ACKNOWLEDGEMENTS

This natural resource inventory is a Montour Falls-specific, adapted, revised, and updated version of the Tompkins County Natural Resources Inventory (2001) with new sections added, used with permission from the Tompkins County Planning Department. The inventory was prepared by Alex Goddard and Kalena Bonnier-Cirone (Interns from the New York Water Resources Institute), and Osamu Tsuda, Climate Smart Communities Specialist Cornell CCE Tompkins County/ NY Water Resources Institute , in conjunction with Kristen Hychka (Post-doctorate Research Specialist, NY Water Resources Institute/Environmental Finance Center) and Katherine Herleman (Clean Energy Communities Coordinator) and Chris Skawski (Clean Energy Communities Intern) from the Cornell Cooperative Extensions Schuyler County. The effort was directed and coordinated by Terry Carroll, Southern Tier NYSERDA Clean Energy Communities Coordinator, Cornell Cooperative Extension of Tompkins County. Feedback and proposed edits were provided by community members of the village for the original template. The data used in this natural resource inventory was the most up-to-date information available as of Fall of 2018, and much of it was provided by the Tompkins County GIS Division. Maps were prepared by Nathan Revor and Hassan Saleem, and the layout was created by Lois Nguyen (Graphic Design Intern, Cornell Cooperative Extension of Tompkins County).

Detailed Table of Contents

INTRODUCTION

What are Natural Resources in the Montour Falls

The Village of Montour Falls is a small community located directly south of Seneca Lake and is well known for its picturesque location surrounded by many water features such as Watkins Glen and Shequaga Falls located right in the village. While the village has had its struggles with the declining and aging village population and constant flooding, the community has worked very hard to become a county-wide leader in climate smart development and renewable energy. With overall increasing precipitation in the region, the Village of Montour Falls has identified flood resiliency as another major factor to consider which is why the community has decided to create this natural resource inventory as part of the effort to identify key issues and implement better land use development practices. The overarching goal is to develop a series of planning documents and inventories to help plan and create a more sustainable and flood resilient community as well as encourage and act as a model for other surrounding municipalities to become certified Climate Smart Communities.

Picture 1 Shequaga Falls from Downtown Montour Fall

What is a Natural Resource Inventory?

In the simplest form, a Natural Resource Inventory (NRI) is a compilation of existing natural/ ecological resources, according to the New York DEC and Hudson River Estuary Program. Depending on the community, a natural resource inventory could also include historic resources. Oftentimes, the scope and level of detail is determined by the community preparing the document. While the simplest version is just a list of existing resources, the more complex NRIs could include detailed analysis of each existing resource. As the primary purpose of an NRI is to act as an informational source to community members and municipal officials, the secondary purpose of the document is to provide the building blocks for natural resource awareness in the local and regional comprehensive plans as well as building and zoning regulations. In other words, the NRI acts as a regional atlas that could be used when updating or developing local regulations.

While a natural resource inventory is not a planning document per se, this specific NRI is best meant to be used in conjunction with and act as a complimentary tool the municipal and county planning documents. Such planning documents include but are not limited to the Village comprehensive plan, Town of Montour Land Use Plan, and the County-wide Hazard Mitigation Plan. In addition, it is important to understand that because of the limited staff and resources of small municipalities such as Montour Falls, the NRI has been developed in a way that could act as an advisory tool to future development and land use changes, especially in regards to the changing regional climate conditions

and increasing risks of flooding within and surrounding the village (i.e. wetlands and runoff from the surrounding hills).

Why Should Natural Resources be Protected?

Protecting environmental quality is a matter of choices and tradeoffs. As the Village of Montour Falls is located in a valley and is surrounded by Wetlands, it is particularly vulnerable to flooding and extreme runoff. In addition, over the years, the village stormwater infrastructure has been consistently overwhelmed and is in disrepair, leading to the flooding of streets and houses downstream. Because of these reasons, it is important for the village to identify and protect/ or prevent development in areas identified in this natural resource inventory to better protect the safety of its citizens and increase resiliency. At the same time, it is important to understand the negative consequences and effects from changes and interventions caused by human activity. Such negative consequences include wildlife displacement, loss of recreation corridors and scenic vistas, surface and groundwater contamination, increased pervasiveness of invasive species, and increased erosion and flooding. The decisions to allow for development requires the Village of Montour Falls to determine where development should and can take place, what the environmental impacts of this development will be, whether these impacts are worth the result, and whether there are less harmful ways to develop. This document can serve as a guide for the municipality and developers to consider the answers to these questions.

Since much development is irreversible, planning is very important. Long-term planning is one way to minimize the short-term exploitation of the resource base that results from "quick fixes" to localized problems and from competition for resources. Planning at the local, regional, and state levels provides individual municipalities with a rational system for guiding development with respect to the distribution and value of natural resources.

How Can Natural Resources be Protected?

This natural resource inventory identifies many of the natural resources within and surrounding the village. This is the first step in protecting those resources. Private landowners, government agencies, and conservation organizations can use this knowledge to protect the most important of these resources.

There are several major approaches to protecting natural resources. The following is a list of some of the types of options currently used in municipalities throughout municipalities in Upstate NY.

Non-Regulatory Tools

Acquisition

Acquisition with the goal of resource preservation is the surest way of protecting natural resources.

Informal Designations

Planning efforts can raise local awareness of the value and location of important natural resources. Goals for protecting natural resources can be defined in a community's comprehensive plan. Natural resource protection can also be addressed in open space and recreation plans or in plans for a particular resource, such as a watershed protection plan. This will be discussed in further detail on page 83

Educational Programs

Natural resource education programs are another way to help raise awareness of the importance of natural resources and interest in protecting those resources. The Schuyler County Soil and Water Conservation District for example has a number of programs and annual events that are aimed at educating the general public around climate change and the importance of land conservation and protection. The Schuyler County Cooperative Extensions office also provides additional support and education regarding flood preparedness and recovery after major storm events under the environment program.

Regulatory Tools

There are also many regulatory tools available to local municipalities to control land use. Details on these regulatory tools are provided below on page 83. Not all of these tools may match the Town's current goals or capacity. These specific regulatory techniques for protecting resources include:

- Zoning and Subdivision Ordinances – used to protect the public health, safety, and general welfare.
- Local Wetlands Ordinances – regulate disturbance of wetlands beyond those covered under state and federal laws, such as small or isolated wetlands, and can add additional requirements for activities adjacent to wetlands.
- Buffer Requirements – establish minimum distances between a development and a selected natural feature.
- Clustering Requirements – place residential units on a portion of a site to protect a contiguous area of open space or unique feature.
- Performance Zoning – unlike traditional zoning, performance zoning determines whether a land use is permitted based on an assessment of potential impacts.
- Preservation Overlay Zones – geographic areas where more restrictive development regulations are enforced to protect valued natural resources.
- Park Dedications – require developers to contribute land, or cash in lieu of land, to provide for the open space and recreation needs of the subdivision's residents.
- Transfer of Development Rights – landowners in designated preservation areas may sell development rights to allow increased density in other areas of the community.
- Purchase of Development Rights – landowners in designated preservation areas may sell development rights for cash to a government or appropriate organization.

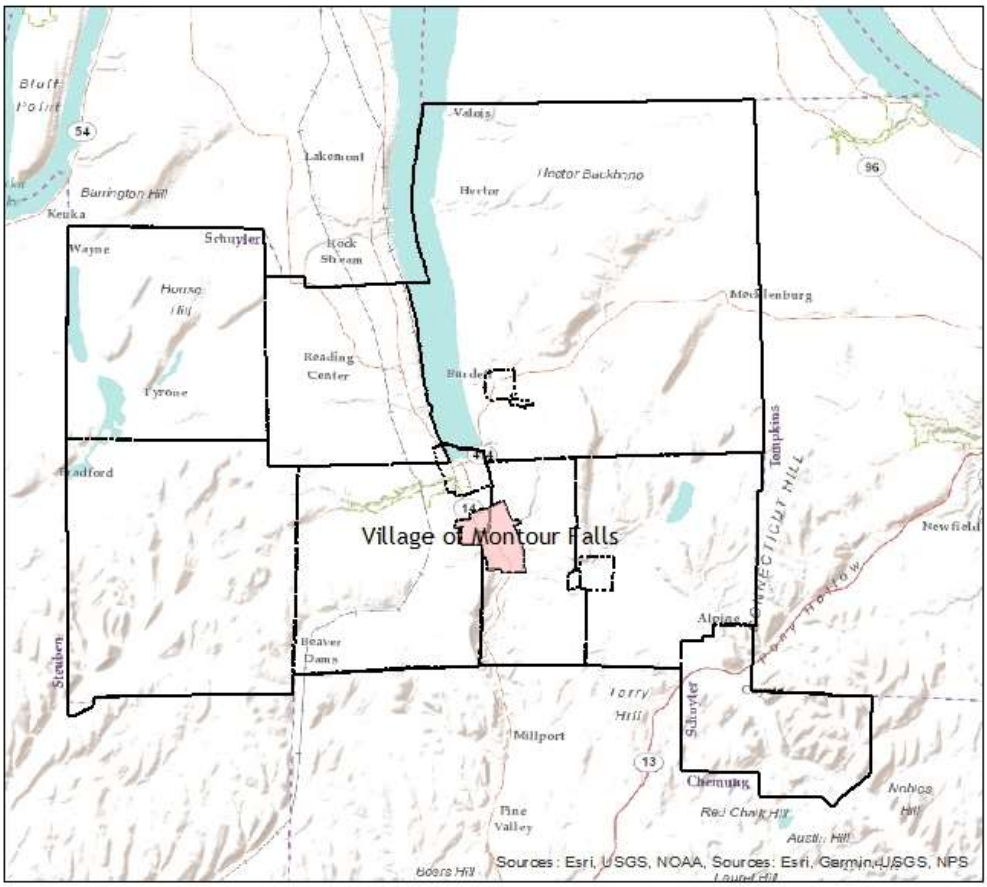
About the Organization of this Natural Resources Inventory

The Montour Falls Natural Resource Inventory begins with a summary of climate conditions and projections for the village. The rest of the inventory is organized into three resource categories: hydrology and aquatic ecosystems, geology and soils, and land use and protected lands. An addition has been made titled "Implementation Tools" which lists the potential methods on preserving existing resources.

About the Data

The data collected for this natural resource inventory was primarily collected through the New York State GIS clearinghouse, USDA, USGS, and the New York State Museum. Flood map data was collected through the Southern Tier Regional Planning Office. Unfortunately, due to the lack of data available on the county and municipal level, much of the data available was retrieved on the state or national level and might not be an absolute accurate representation of the current municipal land characteristics. For more detailed and up-to-date maps, it would be necessary for the county, town, or village to conduct its own mapping and data collection. For further information on each map's data source, please refer to the Resources and References sections which can be found right before each map. In terms of general layout, each map is projected as NAD_1983_UTM_Zone_18N while the scale for most maps are 1:35,000 or 1:75,000, while the maps depicting the entire county is 1:250,000. The background is filled in with the US Terrain Base Map which is provided through ESRI.

Location Within Schuyler County



CLIMATE CONDITIONS AND PROJECTIONS

What is Climate Change?

Climate change refers to a change in typical or average weather in a region. Climate change has always been naturally occurring. However, human actions can also influence climate change, and since the mid-20th century, climate change has been occurring globally at an accelerated pace because of anthropogenic causes. The burning of fossil fuels (e.g. coal, oil, natural gas) is largely responsible for rapidly changing climate conditions since these fuels emit greenhouse gases that trap heat in the Earth's atmosphere. This results in changes to the average temperature and precipitation of regional climates around the world.

Why is Understanding Climate Change Important?

The changing climate is causing sea levels to rise as glaciers and polar ice melt, growing seasons to change as precipitation patterns and temperatures change, and an increase in extreme weather events including heat waves, droughts, and floods. This already impacts how and where we live, from farmers growing different crops to people leaving their no-longer-habitable homes. In addition, warmer temperatures can have adverse effects on health by increasing plants' pollen production and the formation of ground-level ozone, which in turn can worsen respiratory conditions such as asthma and allergies, and by creating a more hospitable environment for disease-carrying insects such as mosquitoes and ticks.

Climate Conditions and Projections in Montour Falls

New York State has a humid continental climate with an average temperature of 47.5°F and an average annual precipitation of 35 inches in the Southern Tier. The following table (Table 1) shows the range of predicted future changes in annual temperature, precipitation, and severe weather events in the Southern Tier.

Table 1: Baseline and Projected Changes in Climate Conditions and Severe Weather Events in the Southern Tier

	Baseline	2020s	2050s	2080s
Temperature	47.5°F	+1.8 to 3.8°F	+3.6 to 7.1°F	+4.2 to 11.6°F
Precipitation	35 inches	-4 to +9%	+2 to +15%	+3 to +16%
# of days per year with maximum temperature exceeding				
90°F	10	15 to 23	22 to 47	28 to 79
95°F	1	2 to 7	2 to 18	4 to 38
Heatwaves				
# per year	1	2 to 3	3 to 6	3 to 9
Average duration (days)	4	4 to 5	5	5 to 7
# of days per year with temperatures at or below freezing (32°F)				
	152	119 to 134	94 to 120	72 to 116
# of days per year with rainfall exceeding				
1 inch	6	6 to 7	6 to 8	6 to 8
2 inches	0.6	0.6 to 1	0.7 to 1	0.7 to 1

Source: NYSDEC, *Observed and Projected Climate Change in New York State: An Overview* (2015); baseline data is 1971-2000 NOAA data

The State's changing climate will negatively impact human health, the economy, and the environment. Warmer temperatures could hurt local economies by adversely affecting the ability to create maple syrup, grow apples, produce dairy, and participate in other agricultural activities. Extremely warm temperatures that occur as heat waves (defined as three or more consecutive days with maximum temperatures above 90°F) are a potentially deadly health hazard. These hotter temperatures in the summertime could also impact ecotourism in the region. In addition, both more frequent droughts and increased precipitation are predicted. Droughts hinder agricultural production and impact overall water use, while long, heavy rains will increase the chances of flash flooding and erosion, which can damage buildings, infrastructure, agriculture, and undeveloped lands. Lastly, the changing climate will permit the expansion of parasites such as ticks, which can carry Lyme disease, and invasive species, some of which are harmful to native species, ecosystems, and people.

Addressing Climate Change

To avoid facing the worst of these climate change projections, we can take measures to address climate change. These measures fall into two categories: mitigation and adaptation. Mitigation refers to the reduction of greenhouse gas emissions, while adaptation refers to changing our practices to match new or inevitable climate conditions (NASA). Examples of mitigation strategies include reducing energy use by taking actions such as turning off electronics when they are not in use or switching to energy efficient LED lightbulbs; switching to renewable energy sources such as solar or hydro power; reforestation to sustainably capture carbon dioxide emissions; and taking the bus, walking, biking, or carpooling instead of driving (NYS DEC). Examples of adaptation strategies include relocating facilities away from areas prone to flooding, creating cooling centers for people to take shelter in on extremely hot days, and reducing water use during droughts.

Using a combination of mitigation and adaptation strategies at the individual, institutional, and municipal levels is important. Climate change cannot be prevented entirely even if humans were to cease greenhouse gas emissions as the greenhouse gases currently in the atmosphere will remain there for decades or even centuries (NASA). Therefore, adaptation to a different climate is necessary. However, we can avoid experiencing the worst of the projections by reducing greenhouse gas emissions through mitigation strategies so that existing issues will not be exacerbated.

Resources and References

National Aeronautics and Space Administration (NASA), What Are Climate and Climate Change?
https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-climate-change-58.html

New York State Department of Environmental Conservation
Observed and Projected Climate Change in New York State: An Overview (2015).
http://www.dec.ny.gov/docs/administration_pdf/climbkgncrra.pdf
Climate Change, http://www.dec.ny.gov/energy/44992.html

Section 1: Hydrology

WATER BODIES

How Are Water Bodies Regulated?

Federal and state agencies, such as the New York State Department of Environmental Conservation (DEC) and United States Army Corps of Engineers (Army Corps), require permits for activities that might affect or disturb a water body and/or its banks. The stringency of these permits corresponds with the DEC classification assigned to the water body (see Table 2) and may range from a general, or unified, permit to a permit tailored to the specific site and type of work conducted. Regulated activities might include streambank maintenance, construction, flood protection and mitigation, dredging, placing fill, and certain agricultural practices.

Commercial, industrial, and agricultural activities that discharge to a water body require a State Pollution Discharge Elimination System (SPDES) permit. This permit is required for a broad range of activities, including the discharge of wastewater, stormwater, or chemical and thermal emissions from municipal treatment plants, industrial plants, utilities, large subdivisions, apartment complexes, and confined animal feeding operations.

Prior to conducting stream-related work or discharging wastewater, the Region 7 Office of the DEC or the Army Corps Buffalo District should be contacted to obtain the necessary approvals and permits. Each of these agencies will automatically forward permit applications to the other, and each agency will contact the applicant if additional permits and/or paperwork are needed.

How Are Water Bodies Classified?

The DEC has assigned most water bodies within the state a letter based on their existing or expected "best use." The most pristine waters are assigned a classification of AA, while the most degraded waters are assigned a classification of D. Table 2 details these classifications.

Table 2: NYSDEC Classifications of Fresh Surface Waters

	Best Use
AA	Drinking (after chlorination)
A	Drinking (after chlorination and filtration)
B	Bathing
C (T)	Fishing (trout)
C	Fishing
D	Secondary contact recreation
Source: New York State Department of Environmental Conservation	

Additional classifications of "T" or "TS" can be added if a water body has sufficient amounts of dissolved oxygen to support trout and trout spawning. Water bodies that are designated as "C (T)" or higher (i.e., "C (TS)", "B", or "A") are collectively referred to as "protected streams" and are subject to additional regulations.

Water Bodies in Municipality

Several water bodies exist within the Village of Montour Falls.

Table 3: Montour Falls Water Bodies Classifications	**Classification**
Catharine Creek	C (T)
Shequaga Creek	C (T)
L'Hommedieu Creek	C
Catlin Mill Creek	C (TS)
Source: New York State Department of Environmental Conservation Environmental Resource Mapper, EPA WATERS Google Earth Plugin	

Fish resources are a key factor in determining water body classifications because they are high on the food chain in aquatic habitats. As such, fish can be used as an indicator of the overall quality of an aquatic ecosystem. Some fish are highly vulnerable, both directly and indirectly, to changes in their environment. They can be directly affected by physical and chemical changes in the water and indirectly affected when changes in the environment affect their food sources or the temperature and turbidity of their habitat.

Reasons to Protect

There are many obvious benefits to protecting waterbodies and their surrounding banks/ riparian buffers; with the constantly changing climate conditions it is important to understand the critical role of natural water networks and how they can protect a community. The following is meant to be an incentive to encourage preservation and protection, and thus increase the community's resiliency to future climate related events.

As discussed above, waterbodies and their surroundings are fragile and can easily be affected by modifications to their structure. According to the Climate Impact Lab, the average temperature in New York State is projected to increase by 10 degrees (F) over the next 100 years. While Upstate New York might not have to worry much about sea level rise, the significant increase in temperature would not only trigger increasingly fluctuant weather patterns, but also precipitation at higher intensities. These more extreme weather patterns are already apparent throughout Upstate NY, as there has been a noticeable increase in precipitation between 5 - 10% every decade since 1960.

A study conducted by New York DEC and Delaware County Soil and Water Conservation District shows that any stream disturbance/ modification (such as stream bed sediment clearing, removal of vegetation along stream bank, man-made change in stream shape or size, etc.) can eventually lead to heavy erosion both upstream and downstream and thus cause flooding that could have otherwise been avoided. Thus, as communities can expect increased flooding events in the near future, it is important to understand how flooding can easily overwhelm any natural infrastructure that has been disturbed by human activity. While updating and improving infrastructure can help increase a community's safety, preserving waterbodies and their surroundings can be one of the most effective ways to improve a community's resilience.

Such resources can be preserved through multiple methods which are detailed in the *Implementation Tools* section of this document.

Maps and Data

The map on page 18 shows permanent streams – those that flow year-round - and their protection status in the Village of Montour Falls. Other maps in this document show intermittent (or seasonal) streams as well, which only flow when they receive water from upstream, groundwater, and/or precipitation. The data for this map comes from the New York State GIS Clearinghouse dataset entitled "Water Quality Classifications - NYS," last revised in May 2017.

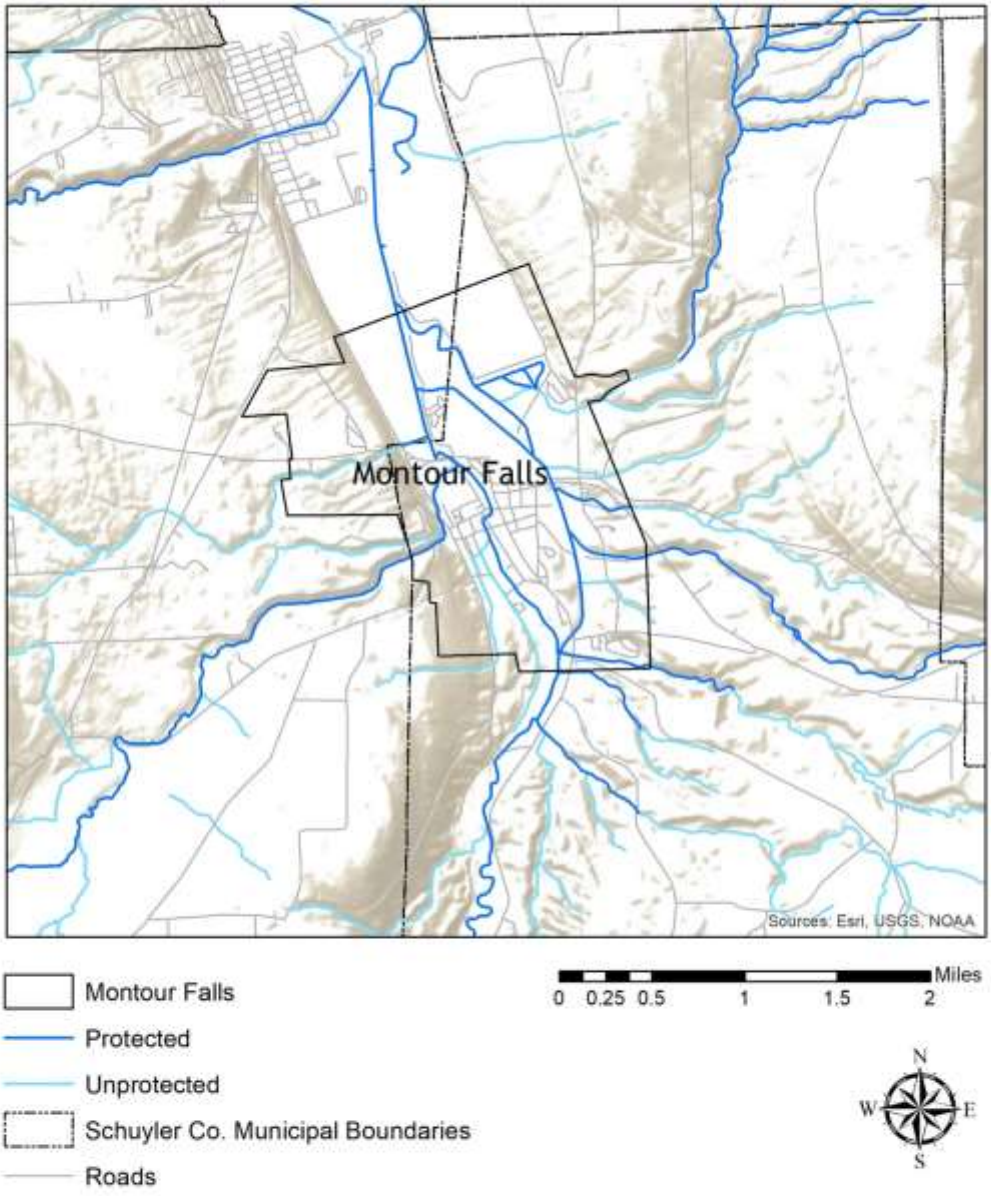
Resources and References

Army Corps of Engineers, Buffalo District, http://www.lrb.usace.army.mil/
Climate Impact Lab http://www.impactlab.org/

Delaware County Post-Emergency Stream Intervention :
https://www.dec.ny.gov/docs/administration_pdf/streammnll.pdf
New York State Department of Environmental Conservation
DEC Regulations, Chapter X: Division of Water, http://www.dec.ny.gov/regs/2485.html
Protection of Waters: Disturbance of the Bed or Banks of a Protected Stream or Other Watercourse, http://www.dec.ny.gov/permits/6554.html

New York State GIS Clearinghouse, http://gis.ny.gov/

United States Environmental Protection Agency, "Streams,"
https://archive.epa.gov/water/archive/web/html/streams.html


Montour Falls
Sources: Esri, USGS, NOAA
Montour Falls
Protected
Unprotected
Schuyler Co. Municipal Boundaries
Roads
Miles
0 0.25 0.5 1 1.5 2
N
W
E
S

WATERSHEDS

What Is a Watershed?

A watershed is the land area that contributes water to a given point, such as a stream or lake. Contributing sources of water for a watershed include (but are not limited to) springs, streams, seeps, ditches, culverts, marshes, wetlands, swamps, and ponds. Eventually, all surface water, some groundwater resources, and precipitation falling within a watershed drain into a single receiving water body such as a stream, river, lake, or wetland.

Watersheds exist at various scales within a hierarchical structure. Gullies and ravines trickle into streams, which in turn feed into larger streams or rivers. Each of these water bodies (gully, ravine, stream, etc.) drains its own particular watershed so that larger watersheds are comprised of several smaller watersheds. While the term watershed is often used interchangeably with "drainage basin", the term drainage basin usually refers to a larger watershed such as the Susquehanna River Drainage Basin or the Lake Ontario Drainage Basin. Though the Village of Montour Falls is within the Seneca Lake Inlet watershed, it is also within the larger Seneca-Oneida-Oswego River drainage basin.

Why Are Watersheds Important?

Land use throughout a watershed (or the commercial, industrial, agricultural, and/or residential activities a land area can support) and the availability of reliable water sources within a watershed are directly related. That is, the land use in a particular area is often determined by the availability of reliable water supplies, and land use is a key determinant of the quality, quantity, and availability of local water resources. Because of this dynamic relationship between water and land use, the characteristics of the entire watershed must be considered when addressing water quality and water quantity issues, including such factors as the amount of impervious surface and effectiveness of local land management practices.

Additionally, the critical influence and impact of water on important ecological and economic systems (such as provision of drinking water, flooding, recreation, and future economic growth) make watersheds increasingly common management and planning units. State and federal agencies utilize and look favorably on water-related management and planning processes that also utilize the principles and concepts of watershed management.

How are Watersheds Regulated?

Though activities within a watershed can greatly influence the ecosystems they contain, many regulations apply to specific waterbodies or wetlands within a watershed and not the watershed itself.

Watersheds in Montour Falls

The Village of Montour Falls lies in one watershed–Seneca Lake Inlet watershed. This watershed drains into Seneca Lake, the largest of the Finger Lakes. This means that all the water that falls in the Village of Montour Falls and runs off the landscape ends up in Seneca Lake. Montour Falls is part of the greater Seneca-Oneida-Oswego River drainage basin, which ultimately drains into the Seneca River, north of Seneca Lake.

Table 4: Watersheds in Montour Falls	Acres	Sq. Miles (approx.)	Drainage Basin
Seneca Lake Inlet	77,795	122	SENECA-ONEIDA-OSWEGO RIVER
Source(s): USGS			

Watershed Role with Changing Weather

As the temperature of Upstate New York increases and extreme weather patterns become more frequent, focusing on protecting and managing the watershed will not only increase resilience, but also protect community health from the harmful runoffs that are a result of increased high-volume precipitation. According to data from the Research Program on Climate Change, Agriculture, and Food Security, New York's southern-tier and Central region will likely see up to an 80mm increase in precipitation between 2015 and 2050. With the increase in impervious surfaces such as roads, parking lots, and industrial lands, runoff will increase and contaminate the local water networks of waterbodies, increasing the probability of harmful algal bloom (Cayuga Watershed Intermunicipal Organization).

While there are programs such as the Routine Monitoring Statewide Program which monitors watershed throughout the state, there are direct actions that local governments can take to protect watersheds in their municipality. According to the NYS Department of State Local Government Handbook, the following are potential actions a local government can take to preserve watersheds/ wetlands:

1) All wetlands that are smaller than 12.4 acres and that are not deemed of 'unusual importance,' are subject to the exclusive jurisdiction of the municipalities where the wetlands are located (ECL §24-0507).

2) Under ECL, §24-0501, a local government may enact a Freshwater Wetlands Protection Law to fully assume jurisdiction over all freshwater wetlands within its jurisdiction from DEC, provided its law is no less protective of wetlands than Article 24 of the ECL and provided that DEC certifies that the municipality is capable of administering the Act. There is also a limited opportunity for counties to assume wetlands jurisdiction if the local government declines.

3) Under ECL, § 24-0509, local governments can now adopt freshwater wetland regulations applying to wetlands already mapped and under the jurisdiction of DEC, provided that the local regulations are more protective of wetlands than the state regulations in effect. No pre-certification by DEC is required."

In addition to the above, communities can protect critical waterbodies/ wetlands and thus watersheds though SEQURA by identifying them as unique natural areas; adopt local regulations in the comprehensive plan for stormwater control, ordinances for sediment and erosion control, building and sanitary codes, floodplain regulation, and timber harvesting guidelines or other vegetation removal standards; and frequently monitoring local project processes for regulatory compliance (US EPA).

Map and Data

The map on page 23 shows the different watersheds in and near the Village of Montour Falls. The data used for the map came from USGS.

Resources and References

Cayuga Lake Watershed Intermunicipal Organization, http://www.cayugawatershed.org/

Cayuga Lake Watershed Network, http://www.cayugalake.org/

Cornell Cooperative Extension of Dutchess County, Natural Resources, http://ccedutchess.org/environment/natural-resources

Cornell University Geospatial Information Repository (CUGIR), https://cugir.library.cornell.edu/

Dutchess County Department of Planning and Development, "Chapter 5: Water Resources of Dutchess County, NY," Natural Resources Inventory, 2010 (originally published in 1985), http://www.co.dutchess.ny.us/CountyGov/Departments/Planning/nrichapfive.pdf
NYS Local Government Handbook: https://www.dos.ny.gov/lg/publications/Local_Government_Handbook.pdf

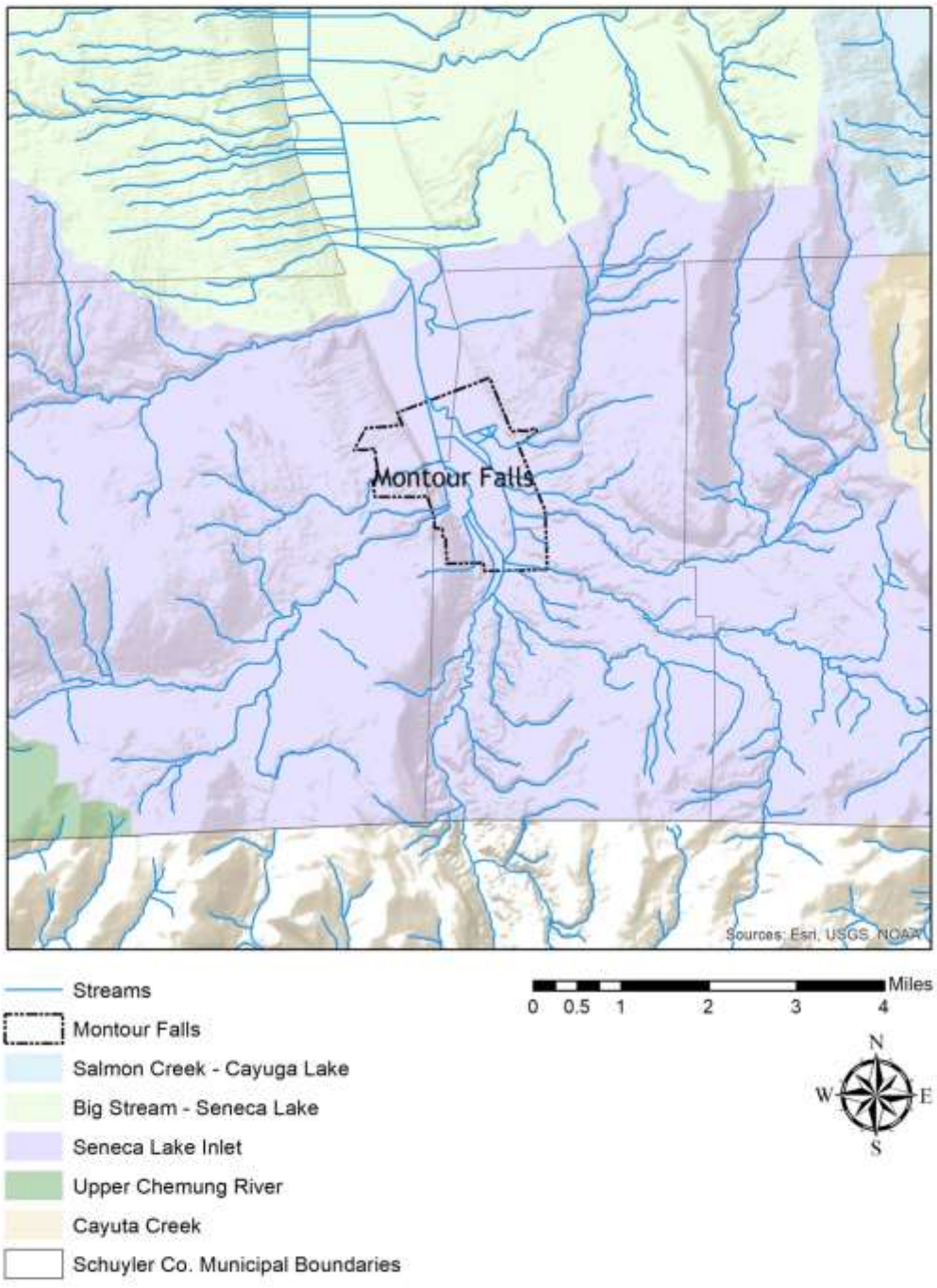
Research Program on Climate Change, Agriculture, and Food Security: http://www.ccafs-climate.org/data/

State Wetland Managers Association: https://www.aswm.org/

U.S. Department of Agriculture, Natural Resources Conservation Service, Hydrologic Unit Boundaries, https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/nri/?cid=nrcs143_013728

U.S. Environmental Protection Agency
- Surf Your Watershed, https://cfpub.epa.gov/surf/locate/index.cfm
- Healthy Watersheds Protection, https://www.epa.gov/hwp

Watersheds


Montour Falls
Sources: Esri, USGS, NOAA
Streams
Montour Falls
Salmon Creek - Cayuga Lake
Big Stream - Seneca Lake
Seneca Lake Inlet
Upper Chemung River
Cayuta Creek
Schuyler Co. Municipal Boundaries
0 0.5 1 2 3 4
Miles
N
W
E
S

WETLANDS

What Is a Wetland?

Wetlands, according to the United States Army Corps of Engineers (Army Corps), are "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, wet meadows, and similar areas." According to the New York State Department of Environmental Conservation (DEC), "Freshwater wetlands are those areas of land and water that support a preponderance of characteristic wetlands plants that out-compete upland plants because of the presence of wetlands hydrology (such as prolonged flooding) or hydric (wet) soils. Freshwater wetlands commonly include marshes, swamps, bogs, and fens." Wetlands such as swamps and marshes are often easily recognizable, but some wetlands, such as forested wetlands and wet meadows, are not obvious because they are dry during part of the year or do not have standing water.

Why Are Wetlands Important?

Wetlands are critical natural ecosystems and provide a variety of benefits such as:

- filtering harmful toxins, nutrients, and sediment from surface runoff;
- storing floodwaters and reducing the magnitude of flood events; and
- providing valuable habitat for a diverse array of flora and fauna, including many rare, threatened, or endangered species.

The recreational uses associated with wetlands are also very diverse and include birdwatching, hunting, and fishing, all of which provide direct economic benefits to local communities. Because wetlands are crucially important both economically and environmentally, they are highly regulated by the Army Corps and the DEC.

How Are Wetlands Regulated?

The Army Corps regulates wetlands under Section 404 of the Clean Water Act and issues wetland permits for the placement of fill or dredge materials and the construction of certain structures in waterways (navigable and non-navigable) and wetlands. Disturbances to wetlands must be mitigated in accordance with Army Corps regulations. The Army Corps permit required for activities within a wetland, and the amount of wetlands mitigation required, vary depending on the type of project proposed and the area of wetland impacted.

The DEC primarily regulates wetlands that are 12.4 acres (5 hectares) or larger in size under the Freshwater Wetlands Act. It protects smaller wetlands if they are considered to have unusual local importance. For any work occurring within a wetland or within 100 feet of a wetland boundary, the DEC requires that a wetlands permit be obtained.

Prior to conducting work in or near a wetland, the Regional DEC office or the Army Corps district office should be contacted to obtain the necessary approvals and permits. Each of these agencies will automatically forward permit applications to the other, and each agency will contact the applicant if

additional permits and/or paperwork are needed. If permits are not obtained or wetlands are improperly altered, the Army Corps and the DEC have the authority to levy fines.

How Are Wetlands Classified?

The DEC classifies and ranks wetlands according to their respective functions, values, and benefits. Of the four classes of wetlands, Class I wetlands are the most valuable and are subject to the most stringent standards. For regulatory purposes, the Army Corps only classifies wetlands as regulated or not regulated based on the presence of wetland hydrology, hydric soils, and hydrophytic vegetation (wetland plants).

Wetlands' Role with Climate Change

As noted above, wetlands act as a key component to the ecosystem, not just for the municipality, but also for the entire region and watersheds associated with that region. According to the United States Environmental Protection Agency (EPA), wetlands are one of the most productive ecosystems that act as a "natural supermarket" for native species, as well as often act as a natural sponge to slow down and distribute flood runoff waters. The importance of wetlands is especially true for much of the developed and or agricultural areas of Upstate NY where the topography is relatively hilly or mountainous and the runoff rates are relatively high.

In terms of filtration, wetlands act as a vital resource to prevent contamination of drinking waters. While water treatment plants deal with direct waste from communities, most rural septic systems do not deal with ditch runoff waters which contain contaminants from roads, agriculture, and even landfills (NYS DEC). Unless this water enters a wetland, it will directly harm and pollute the local water system and resources. One direct effect of this contamination include algal bloom in waterbodies from heightened nutrient levels (such as phosphates). This ultimately leads to a chain of events triggering public health and environmental issues, as well as direct and indirect negative impacts on local and regional economies. As our climate changes and with increased precipitation, preserving these wetlands will foster protection of both natural and public **health**.

In addition to health concerns, wetlands are a crucial entity to local wildlife. While much of Upstate New York is fortunate to have a great deal of greenery throughout the state, wetlands are known to be the main habitat for the bottom of the food chain, which when affected or modified would create a domino effect for all other species that directly or indirectly rely on that food source (US EPA). This cycle involved dead leaves and other plant debris breaking down, becoming detritus which then feeds small aquatic insects, shellfish and small fish which ultimately are prey to larger aquatic and terrestrial animals. Rather than the high nutrient water directly entering and contaminating waterbodies, these resources are partially ingested by wildlife and the remainder enters the ground. Thus it is reasonable to say that wetlands are crucial for all wildlife survival.

Unlike waterbodies, wetland borders can be difficult to delineate. The wetland map below therefore can be a useful tool to determine what parcels should and or do not need to be preserved, especially when overlaid and compared with other maps such as the flood or land cover map depicted below on page 33 & 61, respectively. Because wetlands are fragile ecosystems, a 100-foot buffer is legally established by the state around each individual wetland. The boundaries are determined based on three factors: existence of hydrophytic vegetation, hydric soil type, and standing water. In order to be designated as a wetland, usually two or more of the factors must exist. While the map below may represent existing wetlands, their existence and size can continually fluctuate., especially with climate change. In order to have up to date maps, it is

necessary for communities to actively be aware of the changing landscape. If a municipal official or community member believes they know of a wetland that is not mapped, the following manual can be used to identify potential new wetlands: https://www.dec.ny.gov/docs/wildlife_pdf/fwdelman.pdf

Mapped Wetlands in Montour Falls

The entire village of Montour Falls is surrounded by wetlands, most notably the Bad Indian Wetlands/ Swamps, also known as the Catherine Creek Wildlife Management Area. While much of these wetlands are not located within the village boundary, due to its close proximity to the village, it is important to consider the entire wetland as part of the village. This area is mapped both on the state and federal level. As a result of the village being similar elevation as the wetlands, large parts of the village are often flooded, especially those that are located closer to the swamp. As climate change continues to increase the overall amount of precipitation, it is important to realize the role of these low-lying wetlands and how they need to be managed to protect no only the wildlife that live in the area, but also the community that lives in close proximity to these wetlands.

Table 5: Wetlands in Montour Falls (Total Municipality 1818 acres)

Dataset	Acres of Wetlands	Percent of Municipality
National Wetlands Inventory wetlands	422	23.2%
NYSDEC Freshwater Wetlands	256	14.1%

As the map at the end of this wetlands section depicts, there are more federally mapped wetlands than state. This is primarily because the NYS mapped wetlands are only depicted if they are under special protection status, whereas the federally mapped wetlands are not. Thus, to get a better understanding of the existing conditions of the village's wetlands, it is best to refer to the federally mapped wetlands, as while they might not be qualified to be protected, they have the same characteristics as all other wetlands. In addition, it is important to note that the DEC wetlands are not updated as frequently as the federally mapped wetlands. Thus, when considering land use changes and or protection of natural habitat, it is best to refer to the federally mapped wetlands.

Maps and Data

The map on page 28 shows the NYSDEC Freshwater Wetlands and National Wetlands Inventory Wetlands. Some subsequent maps also depict the federally mapped wetlands to give the reader a better understanding of where these wetlands exist and to give a more in depth understanding of the land's characteristics.

Although the Army Corps and the DEC create and periodically update wetlands maps, these maps are developed for use at a very broad scale (1:200,000) and are best used as an indicator that wetlands are present, and that an on-ground, site-specific investigation by a qualified wetland specialist (Army Corps Engineer, County Soil and Water staff, or private consultant) is warranted. Many wetlands do not appear on wetland maps, so if land appears to be wet, or has typical wetland plants or soils, landowners should call the Army Corps or the DEC prior to altering the land to avoid wetland destruction and possible fines.

For questions about wetlands on active farmlands or the Wetlands Reserve Program (which makes payment to landowners for establishing wetland easements on their agricultural property), contact the USDA Natural Resources Conservation Service, Ithaca Office.

Resources and References

Cornell University Geospatial Information Repository (CUGIR), https://cugir.library.cornell.edu/
Environmental Conservation Agency (EPA), Wetlands: https://www.epa.gov/wetlands/why-are-wetlands-important

Mitsch, W.J. and J.G. Gosselink (1986). *Wetlands*. New York: Van Nostrand Reinhold.

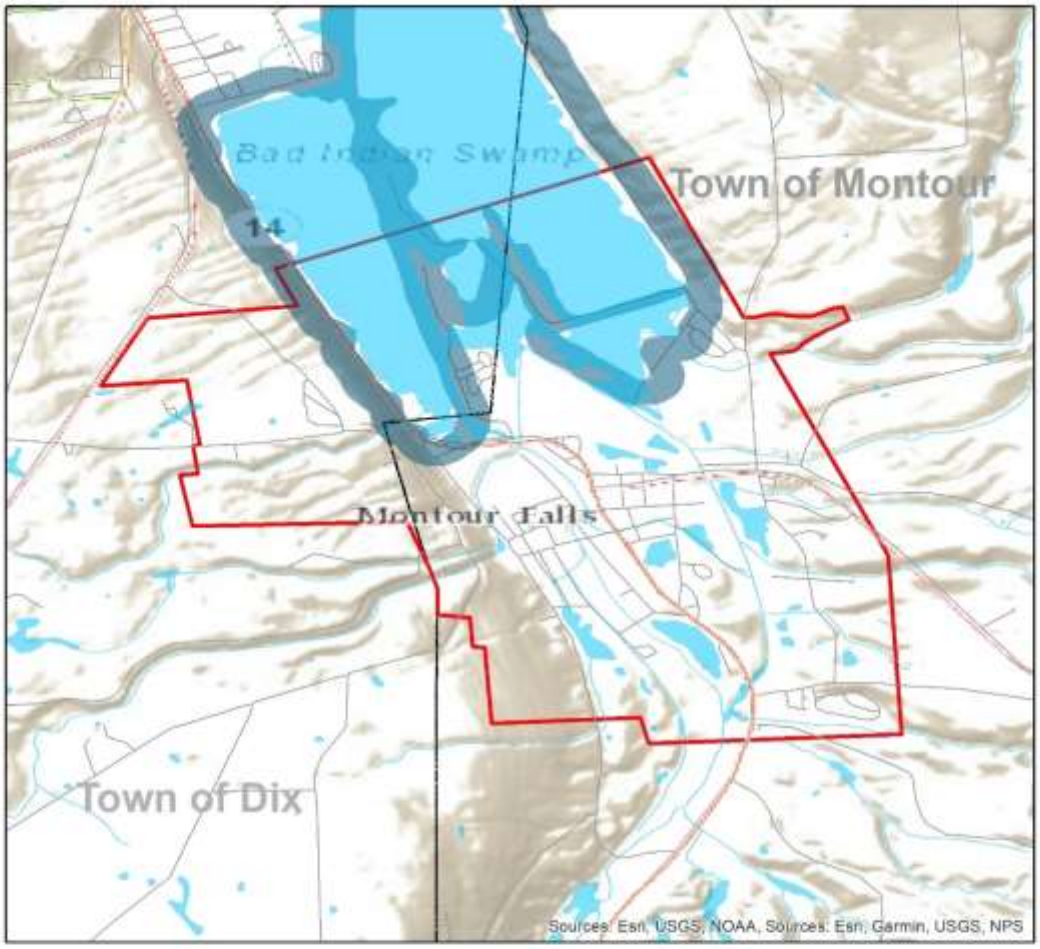
New York State Department of Environmental Conservation
- Freshwater Wetlands Permits, http://www.dec.ny.gov/permits/6058.html
- Freshwater Wetlands Mapping, http://www.dec.ny.gov/lands/5124.html
- Freshwater Wetlands Program, http://www.dec.ny.gov/lands/4937.html

U.S. Army Corps of Engineers
- Regulatory Program and Permits, http://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/
- Buffalo District, http://www.lrb.usace.army.mil/

U.S. Department of Agriculture, Natural Resources Conservation Service
- Ithaca Service Center, https://offices.sc.egov.usda.gov/locator/app?service=action/1/ServiceCenterSummary/4/agencyToOfficeLink
- Wetlands, https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/wetlands/
- Wetlands Reserve Program, https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/wetlands/

U.S. Fish and Wildlife Service, National Wetlands Inventory, https://www.fws.gov/wetlands/data/State-Downloads.html

State and Federal Wetlands



0 0.25 0.5 1 Miles

N
W E
S

Federal Wetlands
State Regulated Wetlands
Village of Montour Falls
Township Boundaries
Roads

Data Source: CUGIR
Date Created: 6/24/19
Created by: NYSWRI

FEMA Flood Zones

What Are Flood Hazard Areas?

Flood Hazard Areas (FHA) are areas that the Federal Emergency Management Association (FEMA) has determined to be vulnerable to flooding. See Table 6 for a description of flood event frequencies.

Why Are Flood Hazard Areas Important?

Flood events are part of natural hydrological and seasonal cycles and may also occur more frequently as the global climate changes. The size and location of the areas, which are typically inundated during flood events, as well as the magnitude of the event, are significantly influenced by the total area of impervious surface (roads, parking lots, etc.) and wetlands within a watershed. Creation of or increases in impervious surfaces, diversion of water off the landscape (to ditches or nearby water bodies), and the loss of wetlands that help store and control floodwaters cause higher volumes and peak flows of storm water runoff. It should also be noted that while floods can cause damage to infrastructure, the economy, and the environment, periodic inundation can benefit the habitat of certain flora and fauna species and add nutrients to agricultural lands located in flood areas.

Flood Hazard Areas in Montour Falls

FEMA produces paper Flood Insurance Rate Maps (FIRMs) to show areas subject to flooding as determined by historic, meteorological, and hydrological data, as well as open space conditions, flood control structures, and land use in the watershed at the time the FEMA study is conducted. These maps delineate Special Flood Hazard Areas, which are areas that "will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year," commonly referred to as 100-year or base flood areas. These maps may also include the elevation of the base flood (100-year flood event), flood insurance risk zones, and areas subject to inundation by a 0.2%-annual-chance or 500-year flood event, all of which may be used to establish the National Flood Insurance Program's (NFIP) flood insurance premiums.

Climate Change in Flood Hazard Areas

As most would expect, flood hazard areas are prone to increased risks of flooding over the course of time as weather patterns become more extreme. While Flood Hazard Area maps provided by FEMA can depict a great deal of areas that are threatened by flooding, it is important to note that most these maps and data are outdated, as FEMA does not consider the forecasted changes of climate change. As a result, the maps do not depict all areas that are actually affected by flooding. According to the National Weather Service, with current and forecasted weather patterns in New York State and the region's relatively mountainous characteristics, streams that are only 6 inches deep could easily swell up to 10 feet deep in less than an hour. Additionally, with the fluctuating winter weather patterns, snowmelts can also contribute to serious flooding which could overwhelm streams, ditches and infrastructure that is not built to handle such high quantities of runoff. Such events could thus cause floods in unforeseen areas and lead to damage that is not covered by FEMA's Flood Insurance Program. While there are multiple different approaches to mitigating these type of problems, it is up to individual communities to determine which areas might be most affected by extreme weather patterns.

According to the NYS DEC, flooding events in Upstate NY are expected to increase at a constant rate of 17% every decade. While this increase might sound modest for some, the implications of such increases not only

means an overall increase in 100 and 500 year floods (maps depicted below), but also the geographical expansion of such flooding events. While avoiding such changes might not be possible, acquisition and preservation of these flood hazard areas determined by the community is highly encouraged. Additionally, forecasting how flooding could expand and affect land not currently designated as flood hazard areas using tools from the Army Corps of Engineers such as the Climate Impact Hydrology and HEC GeoHMS from ESRI could be extremely beneficial.

Additional tools and their descriptions can be found at the following links:

- Army Corps of Engineers (ACE): https://www.usace.army.mil/corpsclimate/Public_Tools_Dev_by_USACE/
- USACE Hydrology Tools: http://www.hec.usace.army.mil/software/
- ESRI Flood Planning: https://solutions.arcgis.com/local-government/help/flood-planning/

Maps and Data

FEMA publishes the data from paper FIRMs and Letters of Map Revision (LOMRs) online as a digital database called the National Flood Hazard Layer (NFHL). FEMA also offers Flood Risk Maps (FRM), Flood Risk Reports (FRR), and Flood Risk Databases (FRD) online to help community officials and the general public assess and visualize flood risk. The flood hazard boundary has an effective date of 1985. The age of the base data should be considered when using these maps for planning purposes.

The measurement used to estimate the frequency of a flood event can be confusing because a 100-year flood event is not a flood event that is likely to occur once every 100 years. Rather, it has a one percent chance of occurring or being exceeded during a one-year period, a 10% chance of occurring during a 10-year period, an 18% chance of occurring in a 20-year period, and so on. The following table shows the likelihood of occurrence of flood events during specified intervals of time.

Table 6: Likelihood of Experiencing at Least One Flood Event

Flood Event	In 1 year	In 10 years	In 20 years	In 25 years	In 30 years	In 50 years	In 100 years
10-year	10%	65%	88%	93%	96%	99%	99.99%
25-year	4%	34%	56%	64%	71%	87%	98%
50-year	2%	18%	33%	40%	45%	64%	87%
100-year	1%	10%	18%	22%	26%	39%	63%
500-year	0.2%	2%	4%	5%	6%	10%	18%
Source: *Water Courses* Vol. 5, Issue 1, Spring 1998. A Newsletter from Cornell Cooperative Extension and the Department of Soil, Crop and Atmospheric Sciences, Cornell University							

The 100-year flood maps for the Village of Montour Falls were obtained through FEMA GIS data for Schuyler County. Within the Village of Montour Falls, the northern third is at the highest risk of flooding due to its swampy nature and low elevation. Other areas near wetlands face risk of flooding as well, though the western section of the municipality is less so, due to its overall higher elevation.

Resources and References

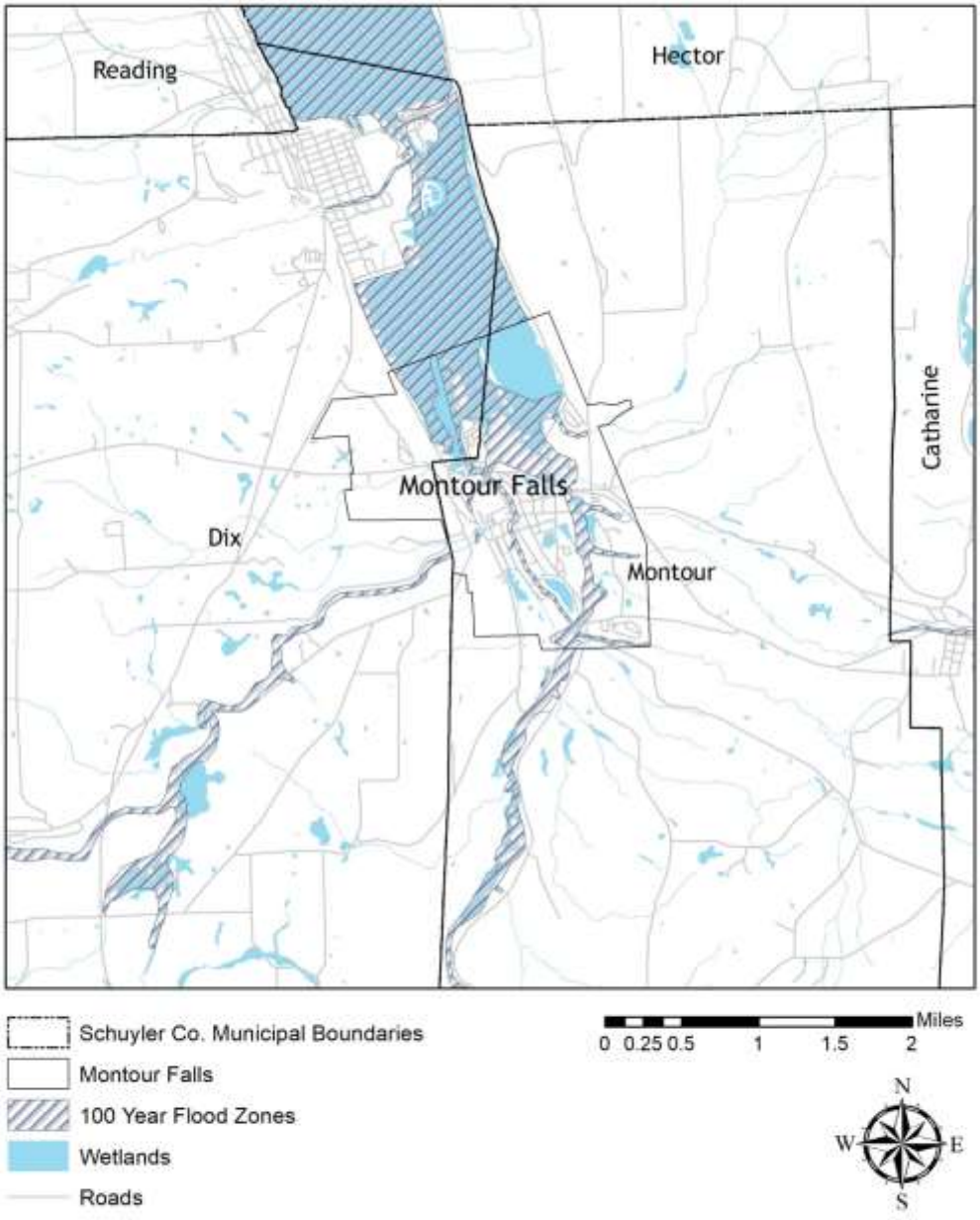
Federal Emergency Management Act (FEMA)

Town of Caroline, Flood Map Service Center, https://msc.fema.gov/portal/search?AddressQuery=caroline%20ny#searchresultsanchor

National Flood Insurance Program, https://www.fema.gov/national-flood-insurance-program

National Weather Service Temperature Map: https://www.weather.gov/current

100 Year Flood Zones



AQUIFERS

What Is an Aquifer?

Aquifers are geologic formations beneath the Earth's surface that store and yield groundwater. One or more aquifers can lie beneath any given point on the Earth's surface; and the location, size, capacity, depth, and flow characteristics of an aquifer are directly related to the geology and hydrology of the particular aquifer and its recharge area. (See definition of recharge area below.)

Aquifers are usually described as confined or unconfined. Typically, confined aquifers are covered with, or consist of, less permeable substances such as clay or contiguous shale. Unconfined aquifers consist of unconsolidated materials such as sand and gravel, which allow substances to easily percolate from the surface to the aquifers below.

The uppermost boundary of surficial aquifers (those closest to the Earth's surface) is defined by the water table, which is where the spaces in unconsolidated sediments and the openings in bedrock are fully saturated. The spaces between soil and rock particles in the unsaturated zone, located above the water table, are only partially occupied by water. The water table rises and falls depending on the rates of groundwater recharge and discharge, the capacity of the aquifer, the rate of water use by plants on the surface (transpiration), and water withdrawals.

Aquifers can be replenished—or recharged—by the infiltration of precipitation and surface water runoff through soil, as well as by surface water resources such as streams, creeks, wetlands, and floodplains. The land area that contributes to this infiltration is called a recharge area. Recharge areas may replenish aquifers directly beneath them (as in the case of unconfined or surficial aquifers) or they may recharge aquifers far away (as in the case of confined aquifers).

Why Are Aquifers Important?

Aquifers are an important source of water for residential, commercial, and industrial uses. In New York State, groundwater typically contributes more than half of the total annual flow to local streams and creeks.

Because aquifers are replenished by the infiltration of surface water, impervious surfaces (pavement from roads or parking lots, roofs, building footprints, etc.) decrease recharge areas and threaten aquifers by inhibiting infiltration of precipitation and surface water through the soil. Any contaminant contained in or near an aquifer and/or its recharge area may potentially contaminate the aquifer. Potential contaminants include bacteria and pathogens leaching from septic systems; gas, salt, and oil washed from parking lots; fertilizers; pesticides; hazardous or toxic waste spills; and petroleum or oil leaking from underground storage tanks.

Some groundwater migrates slowly and can take several years to decades or even centuries to move contaminants from the point of origin to the point of discharge. Once degraded, an aquifer can become unusable, and oftentimes remediation is not technologically or economically feasible. Moreover, because of groundwater and surface water interactions, contamination in an aquifer may eventually contaminate surface water as well.

The quantity of water contained within an aquifer and the aquifer's ability to serve as a reliable supply of water must also be considered. Generally, an aquifer's geology, retention, and recharge characteristics determine the quantity of water available. When water is withdrawn at a rate faster than it is recharged, the aquifer can be depleted. Generally, this occurs when too many wells withdraw water from an aquifer.
The map below depicting aquafers shows the general productivity and amount of water that can be pumped. While it can be difficult to track the behavior of aquafers, the locational information depicted on the map can be used to better understand what areas can be preserved and protected to mitigate future contamination of these valuable resources. This is especially important with continuously increasing amounts of runoff from agricultural lands and urban impermeable surfaces which carry contaminants that could be harmful to both the environment and human health.

Aquifers in Montour Falls

As depicted in the map below, most of the village is part of a large aquifer. This makes sense since a large portion of the village is part of or surrounded by wetlands and swamps. As mentioned above, aquifers are a major source of drinking water, and while this specific aquifer might not be used for consumption purposes, it is still an integral part to the operation of creating clean water supplies to living organisms. Without these underground features, the earth would no longer able to sustain the current existing species and environment. In other words, as the map show the entire town is part of an aquifer, it is important to consider implications of future development and land use changes both in the village and surrounding areas.

Maps and Data

The map below depicts all the existing aquifers across municipal boundaries. The features depicted in dark blue tend to produce more water than those in light blue (located closer to Seneca Lake) The data was originally collected from the USDA GIS Data Portal. Similar datasets containing aquifer data are available from the NYS GIS Clearinghouse under the names "Primary Aquifers - 1:24,000," "New York State Aquifers," and "Unconsolidated Aquifers at 1:250,000." This map is not intended to be used for detailed site evaluations as the determination of precise aquifer locations and characteristics requires additional evaluation.

Resources and References

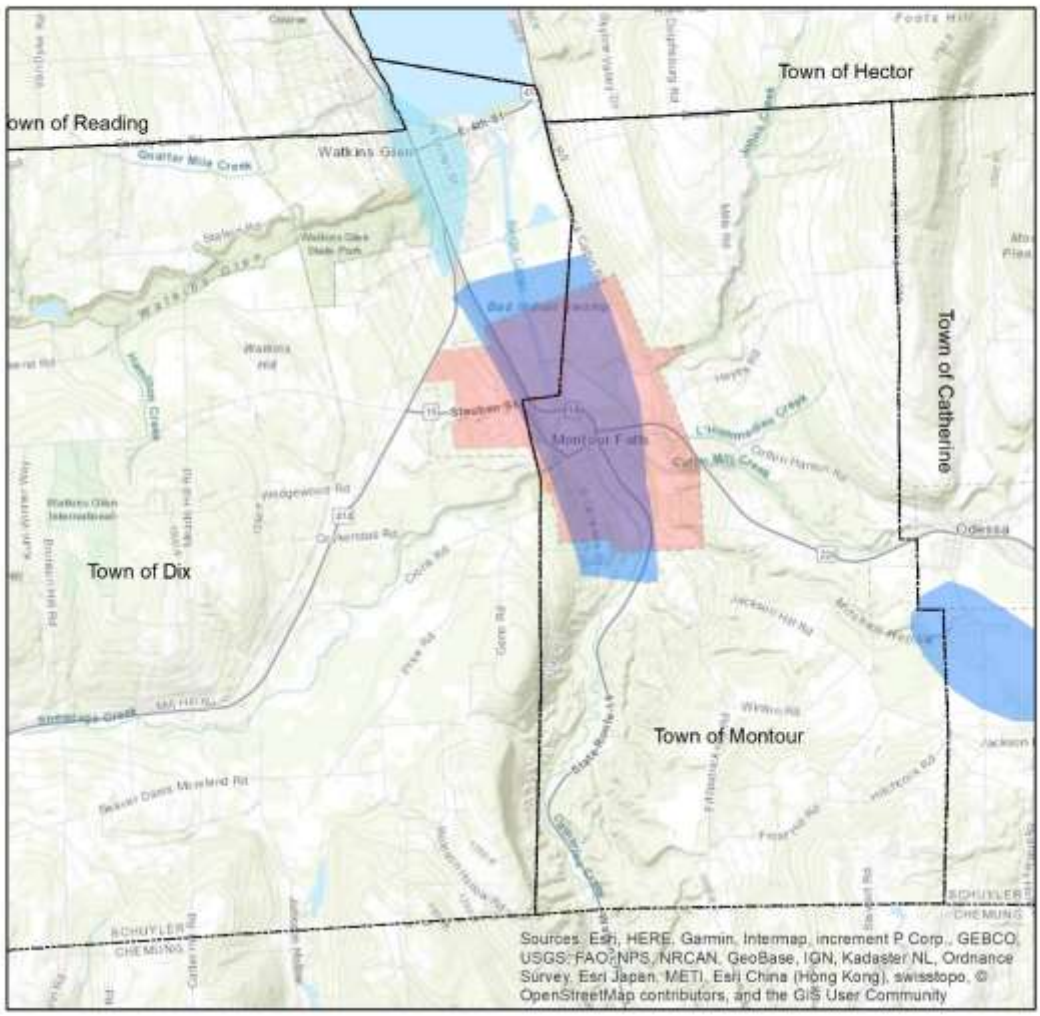
Miller, T.S. (1990). *Sand and Gravel Aquifers of Schuyler County, New York.* U.S. Department of Energy, U.S. Geological Survey, Water-Resources Investigations Report 90-4073.

New York State GIS Clearinghouse, http://gis.ny.gov/

U.S. Geological Survey, New York Water Science Center, Ithaca Program Office, https://ny.water.usgs.gov/about/officeithaca.html

Winter, T.C., J.W. Harvey, O.L. Franke and W.M. Malley (1998). *Ground Water and Surface Water: A Single Resource.* USGS Circular.

Montour Falls Aquifers



0 1.25 2.5 5 Miles

Schuyler Townships

Village of Montour Falls

Gallons/ Min

10-100

5->500

Created on: 6/19/19
Data Source: NYS GIS Clearinghouse
Created by: Cooperative Extensions - Tompkins

Section 2: Geology and Soils

SLOPE AND TOPOGRAPHY

What Are Slope and Topography?

Slope and topography describe the shape and relief of the land. Topography is a measurement of elevation, and slope is the change in that elevation over a certain distance. Topography may be measured with lines that connect points representing the same elevation; these are called topographic contours. Slope is measured by calculating the difference in the elevation from one point to another divided by the lateral distance between those points. Topographic data can also be used to create a model of the land's surface called a digital elevation model (DEM).

Why Are Slope and Topography Important?

Topography and slope should be considered when drawing up site plans for any construction project and most agricultural activities. Consideration of the slope of the land is important to reduce construction costs, to minimize risks from natural hazards such as flooding and landslides, to reduce erosion, and to minimize the impacts of proposed development on natural resources such as soils, vegetation, and water systems.

As described in Flood Hazard Areas, topography can play a major role in the amount of runoff during flash flooding. While there are many different types of topographies throughout the state, much of the Southern-tier is mountainous. This can create extremely dangerous situations for communities located along hillsides or in ravine settings, as runoff water accumulates in low elevations. As described above, flash floods can easily occur in streams and rivers located in valleys/ ravines, even with moderate precipitation. As a result, communities located in these low-lying area are most likely to be affected by extreme weather patterns. Thus, it is important to consider topography when determining communities that are most vulnerable to flooding. The Map depicting slope and Hydrology on page 42 can be useful in helping determine the behavior of water during flooding and areas that might be prone to extreme runoff and potentially mudslides. Areas that are marked with dark blue and their surroundings are especially an area of concern, as water naturally flows downward and accumulates, thus triggering floods and mudslides.

Slope and Topography in Montour Falls

As previously mentioned, multiple times, the village of Montour Falls is located in a valley surrounded by steep slopes which tend to produce high level of runoff from the top of the hills. While ditches along the road have been actively maintained by the village, due to the increasing amount of rain and steep slopes, the stormwater infrastructure continues to erode on an annual basis. The map depicted below depicts these steep slopes, or area of concern that can increasingly be a threat to the community living downhill from these areas. Because the valley in which the village is located is relatively flat, the water flow from the hills to Seneca Lake are relatively slow, thus causing the marshy environment surrounding the village. Table 7 summarizes the development potential of land based on its degree of slope.

Table 7: Development Potential Based on Degree of Slope	
Degree of Slope	Development Potential
0% to 1%	Suitable primarily for agriculture that uses flood irrigation unless extensive drainage infrastructure is installed
1% to 3%	Suitable for most development
3% to 8%	Suitable for medium-density development
8% to 15%	Suitable for moderate to low-density residential development as well as pastures, forests, and vineyards
15% to 25%	Suitable for low-density residential development as well as pastures, forests, vineyards, and recreational uses
Over 25%	Recreational uses and open space
Sources: Anderson, L.T. (2000). *Planning the Built Environment*. New York: Routledge, and Lehigh Valley Planning Commission, *Steep Slopes: Guide and Model Regulations* (2008).	

Maps and Data

The hillshade map depicted on the following page depicts the general topographical characteristics of the land within and surrounding the village of Montour Falls. This map was produced from a Digital Elevation Model originally provided by the USDA and USGS. The layer can be downloaded through the link provided below in the resource and reference section. The slope map was produced through ESRI using the same Digital Elevation Model. As the name states, the purpose of this map is to depict the slope, or the steepness of the designated area. Following this is a slope map combined with the federal wetland layer to depict the areas which water accumulates.

Resources and References

Anderson, L.T. (2000). *Planning the Built Environment*. New York: Routledge.

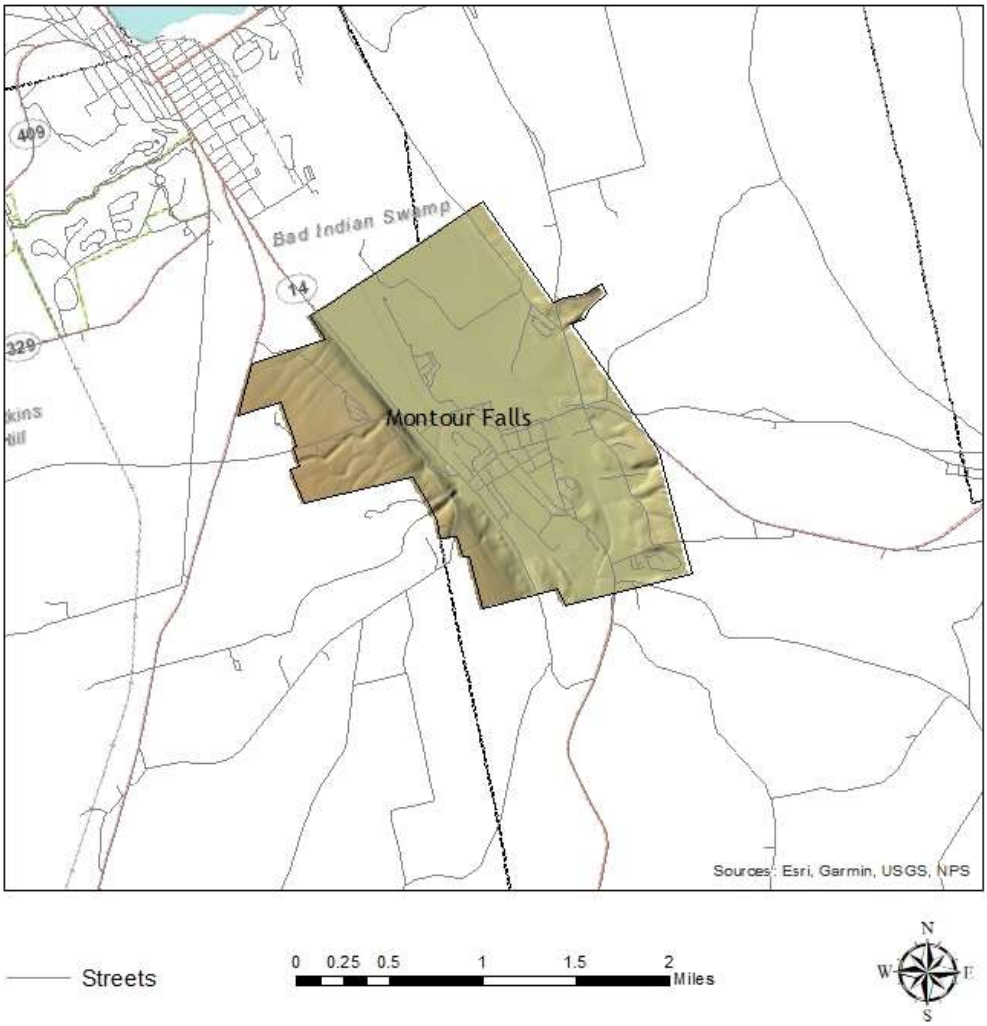
Fakundiny, R. H., & Albanese, J. R. (2005). New York State Geological Survey (NYSGS). In P. Eisenstadt & L. E. Moss (Eds.), The Encyclopedia of New York State. Syracuse, NY: Syracuse University Press.

Lehigh Valley Planning Commission, *Steep Slopes: Guide and Model Regulations* (2008), http://www.lvpc.org/pdf/SteepSlopes.pdf

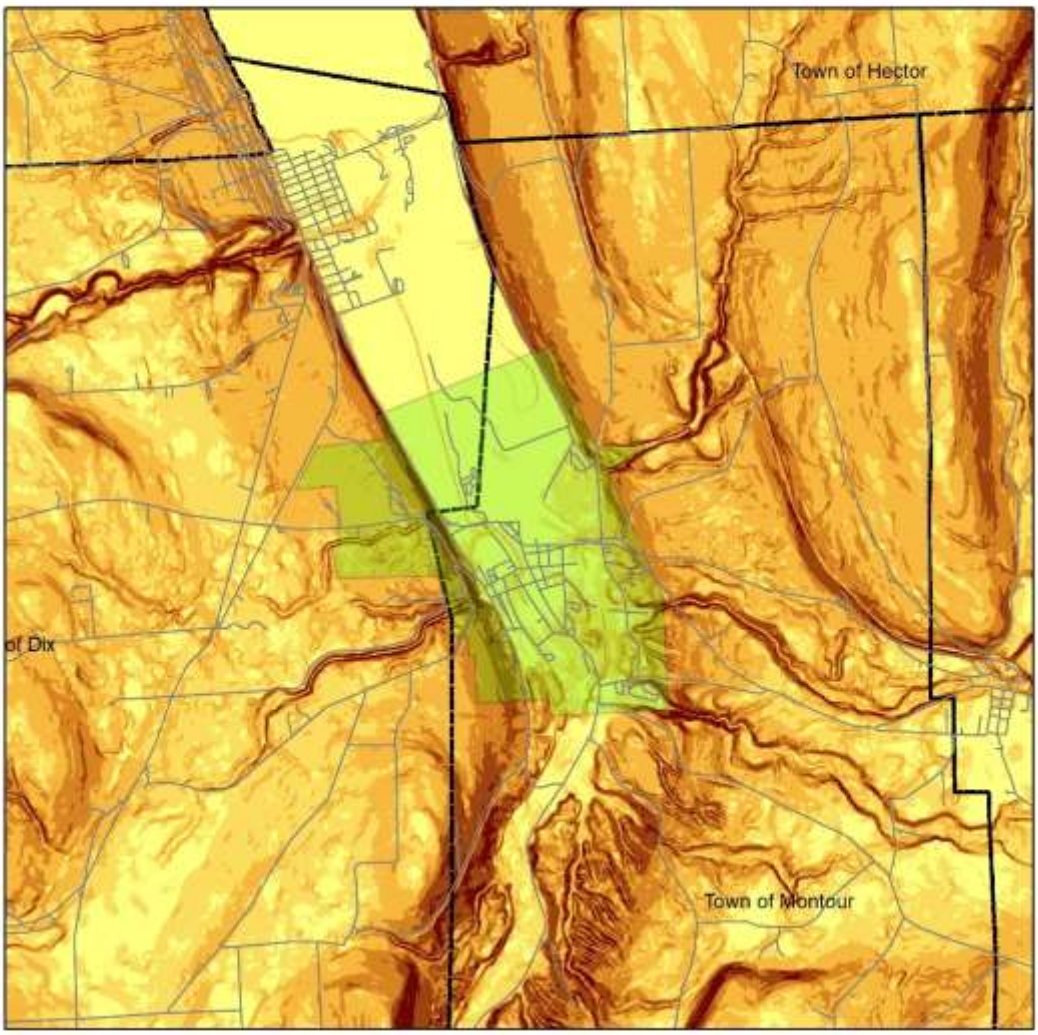
New York State GIS Clearinghouse, http://gis.ny.gov/

U.S. Geological Survey, New York Water Science Center, Ithaca Program Office, https://ny.water.usgs.gov/about/officeithaca.html

Montour Falls Hillshade Map



Montour Falls Slope



Roads
Village of Montour Falls
Schuyler Townships

Slope (%)

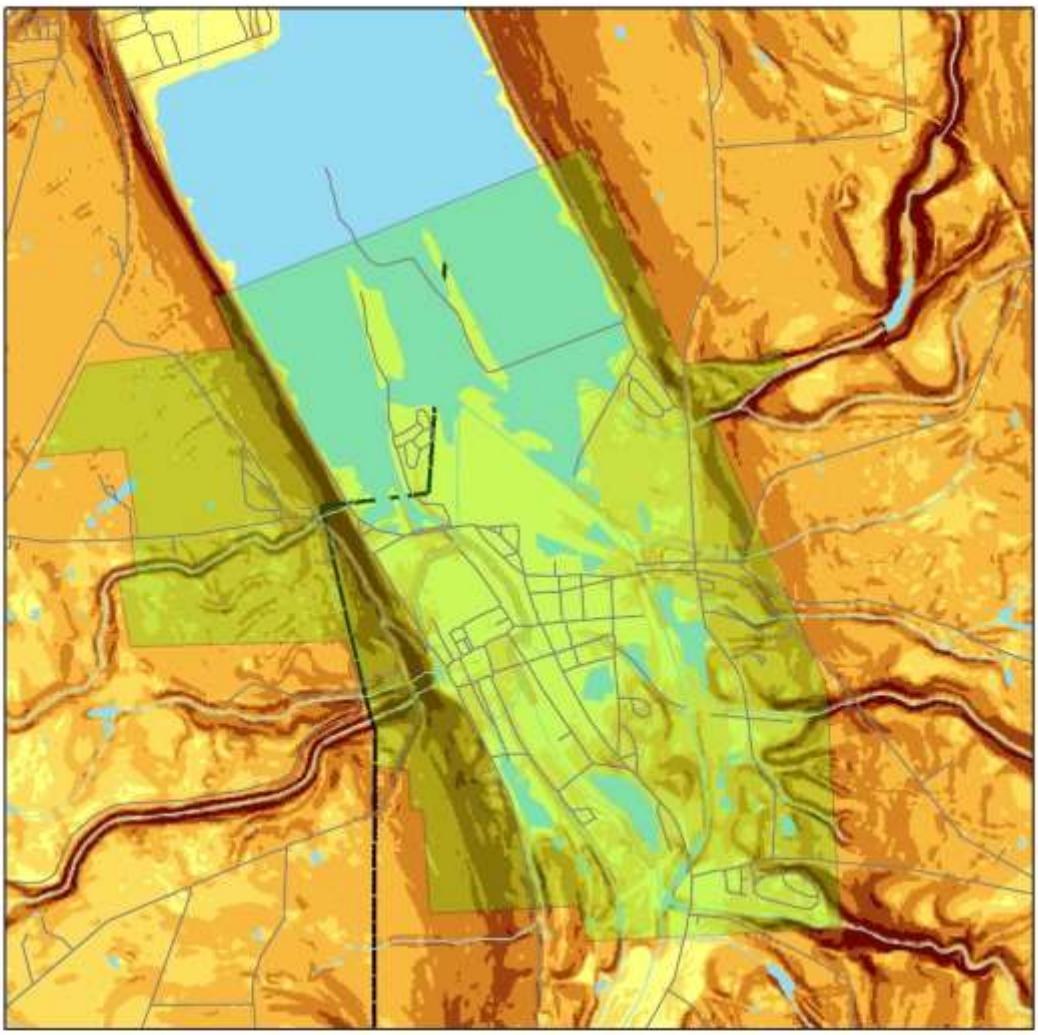
0 - 1
1.1 - 3
3.1 - 8
8.1 - 15
15.1 - 25
25.1 -

0 0.5 1 2 Miles

N
W E
S

Created on: 6/19/19
Data Source: NYS GIS Clearinghouse
Created by: Cooperative Extensions - Tompkins

Montour Falls Slope



Roads
Village of Montour Falls
NY Federal Wetlands
Schuyler Townships

Slope (%)

0 - 1
1.1 - 3
3.1 - 8
8.1 - 15
15.1 - 25
25.1 -

0 0.25 0.5 1 Miles

N
W E
S

Created on: 6/19/19
Data Source: NYS GIS Clearinghouse
Created by: Cooperative Extensions - Tompkins

BEDROCK GEOLOGY

What Is Bedrock Geology?

Bedrock geology describes the basic rock formations that underlie soils and unconsolidated materials (see Surficial Geology section). Bedrock occasionally protrudes through these materials or may be exposed alongside roads and creek beds. These rocks, formed millions of years ago, constitute the foundation of materials and topography in a region. Bedrock is found beneath the soils and may be buried beneath glacial till, composed of rock fragments of various sizes that were released from glaciers as they receded.

Why Is Bedrock Geology Important?

In some part of New York, the depth to bedrock is relatively shallow, sometimes only 5 to 10 feet below the surface of the soil. Shallow depth to bedrock significantly impacts the location, development, maintenance, and cost of public services, such as sewers, water supply systems, and roads. Construction feasibility and costs for private investments, such as building foundations, septic tanks, and private roads, are partially dependent on the depth to bedrock. Shallow bedrock may also be subject to frost heaving and deformation. Determination of bedrock qualities must be made on a site-specific basis.

How Was Bedrock Formed?

Approximately 550 million years ago, the land that is now Montour Falls and the surrounding region was submerged under an ancient sea. Over the course of 325 million years, layers of sediment (sand, mud, salt, and lime) were deposited on the lake bottom and slowly hardened into beds of sedimentary rocks that we now know as sandstone, shale, and limestone.

Bedrock Geology in Montour Falls

The Village of Montour Falls has only one main bedrock type, which is the Gardeau formation.

Gardeau Formation: The Gardeau formation is a geologic formation located in Western New York. It is mainly comprised of shale and siltstone. This bedrock was formed during the Upper Devonian age, which was roughly 400 million years ago.

Maps and Data

The New York State Geological Survey has produced a geographic data set of bedrock geology. The Bedrock Geology map was created at a scale of 1:2,500,000, and depicts general locations of various rock formations; it should not be used for any site-specific analyses.

For more detail on New York State Bedrock formations, go to the following website:
http://www.nysm.nysed.gov/data/bedrock.txt

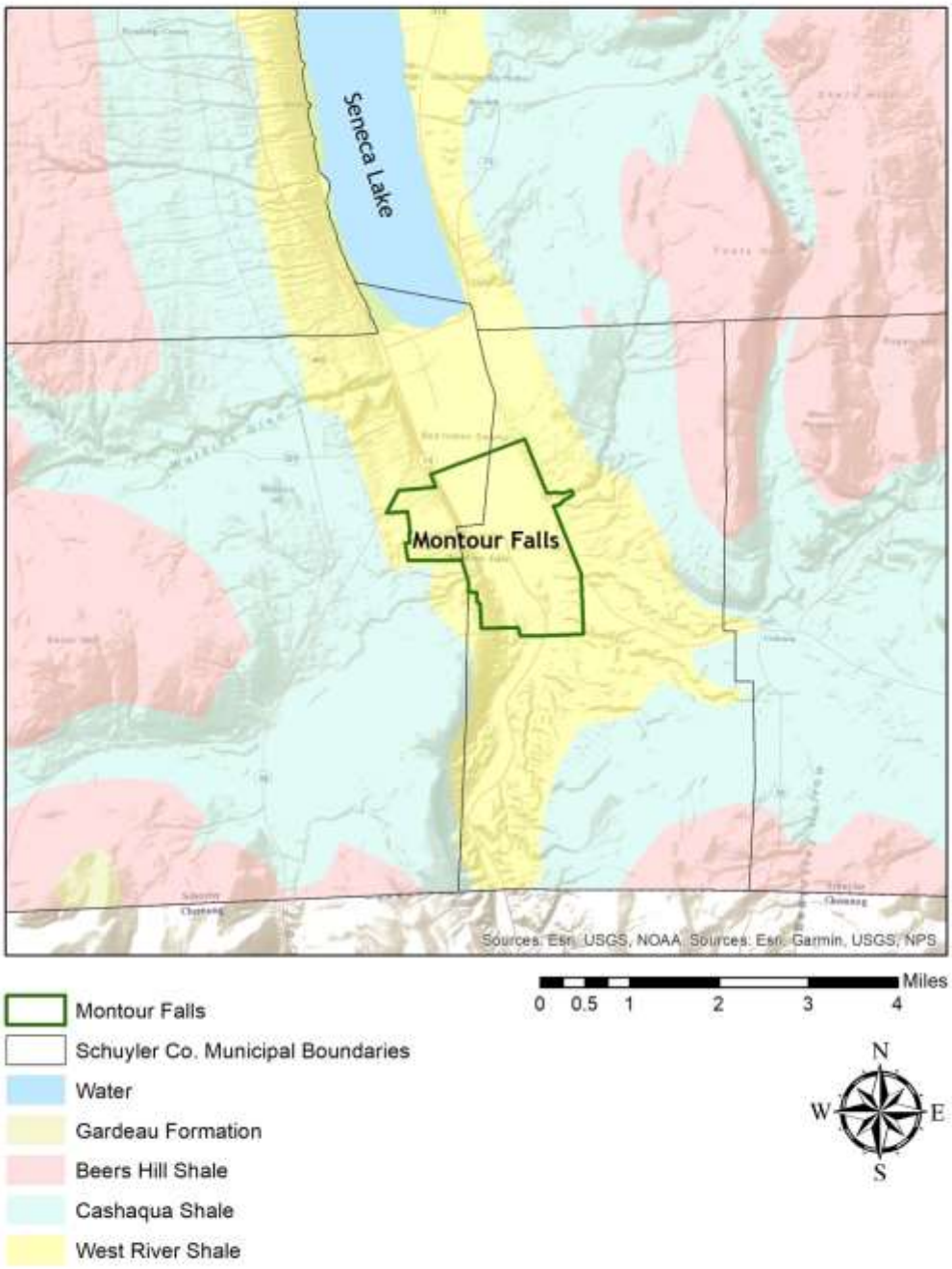
Resources and References

Fakundiny, R. H., & Albanese, J. R. (2005). New York State Geological Survey (NYSGS). In P. Eisenstadt & L. E. Moss (Eds.), The Encyclopedia of New York State. Syracuse, NY: Syracuse University Press.

U.S. Geological Survey
National Geologic Map Database, https://ngmdb.usgs.gov/Geolex/search
New York Water Science Center, Ithaca Program Office,
https://ny.water.usgs.gov/about/officeithaca.html

Von Englen, O.D. (1961). *The Finger Lakes Region: Its Origin and Nature*. Ithaca, NY: Cornell University Press.

Bedrock


Seneca Lake
Montour Falls
Sources: Esri, USGS, NOAA
Sources: Esri, Garmin, USGS, NPS
Miles
0 0.5 1 2 3 4
N
W
E
S
Montour Falls
Schuyler Co. Municipal Boundaries
Water
Gardeau Formation
Beers Hill Shale
Cashaqua Shale
West River Shale

SURFICIAL GEOLOGY

What Is Surficial Geology?

Surficial geology describes the rocks and unconsolidated materials that lie between bedrock and the surface of the land. In the Finger Lakes region, glaciers that receded 12,000 to 25,000 years ago deposited these materials. When the glaciers receded, the rock and debris frozen within the ice were left behind in various formations depending upon how fast or slow the glacier receded. These formations contain various sized particles and are classified by the shape of formation, the thickness, and the type and size of particles found.

Why Is Surficial Geology Important?

Surficial geology is important because the characteristics of materials below the earth's surface influence the feasibility of constructing buildings and roads. Surficial deposits commonly determine soil composition and therefore may affect agricultural viability. This information can also be used to better understand the runoff, as permeability can vary depending geological composition and soil type (discussed in further detail below on page 49).

Additionally, while it is important to consider how the geological characteristics can handle flooding, it is also important to consider how different surfaces can be affected by droughts. While Upstate New York is fortunate to not be threatened by water scarcity, that does not mean that the ground is consistently saturated. Thus, as the community develops it is important to preserve and protect as many surfaces that are more permeable and can handle variant weather patterns. The map that depicts soil drainage (page 54) can be a useful tool to determine future land uses.

Surficial Geology Deposits in Montour Falls

There are six types of surficial geology deposits in Montour Falls:

Kame Deposits are usually small and irregular in sizes deposited by glaciers and are usually found in valleys. They are usually a mixture of coarse and fine gravel in layers that are usually between 30 and 100 feet thick.

Kame Moraines are glacial deposits that can vary in size and are laden with calcareous cement with a thickness between 30 and 100 feet.

Lacustrine Silt and Clay is generally laminated (layered) silt and clay, deposited in proglacial lakes, generally calcareous, low permeability, potential land instability, with a variable thickness of up to 160 feet.

Till deposits are poorly sorted (particles of varying sizes) material of variable texture such as clay, silt-clay, or boulder clay that were deposited beneath the glacial ice. Permeability of these deposits varies with the amount of compaction. Thicknesses vary from 3 to 160 feet.

Bedrock is exposed bedrock that lies on the surface of the landscape.

Swamp Deposits are deposits of fine silt and clay that create a swamp in the landscape when flooded with water.

Table 8 summarizes the surficial geology of Montour Falls.

Table 8: Surficial Geology of Montour Falls	
Type of Surficial Geology Deposit	*Percent of Municipality*
Lacustrine Silt and Clay	58%
Bedrock	25%
Kame Moraine	8%
Swamp Deposits	4%
Kame Deposits	4%
Till	1%

Maps and Data

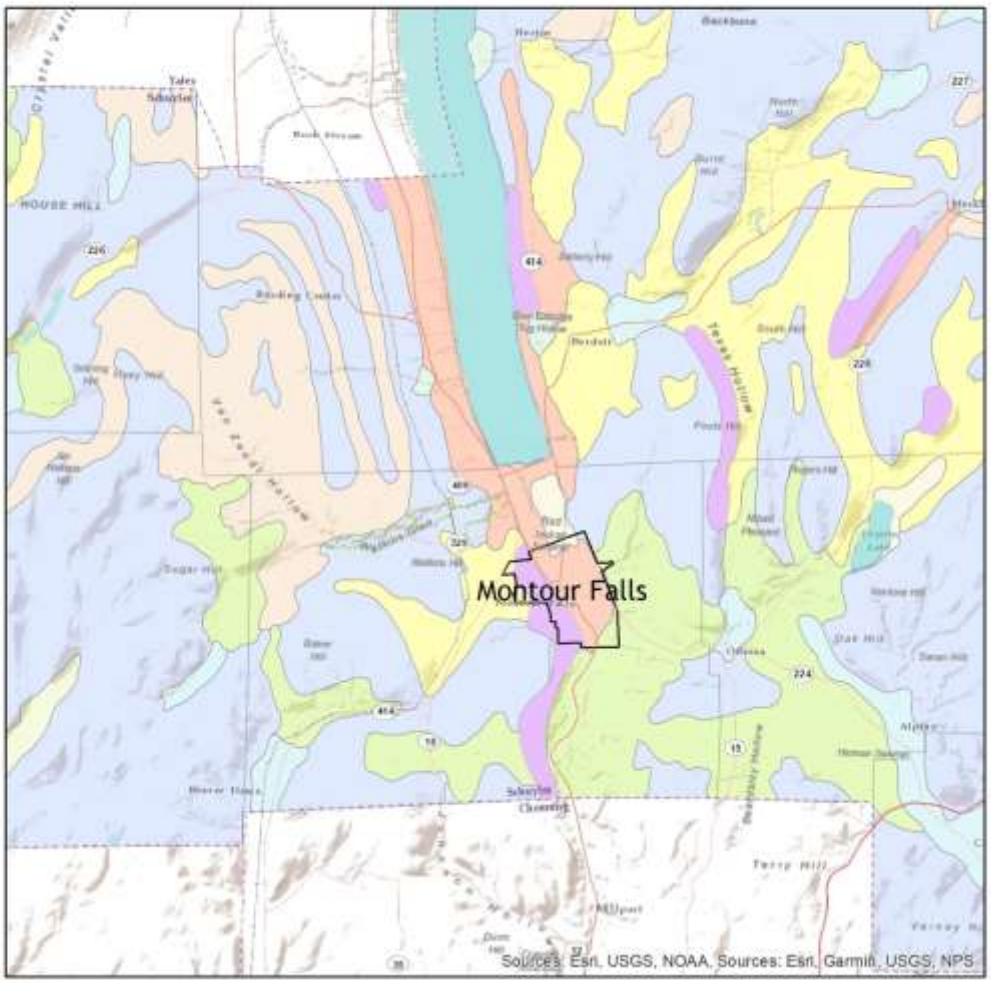
The following map shows the surficial geography of Montour Falls. The dataset is available from the USGS

Resources and References

Fakundiny, R. H., & Albanese, J. R. (2005). New York State Geological Survey (NYSGS). In P. Eisenstadt & L. E. Moss (Eds.), The Encyclopedia of New York State. Syracuse, NY: Syracuse University Press.

U.S. Geological Survey
National Geologic Map Database, https://ngmdb.usgs.gov/Geolex/search
New York Water Science Center, Ithaca Program Office,
https://ny.water.usgs.gov/about/officeithaca.html

Surficial Geology



- Montour Falls
- Till Moraine
- Till
- Bedrock
- Swamp Deposits
- Outwash Sand and Gravel
- Lacustrine Silt and Clay
- Lacustrine Sand
- Kame Moraine
- Kame Deposits
- Water
- Recent Alluvium
- Schuyler Co. Municipal Boundaries

Miles
0 0.75 1.5 3 4.5 6

N
W E
S

SOILS

What Are Soils?

Soil is a mixture of mineral particles, organic matter, water, and air. Soils are often described in terms of their primary texture (e.g., sand, silt, and clay).

Why Are Soils Important?

Soils affect a variety of human activities from agriculture to the engineering and construction of roads, buildings, and sewage disposal systems. They are critical in determining the productivity and viability of agricultural operations. The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) evaluates soils in terms of their capability to support agriculture. These range from Class I soils, which are productive and easy to work, to Class VIII soils, which are not suitable for growing crops, pasture, or trees for profit.

Planning boards, elected officials, zoning officers, developers, etc., can use soil maps to identify areas suitable for future development of homes, industry, agriculture, and recreation. For example, a soil map may indicate poorly drained areas, which should not be used for residential development because of the need for costly drainage facilities and because they may be sites of existing or potentially restored wetlands. Soil maps can also be used to assess the likelihood of finding suitable sites for individual, on-site, sewage disposal systems.

Classification of Soils

NRCS (and its predecessor, the Soil Conservation Service) is the agency responsible for preparation of maps showing soil series containing soils that share common profiles. Soil series are further divided into soil types that share common physical features, general properties that affect the use of the soil, and properties that limit suitability for cultivation.

Ontario, Lima, Lansing, Honeoye, and Conesus series soils are frequently used for farming hay, corn, oats, wheat, soy beans, dry beans, some vegetables, and deciduous fruit. Conesus series soils can also be used as dairy pasture and for growing grapes. Wooded areas on these soils support sugar maple, red oak, white oak, American beech, white ash, and black cherry, among other types of trees.

Rhinebeck, Niagara, Hudson, Dunkirk, and Collamer series soils can support hay, oats, corn, small grains, small fruits, and some vegetables. These soils can also be used as pasture. Trees that grow well with this soil include sugar maples, red oaks, black cherries, basswood, hickories, and hemlocks.

Valois Howard Bath series soils are well drained and do not get saturated easily, thus usually used for growing hay, pasture, corn or small grains, that is when the land is level or rolling. Woodlands that are located on this soil series usually have sugar maple, American Beech, red oak, and similar hardwoods.

Volusia, Mardin, and Lordstown series soils are often cleared but idle. Much of these soils are reverting to brush and trees. These soils can be used to support silage corn, small grains, hay, and pasture. Some farmers have grown potatoes in this soil on sloping areas. Wooded areas on these soils support sugar maple, beech, white ash, black cherry, and hemlock.

Weyland, Teel, Hamlin series soils consists of very deep, moderately well drained soils on floodplains. They formed in nearly level, silty alluvial deposits. Permeability is moderate throughout the solum. Slope ranges from 0 to 3 percent. Mean annual temperature is 49 degrees F, and mean annual precipitation is 37 inches. Extensively used for hay, corn, small grains and pasture. Less extensively used for growing vegetables and nursery crops. Woods are of sugar maple, ash, hemlock, beech and elm.

In addition to being evaluated in terms of agricultural viability, soil types have been assessed by the NRCS in terms of their suitability for various types of development. Soil characteristics that are considered in this assessment are depth to seasonal high-water table, depth to bedrock, flood potential, and permeability. Depth to seasonal high-water table affects both building foundation and septic system siting. A seasonal high-water table can cause flooding in basements or cause a septic system to malfunction. A high-water table can also affect the ability of a soil to support weighty structures.

Permeability and soil types

As described above in *Surficial Geology*, all surficial characteristics, including soil types can have a major impact on determining the characteristics of flooding as well as the structural stability of the surrounding lands. Soil types also determine land use such as agricultural, urbanized, and conserved lands, which also have major effects on the volume of runoff and thus the contamination of local and regional aquafers, wetlands, and waterbodies.

Soils can be broken down into four Hydric Soil Categories (HSC) based on their permeability. The list below was originally retrieved from the Engineering Division of the Natural Resource Conservation Service, United States Department of Agriculture, Technical Release–55 and can be a useful description in determining the characteristics of local soils:

Group A is sand, loamy sand or sandy loam types of soils. It has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.

Group B is silt loam or loam. It has a moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.

Group C soils are sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.

Group D soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high-water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

As for the soil types that exist in the MUNICIPALITY NAME, the table below shows which soils belong to which Hydrologic Soil Groups:

Soil Name	Hydrologic Soil Group
Rhinebeck, Niagara, Hudson, Dunkirk, and Collamer series	C
Volusia, Mardin, and Lordstown series	C
Valois Howard Bath series	B
Weyland, Teel, Hamlin series soils	B/D

NOTE for Dual Category: The first letter applies to the drained condition/ and the second to the undrained condition.

The above can help determine not just the permeability of the soil, but also the characteristics of erosion due to precipitation. Volumes of silt and sand can determine the soil's erosion factor; higher volume of silt and sand means higher erosion, and thus higher possibilities of landslides. With this information, the soil types map on page 53 can be useful when determining what areas are most suitable for development and or conservation.

Maps and Data

Soils are mapped at various levels of detail, the two most common being general soil maps and soil surveys.

General soil maps show soil associations that share a characteristic landscape and pattern of soils. The soils within any one association may be somewhat similar, but they commonly differ in many important characteristics. These maps are suitable for planning large areas such as multi-county regions and large drainage basins. The data used to create this map comes from the U.S. Department of Agriculture's Natural Resources Conservation Service's Soils Division's U.S. General Soil Map, downloaded in 2015. A summary of soil types in Montour Falls is included in Table 9.

Table 9: Soil Types in Montour Falls	
Soil Type	Percent of Land in Municipality
Rhinebeck, Niagara, Hudson, Dunkirk, and Collamer series	9.6%
Volusia, Mardin, and Lordstown series	21%
Valois Howard Bath series	6.3%
Weyland, Teel, Hamlin series soils	63%

Soil survey maps are more detailed. The area of soil delineated on these maps can be as small as one or two acres. These maps can be used for planning at the county or municipal level. This soil data is available via the U.S. Department of Agriculture's Natural Resources Conservation Service's Soils Division.

Also included are a map of drainage based on soil type (see page54), a map of prime agricultural soils (see page 55), and a map of hydric soils (see page 56). The soil drainage map is derived from the U.S. General Soil Map. The data for the prime agricultural soils and hydric soils were provided by the national SSURGO dataset retrieved from the USDA.

Soil drainage refers to a soil's ability to retain water and is influenced by soil texture and organic content. The soil drainage map classifies Valois-Howard-Bath as soils that drain moderately well; Volusia-Mardin-Lordstown and Rhinebeck-Niagara-Hudson-Dunkirk-Collamer as somewhat poorly drained; and Weyland-Teel-Hamlin as moderately well drained in drained areas and poorly drained in undrained areas. As observed on the drainage map below, the village itself is designated as poorly drained. This is perhaps because of the relatively large amounts of impermeable surfaces (i.e. concrete and blacktop).

According to the USDA, prime agricultural land "is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses", whereas farmland of statewide importance is land that might not fit the definition of prime farmland, but is still significant compared to the other surrounding land that does not have any designation. This land is determined based on soil quality, the length of the growing season, and moisture supply. In terms of Montour Falls, a large portion of the village is designated as prime farmland. At the same time, these areas are mostly areas which are already occupied by residential housing, whereas the areas which are not marked as prime farmland are more likely to be open space or industrial areas. In addition to prime farmland, there is also some farmland of statewide importance located on the hills west of the village.

Lastly, hydric soils are soils that lack oxygen for an extended period of time due to saturation or flooding, such as soils in wetlands. Hydric soils can be naturally or artificially produced.

Resources and References

Cornell Cooperative Extension, Cornell Small Farms Program, Soil Drainage, http://smallfarms.cornell.edu/plan-your-farm/accessing-evaluating-land/evaluating-land-tutorial/know-your-soils/soil-drainage/

U.S. Department of Agriculture, Natural Resources Conservation Service, Soil Division

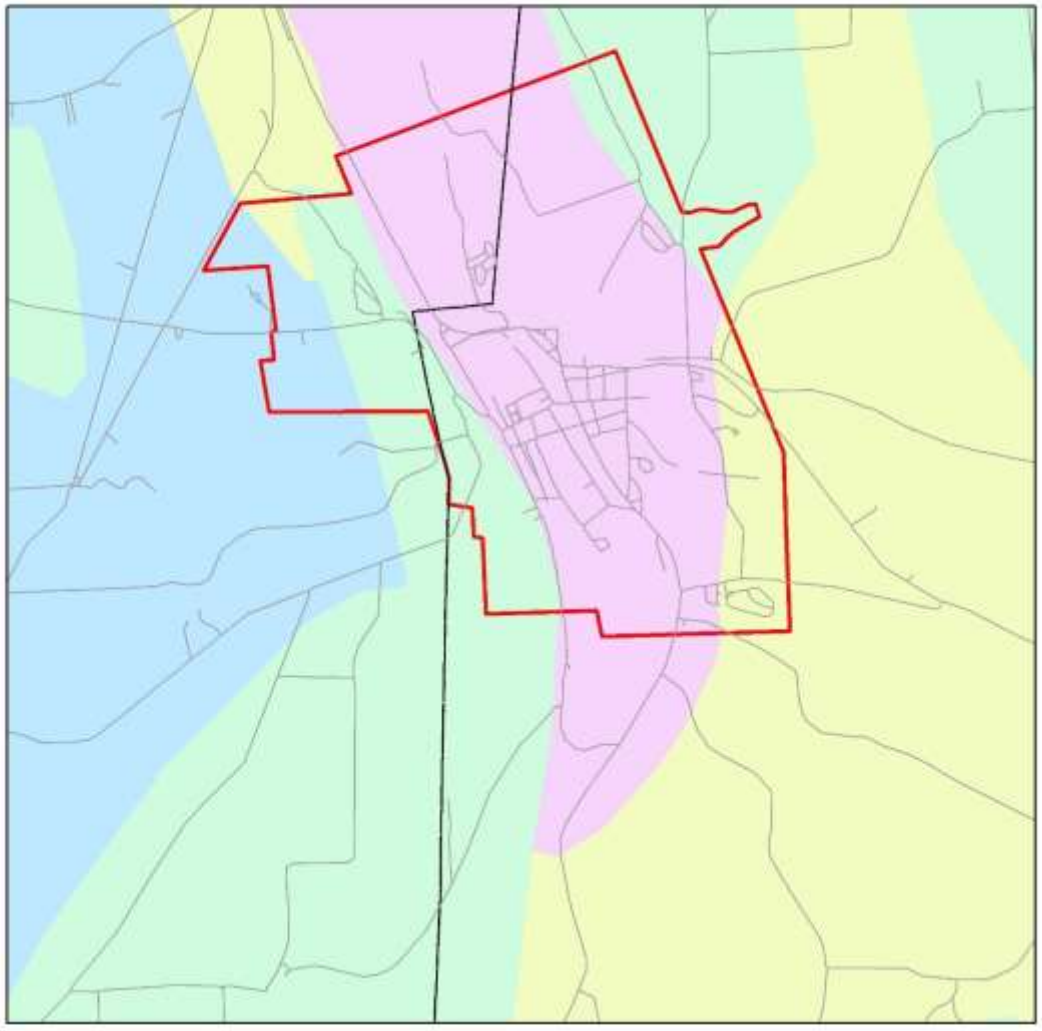
Hydric Soils – Introduction, https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961
Official Soil Series Descriptions (OSDs), https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/class/data/?cid=nrcs142p2_053587
U.S. General Soils Map, https://gdg.sc.egov.usda.gov/GDGOrder.aspx?order=QuickState

U.S. Department of Agriculture, Soil Conservation Service, & Cornell University Agricultural Experiment Station. (1965). Soil Survey: Tompkins County, New York (1961 No. 25). Washington, D.C.: U.S. Government Printing Office.

US Department of Agriculture National Engineering Handbook Par 630 Chapter 7: https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba

USDA Web Soil Survey: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Soil Series



N
W E
S

0 0.25 0.5 1 Miles

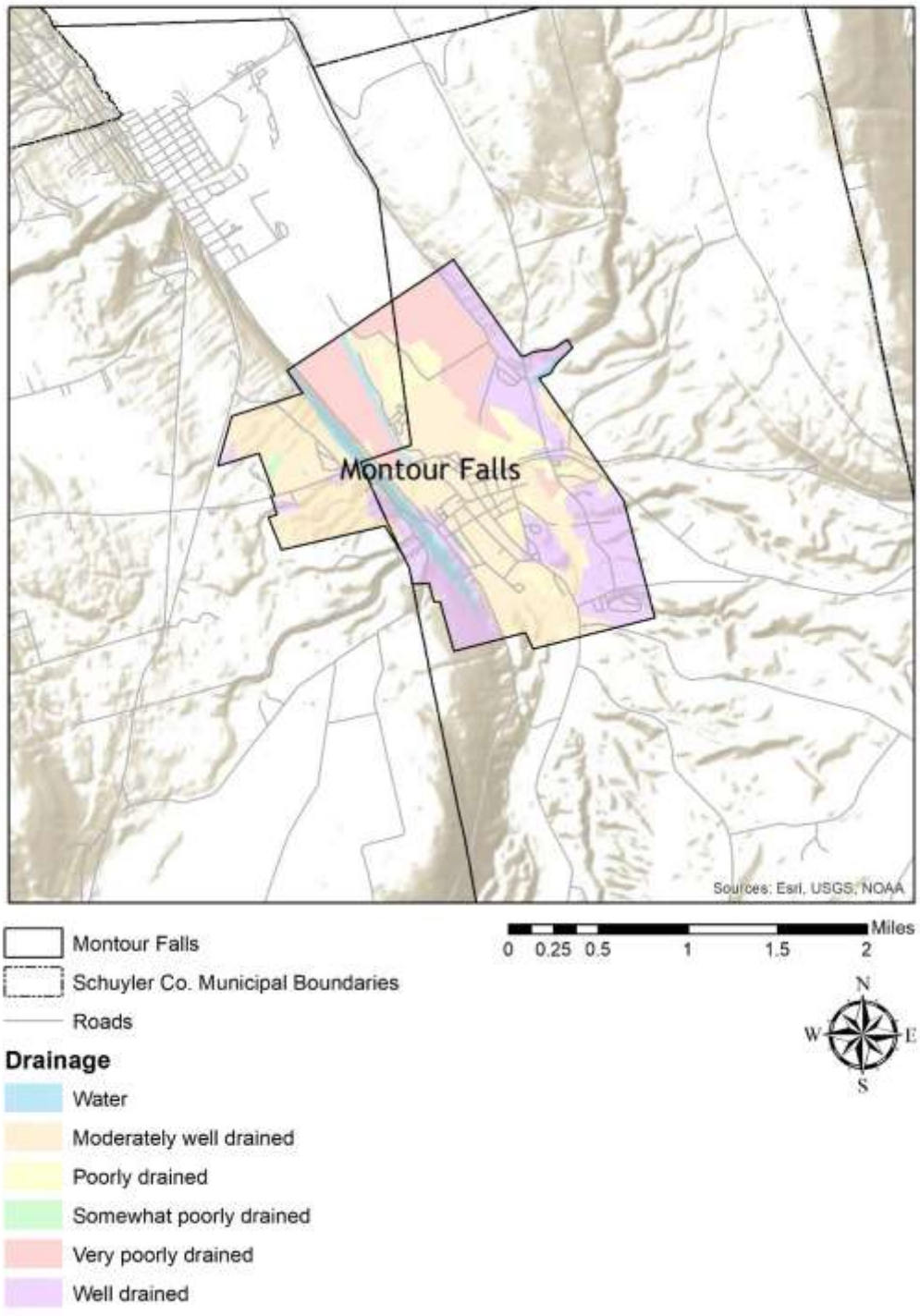
Roads
Town Boundary
Montour_Falls

Soil Series Names

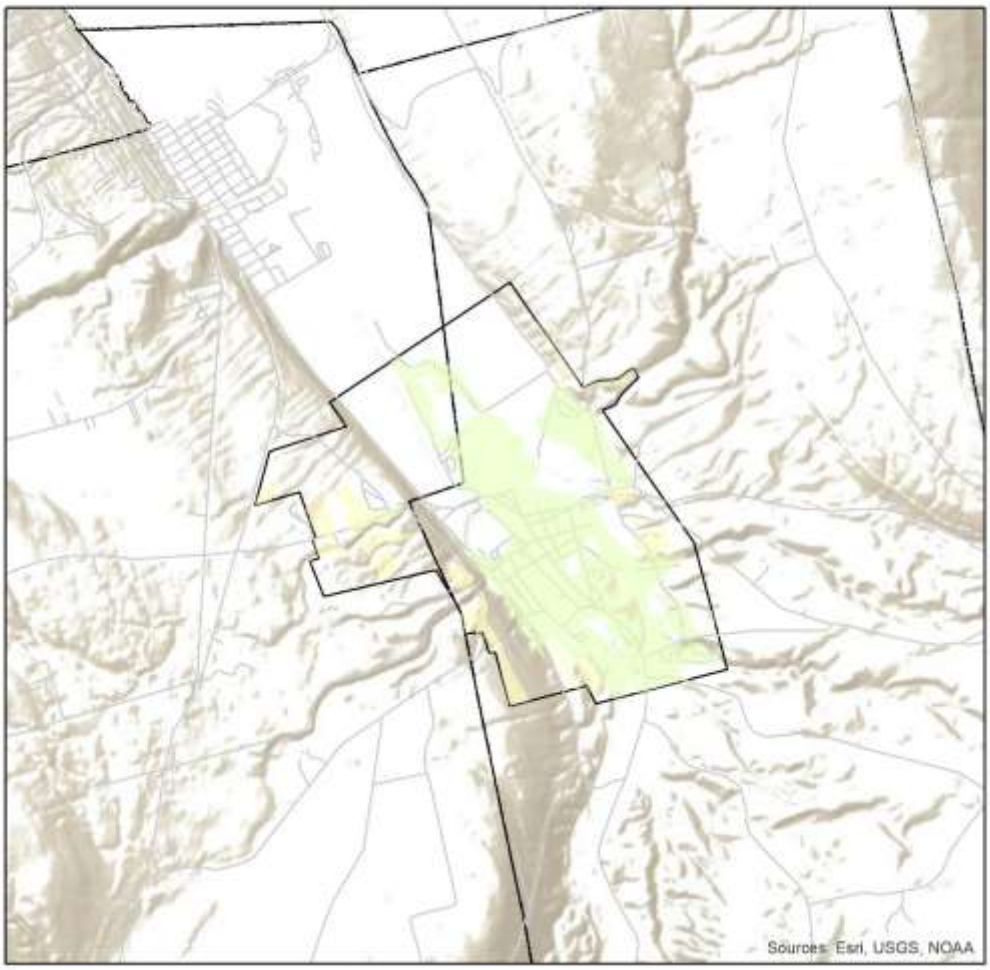
Rhinebeck-Niagara-Hudson-Dunkirk-Collamer (s5987)
Valois-Howard-Bath (s5974)
Volusia-Mardin-Lordstown (s5975)
Wayland-Teel-Hamlin (s6008)

Data Source: CUGIR
Created By: CCE Tompkins/ WRI
Date Created: 7/1/19

Soil Drainage



Prime Farm Land



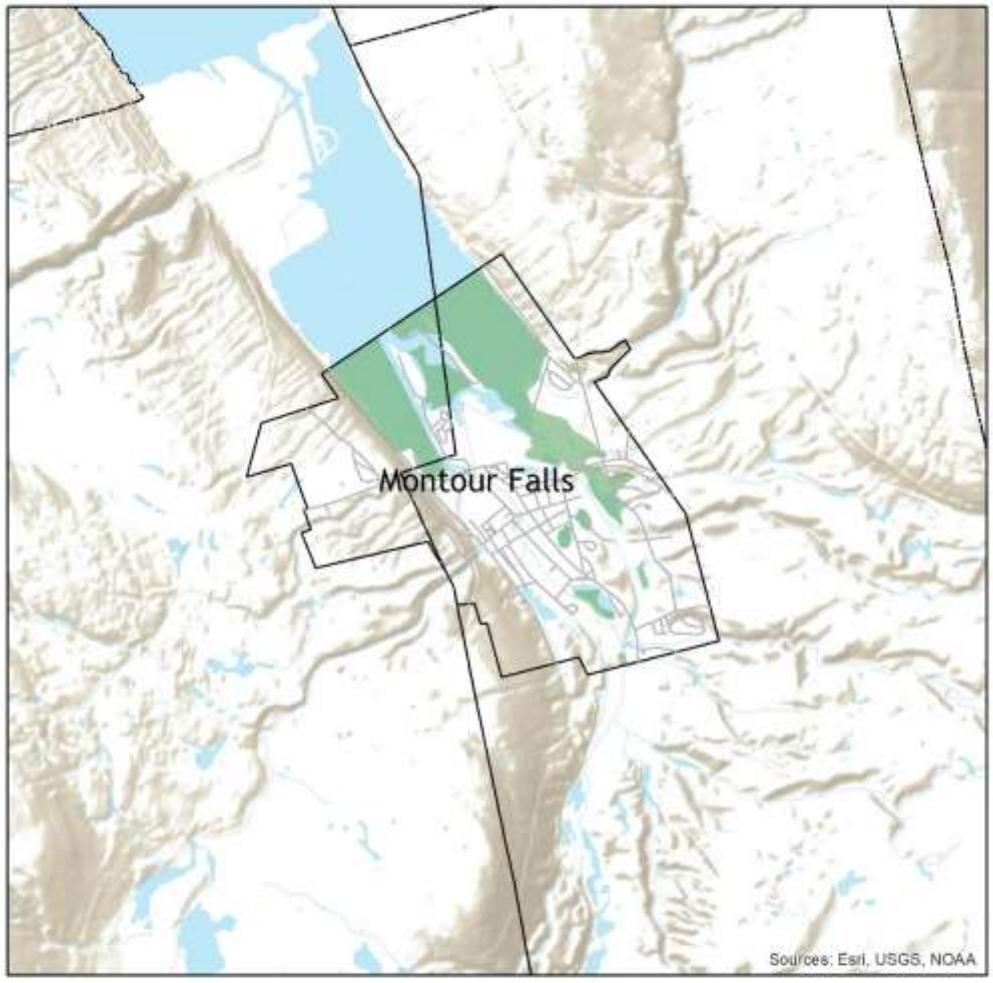
Farmland Importance

- Prime Farmland
- Farmland of statewide importance
- Prime farmland if drained
- Roads
- Schuyler Co. Municipal Boundaries
- Montour Falls

0 0.25 0.5 1 1.5 2 Miles

N W E S

Hydric Soils



Roads
Montour Falls
Schuyler Co. Municipal Boundaries
Hydric Soils
Wetlands

Miles
0 0.25 0.5 1 1.5 2

N
W E
S

2019 Montour Falls NRI
Created by: CCE and NYSWRI
Data Source: CUGIR, SSURGO, USGS, NOAA

Section 3: Land Use and Protected Lands

LAND USE AND LAND COVER

What Are Land Use and Land Cover?

Land use refers to how humans use the landscape and includes categories such as residential development and agriculture. Land cover refers to the physical cover of the land, whether natural or manmade. These categories range from forests and wetlands to impervious surfaces and cleared fields.

Why Are Land Use and Land Cover Important?

The current land use and land cover information enables communities to identify existing land use patterns, and, consequently, make better informed decisions concerning proposed land uses, development suitability analyses, and comprehensive planning. These data provide a static picture of development patterns and may be used as a benchmark for future land use and land cover analyses. In addition to future development patterns, this data may also be used for historical analyses when old data becomes available in Geographic Information System (GIS) format.

As previously discussed, due to increasing extreme weather patterns, it is important for a community to carefully plan development and future land use to prevent any unnecessary disturbance to the area. It is also helpful to consider how the land cover will change with the increasing temperatures and how, as a result, land use and development can be affected. According to the USDA, native tree species such as the Sugar Maple are projected to migrate north between now and 2100. In addition to changing species, the density of forests is expected to thin-out over time, causing less ground stability and thus increased potential for landslides. Between 2000 and 2050, the northeast is expected to have an overall decline in forest and cropland by 7 and 6% respectively. The Village of Montour Falls will especially be vulnerable to this since nearly 1/5 of their land is covered by deciduous forest.

Additionally, the land use map and data for the Village of Montour Falls exemplifies the importance of wetlands in this community, as roughly a quarter of the land is covered by wetlands. Even with their critical role in the Earth's ecosystem, over 35% of wetlands across the planet were lost since 1970. The decline is associated with urbanization, agriculture, climate change, and population rise. However, wetland areas are especially vulnerable to climate change. It is important that they are included in this map and protected by the Village of Montour Falls, as wetlands are critical for many ecosystems and support over 125,000 freshwater species. Wetlands are also essential in alleviating consequences from flooding or droughts.

While it is not possible to predict exactly how the land cover will change over time, it is possible to forecast change by referring to and cross-comparing current with historical land cover maps. Because land use and land cover can directly be controlled by government, updating land use and zoning laws according to current projections can have a drastic positive impact on both the well-being of the community and environment. Historical Land cover data can be retrieved from the USDA website. The maps below are also useful as they depict the present land uses. As developed and agricultural land uses increase, it is vital to fully understand current land cover characteristics and agricultural lands and identify the changing trends of the municipality.

By comparing current land covers and FEMA flood maps, it is possible to see how changing land cover has influenced the behavior of flooding. Also, by overlaying soil types with land cover, it is possible to

determine the parcels that should be protected versus those that can potentially be developed without causing disturbance to current wildlife corridors or floodplains.

Land Use and Land Cover in the Village of Montour Falls

The Land Use Land Cover Data was originally downloaded from the National Geospatial Data Asset (NGDA) data portal that was originally published in 2011 and amended in 2014. While the data is not up-to-date, it is expected to be fairly accurate, as the land use composition of the Village of Montour Falls, NY has not changed drastically.

In correspondence to the map below, Emergent Herbaceous Wetlands cover nearly a fourth of the land in the Village of Montour Falls. Land use for development, whether it is low, moderate, or high intensity did not cover a significant portion of land in the Village of Montour Falls, and is approximately 6%.

Table 10: Land Use and Land Cover by Category

Category	Percentage of Total Area Including Water Bodies	Examples of Individual Classes
Barren Land (Rock/Sand/Clay)	.1%	Vegetation has been cleared but no development
Cultivated Crops	1.2%	Annual crop production
Deciduous Forest	19.9%	Trees with falling leaves in the Fall
Development High Intensity	.4%	Intensity = Density
Developed Low Intensity	4.5%	Intensity = Density
Developed Medium Intensity	1.7%	Intensity = Density
Developed Open Space	6.4%	Large-lot single-family housing units, parks, planted vegetation for recreational or aesthetic purposes, or erosion control
Emergent Herbaceous Wetlands	23.4%	Perennial herbaceous vegetation accounting for greater than 80% of vegetative cover
Evergreen Forests	.5%	Trees maintain their leaves all year and are greater than 5 meters tall
Hay/Pasture	17.8%	Ares of grass or legume planted for livestock grazing or seed/hay production
Herbaceous	1.5%	Areas dominated with 80% of greater herbaceous vegetation
Mixed Forest	9.2%	Mixture of deciduous or evergreen species covering more than 20% of land area
Shrub/Scrub	7.2%	Woody vegetation less than 6 m (20 feet) tall
Water	1.2%	Natural lakes, ponds

Woody Wetlands	5%	Forest or shrubs account for more than 20% of vegetative cover

Maps and Data

The map on page 61 shows land use/land cover in the Village of Montour Falls. Data for this map was provided by the United States Geological Survey and was last updated in 2014. To find this data, use this link.

Resources and References

Australian Government: Department of Environment and Energy, https://www.environment.gov.au/water/wetlands/publications/wetlands-climate-change

Cornell Cooperative Extension, ulster.cce.cornell.edu/agriculture/farmland-access-protection/agricultural-districts

Cornell University Geospatial Information Repository (CUGIR), https://cugir.library.cornell.edu/

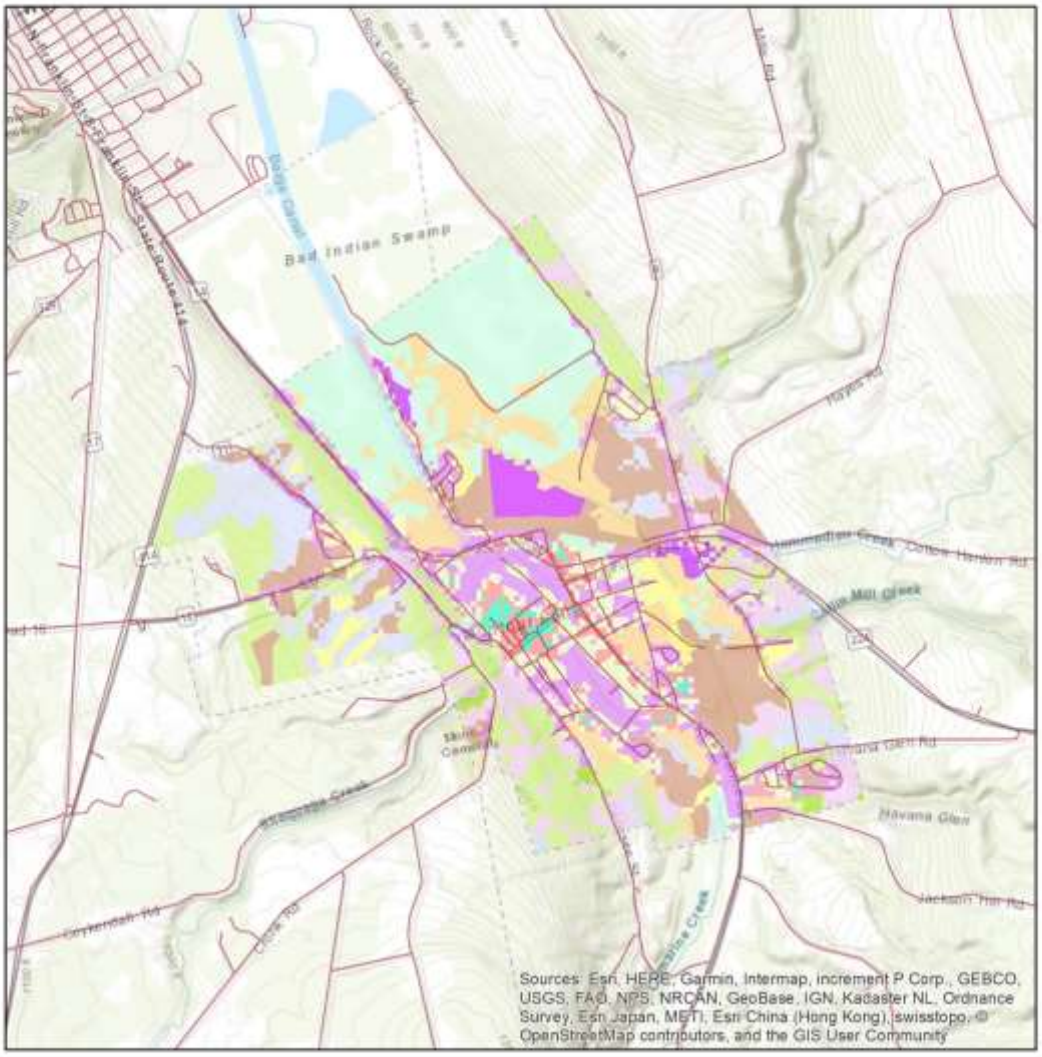
Cornell University Institute for Resource Information Systems (IRIS), http://iris.css.cornell.edu/index.html

United Nations Climate Change https://unfccc.int/news/wetlands-disappearing-three-times-faster-than-forests

United States Geological Survey, https://www.sciencebase.gov/catalog/item/581d050ce4b08da350d52363

US Department of Agriculture, https://www.fs.usda.gov/ccrc/topics/species-distribution-models

Land Use Land Cover



Roads

Land Cover Types

- Barren Land (Rock/Sand/Clay)
- Cultivated Crops
- Developed, High Intensity
- Developed, Low Intensity
- Developed, Medium Intensity
- Developed, Open Space
- Deviduous Forest
- Emergent Herbaceous Wetlands
- Evergreen Forest
- Grassland/Herbaceous
- Mix Forest
- Open Water
- Pasture/ Hay
- Shrub/Scrub
- Woody Wetlands

AGRICULTURE LAND USE

How Is the Agriculture Industry Relevant?

Agriculture is a rich industry for both New York State's economy, Schuyler County, and the Village of Montour Falls. The net market value of the 400 farms, covering 219,000 acres in Schuyler County is worth $14 million. Of the 219,000 acres, 142,000 is forested land, 64,000 acres are dedicated for agriculture, 8,800 acres are of open water, 3,000 acres of urban land, and 1,400 acres of wetlands. Land use for cropland in Schuyler County has slightly declined in the past 50 years, but land used for animal pasture has increased. Environmental concerns outlined by the Schuyler County Planning Commission include nonpoint source pollution from sediment, nutrient loading from fertilizer application, manure, silage leachate, and contaminants from pesticides. These environmental concerns, as a product of agriculture industry practices, are anticipated to increase with climate vulnerability and variability. Additionally, changes in the climate will greatly impact the agriculture industry and the livelihoods of people who work in this industry.

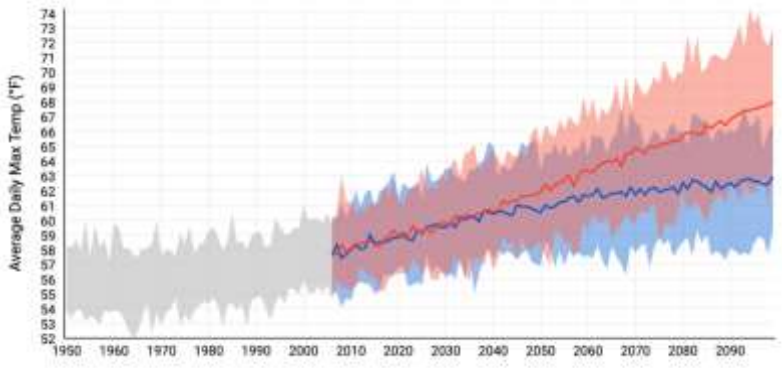
The overall challenges the agriculture industry will face, as a result of climate change, include flooding, drought, heat stress, rising temperatures, more frequent heavy rainfall events, insects reproducing quicker, super weeds, and a vulnerable livestock industry. The impacts of climate change will affect production sites and surrounding ecosystems. This section will dive deeper into the consequences of climate change and how they will specifically impact the agriculture industry of Schuyler County, New York, and subsequently the Village of Montour Falls.

What Is the Agriculture Profile?

As of 2012, Schuyler county had 393 farms that were an average size of 176 acres in size. In total, farms cover 69,222 acres of county land. Over seventy percent of the total market value of products sold out of Schuyler County are from the livestock industry, which is equivalent to over $31 million. Although 29% of the total market value is from crop sales, approximately 55% of land used in Schuyler County is for cropland.

How Will Rising Temperature Effect the Agriculture Industry?

With current emission rates, temperatures are expected to increase in Schuyler County. The graph on the right predicts how temperatures will increase with both a lower and higher emissions scenario. The lower emissions scenario is assuming that by 2040 emissions begin to decrease. The higher emission scenario is assuming that emission will continue to rise through the end of the



21st century. To engage with this tool and take a closer look as to how temperature will change in Schuyler County because of climate change, click here.

Changes in temperature will have significant impacts on a variety of agriculture and rural land. Between the years 2013 and 2016, 11% of the crops lost in the northeast was due to an increase in temperature. Many crops are heat sensitive and a 1° Fahrenheit difference can pose significant threats. Heat stress will significantly impact grain productivity yields, especially commonly grown varieties of sweet corn that prefer temperatures cooler than what is projected to be the norm in future years. While farmers can switch to cultivating seed varieties that are better adapted for warmer summers, they will have to find a new market for their product. Rising temperatures will also cause an increase in demand for water resources, especially for crops that previously have not been irrigated.

New York is currently the fifth leading dairy producing state in the United States. Over seventy percent of the total market value of Schuyler County's agriculture industry is from the livestock sector, which is equivalent to $31 million. Increasing temperatures creates unhealthy living conditions, decreases the quality of milk produced, and will require investment in air conditioning units in order to create a cooler living environment for livestock.

Higher temperatures, along with increasing atmospheric CO_2 promotes weed growth and migration of certain species north. It is predicted that certain pesticides, such as glyphosate, will not be as effective with climate change. Insect life cycles will also be impacted by rising temperatures and some species will multiple five times faster than their current rate.

How Is Drought Occurrence Expected to Change?

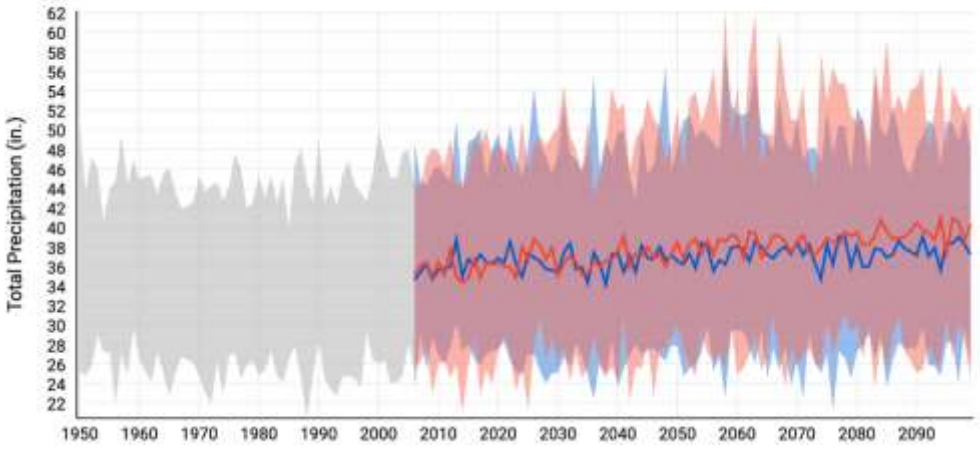
Historically, New York State experiences plentiful rainfall in the summer. However, frequency and severity of drought events will significantly impact rain-fed crops and decline in overall crops yields. Between 2013-2016 the most significant factor of crop loss in the northeast was due to drought (38.1%).

Adaptation strategies to prepare for drought are not simple and can require expensive landowner investment. Farmers can invest by increasing irrigation, but this places pressure on water supply, delivery systems, and the need to implement water rights policy. Uncertainty of weather precipitation extremes will require changes in current irrigation systems. By 2090, it is estimated that the United States demand in irrigated agriculture land would increase by 4.5 – 21.9 million ha. While the northeast is not expected to have extreme moisture deficits in comparison to other parts of the country, this region is predicted to demand an additional 25,00 hectares of irrigated land.

How Will Precipitation Events Change?

Since 1958, precipitation as a result of heavy storms increased by 70% and frequency of these events is only expected to increase. The frequency in these events is predicted to take place in the winter and spring. Earlier and heavier onset of rain in the spring will cause snow to melt sooner, thus the soil will be

drier in the summer and fall. Between 2013- 2016, approximately 33% of crops in the northeast were lost due to excess moisture. The graph on the right is a prediction as to how precipitation will change in Schuyler County, as a result of climate change.



The increase in precipitation will stimulate flooding, which can have cascading negative effects on surrounding natural resources and farmland. Schuyler County is especially vulnerable because the composition of the soil present. Schuyler County has already had four previous extreme floods in the years 1996, 1996, 2003, 2012, which were announced as federal disasters.

The impacts of flooding on farmland can be extremely severe. Flooding can cause a loss of beneficial fungi in the soil, complete erosion, and an increase in sand and debris mixed onto prime agriculture soil. All of these consequences from flooding can cause extreme financial burdens on farmers and loss in crop yields. While there are ways to mitigate these issues, such as planting cover drops, tiling, and tile drainage, none of these are particularly desired by landowners. Farmers can make financial investments for drainage systems in their fields. However, this could possibly impose financial burdens.

Increasing occurrences of heavy rainfall patterns will cause certain leaf and root pathogens, such as root anoxia, late blight, and other roots diseases that are caused by fungal species such as *Pythium* and *Rhizoctonia* to be more frequent. Planting will be commonly delayed because of spring flooding. Flooding can reduce yield and increase root damage, heavy machinery working over wet soils will cause soil compaction, erosion after heavy rainfall, and water contamination. The environmental impacts of more frequent extreme precipitation will be water contamination from fertilizer and manure transported by runoff.

Resources and References

"Climate Change Impacts on Northeast Agriculture: Overview", https://www.uvm.edu/vtvegandberry/ClimateChange/ClimateChangeImpactsNortheastAgriculture.pdf

Cornell Cooperative Extension, https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/8/4308/files/2015/01/CornellClimateChange_Farming-Success-in-an-Uncertain-Climate-Dec2014_FINAL-1vhyplo.pdf

"Impact of climate change on the dairy industry in temperate zones: Predications on the overall negative impact and on the positive role of dairy goats in adaptation to earth warming", doi:10.1016/j.smallrumres.2014.11.005

National Oceanic and Atmospheric Administration, https://crt-climate-explorer.nemac.org/location/?county=Schuyler County&city=Schuyler County, NY&fips=36097&lat=42.3796425&lon=-76.87209610000002

The Nature Conservancy, https://www.nature.org/media/initiatives/new_york_factsheet_5.pdf

"Responding to Climate Change in New York State: The ClimAID Integrated Assessment for Effective Climate Change Adaptation in New York State", https://www.nyserda.ny.gov

Schuyler County: Hazard Mitigation Plan, http://www.schuylercounty.us/DocumentCenter/View/5087/Schuyler-County-HazMit-Plan-2016-2021---REVISED
Schuyler County Planning Commission http://www.schuylercounty.us/DocumentCenter/View/1368/SCHUYLER-COUNTY-COMPREHENSIVE-PLAN-2004---Full-Document

Soil Science Society of America, https://www.soils.org/files/science-policy/caucus/briefings/farming-after-flood.pdf.

"Two Challenges for U.S. Irrigation Due to Climate Change: Increasing Irrigated Area in Wet States and Increasing Irrigation Rates in Dry States", doi:10.1371/journal.pone.0065589

United States Department of Agriculture, https://www.nass.usda.gov/Publications/AgCensus/2012/Online_Resources/County_Profiles/New_York/cp36097.pdf.

United States Environmental Protection Agency, https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-ny.pdf.

"Unique challenges and opportunities for northeaster US crop production in a changing climate", https://link.springer.com/content/pdf/10.1007%2Fs10584-017-2109-7.pdf

NATURAL HERITAGE SITES

What Is a Natural Heritage Site?

A Natural Heritage Site is a point or area representing specific natural resource information documented by the New York Natural Heritage Program. The goal of this program, a joint venture of the New York State Department of Environmental Conservation (DEC) and The Nature Conservancy (TNC) since 1985, is to compile and maintain an up-to-date inventory of the location and status of New York State's rarest animal and plant species and its ecological communities. As of 2017, the Natural Heritage Program monitors the status of 802 rare plant species, 466 rare animal species, and 179 ecological community types in New York State.

Why Are Natural Heritage Sites Important?

The databases maintained by the New York Natural Heritage Program can assist in identifying threatened or endangered species and ecological communities in the Village of Montour Falls. This knowledge can be incorporated into planning, conservation, and natural resources management to help conserve the plants, animals, and ecological communities that represent the County's natural heritage. Though not a requirement of the State Environmental Quality Review Act (SEQRA), the Natural Heritage Program will search its databases upon request for proposed actions subject to SEQRA review.

Natural Heritage Sites in the Village of Montour Falls

Currently, six natural heritage sites exist in the Village of Montour Falls. Some of these areas are habitats for rare plants, animals, and natural communities near the Village of Montour Falls. For information concerning the data, or to request site specific information, contact the New York Natural Heritage Program. http://www.dec.ny.gov/gis/erm/

Maps and Data

The map on page 68 shows significant natural communities and rare plants and animals in the Village of Montour Falls**.** This data was provided by the following sources: Cornell University Geospatial Information Repository and New York State GIS. February 2018.

Information on the status and distribution of rare and endangered animals and plants, and the best examples of New York State's ecological communities, is collected, stored, and analyzed in databases maintained by the Natural Heritage Program. This information has been assembled from historical records and collections maintained by scientific institutions such as the New York State Museum, and from field surveys by staff from the New York Natural Heritage Program and other scientific groups.

Neither site-specific nor comprehensive surveys for rare species and significant natural communities have been conducted for the entire state. Therefore, these data cannot be relied on as a definitive statement of the presence or absence of rare species or significant ecological communities, and cannot be substituted for on-site surveys that may be required for environmental assessment.

Resources and References

Cornell University Geospatial Information Repository https://cugir.library.cornell.edu/

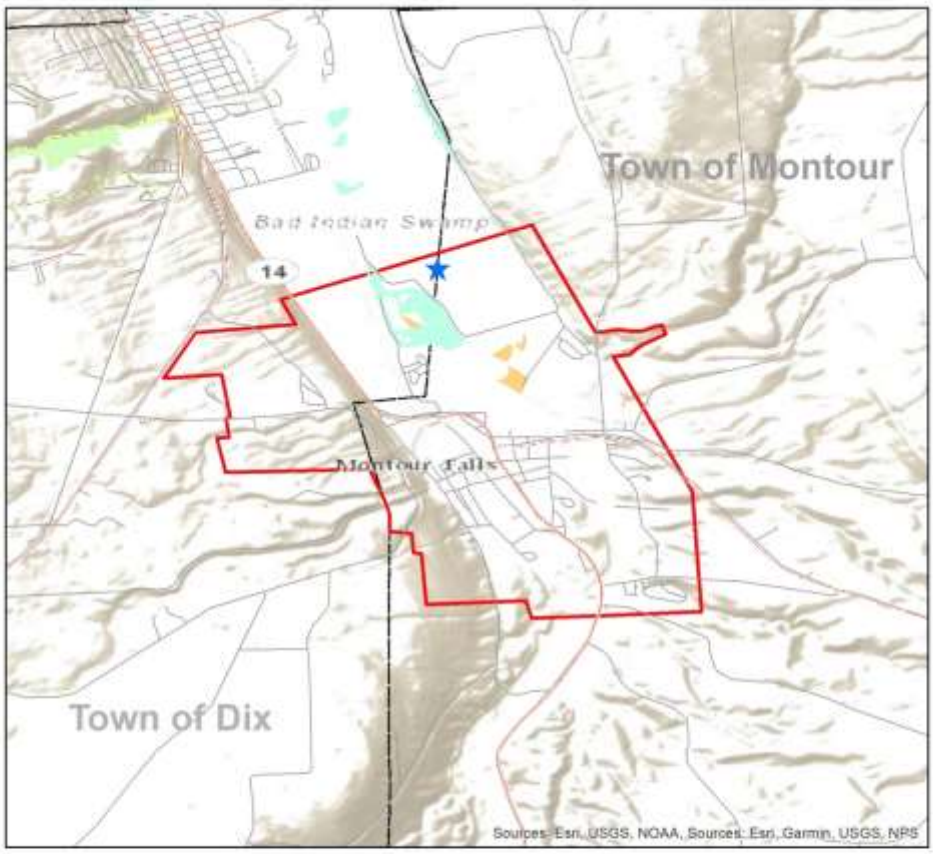
New York Natural Heritage Program, http://www.dec.ny.gov/animals/29338.html

New York Natural Heritage Program, SUNY College of Environmental Science and Forestry. January, 2018. Element Occurrence Spatial Data Set. Albany, New York.

New York State Department of Environmental Conservation
Division of Fish and Wildlife, http://www.dec.ny.gov/about/634.html
Division of Marine Resources, http://www.dec.ny.gov/about/796.html
List of Endangered, Threatened and Special Concern Fish & Wildlife, Species of New York State, http://www.dec.ny.gov/animals/7494.html

New York State GIS Data Set https://gis.ny.gov/gisdata/inventories/details.cfm?DSID=1241

Natural Heritage Sites



0 0.25 0.5 1
Miles

Data Source: CUGIR
Date Created: 6/24/19
Created by: NYSWRI

Bird Conservation Area

★ Catharine Creek

NYS Natural Heritage Communities

- Calcareous shoreline outcrop
- Floodplain forest
- Hemlock-northern hardwood forest
- Shale cliff and talus community
- Silver maple-ash swamp
- Village of Montour Falls
- Township Boundaries
- Roads

SIGNIFICANT NATURAL SITES

What Is a Significant Natural Site?

Significant Natural Sites are locations that are identified to have important scenic and environmental qualities. These sites are outlined in the Village of Montour Falls 2017 Comprehensive Plan. Any development purposed within an identified significant natural site will follow stringent review for the impacts it would have on these sites. The Significant Natural Sites cover a variety of terrain, such as, marshes, hiking areas, and locations critical to wildlife habitat.

Why Are Significant Natural Sites Important?

Significant Natural Sites are recognized because of their outstanding qualities that render them as "significant" within the Village of Montour Falls. Often, the characteristics that make a site significant are important for scenic and environmental reasons. These sites will be critical to represent when reviewing development proposals that could possibly occur in the site or adjacent.

What Are the Criteria for a Significant Natural Site?

There are two primary criteria that must be met in order to be identified as a significant natural site.

1. **Scenic Qualities** is an important criterion point when determining which sites are of upmost significance to the Village of Montour Falls. Scenery is important to the citizens of the Village of Montour Falls, in order to preserve land for their own enjoyment and view.

2. **Environmental Quality** is the additional important criterion for categorizing a site as "significant" for the Village of Montour Falls. Environmental quality is a central reason for conserving and determining sites as "significant."

Significant Natural Sites in the Village of Montour Falls

The Catharine Valley Trail takes you along a multiuse pathway that highlights civic buildings, a waterfall, and the nature of the Watkins Glen marina. The trail formed follows parts of the retired Northern Central Railway and Chemung Canal towpath, and ultimately to Seneca Lake.

She-Qua-Ga Falls is perfectly located in a location surrounded by scenic and natural beauty. Tucked near colonial-style buildings and in close proximity to Main St, She-Qua-Ga Falls is a great stop for both types of scenery.

Situated in the Havana Glen Park is the spectacular view of Eagle Cliff Falls, Montour Falls, and other scenic waterfalls. The first visitors of the park were in 1867 and the area is still open to the public for hiking and camping.

Aunt's Sarah's Falls is the perfect stop for visitors who wish to avoid hiking to fall locations, as it is visible from the road and parking lot. The fall cascades for ninety feet before fanning out at the bottom. This is a great stop in both the summer and winter to see either the flowing waterfall or how it freezes over in winter temperatures.

Queen Catharine Marsh covers 402 acres of marsh land. The land is great for recreational purposes such as hiking, bird watching, and boating. Sections of this marsh were administered by the New York State Department of Environmental Conservation, while others are privately owned. Many at risk species use this marsh area as breeding land. Along the marsh, visitors can hike a 7.5 mile loop trail.

Rock Cabin Road is situated in Queen Catharine Marsh. This road is elevated in relation to the marsh and is perfect for viewing the natural beauty around. It's a popular attraction to community members and a variety of plants and animals can be viewed from the road.

Maps and Data

The following map shows the location and names of six Significant Natural Sites the Village of Montour Falls**.** The data for this map was provided by the Village of Montour Falls and was last updated in 2017. Information available for each UNA includes the reason for selecting the site, special land use information, adjacent land use data, vulnerability of the site, vegetation cover types, ecological communities, rare, threatened or endangered species, geologic and water features, slope, and soils. This information is available from the Village of Montour Falls 2017 Comprehensive Plan.

Resources and References

Audubon - Important Bird Areas: Queen Catharine Marsh https://www.audubon.org/important-bird-areas/queen-catharine-marsh

CNY Hiking https://www.cnyhiking.com/QueenCatharineMarshLoopTrail.htm

Dig the Falls https://digthefalls.com/havana-glen-park-eagle-cliff-falls/

NY Department of Environmental Conservation
https://www.dec.ny.gov/docs/fish_marine_pdf/pfrcathrneck.pdf

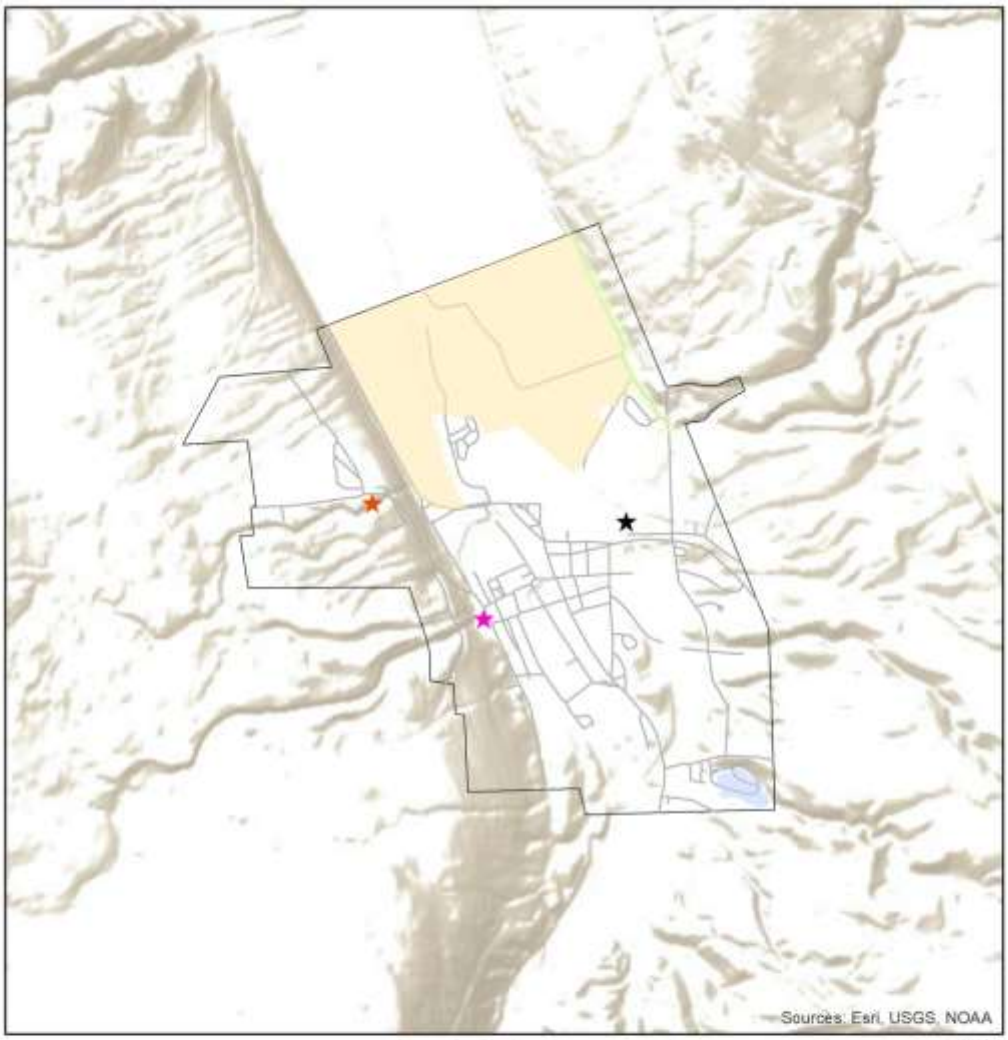
Rails to Trails Conservancy https://www.traillink.com/trail/catharine-valley-trail/

Stay in the Finger Lakes http://www.stayfingerlakes.com/attractions/parks/aunt-sarah/

World of Waterfalls https://www.world-of-waterfalls.com/waterfalls/eastern-us-she-qua-ga-falls/

2017 Comprehensive Plan | Montour Falls, NY
http://www.stcplanning.org/usr/Program_Areas/NYSERDA/Montour%20Falls%20Comp%20Plan_JuneDraft.pdf

Significant Natural Sites



Shequaga Falls Park
Aunt Sarah's Falls
Catharine Creek
Rock Cabin Road
Havana Glen
Queen Catharine Marsh
Roads
Montour Falls

0 0.25 0.5 1 1.5 2 Miles

N
W E
S

2019 Montour Falls NRI
Created By: CCE and NYSWRI
Data Source: CUGIR, USGS, NOAA

PROTECTED OPEN SPACE

What Is Protected Open Space?

According to the Village of Montour Falls 2017 Comprehensive Plan, almost 50% of the population believes that protecting environmental space is "somewhat important" in the competing interest between preserving natural resources and development pressures. It is suggested that by improving certain retail/service gaps both natural resources would be preserved, and the economy would benefit. Some of the gap solutions include canoe and kayak rental, bicycle rental, hiking tour, fishing rentals, recreation equipment rentals, small scale bed and breakfasts, and restaurants for visitors.

New York State Parks in the Village of Montour Falls

New York State owns public lands throughout the state. Because they are owned by the State, all citizens have access to the lands. These lands include state forests, state parks, and wildlife management areas. State forests are managed by the DEC and include reforestation areas, multiple-use areas, unique areas, and state nature and historic preserves. State forests can be used for recreational purposes or for managing ecosystem health and protecting rare, threatened, and endangered species. State parks serve similar purposes but are not limited to forest ecosystems.

Parks are managed by the New York State Office of Parks, Recreation, and Historic Preservation, primarily for recreation and tourism. These lands often contain outstanding natural or historic resources. Permitted uses, such as hunting, fishing, biking, camping, ATV, and snowmobile and horseback riding, vary from park to park.

In the Village of Montour Falls, there are 0 state forests, 3 state parks, and 1 wildlife management areas.

She-Qua-Ga Falls Park is a .2-acre park area that can be used for hiking, camping, and enjoying the scenery.

Havana Glen Park is a 11-acre space that can used for hiking, camping, viewing wildlife and nature.

Catharine Creek Wildlife Management Area is a 334-acre space that includes wildlife and habitat management and wildlife dependent recreation according to the New York State Department of Environmental Conservation. At Catherine Creek Marsh Wildlife Management Area, fishing, bird watching, hiking, hunting, and trapping are common recreational activities.

Marina Park is a 28-acre space that includes trails and camping for recreational activity.

Why Are These Preserves, Conservation Easements, Natural Areas, and State Lands Important?

Nature preserves, conservation easements, natural areas, and state lands protect important landscapes from development and uses that may damage their natural features. These lands protect key plant and animal species and their habitats, protect watersheds and the quality of water in the area, and provide recreational opportunities to everyone. Most importantly, open space can act as a retention and relief zone for excess water during flood events. They also add economic value to their surrounding areas by providing areas for recreation, enhancing tourism and increasing land values. In addition, they provide

important educational opportunities for teaching about botany, natural history, entomology and cultural history. Although municipal governments do not have direct control of these lands, they may be able to use them in their planning efforts to create greenways, biological corridors, and recreational trails.

New York State WMAs and Forests are also utilized for logging. Logging in State Forests are monitored by the DEC to ensure that trees of varying sizes and ages are left for future generations. The focus of logging activities in WMAs is to manage habitat and provide a diversity of vegetation types and wildlife species.

Maps and Data

The map on page 76 shows state parks and wildlife management areas/preserves. This data is available from The Village of Montour Falls 2007 & 2017 Comprehensive Plan.

Resources and References

Cornell University, Cornell Botanic Gardens, Natural Areas, http://www.cornellbotanicgardens.org/our-gardens/natural-areas

Finger Lakes Land Trust
Find a Preserve, http://www.fllt.org/learntheland/preserves/
About the Finger Lakes Land Trust, http://www.fllt.org/about/

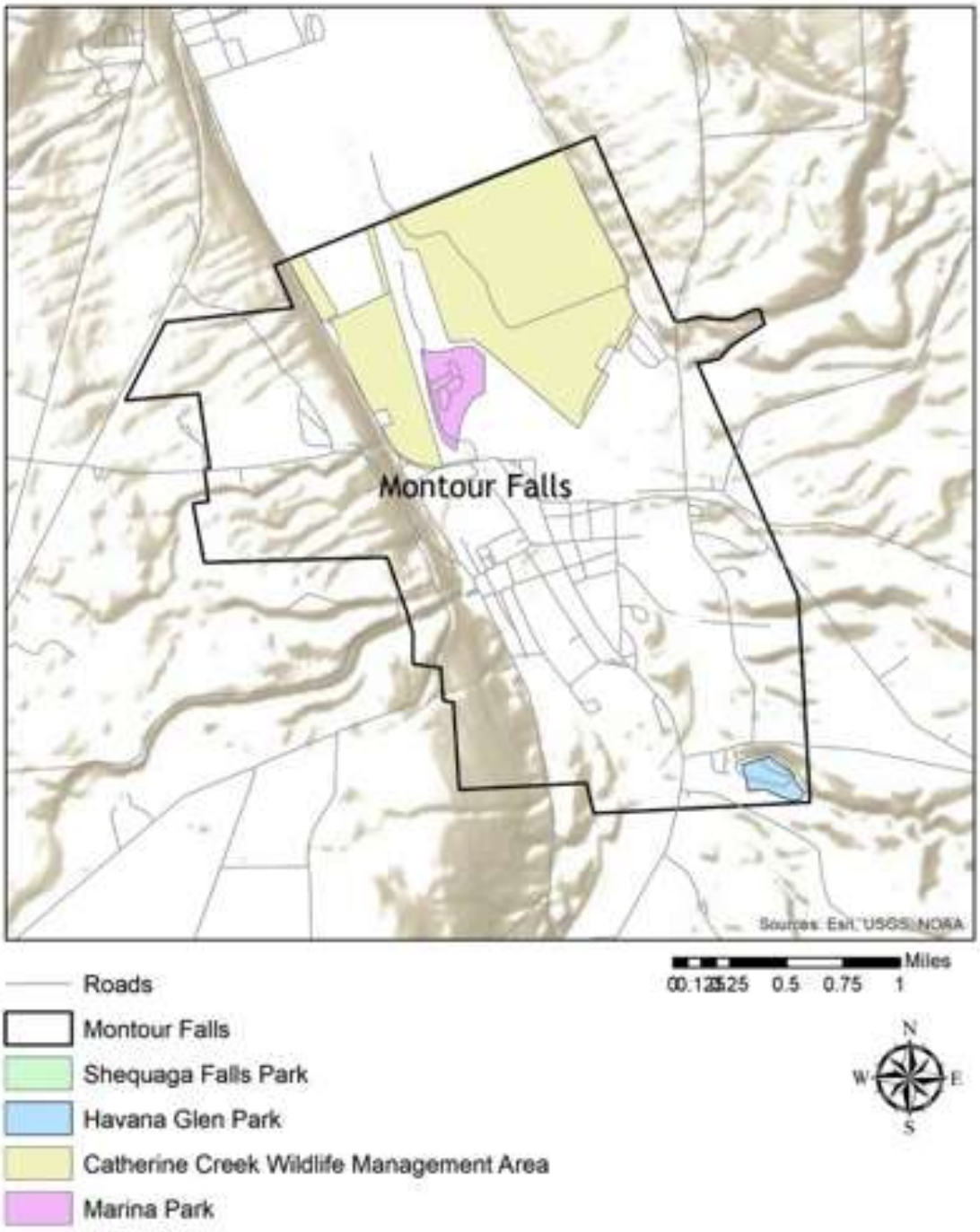
The Nature Conservancy, Places and Preserves, Central & Western New York, https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newyork/places-preserves/central-western-new-york-preserves.xml

New York Department of Environmental Conservation https://www.dec.ny.gov/outdoor/24429.htmlNew York Falls http://nyfalls.com/waterfalls/havana-glen/

New York State Department of Environmental Conservation
State Forests, http://www.dec.ny.gov/lands/40672.html
Wildlife Management Areas, http://www.dec.ny.gov/outdoor/7768.html

New York State Department of Parks, Recreation and Historic Preservation, https://parks.ny.gov/

Open Space


Montour Falls
Sources: Esri, USGS, NOAA
Miles
0 0.125 0.25 0.5 0.75 1
N
W
E
S
Roads
Montour Falls
Shequaga Falls Park
Havana Glen Park
Catherine Creek Wildlife Management Area
Marina Park

SIGNIFICANT VIEWSHEDS

What is a Significant Viewshed?

In the Village of Montour Falls 2017 Comprehensive Plan, a viewshed is an area of significant natural landscape that you can see from any given point. The Significant Viewsheds listed by the Village of Montour Falls are important for preservation matters and to protect that view from various locations.

Significant Viewsheds in the Village of Montour Falls

The Village of Montour Falls defines a significant viewshed as "the area on the ground, hills, water, and threes you can see from a given point." There is a total of seven significant viewsheds in Montour Falls. Distinctive views are determined to "make a clear, unmistakable impression" on the viewer, and are supposed to be the best views in the Village of Montour Falls. These are each documented below.

Significant Viewshed 1: Hospital Hill

The view can be observed from the Schuyler Hospital and primary Care Center parking lots. The view displays the south of Montour Falls, Queen Catharine Marsh, and parts of Seneca Lake.

Source: Comprehensive Plan 2017 | Montour Falls & Comprehensive Plan Village of Montour Falls Draft, 2007

Significant Viewshed 2: She-Qua-Ga falls

She-Qua-Ga Falls is the largest fall in Montour Falls located on the western side of town. The waterfall is over 150 feet tall and is accessible year round. She-Qua-Ga Creek starts 8 miles west before feeding into She-Qua-Ga Falls. Ultimately, the water from She-Qua-Ga Falls drains into Seneca Lake.

Source: NY Falls, 2013

Significant Viewshed: Skyline Drive

Route 8 provides the view of the valley, marsh, villages, and lake towards Montour Falls from Catharine Valley.

Source: Comprehensive Plan 2017 | Montour Falls

Significant Viewshed 4: Queen Catharine Marsh from Rock Cabin Road

Queen Catharine Marsh covers 890 acres and is the natural habitat of a variety of wildlife species. On the east coast, it is one of the largest cattail marshes and there are trails for hiking in this marsh area and can be used for hunting, trapping, and fishing.

Source: Department of Environmental Conservation & Comprehensive Plan Village of Montour Falls Draft, 2007

Significant Viewshed 5: Route 224 Hill

This view can be seen when driving down Route 224 from Odessa to the Village of Montour Falls.

Source: Comprehensive Plan 2017 | Montour Falls

Significant Viewshed 6: Glorious T Historic District

In the Glorious T Historic District, a mixture of architecture styles surrounds the Shequaga Falls. A twenty five minute self-guided tour of the area is available for anyone visiting.

Source: Scenic USA – New York

Significant Viewshed 7: Pocket Park

This pocket park is designed to provide a green space in an area particularly dense with urban development. The area photographed above is where the Village of Montour Falls Farmer's Market is located.

Source: Comprehensive Plan 2017 | Montour Falls

Why are Significant Viewsheds Important?

Scenic resources contribute to the day-to-day quality of life of the Village of Montour Falls residents, as well as attract visitors to the area. They are a large part of what makes this region such a beautiful and desirable place to live, work, and visit. Documenting where these resources are makes it easier to protect and manage them. Scenic views can be protected through measures such as zoning ordinances.

Maps and Data

The map on page 82 shows the locations of Distinctive, Noteworthy, and Characteristic Views in the Village of Montour Falls, as well as views that were inventoried but did not fall under any of these three categories. Data was provided by the Village of Montour Falls 2017 Comprehensive Plan and Cornell Cooperative Extension. Please note that the map titled “Scenic Resources” is the equivalent to the name “Significant Viewsheds”, outlined by the Village of Montour Falls.

Resources and References

Comprehensive Plan Village of Montour Falls Draft, 2007, https://www.schuylercounty.us/DocumentCenter/View/1598/A-Comprehensive-Plan-for-the-Village-of-Montour-Falls-and-Town-of-Montour?bidId=

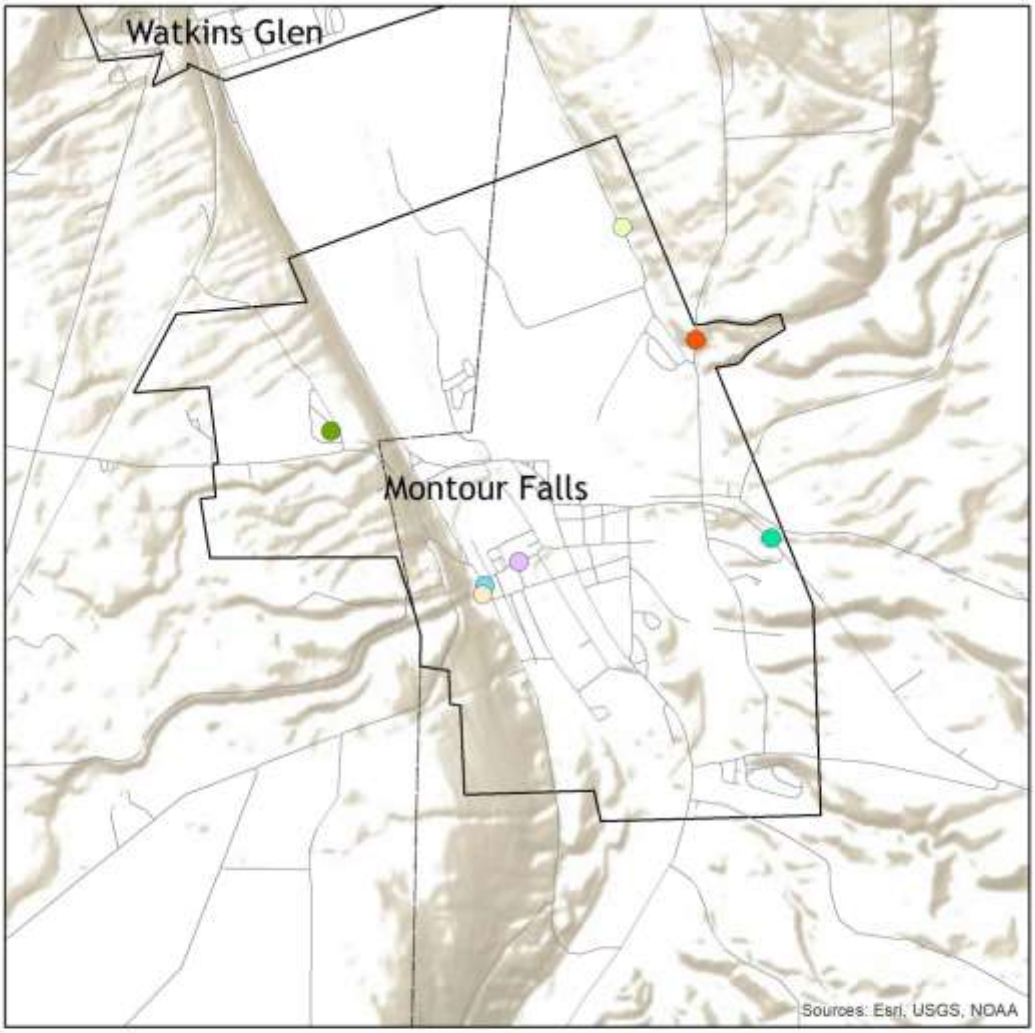
Department of Environmental Conservation, https://www.dec.ny.gov/outdoor/24429.html

NY Falls, 2013, http://nyfalls.com/waterfalls/shequaga-falls/

Scenic USA – New York, 2019, https://www.scenicusa.net/092211.html

2017 Comprehensive Plan | Montour Falls, NY, http://www.stcplanning.org/usr/Program_Areas/NYSERDA/Montour%20Falls%20Comp%20Plan_JuneDraft.pdf

Scenic Resources



- Shequaga Falls
- Skyline Drive
- Rock Cabin Road
- Hospital Hill
- Route 224 Hill
- Pocket Park
- Glorious T Historic District
- Roads
- Montour Falls
- Schuyler Co. Municipal Boundaries

0 0.25 0.5 1 Miles

N
W E
S

2019 Montour Falls NRI
Created by: CCE and NYSWRI
Data Source: USGS, NOAA, Google Earth

IMPLIMENTATION TOOLS

Once parcels have been identified, the following tools are meant to help municipal officials implement actions that they believe are necessary to protect the community and environment to prepare for the effects of climate change. While the primary goal of this document is meant to help communities identify potential areas of interest within municipal boundaries, this section is meant to provide supplemental assistance to guide communities towards a more sustainable future.

As this NRI is intended and designed for a specific municipality, it is possible to consider parcels on an individual basis. While there is no specific method to identifying specific parcels, having an overview of the general process can of land evaluation can be useful before proceeding.

The main activities in a land evaluation are as follows:

1. Initial consultations, concerned with the objectives of the evaluation, and the data and assumptions on which it is to be based
2. Description of the kinds of land use to be considered, and establishment of their requirements
3. Description of land mapping units, and derivation of land qualities
4. Comparison of kinds of land use with the types of land present
5. Economic and social analysis
6. Land suitability classification (qualitative or quantitative)
7. Presentation of the results of the evaluation.

List from *A Framework for Land Evaluation,* 4.2

Assuming that the economic and social analysis is conducted separately, there are many ways to conduct a land suitability analysis. This can be done using the evaluation instruction manual provided by the Food and Agricultural Organization of the United Nations:
http://www.fao.org/docrep/x5310e/x5310e00.htm#Contents

Once parcels have been evaluated and selected, the following methods could be used to preserve or protect the parcels.

- **Transfer or Purchase of Development Rights**
  When development rights are transferred, the development potential of a site becomes its own good that can be bought and sold by the owner and sold to an individual land owner or developer who wishes to build on another property at higher density that the zoning allows.

  A transfer of development rights for multiple parcels can also be coupled with cluster zoning ordinance. This would allow for property owners to earn back some of the value of their land that they will forego by not developing it, and will accommodate residential or commercial growth without sprawling into properties with ecological or historic significance.

  Source: https://www.dos.ny.gov/lg/publications/Transfer_of_Development_Rights.pdf

- *Advantages:*
  - Properties remain on tax rolls
  - The program does not create a financial shortfall for the landowner
  - No direct expenditure of municipal funds to purchase property.
- *Disadvantages:*
  - A transfer of development rights program necessitates ongoing administration and careful oversight

- **Conservation Easement**
  Conservation easements are used to protect wildlife, ecosystems, natural habitats, wetlands, and other valuable ecological resources while maintaining a property's private ownership. As a result, the properties do not have to be purchased outright by a public organization in order to preserve the parcel.
  Easements would be permanent, legally binding, and would prevent of strictly regulate future development that would occur on the property. This assessment would thus be the compensation to the landowner who would have the monetary loss by conserving his/ her land. If the two parties (land owner and governmental agency) agree upon a price for the easement, the governmental agency would then purchase these rights which would subsequently enforce the agreement made in the easement.
  Source: http://www.dec.ny.gov/lands/41156.html
  - *Advantages:*
    - Straight forward
    - Future modifications that enhance quality or public use do not require the consent of a private owner.
    - Ultimate ownership control of property
  - *Disadvantages:*
    - Local government must take direct expenditure
    - Property is removed from tax rolls
    - Acquisition is likely to be subject to public debate

- **Private Acquisition by Non-Profit Conservation Groups**
  Non-profit conservation groups, such as land trusts, can be a vital resource for preserving scenic, historic, and ecological resources. In New York State, 90 land trusts are at work preserving land throughout the state, in both rural and urban areas. Mission based organizations often have extensive experience writing grants, and if their sole mission is acquisition and maintenance, they may be able to expedite the acquisition process through sharp negotiation skills and legal expertise. It will be important for the municipality to be vigilant in vetting the mission of each organization to ensure that the ecological resource will be treated in a way to enhance its quality.
  Less than fee-simple acquisition is a more common technique used to protect natural resources. The acquisition of conservation easements (through purchase or donation from a willing seller) is used by land trusts and municipalities to restrict the type and amount of development permitted on a particular parcel of land. The Purchase of Development Rights on agricultural lands is an example of a conservation easement program.

  - *Advantages:*

        - No direct acquisition expense for the municipality.
        - No direct maintenance expense for the municipality.
    - *Disadvantages:*
        - Private Ownership
        - Property removed from tax rolls.

- **Zoning:**

  Zoning is another useful tool that can be directly used at a municipal level to control development. While much of Upstate New York is underdeveloped, that is likely to change with the increasing population and changing climate. Therefore, utilizing and updating municipal zoning will not only increase resiliency but will lead to more sustainable growth within the region.

    - *Advantages:*

      Property owners maintain the value of their property

      Properties maintain their historic and ecological significance

    - *Disadvantages:*

      Some developers may be forgo development due to stringent review requirements

- **Performance Zoning:**
  Performance zoning is an alternate technique to conventional zoning. While conventional zoning has static standards for designated areas, performance zoning regulates the design and location of development based on land's suitability and geographical orientation. Once the criteria for performance is developed, a municipality can use this as a tool to guide development and protect important natural resources. At the same time, land owners and developers would have greater flexibility to meet their zoning requirements.
    - *Advantages*
        - Utilizes existing characteristics of property and conserves energy use.
        - Can be customized based on each property.
        - Can be controlled by municipality to protect specific lands.
        - Encourages mixed use development and in general more variety in use
        - Does not need to be consistently modified
    - Districts
        - Eliminates districts and a sense of uniformity which can be difficult for a community to handle
        - Could give developer too much authority and power which might create conflicting situations within the community
        - Could potentially be a complex system to manage, especially for municipalities with limited resources and staff.
- **Impact Fee**
  An impact fee is imposed by the municipal government. The fee is for developers who want to build or modify the local land use and thus permanently change the existing landscape. While this can be extremely useful in urban settings, this could also be used in rural communities to protect natural resources. The fees received from the developer could be then used to fix or mitigate any damage caused by the development.
    - Advantages
        - No cost to municipalities
        - Can be controlled to protect certain areas

- Disadvantages
  - Discourages development and investment

Resources and References

Food and Agricultural Organization of the United Nations:
http://www.fao.org/docrep/x5310e/x5310e05.htm#4.3%20kinds%20of%20land%20use%20and%20their%20requirements%20and%20limitations

New York State Division of Local governmental Services:
https://www.dos.ny.gov/lg/publications/Transfer_of_Development_Rights.pdf

New York State Department of Environmental Conservation:

http://www.dec.ny.gov/lands/41156.html