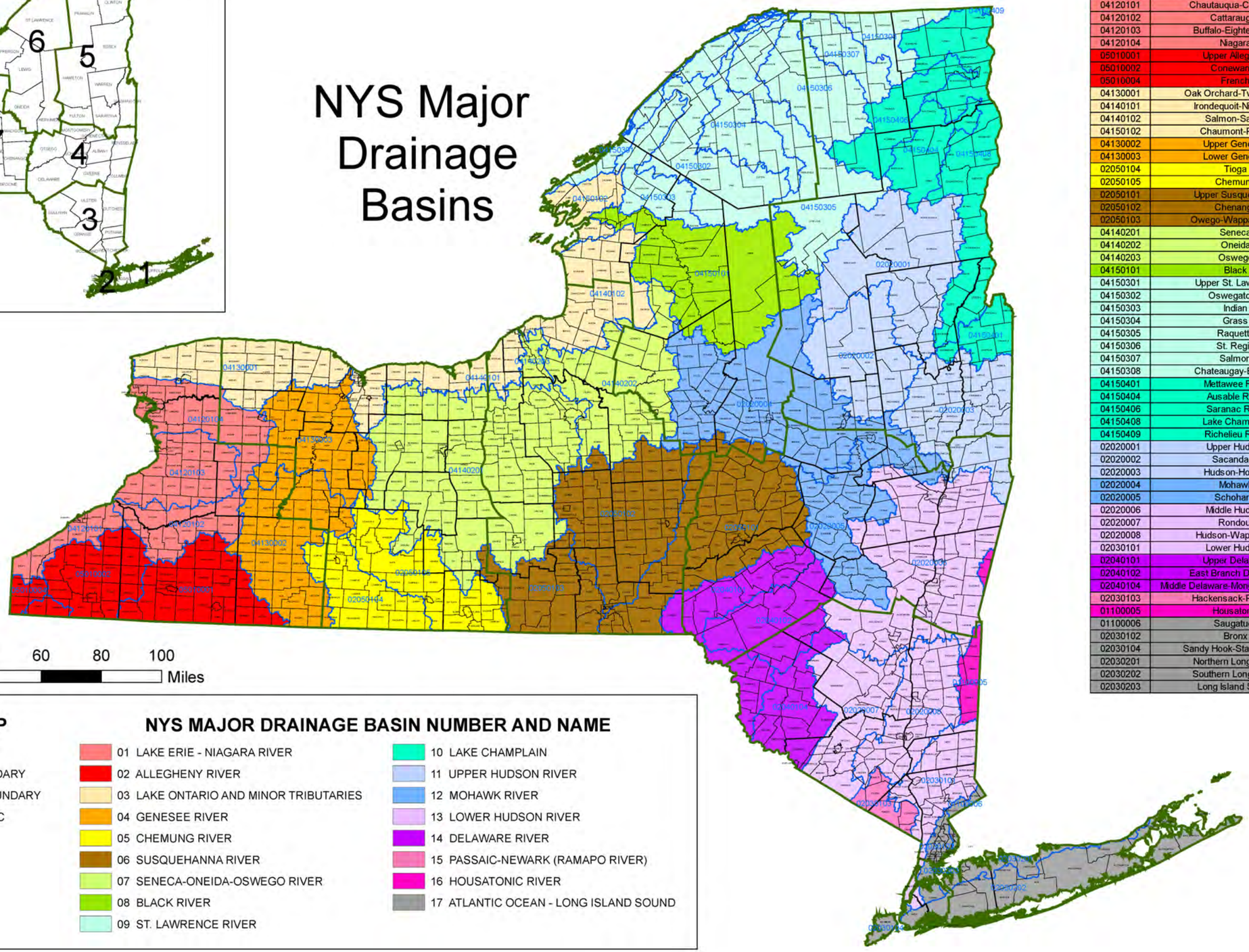
1: This issue is addressed in an ordinance, but local guidelines are generic and/or optional; or the ordinance defers to Federal/State/County regulations.

2: This issue is addressed in an ordinance, with general local guidelines provided.

3: This issue is addressed in an ordinance, with local guidelines that are consistent with accepted Best Management Practices.

NYS Major Drainage Basins





HUC 8	HYDROLOGIC UNIT NAME
04120101	Chautauqua-Conneaut
04120102	Cattaraugus
04120103	Buffalo-Eighteenmile
04120104	Niagara
05010001	Upper Allegheny
05010002	Conewango
05010004	French
04130001	Oak Orchard-Twelvemile
04140101	Irondequoit-Ninemile
04140102	Salmon-Sandy
04150102	Chaumont-Perch
04130002	Upper Genesee
04130003	Lower Genesee
02050104	Tioga
02050105	Chemung
02050101	Upper Susquehanna
02050102	Chenango
02050103	Owego-Wappasening
04140201	Seneca
04140202	Oneida
04140203	Oswego
04150101	Black
04150301	Upper St. Lawrence
04150302	Oswegatchie
04150303	Indian
04150304	Grass
04150305	Raquette
04150306	St. Regis
04150307	Salmon
04150308	Chateaugay-English
04150401	Mettawee River
04150404	Ausable River
04150406	Saranac River
04150408	Lake Champlain
04150409	Richelieu River
02020001	Upper Hudson
02020002	Sacandaga
02020003	Hudson-Hoosic
02020004	Mohawk
02020005	Schoharie
02020006	Middle Hudson
02020007	Rondout
02020008	Hudson-Wappinger
02030101	Lower Hudson
02040101	Upper Delaware
02040102	East Branch Delaware
02040104	Middle Delaware-Mongaup-Brodhead
02030103	Hackensack-Passaic
01100005	Housatonic
01100006	Saugatuck
02030102	Bronx
02030104	Sandy Hook-Staten Island
02030201	Northern Long Island
02030202	Southern Long Island
02030203	Long Island Sound

BASE MAP

- DEC REGIONS
- COUNTY BOUNDARY
- TOWN/CITY BOUNDARY
- NYS 8 DIGIT HUC

NYS MAJOR DRAINAGE BASIN NUMBER AND NAME

- 01 LAKE ERIE - NIAGARA RIVER
- 02 ALLEGHENY RIVER
- 03 LAKE ONTARIO AND MINOR TRIBUTARIES
- 04 GENESEE RIVER
- 05 CHEMUNG RIVER
- 06 SUSQUEHANNA RIVER
- 07 SENECA-ONEIDA-OSWEGO RIVER
- 08 BLACK RIVER
- 09 ST. LAWRENCE RIVER
- 10 LAKE CHAMPLAIN
- 11 UPPER HUDSON RIVER
- 12 MOHAWK RIVER
- 13 LOWER HUDSON RIVER
- 14 DELAWARE RIVER
- 15 PASSAIC-NEWARK (RAMAPO RIVER)
- 16 HOUSATONIC RIVER
- 17 ATLANTIC OCEAN - LONG ISLAND SOUND

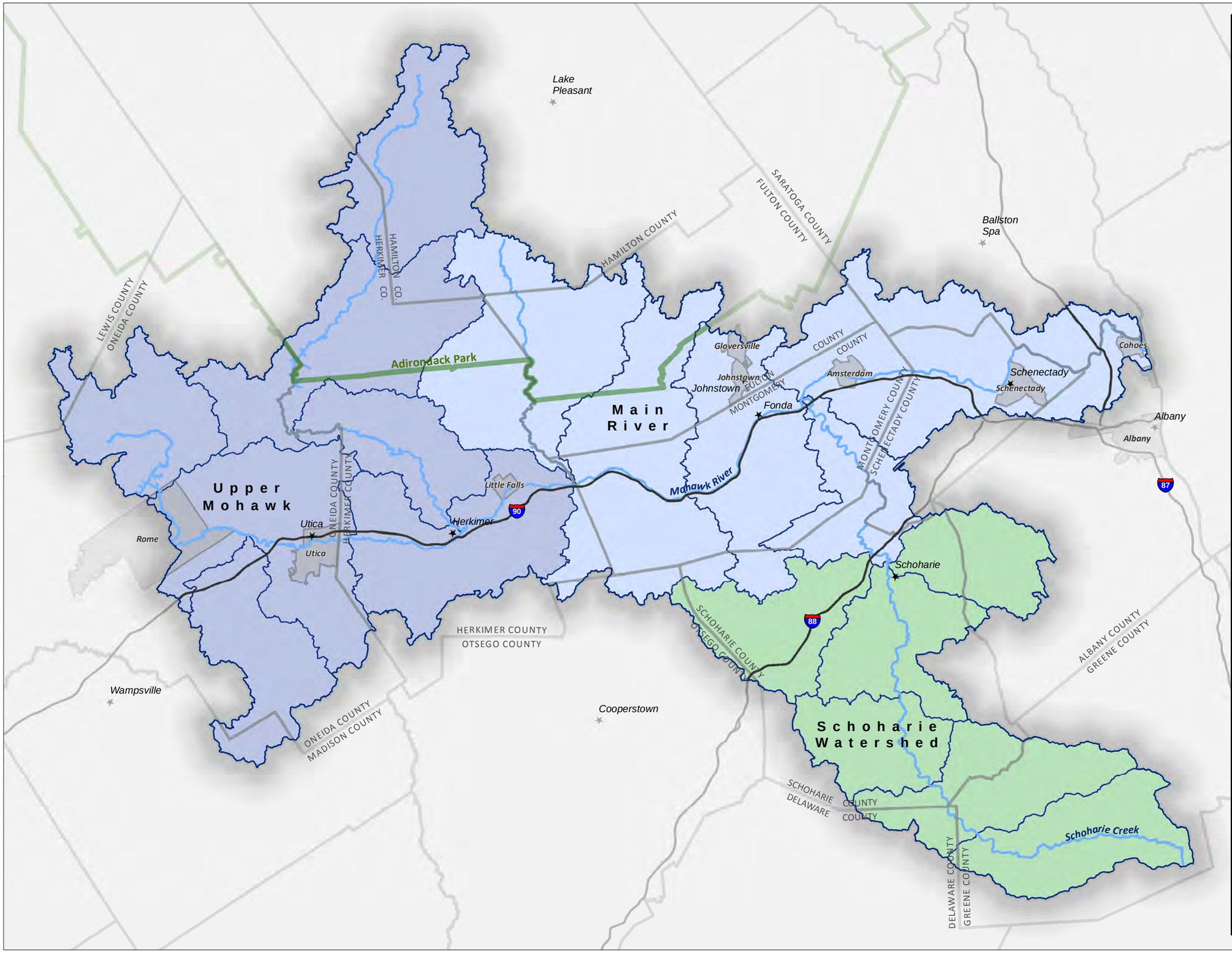
MAP 2-1

October 2012

WATERSHED

MAP 2-2

Mohawk River Watershed Management Plan



Legend

Watershed Boundaries

HUC 10 Watersheds

Regional Watersheds

- Main River
- Upper Mohawk
- Schoharie Watershed

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

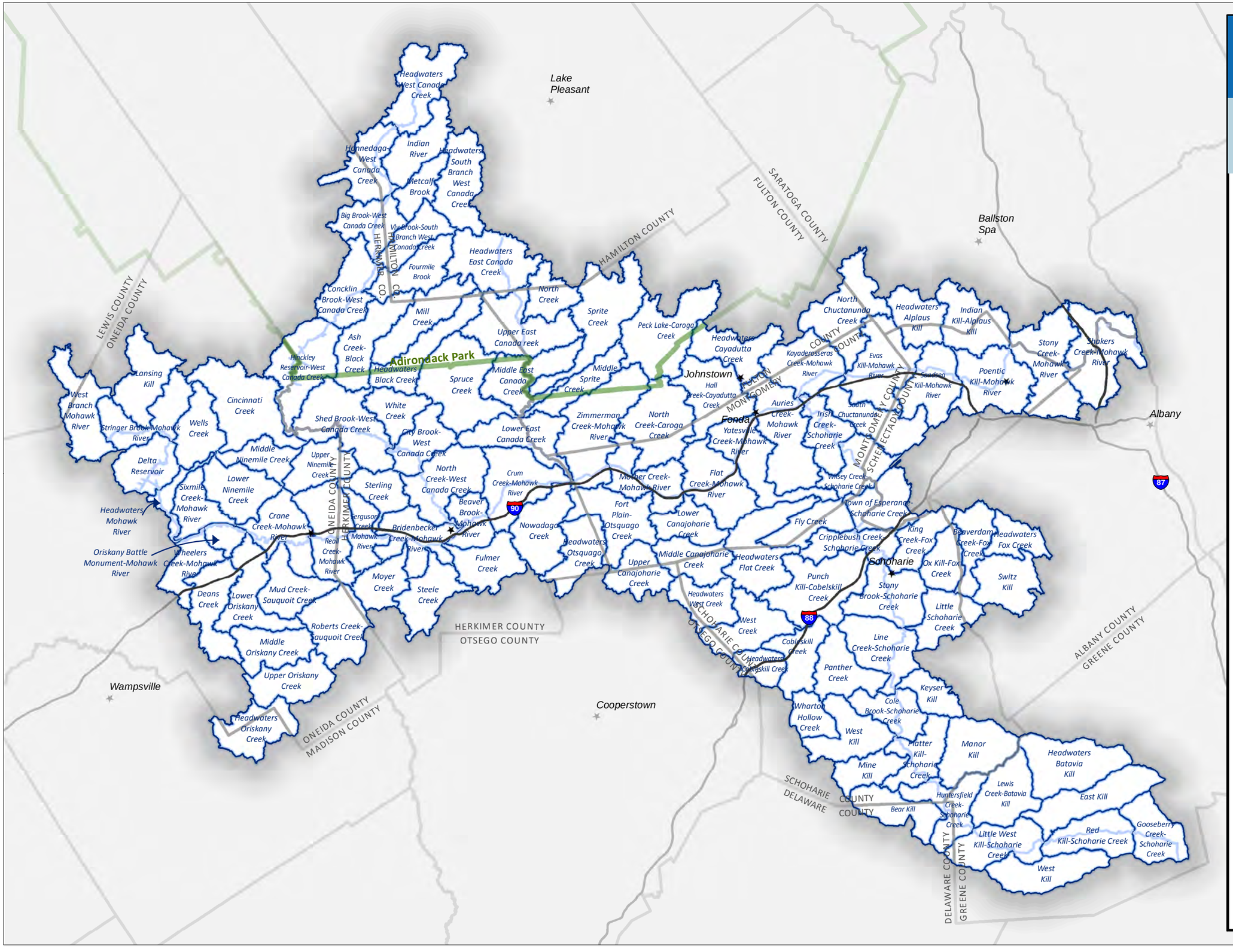
0 2.5 5 10 Miles

Sources: Watershed Boundaries and Regions: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC



SUBWATERSHEDS (HUC 12)

MAP 2-3

Mohawk River Watershed Management Plan

Legend

Watershed Boundaries

HUC 12

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

ELEVATION

MAP 2-4

Mohawk River Watershed Management Plan

Legend

Elevation

Feet AMSL

High : 4,046

Low : 6

Lake Pleasant
Ballston Spa
Johnstown
Fonda
Schenectady
Albany
Utica
Herkimer
Schoharie
Wampsville
Cooperstown

HAMILTON COUNTY
SARATOGA COUNTY
FULTON COUNTY
LEWIS COUNTY
ONEIDA COUNTY
HERKIMER CO.
HAMILTON CO.
Adirondack Park
FULTON COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
Mohawk River
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ALBANY COUNTY
GREENE COUNTY
ONEIDA COUNTY
MADISON COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
Schoharie Creek
DELAWARE COUNTY
GREENE COUNTY

87
90
88

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA, Elevation: USGS NED (Seamless).

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

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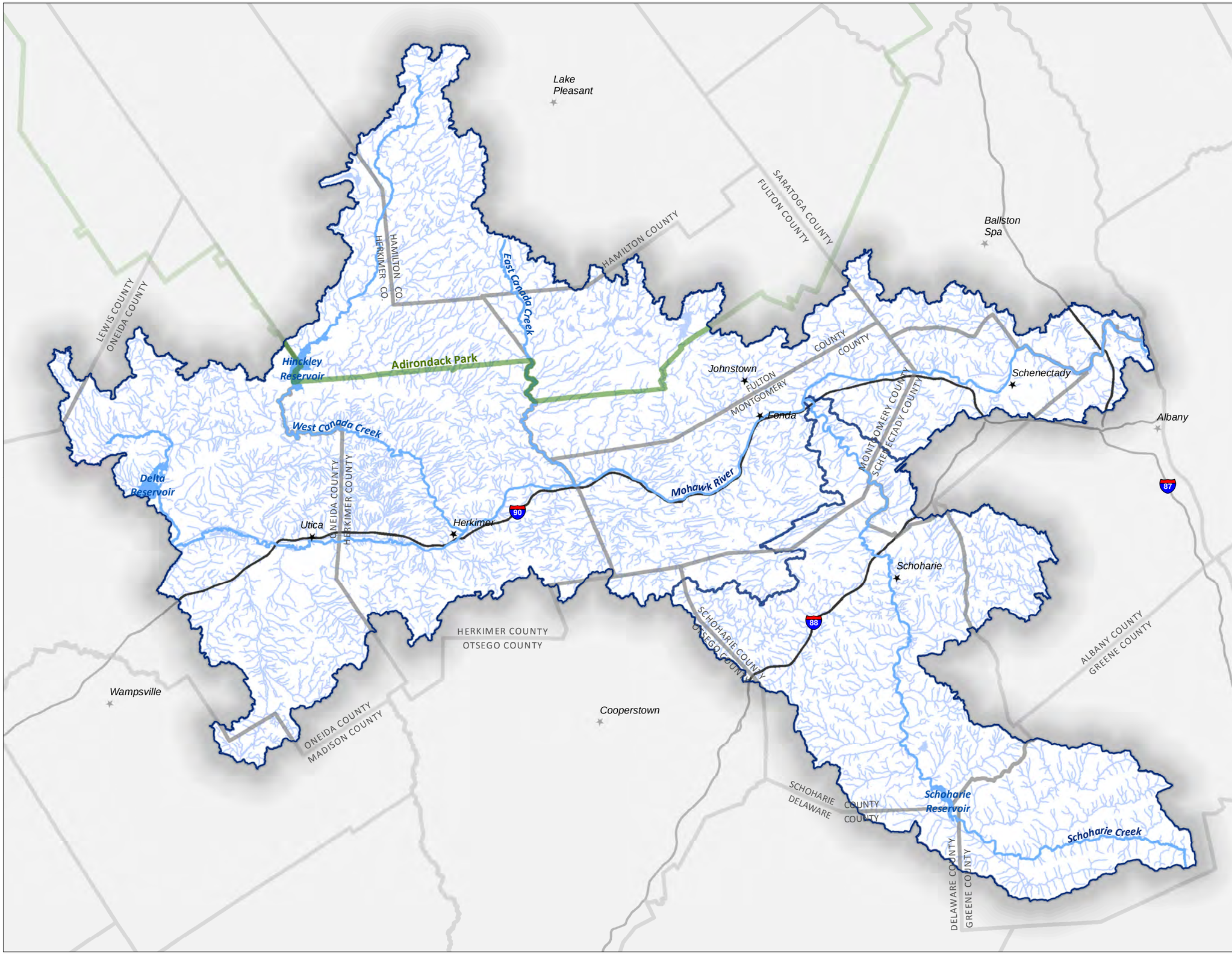

HYDROGRAPHY

MAP 2-5

Mohawk River Watershed Management Plan

Legend

- NHD Flowline / Line
- NHD Area / Waterbody

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA.

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Developed By:

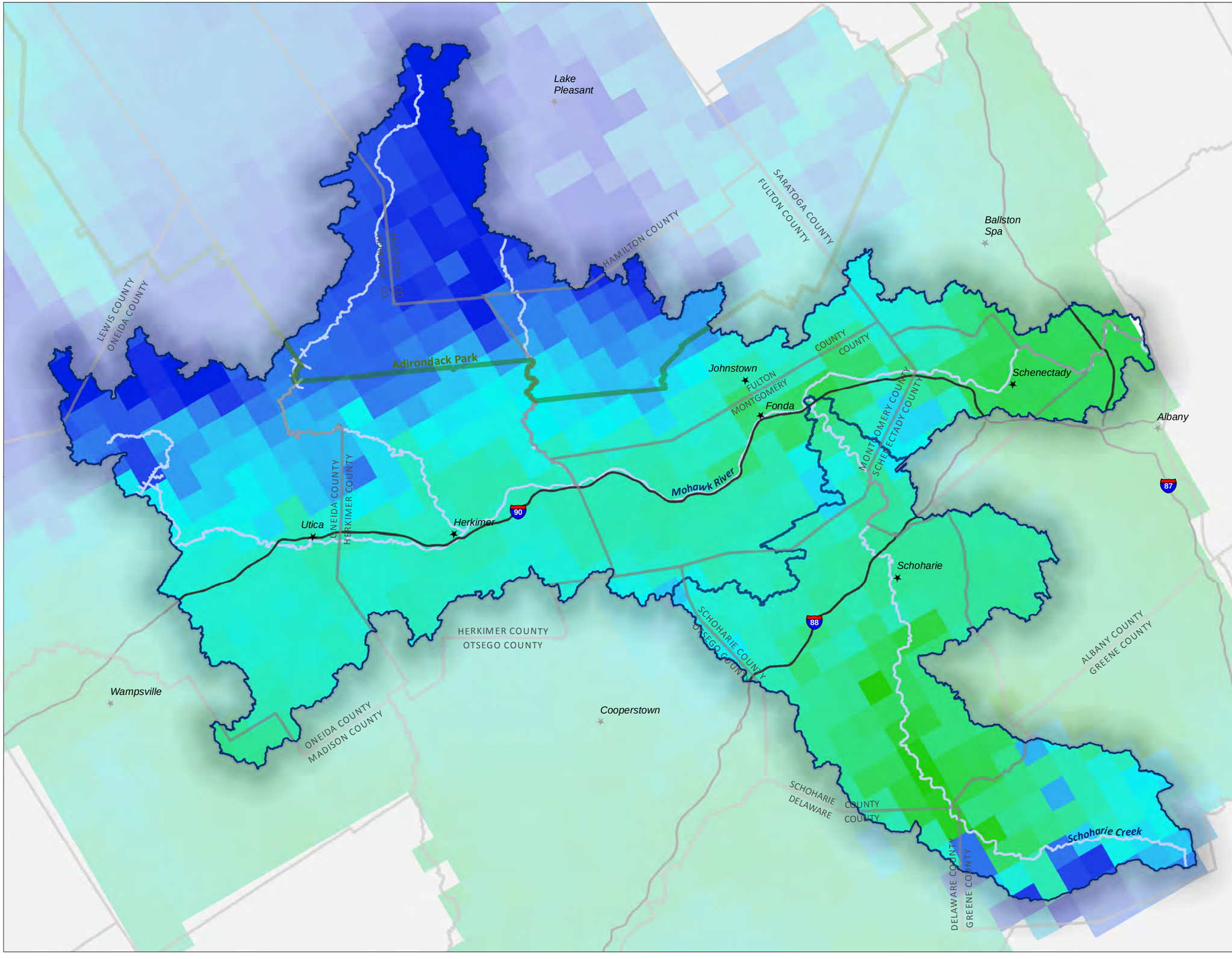
MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

STONE ENVIRONMENTAL INC

AVERAGE ANNUAL PRECIPITATION

MAP 2-6

Mohawk River Watershed Management Plan



Legend

Projected Precipitation

mm x 100

High : 180,296

Low : 84,507

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Average Annual Precipitation: PRISM 1971 - 2000 and 1961 - 1990.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

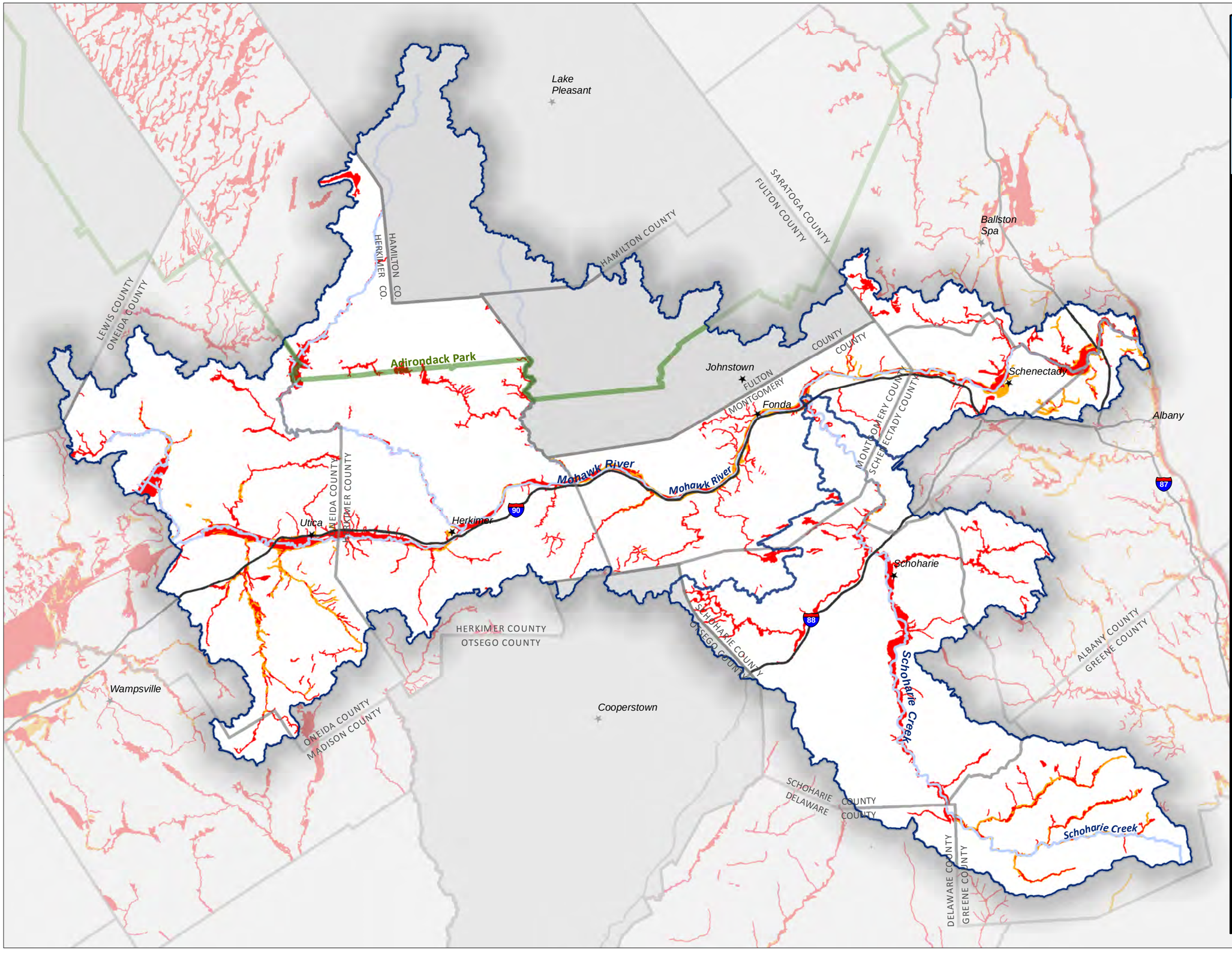
Developed By:

STONE ENVIRONMENTAL INC

FEMA FLOOD ZONE BOUNDARIES

MAP 2-7

Mohawk River Watershed Management Plan



Legend

Flood Zone

- 100-Year
- 500-Year
- No FEMA Data Available

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Flood Zones, derived from Flood Insurance Rate Maps published by FEMA. Montgomery flood data is preliminary data and has not yet been approved. Flood data not available for Hamilton, Fulton, Otsego, and Lewis Counties.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

SURFICIAL GEOLOGY

MAP 2-8

Mohawk River Watershed Management Plan

Legend

SurficialGroup

- Rock
- Sand and Gravel
- Silt and Clay
- Till

Lake Pleasant
Ballston Spa
Johnstown
Fonda
Schenectady
Albany
Utica
Herkimer
Wampsville
Cooperstown
Schoharie
Adirondack Park
Mohawk River
Schoharie Creek
LEWIS COUNTY
ONEIDA COUNTY
HERKIMER CO.
HAMILTON CO.
HAMILTON COUNTY
FULTON COUNTY
SARATOGA COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
ALBANY COUNTY
GREENE COUNTY
DELAWARE COUNTY
MADISON COUNTY
87
90
88

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Surficial Geology: NYS Dept. of Education, classifications based on input from Elizabeth Nystrom.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:
STONE ENVIRONMENTAL INC

BEDROCK GEOLOGY

MAP 2-9

Mohawk River Watershed Management Plan

Lake Pleasant
Ballston Spa
Gloversville
Johnstown
Amsterdam
Fonda
Clifton Park
Cohoes
Schenectady
Rotterdam
Albany
Utica
Rome
Herkimer
Wampsville
Cooperstown
Schoharie

HAMILTON COUNTY
HERKIMER CO.
FULTON COUNTY
SARATOGA COUNTY
LEWIS COUNTY
ONEIDA COUNTY
Adirondack Park
FULTON COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ALBANY COUNTY
GREENE COUNTY
ONEIDA COUNTY
MADISON COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY

Legend

Bedrock Groups

- Black Shale
- Carbonates
- Crystalline
- Glacial (bedrock type not mapped)
- Metamorphosed clastic
- Sandstone
- Shale
- Shale and Carbonates
- Shale and Sandstone
- Water

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Bedrock Geology: NYS Dept. of Education, classifications based on input from Elizabeth Nystrom.

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Developed By:

STONE ENVIRONMENTAL INC

HYDROLOGIC SOIL GROUPS

MAP 2-10

Mohawk River Watershed Management Plan

Lake Pleasant
Ballston Spa
Adirondack Park
Johnstown
Fonda
Schenectady
Albany
Utica
Herkimer
Mohawk River
Schoharie
Wampsville
Cooperstown
Schoharie Creek

HAMILTON COUNTY
FULTON COUNTY
SARATOGA COUNTY
HERKIMER CO.
LEWIS COUNTY
ONEIDA COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
ALBANY COUNTY
GREENE COUNTY
ONEIDA COUNTY
MADISON COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY

90 87 88

Legend

Hydrologic Group (SSURGO)

- Unknown or Water
- A: High Infiltration
- A/D: High Infiltration, Shallow Water Table
- B: Moderate Infiltration
- B/D: Moderate Infiltration, Shallow Water Table
- C: Slow Infiltration
- C/D: Slow Infiltration, Shallow Water Table
- D: Very Slow Infiltration
- Data Not Available

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Hydrologic Soil Groups: Stone, derived from SSURGO.

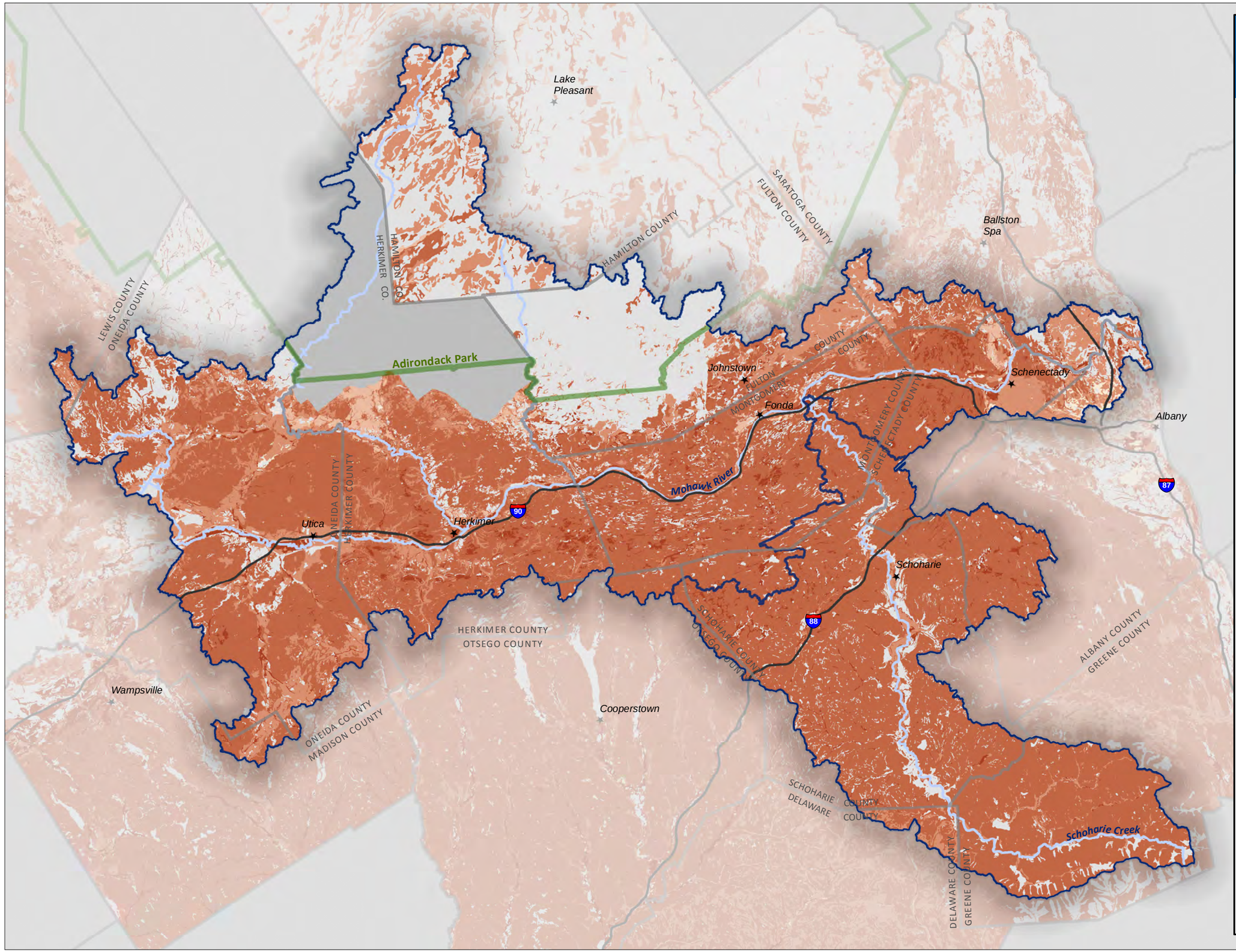
This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:
STONE ENVIRONMENTAL INC

EROSION POTENTIAL

MAP 2-11

Mohawk River Watershed Management Plan



Legend

Soil Erodibility (SSURGO)

k factor

- 0.1
- 0.11 - 0.15
- 0.16 - 0.28
- 0.29 - 0.32
- 0.33 - 0.43
- Unknown
- Data Not Available

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Erosion Potential: Stone, derived from SSURGO.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

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2006 LAND COVER

MAP 2-12

Mohawk River Watershed Management Plan

Legend

NLCD 2006

- Barren Land
- Cultivated Crops
- Deciduous Forest
- Developed, High Intensity
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Emergent Herbaceous Wetlands
- Evergreen Forest
- Hay/Pasture
- Herbaceous
- Mixed Forest
- No change
- Open Water
- Shrub/Scrub
- Woody Wetlands

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; 2006 Land Cover: National Land Cover Database, USGS.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

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NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

Lake Pleasant
Ballston Spa
Albany
Schenectady
Johnstown
Fonda
Utica
Herkimer
Schoharie
Wampsville
Cooperstown
Adirondack Park
Mohawk River
Schoharie Creek
LEWIS COUNTY
ONEIDA COUNTY
HERKIMER CO.
HAMILTON COUNTY
SARATOGA COUNTY
FULTON COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ONEIDA COUNTY
MADISON COUNTY
ALBANY COUNTY
GREENE COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY
90
88
87

ECOLOGICAL ZONES

MAP 2-13

Mohawk River Watershed Management Plan

Ecozones

- CENTRAL APPALACHIANS
- HELDERBERG HIGHLANDS
- SCHOHARIE HILLS
- CATSKILL PEAKS
- DELAWARE HILLS
- ERIE-ONTARIO PLAIN
- MOHAWK VALLEY
- CENTRAL HUDSON
- TUG HILL TRANSITION
- CENTRAL TUG HILL
- BLACK RIVER VALLEY
- WEST ADIRONDACK TRANSITION
- WEST ADIRONDACK FOOTHILLS
- K03 CENTRAL ADIRONDACKS
- EAST ADIRONDACK FOOTHILLS
- EAST ADIRONDACK TRANSITION

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Ecological Zones, NYS Department of Environmental Conservation.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

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NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

Lake Pleasant
Ballston Spa
Adirondack Park
Johnstown
Schenectady
Albany
Fonda
Mohawk River
Utica
Herkimer
Schoharie
Wampsville
Cooperstown
Schoharie Creek

HAMILTON COUNTY
HERKIMER CO.
HAMILTON CO.
LEWIS COUNTY
ONEIDA COUNTY
SARATOGA COUNTY
FULTON COUNTY
FULTON COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ALBANY COUNTY
GREENE COUNTY
ONEIDA COUNTY
MADISON COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY

90
88
87

SENSITIVE ENVIRONMENTAL AREAS

MAP 2-14

Mohawk River Watershed Management Plan

Legend

- Stream/Lake Buffer (50 ft)
- Steep Slopes >= 15%
- Wetlands
- Hydric Soils

Flood Zone

- 100-Year
- 500-Year

Primary Aquifers

- Unconfined
- Confined
- Unknown

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Wetlands: Adirondack Park Agency, within Adirondack Park and NYS Dept. of Environmental Conservation outside of Adirondack Park; Stream buffers, Stone derived from NHD; Steep Slopes, Stone derived from USGS DEM; Hydric Soils, Stone derived from SSURGO; Primary Aquifers, NYDEC; Flood Zones, published by FEMA. Montgomery flood data is preliminary data and has not yet been approved. Flood data not available for Hamilton, Fulton, Otsego, and Lewis Counties.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

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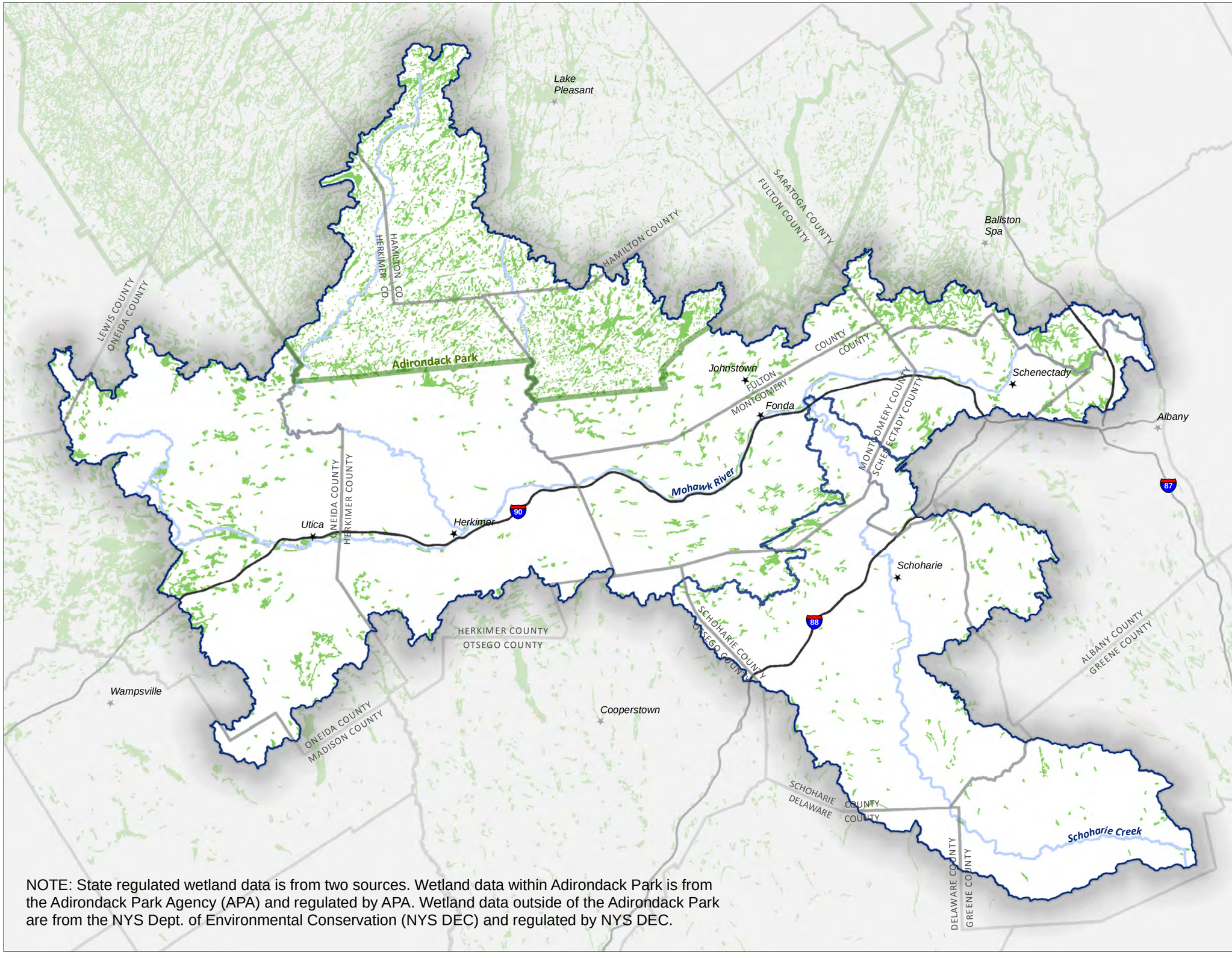
NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

Lake Pleasant
Ballston Spa
Johnstown
Fonda
Schenectady
Albany
Utica
Herkimer
Schoharie
Wampsville
Cooperstown
Adirondack Park
Mohawk River
Schoharie Creek
LEWIS COUNTY
ONEIDA COUNTY
HERKIMER CO.
HAMILTON CO.
HAMILTON COUNTY
SARATOGA COUNTY
FULTON COUNTY
FULTON COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ALBANY COUNTY
GREENE COUNTY
ONEIDA COUNTY
MADISON COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY
90
87
88



NOTE: State regulated wetland data is from two sources. Wetland data within Adirondack Park is from the Adirondack Park Agency (APA) and regulated by APA. Wetland data outside of the Adirondack Park are from the NYS Dept. of Environmental Conservation (NYS DEC) and regulated by NYS DEC.

WETLANDS

MAP 2-15

Mohawk River Watershed Management Plan

Legend

Wetlands

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

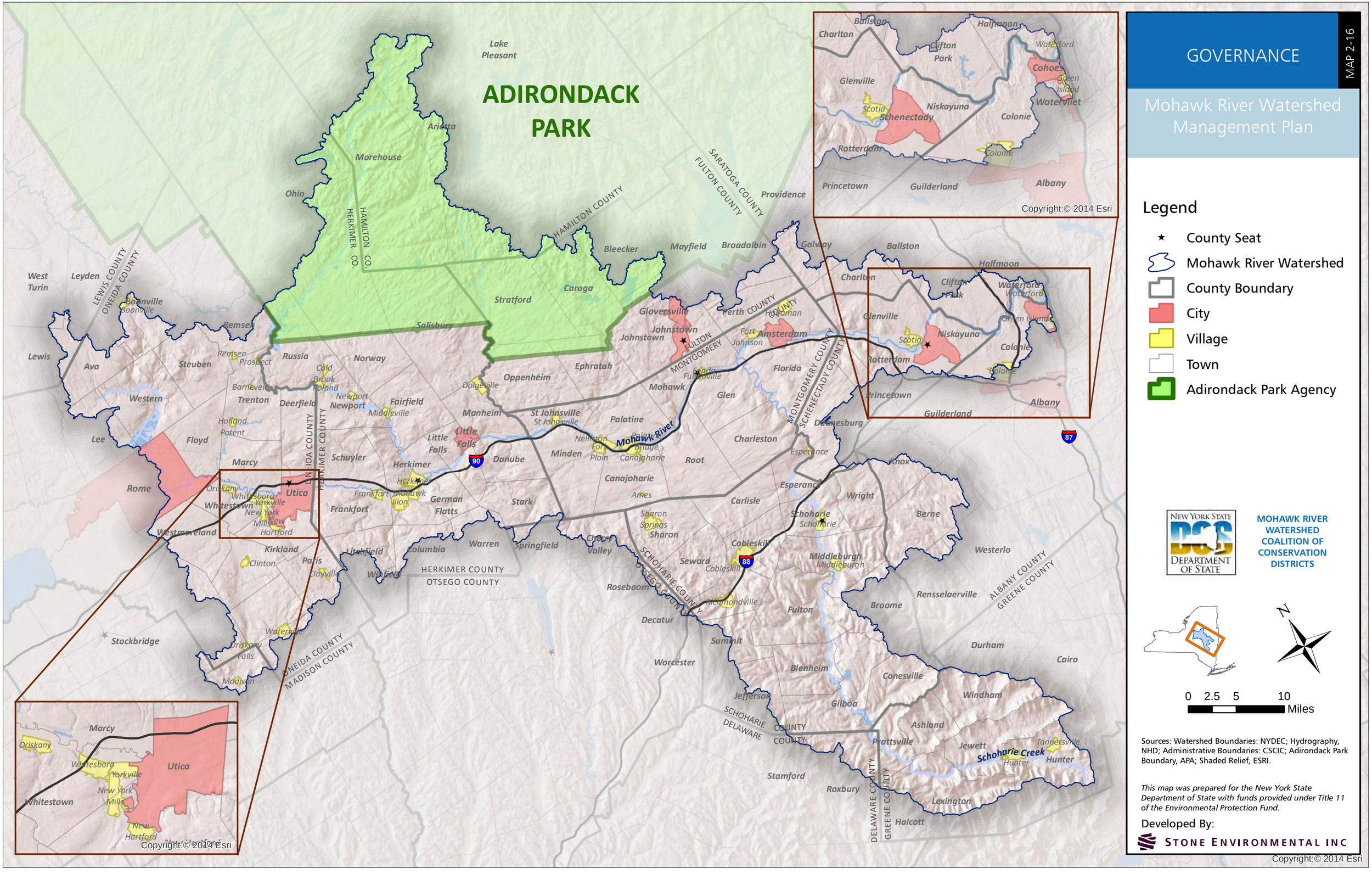
0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Wetlands: Adirondack Park Agency, within Adirondack Park and NYS DEC outside of Adirondack Park.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC



GOVERNANCE

MAP 2-16

Mohawk River Watershed Management Plan

Legend

- County Seat
- Mohawk River Watershed
- County Boundary
- City
- Village
- Town
- Adirondack Park Agency

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Shaded Relief, ESRI.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

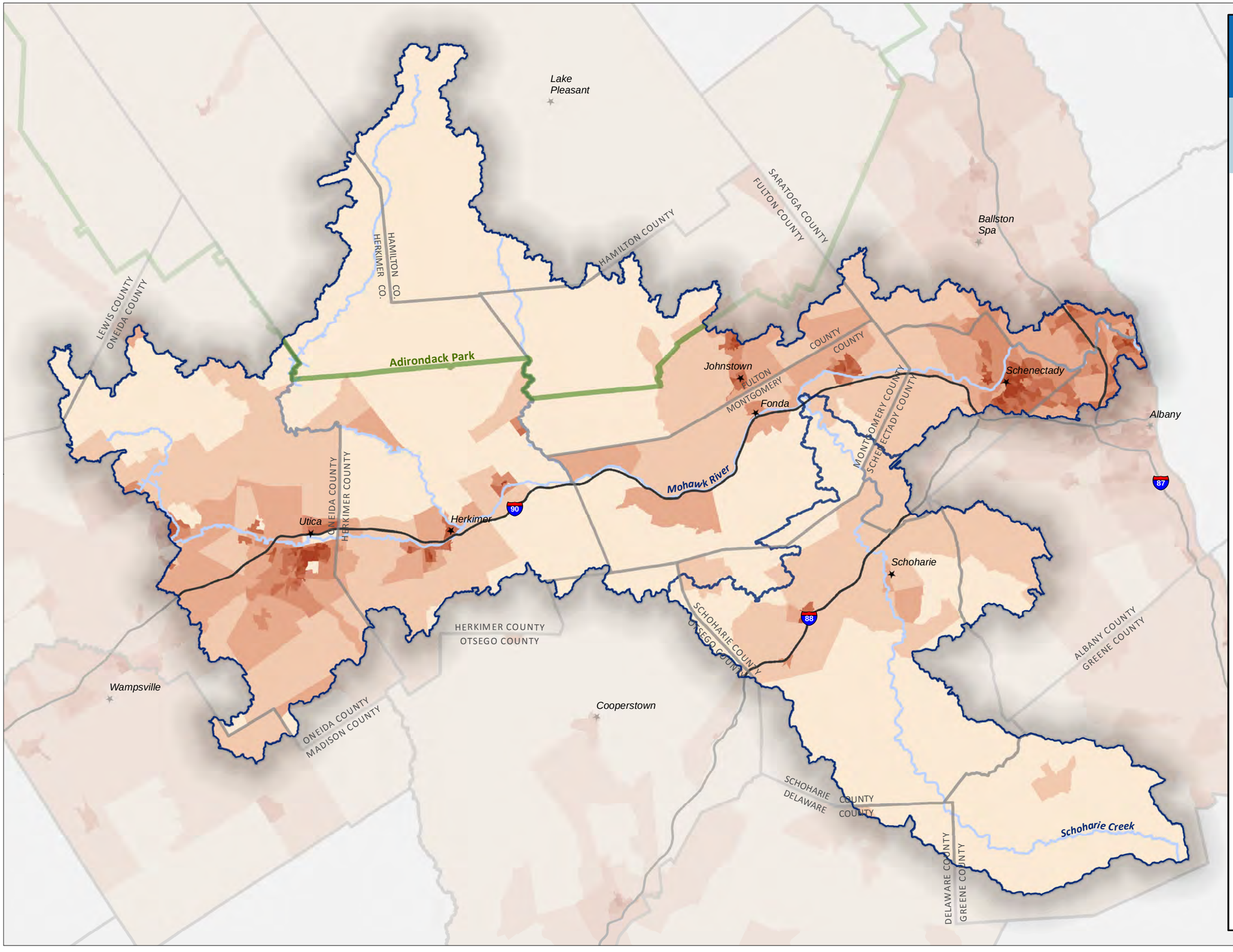
Developed By:

STONE ENVIRONMENTAL INC

2010 POPULATION DENSITY

MAP 2-17

Mohawk River Watershed Management Plan



Legend

People Per Sq. Mile by Block Group

- 0 - 50
- 51 - 125
- 126 - 500
- 501 - 1,750
- 1,751 - 3,500
- 3,501 - 7,500
- 7,501 - 30,890

NEW YORK STATE DOS DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; People Per Square Mile (2010 Block Groups), U.S. Census Bureau.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

INFRASTRUCTURE

MAP 2-18

Mohawk River Watershed Management Plan

Legend

Infrastucture

- Dam
- Bridge
- MS4 Stormwater Outfall

- Highway
- Secondary Road
- Local Road
- Ramp or Other
- Trail
- Railroad

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Roads: NYS Office of Cyber Security, ALIS; Bridges and Rail Lines: NYS Department of Transportation; Stormwater Outfalls and Dams: NYS Department of Environmental Conservation.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:
STONE ENVIRONMENTAL INC

LAND USE FROM ASSESSOR CODES

MAP 2-19

Mohawk River Watershed Management Plan

Legend

- Unknown
- Vacant Land
- Agriculture
- Wild, Forested, Conservation, Parks
- Residential
- Commercial
- Industrial
- Community Services
- Public Services
- Recreation and Entertainment

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Land Use: Stone, derived from Assessor data (Albany, Delaware, Fulton, Greene, Hamilton, Herkimer, Lewis, Madison, Montgomery, Oneida, Otsego, Saratoga, Schenectady, Schoharie Counties)

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

POLLUTION SOURCES

MAP 2-20

Mohawk River Watershed Management Plan

Legend

- Superfund Sites
- Brownfields
- Landfills
- Pollutant Discharge Sites

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; SPDES permits: NYS Dept. of Environmental Conservation (updated 10/2011; Landfills, superfund and brownfield sites: US EPA (updated 8/20/2007).

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

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Lake Pleasant
Ballston Spa
Gloversville
Johnstown
Amsterdam
Schenectady
Cohoes
Albany
Fonda
Little Falls
Herkimer
Utica
Rome
Wampsville
Cooperstown
Schoharie
Adirondack Park
Mohawk River
Schoharie Creek
LEWIS COUNTY
ONEIDA COUNTY
HAMILTON CO.
HERKIMER CO.
HAMILTON COUNTY
SARATOGA COUNTY
FULTON COUNTY
FULTON COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ALBANY COUNTY
GREENE COUNTY
ONEIDA COUNTY
MADISON COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY
90
88
87

BUILDING PERMITS 1990 - 2010

MAP 2-21

Mohawk River Watershed Management Plan

Lake Pleasant
Ballston Spa
Johnstown
Fonda
Schenectady
Albany
Utica
Herkimer
Schoharie
Wampsville
Cooperstown
Adirondack Park
Mohawk River
Schoharie Creek

HAMILTON COUNTY
SARATOGA COUNTY
FULTON COUNTY
LEWIS COUNTY
ONEIDA COUNTY
HERKIMER CO.
HAMILTON CO.
MONTGOMERY COUNTY
SCHENECTADY COUNTY
HERKIMER COUNTY
ONEIDA COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
ALBANY COUNTY
GREENE COUNTY
ONEIDA COUNTY
MADISON COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY

87
90
88

Legend

Building Permits by Place

- 0 - 15
- 16 - 75
- 51 - 75
- 76 - 150
- 151 - 250
- 251 - 500
- 501 - 3611

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Building Permits, U.S. Census Bureau.

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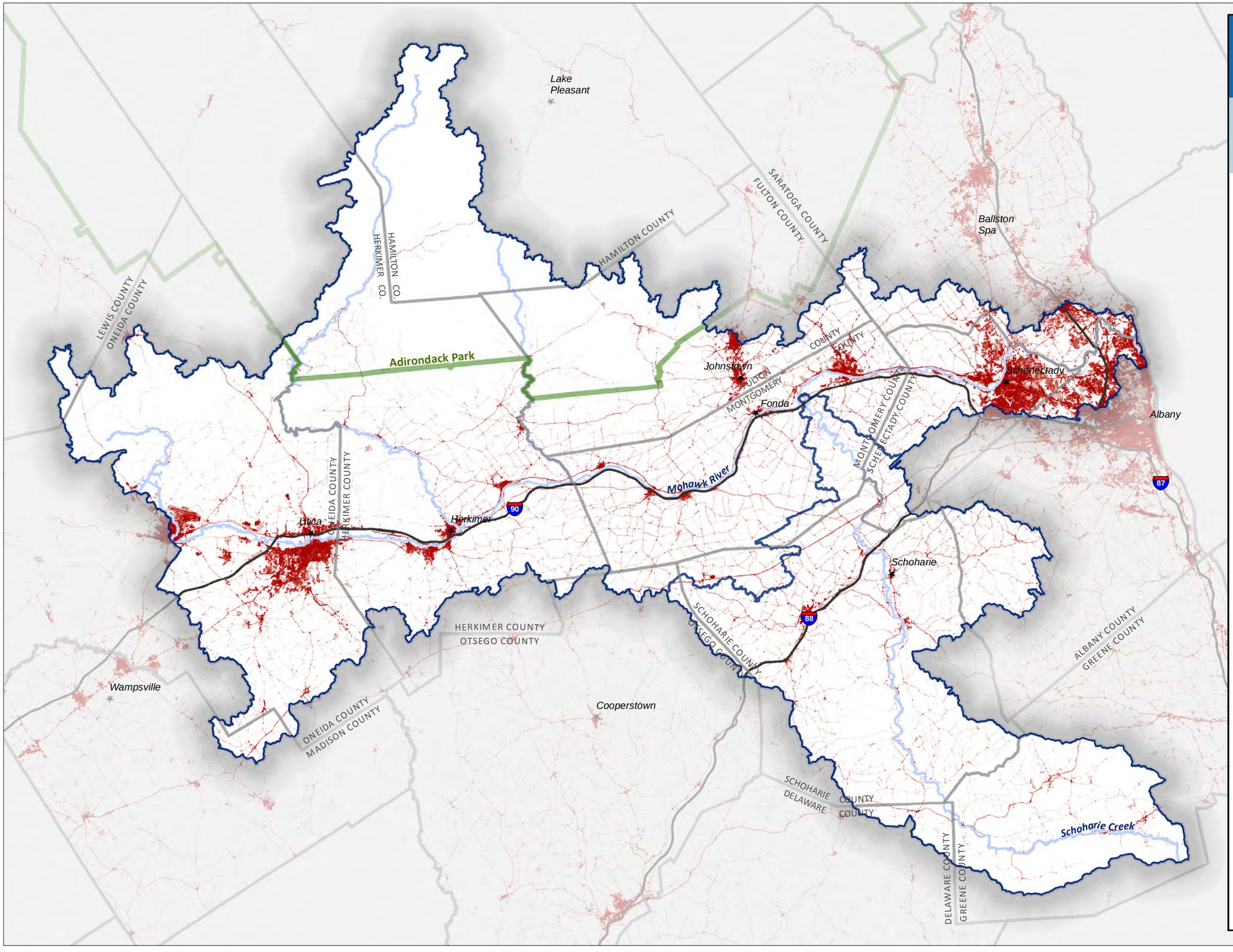
2006 PERCENT IMPERVIOUS

MAP 2-22

Mohawk River Watershed Management Plan



Legend

NLCD 2006 Impervious

Percent Impervious

High : 100

Low : 0

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; 2006 Percent Impervious Landcover: National Land Cover Database, USGS.

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PRIME FARMLAND SOILS

MAP 2-23

Mohawk River Watershed Management Plan

Legend

Prime Farmland (SSURGO)

- All areas are prime farmland
- Prime farmland if drained
- Farmland of statewide importance
- Not Prime Farmland
- Data Not Available

Lake Pleasant
Ballston Spa
Johnstown
Fonda
Schenectady
Albany
Utica
Herkimer
Schoharie
Wampsville
Cooperstown
Adirondack Park
Mohawk River
Schoharie Creek
HAMILTON COUNTY
HERKIMER CO.
LEWIS COUNTY
ONEIDA COUNTY
SARATOGA COUNTY
FULTON COUNTY
FULTON COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ALBANY COUNTY
GREENE COUNTY
ONEIDA COUNTY
MADISON COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY
90
87
88

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Prime Farmland Soils: Stone, derived from SSURGO.

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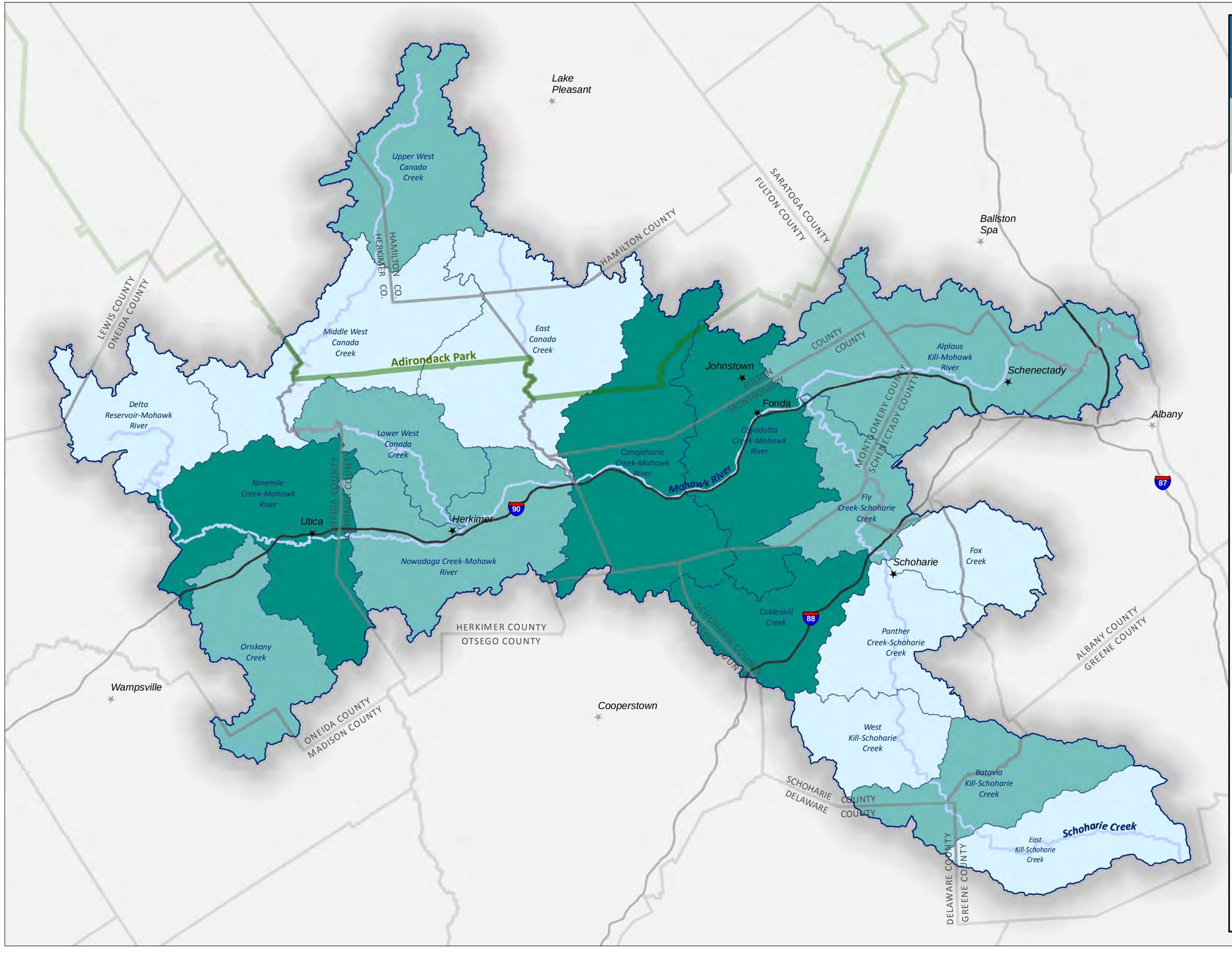
WATERSHED ASSESSMENT: WATER QUALITY HUC 10

MAP 2-24

Mohawk River Watershed Management Plan



Legend

Water Quality Score

- Low: 18 - 22
- Medium: 23 - 27
- High: 28 - 36

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Watershed Assessment, Stone and Mohawk River Watershed Coalition of Conservation Districts.

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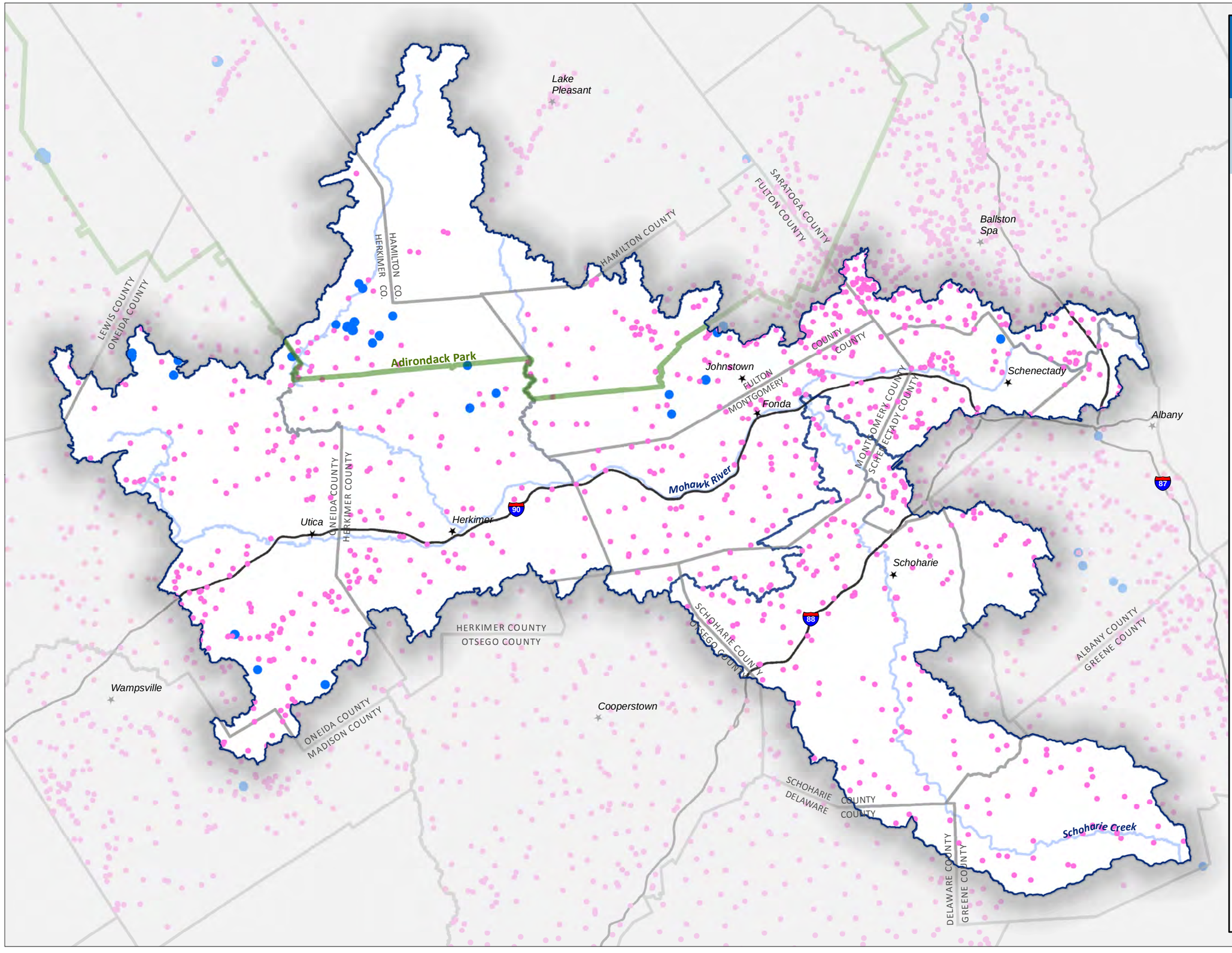
DRINKING WATER LAKES AND RESERVOIRS AND WELLHEADS

MAP 2-25

Mohawk River Watershed Management Plan



Legend

- Wellheads
- **Drinking Water Lakes and Reservoirs**

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Drinking Water Lakes and Reservoirs: NYDEC; Wellheads: DOW - Bureau of Water Resource Management.

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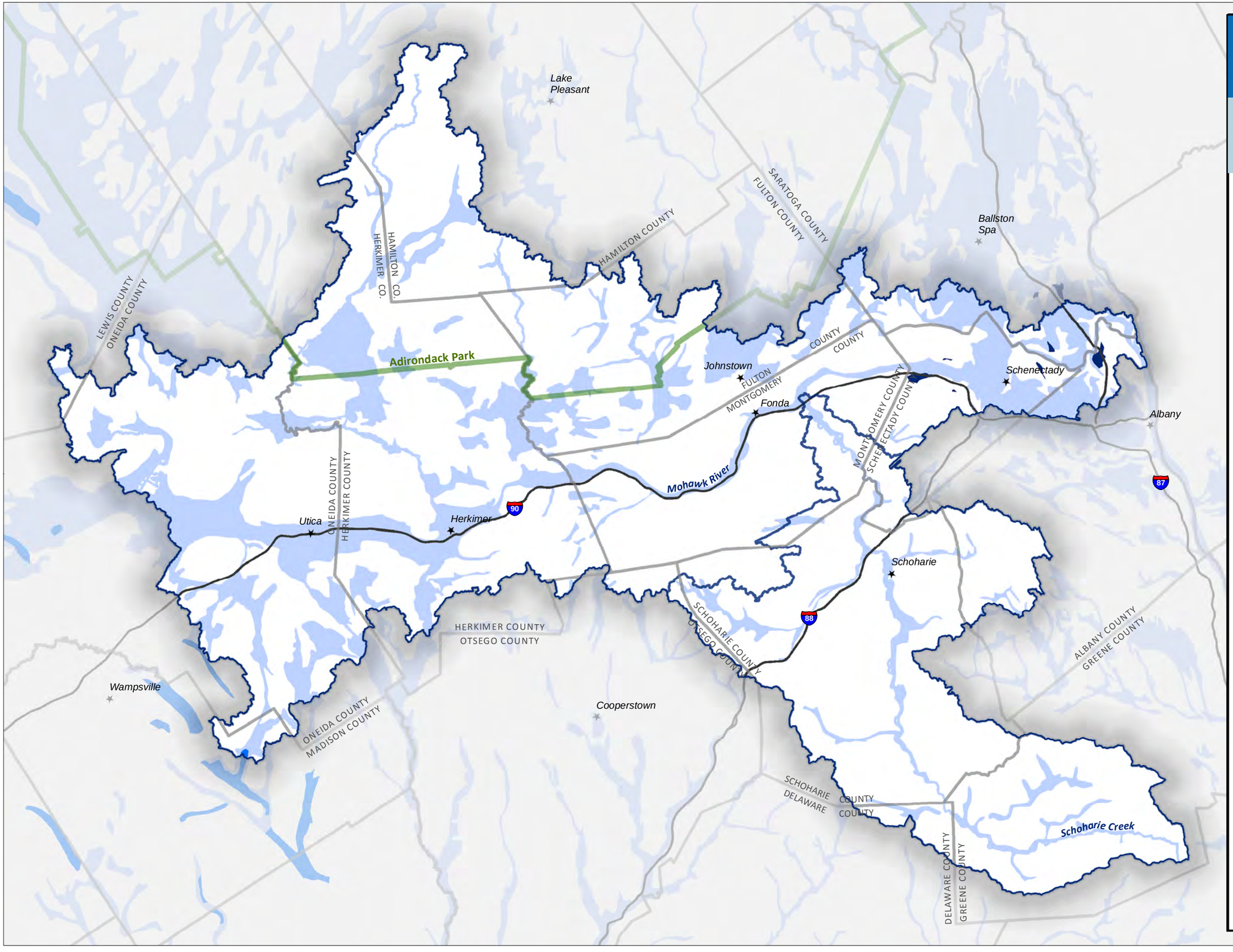
PRINCIPAL AQUIFERS

MAP 2-26

Mohawk River Watershed Management Plan



Legend

Aquifers

- Unconfined
- Confined
- Unknown

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Unconsolidated Aquifers, NYS Dept. of Health.

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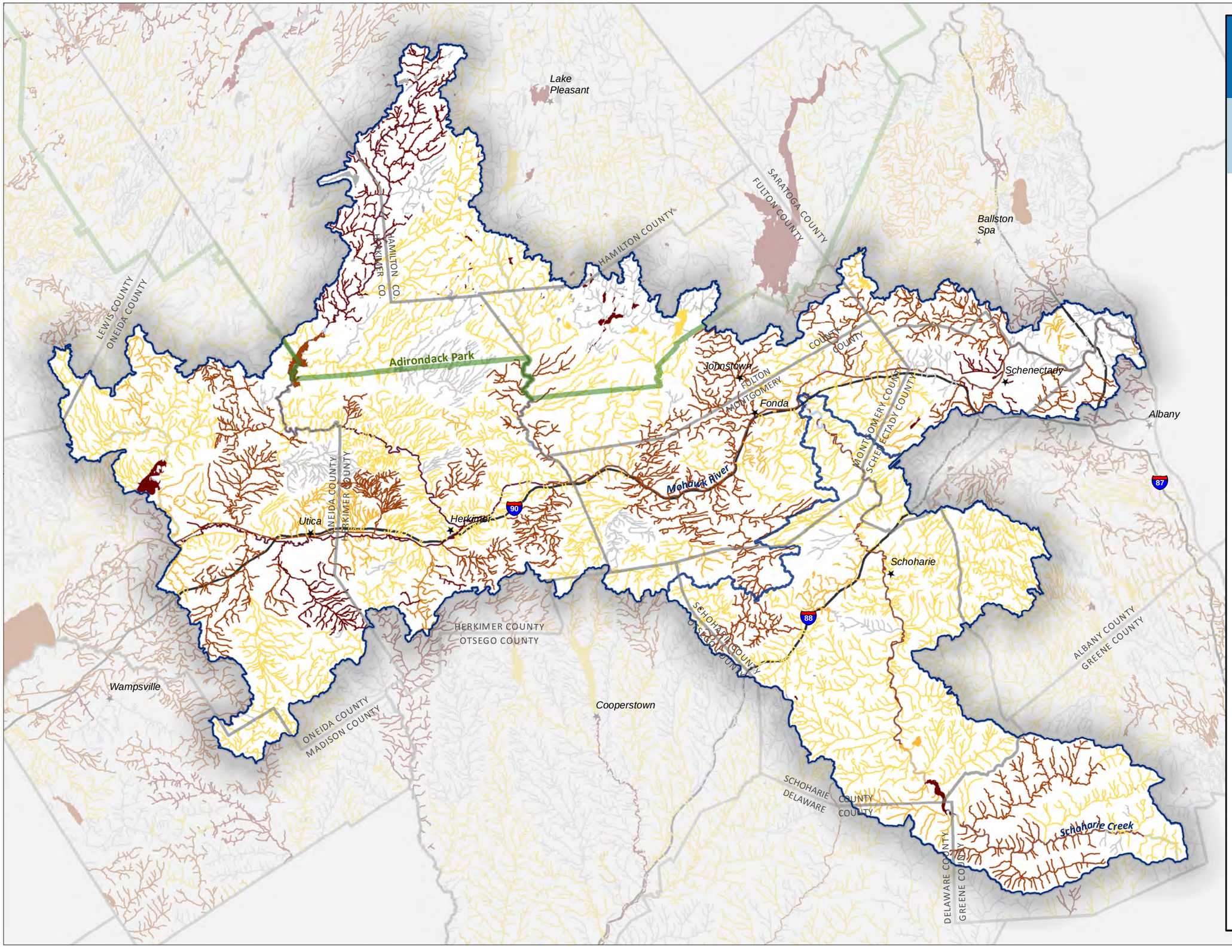
PRIORITY WATERS LIST STREAM IMPAIRMENT

MAP 2-27

Mohawk River Watershed Management Plan



Legend

Priority Waters List

- **Impaired Segment**
- **Minor Impacts**
- **Threatened**
- **Need Verification**
- **No Known Impacts**
- **UnAssessed**

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Priority Waters List Stream Impairment: NYS DEC.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

Chapter 3: Subwatershed Assessment

3.1 Objective of the Assessment

The structure of watersheds is dendritic or tree-like with smaller streams joining progressively larger ones (see Map 2-5). Thus, the watershed as a whole can be divided into a series of nested "subwatersheds" as illustrated by the HUC-8 through HUC-12 notation. Effective management of water quality in the basin as a whole depends on recognizing this fundamental structure of the watershed, starting with smaller units and addressing restoration and protection efforts to progressively larger, more inclusive ones. The objective, therefore, is to assess water-quality issues at their source, and to set priorities for remediating degraded parts of the watershed and protecting those that are not degraded but may be in danger of becoming so without effective management. Recommendations for addressing the restoration and protections issues uncovered in this assessment are discussed in Chapter 4.

3.2 Assessment Criteria and Procedure

To complete this assessment, each of the 12-digit HUC subwatersheds in the Mohawk River Watershed was evaluated using a set of quantitative indicators for three aspects of watershed health: water quality, land use, and habitat. The evaluation assigned a score of 1 to 5 for each of various quantitative indicators (metrics) of watershed health. The scores associated with these metrics of watershed health were combined to a final score; some were weighted for overall significance. The amalgamated scores can be used to help define priority areas (subwatersheds with the lowest overall scores), while preserving important information regarding the underlying causes for concern. Quantitative indicators and resulting scores for the three aspects of watershed health are described in this section. The selected metrics include both causal and response variables. Watershed assessment maps at the HUC-12 subwatershed level are available at the online Interactive Mapping Tool for the Mohawk River Watershed.

3.3 Summary of Assessment Results

While it is important to understand the relative health of 12-digit HUC subwatersheds, of which there are 116 in the Mohawk River watershed, consolidating this data at the 10-digit HUC subwatershed level provides a broader view. The following discussion will be based on the 18 10-digit HUC subwatersheds in the watershed.

3.3.1 Water Quality Indicators and Scores

Four metrics were used to evaluate water quality:

- *Percent Impaired per WI/PWL*. The sum of waterbody segments that are impaired, have minor impacts, or are threatened, as a percentage of the total length of waterbody segments. The data source for this assessment is the 2010 NYSDEC Waterbody Index/Priority Waterbodies List, a compendium of data and local knowledge regarding the extent to which lakes and streams support their designated use. Designated uses include drinking water supply, shell fishing, public bathing, recreation, fish consumption, aquatic life, habitat/hydrology, and aesthetics.

- *Percent Groundwater Recharge*. The area of principal aquifers as a percentage of the subwatershed area. This indicator is used to highlight where aquifer protection is needed.
- *Percent Wetland and Forest*. The total area of forest and wetland land cover as a percentage of the subwatershed area. Forest and wetlands provide excellent protection for waterbodies.
- *Percent Natural Riparian Cover*. The area of forest, wetland, and grasslands within 150 feet of waterbodies as a percentage of the total riparian corridor area within the subwatershed.

The relative water quality scores calculated from these four metrics are presented in Table 3-1 and displayed in Map 3-1. There is a strong correlation between the presumed causal variables (riparian buffers, wetlands/forests) and the response variable (extent to which waters support their designated best use).

Medium to high water quality scores are found in areas that are undeveloped and have a high percentage of wetland and forest cover and natural riparian buffers around waterbodies. In contrast, subwatersheds with extensive areas of residential/commercial development or lands in agricultural use exhibit more waterbody segments that are considered impaired. The land use indicators and scores that support this statement are described in section 3.3.2.

TABLE 3-1
Summary of Water Quality Assessment Scores at the 10-Digit HUC Subwatershed Level

Subwatershed	% Impaired	% Groundwater Recharge	% Wetland / Forest	% Riparian	Total Score
UPPER MOHAWK					
Oriskany Creek	4	2	2	4	24
Ninemile Creek	3	2	2	4	22
Nowadaga Creek	3	2	3	4	24
Lower W. Canada Ck.	4	2	3	4	26
Delta Reservoir	5	1	4	4	28
Middle W. Canada Ck.	4	2	5	4	30
Upper W. Canada Ck.	3	1	5	4	26
MAIN RIVER					
Cayadutta Creek	2	1	3	3	18
Canajoharie Creek	4	1	3	3	22
Alplaus Kill	3	3	3	3	24
Fly Creek	5	1	3	3	24
East Canada Creek	5	2	5	4	32
SCHOHARIE WATERSHED					
Cobleskill Creek	4	1	3	3	22
Batavia Kill	3	1	5	4	26
Fox Creek	5	1	5	4	30
West Kill	5	1	5	4	30
East Kill	3	1	5	5	28
Panther Creek	5	1	4	4	28

The highest possible score for water quality is 40 and the lowest score is 8. The most important indicator is Percent Impaired, which is based on NYSDEC Waterbody Index/Priority Waterbody List (WI/PWL). A score of 5 indicates good water quality. The metric Percent Ground Water (GW) Recharge was included to ensure that aquifers recharge areas were included in the assessment of priority regions for restoration and protection measures. The aquifer scores range from 1-5 indicating low to high aquifer recharge areas within the subwatersheds. Consequently, a score of 1 for Percent Ground Water Recharge does not indicate adverse ground water quality conditions, only that the subwatershed does not encompass extensive land areas overlying principal aquifers. A score of 5 for this metric indicates that there is substantial land area within the subwatershed that overlies principal aquifers, and thus that protective measures are likely indicated. Given the scoring criteria for these metrics, total water quality scores of around 30 can indicate excellent conditions, particularly when the Percent Impaired is assigned a value of 5. Because water quality is the most important factor in watershed health, it was assigned a weighting factor of 2 (i.e., the indicator scores were summed and multiplied by 2 to calculate the water quality score).

3.3.2 Land Use Indicators and Scores

Seven metrics were used to evaluate land use:

- *Percent Agriculture*. The sum of the cultivated crop cover plus hay/pasture cover as a percentage of the total subwatershed area.
- *Soil Erodibility*. The weighted average K-factor for the soil types in the subwatershed on a scale of 0.10–0.50.
- *Livestock/Acre of Pastureland*. Based on animal-unit data from the 2007 USDA Census of Agriculture, calculated by the dividing the total animal population in the subwatershed by the area of pastureland.
- *Percent Forest*. The land area classified as forested (deciduous, evergreen, mixed) as a percentage of the total area within the subwatershed.
- *Percent Urban*. The sum of the four urban classes (development intensity-high, medium, low, plus urban open space) as a percentage of the total area within the subwatershed.
- *Percent Impervious*. Shown on land cover maps as Percent Impervious, with the indicator for the subwatershed calculated as the average percent impervious.
- *Percent Change in Residential Development since 1990*. Based on the number of parcels for which building permits were issued for the period 1990-2011; calculated as the percent increase in residential parcels since 1990.

The relative land use scores are presented in **Table 3-2** and displayed in **Map 3-2**. It is clear that the HUC-10 subwatersheds exhibiting low scores are either highly developed or have extensive agricultural lands. Given that Schenectady, the Albany suburbs, and the Utica/Rome area comprise the only urbanized areas within the Mohawk River watershed, most of the subwatersheds that score low based on land use are associated with the agriculture regions, notably in the fertile Mohawk River lowlands. Medium to high scores are found in and adjacent to the Adirondacks and Catskills; these areas have little to no development or intensive agriculture. The range of possible scores for land use is 10.5–52.5. The subwatersheds with relatively low scores of 30–36 tend to be high in percent agricultural land use, low in percent forest, and/or high in percent change in development. Subwatersheds with higher scores of 37–45 are the opposite, low in agriculture, high in forest cover, and low in development. The assessment of land use was assigned a weighting factor of 1.5.

TABLE 3-2
Summary of Land Use Assessment Scores at the 10-Digit HUC Subwatershed Level

Subwatershed	% Ag	Soil Erodibil.	Livestock /acre	% Forest	% Urban	% Impervious	% Chg-Dev	Total Score
UPPER MOHAWK								
Oriskany Creek	1	2	2	2	5	5	3	30
Ninemile Creek	3	2	2	2	5	5	4	34.5
Nowadaga Creek	2	2	2	2	5	5	5	34.5
Lower W. Canada Creek	2	2	2	2	5	5	5	34.5
Delta Reservoir	4	2	2	3	5	5	3	36
Middle W. Canada Creek	5	3	2	3	5	5	4	40.5
Upper W. Canada Creek	5	3	5	5	5	5	4	48
MAIN RIVER								
Cayadutta Creek	1	2	2	2	5	5	5	33
Canajoharie Creek	2	2	2	2	5	5	5	34.5
Alplaus Kill	3	2	2	2	4	5	5	34.5
Fly Creek	2	2	2	3	5	5	5	36
East Canada Creek	5	2	2	4	5	5	5	42
SCHOHARIE WATERSHED								
Cobleskill Creek	1	2	3	3	5	5	3	33
Batavia Kill	4	2	3	4	5	5	5	42
Fox Creek	3	2	3	3	5	5	3	36
West Kill	4	2	3	4	5	5	2	37.5
East Kill	5	2	3	5	5	5	5	45
Panther Creek	4	2	3	4	5	5	4	40.5

3.3.3 Habitat Indicators and Scores

Four metrics were used to evaluate habitat:

- *Percent Aquatic Life Precluded, Impaired, or Stressed*. Focuses on in-stream habitat and benthic macroinvertebrates. Aquatic life is one of the uses assessed as part of the WI/PWL, and the indicator is calculated similar to Percent Impaired for water quality.
- *In-Stream Habitat Altered, Moderate, or Severe Assessments*. Based on results of NYSDEC biomonitoring program. For those streams that have been assessed, and other than "natural" conditions were observed, a low score is assigned. A high score is assigned to streams that have not been assessed.
- *Endangered Species Observations*. Based on sightings of endangered species by the National Heritage Program. If there have been sightings, the score is high, and if no sightings, the score is low.
- *Percent Intolerant Fish Species*. Based on Mohawk River watershed fish species using the USEPA's Index of Biotic Integrity (IBI) metrics. The indicator is the number of pollution-intolerant species found (e.g. trout) as a percentage of the total number of species found in the subwatershed.

The relative Habitat scores are presented in Table 3-3 and displayed in Map 3-3. Note that the relative Habitat scores do not track the relative Water Quality scores to the extent evident in the Land Use scores. One might expect a stronger correlation between habitat and water quality scores, given the inclusion of metrics related to in-stream habitat. The difference appears to be a result of the metric related to the presence of endangered species; the presence of endangered species raises the score even if an in-stream metric such as the Percent Aquatic Life scores low.

The metric for percent aquatic life classified with some degree of impairment is a key measure of water quality conditions and a robust metric for assessing the health of the subwatersheds. These data are readily collected using standard benthic macroinvertebrate community measures and are suitable for a (trained) volunteer monitoring effort. Benthic macroinvertebrate data have been reported for many streams throughout the basin.

The highest possible score for the habitat assessment is 20, and the lowest possible score is 4. The most important indicator is Percent Aquatic Life Impaired because of the robust relationship between water quality conditions and the benthic macroinvertebrate community in a stream. Moreover, it is important to note that the classification "impaired" encompasses the NYSDEC range of "threatened, stressed, impaired, and precluded" as used in the WI/PWL. A score of 3 or lower indicates that aquatic life is impaired in over 40% of the stream miles in the subwatershed. The assessment of habitat was assigned a weighting factor of 1.

TABLE 3-3
Summary of Habitat Assessment Scores at the 10-Digit HUC Subwatershed Level

Subwatershed	% Aquatic Life Impaired	In-Stream Habitat	Endangered Species	% Intolerant Fish Species	Total Score
UPPER MOHAWK					
Oriskany Creek	4	1	5	3	13
Ninemile Creek	3	1	5	3	12
Nowadaga Creek	3	1	5	5	14
Lower W. Canada Creek	5	1	5	3	14
Delta Reservoir	5	5	5	3	18
Middle W. Canada Creek	4	5	5	3	17
Upper W. Canada Creek	3	5	5	3	16
MAIN RIVER					
Cayadutta Creek	2	1	5	3	11
Canajoharie Creek	4	1	5	5	15
Alplaus Kill	2	5	5	3	15
Fly Creek	5	5	5	3	18
East Canada Creek	5	5	5	5	20
SCHOHARIE WATERSHED					
Cobleskill Creek	4	1	5	3	13
Batavia Kill	4	1	5	3	13
Fox Creek	5	5	5	3	18
West Kill	5	5	5	3	18
East Kill	5	1	5	3	14
Panther Creek	5	5	5	5	20

The indicator In-Stream Habitat is useful, but limited. It is based on the NYSDEC biomonitoring program, and not all streams within the Mohawk River Watershed have been assessed. A score of 1 indicates that some of the streams in the subwatershed have been assessed by NYSDEC, and were found to have conditions less than natural. A score of 5 indicates that none of the streams within the subwatershed have been assessed. The endangered species indicator is based on observations, with a score of 5 signifying "yes," these species are known to be present, and a score of 1 signifying "no," there is no documentation of the presence of endangered species. As is evident in Table 3-3, endangered species have been observed in all 18 of the 10-digit HUC subwatersheds in the Mohawk River Watershed. However, when assessed at the 12-digit HUC subwatershed level, there is better differentiation of location. The indicator Percent Intolerant Fish Species indirectly measures the degree of pollution in streams, with the higher the percent and score, the lower the level of pollution, and vice versa.

3.3.4 Overall Score

The total relative assessment scores (incorporating water quality, land use, and habitat results) for each of the 10-digit HUC subwatersheds are shown in **Map 3-4**. The dark-shaded subwatersheds exhibit the lowest one-third of the scores; these subwatersheds are associated with the highest percentages of residential, commercial, or agricultural land uses. These subwatersheds tend to be in the Mohawk River lowlands. The medium-shaded subwatersheds exhibit the mid-range of assessment scores; these also tend to be in the Mohawk River lowlands. The highest scoring subwatersheds are located in the pristine undeveloped areas of the Adirondacks and Catskills.

TABLE 3-4
Summary of Total Assessment Scores at the 10-Digit HUC Subwatershed Level

Subwatershed	Water Quality Score	Land Use Score	Habitat Score	Total Score
UPPER MOHAWK				
Oriskany Creek	24	30	13	67
Ninemile Creek	22	34.5	12	68.5
Nowadaga Creek	24	34.5	14	72.5
Lower W. Canada Creek	26	34.4	14	74.5
Delta Reservoir	28	36	18	82
Middle W. Canada Creek	30	40.5	26	87.5
Upper W. Canada Creek	26	48	16	90
MAIN RIVER				
Cayadutta Creek	18	33	11	62
Canajoharie Creek	22	34.5	15	71.5
Alplaus Kill	24	34.5	15	73.5
Fly Creek	24	36	18	78
East Canada Creek	32	42	20	94
SCHOHARIE WATERSHED				
Cobleskill Creek	22	33	13	68
Batavia Kill	26	42	13	81
Fox Creek	28	36	18	82
West Kill	30	37.5	18	85.5
East Kill	28	45	14	87
Panther Creek	28	40.5	20	88.5

The summary of scoring for the three sets of metrics (water quality, land use, habitat) is presented in Table 3-4. Within the three major regions, the 10-digit HUC subwatersheds are listed from the lowest to the highest total score. **Recall that relatively low scores indicate potential impairment and suggest the need restoration.** In contrast, relatively high scores indicate healthy conditions that warrant protection. Based on the scoring system, the lowest possible score for the combined total would be 22.5 and the highest possible score would be 112.5.

3.4 Discussion of Assessment Results

Referring to the assessment total scores as depicted on Map 3-4 and Table 3-4, there are three scoring categories, Low, Medium, and High, with the following ranges:

Low Scores of 62–72.5. Subwatersheds in this range are considered unhealthy and in need of *restoration.*

Medium Scores of 73–83.5. Subwatersheds in this range have a mix of unhealthy and healthy conditions and need both *restoration and protection.*

High Scores of 84–94. Subwatersheds in this range are considered healthy and in need of *protection.*

NOTE: For this discussion, refer to the maps and tables as follows:

Water Quality Scores	Map 3-1 and Table 3-1
Land Use Scores	Map 3-2 and Table 3-2
Habitat Scores	Map 3-3 and Table 3-3
Total Scores	Map 3-4 and Table 3-4

3.4.1 Low-Scoring Subwatersheds (Total Scores: 62–72.5)

The six subwatersheds with the lowest scores are primarily located in the lowlands along the Mohawk River. The Cobleskill Creek subwatershed is adjacent to and south of Canajoharie and Cayadutta Creek.

Upper Mohawk:	Oriskany Creek (67)
	Ninemile Creek (68.5)
	Nowadaga Creek (72.5)
Main River:	Cayadutta Creek (62)
	Canajoharie Creek (71.5)
Schoharie Watershed:	Cobleskill Creek (68)

Water Quality

Water quality scores are relatively low in each of these six subwatersheds. The Percent Impaired per the WI/PWL ranges from 20–80%, with aquatic life (benthic macroinvertebrates) as the impacted use. Cayadutta Creek has the highest percent impairment at 60–80%, with Ninemile Creek, and Nowadaga Creek at 40–60%. Percent impairment for Oriskany Creek, Canajoharie Creek, and Cobleskill Creek is in the 20–40% range.

Waterbodies on the 2012 NYS Compendium of Impaired Waters {303(d) List}

<u>Ninemile Creek</u>		
Mohawk River Main Stem	Part 1	Floatables, Pathogens, Oxygen Demand
	Part 2b	PCBs
Utica Harbor	Part 1	Floatables, Pathogens, Oxygen Demand
	Part 2b	PCBs
Ninemile Creek	Part 1	Pathogens
Ballou, Nail Creeks	Part 1	Oxygen demand, Phosphorus
Sauquoit Creek	Part 2b	PCBs
Threemile Creek	Part 2b	PCBs
<u>Nowadaga Creek</u>		
Mohawk River Main Stem	Part 1	Floatables, Pathogens, Oxygen Demand
	Part 2b	PCBs
Mohawk R/Barge Canal	Part 2b	PCBs
Steele Creek	Part 1	Silt/Sediment, Phosphorus
<u>Cobleskill Creek</u>		
Cobleskill Creek	Part 1	Pathogens

Land Use

The relatively low land use scores are due to a combination of high agricultural land use and development. The percent agricultural land cover ranges from 20% to more than 40%, which is considered to be high. Livestock density is also on the high side. Coincident with the relatively high agricultural land use, forest cover is on the low side at 20–40%.

Residential and commercial development is also high in these subwatersheds. Ninemile Creek has the highest population density with the cities of Utica and Rome, and has three of the fastest growing communities in the region, New Hartford, Whitestown, and Marcy. Oriskany Creek has areas of relatively high population density with Clinton and Westmorland, also one of the fastest growing communities. Nowadaga Creek, Canajoharie Creek, and Cayadutta Creek have high population densities in the communities along the Mohawk River with Frankfort, Ilion, Mohawk, Herkimer, Little Falls, Fort Plain, Canajoharie, and Fonda. Cayadutta Creek also has the developed areas of Gloversville and Johnstown.

Habitat

Percent aquatic life impaired ranges from 20–80%, which, along with percent intolerant fish at a median level of 5–20%, results in relatively low habitat scores. Endangered species have been observed in these subwatersheds.

Sources of Pollution

Both point and nonpoint sources of pollution affect the six low-scoring subwatersheds. A total of 33 municipal wastewater treatment plants (WWTPs) are located within the six subwatersheds, representing 40% of the total number of WWTP within the entire Mohawk River watershed. Ninemile Creek alone receives treated effluent from 14 WWTPs. Treated effluent from these facilities are discharged directly into the Mohawk River or its tributaries, and are regulated under the NYSDEC SPDES permit system. However, most of the WWTP are not designed to substantially reduce the concentrations of the nutrients phosphorus and nitrogen; these nutrients may contribute to eutrophication of waterbodies and cause algal blooms.

Other point sources of pollution include two USEPA Superfund sites, one in Rome at the former Griffiss AFB and one at the Johnstown landfill. There are also 16 brownfield sites (14 in Ninemile Creek), which are primarily old manufacturing sites in the cities of Utica and Rome where contaminants (chemicals, petroleum products) have leaked into the soil.

Nonpoint source pollution, which is due to runoff from the land, comes mainly from agricultural and urban areas. Agricultural runoff includes sediment, nutrients (nitrogen and phosphorus), pesticides, and herbicides. Urban runoff similarly includes nutrients, pesticides, and herbicides from lawn treatments, but also contaminants from roadways, automotive fluids and salt and particulates from winter deicing. In addition to contaminants, urban areas contribute high volumes of stormwater runoff from the impervious surfaces such as pavement and rooftops.

3.4.2 Mid-Scoring Subwatersheds (Total Scores: 73–83.5)

Six subwatersheds score in the mid-range, as listed below. Two of the subwatersheds, Alplaus Kill and Fly Creek, are located in Mohawk River lowlands, while the remaining four are located in the mid-uplands, two in the Upper Mohawk and two in the Schoharie Watershed.

Upper Mohawk:	Lower West Canada Creek (74.5)
	Delta Reservoir (82)
Main River:	Alplaus Kill (73.5)
	Fly Creek (78)
Schoharie Watershed:	Batavia Kill (81)
	Fox Creek (82)

Water Quality

The water quality exhibited by streams draining these subwatersheds varies significantly. The Alplaus Kill has low water quality with percent impairment of waterbodies in the range of 40–60%. The waterbody use most affected by the poor water quality is aquatic life. Of note for the Alplaus Kill is that 40–60% of the area has ground water resources, notably the Great Flatts aquifer. Protecting the recharge areas for the principal aquifers is important for preventing groundwater contamination.

An upland subwatershed, Batavia Kill, also has a percent impairment of 40–60%, but the use most affected is habitat and hydrology, which is considered stressed. During flooding conditions, water flowing over land areas with highly erodible soils can transport large amounts of sediment. The remaining subwatersheds have good water quality, with Delta Reservoir, Fly Creek, and Fox Creek exhibiting under 20% impairment. The metric for Lower West Canada Creek was calculated to be 20–40%.

Waterbodies on the 2012 NYS Compendium of Impaired Waters {303(d) List}

<u>Alplaus Kill</u>		
Collins Lake	Part 1	Phosphorus
Mariaville Lake	Part 1	Phosphorus
<u>Batavia Kill</u>		
Schoharie Reservoir	Part 1	Silt/Sediment

Land Use
Land uses also vary considerably within the six mid-scoring subwatersheds. Lower West Canada Creek and Fly Creek have relatively high percentage of lands in agricultural use (30–40%); Delta Reservoir and Batavia Kill have 10–20% agricultural land use; agriculture encompasses 20–30% of the land use within the Alplaus Kill and Fox Creek subwatersheds. Forest cover ranges from 20–40% in the lowland subwatersheds to 60–80% in the upland subwatersheds.

Residential and commercial development is concentrated in the Alplaus Kill subwatershed with the municipalities of Halfmoon, Amsterdam, Schenectady, Clifton Park, Colonie, Cohoes, and Niskayuna. The population density in the Schoharie region is relatively low, with the exception of Windham in the Batavia Kill subwatershed, which is experiencing growth pressure.

Habitat
The habitat scores are, in general, relatively high for the six mid-scoring subwatersheds. The exception is the Alplaus Kill, where the percent aquatic life impaired is relatively high at 60–80%, which is consistent with the high percent impairment for waterbodies. Throughout these subwatersheds, the percent of intolerant fish ranges from 5–20%, and endangered species have been observed.

Sources of Pollution
There are 36 municipal WWTP in these six subwatersheds (44% of the total in the watershed), with 26 discharging to stream segments within in the Alplaus Kill subwatershed, and 6 discharging treated effluent to streams within the Batavia Kill subwatershed. There are nine brownfield sites, all in the Alplaus Kill, and there are no USEPA Superfund sites.

Nonpoint source pollution varies with land use. The potential for agricultural runoff is highest in Lower West Canada Creek and Fly Creek and lowest in Batavia Kill and Delta Reservoir. Urban runoff is of most concern in the Alplaus Kill subwatershed, given the population density and high percentage of impervious surfaces.

3.4.3 High-Scoring Subwatersheds (Total Scores: 84–94)

Six subwatersheds scored high, and are located within the northern and southern uplands of the Mohawk River watershed. Major portions of the Middle and Upper West Canada Creek and East Canada Creek subwatersheds are within in the Adirondack Park, while West Kill, East Kill, and Panther Creek are located in the Catskill Park.

Upper Mohawk:	Middle West Canada Creek (87.5) Upper West Canada Creek (90)
Main River:	East Canada Creek (94)
Schoharie Watershed:	West Kill (85.5) East Kill (87) Panther Creek (88.5)

Water Quality
Five of the six subwatersheds exhibit high water quality scores. The high scores reflect the extent of intact wetland/forest cover and riparian buffers; these metrics vary between 60% and 80%. The metric indicating percent of impaired stream miles was mostly centered in the <20–40% range; three of the six subwatersheds scored under 20%, while two scored in the 40–60% range. Upper West Canada Creek in the Adirondacks has been impacted by

acid rain causing aquatic life to be impaired, while East Kill in the Catskills has had habitat and hydrology affected by large amounts of sediment transported during recent extreme storm events.

Waterbodies on the 2012 NYS Compendium of Impaired Waters {303(d) List}

Upper West Canada Creek

West Canada Creek, Upper	Part 2a	Acid/Base (pH)

Land Use

Land use in these subwatersheds is conducive to good water quality. The percent agriculture is less than 10% for four of the six subwatersheds and in the range of 10–20% for the remaining two. Forest cover is high, mainly in the range of 60–80%. Population density is low; communities are villages and hamlets, not cities. The two largest municipalities are Middleburg in the Schoharie region and Dolgeville in the Upper Mohawk.

Habitat

Habitat scores are high for four of the six subwatersheds. Upper West Canada Creek had a medium score due to effect of acid rain and low pH on aquatic life. East Kill also had a medium score, which was due to assessed in-stream habitat being less than natural. However, this does not appear to be a major problem since percent aquatic life impaired is low at less than 20%. Endangered species have been observed throughout these subwatersheds, and the percent of intolerant fish ranges from 5–20%, with the exception of East Canada Creek and Panther Creek at greater than 20%.

Sources of Pollution

Consistent with the lack of developed areas, there are few point sources discharging to stream segments within the subwatersheds. There are 13 permitted discharges from municipal WWTPs (16% of the total in the watershed); eight of the plants discharge to stream segments within the East Kill subwatershed. There are no brownfield or USEPA Superfund sites.

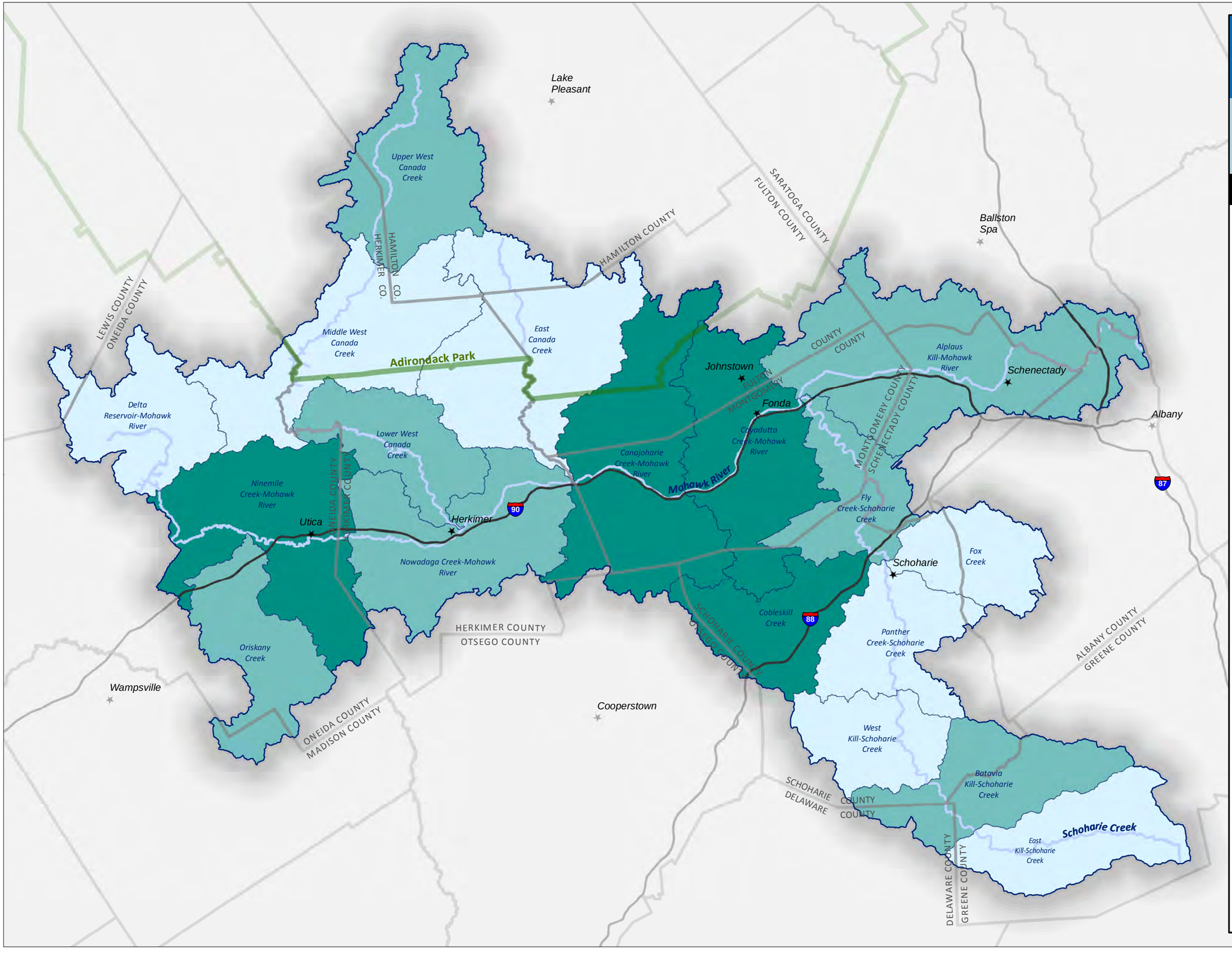
Nonpoint sources of pollution are also low, consistent with the minimal agricultural land use and lack of population centers with impervious surfaces. The preponderance of undisturbed land cover helps retain and infiltrate precipitation and snowmelt, greatly reducing runoff and the risk that nonpoint sources of pollution will reach the waterways.

WATERSHED ASSESSMENT: WATER QUALITY HUC 10

MAP 3-1

Mohawk River Watershed Management Plan

CHARACTERIZATION REPORT



Legend

Water Quality Score

- Low: 18 - 22
- Medium: 23 - 27
- High: 28 - 36

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Watershed Assessment, Stone and Mohawk River Watershed Coalition of Conservation Districts.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

WATERSHED ASSESSMENT: LAND USE HUC 10

MAP 3-2

Mohawk River Watershed Management Plan

CHARACTERIZATION REPORT

Legend

Land Use Score

- Low: 30 - 36
- Medium: 37 - 42
- High: 43 - 48

Lake Pleasant
Ballston Spa
Johnstown
Fonda
Schenectady
Albany
Utica
Herkimer
Wampsville
Cooperstown
Schoharie

Upper West Canada Creek
Middle West Canada Creek
East Canada Creek
Lower West Canada Creek
Delta Reservoir-Mohawk River
Ninemile Creek-Mohawk River
Oriskany Creek
Nowadaga Creek-Mohawk River
Canajoharie Creek-Mohawk River
Caradutta Creek-Mohawk River
Alplaus Kill-Mohawk River
Fly Creek-Schoharie Creek
Fox Creek
Cobleskill Creek
Panther Creek-Schoharie Creek
West Kill-Schoharie Creek
Batavia Kill-Schoharie Creek
East Kill-Schoharie Creek

Adirondack Park
Mohawk River
Schoharie Creek

LEWIS COUNTY
ONEIDA COUNTY
HERKIMER CO.
HAMILTON CO.
HAMILTON COUNTY
SARATOGA COUNTY
FULTON COUNTY
FULTON COUNTY
MONTGOMERY COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ONEIDA COUNTY
MADISON COUNTY
ALBANY COUNTY
GREENE COUNTY
SCHOHARIE COUNTY
DELAWARE COUNTY
DELAWARE COUNTY
GREENE COUNTY

90
87
88

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Watershed Assessment, Stone and Mohawk River Watershed Coalition of Conservation Districts.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

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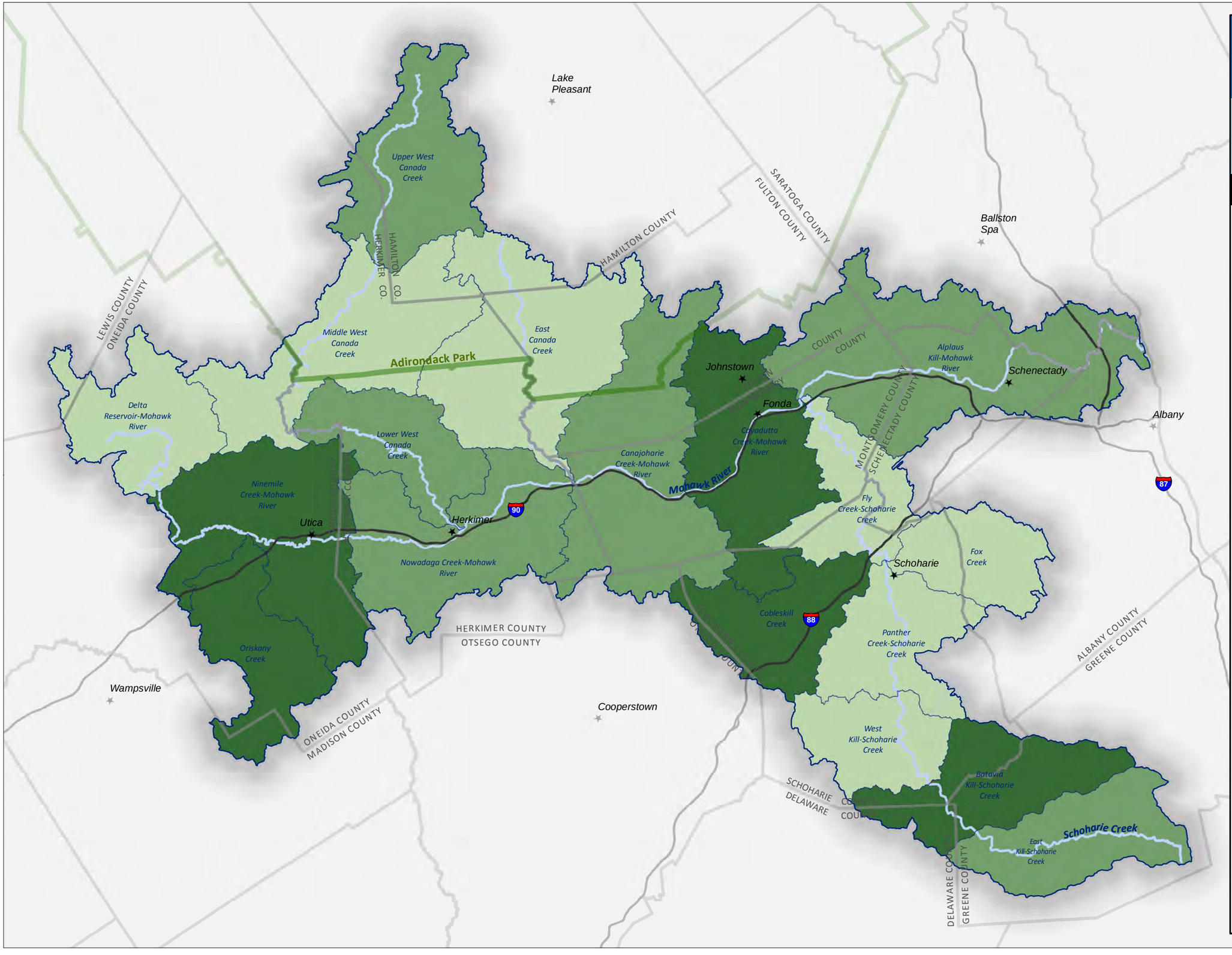
WATERSHED ASSESSMENT: HABITAT HUC 10

MAP 3-3

Mohawk River Watershed Management Plan

CHARACTERIZATION REPORT



Legend

Habitat Score

- Low: 11 - 13
- Medium: 14 - 16
- High: 17 - 20

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Watershed Assessment, Stone and Mohawk River Watershed Coalition of Conservation Districts.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

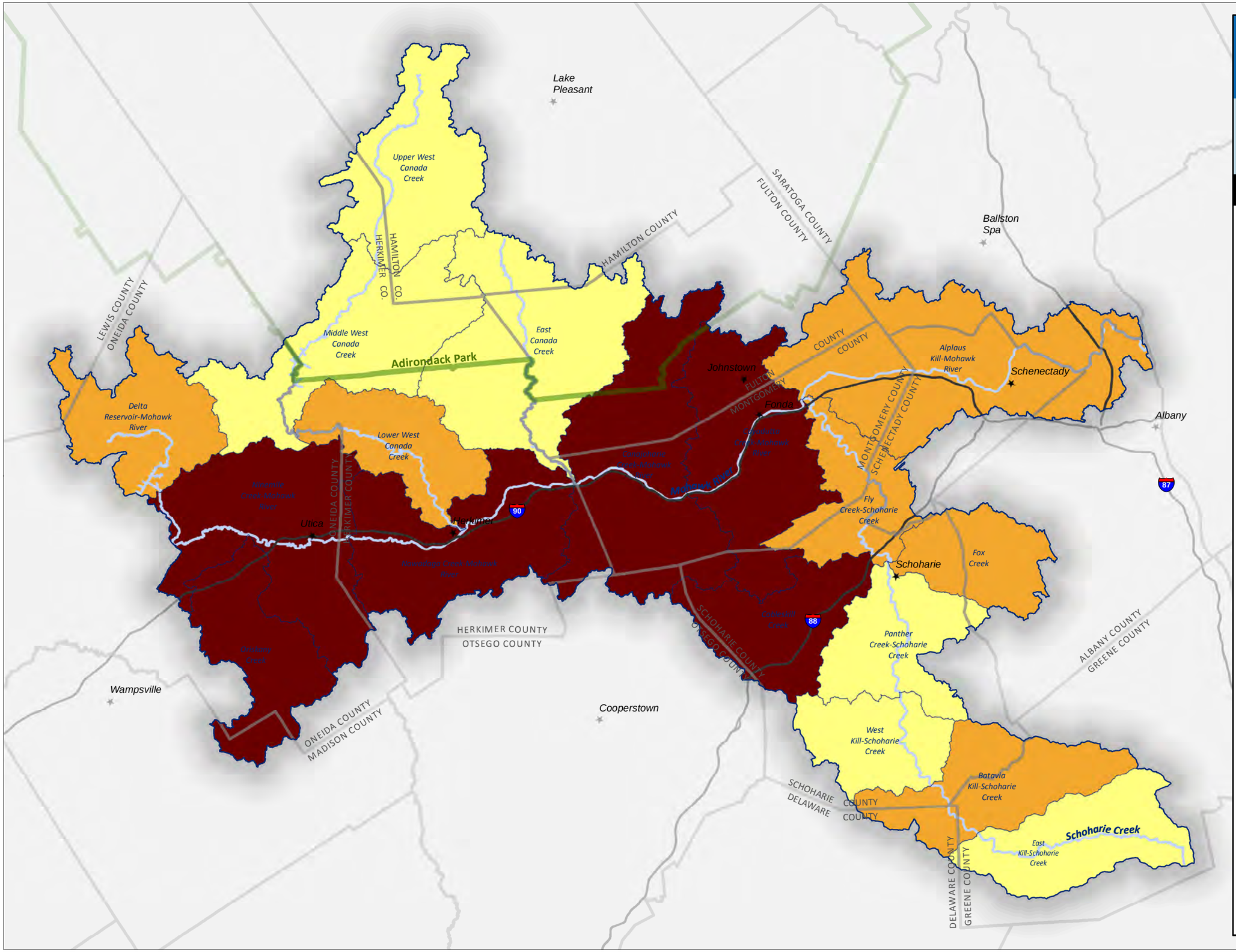
MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

WATERSHED ASSESSMENT: TOTAL SCORE HUC 10

MAP 3-4

Mohawk River Watershed Management Plan

CHARACTERIZATION REPORT



Legend

Total Score

- Low: 62 - 72.5
- Medium: 73 - 83.5
- High: 84 - 94

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Watershed Assessment, Stone and Mohawk River Watershed Coalition of Conservation Districts.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

STONE ENVIRONMENTAL INC

Chapter 4: Recommendations

4.1 Overview of Goals and Strategies

The purpose of the Mohawk River Watershed Management Plan is to improve conditions in the watershed to protect and restore water quality and habitat throughout this 3,460-square-mile area of Central New York, while revitalizing waterfront communities and improving the quality of life for residents. Quality of life encompasses multiple dimensions; these include economic development, resilience to damaging storms and floods, food security, recreational opportunities, clean air, and an ample supply of clean water. Achieving the seven goals articulated by the Watershed Advisory Committee will be challenging and will require a coordinated effort at many levels, including federal, state and local governments, educational institutions, resource management agencies, not-for-profit organizations, and the public at large. As set forth in previous chapters, these seven goals are:

1. Protect and restore the quality and ecological function of water resources
2. Protect and enhance natural hydrologic processes
3. Promote flood hazard risk reduction and enhanced flood resilience
4. Protect, restore, and enhance fish and wildlife habitat
5. Revitalize communities and waterfronts and adopt smart growth land use practices
6. Promote agriculture and other working landscapes
7. Increase watershed awareness

Actions taken to achieve these goals will not only restore or protect the natural processes of a healthy watershed, but will also bring beneficial economic consequences to the communities within the watershed.

This chapter presents three general strategies that support goals for the Mohawk River Watershed: Implement Best Management Practices, Advance Municipal Actions, and Advance Collaboration and Partnerships. The first two strategies are proposed as a framework for organizing the recommendations for actions and practices. The third strategy encompasses the many parallel efforts by agencies and organizations working to build a better future and quality of life for communities in the watershed. The strategies are defined in terms of *components* that support goals for the watershed:

Strategy 1: Implement Best Management Practices. Implement best management practices to protect and restore natural hydrology, reduce erosion and sedimentation, minimize pollution, and protect and restore habitats.

Strategy 2: Advance Municipal Actions. Advance municipal actions to promote sustainability, reduce risk of flood damage, and revitalize communities and waterfronts through the adoption of appropriate zoning and land use policies to encourage cluster development, protect steep slopes, protect and enhance floodplains, reduce impervious surfaces, protect, restore or enhance unique and natural areas, riparian areas, and wetlands.

Strategy 3: Advance Collaboration and Partnerships. Advance collaboration and partnerships to promote sustainable communities, smart growth, economic development, and environmental quality through advancing collaboration and partnerships with the NYSDOS Local Waterfront Revitalization Program, Mighty Waters Working Group, NYSDEC Mohawk River Basin Action Agenda, New York Rising Community Reconstruction Program, and the Cleaner, Greener Communities Program.

In this chapter, the strategies and their components (e.g., minimize pollution) are developed into a set of detailed recommendations for practices and other actions that can be implemented in the watershed. The recommendations address current conditions of the natural and built environment, as presented in Chapters 2 and 3. Since each community and subwatershed faces unique conditions influencing water quality, hydrology and flooding, waterfront revitalization, community development, etc., many of the recommendations are discussed in terms of their relevance within each of the three main watershed regions and subwatershed areas within those regions. In Chapter 5: Implementation, Tracking, and Monitoring, the recommendations are presented in greater detail with consideration of location, cost, and implementation partners for various restoration and protection projects. The Mohawk River Watershed Management Plan will be a "living document" that is updated as actions and projects are implemented and new actions and projects are identified as necessary and incorporated into recommendations. These updates will be published on the Mohawk River Watershed Coalition website and reflected in the Interactive Mapping Tool for the Mohawk River Watershed.

4.2 Strategy 1: Implement Best Management Practices

Implement best management practices to protect and restore natural hydrology, reduce erosion and sedimentation, minimize pollution, and protect and restore habitats.

Best Management Practices (BMPs) are effective, practicable actions or processes that can be implemented to support watershed goals. In this section, the BMP strategy is discussed first in terms of its components and their relationship to key watershed goals, and then in terms of specific recommendations that can be implemented in agricultural, developed, or all areas of the watershed. Finally, BMPs are discussed in terms of their relevance to regions and subwatersheds. The BMP recommendations were developed with input from SWCD staff, who were instrumental in developing this Watershed Management Plan. In Chapter 5, these BMPs are linked to specific projects that have been proposed or initiated by SWCDs throughout the watershed.

Many aspects of this strategy carry economic implications for watershed communities. For example, polluted waterbodies reduce recreational use and tourism, and cleansing or finding substitutes for water resources tends to be expensive. Aquatic as well as terrestrial invasive species not only degrade habitat for native species, but also detract from the economic value of the watershed, affecting agriculture and recreation, and can be very costly to control. The aesthetically attractive landscape of much of upstate New York—including the Mohawk River Watershed—is a well-recognized economic asset to the area. Finally, minimizing runoff that contributes to excessive stream flow can help reduce the frequency and intensity of localized flooding in the watershed, which carries an obvious economic benefit.

4.2.1 Strategy Component 1A: Implement BMPs to Protect and Restore Natural Hydrology

Restoring natural hydrology reduces the risk of flooding and its concomitant losses to agriculture and the built environment, and thus bears directly on the economic health of the communities within the watershed. As such, this BMP component for watershed health addresses the following goals of this Watershed Management Plan:

Goal 2: Protect and enhance natural hydrologic processes
Goal 3: Promote flood hazard risk reduction and enhanced flood resilience

Precipitation that falls on the landscape will follow diverse paths, depending on the intensity and duration of the precipitation and the suite of environmental conditions encountered. Water may run into streams, or be retained in lakes, ponds, or wetlands. It may seep into the ground and replenish aquifers. Storage in wetlands or percolation into the soil helps reduce the volume of water flowing across the land surface and into the surface network of streams and rivers, thereby reducing flooding. Extended contact with the soil and vegetation allows the absorption of harmful materials, mitigating their impact.

Human activities that modify surface drainage, disturb vegetative cover, and increase impervious surfaces will inevitably affect natural hydrology. Even in relatively undeveloped landscapes, periods of intense rainfall or rapidly melting snow can overwhelm the capacity of the surface drainage network and lead to flooding. The potential energy of flowing water, especially during storm conditions when velocity is high, can lead to erosion of the landscape with adverse impacts on the built environment and the loss of important resources. Therefore, many of the recommendations aim to replicate the natural hydrology of the Mohawk River Watershed and its subwatersheds. The USEPA has determined that well-planned, clustered, higher-density development reduces per-household storm-water run-off and allows for the natural management of water, thus reducing run-off pollution and disturbance of natural systems and habitats.[1]

4.2.2 Strategy Component 1B: Implement BMPs to Reduce Erosion and Sedimentation

Reducing erosion and sedimentation improves water quality; restores in-stream habitats for fish and other organisms; supports the economies of waterfront and other watershed communities by reducing water-treatment costs and improving the aesthetic and recreational qualities of waterbodies; and supports agriculture by preserving valuable topsoil and the loss of streamside land. As such, this BMP component for watershed health addresses the following goals of this Watershed Management Plan:

Goal 1: Protect and restore the quality and ecological function of water resources
Goal 4: Protect, restore, and enhance fish and wildlife habitat
Goal 5: Revitalize communities and waterfronts and adopt smart growth land use practices
Goal 6: Promote agriculture and other working landscapes

A number of the recommended practices have the goal of retaining soil on the land and preventing its movement into waterways. Not only can erosion cause the loss of valuable topsoil, degrade streambanks and alter the course of streams, it carries silt and sediment into the water, making it turbid and reducing its quality. The subsequent deposition of suspended sediment alters aquatic habitats, adversely affecting organisms at multiple levels in the food web.

4.2.3 Strategy Component 1C: Implement BMPs to Minimize Pollution

Minimizing pollution restores water quality, improves fish and wildlife habitat, and supports communities faced with dealing with polluted waters. As such, this BMP component for watershed health addresses the following goals of this Watershed Management Plan:

Goal 1: Protect and restore the quality and ecological function of water resources
Goal 4: Protect, restore, and enhance fish and wildlife habitat
Goal 5: Revitalize communities and waterfronts and adopt smart growth land use practices

[1] USEPA. 2006 (January). *Protecting Water Quality with Higher Density Development.* Available at http://www.epa.gov/dced/pdf/protect_water_higher_density.pdf.

Water pollution may be defined as any impairment of the suitability of water for any of its beneficial uses, actual or potential, by human-induced changes in the quality of the water.[2] It is sometimes useful to think of water pollutants in two broad categories: nutrients stimulate the growth of organisms in the water, especially algae and plants, which increases the turbidity of the water and may have other adverse effects; toxins—broadly construed—may be harmful to aquatic organisms or human health. Many of the recommendations aim to minimize the generation and movement of nutrients and other chemicals into the Mohawk River and its subwatersheds.

4.2.4 Strategy Component 1D: Implement BMPs to Protect and Restore Habitats

Habitats in and near streams are important in maintaining good water quality, providing an ecosystem service that might otherwise be expensive or impossible to duplicate. Inasmuch as water- and wildlife-based recreation is important to many communities in the watershed, protecting and restoring habitats also represents an investment in watershed communities. Therefore, this BMP component for watershed health addresses the following goals of this Watershed Management Plan:

Goal 1: Protect and restore the quality and ecological function of water resources
Goal 4: Protect, restore, and enhance fish and wildlife habitat
Goal 5: Revitalize communities and waterfronts and adopt smart growth land use practices

A successful watershed management planning effort must consider ways to improve and protect both terrestrial and aquatic habitats within the watershed. The presence of a healthy fishery, for example, requires not only the presence of the fish themselves, but the resources upon which the fish depend—a food web that sustains them with nutrients and energy, the plants and algae that replenish the oxygen in the water, and appropriate physical spaces in which to live and spawn.

The terrestrial environment is essential as well. Forests, for example, provide timber directly, but they also provide habitat for many beneficial terrestrial organisms. The quality of such habitat is reduced when the total area of habitat is reduced, as well as when habitats are fragmented. Creating corridors between otherwise fragmented areas of natural forest habitat improves their quality.

Terrestrial vegetation, including forest cover, is linked to the natural hydrology of the watershed. Forested riparian areas absorb runoff and restrict the direct flow of water and the sediment, nutrients and other chemicals it contains directly into streams. Through transpiration, forests also transfer water from the land into the atmosphere, and this can have a significant effect on the hydrology.

The advent of exotic, invasive species can also greatly degrade the quality of the watershed. Such species—plants or animals—are often capable of rapid proliferation and can crowd out or otherwise outcompete the native species. Some exotic invasive species are predators or parasites of native species and harm the native species directly. Some aquatic invasive species disrupt the food web or clog waterways to such an extent that boating or other water-based recreation is impossible.

[2] Warren, Charles E. 1971. *Biology and Water Pollution Control*. Philadelphia: W. B. Saunders Co.

4.2.5 Watershed-Wide BMP Recommendations

The Best Management Practices identified below are grouped in terms of their relevance to agricultural, developed/developing areas, or all areas of the watershed.[3] A summary of these recommendations and their relationship to the strategy components for BMP implementation is shown in **Table 4-1**, which follows the list of recommendations for BMP implementation applicable to all areas.

4.2.5.1 Agricultural Areas

Restore or create vegetated riparian buffer zones. Riparian buffer zones impede the direct runoff of water, allowing it to be absorbed and percolate into the ground or be taken up by the vegetation. Not only does this provide a buffer for the flow of water and reduce erosion, it also reduces the flow of pollutants from the landscape into waterways.

Restore wetlands. Like vegetated riparian zones, wetlands serve to buffer the flow of water and pollutants the water may carry directly into waterways. Wetlands serve as water storage areas, reducing the intensity of flooding, and they provide habitat for many wildlife species.

Improve animal feeding and waste operations and nutrient management programs. Animal feed and animal waste that find their way into waterbodies introduce nutrients that lead to eutrophication and reduced water quality.

Initiate or continue formal programs to reduce the impact of agriculture. Agricultural Environmental Management (AEM), prescribed grazing, and established soil erosion BMPs represent integrated strategies to reduce soil erosion and to prevent the export of nutrients from farms.

4.2.5.2 Developed Areas

Initiate green Infrastructure, preserve green space, and decrease impervious surfaces. These strategies contribute to the management of stormwater in built-up areas by reducing the direct flow of water and pollutants that might otherwise be washed directly into streams. Application of natural processes like these to absorb stormwater also mitigates the risk of flooding and has an impact on the management of water quality. Examples of green infrastructure in developed areas include stream buffers, greenbelts, vegetative zones between impervious surfaces and storm sewers (including rain gardens), street trees, rooftop gardens, and permeable pavement. Examples of ways to decrease impermeable surfaces includes directing new development toward existing cities and villages, reducing parking lot and road width requirements, and allowing higher density development.

Improve floodplain development standards. In order to reduce the risk of damage to infrastructure and property from flood events, consider measures such as requiring increased setbacks and buffers, elevation of existing structures and infrastructure, and prohibition of septic tanks in the floodplain.

Incorporate/apply/incentivize/reward smart growth. Smart growth is a holistic approach to planning aimed not only toward improving water quality—partly by preserving green space and reducing per capita impervious surfaces—but also toward reducing auto dependence, reducing greenhouse gas emissions and other air pollutants, reducing infrastructure costs, and developing livable communities more conducive to physical and social wellbeing. The essential principals of smart growth include creating development patterns that are compact and include a mix of land uses in close proximity. Streets are designed to interconnect in a system of short blocks, which accommodate walking, biking, transit and the automobile. Smart growth also promotes a balance between private

[3] Some of these BMPs are relevant for municipalities and are thus related to components of Strategy 2, Municipal Actions.

property and the shared space of the public realm. These principles can be actively advanced at the municipal and regional level.

Implement stormwater management plans. Municipal Separate Storm Sewer Systems (MS4s) are stormwater collection systems (not associated with sanitary sewerage systems) that discharge into a waterbody. Urbanized areas subject to the USEPA's MS4 program are required to develop a program to reduce the transport of pollutants via storm sewers.

Address combined sewer overflows. In certain older municipalities, a single sewerage (piping) system collects both sanitary and stormwater and directs this flow to a wastewater treatment plant. During periods of intense precipitation the capacity of the wastewater collection system is exceeded, and a mixture of stormwater and sanitary sewage is discharged to the waterways through relief points in the collection system called combined sewer overflows. Remedial measures include separating the stormwater collection system from the sanitary system, installing storage capacity, or adopting green infrastructure measures designed to reduce the peak rate of stormwater runoff.

4.2.5.3 All Areas

Address failing septic systems near streams and lakes and promote tertiary treatment to remove phosphorus at WWTPs. These strategies are aimed at reducing the load of nutrients discharged to waterbodies in the watershed. Throughout the northeastern US, phosphorus loading is the principal cause of eutrophication and its concomitant impact on water quality. Secondary treatment at WWTPs typically removes organic matter and pathogens, but removal of phosphorus and other specific nutrients requires tertiary treatment. Failing septic systems may contribute nutrients and pathogens to nearby waterbodies. Even well-maintained septic systems may be a source of nutrients, depending on their distance from waterways, the age of the system, and the characteristics of the soil matrix between the leach field and the receiving water.

Ensure compliance with SPDES permits. These permits regulate the discharge of pollutants from WWTPs and other point sources.

Improve Department of Public Works sand and salt storage facilities. Runoff from these storage facilities contributes to sediment load and salt content of receiving waterbodies.

Address legacy and transboundary contaminants (e.g., Superfund, Brownfield, mercury). Two Superfund sites have been identified in the Mohawk River Watershed. These areas are regulated under the USEPA program to clean up the nation's worst hazardous waste sites. Some developed areas in the Mohawk River Watershed contain Brownfield sites, former industrial or storage areas where chemical pollutants have infiltrated the soil, serving as an actual or potential source of pollution for surface and/or groundwater. Reclaiming or restoring such sites will contribute to improved water quality.

Reduce streambank erosion through natural stream design methods. Reducing streambank erosion reduces both the sediment load added to the stream and the damaging effects on the surrounding landscape.

Protect drinking water supplies. Both surface water and groundwater serve as drinking water sources for people in the watershed. Specific actions may be required to protect the quality and the quantity of flow of these sources.

Encourage forest management planning. The goal of this general recommendation encompasses maintaining healthy forests and ensuring sustainable sources of timber, as well as preventing erosion and the resultant water quality impairment.

Protect wetlands and wildlife management areas. Protecting these areas preserves habitat for resident flora and fauna and reduces the risk that invasive species will become established. In addition, intact wetland and upland ecosystems promote natural hydrology and prevent soil loss by erosion.

Best Management Practices recommendations that can be applied watershed-wide are presented in Table 4-1. Some of the BMPs were not included in the discussion.

TABLE 4-1
BMP Recommendations to Support Watershed Management Goals

BMP Recommendation	Targeted BMP Component			
	Protect & Restore Natural Hydrology	Reduce Erosion & Sedimentation	Minimize Pollution	Protect & Restore Habitats
Agricultural Areas				
Restore/increase riparian buffers	X	X	X	X
Restrict animal access to streams		X	X	
Restore/protect wetlands	X	X	X	
Continue AEM programs		X	X	
Expand nutrient management programs			X	
Promote prescribed grazing		X		
Improve animal feeding and waste operations			X	
Implement soil erosion BMPs		X		
Developed Areas				
Implement stormwater management practices	X			
Implement green infrastructure practices	X			
Preserve green space	X			X
Address legacy/transboundary contaminants (e.g., Brownfields, Superfund, mercury)			X	
Address Combined Sewer Overflow issues			X	
Encourage smart growth	X			X
Increase pervious surfaces	X			
All Areas Watershed-Wide				
Address failing septic systems near waterbodies			X	
Protect drinking water supplies	X		X	
Reduce streambank erosion w/ natural design	X	X		
Ensure compliance w/ SPDES permits			X	
Promote advanced phosphorus removal at WWTPs			X	
Encourage forest management planning		X		X
Improve DPW sand and salt storage facilities			X	
Protect wildlife management areas				X
Enhance in-stream habitat				X
Protect trout spawning waters				X
Regulate development along streams	X	X	X	
Seed drainage ditches to prevent erosion		X		
Quantify impacts of varying flow from reservoirs	X			X
Restore natural floodplains	X			
Manage invasive species				X

4.2.6 Specific BMP Recommendations for Regions

Members of the Coalition and project partners completed detailed assessments of the subwatersheds (classified by 12-digit HUC) to identify what actions might be required to address specific sources of water quality or habitat impairment in those areas. The following subsections summarize the recommendations by the three major watershed regions: Upper Mohawk, Main River, and Schoharie Watershed.

4.2.6.1 Upper Mohawk Region

The subwatersheds within the Upper Mohawk Region are summarized in Table 4-2, and a summary of recommendations for this region is presented in Table 4-3.

TABLE 4-2
Subwatersheds of the Upper Mohawk Region

10-Digit HUC	12-Digit HUC	
Middle West Canada Creek	Hinckley Reservoir	Fourmile Brook
	Cincinnati Creek	Mill Creek
	Conklin Brook	Headwaters of Black Creek
Lower West Canada Creek	Shed Brook	City Brook
	White Creek	North Creek
Upper West Canada Creek	Headwaters of West Canada Creek	Metcalf Brook
	Honnedaga	Big Brook
	Indian River	Vly Brook
	South Branch West Canada Creek	
Delta Reservoir	West Branch Mohawk River	Wells Creek
	Lansing Kill	Delta Reservoir
	Stringer Brook	
Oriskany Creek	Deans Creek	Upper Oriskany Creek
	Lower Oriskany Creek	Headwaters Oriskany Creek
	Middle Oriskany Creek	
Ninemile Creek	Headwaters Mohawk River	Oriskany Battlefield
	Sixmile Creek	Crane Creek
	Lower Ninemile Creek	Reall Creek
	Middle Ninemile Creek	Mud Creek
	Upper Ninemile Creek	Saquoit (Roberts) Creek
	Wheeler Creek	
Nowadaga Creek	Ferguson Creek	Crum Creek
	Sterling Creek	Nowadaga Creek
	Moyer Creek	Fulmer Creek
	Steele Creek	Beaver Brook
	Bridenbecker Creek	

Upper and Middle West Canada Creek

Much of the northern part of this watershed region lies within the Adirondack Park or otherwise largely in forested land. As a result, water quality here is, on the average, relatively good with high assessment scores. Recommendations for these areas are therefore mostly directed at protecting the existing attributes that promote good water quality, protecting forested riparian buffer zones and controlling streambank erosion. Where timber harvesting occurs, it should be done employing best management practices to reduce erosion and the flow of

nutrients and sediment into watercourses. Where necessary, the in-stream habitat should be enhanced to maintain biological integrity and support fisheries. Failing septic systems along streams and lakes in this area should be repaired or replaced to prevent nutrient pollution of the water. Where agriculture occurs in these areas, agricultural BMPs should be employed to reduce erosion and the flow of nutrients and sediment into watercourses.

The Upper and Middle sections of West Canada Creek subwatersheds continue to suffer adverse impact from acid precipitation and atmospheric deposition of mercury, and Upper West Canada Creek is on the 303(d) list of impaired waterbodies for this reason. The only long-term solution is the reduction of emissions from coal-fired power plants in the Midwest.

Lower West Canada Creek and Delta Reservoir

Closer to the main stem of the Mohawk River agriculture intensifies and has a greater effect on water quality. Recommendations here aim to reduce erosion and prevent the movement of soil and nutrients into waterbodies. Maintaining or establishing riparian buffer zones, implementing soil erosion BMPs and maintaining or restoring wetlands. Animal feed and waste should be managed so as to reduce the runoff of nutrient-laden water into streams, and animal access to streams should be restricted.

Ninemile Creek, Oriskany Creek, and Nowadaga Creek

These subwatersheds lie along the main stem of the Mohawk River and in the heavily farmed upland areas to the south. In many of these agricultural areas, watershed health is compromised by soil erosion and runoff. Recommendations to restore watershed health in these areas are aimed at mitigating these negative impacts: creating or increasing riparian buffer zones, restoring wetlands and employing soil erosion BMPs. Managing animal feed and waste operations and keeping animals out of streams will reduce the nutrient load entering waterbodies and mitigate eutrophication.

The cities of Rome and Utica and other developed areas lie along the Mohawk River in these subwatersheds. Recommendations for these developed areas address the restoration of impaired waterbodies and elimination, or at least reduction, of point and non-point sources of pollution. Implementing stormwater management plans in MS4 communities and reducing impervious surfaces, perhaps by preserving or increasing green space, can reduce the flow of pollutants into waterbodies and help to ameliorate periodic flooding. Encouraging smart growth and implementing green infrastructure initiatives in Utica and Rome can reduce run-off and the flow of pollutants. Green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. It includes stormwater management systems that mimic nature by soaking up and storing water. These communities should also continue to address the issue of combined sewer overflows, which transport stormwater as well as untreated wastes into waterbodies during times of high rainfall or snowmelt.

Recommendations also include continuing to address issues associated with a number of brownfield sites and a Superfund site (the former Griffiss Air Force Base near Rome) that lie in this region. A number of stream segments in this area appear on NYDEC's 2012 Section 303(d) list of impaired waterbodies. Remedial actions to address these issues should be initiated or continued, and compliance with SPDES permits for facilities in these areas should be ensured.

A summary of the recommended BMPs for each of the HUC-10 subwatersheds in the Upper Mohawk Region is presented in **Table 4-3**. These recommendations came from subwatershed assessment reports prepared by Mohawk River Watershed Coalition Soil and Water Conservation Districts, and as such the wording of the BMPs varies slightly from those listed in Table 4-1.

TABLE 4-3
BMP Recommendations for the Upper Mohawk Region

SUBWATERSHED (10-DIGIT HUC)	Recommendations to protect & restore natural hydrology (Strategy Component 1A)	Recommendations to reduce erosion and sedimentation (Strategy Component 1B)	Recommendations to minimize pollution (Strategy Component 1C)	Recommendations to protect & restore habitats (Strategy Component 1D)
Upper West Canada Creek	– Protect wetlands – Protect forested riparian buffers	– Develop forest management planning – Stabilize streambanks	– WWTP in Barneveld – Address failing septic systems	– Enhance in-stream habitats
Middle West Canada Creek	– Protect wetlands – Protect forested riparian buffers	– Employ forest management planning	– Address failing septic systems – Apply agricultural BMPs	
Lower West Canada Creek	– Restore/protect riparian buffers – Restore wetlands – Manage urban stormwater	– Stabilize stream banks – Apply AEM	– Apply AEM – Upgrade WWTPs – Address failing septic systems	– Enhance in-stream habitats – Protect trout spawning water
Delta Reservoir	– Restore/protect riparian buffers – Restore wetlands – Work w/ Canal Corp. to stabilize water levels	– Develop forest management planning – Stabilize streambanks – Stabilize steep slopes	– Apply agricultural BMPs	
Oriskany Creek	– Restore/protect riparian buffers	– Stabilize streambanks w/ natural stream design – Employ soil conservation methods on farms	– Apply agricultural BMPs	
Ninemile Creek	– Enhance forested buffers – Restore/protect wetlands – Preserve green space – Employ control measures in MS4 communities – Employ green infrastructure – Redevelop vacant impervious surfaces	– Develop forest management plans – Work w/ farmers on conservation plans – Encourage smart growth – Implement natural stream design	– Address legacy contaminants (e.g., clean-up of Griffiss AFB) – Address CSO issues – Ensure compliance with SPDES permits	– Protect wildlife management areas
Nowadaga Creek	– Install riparian buffers – Restore wetlands – Manage stormwater	– Stabilize streambanks w/ natural stream design	– Apply agricultural BMPs – Address 303(d) issues – Improve DPW sand and salt storage – Upgrade WWTPs to tertiary treatment for phosphorus	

4.2.6.2 Main River Region

The subwatersheds in the Main River Region are summarized in Table 4-4, and a summary of BMP implementation recommendations for this region is presented in Table 4-5.

TABLE 4-4
Subwatersheds of the Main River Region

10-Digit HUC	12-Digit HUC	
Alplaus Kill	North Chuctanunda Creek	Kayaderosseras Creek
	South Chuctanunda Creek	Evas Kill
	Sandsea Kill	Indian Kill
	Poentic Kill	Stony Creek
	Shakers Creek	Headwaters Alplaus Kill
Fly Creek	Irish Creek	Wilsey Creek
	Fly Creek	Cripple Bush Creek
	Town of Esperance	
Cayadutta Creek	Headwaters Cayadutta Creek	Hall Creek
	Auries Creek	Yatesville Creek
	Flat Creek	Headwaters Flat Creek
Canajoharie Creek	Peck Lake	Zimmerman Creek
	North Creek	Mother Creek
	Fort Plain-Otsquago Creek	Lower Canajoharie Creek
	Middle Canajoharie Creek	Upper Canajoharie Creek
East Canada Creek	Headwaters East Canada Creek	Upper East Canada Creek
	Middle East Canada Creek	Lower East Canada Creek
	Spruce Creek	Sprite Creek
	Middle Sprite Creek	North Creek

East Canada Creek

The northeastern upland portion of the Main River region of the Mohawk River Watershed (East Canada Creek 10-digit HUC) lies largely within the Adirondack Park and has little agriculture and few developed areas. There are relatively few negative impacts on the environmental quality of this area, and the aim of recommended actions should be to protect the landscape from further degradation.

Forests and wetlands cover much of this area with expansive riparian buffer areas and few impervious surfaces. These conditions should be protected. With low population density, little agriculture and few sources of point or nonpoint pollution, there are few serious threats to water quality, and these conditions should be maintained.

The few WWTPs that are present should be upgraded to tertiary treatment to remove phosphorus. Failing septic systems near streams or lakes should be repaired or replaced. In-stream habitats should be maintained or improved where necessary and mechanisms for preventing the introduction of invasive species or their control, once introduced, should be instituted.

Canajoharie Creek, Cayadutta Creek, Alplaus Kill

Lying in lowland areas along the main stem of the Mohawk River, these areas are subject to intensive agriculture. They also have a long history of industrial, commercial, and residential development and contain the cities of

Amsterdam, Johnstown, Schenectady and parts of Albany. The principal aim of watershed management in these areas must be to mitigate the sources of degradation and restore environmental quality.

Actions that reduce runoff from the landscape directly into waterways will reduce erosion, impede the flow of pollutants, and reduce the risk of flooding. In agricultural areas, restoring or increasing riparian buffer zones and restoring wetlands serve to reduce runoff. Improving animal feeding and waste operations and expanding nutrient management programs reduce the flow of pollutants, especially nutrients, into streams, preventing eutrophication and the water-quality problems associated with it. Established programs for AEM, prescribed grazing and soil erosion BMPs should be implemented or expanded.

Developed areas in this Main River region have many impervious surfaces. As rain flows off these surfaces directly into waterways, it carries pollutants—road salt and sand, petroleum products, solid wastes, etc. Since the flow-buffering effect of percolation to the soil is prevented, variation in flow volume and the risk of periodic flooding is increased. Many recommended strategies for these developed areas are aimed at reducing runoff and the flow of the pollutants. Smart growth and green infrastructure principles that concentrate development in already developed areas, increase green spaces, increase development densities, and decrease road width and parking requirements, will serve to reduce and filter stormwater runoff. Communities with municipal separate stormwater systems must implement stormwater management programs that may include some of these elements.

Other recommendations for managing this region are aimed at reducing the generation and flow of pollutants into waterbodies. Combined sewer overflows, where they occur, should be managed or eliminated to prevent the flow of untreated sewage, and WWTPs should be upgraded to tertiary treatment to reduce phosphorus pollution, and SPDES permit conditions should be enforced. Failing septic systems near streams and lakes should be improved. There are a number of brownfields and a Superfund site (Johnstown Landfill) in this region as well, and programs to restore these areas should be continued.

Fly Creek–Schoharie Creek

This subwatershed comprises the lower reaches of Schoharie Creek up to its confluence with the Mohawk River. Although this subwatershed lies close to the main stem of the Mohawk River and drains directly into it, it has little industrial, commercial, or residential development. Agricultural land use, however, is relatively high, and recommendations for this area aim both to protect and to restore the subwatershed.

For agricultural areas, recommended management strategies to reduce runoff, control erosion and prevent the flow of pollutants into lakes and streams, are similar to those for agricultural areas in the Canajoharie Creek-Mohawk River, Cayadutta Creek-Mohawk River, Alplaus Kill-Mohawk River, discussed above.

In areas where the impact of agriculture or development is less, recommendations are directed toward protecting the natural qualities of the watershed. These include protecting vegetated riparian buffer areas, wetlands and wildlife management areas, reducing streambank erosion through natural stream design and addressing failing septic systems near lakes and streams.

A summary of the recommended BMPs for each of the HUC-10 subwatersheds in the Main River Region is presented in **Table 4-5**. These recommendations came from subwatershed assessment reports prepared by Mohawk River Watershed Coalition Soil and Water Conservation Districts, and as such the wording of the BMPs varies slightly from those listed in Table 4-1.

TABLE 4-5
BMP Recommendations for the Main River Region

SUBWATERSHED (10-DIGIT HUC)	Recommendations to protect & restore natural hydrology (Strategy Component 1A)	Recommendations to reduce erosion and sedimentation (Strategy Component 1B)	Recommendations to minimize pollution (Strategy Component 1C)	Recommendations to protect & restore habitats (Strategy Component 1D)
Alplaus Kill	– Manage stormwater in MS4s – Restore forested riparian buffers – Restore wetlands – Educate homeowners re stormwater runoff – Employ green infrastructure – Decrease impervious surfaces – Encourage smart growth	– Restrict animal access to streams – Employ forest management BMPs – Employ agricultural BMPs	– Employ nutrient and waste management BMPs on farms – Address failing septic systems – Upgrade WWTPs to reduce phosphorus	
Fly Creek	– Maintain forested riparian buffers – Restore/protect wetlands	– Employ soil conservation BMPs – Prevent soil erosion on steep slopes – Reduce streambank erosion	– Employ nutrient and waste management BMPs on farms – Address failing septic systems	– Protect wildlife management areas
Cayadutta Creek	– Restore forested riparian buffers	– Restrict animal access to streams – Employ soil conservation BMPs	– Upgrade WWTPs to reduce phosphorus – Employ nutrient and waste management BMPs on farms – Protect drinking water supplies – Address brownfield and Superfund sites	
Canajoharie Creek	– Install riparian buffers – Restore wetlands	– Prevent streambank erosion	– Manage animal feeding operations	– Conduct biodiversity assessments
East Canada Creek	– Protect forested riparian buffers		– Upgrade WWTPs – Address failing septic systems	– Maintain or improve in-stream habitats

4.2.6.3 Schoharie Watershed Region

The subwatersheds in the Schoharie Watershed Region are summarized in Table 4-6, and a summary of recommendations for this region is presented in Table 4-7.

TABLE 4-6
Subwatersheds of the Schoharie Watershed Region

10-Digit HUC	12-Digit HUC	
Cobleskill Creek	Headwaters West Creek Punch Kill Cobleskill Creek	West Creek Schenevus Creek
Batavia Kill	Huntersfield Creek Bear Kill Manor Kill	Lewis Creek Headwaters Batavia Kill
East Kill	East Kill West Kill Gooseberry Creek	Little West Kill Red Kill
West Kill	West Kill Wharton Hollow Platter Kill	Mine Kill Cole Brook
Panther Creek	Panther Creek Little Schoharie Creek Stony Brook	Keyser Kill Line Creek
Fox Creek	Headwaters Fox Creek Beaver Dam Creek Switz Kill	Ox Kill King Creek

Cobleskill Creek

Relatively high agricultural land use in this subwatershed compromises water quality. Recommendations to restore water quality here are directed toward reducing runoff and the flow of nutrients from agricultural areas into streams. These should include encouraging the protection of wetland areas for flood attenuation, nutrient control and habitat improvement. Critical riparian buffer areas should be restored or protected to control nutrient input, bank erosion and the flow of nutrients. Animal waste and feed should be managed so as to minimize the movement of nutrients into waterbodies. Established programs for AEM, prescribed grazing and soil erosion BMPs should be implemented or expanded.

Parts of this subwatershed, especially the Village of Cobleskill have moderate levels of commercial and suburban development with the concomitant problems of increased impervious surfaces. Recommendations here include the application of the principles of smart growth and the preservation of green space. Communities with municipal separate stormwater systems must implement stormwater management programs that may include some of these elements. Failing septic systems near streams should be repaired or replaced and WWTPs in these areas should apply tertiary treatment to remove phosphorus.

Some segments of Cobleskill Creek appear on the NYDEC's Section 303(d) list of impaired waterbodies (see Chapter 3), and these issues should be addressed.

Batavia Kill–Schoharie Creek

Much of this subwatershed lies in upland forested areas with relatively low intensity of agriculture and few developed areas. Recommendations, therefore, for much of this subwatershed involve protecting those attributes

that promote good water quality. Nonetheless, the presence of steep slopes, combined with erodible soils has led to turbidity of a number of streams. Schoharie Reservoir, in this subwatershed, appears on the NYDEC's Section 303(d) list of impaired waterbodies because of silt and sediment. Recommendations here include reducing streambank erosion though natural stream design methods and protecting riparian buffer zones.

West Kill, East Kill, Panther Creek

These subwatersheds have few developed areas and relatively little agriculture. Forest cover is high. Recommendations here are largely for protecting existing attributes that support good water quality. Some streams carry excess sediment loads because of streambank erosion and highly erodible soils. Recommendations include the application of natural stream design methods, protecting forested riparian buffers, and managing stormwater in developed areas.

Fox Creek

This subwatershed has a mix of agricultural and residential land use, and very little commercial land use. Land cover is approximately 60% agricultural and 30% mixed forest. Forest cover increases to the south in the higher terrain of the Catskills. Water quality throughout the subwatershed is good, thus recommendations are mainly for protecting water quality. In agricultural areas, increasing riparian buffers and restoring wetlands are recommended, along with restricting animal access to streams. To reduce erosion along streams, streambanks should be stabilized in areas of highly erodible soils. Also, development along streams should be regulated, which would include requirements such as setbacks, riparian buffers, and floodplain protection. To better understand habitat health, biodiversity assessments are recommended. Failing septic systems are an issue for Warner's Lake.

A summary of the recommended BMPs for each of the HUC-10 subwatersheds in the Schoharie Watershed Region is presented in Table 4-7. These recommendations came from subwatershed assessment reports prepared by Mohawk River Watershed Coalition Soil and Water Conservation Districts, and as such the wording of the BMPs varies slightly from those listed in Table 4-1.

TABLE 4-7
BMP Recommendations for the Schoharie Watershed Region

SUBWATERSHED (10-DIGIT HUC)	Recommendations to protect and restore natural hydrology (Strategy Component 1A)	Recommendations to reduce erosion and sedimentation (Strategy Component 1A)	Recommendations to minimize pollution (Strategy Component 1C)	Recommendations to protect and restore habitats (Strategy Component 1D)
Cobleskill Creek	– Restore riparian buffers – Restore wetlands – Implement stormwater management practices – Preserve green space	– Restrict animal access to streams – Reduce streambank erosion – Implement soil erosion BMPs	– Address failing septic systems – Employ nutrient and waste management BMPs on farms – Monitor road salt at bridge crossings	
Panther Creek	– Restore riparian buffers	– Stabilize streambanks		– Control invasive plants
Batavia Kill	– Increase riparian buffers	– Stabilize streambanks		
Fox Creek	– Restore wetlands – Increase riparian buffers	– Regulate streamside development – Stabilize streambanks – Restrict animal access to streams – Regulate development along streams	– Address failing septic systems (Warner's Lake)	– Conduct biodiversity study along streams
West Kill	– Address streamflow below reservoir – Restore/increase riparian buffers	– Seed roadside ditches – Stabilize streambanks		– Conduct biodiversity study of streams – Manage culvert for fish migration
East Kill	– Enhance riparian buffers – Install adequate culverts	– Stabilize streambanks – Discourage development near streams		– Control invasive species

4.3 Strategy 2: Advance Municipal Actions

Advance municipal actions to promote sustainability, reduce the impact of flooding and enhance flood resilience, and revitalize communities and waterfronts through the adoption of appropriate zoning and land use policies in the areas of cluster development, control development on steep slopes, floodplain protection, reduce impervious surfaces, protect and restore unique and natural areas, riparian areas, and wetlands.

Municipalities have the regulatory authority under NY state law to adopt local laws governing land use. Many of the tools available to local governments (such as comprehensive planning, zoning, subdivision ordinances, site plan review, etc.) can ultimately affect the potential for water resources protection by reducing the potential for nonpoint source pollution and flooding. Stormwater management and controls on sediment and erosion are key tools available to municipalities. In addition, local land use laws can afford additional protections to critical areas such as wetlands and riparian zones.

As part of the development of the Mohawk River Watershed Management Plan, existing land-use regulations were reviewed for their ability to protect water quality and habitat conditions that challenge the three watershed regions. Seven regulatory tools were identified as holding the potential to help move the watershed communities toward realizing the goals of this Plan. The following subsections describe components of the municipal action strategy, along with recommendations for their adoption. A summary of these recommendations is presented in Table 4-8 (at the end of this subsection). For additional regional summaries, as well as community-specific results, refer to the Mohawk River Watershed Regulatory Review & Analysis (sections 3.1–3.4).[4]

4.3.1 Strategy Component 2A: Increase Density of Cluster Development

The purpose of increased density cluster development is to reduce the impact of new construction on floodplains, streams, wetlands, woodlots, farmland and other environmentally sensitive features. Cluster development regulations typically allow for increased density in areas where that density would result in the preservation and permanent protection of the features described above. As it relates to water quality, clustering can result in a reduction in the broad creation of new impervious surfaces, which can lessen the impact of stormwater runoff on areas outside the development. Additionally, by requiring that naturally vegetated buffers be maintained around lakes, streams and other waterbodies, significant water quality benefits can be obtained.

The lack of cluster development regulations was identified as one of the top five major gaps in all three regions:

- Main River Region – Approximately 52% of municipalities in the Main River Region do not have provisions in their regulatory programs addressing cluster development. Of those that do, only 6% are consistent with best management practices.
- Upper Mohawk Region – Approximately 75% of municipalities in the Upper Mohawk Region do not have any provisions in their regulatory programs addressing cluster development. Of those that do, only 1% are consistent with best management practices.
- Schoharie Watershed Region – Approximately 57% of municipalities in the Schoharie Watershed Region do not have any provisions in their regulatory programs addressing cluster development. Of those that do, only 8% are consistent with best management practices.

[4] Bergmann Associates. 2014 (January). *Mohawk River Watershed Regulatory Review & Analysis*. Prepared for the Mohawk River Watershed Coalition of Conservation Districts. Link to Executive Summary or Full Report.

Recommendations to Increase Density of Cluster Development

Where local gaps exist, municipalities should incorporate one or more of the following in their land use control or incentive-based program:

Establish ordinances for higher density cluster development and PUDs. Higher density cluster development and Planned Unit Development (PUD) ordinances should be developed to specifically support environmental objectives such as natural area preservation and stormwater absorption. This should incorporate design standards such as impervious surface limits, riparian buffer zones, green infrastructure requirements, woodlot protection, steep slope regulations, and other BMPs identified elsewhere in this document.

Require buffers around water features in developments. Open spaces associated with higher density cluster development should be placed in lake or streamside areas of the property to buffer the developed areas of the property from these natural water features.

Offer incentives to developments that preserve open space. Provide density bonuses to developments that preserve open space or agriculture. Density bonuses permit higher development density on one portion of a property if the remaining land is preserved for open space or agriculture.

Allow cluster development by right. Municipalities can permit cluster development under current zoning, assuming that the ordinance provides specific guidelines for reducing environmental impacts and that all specific provisions of the cluster development provision are met.

Encourage higher density cluster developments at the hamlet-, village- and/or city-scale rather than as single use subdivisions. This approach not only takes pressure off undeveloped land but would also shape development into mixed-use walkable communities. The resulting mixed-use communities would have the additional environmental benefit of reducing the number of vehicle trips required by local residents. This is a particularly important smart growth practice for minimizing sprawl.

4.3.2 Strategy Component 2B: Control Development on Steep Slopes

Generally speaking, steep slopes tend to be more erosive than flatter slopes. As such, communities often regulate development in these areas so as to prevent erosion and reduce the risk of landslides that endanger lives, damage property and infrastructure, degrade wildlife habitat, and impact water quality by increasing sedimentation.

The lack of regulations addressing development on steep slopes was identified as one of the top five major gaps in two of the three regions:

- Main River Region – Approximately 64% of municipalities in the Main River Region do not have any provisions in their regulatory programs addressing development on steep slopes. Of those that do, only 15% are consistent with best management practices.
- Upper Mohawk Region – Only 25% of municipalities in the Upper Mohawk Region have provisions in their regulatory programs addressing development on steep slopes, of which, only 4% are consistent with best management practices.

Recommendations to Control Development on Steep Slopes

Where local gaps exist, municipalities should incorporate the following recommendations in their regulatory program (see Section 3 of the *Mohawk River Watershed Regulatory Review & Analysis* for community-specific recommendations):

Adopt an ordinance regulating development on steep slopes. This ordinance should require the use of measures designed to prevent/reduce runoff and erosion on all development sites with slopes greater than a predetermined threshold, or require the development of an Erosion, Sediment and Stormwater Control Plan. Alternatively, this ordinance could prohibit development on slopes exceeding a predefined threshold. Typical steep slope thresholds range from 8 to 15%.

Designate a steep slope overlay zone. All development within that zone would be required to implement measures designed to prevent/reduce runoff and erosion. This steep slope ordinance could be included as part of a stormwater, sedimentation, and erosion control ordinance, or it could be created as a stand-alone ordinance.

4.3.3 Strategy Component 2C: Provide Floodplain Protection

Floodplains provide a number of societal benefits related to water quality and watershed management and can be far more effective than many man-made structures (e.g., floodwalls, stream channelization) in reducing downstream flood peaks. By providing flood and erosion control by storing and slowly releasing floodwaters, floodplains can help reduce the depth and velocity of flooding. Naturally vegetated floodplains also trap sediments and pollutants and prevent them from being carried downstream.

While the vast majority of watershed municipalities participate in the National Flood Insurance Program and have enacted the necessary ordinances to do so, many of these are not consistent with accepted best management practices. Floodplain regulatory gaps were identified as one of the top five major gaps in all three regions:

- Main River Region – More than two-thirds of municipalities in the Main River Region have provisions in their regulatory programs addressing floodplain protection, but only 6% are consistent with best management practices.
- Upper Mohawk Region – Approximately 48% of municipalities in the Upper Mohawk Region do not have any provisions in their regulatory programs addressing floodplain protection. Of those that do, only 3% are consistent with best management practices.
- Schoharie Watershed Region – Although 86% of municipalities in the Schoharie Watershed Region have provisions in their regulatory programs addressing floodplain protection, only 8% are consistent with best management practices.

Recommendations to Provide Floodplain Protection

Where local gaps exist, municipalities should incorporate the applicable recommendations in their land use control program:

Adopt the most recent NYSDEC Model Local Law for Flood Damage Reduction. The most up-to-date model laws are available from the NYSDEC's Floodplain Management Section.

Prohibit new impervious surfaces in undeveloped floodplains. Avoiding the creation of new impervious surfaces can lessen the impact of stormwater runoff.

Prohibit on-site septic systems in floodplains. Such systems can leach wastewater into waterways if flooding occurs.

Incorporate the No Adverse Impacts (NAI) Floodplains Strategy into the existing regulatory structure. This strategy requires that proposed developments take into consideration their impacts on increased flood stages, flood velocity, flood flows or the increased potential for sediment and erosion within the watershed. The goal is to ensure that actions in one community do not adversely affect the flood risks for other communities unless the proper mitigation is identified.

4.3.4 Strategy Component 2D: Minimize Impervious Surfaces

Impervious surfaces are those surfaces through which the infiltration of rainwater and snowmelt is slowed or impeded (e.g., parking lots, roads, sidewalks, patios). By removing natural land cover (e.g., grasses, forests) and replacing it with impervious surfaces, the soil's ability to absorb nutrients and trap particulate material is decreased, resulting in increased amounts of pollutants washing into surface waterbodies. In addition to increased pollutant transport, the hydrologic effects of increased runoff from areas with impervious surfaces can affect downstream conditions, including contributing to localized flooding and transfer of pollutants.

The lack of impervious surface regulations was identified as one of the top five major gaps in all three regions.

- Main River Region – Approximately 67% of municipalities in the Main River Region do not have any provisions in their regulatory programs addressing impervious surfaces. Of the 33% that do, only 9% are consistent with best management practices.
- Upper Mohawk Region –Only 9% of municipalities in the Upper Mohawk Region have provisions in their regulatory programs addressing impervious surfaces, most of which are consistent with best management practices.
- Schoharie Watershed Region – Approximately 70% of municipalities in the Schoharie Watershed Region do not have any provisions in their regulatory programs addressing impervious surfaces. Of those that do, only 8% are consistent with best management practices.

Recommendations to Minimize Impervious Surfaces

Where local gaps exist, municipalities should consider incorporating the following recommendations in their regulatory program:

Define* Total Impervious Surface Area *to include all impervious surfaces on land plots. Include a definition for *Total Impervious Surface Area* that encompasses all impervious surfaces located on a particular plot of land, including, but not limited to structures (primary, accessory, and/or storage), sidewalks, driveways, and patios.

Incorporate standards for* Total Impervious Surface Area *in municipal zoning ordinances. For rural communities, impervious surfaces should be limited to 10–15% or 2,500 square feet of any lot, whichever is greater, unless a system of stormwater management and artificial recharge of precipitation is developed. For higher density locations (e.g., village cores, urban centers, etc.), impervious surface limits should range from 60–80%. Note that these are just guidelines and that specific thresholds will vary by location and place type (e.g., urban, rural, suburban).

Prohibit or limit new impervious surfaces in riparian zones and floodplain areas. Avoiding the creation of new impervious surfaces can lessen the impact of stormwater runoff and reduce nonpoint source pollution.

Encourage development and redevelopment of existing hamlets/villages/cities. By encouraging the development and redevelopment of existing hamlets, villages and cities, municipalities can limit the amount of new impervious surface added to watersheds.

Encourage compact, higher-density, mixed-use development in areas of high development pressure. This type of development uses less impervious surface per person than low density sprawl.

Incorporate green infrastructure requirements into local land use codes. Examples of green infrastructure include stream buffers, greenbelts, and vegetative zones between impervious surfaces and storm sewers.

4.3.5 Strategy Component 2E: Protect Unique and Natural Areas

Abundant and scenic open spaces are a defining characteristic of the Mohawk River watershed. In addition to providing opportunities for both active and passive recreation, these natural areas can also help to combat pollution and improve water quality by minimizing erosion and reducing runoff to local streams and waterbodies. Protection of these areas can also reduce habitat fragmentation by connecting existing natural areas into a single network.

The lack of regulations addressing the protection of unique and other natural areas was identified as one of the top five major gaps in all three regions:

- Main River Region – Approximately 48% of municipalities in the Main River Region do not have any provisions in their regulatory programs addressing the protection of unique and other natural areas. Of those that do, only 6% are consistent with best management practices.
- Upper Mohawk Region – Approximately 41% of municipalities in the Upper Mohawk Region have provisions in their regulatory programs addressing the protection of unique and other natural areas, of which, only 1% are consistent with best management practices.
- Schoharie Watershed Region – Although 76% of municipalities in the Schoharie Watershed Region have provisions in their regulatory programs addressing the protection of unique and other natural areas, only 8% are consistent with best management practices.

Recommendations to Protect Unique and Natural Areas

Where local gaps exist, municipalities should consider incorporating one or more of the following in their land use control and incentive-based programs to address the protection of unique and other natural areas:

Designate specific areas as Critical Environmental Areas (CEAs). To be designated as a CEA within a given municipality, an area must have an exceptional or unique character with respect to one or more of the following: (1) a benefit or threat to human health; (2) a natural setting (e.g., fish and wildlife habitat, forest and vegetation, open space and areas of important aesthetic or scenic quality); (3) agricultural, social, cultural, historic, archaeological, recreational, or educational values; or (4) an inherent ecological, geological or hydrological sensitivity to change that may be adversely affected by any change.

Designate areas as nature preserves or afford protections similar to CEAs. Specific areas within a given municipality can be designated as nature preserves, or afforded protections similar to those provided to CEAs.

Require tree survey and integrated site plan for new development. As part of Site Plan Review, require that all new development (and substantial improvements) provide a tree survey and an integrated site plan which includes

a woodlot protection plan, a landscape plan and any additional development on the site, including all new or expanded structures, utilities, access roads, grading or other activities, which may adversely affect woodlots. To reduce the burden on landowners, tree surveys, woodlot plans and landscape plans can be limited to only those areas that will actually be disturbed.

4.3.6 Strategy Component 2F: Protect Riparian Areas

Preventing pollutants from entering waterbodies is considerably more cost-effective than attempting to remediate polluted water. One of the most effective (and least expensive) best management practices to reduce the amount of pollutants entering waterbodies is the use of naturally vegetated riparian buffers. Riparian buffers absorb eroding soils and other pollutants during land grading activities, capture and filter pollutants from post-development stormwater runoff and help to trap fertilizers, pesticides and siltation from croplands, and animal waste from pastures, barnyards and intensive livestock operations. While buffers extending 300 feet beyond the shoreline are recommended as the most effective means to protect waterways, 100-foot buffers are a typical compromise that balances the rights of landowners with the need to improve and preserve water quality.

Generally, municipalities in the Main River and the Upper Mohawk Regions are addressing lake and stream protection at a level somewhat consistent with best management practices, although some gaps do exist. The lack of regulations addressing the protection of lakes, streams and other waterbodies was identified as one of the top five major gaps in only one of the three regions:

- Schoharie Watershed Region – Approximately 54% of municipalities in the Schoharie Watershed Region do not have any provisions in their regulatory programs addressing lake and stream protection.

Recommendations to Protect Riparian Areas

Where local gaps exist, municipalities should incorporate the following recommendations in their land use control or incentive-based program:

Incorporate Shorelines in the definitions section of a municipal zoning ordinance. This definition should include the shorelines of lakes, streams, creeks, ponds, wetlands, and other waterbodies.

Adopt a stream/shoreline buffer ordinance for new development and significant redevelopment in watershed municipalities. This ordinance should prohibit the placement of impervious surfaces within the buffer zone and require that the buffer be naturally vegetated.

Develop guidelines for a naturally vegetated (preserved or planted) water quality buffer adjacent to all shorelines. Provisions should be included that require the planting of a buffer when improvements to an existing lakefront or shoreline property or structure are proposed, and where such a buffer does not exist. Buffers, in this context, are not necessarily forested. These guidelines should also address the differences between vegetated buffers in steeply sloped areas and those areas characterized by relatively flat terrain.

Require exclusionary livestock fencing around streams and stream banks to reduce access by livestock. Variances can be granted for specific stream crossing locations determined necessary for livestock movements on a given property.

4.3.7 Strategy Component 2G: Protect Wetlands

Like floodplains, wetlands provide a number of ecosystem services that contribute to water quality, such as filtering out pollutant- and sediment-laden run-off prior to it entering streams, providing valuable flood protection, acting as storage basins and reducing the amount of downstream flow. To ensure that these services continue, state and federal legislation has been developed to protect these natural features. However, gaps in these laws leaves isolated wetlands smaller than 12.4 acres unprotected in New York State. As such, the only way to extend protection to all wetlands is through the use of local municipal ordinances.

The lack of regulations addressing wetland protection was identified as one of the top five major gaps in only one of the three regions:

- Schoharie Watershed Region – Approximately 30% of municipalities in the Schoharie Watershed Region do not have any provisions in their regulatory programs addressing lake and stream protection.

Recommendations to Protect Wetlands

Where gaps exist, municipalities should incorporate the following recommendations in their regulatory program:

Incorporate Shorelines in the definitions section of a municipal zoning ordinance. This definition should include the shorelines of lakes, streams, creeks, ponds, wetlands, and other waterbodies.

Require Wetland Determination from USACOE for new developments and substantial improvements. As part of Site Plan Review, municipalities can require that all new development (and substantial improvements) provide a Wetland Determination from the U.S. Army Corps of Engineers. A Wetland Determination is a baseline assessment conducted to determine whether wetlands are present, as well as their jurisdictional status.

Adopt a wetland protection ordinance protecting wetlands that fall within the federal/state regulatory gap. This ordinance could exempt certain non-permanent agricultural operations (for example, tilling).

A summary of the recommended municipal action practices for the seven components discussed above is presented in **Table 4-8.**

TABLE 4-8
Recommendations to Support Municipal Action Strategy and Components

Municipal Action Components and Recommendations		
Increase Density of Cluster Development	**Strategy Component 2A**	**Goals 1, 4, 5**
Establish ordinances for higher density cluster development and PUDs		
Require buffers around water features in cluster developments		
Offer incentives to preserve open space		
Allow cluster development by right		
Encourage cluster development at hamlet/village/city scale		
Control Development on Steep Slopes	**Strategy Component 2B**	**Goals 1, 5**
Adopt ordinance regulating development on steep slopes		
Designate a steep slope overlay zone		
Provide Floodplain Protection	**Strategy Component 2C**	**Goals 1, 2, 5**
Adopt the most recent NYSDEC Model Local Law for Flood Damage Reduction		
Prohibit the creation of new impervious surfaces in undeveloped floodplains		
Prohibit on-site septic systems in floodplains		
Incorporate NAI Floodplains Strategy into existing regulatory structure		
Minimize Impervious Surfaces	**Strategy Component 2D**	**Goals 1, 3, 5**
Define *Total Impervious Surface Area* to include all impervious surfaces on plots		
Incorporate *Total Impervious Surface Area* standards in zoning ordinances		
Prohibit or limit new impervious surfaces in riparian zones and floodplain areas		
Encourage development/redevelopment of existing hamlets, villages, cities		
Encourage compact, higher-density, mixed-use in areas of high development pressure		
Incorporate green infrastructure requirements into local land use codes		
Protect Unique and Natural Areas	**Strategy Component 2E**	**Goals 1, 4**
Designate specific areas within a given municipality as CEAs		
Designate areas as nature preserves or afford protections similar to CEAs		
Require tree survey and integrated site plan for new development		
Protect Riparian Areas	**Strategy Component 2F**	**Goals 1, 2, 3**
Incorporate Shorelines in the definitions section of a municipal zoning ordinance		
Adopt stream/shoreline buffer ordinance for new development/significant redevelopment		
Develop guidelines for naturally vegetated buffer adjacent to all shorelines		
Require exclusionary livestock fencing around streams and stream banks to reduce access by livestock		
Protect Wetlands	**Strategy Component 2G**	**Goals 1, 3, 4**
Incorporate Shorelines in the definitions section of a municipal zoning ordinance		
Require Wetland Determination for new developments / substantial improvements		
Adopt ordinance protecting wetlands that fall within the federal/state regulatory gap		

4.4 Strategy 3: Advance Collaboration and Partnerships

Advance collaboration and partnerships to promote sustainable communities, smart growth, economic development, and environmental quality through advancing collaboration and partnerships with the NYSDOS Local Waterfront Revitalization Program (LWRP), Mighty Waters Working Group, NYSDEC Mohawk River Basin Action Agenda, New York Rising Community Reconstruction (NYRCR) Program, and the Cleaner, Greener Communities Program.

The development of this Mohawk River Watershed Management Plan is itself an example of effective collaboration and partnerships. As noted in Chapter 1, the 14 county SWCDs within the Mohawk River Watershed formed the Mohawk River Watershed Coalition of Conservation Districts in 2009. Montgomery County applied for and was awarded a 2009 grant from the NYS Department of State's Title 11 Environmental Protection Fund (EPF) Local Waterfront Revitalization Program (LWRP) to prepare a watershed plan in partnership with the 14 SWCDs. The Plan was developed in collaboration with the Mohawk River Watershed Advisory Committee, which includes representatives from the NYSDOS, NYSDEC, USGS, the State University of New York, Union College, the U.S. National Park Service, The Nature Conservancy, NYS Canal Corporation, Cornell Cooperative Extension, Cornell Water Resources Institute, NYS Dept. of Agriculture and Markets, Tug Hill Commission, Capital District Regional Planning Commission, Herkimer-Oneida Counties Comprehensive Planning Program, USDA NRCS, USACOE, NYSDOT, Empire State Development, USFWS, all 14 SWCDs in the watershed, and watershed municipalities.

The active participation of these agencies and organizations reflects the importance of the Mohawk River Watershed and the severity of the flood-related damages incurred in recent years. There are five major program initiatives underway in the watershed; the goals of these related programs are described in the subsections that follow. Many specific projects recommended by these programs are included in Chapter 5. The key programs include

- NYSDOS Local Waterfront Revitalization Program
- Mighty Waters Working Group
- NYSDEC Mohawk River Basin Action Agenda
- New York Rising Community Reconstruction Program
- Cleaner, Greener Communities Program

In addition, the U.S. Army Corps of Engineers (USACOE) plans to complete a detailed hydrologic evaluation of the basin once federal funding is approved. Following the floods of 2006, Congress requested a reconnaissance study of the Mohawk River, which was completed in 2008. The next step is to complete a feasibility study, followed by specific recommendations to enhance flood resiliency in the watershed. As of the end of 2014, the feasibility study had not yet been funded by Congress. Once the study is funded, the USACOE will coordinate with this Plan and adjust the scope of work to carry forward the tasks that the Mohawk River Watershed Coalition prioritizes. Per agreement with the USACOE in 2011, the cost of the Mohawk River Watershed Management Plan will serve as the local match for the federal investment in the planned feasibility study and action plan.

All the cited programs and initiatives encompass water resource management issues related to water quantity (flooding) and/or quality. The vision and goals of the Mohawk River Watershed Management Plan are clearly focused on all aspects of water resources in the watershed, including water quality, hydrologic processes, flood hazard risk reduction, fish and wildlife habitat, waterfront communities, and working landscapes such as agriculture. As the Watershed Management Plan is implemented, it will be important to continue the effective collaboration and working partnerships among agencies fostered by its development.

4.4.1 Strategy Component 3A: Local Waterfront Revitalization Program

The objective of the Local Waterfront Revitalization Program (LWRP) is to assist local governments and community organizations in planning and implementation of sustainable initiatives for community revitalization. This program has accomplished a great deal to advance community and waterfront revitalization, including Main Street and downtown revitalization efforts, in communities adjacent to the Mohawk River. The vision for the Mohawk River Watershed (section 1.1.1) states, in part, that "vibrant watershed communities find prosperity in the strong economy where water-based recreation and tourism thrive along the waterfront."

City of Amsterdam Local Waterfront Revitalization Program. This program was approved in 1993, and with EPF LWRP funding led to design, planning and construction of streetscapes, waterfront parks, and trail facilities on both sides of the river. The "Proposed Land and Water Uses and Proposed Projects" section of the City's Local Waterfront Revitalization Program states that "primary water use shall be recreational boating" and that "a key component of the City's waterfront revitalization strategy is to take advantage of the recreational tourism potential of the Erie Canal." The proposed water projects all aim to fulfill this goal – the Downtown Waterfront Park which now exists as the Riverlink Park. The ongoing redevelopment of Chalmers Mill is the southern terminus of the multi-million dollar Overlook Bridge, which is also under construction, as is the West End Boat Launch located near Lock 11.

City of Little Falls Local Waterfront Revitalization Program. Approved in 2010, many of the proposed projects are land based, but several are canal or waterside, boating, recreational and access oriented such as Canal Harbor Development and Enhancements, and trail development on both sides of the river. Little Falls Canal Harbor is one of eight designated Harbor Centers on the NYS Canal System.

Western Montgomery draft Local Waterfront Revitalization Program. Completed in 2005, this draft program includes the towns of Minden, St. Johnsville, and the villages of Fort Plain, St. Johnsville. Trail, boating and recreational projects are included, as well as Otsquago Creek Stabilization, which is also a priority for the Montgomery County NY Rising Community Reconstruction Plan. Planning for the Old Military Road Trail in Fort Plain is complete. A grant for implementation is in place but on hold while the village concentrates on storm recovery. Significant upgrades to the St. Johnsville Marina have also been completed with EFP LWRP funding.

Central Mohawk draft Local Waterfront Revitalization Program. With a draft completed in 2000, this program includes the town of German Flatts and the villages of Frankfort, Ilion, Middleville and Mohawk. Relevant proposed projects include trail, park and marina development; stormwater sewer upgrades; stream bank stabilization. A 2014 award will address improve community resiliency, enhance water quality, and promote tourism and recreation (preparing designs for floodplain restoration and public recreation amenities) in the town of German Flatts and village of Mohawk.

Mid-Montgomery County draft Local Waterfront Revitalization Program. With a draft completed in 2009, this program includes the towns of Glen and Mohawk, and the villages of Fonda and Fultonville. There are several relevant "Water and Land Use Goals and Projects" focusing on enhanced access to the waters. Proposed projects include development of a waterfront park and marina and enhancement of regional trails. Design of a new public waterfront park at the Fonda Canal Maintenance Facility is nearing completion, while the dock and overlook in Fultonville is finished and in use.

4.4.2 Strategy Component 3B: Mighty Waters Working Group

In 2010, U.S. Congressman Paul Tonko, who represents New York's 20th district (then the 21st district), hosted the first Mighty Waters Conference. The conference focused on promoting sustainable and responsible waterfront development projects as a means to improve the quality of life in communities along the Hudson and Mohawk Rivers and Erie Canal. As a result, the Mighty Waters Task Force was created. The mission of the Task Force is to identify and implement effective legislative and administrative means that will (1) ensure that federal agencies and resources are used more effectively to benefit the region, (2) attract additional federal resources where necessary, and (3) galvanize local and regional interest in waterway-related projects and policies.

In 2012, Governor Andrew Cuomo directed NYSDEC and NYSDOS to create a cabinet-level Mighty Waters Working Group to promote economic revitalization and environmental sustainability in the Mohawk Valley area. The working group will further the goals of Congressman Tonko's Mighty Waters Initiative and support the work of the Mohawk Valley and Capital Region Economic Development Councils and a number of State agencies. The working group will partner and collaborate with businesses, local governments, academic institutions, federal agencies, civic leaders, and non-governmental organizations. The working group will also position the region to receive and strategically deploy federal resources that may become available.

Coordination of working group efforts toward economic development and community revitalization will be undertaken by NYSDOS, which has worked extensively with localities in the Mohawk Valley to enhance community development through its Local Waterfront Revitalization Program. This effort builds upon, and will work within, the Governor's Regional Economic Development Councils for the Capital Region and Mohawk Valley.

NYSDEC will coordinate the working group partnership's efforts to improve environmental sustainability and flood hazard risk reduction, bringing elements of an award-winning watershed collaboration for the Hudson River Watershed to the Mohawk River valley. The resulting Action Agenda for the Mohawk is described below in section 4.4.3.

The working group will also coordinate with the Cleaner Greener Communities Program administered by NYSERDA. That program (described below in section 4.4.5) will fund the development of comprehensive sustainability plans in the Mohawk Valley and Capital Region. Additional State agencies participating in the working group include Department of Agriculture and Markets, Empire State Development Corporation, New York State Canal Corporation, State Office of Emergency Management, and the New York State Office of Parks, Recreation, and Historic Preservation.

The following Mighty Waters municipal projects, mostly related to waterfront revitalization, are listed under the appropriate Mohawk River Watershed Management Plan goal.

Goal 3: Promote flood hazard risk reduction and enhanced flood resilience.

Resilience Design Planning	(Cohoes (Ci))

Goal 5: Revitalize communities and waterfronts and adopt smart growth land use practices.

Blueway Loop Trail	(Cohoes (Ci))
Waterfront Upland Development	(Cohoes (Ci))
Fort Herkimer Canoe and Kayak Park	(German Flatts (T))
Pedestrian Connections and Waterfront Access II: Benton's Landing	(Little Falls (Ci))
Benton's Landing and Downtown Boater Access	(Little Falls (Ci))
Waterfront Parks	(Little Falls (Ci))

Mohawk Valley Gateway Overlook	(Amsterdam (Ci)) – construction underway
River Walk	(Amsterdam (Ci)) – planning underway
Canalway Trail I: Eastern Montgomery	(Montgomery County)
Canalway Trail II: Countywide	(Montgomery County)
Blueway Trail Launches	(Montgomery County)
Bellamy Harbor Park	(Rome (Ci)) – construction imminent
NYS Canalway Trail	(Rome (Ci))
Rod Mill Reuse Strategy	(Rome (Ci)) – construction underway
Utica Harbor Redevelopment	(Utica (Ci)) – planning underway
Mohawk Towpath	(Clifton Park (T))
Mohawk Hudson Bike Trail Rotterdam Extension I: Underpass	(Rotterdam (Ci))
Mohawk Hudson Bike Trail Rotterdam Extension II: Construction	(Rotterdam (Ci))
ALCO Riverfront Revitalization Project	(Schenectady (Ci)) – planning underway
Eastern Gateway Enhancement Project	(Scotia (V))
Scotia/Glenville Canalway Trail	(Scotia (V))

There are several water-related projects that Mighty Waters communities hope to implement. These include:

- Montgomery County: Villages of Canajoharie and Palatine Bridge—Consolidation/expansion of sanitary sewer service
- Oneida County: City of Utica—Utica Harbor Redevelopment (Harbor Point Recreational Area / Utica Marsh Natural Area)
- Herkimer/Oneida Counties: Preparation of intermunicipal Local Waterfront Revitalization Plans.

4.4.3 Strategy Component 3C: Mohawk River Basin Action Agenda

The NYSDEC and its partners developed the Mohawk River Action Agenda as a means to promote coordinated management of the environmental and cultural resources of the Mohawk River and its watershed. The five areas addressed by the Action Agenda are congruent with the vision and goals of the Watershed Advisory Committee that developed this Watershed Management Plan; the areas include elements of both the natural and the built environment, with a focus on sustainable communities. The five elements are fish, wildlife, and habitats; water quality; flood hazard risk reduction; community revitalization; and working landscapes. The NYSDEC has established a Mohawk River Basin Program, modeled on the successful Hudson River Estuary Program, to coordinate the many projects and initiatives underway.

Recently, the Mohawk River Basin Program published a paper entitled "Mohawk River Basin Initiative 2014-2016," which focuses on the need for additional basin information. Early in 2014, a workshop was held to "identify specific research needs and address filling data gaps in the Mohawk River Basin. The overall purpose of the workshop was to compile the opinions of these diverse experts into a 'Research Initiative' document." Three of the five Action Agenda areas were addressed: Fish, Wildlife, and Habitats; Water Quality; and Flooding.

4.4.4 Strategy Component 3D: New York Rising Community Reconstruction Program

The New York Rising Community Reconstruction (NYRCR) Program was established to provide additional rebuilding and revitalization assistance to communities severely damaged by Superstorm Sandy, Hurricane Irene, and Tropical Storm Lee. To facilitate community redevelopment planning and the resilience of communities, the state established the NYRCR Program and allocated $25 million to planning for the most affected communities.

The completion of a NYRCR Plan is an important step toward rebuilding a more resilient community. Each NYRCR Plan was locally driven by a Planning Committee that assessed storm damages and current risk, identified community needs and opportunities, and developed recovery and resiliency strategies. Each plan identifies projects and implementation actions to help fulfill those strategies.

Each NYRCR planning area is eligible for between $3 million and $25 million of Community Development Block Grant (CDBG) dollars to implement elements of their plans. The NYRCR Team is also working to help communities identify other federal, state, local, nonprofit, and private resources to supplement this funding. Some projects and actions identified in the plans are longer-term, and need to be further developed before their implementation may begin.

Four community reconstruction plans and three countywide resiliency plans were developed for affected areas of the Mohawk River watershed. The plans may be viewed at the New York Rising website.

- City and town of Amsterdam and town of Florida NYRCR Plan
- City of Schenectady and town of Rotterdam NYRCR Plan
- Towns and villages of Esperance, Schoharie, and Middleburgh NYRCR Plan
- Village of Waterford NYRCR Plan

- Herkimer County Communities: Herkimer County NY Rising Countywide Resiliency Plan
- Montgomery County Communities: Montgomery County NY Rising Countywide Resiliency Plan
- Oneida County Communities: Oneida County NY Rising Countywide Resiliency Plan

The NY Rising countywide resiliency plans for Oneida, Herkimer, and Montgomery Counties include projects recommended based on flood mitigation studies conducted by the engineering firm Milone and MacBroom, Inc., of Cheshire, CT. The 13 studies focused on specific streams or reaches of streams that flooded during recent storm events, and caused property damage to towns and villages. An example is the flooding of Fulmer Creek in Herkimer County that caused damage to structures within the town of German Flatts and the village of Mohawk. The Fulmer Creek study recommendations included several specific actions and resulted in an EPF LWRP award in 2014.

The Milone and MacBroom studies were used to help develop recommended projects in the countywide resiliency plans for Oneida, Herkimer, and Montgomery Counties in sections on natural and cultural resources, and in support of the following strategies:

- Utilize a combination of streambank restoration/alignment and upgrading of infrastructure at stream crossings to reduce erosion and mitigate flooding and losses (Oneida and Herkimer Counties).
- Preserve and restore natural areas including floodplains, streams, and wetlands to help mitigate flooding via watershed and stream restoration projects.

Some of the projects are listed in Chapter 5: Implementation, Tracking, and Monitoring, and can be found in the regional tables of recommended projects, Table 5-3, Upper Mohawk, and Table 5-5, Main River. For the Fulmer Creek example, the project is listed as “Fulmer Creek Bank Stabilization.” Full lists of projects in the countywide resiliency plans can be viewed at the New York Rising website.

4.4.5 Strategy Component 3E: Cleaner, Greener Communities Program

The Cleaner, Greener Communities Program was announced by Governor Cuomo in his 2011 State of the State address as a $100 million competitive grant program to encourage communities to develop regional sustainable

growth strategies. The Regional Sustainability Planning Program is the first stage of the Cleaner, Greener Communities program and is intended to provide the necessary resources for each region in New York State, as defined by the boundaries of the Regional Economic Development Councils, to develop a comprehensive sustainability plan. The plans that result from this program will

- Establish a statewide sustainability planning framework that will aid in statewide infrastructure decision making.
- Outline specific and tangible actions to reduce greenhouse gas emissions consistent with a goal of 80% carbon reductions by the year 2050.
- Inform municipal land use policies.
- Serve as a basis for local government infrastructure decision making.
- Help guide infrastructure investment of both public and private resources.
- Provide every region with a sustainability plan that will enable them to strategically identify and prioritize the projects they submit for consideration to the Implementation Grant stage.

The Mohawk Valley Regional Sustainability Plan, completed in 2013, includes elements focused on transportation, land use, energy, water management, waste management, economic development, and agriculture and forestry. For water management, the goal of the plan is to "Maintain Water Quality."

4.4.6 USEPA's Nine Minimum Elements of a Watershed Management Plan

The U.S. Environmental Protection Agency has developed a framework for watershed management plans that are developed and implemented for threatened or impaired waters using funding from Clean Water Act section 319. As noted in Chapter 2: Watershed Characterization, about one-third (2,340 miles) of the more than 6,600 river miles in the Mohawk River Basin are included on the 2010 Priority Waterbodies List (PWL) as either not supporting uses or having minor impacts or threats to water quality. Most (79%) of these PWL-designated river miles are considered Stressed or Threatened; these waters fully support designated uses but exhibit declining water quality and/or aquatic habitat conditions. Only about 7% of all stream segments within the watershed are designated as Impaired, signifying that the waters do not fully support their designated uses. Twenty-seven (27) of the 136 separate lake segments in the Mohawk River Watershed are included on the PWL as having either impaired uses or minor impacts/threats to uses. These impaired/impacted lakes represent nearly one-half (47%) of the total lake acres in the basin. Impairments to two of the four largest lakes in the basin (Delta Reservoir and Schoharie Reservoir) account for over 3,500 impaired acres, or 58% of the total impaired lake acres in the basin where fish consumption, recreational uses and/or aquatic life are not fully supported.

The USEPA nine minimum elements to be included in a section-319-funded watershed management plan for threatened or impaired waters are as follows:

1. Identify the causes and sources of pollution
2. Estimate pollutant loading into the watershed and the expected load reductions to be realized with implementation of the recommendations
3. Describe management measures that will achieve load reductions and target critical areas
4. Estimate the amounts of technical and financial assistance and the relevant authorities needed to implement the plan
5. Develop an information/education component
6. Develop a project schedule

7. Describe the interim, measurable milestones
8. Identify indicators to measure progress
9. Develop a monitoring component

The nine elements are addressed in the NYSDOS guidebook *Watershed Plans: Protecting and Restoring Water Quality*, which was used as a framework for developing the Mohawk River Watershed Management Plan. However, due of the size of the watershed, it was not feasible, within the project budget, to estimate the loading reductions to be achieved by implementing specific recommended actions for threatened or impaired waterways (element 2). This important analysis will therefore be carried over as a recommended action for the specific segments to be targeted for remedial measures, as set forth in Chapter 5.

Chapter 5: Implementation, Tracking, and Monitoring

5.1 Introduction

This chapter connects recommendations in Chapter 4 to strategy components to be advanced and watershed goals to be achieved, while also providing context and greater geographic detail on site-specific projects, and includes an approach to tracking the implementation of projects and monitoring effectiveness over time. The discussion is organized by the three main regions of the Mohawk River watershed—Upper Mohawk, Main River, and Schoharie Watershed—and is grouped by the HUC-10 subwatersheds, but encompasses recommendations for projects at the finer, 12-digit HUC level. Project level recommendations tend to focus on addressing impairments in the low-scoring subwatersheds, which exhibit degraded conditions of water quality, aquatic habitat, and/or land use patterns. Broader scale recommendations for high scoring and mid-scoring subwatersheds include actions designed to be protective of waters and related resources.

The majority of recommended actions are related to advancing ***Strategy 1: Implement best management practices*** *to protect and restore natural hydrology, reduce erosion and sedimentation, minimize pollution, and protect and restore habitats.*

The recommendations related to ***Strategy 2: Advance municipal actions*** *to promote sustainability, reduce risk of flood damage, and revitalize communities and waterfronts through the adoption of appropriate zoning and land use policies to encourage cluster development, protect steep slopes, protect and enhance floodplains, reduce impervious surfaces, protect, restore or enhance unique and natural areas, riparian areas, and wetlands* (summarized in Table 4-8) apply to all three regions of the Mohawk River watershed, and the priority for implementing these practices is focused on HUC-10 subwatersheds with low assessment scores, similar to implementation of Strategy 1. For ***Strategy 3: Advance collaboration and partnerships***, ongoing implementation of the Plan includes working with the organizations and on initiatives discussed in Chapter 4, section 4.4 *(promoting sustainable communities, smart growth, economic development, and environmental quality through advancing collaboration and partnerships with the NYSDOS Local Waterfront Revitalization Program, Mighty Waters Working Group, NYSDEC Mohawk River Basin Action Agenda, New York Rising Community Reconstruction Program, and the Cleaner, Greener Communities Program)*.

For each of the three main regions, this chapter presents specific information designed to foster implementation of the watershed strategies: (1) a table recommending *actions and practices* for HUC-10 subwatershed locations, including estimated cost range and timetable for implementation; and (2) a table listing specific *projects* at the HUC-12 subwatershed level, including lead organization(s), potential funding sources, estimated cost, and timing. As indicated above, this information tends to focus on the recommendations for Strategy 1. However, since the Watershed Management Plan will be a "living document," specific projects for Strategies 2 and 3 will, when identified, be added to the regional sections of this chapter. Updates to the Plan will be published on the Mohawk River Watershed Coalition website and reflected in the Interactive Mapping Tool for the Mohawk River Watershed.

This Mohawk River Watershed Management Plan exemplifies a philosophy of "ongoing implementation and reassessment"; with strong encouragement from the NYSDOS and other funding partners, projects that can improve water quality and habitat conditions within the watershed were included in grant requests prior to completion of the Plan. Projects that have already been funded but not yet installed, projects submitted for grant funding, and projects recommended for future funding are included in the second table presented for each region.

Finally, recommendations for a commitment and approach to ongoing implementation and monitoring are presented. Monitoring the effectiveness of the individual projects is an essential component of continuous improvement; managers can learn which techniques are best suited to certain areas and improve estimates of cost and longevity. Monitoring can also provide information and knowledge regarding watershed health and provide a means for early detection of and rapid response to emerging threats.

5.2 Strategies for the Watershed: Actions, Practices, and Projects

The strategies for watershed health, as discussed in Chapter 4, are referenced in this chapter as follows:

Strategy 1: Implement Best Management Practices to protect and restore the watershed as follows:

- 1A: Protect and restore natural hydrology
- 1B: Reduce erosion and sedimentation
- 1C: Minimize pollution
- 1D: Protect and restore habitats

Strategy 2: Advance municipal actions to promote sustainability, reduce the impact of flooding and enhance flood resilience and revitalize communities and waterfronts through the adoption of the appropriate zoning and land use policies in the following areas:

- 2A: Increase density of cluster development
- 2B: Control development on steep slopes
- 2C: Provide floodplain protection
- 2D: Minimize impervious surfaces
- 2E: Protect unique and natural areas
- 2F: Protect riparian areas
- 2G: Protect wetlands

Strategy 3: Advance collaboration and partnerships to promote sustainable communities, smart growth, economic development, and environmental quality through the following initiatives:

- 3A: NYSDOS Local Waterfront Revitalization Program (LWRP)
- 3B: Mighty Waters Working Group
- 3C: NYSDEC Mohawk River Basin Action Agenda
- 3D: New York Rising Community Reconstruction (NYRCR) Program (includes countywide resiliency plans)
- 3E: Cleaner, Greener Communities Program

Cost ranges for recommend actions and practices are represented as follows in tables throughout this chapter:

$	Up to $25,000
$$	$25,000 to $50,000
$$$	$50,000 to $100,000
$$$$	$100,000 to $500,000
$$$$$	$500,000+

There are many potential funding sources for implementation of recommendations in the Mohawk River Watershed, with the main sources being federal, state, and local (within these main sources, funding is generally program-specific). An overview of some potential funding sources, programs funded, and eligible activities is presented in **Table 5-1**. In the sections that follow, tables presenting recommended projects for each region in the Mohawk River Watershed include funding sources only at the main levels of federal, state, and local.

TABLE 5-1
Potential Funding Sources for Mohawk River Watershed Recommended Projects

Funding Source	Program	Eligible Activities
STATE		
NYS Dept. of Agriculture and Markets	Agricultural Nonpoint Source Abatement and Control Program	Program funds are available for nonpoint source abatement and control projects that plan (AEM Tier III) or implement (AEM Tier IV) Agricultural BMP Systems on New York farms. All projects must consist of activities that will reduce, abate, control, or prevent nonpoint source pollution originating from agricultural sources.
NYS Dept. of Environmental Conservation (NYSDEC)	Water Quality Improvement Project Program (WQIP) Mohawk River Basin Action Agenda Grants	A competitive, reimbursement grant program that directs funds from the NYS Environmental Protection Fund (NYSEPF) to projects that reduce polluted runoff, improve water quality and restore habitat in New York's waterbodies. Eligible project types include nonagricultural nonpoint source abatement and control, municipal wastewater treatment, aquatic habitat restoration, and municipal separate storm sewer systems. Provides funding through the Mohawk River Basin Program to implement priorities outlined in the program's Action Agenda aimed at fish, wildlife and habitats; water quality; flood hazard risk reduction; community planning and revitalization; and working landscapes, land use and open space.
NYS DEC / NYS Environmental Facilities Corporation (NYSEFC)	Clean Water State Revolving Fund	Provides low-interest rate financing to municipalities to construct water quality protection projects such as sewers and wastewater treatment facilities. Eligible projects include point source projects such as wastewater treatment facilities and nonpoint source projects such as stormwater management projects and landfill closures, as well as certain habitat restoration and protection projects in national estuary program areas.
NYS Dept. of State (NYSDOS)	Local Waterfront Revitalization Program (LWRP)	Provides matching grants from the NYSEPF to revitalize communities and waterfronts. Eligible activities include preparing or implementing a LWRP; redeveloping hamlets, downtowns, and urban waterfronts; planning or constructing land and water-based trails; preparing or implementing a lakewide or watershed revitalization plan; preparing or implementing a community resilience strategy.
NYS Dept. of Transportation (NYSDOT)	Transportation Alternatives Program	Provides funding for roadway improvements and culvert and bridge replacements, as well as pedestrian and bicycle paths.
NYS Environmental Facilities Corporation (NYS EFC)	Green Innovation Grant Program	Provides grants on a competitive basis to projects that improve water quality and demonstrate green stormwater infrastructure in New York. Eligible green infrastructure practices include: permeable pavement, bioretention, green roofs and green walls, stormwater street trees/urban forestry program designed to manage stormwater, construction or renovation of wetlands, floodplains or riparian buffers, stream daylighting, downspout disconnection, and stormwater harvesting and reuse.
NYS Office of Parks, Recreation and Historic Preservation (NYS OPHRP)	Environmental Protection Fund Municipal Grants Program	Funding is available for the acquisition, planning, development, and improvement of parks, historic properties, and heritage areas located within the physical boundaries of the state. Funding is available for the following grant categories: Park Acquisition, Development and Planning Program; Historic Property Acquisition, Preservation and Planning Program; Heritage Areas System Acquisition, Development and Planning Program.
FEDERAL		
Federal Emergency Management Agency (admin. by NYS Div. of Homeland Security and Emergency Services)	Pre-Disaster Mitigation Grant Program	Offers pre-disaster project grants to eligible government subapplicants to avoid or reduce the loss of life and property in future events.
U.S. Dept. of Agriculture, Natural Resources Conservation Service (USDA-NRCS)	Conservation Reserve Program (CRP) Wetland Reserve Program (WRP) Wildlife Habitat Incentives Program (WHIP) Environmental Quality Incentives Program (EQIP)	Provides technical assistance and funding for the installation of agricultural BMPs, including riparian buffers, wetland restoration, wildlife habitat protection, and other environmental improvements for agriculture.
LOCAL		
Municipalities	Municipal budgets—no particular program	Provide funding in the form of labor and equipment from Departments of Public Works to do tasks such as clean debris from streams, culverts, storm drains, etc.

5.2.1 Upper Mohawk Region

As displayed in Map 5-1, the low-scoring subwatersheds (Oriskany Creek, Ninemile Creek, and Nowadaga Creek) are located along the main stem of the Mohawk River and include the developed areas of Greater Rome and Greater Utica. Outside of the developed areas, there is a substantial amount of agricultural land use along the valley lowlands. There are numerous point sources of pollution including municipal wastewater treatment plants and a USEPA Superfund site at the former Griffiss Air Force Base. This combination of land uses and sources of pollution have led to a significant impairment of waterbodies, resulting in the recommendations discussed in Chapter 4. For the remainder of the Upper Mohawk Region, the HUC-10 assessment scores were in the mid- to high range (Lower West Canada Creek, Delta Reservoir, Middle West Canada Creek, and Upper West Canada Creek).

Recommended actions and practices for the Upper Mohawk region for Strategy 1 are summarized in Table 5-2. The priority for implementing recommended actions and practices is based primarily on assessment scores; low-scoring subwatersheds in need of restoration were assigned a higher priority compared with mid- and high-scoring subwatersheds. Cost, potential funding sources, and timing were considered as well. As a consequence, the implementation strategy is weighted toward restoration-focused actions and practices within the low scoring HUC-10 subwatersheds. However, protection-focused actions and practices that are relatively simple and low-cost may be implemented in advance of more costly and complex restoration efforts. The Oriskany Creek, Ninemile Creek, and Nowadaga Creek HUC-10 subwatersheds are italicized in Table 5-2 to emphasize priority.

Ultimately, implementation requires on-the-ground projects and changes to municipal codes. Members of Coalition and other watershed stakeholders have proposed specific projects for implementation designed to restore and protect subwatersheds in their counties. The projects and other actions that have been proposed to date for the upper Mohawk River region are summarized in Table 5-3 (this is a snapshot of recommended projects as of the end of 2014; other projects will continue to be added). Some of the listed projects have already been funded, some have been submitted for funding, and others await future funding. Projects will be implemented at the HUC-12 subwatershed level. The lead municipality, strategy category, goals addressed, target subwatershed(s), lead organization, potential funding sources, potential cost, and timing are included in Table 5-2.

TABLE 5-2
Upper Mohawk Region: Recommended Actions and Practices

Recommendation	Locations (HUC-10)	Cost	Timing(Years)
Strategy Component 1A: Protect and restore natural hydrology			
Restore/protect wetlands	*All*	$$$	3-5
Restore/protect riparian buffers	*All*	$$$	3-5
Implement stormwater management practices	Lower W. Canada Creek *Oriskany Creek* *Ninemile Creek* *Nowadaga Creek*	$$$$$	5+
Stabilize water levels (w/ Canal Corp)	Delta Reservoir	$$	3-5
Preserve green space	*Ninemile Creek*	$$	3-5
Implement green infrastructure practices	*Ninemile Creek*	$$$	3-5
Redevelop vacant impervious surfaces	*Ninemile Creek*	$$$	5+
Employ control measures in MS4 communities	*Ninemile Creek*	$$$	3-5

Table 5-2, continued

Recommendation	Locations (HUC-10)	Cost	Timing(Years)
Strategy Component 1B: Reduce erosion and sedimentation			
Encourage forest management planning	Middle W. Canada Creek Delta Reservoir *Ninemile Creek*	$	1-2
Stabilize streambanks w/ natural stream design	Middle W. Canada Creek Lower W. Canada Creek Delta Reservoir *Oriskany Creek* *Ninemile Creek* *Nowadaga Creek*	$$$$$	3-5
Stabilize steep slopes	Delta Reservoir	$$$	3-5
Install soils conservation practices	*Oriskany Creek* *Ninemile Creek*	$$	1-2
Incorporate smart growth land use practices	*Ninemile Creek*	$	1-2
Strategy Component 1C: Minimize pollution			
Upgrade WWTPs to tertiary treatment to remove phosphorus	Middle W. Canada Creek Lower W. Canada Creek *Nowadaga Creek*	$$$$$	5+
Address failing septic systems	Upper W. Canada Creek Middle W. Canada Creek Lower W. Canada Creek	$$$$	3-5
Apply agricultural BMPs related to water pollution Restrict animal access to streams Expand nutrient management programs Improve animal feeding and waste operations	Lower W. Canada Creek Delta Reservoir *Oriskany Creek* *Nowadaga Creek*	$$$$	3-5
Address legacy contaminants (e.g., Superfund sites)	*Ninemile Creek* (Griffiss AFB)	$$$$	3-5
Address Combined Sewer Overflow (CSO) issues	*Ninemile Creek*	$$$$	5+
Strategy Component 1D: Protect and restore habitats			
Enhance in-stream habitats	Lower W. Canada Creek	$$	3-5
Protect trout spawning water	Lower W. Canada Creek	$	3-5
Protect wildlife management areas	*Ninemile Creek*	$	1-2

TABLE 5-3
Upper Mohawk Region: Recommended Projects

County Municipality (-ies)	Project (1)	Strategy	Goal	Target Subwatersheds	Lead Organization	Funding Sources	Potential Cost	Timing 1-2 Yrs	Timing 3-5 Yrs	Timing 5+ Yrs
Oneida County										
Towns: Sangerfield, Marshall, Kirkland, Westmoreland, Whitestown	Oriskany Creek Stormwater Management	1A	1,2,3	Headwaters Oriskany Creek, Upper Oriskany Creek, Middle Oriskany Creek, Lower Oriskany Creek	Oneida SWCD	State (4)	$368,250	X		
Towns: New Hartford, Kirkland	Mud Creek Stormwater Management (2)	3D	1,2,3	Mud Creek	Towns: New Hartford, Kirkland	State	$5 million+			X
Towns: New Hartford, Whitestown, Paris	Sauquoit Creek and Palmers Creek Bank Stabilization (2)	3D	1,2,3	Sauquoit Creek	Towns: New Hartford, Whitestown, Paris	State	$1.5 million		X	
All Towns	Floodplain and Stormwater Regulation Updates for Municipalities	2C	1,2,3	All HUC-12s in Oneida County	Oneida County Department of Planning	State	No Cost	X		
Hamilton County										
Towns: Arieta and Morehouse	Aquatic Habitat and Fish Passage Assessment and Improvement Project	1D	1,3,4	Headwaters E Canada Creek, Headwaters So. Branch W Canada Creek, Vly Brook-So. Branch W Canada Creek, Fourmile Brook	Hamilton SWCD	Local	$20,000-35,000	X		
Towns: Arieta and Morehouse	Stream Debris Removal and Bank Stabilization	1A	1,2,3	Headwaters E Canada Creek, Headwaters So. Branch W Canada Creek, Vly Brook-So. Branch W Canada Creek, Fourmile Brook	Hamilton SWCD	Local	$10-25,000	X		
Towns: Arieta, Lake Pleasant, and Morehouse	Invasive Species Assessment and Control	1D	4	All HUC-12s in HUC-10 Upper W Canada Creek, HUC-12s in north portion of HUC-10 E Canada Creek	Hamilton SWCD	State (4)	$20,000	X		
Towns: Arieta, Lake Pleasant, and Morehouse	Re-vegetation of roadside ditches	1B	1,4	All HUC-12s in HUC-10 Upper W Canada Creek, HUC-12s in north portion of HUC-10 E Canada Creek	Hamilton SWCD	State (4)	$16,000		X	

Table 5-3, continued

County Municipality (-ies)	Project (1)	Strategy	Goal	Target Subwatersheds	Lead Organization	Funding Sources	Potential Cost	Timing 1-2 Yrs	Timing 3-5 Yrs	Timing 5+ Yrs
Madison County										
Towns: Madison and Eaton	Agricultural Waste Management	1C	1,6	Oriskany Creek Headwaters	Madison SWCD	Federal	$20,000		X	
	Soil Stabilization through Cover Crops	1B	1,4,6	Oriskany Creek Headwaters	Madison SWCD	Federal	$50,000-$70,000		X	
	South Street Flood Reduction Project	1A	3	Oriskany Creek Headwaters	Madison SWCD	State (4)	$50,000	X		
	Stream Buffers	1A	1,4,6	Oriskany Creek Headwaters	Madison SWCD	State (4)	$25,000		X	
	Stream Restoration	1A	1,2,3	Oriskany Creek Headwaters	Madison SWCD	State (4)	$65,000		X	
Herkimer County										
Town of Manheim	Crum Creek Slip Bank Stabilization	3D	1,2,3,4, 5,6	Crum Creek	Herkimer SWCD	State	$100,000		X	
Town of German Flatts	Fulmer Creek Bank Stabilization and Stormwater Management (2)	3D	1,2,3,	Fulmer Creek	Town of German Flatts	State	$1.5 million			X
Village of Herkimer	Herkimer County Community College Stormwater Mgt.	3D	1,2,3,4	Bridenbecker Creek	Herkimer SWCD	State	$25,000-$50,000	X		
Towns of Danube,	Nowadaga Creek Bank Stabilization and Stormwater Management (2)	3D	1,2,3	Nowadaga Creek	Town of Danube	State	$500,000		X	
Village of Frankfort	Moyer Creek Embankment Repair (2)	3D	1,2,3	Moyer Creek	Village of Frankfort	State	$860,000		X	
Town of Fairfield Village of Middleville	West Canada Creek and Maltanner Creek Sediment Control and Stream Maintenance (2)	3D	1,2,3	City Brook	Town of Fairfield, Village of Middleville	State	$500,000		X	
Village of Herkimer	Bellinger Creek Stream Maintenance (2)	3D	1,2,3	Bridenbecker Creek	Village of Herkimer	State	$2.2 million		X	
Town of Manheim	East Canada Creek Sediment Removal (2)	3D	1,2,3	Lower E Canada Creek	Town of Manheim	State	$500,000			X
Town of Norway	White Creek Streambank Protection (2)	3D	1,2,3	White Creek	Town of Norway	State	$50,000		X	

Table 5-3, continued

County Municipality (-ies)	Project (1)	Strategy	Goal	Target Subwatersheds	Lead Organization	Funding Sources	Potential Cost	Timing 1-2 Yrs	Timing 3-5 Yrs	Timing 5+ Yrs
All Towns (Herkimer County)	Develop Uniform Floodplain and Land Use Regulations	2C	1,2,3	All HUC-12s in Herkimer County	Herkimer-Oneida Counties Planning Department	State	<$500,000	X		
Multiple Counties										
Oneida County Herkimer County	Watershed Modeling (3)	1B,1C	1,2,4	All HUC-12s in HUC-10s: Upper, Mid & Lower W Canada Creek., Nowadaga Creek, Delta Reservoir, Ninemile Creek, Oriskany Creek	Herkimer SWCD	State	$45,000		X	

NOTES:
(1) Unless otherwise noted, projects are based on recommendations from the Mohawk River Watershed Coalition SWCD's HUC-12 Assessment Reports.
(2) This project includes one or more specific actions along this particular stream that include the implementation of stormwater management and natural stream design practices. Refer to the Oneida County and Herkimer County NY Rising Countywide Resiliency Plans.
(3) The Watershed Modeling project will address the need to estimate pollutant loading reductions to be achieved by implementing specific recommended actions for threatened or impaired waterways.
(4) This project has been partially funded by a NYS Department of State Title 11 EPF Local Waterfront Revitalization Program grant.

KEY:

Strategy 1: Implement Best Management Practices
1A: Protect and restore natural hydrology
1B: Reduce erosion and sedimentation
1C: Minimize pollution
1D: Protect and restore habitats

Strategy 2: Advance Municipal Actions
2A: Cluster development
2B: Steep slopes
2C: Floodplain protection
2D: Impervious surfaces
2E: Unique and natural areas
2F: Riparian areas
2G: Wetlands

Strategy 3: Advance Collaboration and Partnerships
3A: Local Waterfront Revitalization Program
3B: Mighty Waters Working Group
3C: Mohawk River Basin Action Agenda
3D: NY Rising Community Reconstruction Program
3E: Cleaner, Greener Communities Program

5.2.2 Main River Region

As displayed in Map 5-2, the low scoring HUC-10 subwatersheds in the Main River region (Cayadutta Creek and Canajoharie Creek), encompass the main stem of the Mohawk River and include the fertile valley lowlands with relatively high agricultural land use. To the east, the Alplaus Kill, also along the main stem, was mid-scoring, but on the low side. In addition to agriculture, there are many villages and cities stretching from Herkimer to Schenectady. The remaining subwatersheds in the region include mid-scoring Fly Creek along the Schoharie Creek, and high-scoring East Canada Creek in the southern Adirondacks. The recommended actions and practices for the Main River region are summarized in Table 5-4, and grouped by their strategy components in meeting the overall goal of restoring watershed health. Cayadutta Creek and Canajoharie Creek HUC-10 subwatersheds are italicized to show priority. Projects to help advance these strategies within the Main River region are listed in Table 5-5.

TABLE 5-4
Main River Region: Recommended Actions and Practices

Recommendation	Locations (HUC-10s)	Cost	Timing (Years)
Strategy Component 1A: Protect and restore natural hydrology			
Restore/install/protect forested riparian buffers	*Cayadutta Creek* *Canajoharie Creek* Alplaus Kill Fly Creek East Canada Creek	$$$	3-5
Restore/protect wetlands	*Canajoharie Creek* Alplaus Kill Fly Creek	$$$	3-5
Implement stormwater management practices in MS4 areas	Alplaus Kill *Cayadutta Creek* *Canajoharie Creek*	$$$$	3-5
Educate homeowners re stormwater runoff	Alplaus Kill	$	1-2
Implement green infrastructure practices	Alplaus Kill	$$$	3-5
Decrease impervious surfaces	Alplaus Kill	$$$	3-5
Strategy Component 1B: Reduce erosion and sediment transport			
Employ soil conservation BMPs	*Cayadutta Creek* Fly Creek (steep slopes)	$$$	3-5
Restrict animal access to streams	*Cayadutta Creek* Alplaus Kill	$$$	3-5
Prevent streambank erosion	*Canajoharie Creek*	$$$$	5+
Prevent soil erosion on steep slopes	Fly Creek	$$$	3-5
Employ agricultural BMPs	Alplaus Kill	$$$	3-5
Employ forest management BMPs	Alplaus Kill	$$	5+
Strategy Component 1C: Minimize pollution			
Upgrade WWTPs to tertiary treatment for phosphorus removal	*Cayadutta Creek* Alplaus Kill	$$$$	5+
Employ nutrient and waste management BMPs on farms	*Cayadutta Creek* Fly Creek	$$	1-2
Protect drinking water supplies	*Cayadutta Creek*	$$	1-2
Protect the Great Flats aquifer	Alplaus Kill	$$$	3-5
Address failing septic systems near waterbodies	Alplaus Kill Fly Creek	$$$	3-5
Address brownfield and Superfund sites	*Cayadutta Creek*	$$$$$	5+
Strategy Component 1D: Protect and restore habitats			
Conduct biodiversity assessments	*Canajoharie Creek*	$	1-2
Maintain or improve in-stream habitats	East Canada Creek	$$$	3-5
Protect wildlife management areas	Fly Creek	$$	1-2

TABLE 5-5

Main River Region: Recommended Projects

County Municipality (-ies)	Project (1)	Strategy	Goal	Target Subwatersheds	Lead Organization	Funding Sources	Potential Cost	Timing 1-2 Yrs	Timing 3-5 Yrs	Timing 5+ Yrs
Fulton County										
Towns: Johnstown, Broadalbin, Mayfield, Bleecker, Caroga, Stratford, Ephratah, Oppenheim	*Invasive Species Assessment and Control*	*1D*	*1,4*	*HUC-12s in portions of HUC-10s: East Canada Creek, Canajoharie Creek, Cayadutta Creek*	*Fulton SWCD*	*State (4)*	*$40,0000*	*X*		
Town: Johnstown Cities: Johnstown and Gloversville	Stormwater Management	1A	1,2,3	HUC-12s: Headwaters Cayadutta Creek, Hall Creek, (Cities: Johnstown, Gloversville)	Fulton SWCD	State (4)	$40,000	X		
Towns: Caroga Lake and Bleecker	Boat Wash Stations for Invasive Species Control	1D	1,4	HUC-12s: Peck Lake, Sprite Creek	Fulton SWCD	State (4)	$310,000		X	
Schenectady County										
Town: Rotterdam	Water Quality Monitoring Gauges	1C	1,2,3,4	Great Flats Aquifer	Schenectady SWCD	State	$100,000-$500,000		X	
Towns: East Glenville, Alplaus, Niskayuna, Scotia, Rotterdam, Duanesburg	Re-vegetation of Roadside Ditches	1B	1	HUC-12s: Sandsea Kill, Poentic Kill, Stony Creek	Schenectady SWCD	State (4)	$12,000		X	
Montgomery County										
Town of Minden Village of Fort Plain	Otsquago Creek Restoration (2)	3D	1,2,3	Otsquago Creek	Montgomery SWCD	State	$1 million		X	
Village of St. Johnsville	Zimmerman Creek Restoration (2)	3D	1,2,3	Zimmerman Creek	Montgomery SWCD	State	$1 million		X	
Village of Canajoharie	Canajoharie Creek Wall Restoration (2)	3D	1,2,3	Lower Canajoharie Creek	Village of Canajoharie	State	$1 million		X	
Saratoga County										
Towns: Ballston, Clifton Park, Charlton, Galway	Invasive Species Assessment and Control	1D	1.4	North Chuctanunda Cr, Evas Kill, Headwaters Alplaus Kill, Indian Kill, Stony Cr., Shakers Cr.	Saratoga SWCD	State (4)	$25,000	X		
Multiple Counties										
Portions of Hamilton, Fulton, Montgomery, Saratoga, and Schenectady Counties	Watershed Modeling (3)	1B,1C	1,2,4	HUC-12s in the following HUC-10s: Alplaus Kill, Fly Creek, Cayadutta Creek, Canajoharie Creek, East Canada Creek	Schenectady SWCD	State	$45,000		X	

NOTES: (1) Unless otherwise noted, projects are based on recommendations from the Mohawk River Watershed Coalition SWCD's HUC-12 Assessment Reports.

(2) This project includes one or more specific actions along this particular stream that include the implementation of stormwater management and natural stream design practices. Refer to the Montgomery County NY Rising Countywide Resiliency Plan.

(3) The Watershed Modeling project will address the need to estimate pollutant loading reductions to be achieved by implementing specific recommended actions for threatened or impaired waterways.

(4) This project has been partially funded by a NYS Department of State Title 11 EPF Local Waterfront Revitalization Program grant.

KEY: **See strategy key on p. 5-8.**

5.2.3 Schoharie Watershed Region

As displayed in Map 5-3, the Schoharie Watershed region has only one low-scoring subwatershed (Cobleskill Creek) based on the assessment scoring process. Of the remaining five subwatersheds, two are mid-scoring (Batavia Kill and Fox Creek) and three are high-scoring (West Kill, East Kill, and Panther Creek). Cobleskill Creek's low score is due primarily to relatively high agricultural land use, while the mid- and high-scoring subwatersheds have lower agricultural land use and higher forest cover. Sediment loss during storms is an issue in the uplands of the Catskills, due to steep slopes and high soil erodibility, and contributes to the need to stabilize streambanks in these subwatersheds. The recommended actions and practices for this region are summarized in Table 5-6, and grouped by their strategy component in meeting the overall goal of restoring watershed health. The Cobleskill Creek subwatershed is italicized to emphasize its priority for restoration. Specific projects to advance these strategies within the Schoharie Watershed region are listed in Table 5-7.

TABLE 5-6
Schoharie Watershed Region: Recommended Actions and Practices

Recommendation	Locations (HUC-10s)	Cost	Timing (Years)
Strategy Component 1A: Protect and restore natural hydrology			
Restore wetlands	*Cobleskill Creek*, Fox Creek	$$$	3-5
Restore/increase riparian buffers	*Cobleskill Creek*, Panther Creek Batavia Creek, East Kill, Fox Creek	$$$	3-5
Implement stormwater management practices	*Cobleskill Creek,* Panther Creek Batavia Kill, East Kill West Kill, Fox Creek	$$$$$	3-5
Address streamflow below reservoir	West Kill	$$$$	5+
Install adequate culverts	East Kill	$$$	5+
Preserve green space	*Cobleskill Creek*	$$$	3-5
Strategy Component 1B: Reduce erosion and sediment transport			
Stabilize streambanks/address streambank erosion	*Cobleskill Creek*, Panther Creek Batavia Kill, East Kill, Fox Creek	$$$$	3-5
Restrict animal access to streams	*Cobleskill Creek*	$$	3-5
Regulate streamside development	Fox Creek, East Kill	$	1-2
Re-vegetate roadside ditches	West Kill	$$	3-5
Implement soil erosion BMPs	*Cobleskill Creek*	$$$	3-5
Strategy Component 1C: Minimize pollution			
Address failing septic systems	*Cobleskill Creek* Fox Creek (Warner's Lake)	$$$$	3-5
Employ nutrient and waste management BMPs on farms	*Cobleskill Creek*	$$	1-2
Monitor road salt at bridge crossings	*Cobleskill Creek*	$	1-2
Strategy Component 1D: Protect and restore habitats			
Control invasive species	Panther Creek, East Kill	$$	3-5
Conduct biodiversity study of streams	West Kill, Fox Creek	$	3-5
Manage culverts for fish passage	West Kill	$$	3-5

TABLE 5-7
Schoharie Watershed Region: Recommended Projects

County Municipality(-ies)	Project (1)	Strategy	Goal	Target Subwatersheds	Lead Organization	Funding Sources	Potential Cost	Timing 1-2 Yrs	Timing 3-5 Yrs	Timing 5+Yrs
Schoharie County										
County-wide (plus portions of Montgomery, Albany, & Schenectady Cos.)	Flood Mitigation Studies	1A	1,3	All HUC-12s in HUC-8 Schoharie Watershed	Schoharie SWCD	State (3)	$444,000	X		
County-wide	Re-vegetation of Roadside Ditches	1B	1	All HUC 12s in HUC 10s: Cobleskill Creek, Fly Creek, Panther Creek, West Kill	Schoharie SWCD	State (3)	$40,000		X	
Town of Cobleskill Village of Cobleskill	Flood Attenuation Study & Implementation—Mill Creek	1D	1,2,3, 4,5	Punch Kill/Cobleskill Creek	Schoharie SWCD	State, Federal	Study $100,000 Implementation $150,000-200,000		X	
Town of Esperance	Fly Creek Revitalization Project	1A	1,2,3,4, 5,6,7	Fly Creek	Schoharie SWCD	State, Federal	$100,000-500,000		X	
Towns: Conesville, Cobleskill, Schoharie, Middleburgh	Assessment of Prevalence & Removal of Japanese Knotweed (*P. cuspidatum*)	1D	1,2,3, 4,5	Little Schoharie Creek, Manor Kill, Cobleskill Creek, Schenevus Creek, Ox Kill (Fox Creek)	Schoharie SWCD	State	$25,000-30,000		X	
Towns: Middleburgh, Fulton, Gilboa	Riparian Buffer Enhancement Post Emergency Watershed Protection Implementation	1A	1,2,3,4	Little Schoharie Creek, Line Creek, Platter Kill (Schoharie Creek)	Schoharie SWCD	State	$54,000		X	
Albany County										
Towns: Berne, Altamont	Invasive Species Assessment and Control	1D	1,4	HUC 12s: Headwaters Fox Creek, Beaverdam Creek, Switz Kill	Albany SWCD	State (3)	$20,000	X		
Towns: Berne, Altamont	Re-vegetation of Roadside Ditches	1B	1	HUC 12s: Headwaters Fox Creek, Beaverdam Creek, Switz Kill	Albany SWCD	State (3)	$12,000		X	
Towns: Knox, Berne	Conservation Cover Cropping	1B	1,2,3, 4,5	Fox Creek, Switz Kill, Beaverdam Creek	Albany SWCD	State, Federal	$25,000-50,000		X	
Towns: Knox, Berne, Westerlo, & Rensselaerville	Streambank Restoration	1B	1,2,3,4	Switz Kill Headwaters of Fox Creek, Beaverdam Creek, Shaker Creek	Albany SWCD	State	$50,000-100,000		X	
Multiple Counties										
Albany County, Greene County, Schoharie County	Watershed Modeling (2)	1B,1C	1,2,4	HUC 12s in the following HUC 10s: Cobleskill Creek, Batavia Kill, Fox Kill, West Kill, East Kill, Panther Creek	Schoharie SWCD	State	$45,000		X	

NOTES: (1) Unless otherwise noted, projects are based on recommendations from the Mohawk River Watershed Coalition SWCD's HUC-12 Assessment Reports.
(2) The Watershed Modeling project will address the need to estimate pollutant loading reductions to be achieved by implementing specific recommended actions for threatened or impaired waterways.
(3) This project has been partially funded by a NYS Department of State Title 11 EPF Local Waterfront Revitalization Program grant.

KEY: **See strategy key on p. 5-8.**

5.3 Ongoing Implementation, Tracking and Monitoring Progress

The implementation of the Mohawk River Watershed Management Plan will be monitored at two levels. The first level is the ongoing implementation of watershed projects and municipal actions for both restoration and protection of the watershed. The second level is the long-term monitoring of watershed health over a period of years.

5.3.1 Ongoing Implementation

The projects and other actions summarized in Tables 5-2 through 5-7 represent the first round for implementing the recommendations for restoration and protection of the Mohawk River Watershed. As future actions are recommended, they will be prioritized and initiated to the extent that they address the strategies discussed in Chapter 4 and the seven goals of the Mohawk River Watershed Management Plan. Thus, the Plan remains a work in progress, growing and adapting as conditions in the watershed change.

Likewise, implementation of the Plan will be an ongoing process and will continue for many years into the future. Projects will be completed, and new projects will be added. Periodic watershed assessments will be conducted and the Plan will be updated to reflect new information.

To manage this ongoing implementation, a Steering Team will be established comprised of representatives of the Mohawk River Watershed Coalition of Conservation Districts, NYSDOS, NYSDEC, and state and local stakeholders as appropriate. The Steering Team will meet on a regular basis to review progress and determine future watershed projects and funding opportunities. Status reports will be available on the Mohawk River Watershed Coalition website.

5.3.2 Tracking Implementation and Monitoring Progress

It is important to track progress and to document a successful pattern of water-quality improvement resulting from implementation of the Mohawk River Watershed Management Plan. To this end, the description of each of the recommended projects/actions includes measures to track implementation and determine success over the short and the long term.

Implementation strategy activities will be monitored and tracked through the Interactive Mapping Tool for the Mohawk River Watershed. This online interface will store implementation strategy details that can be viewed at the subwatershed scale, including information about the goals addressed, estimated timeline, estimated cost, potential funding sources, responsible party, and project status/progress, where available.

Coalition members will be able to make additions or updates about progress toward completion of different tasks or projects through a separate, secure, online map-based tracking system. Implementation projects may be added or edited by the Coalition through this secure tracking system. These additions or updates will be made directly to the GIS-based subwatershed features and will be viewable in both the secure web tracking system and the existing Interactive Mapping Tool for the Mohawk River Watershed.

The system allows stakeholders to visualize progress of subwatershed management activities and to evaluate progress over the Mohawk River Watershed as a whole. With the interactive mapping tool, implementation strategies can be viewed in conjunction with other Mohawk River Watershed data layers, such as watershed assessment scores, environmental data, and demographic information. Links to the implementation plan

documents are also available through the implementation strategy tracking dataset, such as subwatershed management recommendation reports and grant information, where available.

5.3.3 Monitoring Long-Term Watershed Health

The current status of water quality in each subwatershed was measured by the methods described in Chapter 3: Subwatershed Assessment and assigned three component scores—water quality, land use, and habitat—and a composite score. By periodically repeating the assessment procedure, perhaps every five years, one can follow progress toward achieving the goals set out in the Plan. For example, included in the water-quality metric used in the assessment technique is the status of the waterbody on the 2010 NYSDEC Waterbody Index/Priority Waterbodies List. This list is updated every five years, and, as water quality in a subwatershed improves, its assessment score should show improvement as well.

WATERSHED ASSESSMENT: TOTAL SCORE UPPER MOHAWK

MAP 5-1

Mohawk River Watershed Management Plan

Lake Pleasant

Lowville

Upper West Canada Creek

Middle West Canada Creek

Lower West Canada Creek

Delta Reservoir-Mohawk River

Ninemile Creek-Mohawk River

Nowadaga Creek-Mohawk River

Oriskany Creek

Adirondack Park

Mohawk River

Utica

Herkimer

Johnstown

Fonda

Wampsville

Cooperstown

LEWIS COUNTY
ONEIDA COUNTY
HERKIMER CO.
HAMILTON CO.
HAMILTON COUNTY
SARATOGA COUNTY
FULTON COUNTY
FULTON
MONTGOMERY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ONEIDA COUNTY
MADISON COUNTY

90

88

Legend

Total Score

- Low: 62 - 72.5
- Medium: 73 - 83.5
- High: 84 - 94

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Watershed Assessment, Stone and Mohawk River Watershed Coalition of Conservation Districts.

This map was prepared for the New York State Department of State with funds provided under Title 11 of the Environmental Protection Fund.

Developed By:

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WATERSHED ASSESSMENT: TOTAL SCORE MAIN RIVER

MAP 5-2

Mohawk River Watershed Management Plan

Lake Pleasant
Ballston Spa
Albany
Schenectady
Johnstown
Fonda
Utica
Herkimer
Schoharie
Cooperstown

HAMILTON CO.
HERKIMER CO.
HAMILTON COUNTY
FULTON COUNTY
SARATOGA COUNTY
MONTGOMERY COUNTY
SCHENECTADY COUNTY
ONEIDA COUNTY
HERKIMER COUNTY
HERKIMER COUNTY
OTSEGO COUNTY
SCHOHARIE COUNTY
OTSEGO COUNTY
ONEIDA COUNTY
MADISON COUNTY
ALBANY COUNTY
GREENE COUNTY
SCHOHARIE
DELAWARE
COUNTY

Adirondack Park

East Canada Creek

Canajoharie Creek-Mohawk River

Cayadutta Creek-Mohawk River

Alplaus Kill-Mohawk River

Fly Creek-Schoharie Creek

Mohawk River

90
87
88

Legend

Total Score

- Low: 62 - 72.5
- Medium: 73 - 83.5
- High: 84 - 94

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

N

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Watershed Assessment, Stone and Mohawk River Watershed Coalition of Conservation Districts.

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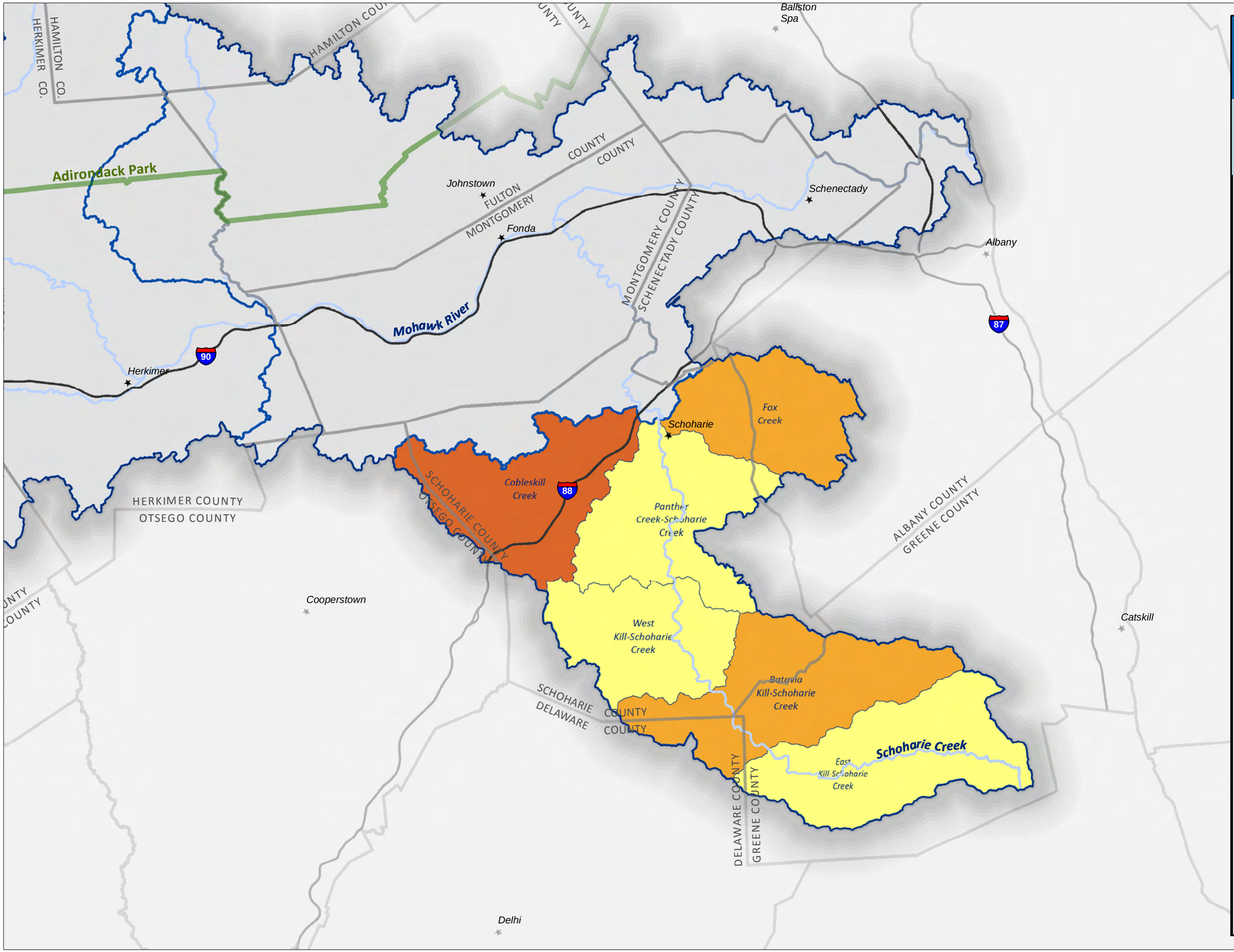
Developed By:

STONE ENVIRONMENTAL INC

WATERSHED ASSESSMENT: TOTAL SCORE SCHOHARIE WATERSHED

MAP 5-3

Mohawk River Watershed Management Plan



Legend

Total Score

- Low: 62 - 72.5
- Medium: 73 - 83.5
- High: 84 - 94

NEW YORK STATE DEPARTMENT OF STATE

MOHAWK RIVER WATERSHED COALITION OF CONSERVATION DISTRICTS

0 2.5 5 10 Miles

Sources: Watershed Boundaries: NYDEC; Hydrography, NHD; Administrative Boundaries: CSCIC; Adirondack Park Boundary, APA; Watershed Assessment, Stone and Mohawk River Watershed Coalition of Conservation Districts.

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