Water Resource Summary

Town of Chatham
2012

New York State Department of Environmental Conservation
Hudson River Estuary Program
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Background

This summary was completed upon request to provide information to the Town of Chatham for land use planning and decision-making. It identifies many of the most critical aspects and locations of the Town's local water resources based on information available to the New York State Department of Environmental Conservation (NYSDEC) and the New York State Water Resource Institute at Cornell University. It should not be considered a complete inventory because it is based only on existing information gleaned from various complementary, but not comprehensive, sources.

This Water Resource Summary complements the Habitat Summary from the Biodiversity Outreach Coordinator of the Hudson River Estuary Program. The summaries compile information on many natural resources, providing the Town of Chatham one source of useful information for town land use and planning decisions. Additional general information about water resources and the state of the waters of the Hudson Valley can be found on NYSDEC's webpages, starting with http://www.dec.ny.gov/lands/5098.html. If you have any questions about this summary, or want to know if it needs to be updated, please contact Andrew Meyer who works on municipal watershed issues.

Central to the information in this document is the concept of watersheds. A **watershed** is all the land that water flows across or under on its way to specific point, such as a river, lake, stream or bay. Precipitation flows through the landscape into intermittent streams, kills, creeks, rivers, aquifers, wetlands and floodplains of the Hudson Valley, connecting the landscape to form the watersheds of the Hudson River estuary and providing many necessities and vital benefits to human communities. When these water resources are working with functioning and healthy ecosystems, they deliver clean drinking water, filter pollutants, comprise habitat for plants and animals, absorb floodwaters, provide numerous recreation opportunities and have inspired citizens for thousands of years living in the Hudson Valley. Local municipalities have a critical role to play in restoring and maintaining the waters of the Hudson Valley. **To maintain our water for future generations, impacts to water resources need to be considered in the local decision-making process.**

This document was created by NYSDEC Hudson River Estuary Program and New York State Water Resource Institute at Cornell University. The Hudson River Estuary Program (http://www.dec.ny.gov/lands/4920.html) protects and improves the historic and scenic Hudson River watershed for all its residents. The program was created in 1987 and extends from the Federal Dam at Troy to the Verrazano Narrows. Its core mission is to:

- ensure clean water,
- protect and restore fish and wildlife habitats,
- provide recreation in and on the water,
- adapt to climate change, and
- conserve the scenic landscape.

The Hudson River Estuary Program is a project funded by the NYS Environmental Protection Fund. The New York State Water Resources Institute at Cornell University (http://wri.eas.cornell.edu/) seeks to foster an understanding of the critical connections between us and the waters of New York State, and to empower communities to make informed decisions about land use that minimize impacts to our water resources, including drinking water supplies, floodplains, and aquatic habitats.

Table of Contents

List of Figures

List of Tables

Introduction

Effective conservation, of which watershed management is an important component, occurs across property and political boundaries and requires a broader view of natural landscapes. This document will help to identify areas of your town where important resources exist and overlap. This summary is especially useful for setting priorities that support town planning through open space plans, comprehensive plans, natural resource inventories, and for developing critical environmental areas. Communities can incorporate their summaries directly into local plans or use the information to write their own documents. This summary goes hand-in-hand with the Habitat Summary also provided by the Hudson River Estuary Program, and together can provide critical information to local land use decisions.

If used to its fullest potential, a familiar and objective inventory can make the development review process faster and cheaper for all those involved. Though this summary does not contain the detail needed for site planning, it is useful for environmental reviews in several ways. First, by identifying high-quality water resources at the town-wide scale, it helps land use decision-makers and applicants place a proposed site plan in the context of the larger watershed. Second, the town can ask applicants to address how their proposed actions will affect the water resources identified in this summary. When town representatives and applicants identify areas and issues of concern at the very beginning of the planning process—before time and money have been invested in plans that ultimately need to be changed—the whole review process can function more smoothly and quickly. And third, the summary informs environmental review by highlighting areas that might need more detailed assessments. While this summary is limited to existing information and is therefore not a substitute for on-the-ground surveys and assessments, it provides a starting point for recognizing high-quality water resources in your town, as well as water resources that should be considered for restoration efforts.

This summary is broken up into three categories: watershed characteristics of the town, water quality standards and assessments, and the current status of water infrastructure in the town. These categories are broken into several topics. Each topic begins with a description and an investigation of potential impacts to our region's water quality. Each section then lists resources that can help municipalities improve the quality of our water resources. And lastly, information specifically about Chatham's water resources is contained in blue boxes, for easy navigation. You will find links throughout this document that will direct you to internet resources, and there is a reference section at the end. External hyperlinks as well as typed websites have been provided. All mentions of Figures and Tables are also internally hyperlinked. Lastly, maps are provided for many of the topics showing information for the Town of

Chatham. When viewed as a pdf, these maps have layers that can be turned on and off, to clarify the most important components depending on the need. The maps are not for jurisdictional or regulatory purposes; please contact your local NYSDEC environmental permits staff with regulatory questions. Also, please note that some of the water resources identified in this document are protected by state or federal programs. We recommend the town continue to work with the DEC Region 4 office in Schenectady and other appropriate agencies on issues involving regulated resources.

Limitations of the maps in this summary

It is important that users of the maps in this summary, and users of geographic information systems (GIS) data in general, understand the limitations of maps and GIS information. GIS data originate from many different sources, produced at different times and for different purposes. GIS data are often collected or developed from remote-sensed information (i.e., aerial photographs, satellite imagery) or derived from paper maps. For these reasons, GIS data can contain all the inaccuracies of the original data, in addition to any errors from converting the data to digital GIS information. Therefore, maps created using GIS data are not a substitute for surveys and direct knowledge.

It is also important to emphasize that this summary contains the most up-to-date information that is available at the time it was produced but new information is always being collected. The datasets contained here could change in important ways in the future. However, as this Water Resource Summary illustrates, using GIS to map information at the townwide-scale can help local decision-makers understand potential impacts, see patterns and relationships in their communities, and make better decisions as a result.

Watershed Characteristics

Watersheds and Subwatersheds

A watershed is all the land that water flows across or under on its way to a common point such as a river, lake, stream or bay. Watersheds are divided by high points on the land, such as ridges, mountains, and hills (Figure 1). Management of water resources are ideally accomplished within a watershed context. The appropriate watershed scale changes depending on the land use questions under consideration. Watershed planning units can encompass everything from the small watershed of two intermittent streams that drain an individual parcel to the much larger Hudson River watershed, about 13,500 square miles. Both eventually flow out to the Atlantic Ocean.

Standard watershed boundaries for the entire US have been created through the United States Geologic Survey's (USGS's) National Hydrography Dataset (http://nhd.usgs.gov/) in a nested hierarchy by size. These regions each have a Hydrologic Unit Code (HUC), and in this summary we use size 12 HUC subwatershed boundaries (delineated to encompass under 40,000 acres, about 60 square miles, each). These HUC 12 subwatersheds are the finest-scale data available for New York State through the USGS. They can be the most useful watershed units for municipalities because they often match the scale of the potential impacts and the authority of towns to eliminate or mitigate them.

There is a very strong relationship between land use and water quality in our streams, wetlands, and waterbodies. Land and water are connected through the interactions of water, sediment, organisms, and chemical components. **Healthy watersheds, including both land and water resources, can recharge groundwater, reduce erosion and flooding impacts, minimize public infrastructure and water treatment costs, and be more resilient to climate change—all ecosystem services that directly benefit our communities and cost less than the alternatives** (See http://water.epa.gov/polwaste/nps/watershed/ecoben_factsheet.cfm for more information).

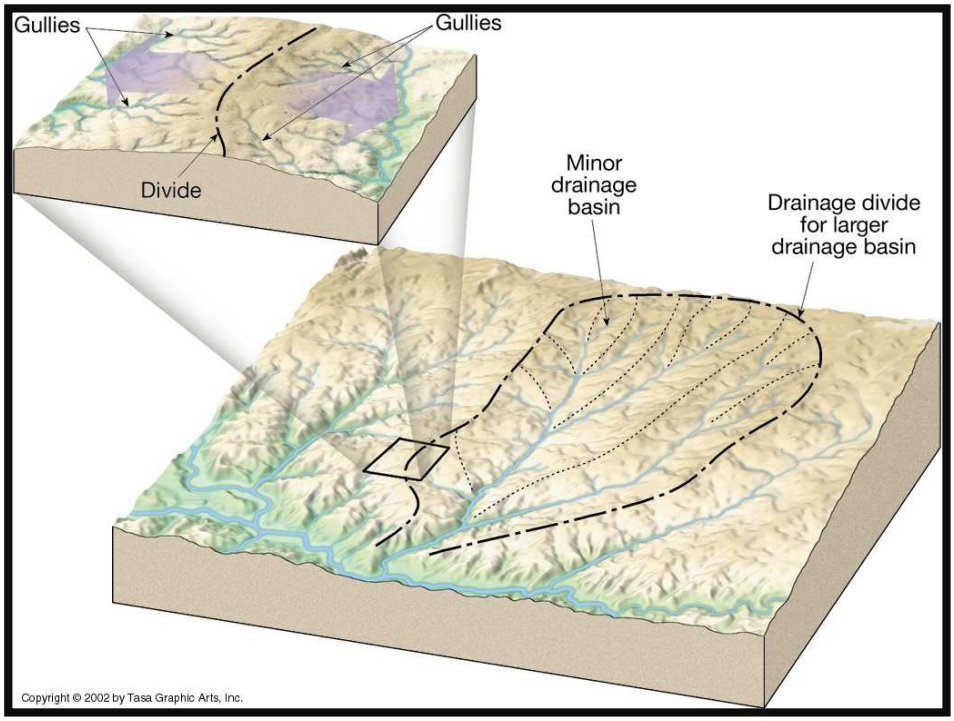


Figure 1: Watersheds are defined by the land that drains to a particular point in the landscape and are separated from one another by topographic divides. Smaller sub-watersheds are nested within larger watersheds.

Chatham Information: Watersheds

All of Chatham is part of the Hudson River watershed, meaning that streams and waterbodies eventually flow into the Hudson River and then into the Atlantic Ocean. At a finer scale, Chatham is part of the 330,000-acre Greater Stockport Creek watershed, which includes the Kinderhook and Claverack creeks and drains all or part of many nearby towns (Figure 2). Surface waters in the Town of Chatham flow into Kinderhook Creek, which then flows into Stockport Creek and quickly into the Hudson River Estuary. This watershed is further divided into subwatersheds, six in the Town of Chatham and four more close by. For many actions and decisions taken by towns, subwatersheds are the most appropriate ecological scale. Below is a list of the HUC 12 subwatersheds in and around Chatham (Figure 3):

- Green Brook-Kinderhook Creek
- Kline Kill
- Stockport Creek-Kinderhook Creek
- Stony Kill
- Tackawasick Creek-Kinderhook Creek
- Valatie Kill

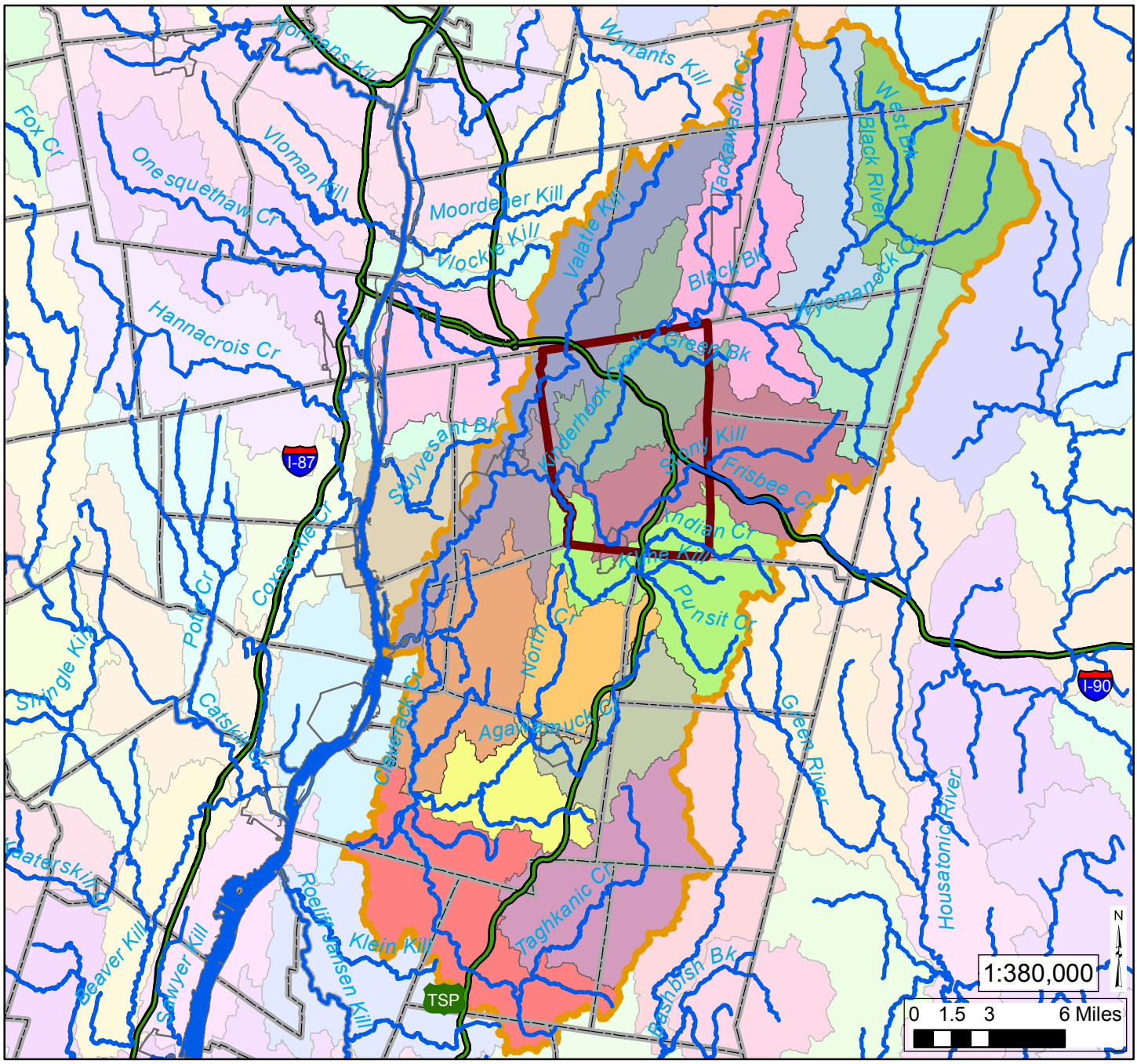
Just outside the town boundary, but visible in the maps of this summary, are these subwatersheds:

- Mill Creek-Hudson River (not in the Greater Stockport Creek watershed)
- Mud Creek-Claverack Creek (flows into Claverack Creek)
- North Creek (flows into Claverack Creek)
- Schodack Creek (not in the Greater Stockport Creek watershed)

The Greater Stockport Creek Watershed, encompassing most of the subwatersheds listed above, has an active watershed group, the Greater Stockport Creek Watershed Alliance (http://www.stockportwatershed.org/).

A watershed is "that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community."
-John Wesley Powell-

Figure 2: The Greater Stockport Creek Watershed, Subwatersheds and Major Streams in the Town of Chatham, Columbia County, NY



Legend

- Major stream
- Interstate or Parkway
- Town of Chatham
- Village boundary
- Town boundary
- County boundary
- Greater Stockport Creek Watershed

This map shows streams and watersheds in and around the Town of Chatham, Columbia County. Subwatershed are shown as well as the outline of the Greater Stockport Creek watershed. This map was produced as part of a Water Resource Summary for the Town. For more information, please contact NYSDEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Data Sources:

Northeast Aquatic Habitat Classification System (EPA, USGS, and TNC) (2010) for Massachusetts streams

USGS National Hydrography Dataset for New York streams and all Hydrologic Unit Code 10 watershed and 12 subwatersheds (2008)

Map Created 2012

Hudson River Estuary

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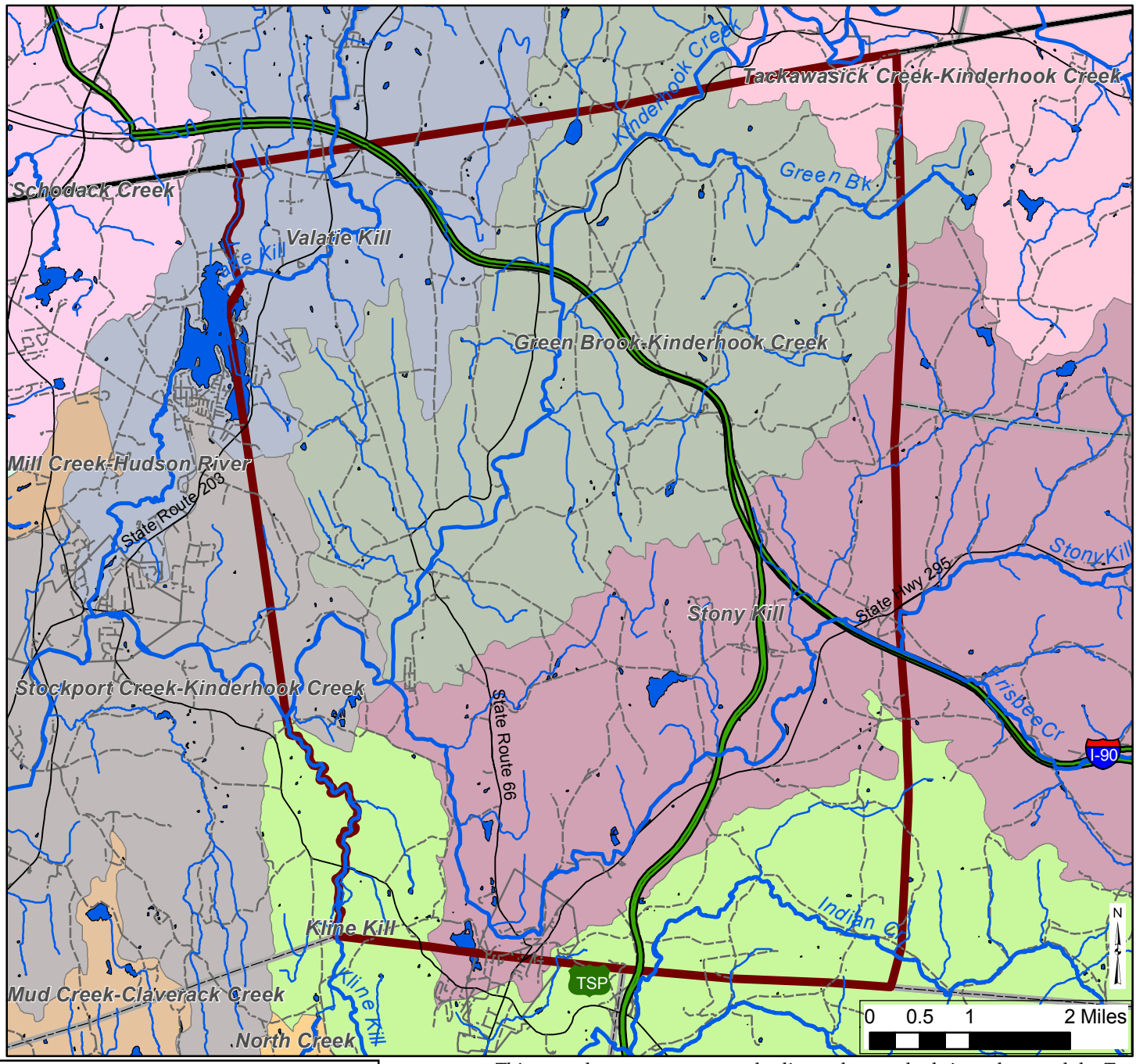
Cornell University

Figure 3: Subwatersheds in the Town of Chatham, Columbia County, NY



Legend

- Minor stream
- Major stream
- Interstate or Parkway
- US, State, and County Roads
- Local Streets
- Town of Chatham
- County boundary
- Village boundary
- Town boundary
- Green Brook-Kinderhook Creek
- Kline Kill
- Mill Creek-Hudson River
- Mud Creek-Claverack Creek
- North Creek
- Schodack Creek
- Stockport Creek-Kinderhook Creek
- Stony Kill
- Tackawasick Creek-Kinderhook Creek
- Valatie Kill

This map shows streams, waterbodies and watersheds in and around the Town of Chatham, Columbia County. Subwatershed boundaries are shown. Due to limitations of the available data, many intermittent and some perennial streams are missing.This map was produced as part of a Water Resource Summary for the Town. For more information, please contact NYSDEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Data Sources:
USGS National Hydrography Dataset for streams and waterbodies and Hydrologic Unit Code 12 subwatersheds (2008)
NYS Office of CSCIC (2011) for road data

Map Created 2012

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Water Resource Institute of New York State
Cornell University

Land Cover

The natural land cover and human land uses in a watershed have a strong influence on the health of the streams and other waterbodies into which they drain. Alteration and removal of natural cover (especially forests and wetlands) can decrease water quality by adding pollutants and sediment to streams. It also limits a stream's natural ability to cope with nutrient input and increases in water quantity. **Changes in natural cover, including substantial increases in impervious cover and decreases in natural cover, can drastically alter stream health and hydrology.** These changes cause more water to reach a stream faster, but enter the stream for a shorter amount of time. At the same time, changes to natural land cover can also decrease the baseflow in streams. When water is not able to infiltrate into the groundwater, streams lose an important source of water during dry periods. Taken together, these impacts can lead to "flashy" streams that carry much more water during storm events, with flooding and erosion consequences, and then run low or dry at other times of the year.

Baseflow: is the portion of stream flow made up by groundwater seepage. Streams are sustained by baseflow during dry times of the year.

In addition to current watershed land cover and use, other factors that can affect water quality include riparian (or streamside) condition and continuity, historical land uses, soils and geology, topography, the extent of wetlands, and point sources of pollution (Center for Watershed Protection 2003). On a subwatershed scale, land uses and management practices within the riparian and floodplain corridor are likely important influences on stream health.

Although many towns in the Hudson Valley are rural communities that aren't characterized by high-density development, it is important to note that building at higher densities is a valuable water resource protection strategy. To accommodate the same number of houses, denser development alters less natural land cover and creates less impervious cover than lower-density, sprawling forms of development. Directing new development and growth to existing village centers uses land more efficiently, saves money, and is often the best option to protect our water resources. The locations and concentrations of developed land cover/land use, as well as of forest, wetland, and agricultural can have substantial impacts on our water resources, both positive and negative. Knowing where these land covers/land uses occur can help a town understand and predict general impacts to our streams, lakes, and wetlands. Those indicators are the focus of land cover in this summary.

Impervious Cover: are surfaces that are impervious to water penetration, such as roads, conventional parking lots and rooftops.

See *Protecting Water Resources with Higher-Density Development* (http://www.epa.gov/dced/pdf/protect_water_higher_density.pdf) and the resource list at the end of the summary for more information on using higher density development as one strategy for protecting water resources. Conservation subdivisions, a development strategy that can help identify and preserve natural areas in residential housing projects, can have good results for our water resources when used appropriately. See *Creating Open Space Networks* (http://www.epa.gov/greenkit/pdfs/envdev1.pdf) in the EPA's Green Communities

toolbox (http://www.epa.gov/greenkit/index.htm) for more information. Another important tool to minimize impacts from loss of natural cover and increases in impervious cover is the use of green infrastructure practices; see the Green Infrastructure section below. See the accompanying Habitat Summary for more discussion on minimizing impacts from development to our habitats and water resources.

Information on land cover and land use comes from the National Land Cover Dataset (NLCD, http://www.mrlc.gov/), which contains land cover and land use information for the entire United States. **There are important limitations to the NLCD;** please see the Appendix 1 for more information on the NLCD data. Used in an appropriate manner, the land cover/land use data can be a useful tool to understand patterns of land use in towns and to identify areas of concern where land use could be impacting our water resources.

Chatham Information: Land Use and Land Cover

Figure 4 shows land use/land cover data within the Town of Chatham from the National Land Cover Database (NLCD). Much of the town is agricultural (including areas with cultivated crops and pasture/hay) or forested, with low-intensity development in many places. The location of various land uses in relation to streams or lakes can be significant for water quality. For example, development adjacent to a stream or near sensitive waterbodies can lead to water quality impacts. For a summary of land cover and land use by subwatershed and for the town as a whole, see Table 1. Town of Chatham code requires conservation subdivisions as the standard practice for major subdivisions and or on parcels greater than 50 acres seeking subdivision into three or more parcels.

The *Columbia County Hazard Mitigation Plan* (http://www.columbiacountyny.com/documents/misc/columbia_hazard_mitigation_plan.pdf) notes that almost every town in the County is losing farmland and forests to residential and commercial uses. The Town of Chatham identified farmland-to-residential development as the overarching trend in the town. Residential development in former agricultural areas could be leading to a number of impacts to the habitats and water resources of the town commonly associated with sprawling forms of development, including habitat fragmentation, alteration of perennial and intermittent stream channels, water quality issues, loss or shrinking of riparian and wetland buffers, and others. See resources above for techniques to help address these impacts.

Impervious Cover

Impervious surfaces are places where precipitation can't infiltrate into the soil and recharge groundwater, resulting in increases in stormwater runoff. Conventional roofs, parking lots, driveways, sidewalks, and roads are common impervious surfaces. Impervious surface cover can be used as a proxy for development within a watershed to look for associated changes to water quality. Research has found that increases in impervious cover are linked to degradation in water quality and aquatic habitat value and an increase in flooding problems (Walsh et al. 2005).

While the location and configuration of impervious surfaces in a watershed are significant, research strongly suggests that a critical threshold of impervious cover (often about 10%) exists beyond which the probability of stream degradation is greatly increased (National Research Council 2008, Walsh et al. 2005). And, in research undertaken in several small Dutchess County watersheds, impacts to nutrient levels in streams have been found when watersheds are less than 5% impervious (Cunningham et al 2009). In the Hudson Valley, impacts associated with impervious cover, such as urban/storm runoff and municipal discharges, are a leading cause of impairment to our streams and lakes (Bureau of Watershed Assessment and Management, Division of Water, NYSDEC 2008). For more information on these impacts see the Waterbody Impairment section in this summary. For more information on stormwater, see the Water Infrastructure section.

On a site-specific scale, there are many actions that can be taken by homeowners and developers and encouraged by planning boards to minimize impervious cover and promote best stormwater management practices. See *Protection Water Quality with Smart Growth Strategies and Natural Stormwater Management in Sussex County, Delaware* (http://www.epa.gov/dced/pdf/2009_0106_sussex_county.pdf) for a good introduction to site-specific actions for minimizing impervious cover. See Appendix 1 for information on areas that have collected fine-scale impervious cover information.

Chatham Information: Impervious Cover

As a whole, the Town of Chatham does not have high impervious surface cover (Table 1). Of the watersheds shown in Figure 3, the Stockport Creek-Kinderhook Creek subwatershed has the highest average impervious cover, at 3.5%. Impervious cover could still be of concern in certain localized areas, such as in the Village of Chatham or around Kinderhook Lake and Smith Pond (Figure 5; also see the section below on Waterbody Impairment and Table 4). When impervious cover amounts are relatively small, as they are in Chatham, other factors such as riparian condition, forest and wetland cover, agriculture, and point-sources of pollution become most important for addressing watershed-scale water quality issues.

Forest Cover

Forests are one of the most beneficial land covers in our region for many reasons, and their benefits to our water resources are well established. Conserving and managing forests are necessary to provide clean drinking water for us and future generations and critical habitat for numerous plants and animals. Research has shown that watersheds with greater percentages of forest cover can save significant drinking water treatment costs. For more information, see an Environmental Protection Agency (EPA) fact sheet on the economic benefits of healthy watersheds (http://water.epa.gov/polwaste/nps/watershed/upload/economic_benefits_factsheet3.pdf).

More information on the value of local forests can be found in the Habitat Resource Summary. Helpful resources to guide forest management for water quality benefits include the Center for Watershed Protection's *Watershed Forestry Resource Guide* (http://www.forestsforwatersheds.org/forests-and-drinking-water/), which offers a summary of projects that explore links between forest cover and economic benefits to our communities. The NYSDEC Division of Lands and Forests' Forest Stewardship Program (http://www.dec.ny.gov/lands/45934.html) provides technical assistance and resources to private forest owners to guide them in their use and management of forest lands. Cornell Cooperative Extension's Forest Connect (http://www2.dnr.cornell.edu/ext/forestconnect/) website also offers valuable information, geared to private forest owners and elected officials. *The Municipal Official's Guide to Forestry in New York State* (http://www2.dnr.cornell.edu/ext/info/pubs/management/MunicipalOfficialsGuideToForestry.pdf) provides a useful guide to promoting healthy forestry through local planning and zoning efforts.

Chatham Information: Forest Cover

Table 1 shows forest cover by subwatershed, which ranges from 42% to 83% in and around the Town of Chatham (see also Figure 3). The importance of large forests, the landscape context of forests, forest quality, and the value of forests for rare species are all addressed in the accompanying Habitat Summary.

Clear-cutting in Chatham could be subject to NYSDEC permitting authority if it is within the 100 foot setback of a state-regulated wetland, though firewood collection and selective cutting do not need permits in this zone. Also, clear-cutting is subject to a Stormwater Pollution Discharge Elimination System (SPDES) general permit if it disturbs more than one acre, though on-going silviculture with a forest management plan is exempt. For general harvesting info see http://www.dec.ny.gov/lands/5242.html, and for more detailed information on timber harvesting and NYSDEC permits, see the stormwater permit frequently asked questions (http://www.dec.ny.gov/docs/water_pdf/constrfaq.pdf). For more information on stormwater pollution prevention plans (SWPPPs), see the Stormwater Management section of this summary. Permits may also be required from the NYSDEC and/or the Army Corps of Engineers for stream crossings.

For guidance on the regulation of specific sites, contact the NYSDEC for the most precise information. For the Town of Chatham, Steven Swenson (1-607-652-2645, stswenso@ gw.dec.state.ny.us) is the NYSDEC biologist responsible for state regulation in the protection of surface water resources.

Agricultural Lands

Farms are a critical part of our communities and have many economic and social benefits. However, agriculture is also one of the biggest sources of impacts to water quality in the Hudson River Estuary watershed (Bureau of Watershed Assessment and Management, Division of Water, NYSDEC 2008), and together with urban/storm runoff, accounts for more than two-thirds of the impacts to our streams. Farms can impact streams by contributing nutrients, pesticides, sediment and bacteria to streams, or by altering stream flow. The effects of agriculture on streams can be managed through best management practices that reduce soil erosion and fertilizer and pesticide applications, which can make their way to our streams and other waterbodies.

For information on minimizing the impacts of agricultural land uses to our streams, local resources include the Columbia County Soil and Water Conservation District (http://www.ccswcd.org/) and the USDA-Natural Resources Conservation Service (http://www.ny.nrcs.usda.gov). The Farmscape Ecology Program (http://hawthornevalleyfarm .org/fep/), based in Ghent, NY, provides many sources of information about agricultural ecology and on-farm biodiversity. Also, the Agricultural Environmental Management (http://www.nys-soilandwater.org/aem/index.html) program of the NYS Soil and Water Conservation Committee is an incentive-based program that assists farmers with common-sense, cost-effective and science-based decisions to help farms meet their business needs and conserve the State's natural resources.

Chatham Information: Agricultural Lands

In the Town of Chatham, subwatersheds vary from 6% to 36% agricultural land cover (see Table 1), including pasture/hay and cultivated crops (NLCD 2006). Agricultural practices may be negatively affecting streams and waterbodies in Chatham's subwatersheds (see the section below on Waterbody Impairment and Table 3), but agricultural impacts to our waters are very dependent on the individual management of farms, so outreach to local farmers involving best management practices has an important role in improving water quality.

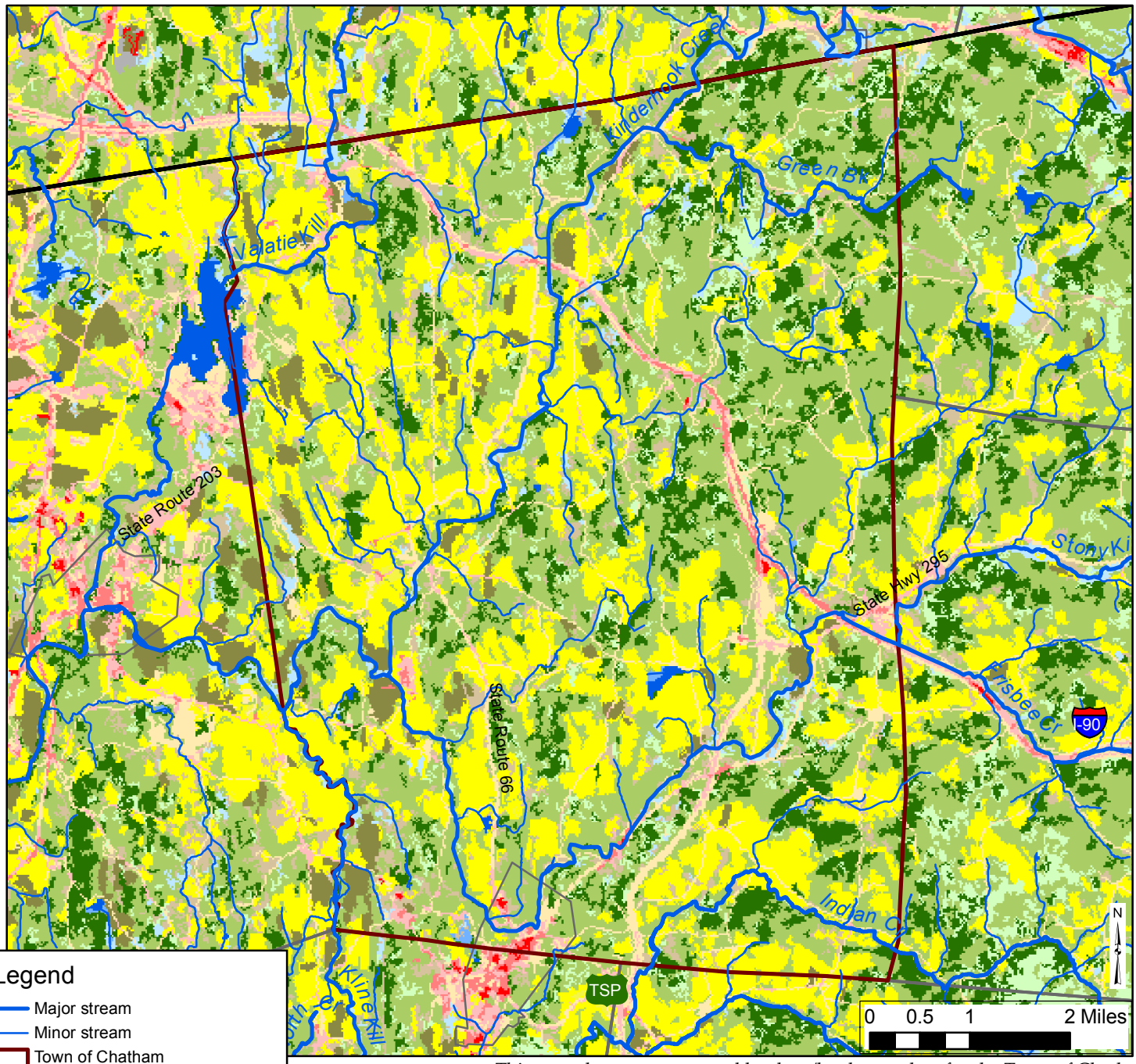
Thousands have lived
without love, not one
without water.
-W.H. Auden-

Table 1: Subwatersheds and land cover/land use in the Town of Chatham, NY

Subwatershed	Area (square miles)	Impervious Surface (%) (mean % imperviousness of each pixel)	Forest Cover (%)	Agricultural lands (%) (including pasture/hay and cultivated crops)
Green Brook-Kinderhook Creek	30	1.0%	63%	23%
Kline Kill	39	1.0%	63%	27%
Stockport Creek-Kinderhook Creek	25	3.5%	42%	36%
Stony Kill	43	1.6%	65%	20%
Tackawasick Creek-Kinderhook Creek	50	0.7%	83%	6%
Valatie Kill	40	2.2%	52%	22%
Average for the Town of Chatham	54	1.5%	54%	30%

The health of our waters is the principal measure of how we live on the land.
-Luna Leopold-

Figure 4: Land Cover and Land Use, including Forests, Agriculture, and Impervious Cover, Town of Chatham, Columbia County, NY



Legend

- Major stream
- Minor stream
- Town of Chatham

NLCD Landcover (2006)

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

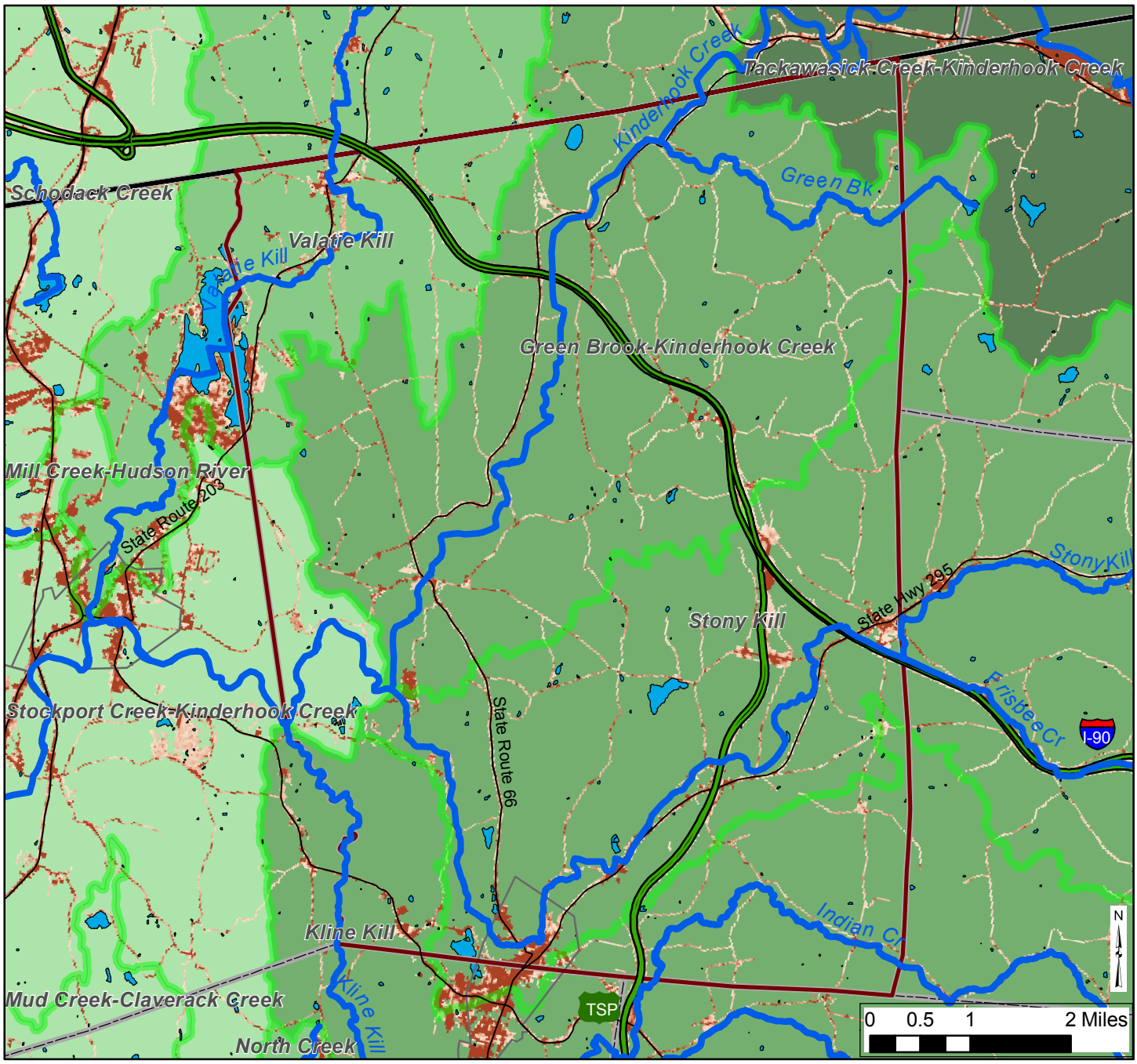
This map shows streams, and landuse/landcover data for the Town of Chatham, Columbia County. Landuse and landcover information is not appropriate for site scale planning. This map was produced as part of a Water Resources Summary for the Town. For more information, please contact NYSDEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Data Sources:
USGS National Hydrography Dataset (2008) for streams
USGS National Landcover Database (2006) for land use and land cover data

Map Created 2012

Hudson River Estuary
Water Resource Institute of New York State
Cornell University

Figure 5: Impervious Cover and Forest Cover in the Town of Chatham, Columbia County, NY



Legend

Subwatershed boundary

Percent Impervious Cover

100% 0%

Percent Forest Cover by Subwatershed

- 0 - 30
- 31 - 45
- 46 - 60
- 61 - 75
- 76 - 90

This map shows percent impervious cover, averaged in 30sq m grids, as well as percent forest cover averaged by subwatershed, for the Town of Chatham, Columbia County. For both datasets, darker colors indicate higher percent cover values. **This map is not appropriate for site planning and is not a viable substitute for on-the-ground knowledge and site visits.** This map was produced as part of a Water Resource Summary for the Town. For more information, please contact NYSDEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Data Sources:

USGS National Land Cover Database Land Cover and Percent Developed Imperviousness (2006) for forest cover and impervious cover

USGS National Hydrography Dataset for streams, waterbodies and Hydrologic Unit Code 12 subwatersheds (2008)

Map Created 2012

Hudson River Estuary

Water Resource Institute of New York State

Cornell University

Aquifers

Aquifers are saturated underground areas that can yield usable amounts of water to wells and springs. Many Hudson Valley communities depend on drinking water extracted from aquifers, both through municipal and private wells. Aquifers are critically important water resources for present and future generations who will need continued access to clean water. Groundwater, which includes aquifers and other underground water, is particularly important during dry periods of the year because it can be a constant source of water moving into our streams and rivers.

Aquifers can become polluted in many ways, including unintentional chemical spills, intentional addition of chemicals to the landscape, as well as improperly spaced or poorly functioning septic systems. Unsustainable aquifer extraction and consumption that exceeds recharge can result in wells running dry, with the associated expense of digging deeper wells or buying water. Excessive extraction can also harm aquatic organisms by changing the stream flows and water temperatures they rely on for survival and successful reproduction.

An overlay district is one form of aquifer protection that can come from a municipality. A district can help protect aquifers in a number of ways, including setting up buffer requirements around wells, requiring maintenance of wastewater treatment facilities, including septic systems, and identifying appropriate land uses in aquifer recharge areas. Examples of municipal aquifer protection in New York are gathered in PACE Land Use Law Center's Gaining Ground database (http://landuse.law.pace.edu/SPT--BrowseResources.php?ParentId=410). Aquifer protection should be tailored to local needs. Contact a watershed specialist to help you navigate this resource.

USGS Aquifer Maps

Aquifers in the state were mapped by the USGS in partnership with the NYSDEC. Because the scale of the original aquifer maps is 1:250,000, these maps indicate only the general location of the unconsolidated aquifers; they are not intended for detailed site evaluations. See Appendix 1 for more information on the USGS aquifer maps.

Other Sources

Sources of data for groundwater information also include: well reports, published groundwater studies, unpublished consultant reports, well constructors, county health departments, and source water assessment reports. In addition, the organizations listed below can provide valuable information and services for protecting aquifers and other groundwater

Chatham Information: Aquifers (USGS)

Figure 6 shows two classes of known, mapped aquifers, which differ in the yield associated with each class. Chatham has both high- and medium-yield aquifers that supply water for both people and streams (Figure 6). Chatham has over 1,700 acres of high-yield and 8,500 acres of mid-yield aquifers. Certain land uses are inappropriate in areas that have been identified as important to a community's drinking water supply, and towns should seek to site potentially harmful land uses in the least sensitive areas. Many streams in Chatham, including the Kinderhook, Valatie Kill, Stony Kill, Kline Kill and Indian Creek are underlain by aquifers, making development choices along streams even more important to the Town.

A more detailed analysis than what we provide here is required to identify more specific potential threats to Chatham's aquifers and groundwater resources.

resources.

Groundwater quality monitoring in New York State is done through a partnership between the NYSDEC Division of Water and the USGS. The Ambient Groundwater Monitoring Program (http://www.dec.ny.gov/lands/36117.html) seeks to assess and report on the quality of the state's groundwater, identify long-term groundwater quality trends, characterize naturally occurring conditions, and establish an initial statewide comprehensive groundwater quality baseline. The Lower Hudson River drainage basin (which includes the Town of Chatham) is undergoing a study over the next three years. Contact Scott Kishbaugh (sakashba@gw.dec.state.ny.us) for more information on the program or the locations of their groundwater quality sampling.

Dutchess County's Waste and Wastewater Authority recently commissioned a countywide aquifer recharge rate analysis. In Dutchess, the rates can be used to calculate sustainable septic densities, helping to prevent aquifers from becoming contaminated through septic outflow that is too dense. The report, *Dutchess County Aquifer Recharge Rates & Sustainable Septic System Density Recommendations*, can be found at: http://www.co.dutchess.ny.us/CountyGov/Departments/Planning/16891.htm and is a useful document for towns that are interested in starting a similar process.

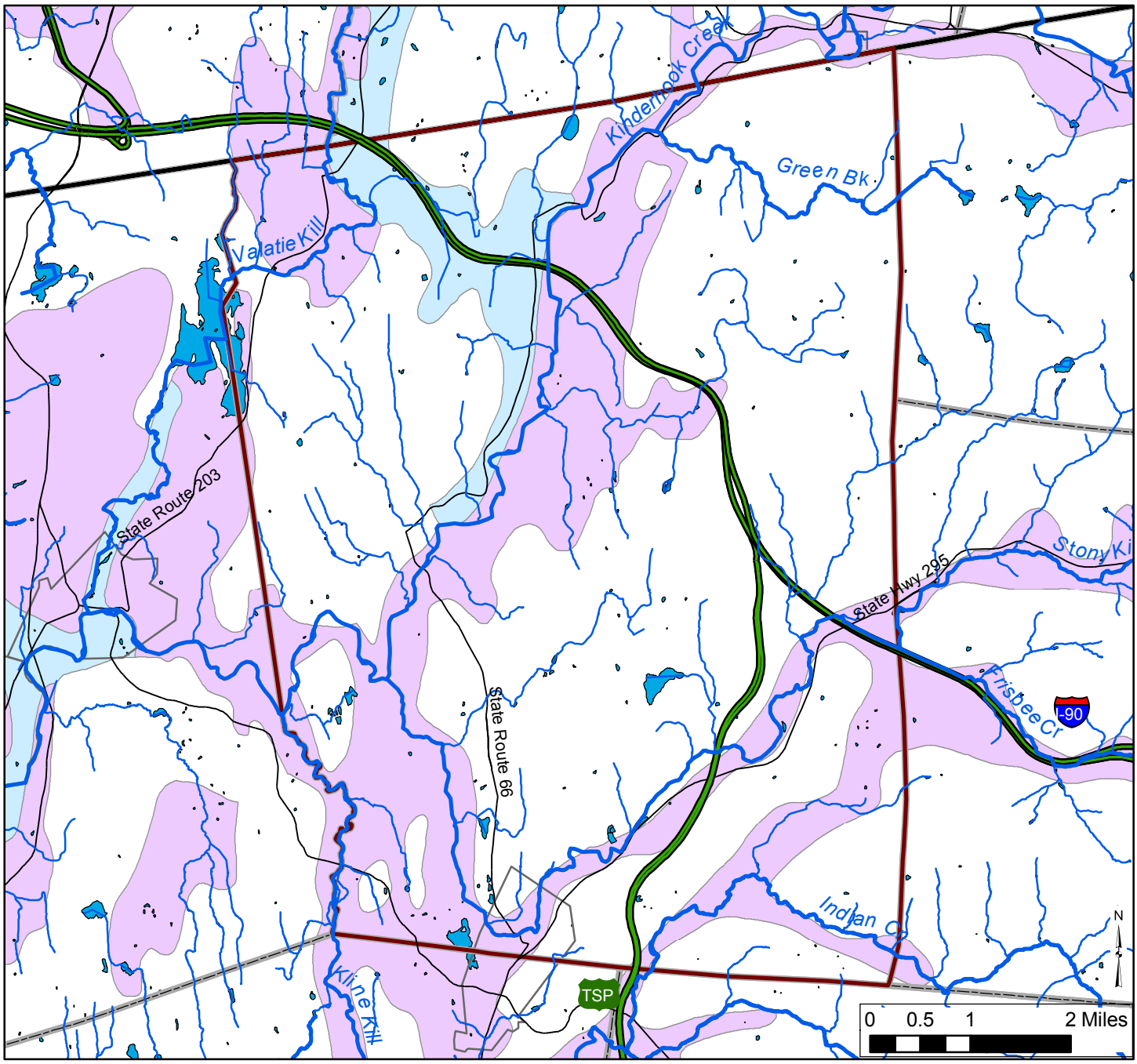
The New York Rural Water Association (http://www.nyruralwater.org/) is a not-for-profit organization that helps public and private rural water and wastewater systems provide safe drinking water and protect the environment at an affordable cost to the user. They can help communities identify areas where groundwater protection is appropriate, look for potential conflicts between land use and groundwater resources, address wellhead or groundwater protection plans, assess wastewater treatment systems, and offer many other services. Contact them (Phone: 518-828-3155 Email: nyrwa@nyruralwater.org) for information on conducting a finer-scale analysis of your community's aquifer and groundwater resources.

Chatham Information: <u>Aquifers</u>

Chatham has been working with the New York Rural Water Association to get more detailed information on groundwater and aquifers in the town. This process is still underway. For more information on this project, contact Steven Winkley, Water Resource Specialist at the New York Rural Water Association (winkley@nyruralwater.org).

When the well is dry, we know the worth of water
-Benjamin Franklin-

Figure 6: Aquifers in the Town of Chatham, Columbia County, NY



This map shows streams, waterbodies and known aquifers for the Town of Chatham, Columbia County. Aquifers were defined as "High Yield" (>100 gpm) and as "Mid Yield (10 to 100 gpm). **Aquifers were mapped at a very course scale (1:250,000) and are for general information only; this map should not be used at the site plan scale.** This map was produced as part of a Water Resources Summary for the Town. For more information, please contact NYSDEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Legend

- Minor stream
- Major stream

Main Unconsolidated Aquifers (1:250,000)

- Unconfined, High Yield
- Unconfined, Mid Yield

Data Sources:

NYSDEC Bureau of Water Resources Management (2008) for aquifer data
USGS National Hydrography Dataset (2008) for streams and waterbodies

Map Created 2012

Hudson River Estuary

Water Resource Institute of New York State

Cornell University

Floodplains and Riparian Buffers

Floodplains and riparian buffers provide many critical functions for a healthy stream and its watershed. Successful stream management done at a watershed scale needs to include the condition and connection of a stream to its floodplain and shoreline. *Life at the Water's Edge: Living in Harmony With Your Backyard Stream* (http://www.epa.gov/ecopage/aquatic/lifedge.pdf) is an accessible document for private property owners that address floodplains, buffers, and other stream management concepts. CatskillStreams.org is a useful website for information on stream stewardship, and links to many other projects dealing with connections between streams and watersheds. The Chemung County Soil and Water Conservation District created a very useful document that provides an overview of streams and stream processes in a watershed context. The document, *Stream Processes, A Guide to Living in Harmony with Streams* (Chemung County Soil and Water Conservation District 2006), can be found on the Chemung County Soil and Water Conservation District (http://www.chemungcountyswcd.com/) website, under stream guide.

Floodplains

Floodplains are low-lying areas, often next to streams and rivers that are inundated when there are heavy precipitation or snow melt events. Floodplains are naturally connected to streams, but they can extend far from their stream or river and don't necessarily have to be alongside streams. Flooding is a natural process, and is one way that a stream reacts to an increase in water coming into the stream. Streams of all sizes can have floodplains at various locations along its length; the total size, distance from the stream, and connection to streams can vary greatly with topography and other local conditions. **Floodplains perform many important functions:**

- prevention of erosion,
- habitat for wildlife,
- temporary storage of floodwaters,
- moderation of peak flows,
- maintenance of water quality,
- recharge of groundwater,
- recreational opportunities,
- and aesthetic benefits.

When left in a natural state, floodplains act as a type of natural infrastructure, providing a safety zone between people and the damaging waters of a flood. Building in floodplains increases the risk of property damage and loss of life. The locations of floodplain boundaries can change over time and in response to changing weather patterns, changes in land use in and around the floodplain and in the surrounding watershed, obstructions in the floodway, stream projects (including dams and levees), and natural stream processes.

The Federal Emergency Management Administration (FEMA) has developed detailed floodplain maps for the National Flood Insurance Program (http://www.fema.gov/national-flood-insurance-program). These Flood Insurance Rate Maps (FIRM) maps show areas that are estimated to have a one percent chance or greater probability of the being inundated in any given year (commonly referred to as the 100-year flood). Areas with 0.2% chance of flooding in a given year (500-year flood) are also included in FIRM maps. While these maps can provide a valuable planning tool, it is important to note that FIRM maps are

Floodplain regulation: Local governments are the primary enforcer of floodplain regulations

only estimates based on the data and modeling technology available at the time of mapping. Due to the unpredictable nature of some kinds of floods, maps also don't show many areas subject to flooding from localized drainage problems including undersized culverts, ice jams, or sheet flooding down a slope.

Communities that adopt floodplain management ordinances in accordance with FEMA guidelines can qualify for federal flood insurance and many different kinds of disaster assistance. FEMA requires that local laws for flood damage prevention contain specific standards for any development in federally mapped Special Flood Hazard Areas (generally this is the 100-year floodplain). In partnership with federal and local governments, NYSDEC's Bureau of Dams and Flood Protection provides technical assistance to communities for the administration of local floodplain regulations, including a model local law for flood damage protection. More information is available at http://www.dec.ny.gov/lands/24267.html or contact the Bureau at 518-402-8185 or floodpln@gw.dec.state.ny.us.

Riparian: describes the ecosystems that occur along a water body, the transitional area influenced by the land and water.

Chatham Information: Floodplains

Based on FIRM maps, 5.3% of Chatham is within a 100-year floodplain and 5.5% is within a 500-year floodplain. *Columbia County Multi-Jurisdictional Hazard Mitigation Plan* (http://www.columbiacountyny.com/documents/misc/columbia_hazard_mitigation_plan.pdf) identifies 45 properties (43 residences and 2 commercial) and 4 critical infrastructures sites at risk for flood damage in Chatham, representing over $159 million dollars in possible flood related losses. The most current FIRM maps that cover the Town of Chatham have effective dates between 1982 and1993. FEMA has recently updated many flood hazard maps across the country to reflect physical changes in floodplains, new data, and modeling capabilities. However, at the time of this writing, no update has been scheduled for Columbia County. An overview map of floodplains in Chatham is available at: http://chathamnewyork.us/wp-content/uploads/2012/06/4-WaterFeatures1.pdf. FEMA data is available at http://www.fema.gov/national-flood-insurance-program/map-service-center (see Map Service Center link).

Riparian Buffers:
Riparian areas include streambanks, lakeshores, wetlands, and floodplains. A riparian buffer, also known as stream buffer, is the vegetated area between a waterbody and human activity, often used to protect the stream from various detrimental influences. A healthy, vegetated riparian buffer helps improve stream health and water quality by:

- filtering and slowing pollution runoff,
- preventing soil erosion,
- providing upland habitat,
- contributing essential nutrients to the food chain,
- providing woody debris for in-stream habitat,
- and shading the stream to keep water temperatures down.

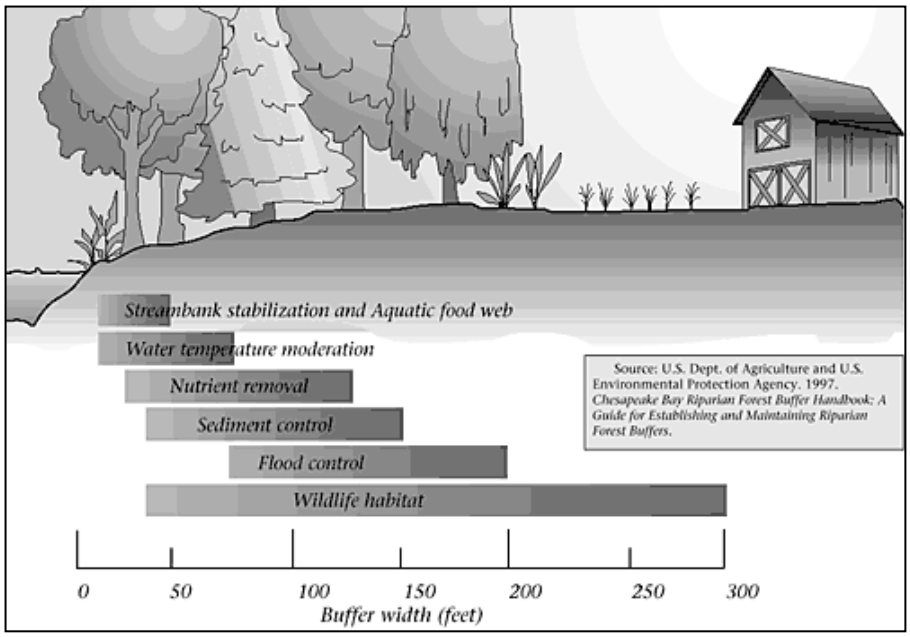


Figure 7: Buffer function based on width

Buffers can also help absorb and slow flood waters to protect human life and property. Varying buffer widths provide differing functions to support human needs and the ecosystem (see Figure 7). We recommend at least a 300-foot buffer for streams. Narrower buffers could still provide viable functions and critical protections, and wider buffers could still be very important to habitat connectivity and other wildlife concerns. Protecting existing buffers and restoring degraded ones can help protect streams.

Municipalities can protect buffers and floodplains by enacting local watercourse buffer ordinances and conservation overlays, and implementing buffer and floodplain protections through State Environmental Quality Reviews (SEQR). Municipalities can also encourage property landowners to allow native trees, shrubs and vegetation to grow along streams. More information on these techniques is available in the NYSDEC Handbook: *Conserving Natural Areas and Wildlife in Your Community: Smart Growth Strategies for Protecting the Biological Diversity of New York's Hudson River Valley* (http://www.dec.ny.gov/lands/50083.html). The Hudson Estuary Trees for Tribs (http://www.dec.ny.gov/lands/43668.html) program provides free native trees and shrubs and technical assistance for replanting riparian areas. In agricultural areas, the United States Department of Agriculture Conservation Reserve Enhancement Program (CREP) (http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=cep) offers support to increased conservation practices such as filter strips and forested buffers.

Chatham Information: Riparian Buffers

Using a coarse estimation based on the land cover within 300 feet of Chatham's mapped streams (but see the NLCD section in Appendix 1 for important limitations of the data) the riparian areas in Chatham are 62% natural cover (47% forests, 7% shrub/scrub and 5% wetlands), 27% agricultural (24% pasture, 27% cultivated) and 11% developed. The large proportion of agricultural cover might reveal opportunities for the community to assist farmers with the identification of best management practices to minimize the impact on streams. See the previous section on Agricultural Lands for more resources.

More detailed studies would be needed to identify specific opportunities for protection and restoration of riparian areas in Chatham.

Water Quality Standards and Assessments

In this section, we report information on waterbody classification, assessment, and impairment. A waterbody's classification, along with its assessment results, leads to an understanding of its health and can lead to the designation of the stream or waterbody as impaired. **This Summary is not a regulatory document; questions about the classification and impairment of specific streams should be directed to the NYSDEC regional office.** The maps displayed here show unofficial stream segment and waterbody information, but are largely consistent with the official version.

The following information on water quality is collected and displayed for particular streams and waterbodies, but it's important to remember that stream management should take place in a watershed context. The effects of land use on streams, and stream health on everything from habitat to real estate values, highlight the critical connection between the two.

Waterbody Classification

The NYSDEC's classification of a waterbody designates the "best uses" that it should be supporting. Waterbodies are classified by letters: A, B, C, or D for freshwater. (For more information about classifications, see: http://www.dec.ny.gov/chemical/23853.html .) For each class, the designated best uses are defined as:

- Class A, AA, A-S, or AA-S – water supply, primary and secondary contact recreation, and fishing
- Class B – primary and secondary contact recreation, fishing
- Class C – fishing and wildlife propagation
- Class D – fishing

Waterbodies with classifications A, B, or C may also have an associated standard of (T), indicating that these are trout waters, or (TS), indicating that these are trout spawning waters. For more information about the best uses designated for each classification, see: http://www.dec.ny.gov/regs/4592.html. The NYSDEC recognizes that some waterbodies have an existing quality that is better than their assigned classification, and uses an antidegredation policy to protect and maintain high-quality streams.

NYSDEC also establishes water quality standards, specific to particular parameters and pollutants, to protect the uses associated with these classifications. Standards can be numerical or narrative. For example, dissolved oxygen has a numerical standard of no less than 7.0 mg/L in trout spawning waters. Turbidity has a narrative water quality standard, which states that there should be "no increase that will cause a substantial visible contrast to natural conditions." Information on surface water and groundwater quality standards can be found in at http://www.dec.ny.gov/regs/4590.html. If waterbodies are not supporting the standards for their best uses, they may be listed on the Priority Waterbody List as Impaired (see Waterbody Impairment section below).

Activities allowed in and around waterbodies are regulated based on their classification and standard. C(T), C(TS), and all types of B and A streams (as well as water bodies under 10 acres located in the course of these streams) are collectively referred to as "protected streams," and are subject to the stream protection provisions of the Protection of Waters

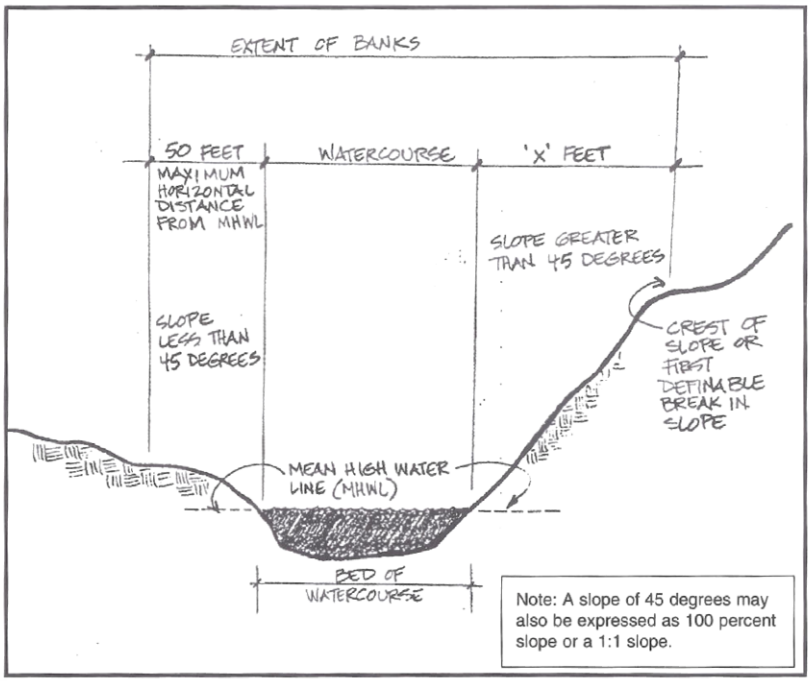


Figure 8: Visual representation of NYSDEC stream bank regulation (NYSDEC Protection of Waters Application sample plans (http://www.dec.ny.gov/permits/6333.html)).

(http://www.dec.ny.gov /permits/6042.html) regulations in Article 15.

On protected streams, the DEC regulates the bed and banks, defined as the area immediately adjacent to and sloping towards the stream, extending 50 feet or more (Figure 8). Activities that excavate, fill, or disturb the bed or banks of protected streams require a NYSDEC permit (see http://www.dec.ny.gov/permits/6554.html for more information). In situations where streams are unmapped in NYSDEC databases, perennial streams take on the classification of the receiving stream while intermittent streams become Class D.

Article 15 also offers protection to the navigable waters of the state. Permits are required from the DEC for direct or indirect excavating or filling of navigable waters, which can include perennial streams and intermittent streams. This regulatory authority also covers estuaries, marshes, tidal marshes and other wetlands inundated at mean high water level or tide that are adjacent and contiguous at any point to any of New York State's navigable waters. See http://www.dec.ny.gov/regs/4438.html#15885 for more information on this form of protection for streams, wetlands and other waterbodies.

While the regulations stemming from stream classifications provide some level of protection from damage to streams' bed and banks, the lack of jurisdiction on "non-protected streams" shouldn't be misinterpreted to mean that the stream or river doesn't need local protection. There is scientific justification to protect all streams and rivers from pollution and damage to their channels (see http://www.americanrivers.org/assets/pdfs/reports-and-publications/Where_Rivers_Are_Born804d.pdf for more information). Unprotected streams are often small, but these small streams run into larger ones, directly affecting their water quality. Strong watershed protection needs to address all water resources in the watershed, not just those that meet certain classifications. Limitations in state regulations should be thought of as an opportunity for local-level protection efforts. NYSDEC encourages municipalities to go beyond the state regulations to protect waterbodies through local measures.

Stream protection from NYSDEC: streams of class C(T) or higher and their bed and banks are regulated by NYSDEC. Wetlands contiguous to those streams may also be regulated.

There are many options available for protecting streams at the local level. Many towns in the Hudson Valley have steep slope ordinances and other land use measures, which provide some protection from

sediment and other pollutants entering our streams. Several towns have gone one step further and enacted watercourse ordinances that measurably help fill the void of critical stream, wetland and watershed protection. *Conserving Natural Areas and Wildlife in Your Community* (http://www.dec.ny.gov/lands/50083.html) is a reference for planning and implementing conservation on a municipal scale. There are several good ideas for municipal stream protection in Chapter 5. For more information on neighboring communities that have enacted local protection measures, contact the Hudson River Estuary Program watershed specialists.

Chatham Information: Waterbody Classification

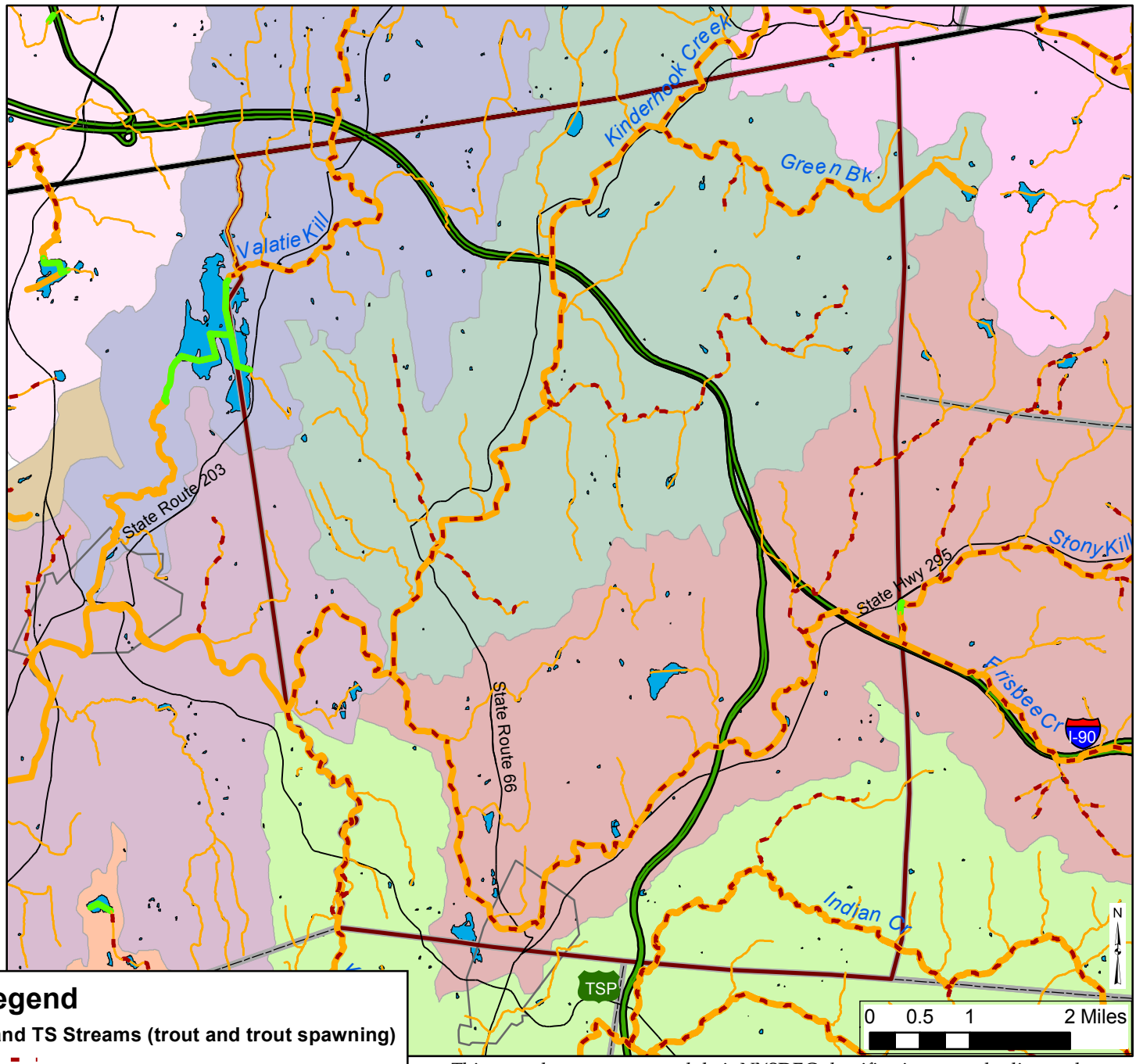
Streams in the town are divided into segments with different classifications (see Table 2). Nearly 100 miles of stream are classified as C in the Town of Chatham, and there is 0.16 miles of class B streams. Kinderhook Lake as well as an unnamed waterbody on the southwestern border of Chatham are Class B. The Town of Chatham has over 47 miles of streams classified as trout supporting (T) and trout spawning (TS) by the NYSDEC (Figure 9). All told, Chatham has almost 50 miles of streams regulated by the NYSDEC. Well over 100 miles of streams (perennial and intermittent) are not considered protected waters by the NYSDEC.

For the Town of Chatham, Steven Swenson (1-607-652-2645, stswenso@gw.dec.state.ny.us) is the NYSDEC biologist responsible for applying state regulation in the protection of surface water resources. Contact him for questions regarding stream classifications.

Table 2: Stream and Waterbody Classifications in the Town of Chatham, NY

Stream Segment	Classification	Managed/Protected to Support
Valatie Kill (Middle and Tribs)	C(T)	Fishing, non-contact recreation; trout population
Kinderhook Creek (Middle and Minor Tribs)	C(T)	Fishing, non-contact recreation; trout population
Kline Kill (and Tribs)	C(TS)	Fishing, non-contact recreation; trout spawning
Kinderhook Creek, Lower, and Minor Tribs	C	Fishing, non-contact recreation
Kinderhook Lake	B	Fishing and contact recreation
Smith Pond	C	Fishing and non-contact recreation
Unnamed segment	B	Fishing and contact recreation

Figure 9: Waterbody Classifications in the Town of Chatham, Columbia County, NY



Legend

T and TS Streams (trout and trout spawning)

NYSDEC Stream Classification

- A
- B
- C
- D

Watershed

- Green Brook-Kinderhook Creek
- Kline Kill
- Mill Creek-Hudson River
- Mud Creek-Claverack Creek
- North Creek
- Schodack Creek
- Stockport Creek-Kinderhook Creek
- Stony Kill
- Tackawasick Creek-Kinderhook Creek
- Valatie Kill

This map shows streams and their NYSDEC classification, waterbodies, and watersheds for the Town of Chatham, Columbia County. See the accompanying summary for a description of stream classifications. Perennial streams that are not shown take on the classification of the waterbody they flow into. This is an unofficial version, however the stream segments are largely consistent with the official regulations. **This map is not appropriate for regulatory purposes, for the most recent information contact NYSDEC Region 4.**This map was produced as part of a Water Resource Summary for the Town. For more information, please contact NYS DEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Data Sources:

NYSDEC (2010) for stream classifications

USGS National Hydrography Dataset for waterbodies and Hydrologic Unit Code 12 subwatersheds (2008)

Map Created 2012

Hudson River Estuary

Water Resource Institute of New York State

Cornell University

Waterbody Assessments

Lake Assessments

Lakes, ponds, and reservoirs are monitored through the Lake Classification and Inventory and through the Citizens Statewide Lake Assessment Program. The former program is conducted by NYSDEC staff and the latter is directed by NYSDEC but run by volunteers from lake associations. Contact Scott Kishbaugh (sakishba@gw.dec.state.ny.us), Program Manager, for more information about these programs and to find out if information has been collected for lakes, ponds, and reservoirs in the Town of Chatham.

Diet for a Small Lake: The Expanded Guide to New York State Lake and Watershed Management (http://www.dec.ny.gov/chemical/82123.html) is a compendium of information about the ecology, monitoring, and management of lakes and watersheds in New York State. The guide is written for both lake residents and professionals.

Stream Assessments - Biomonitoring

Benthic macroinvertebrates (including aquatic insects, worms, clams, snails, and crustaceans) can be used to assess and monitor the water quality of a stream. Biological monitoring, or biomonitoring, in this way provides an excellent indicator of overall water quality at a particular site because macroinvertebrates are sensitive to many environmental impacts and are less mobile than fish. Biomonitoring can integrate the chemical, physical, and biological features of a stream, providing a more comprehensive characterization than each of these measures alone.

Stream biomonitoring represents an important measure of overall water quality; identifying healthy stream segments is key to protecting them. Caution is warranted to avoid impacting these healthy, non-impacted streams through land use disturbances and activities. Once streams are impacted, restoring them is difficult and expensive.

NYSDEC Stream Biomonitoring Unit Data

NYSDEC measures and characterizes waterbody health in two basic ways: best uses and stream biomonitoring. For more information on waterbody characterization based on best uses, see next section on Waterbody Impairment. While best uses characterize stream health for its effect on human uses, stream biomonitoring is a good measure of stream health through aquatic ecology. NYSDEC's Stream Biomonitoring Unit (http://www.dec.ny.gov/chemical/23847.html) conducts biomonitoring sampling throughout New York State.

> ***Biomonitoring*** uses the abundance and kind of aquatic organisms as a measure of waterbody health.

Based on the number and kinds of macroinvertebrates, each sample receives a Biological Assessment Profile (BAP) score between 1 and 10 (with 10 being the healthiest). BAP scores are divided into four water quality impairment categories:

- Severe – BAP score from 0 to 2.5
- Moderate – BAP score from 2.5 to 5
- Slight – BAP score from 5 to 7.5
- Non-impacted – BAP score from 7.5 to 10

Biomonitoring sites are selected for a number of reasons. See Appendix 1 for more information on their selection criteria. Regional trends from 30 years of biomonitoring data (1972-2002) in New York State were published in this report: http://www.dec.ny.gov/chemical/78979.html. Stream biomonitoring data is also available to the public. Contact the Hudson River

Estuary Program watershed specialists for help obtaining the data.

Chatham Information: Stream Biomonitoring (NYSDEC)

Six sites have been sampled using biomonitoring in the Town of Chatham since 1989, including one on the Kinderhook Creek, one on the Kline Kill, and four on the Stony Kill (see Table 3 and Figure 10). Two of these sites have been sampled for more than one year. There were slight improvements in water quality on the Kline Kill (from 2002 to 2008 samples) and the Stony Kill at site 01A (from 1989 to 1990 samples), which were each sampled twice. The biomonitoring data indicates that these steams are relatively healthy, based on the benthic macroinvertebrates present. None of the impaired waterbodies (as identified in the Waterbody Inventory/Priority Waterbodies List, see Table 4) in Chatham have been sampled by the NYSDEC Stream Biomonitoring Unit.

Table 3: NYSDEC Stream Biomonitoring Unit Data in the Town of Chatham

Stream	Watershed	Site	Year	Score	Water Quality Category
Kinderhook Creek	Stockport Creek-Kinderhook Creek	06	2000	8.17	Non-impacted
Kline Kill	Kline Kill	04	2002	6.83	Slight
Kline Kill	Kline Kill	04	2008	7.87	Non-Impacted
Stony Kill	Stony Kill	01	1989	8.05	Non-Impacted
Stony Kill	Stony Kill	01A	1989	7.19	Slight
Stony Kill	Stony Kill	01A	1990	7.29	Slight
Stony Kill	Stony Kill	02	1989	7	Slight
Stony Kill	Stony Kill	02A	1989	6.27	Slight

Wadeable Assessments by Volunteer Evaluators (WAVE)

The NYSDEC Division of Water and the Hudson River Estuary Program are beginning a citizen monitoring program, also using biomonitoring results to look at stream health. Citizen monitors visit a stream and collect and identify stream organisms. WAVE data will be included in federal and state water quality reports and will be used to target NYSDEC assessments and local restoration efforts to where they are most needed. To find out more information about the program and volunteer opportunities, visit www.dec.ny.gov/lands/72898.html, or contact WAVE Coordinator Alene Onion at (amonion@gw.dec.state.ny.us)

Hudson Basin River Watch

Hudson Basin River Watch, in coordination with Watershed Assessment Associates, has also conducted biomonitoring studies in the Hudson River estuary watersheds. Hudson Basin River Watch uses a method similar to the NYSDEC's Stream Biomonitoring Unit, with a BAP score indicating overall water quality.

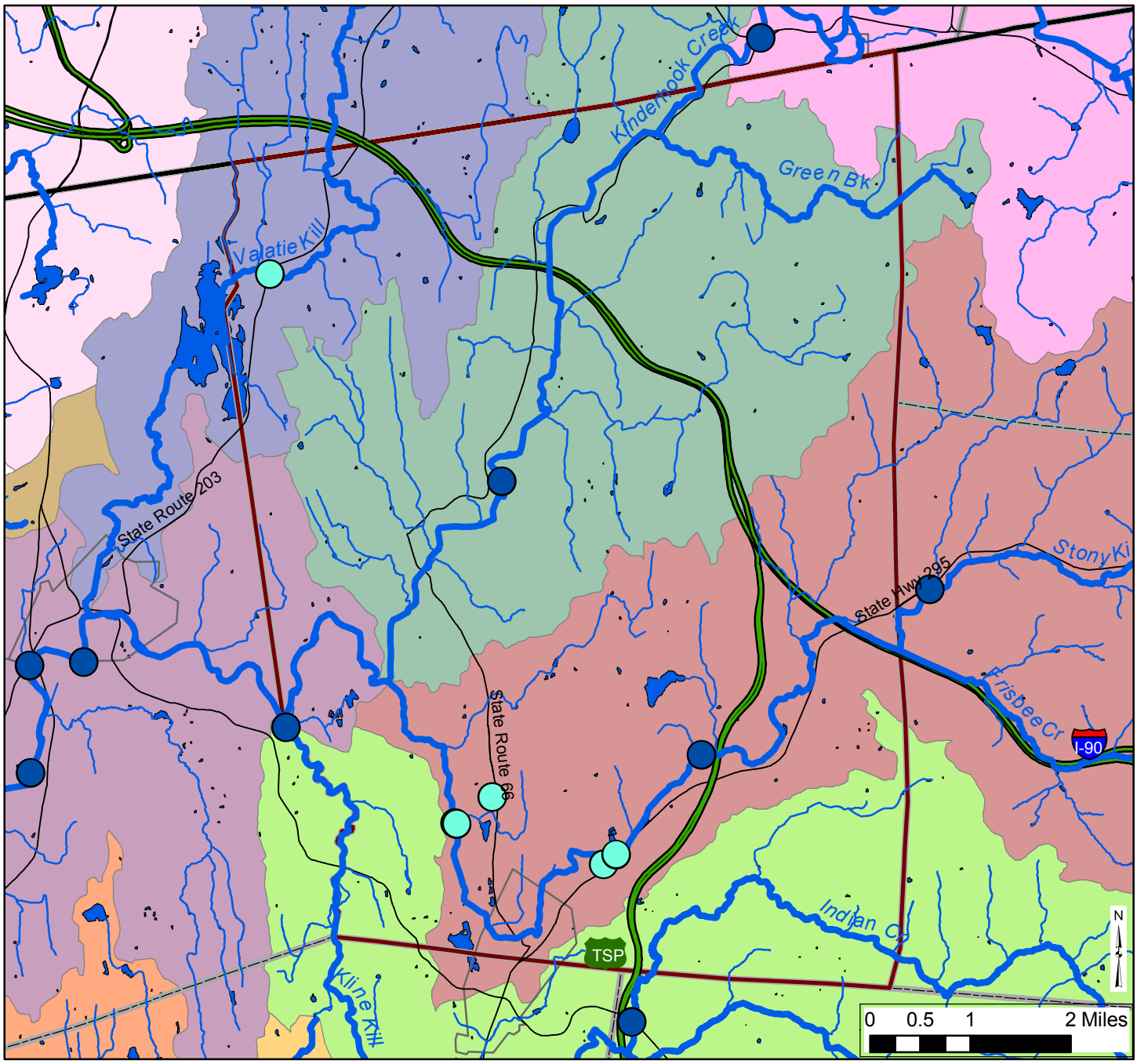
Chatham Information: <u>Stream Biomonitoring (Hudson Basin River Watch)</u>

Hudson Basin River Watch (HBRW) conducted stream biomonitoring of the Stockport Creek watershed, including the Kinderhook Creek watershed in 2006 and 2001 (see Figure 10). Both Watershed Report Cards are available here: http://www.stockportwatershed.org/resources.html

HBRW sampled 10 sites in the Greater Stockport Creek watershed in 2011, and two of them (including one in the Town of Chatham) were slightly impacted while the other eight were non-impacted. HBRW sampled one site on the Stony Kill, downstream of the Village wastewater treatment facility, in 2006 and in 2011. Their results showed that the Biological Assessment Profile score was slightly impacted in both years, though it increased from 5.85 in 2006 to 7.4 in 2011.

In every glass of water we drink, some of the water has already passed through fishes, tress, bacteria, worms in the soil, and many other organisms, including people…. Living systems cleanse the water and make it fit, among other things, for human consumption.
-Elliot A. Norse-

Figure 10: Biomonitoring Samples in the Town of Chatham, Columbia County, NY



Legend

Minor stream
Major stream

Biomonitoring scores

(category of most recent sample)

- non-impacted
- slight
- moderate
- severe

This map shows water quality information based on biomonitoring results taken at particular locations in the Town of Chatham, Columbia County. See the accompanying summary for a description of biomonitoring results. This map was produced as part of a Water Resource Summary for the Town. For more information, please contact NYSDEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Data Sources:

New York State Department of Environmental Conservation, Division of Water, Stream Biomonitoring Unit and Hudson Basin River Watch for biomonitoring results (up to 2011)

USGS National Hydrography Datase for streams, waterbodies and Hydrologic Unit Code 12 watersheds (2008)

Map Created 2012

Hudson River Estuary

Water Resource Institute of New York State

Cornell University

Waterbody Impairment

The Waterbody Inventory/Priority Waterbodies List (WI/PWL) is a document that lists New York State waterbodies and information about their water quality. It is published by the NYSDEC Division of Water. The WI/PWL categorizes rivers/streams, lakes/reservoirs, and estuaries and indicates whether they are meeting their "best uses" based on their NYSDEC classification (see previous section on Waterbody Classification).

There are two components to the WI/PWL: the Waterbody Inventory and the Priority Waterbodies List. The Waterbody Inventory (WI) is a comprehensive list of water quality information for waterbodies in the state. The Priority Waterbodies List (PWL) is a subset of waterbodies from this inventory that experience water quality impacts that can range from possible threats and minor impacts to impairment of designated best uses. Impairment is determined based on NYSDEC's monitoring (including biomonitoring, for more information, see the previous Stream Assessment-Biomonitoring section) and other available information. Impaired waters that do not meet applicable water quality standards are considered for inclusion on the state's Clean Water Act Section 303(d) List.

To better assess water quality at a regional scale, most waterbodies are divided into segments based on classification, size, and land use/character. Each of these segments is categorized as:

- Impaired Waters,
- Waters with Minor Impacts,
- Threatened Waterbodies,
- Waterbodies with Impacts Needing Verification,
- Waterbodies with No Known Impacts, or
- Unassessed Waterbodies.

Waterbodies characterized as Impaired, Waters with Minor Impacts, or Threatened Waterbodies are assigned to the Priority Waterbodies List. These water quality categories are used by DEC to determine whether a waterbody will be included on the federal 303(d) list of impaired waters, and if it needs a Total Maximum Daily Load (TMDL) to be developed to support restoration. The WI/PWL is available on the NYSDEC website. The Lower Hudson River Basin WI/PWL (http://www.dec.ny.gov/chemical/36740.html) is the section that covers the Hudson River estuary watershed.

Waterbody Inventory/Priority Waterbodies List: is the best way to access the state's information on water quality. Access it at Lower Hudson River Basin WI/PWL

Chatham Information: Waterbody Impairment

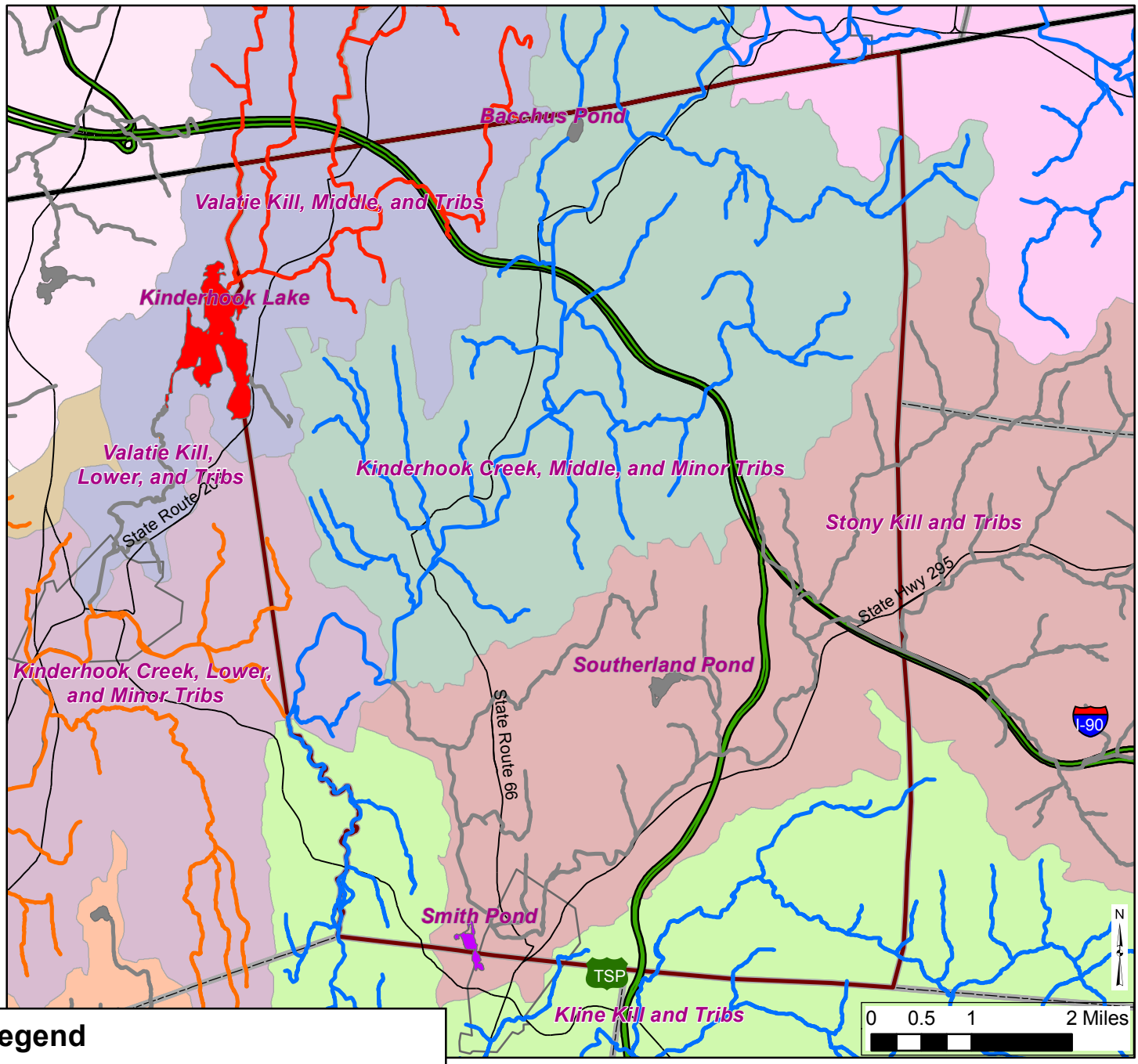
There are ten waterbody segments from the WI/PWL that cover the Town of Chatham (Table 4, Figure 11). Two of these (Valatie Kill, Middle and Tribs, and Kinderhook Lake) are considered "impaired," and are on the New York State 303(d) list of impaired waterbodies. The Valatie Kill, Middle and Tribs, and Kinderhook Lake are impaired for fish consumption. Kinderhook Lake is also listed as a Waterbody with Impairment Requiring TMDL Development due to phosphorus.

Kinderhook Creek, Middle and Minor Tribs, and Kline Kill and Tribs are both listed as No Known Impacts. This designation infers that these streams were found to be generally healthy.

Table 4: Stream Segments and Impacted Uses in the Town of Chatham (from the Waterbody Inventory/Priority Waterbody List, NYSDEC DOW 2008)

Stream Segment	ID	Class	Water Quality	Uses Impacted	Pollutants	Pollutant Source	303(d) List?	Notes
Valatie Kill, Middle, and Tribs	1310-0003	C(T), C	Impaired	*Impaired:* Fish consumption and recreation	*Known:* Priority organics (PCBs)	*Known:* Landfill/land disp (Dewey Loeffel); Suspected: toxic/contaminated sediments	Yes	Dewey Loeffel hazardous waste disposal site
Valatie Kill, Lower, and Minor Tribs	1310-0023	C	Unassessed					
Kinderhook Creek, Middle, and Minor Tribs	1310-0017	C (TS), C(T), C	No known impacts	No use impairment			No	Aquatic life support is fully supported, but may be affected by occasional high temperatures
Kline Kill and Tribs	1310-0028	C(TS), C(T), C	No known Impact	No use impairment			No	
Kinderhook Creek, Lower, and Minor Tribs	1310-0021	C(T), C	Minor impacts	*Stressed:* Aquatic life, recreation, and habitat/hydrology	*Suspected:* Nutrients, thermal changes; *Possible:* metals (lead)	*Suspected:* Agriculture, habitat modification; *Possible:* Toxic/contaminated sediment	No	Nutrient loadings from agricultural and other nonpoint sources. Aquatic habitat in the stream may also be affected by elevated temperatures and the removal of riparian vegetation.
Stony Kill and Tribs	1310-0031	C(TS), C(T), C	Unassessed				No	
Kinderhook Lake	1310-0002	B	Impaired	*Impaired:* Fish consumption and recreation; Stressed: Aquatic life, aesthetics	*Known:* Algal/weed growth (vegetation), nutrients (phosphorus), priority organics (PCBs); *Possible:* D.O./oxygen demand	*Suspected:* On-site septic systems, toxic/contaminated sediments, agriculture, landfill/land disp (Dewey Loeffel), urban/storm runoff	Yes	PCB contamination, aquatic weed and algal growth, and low water transparency
Smith Pond	1310-0009	C	Needs verification	*Stressed:* Recreation (possible)	*Suspected:* Algal/weed growth; *Possible:* Nutrients, salts, silt/sediment	*Suspected:* Urban/storm runoff; *Possible:* On-site septic systems	No	Excessive aquatic vegetation and/or algal growth
Southerland Pond	1310-0032	C	Unassessed				No	
Bachus Pond	1310-0034	C	Unassessed				No	

Figure 11: Waterbody Impairment Information from the Priority Waterbodies List for the Town of Chatham, Columbia County, NY



Legend

Priority Waterbody List stream

- Impaired Segment
- Minor Impacts
- Threatened
- Threatened (Possible)
- Need Verification
- No Known Impact
- UnAssessed

Priority Waterbody List lake/reservoir

- Impaired Segment
- Minor Impacts
- Threatened
- Threatened (Possible)
- Need Verification
- No Known Impact
- UnAssessed

This map shows streams and waterbodies and their NYSDEC impact assessments from the Waterbody Inventory/Priority Waterbody List for the Town of Chatham, Columbia County. These segments don't necessarily align with watershed boundaries. See Table 4 in the accompanying summary for a description of stream assessments and their impairment. **This map is not appropriate for regulatory purposes, for the most recent information contact NYSDEC Region 4.** This map was produced as part of a Water Resource Summary for the Town. For more information, please contact NYSDEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Data Sources:

NYSDEC, Division of Water (2008) for Waterbody Inventory/Priority Waterbody List assessments

USGS National Hydrography Dataset (2008) for waterbodies and Hydrologic Unit Code 12 subwatershed boundaries

Map Created 2012

Hudson River Estuary

Water Resource Institute of New York State

Cornell University

Water Infrastructure

Stormwater Management

Municipal Separated Storm Sewer System (MS4)

A Municipal Separated Storm Sewer System (MS4) is a stormwater collection and conveyance system owned by a state, city, town, village, or other public entity that is not part of a sewage treatment plant or combined sewer system. The MS4 program provides a regulatory framework for municipalities to better manage stormwater and nonpoint source pollution. Regulated MS4 areas are "urbanized areas" (areas with at least 50,000 people and at least 1,000 people per square mile as determined by the US Census), but also include other designated areas.

Currently the MS4 program is in Phase II, which the Environmental Protection Agency (EPA) issued in 1999. Regulated MS4s are required to obtain a State Pollutant Discharge Elimination System (SPDES) permit (GP-0-10-002) from the NYSDEC and develop a stormwater management program. For more information about the MS4 permit, see: http://www.dec.ny.gov/chemical/43150.html .

Municipalities with regulated MS4 areas are required to implement and report on six Minimum Control Measures:

- Public education/outreach
- Public participation/involvement
- Illicit discharge detection and elimination
- Construction site runoff control
- Post-construction runoff control
- Pollution prevention/good housekeeping

For more information from the EPA about the MS4 regulatory program, see: http://cfpub.epa.gov/npdes/stormwater/munic.cfm. For more information about stormwater from the NYSDEC, see: http://www.dec.ny.gov/chemical/8468.html

Chatham Information: Stormwater Management (MS4)

Even in rural areas, stormwater management is important for protecting high-quality streams. Although the Town of Chatham, along with the rest of Columbia County, is not currently designated as an MS4, the six minimum control measures and other strategies could be useful for protecting water quality.

Construction Stormwater Management

The SPDES General Permit for Stormwater Discharges from Construction Activity (GP-0-10-001) is required to be obtained by the owner or operator of a construction project if the project disturbs one acre or more of land. As part of this permit, the owner/operator must complete a Stormwater Pollution Prevention Plan (SWPPP). For more information on the Stormwater Permit for Construction Activities, see: http://www.dec.ny.gov/chemical/43133.html .

In MS4 communities, a representative of the municipality's MS4 program must review and accept the SWPPP before it is submitted to the NYSDEC. The municipal engineer and/or planner will review SWPPPs and provide comments to the planning board, zoning board, or

municipal governing board. Planning boards can also review SWPPPs submitted with site plans. All SWPPPs should describe the erosion and sediment controls that will be used on-site during construction, based on the technical information in the NYS Standards and Specifications for Erosion and Sediment Control (http://www.dec.ny.gov/chemical/29066.html).

The SWPPPs may also be required to describe the post-construction stormwater management practices that will be implemented, based on the standards in the NYS Stormwater Management Design Manual (http://www.dec.ny.gov/chemical/29072.html). Generally, post-construction stormwater management is required if projects disturb five acres or more for single-family residential projects or one acre or more for multi-family or commercial projects. See http://www.dec.ny.gov/docs/water_pdf/gpsconspmt10.pdf Appendix B for details on where post-construction stormwater management is required. (For more information on post-construction stormwater management, see the Green Infrastructure section below.)

If sites are located within the watershed of a 303(d) listed waterbody impaired by pollutants related to construction activity (such as sediment or nutrients), then single family residential projects that disturb one acre or more of land will also require a SWPPP with post-construction stormwater management.

Chatham Information: Stormwater Management (Construction)

In the Town of Chatham, Kinderhook Lake is designated as a waterbody impaired by pollutants related to construction activities, so Stormwater Pollution Prevention Plans (SWPPPs) describing post-construction stormwater management are required for all development projects that disturb one or more acres of land within its watershed.

In the rest of the town, SWPPPs describing post-construction stormwater management are required for single-family residential projects that disturb five or more acres and multi-family or commercial projects that disturb one or more acres.

Post-Construction Stormwater Management and Green Infrastructure

The New York State Stormwater Design Manual (http://www.dec.ny.gov/chemical/29072.html) provides information on how to select, locate, size, and design stormwater management practices to comply with NYS standards for post-construction stormwater management. It also includes a planning process to follow when managing stormwater in new development and redevelopment projects.

This process includes:

1. Site planning to preserve natural features and reduce impervious surface cover,
2. Calculating the amount of runoff that will be produced on-site (based on a typical storm),

Green Infrastructure: weaves natural processes into the built environment, providing not only stormwater management, but also flood mitigation, air quality management, and much more.

3. Reducing runoff by implementing green infrastructure and other stormwater management practices that allow stormwater to infiltrate on-site,
4. Using standard stormwater management practices to treat the rest of the stormwater that is produced, and
5. Designing volume and peak rate control practices, where required.

Green infrastructure practices maintain or restore stormwater's natural flow patterns at a site by allowing runoff to infiltrate into the soil. On a regional scale, green infrastructure includes preserving and restoring natural landscape features, along with reducing impervious surface cover. At the site scale, green infrastructure includes practices that capture stormwater runoff, such as rain gardens, vegetated swales, green roofs, pervious pavement, and rain barrels. These practices allow water to soak into the soil, be used by plants, or be reused. (For more information and a full list of green infrastructure practices, see Chapter 5 of the NYS Stormwater Management Design Manual: http://www.dec.ny.gov/docs/water_pdf/swdm2010chptr5.pdf.)

Green infrastructure and other stormwater practices that reduce runoff should be able to infiltrate the full volume of stormwater produced by the site being developed (the calculation from Step 2, known as the Water Quality Volume). If that can't be done, the designer must provide justifications and identify the specific site limitations. The rest of the stormwater volume should be treated by standard stormwater practices (described in Chapter 6 of the NYS Stormwater Management Design Manual: http://www.dec.ny.gov/docs/water_pdf/swdmchapter6.pdf).

At the municipal scale, it is important to ensure that local laws don't restrict the green infrastructure practices that can be implemented. The New York State Better Site Design Code and Ordinance Worksheet (http://www.dec.ny.gov/docs/remediation_hudson_pdf/cownys.pdf) is a useful tool to assess potential barriers to green infrastructure.

The Hudson River Estuary Program's Green Infrastructure Examples website (http://www.dec.ny.gov/lands/58930.html) has regional examples of green infrastructure demonstration sites, including several practices in Columbia County. Other helpful resources include the Columbia County Soil and Water Conservation District (http://www.ccswcd.org/) and Cornell Cooperative Extension for Columbia and Greene Counties (http://www.ccecolumbiagreene.org/).

Chatham Information: Stormwater Management (Green Infrastructure)

The revised NYSDEC Stormwater Management Design Manual (2010) increased the importance of implementing green infrastructure practices for new development. The Town of Chatham Planning Board should understand green infrastructure practices and regulations, because these practices are strongly encouraged for developments that require post-construction stormwater management. Different practices are appropriate for different sites, and it's essential that these practices are sized/designed correctly, constructed appropriately, and well-maintained.

SPDES Permits and Wastewater

NYSDEC recognizes that point-source pollution is still a significant concern in New York State. To ensure permit compliance, NYSDEC wants to be involved early in the process of planning new facilities or upgrading existing ones. New York State uses the State Pollutant Discharge Elimination System (SPDES) to control wastewater and stormwater discharges in accordance with the Clean Water Act. The NYS program regulates discharges to groundwater and surface water (http://www.dec.ny.gov/permits/6054.html).

New York Water Environment Association (NYWEA) is another good source for information dealing with wastewater treatment at the municipal level. Together with the DEC, they have created the *Handbook on Wastewater Management for Local Representatives* (http://www.dec.ny.gov/chemical/33879.html). NYWEA is currently updating the handbook and plans to make the updated version available from their website (www.nywea.org) by October 2012.

SPDES permit compliance status information is available from the EPA's Enforcement and Compliance History Online (ECHO, (http://www.epa-echo.gov/echo/) website. ECHO is a web-based tool that provides public access to permit, inspection, violation, enforcement action, and penalty information from the past three years. ECHO offers the most comprehensive way of searching for SPDES locations and information about individual SPDES permitted facilities. The easiest way to access data on this web site is to enter a zipcode into the search tool in the upper left of the opening webpage. Each resulting pinpoint on the map can be clicked on for individualized information.

Chatham Information: SPDES and Wastewater

Within the Town of Chatham there are several SPDES permit locations listed in the ECHO database (most are in the Village of Chatham). Information about the Village Sewage Treatment Plant (SPDES ID# NY0023582), including compliance reports, effluent charts, pollutant loading reports and water quality reports can be found through this website.

Contact the NYSDEC Region 4 Water Engineer in Schenectady (518-357-2045) for SPDES permit requirements and more information.

Dams and other Aquatic Barriers

Just as many forest-dwelling species are negatively impacted by forest fragmentation from roads and structures, barriers in streams can isolate and severely limit the range of aquatic species and other organisms that use stream corridors. As mills and road crossings were added to the streams of the Hudson Valley, dams and culverts damaged, blocked off, and cut up the habitat for organisms like our native brook trout. Stream barriers can also have serious effects on local flooding and water quality. Streams flowing into undersized culverts can flood, and in some cases overtake and washout, the road during heavy precipitation or snowmelt events.

Barrier impacts on our plants and animals (especially fish, mussels, amphibians and reptiles) can result in local extinction, potentially leading to global extinction of some of our indigenous and rare mussel species (NYSDEC 2008, NYSDEC 2010). Currently, it's estimated that the Northeast has an average of 7 dams and 106 road-stream crossings per 100 miles of river (Anderson and Olivero Sheldon 2011). The Hudson River watershed has over 2300 dams (NYSDEC Inventory of Dams 2009).

Impacts from aquatic barriers can include:

- flooding hazards due to plugged culverts and impounded water;
- decreased navigational and recreational uses
- altered sediment and nutrient processes;
- changes in water quality (e.g. water temperature);
- reduced dispersal of young animals, resulting in increased competition and reduced gene flow;
- lost access to important, upstream habitats;
- increased road kills from increased attempts to cross the road; and
- increased hazard to motorists because of animal road crossings.

There are no comprehensive inventories of dams or culverts in New York State. The New York State Inventory of Dams and the National Hydrography Dataset both record some dam information, but many dams, especially small ones, are missing or not collected in these datasets. Assessments done by the Estuary Program in trial watersheds indicate that perhaps twice as many dams exists than are recorded in the NYS Dam Inventory. It is important to note that "dams" can be defined in many ways. We are concerned with artificial structures that eliminate or negatively affect the movement of aquatic and semi-aquatic organisms such as migratory and resident fish, mussels, and amphibians, whereas the NYS Inventory of Dams uses size and hazard thresholds to define dams. Culvert datasets do not exist on any standard, county-, or state-wide scale in New York. For this reason, the accompanying map does not include culverts, though they can be a critical source of aquatic fragmentation. The Estuary Program is collecting information on aquatic barriers, specifically ones that are important to the migratory fish, resident fish, mussels and amphibians that live in the Hudson Valley. Check with a watershed specialist for the most recent information.

In the planning phase of stream work, owners should consult with the US Army Corps of Engineers (ACOE) and NYSDEC early in the design process for permit requirements. For the best watershed management, ecological considerations should be applied to all road crossings, not just those that are under DEC or ACOE jurisdictions. Information is available on

NYSDEC's stream crossing website (http://www.dec.ny.gov/permits/49066.html).

Culverts at Road Crossings

Every time a road crosses a stream or river, there is the potential of a hydrologic modification and aquatic barrier. Roads that cross streams should be installed and maintained to have as little impact as possible to the hydrology of the stream as well as the plants and animals that use the stream and floodplains. Bridges, open-bottom arches and similar structures that completely span the waterway and associated floodplain/riparian areas are generally the preferred approach whenever feasible (New Hampshire Stream Crossing Guidelines 2009). *Stream Processes, A Guide to Living in Harmony with Streams* (Chemung County Soil and Water Conservation District 2006, http://www.chemungcountyswcd.com/) anticipates many of the positive and negative issues associated with barrier mitigation and removal.

Dam Replacement or Removal

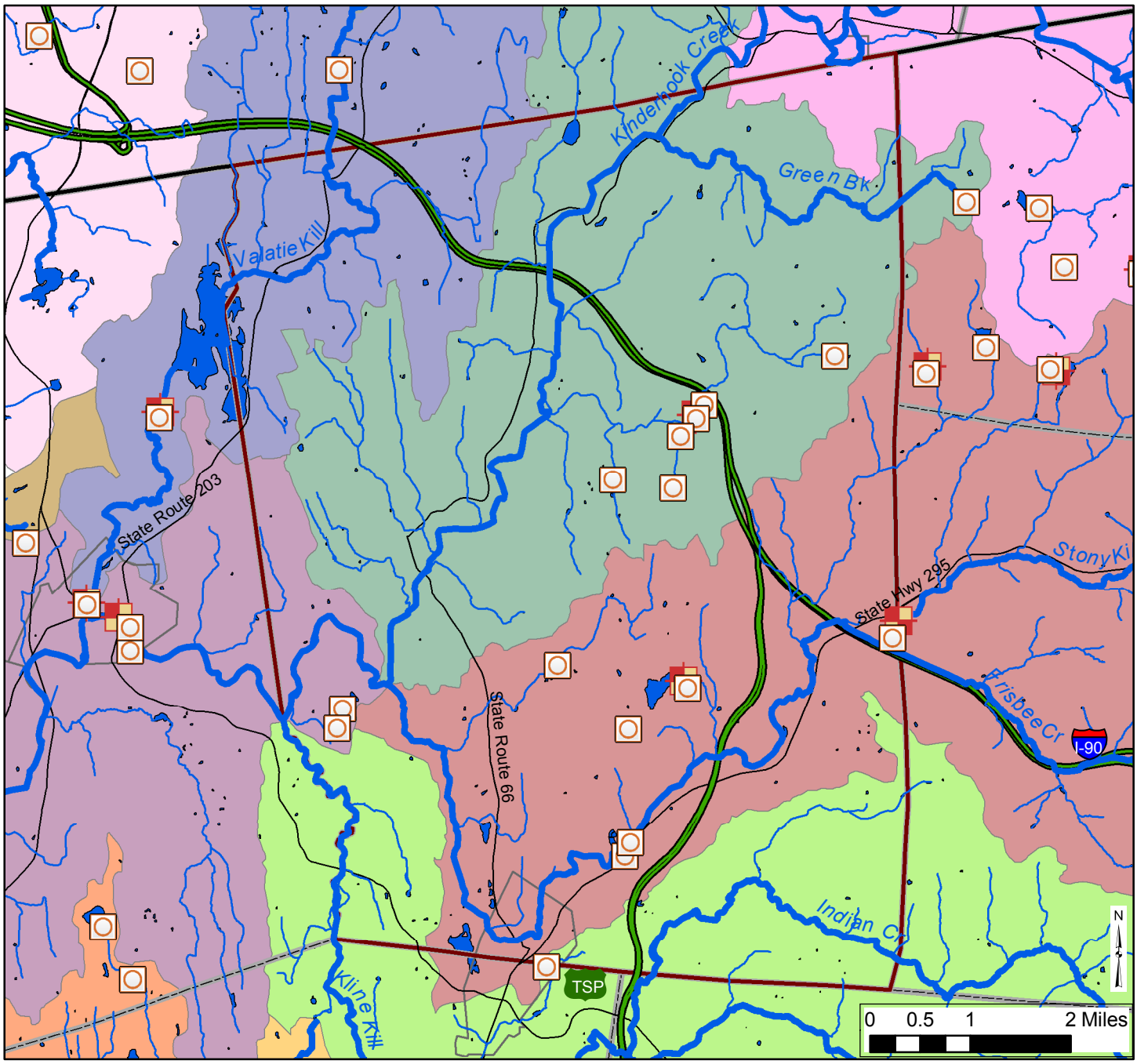
Dams can be aquatic barriers, and can be a hazard to public safety as well as an insurance liability. See Information for Dam Owners (http://www.dec.ny.gov/lands/66952.html) for common problems involving dam maintenance, as well as the *Owners Guidance Manual* (http://www.dec.ny.gov/lands/4991.html) for an introduction to the responsibilities of dam owners. Many dams are also unwanted and unused, and present opportunities for stream restoration and habitat connectivity. However, dam removal is a complex endeavor, and should not be undertaken without first contacting a stream professional. There are many reasons why dam removals could harm the in-stream biodiversity and hydrology, including facilitating the spread of invasive species and releasing potentially contaminated sediment into the stream. The *Dam Removal and Barrier Mitigation in New York State: Preliminary Guidance for Dam Owners and Project Applicants* (http://www.dec.ny.gov/docs/remediation_hudson_pdf/damremoval.pdf) is a useful guide to a well-planned dam removal process.

Chatham Information: Aquatic Connectivity

Figure 12 shows that the Town of Chatham has 17 dams included on the NYSDEC Inventory of Dams or the National Hydrography Dataset. Many small dams and all the culverts are missing from the map. There is likely a culvert almost anywhere a road crosses a stream, though some streams are spanned with bridges. Small dams and culverts have the potential to be just as important to aquatic connectivity as the inventoried dams in Figure 12. Given the limitations to the existing datasets, it's not possible to identify either the most-connected streams in Chatham or the most-fragmented streams. In new development projects, or in planned replacement projects, the town should emphasize designing and installing culverts that do not act as aquatic barriers or flooding constriction points.

In Region 4 of the NYSDEC, which covers Columbia County, culverts need to be sized to accommodate a Q50 storm event and must be embedded 20%. NYSDEC also strongly encourages culverts that span the bank-full width or greater, to minimize potential stream constriction.

Figure 12: Barriers to Aquatic Connectivity in the Town of Chatham, Columbia County, NY



This map shows some man-made barriers to movement of fish, mussels and other aquatic organisms that rely on free-flowing, connected streams in the Town of Chatham, Columbia County. The map shows known locations of dams based on two potentially duplicative datasets; but many dams are missing. Also, this map doesn't show culverts, though they can present serious barriers to many species when not sized and placed correctly and likely exist at the majority of places where a road crosses a stream. This map was produced as part of a Water Resource Summary for the Town. For more information, please contact NYSDEC's Hudson River Estuary Program watershed specialists at (845) 256-3016.

Legend

- NYSDEC Inventory of Dams
- National Hydrography Dataset dams
- Minor stream
- Major stream

Data Sources:
NYSDEC (2009) and National Hydrography Dataset (2008) for dam locations
USGS National Hydrography Dataset (2008) for streams, waterbodies and Hydrologic Unit Code 12 subwatersheds
Map Created 2012

Hudson River Estuary
Water Resource Institute of New York State
Cornell University

References and Resources

Watershed Characteristics

Land Cover

Center for Watershed Protection. 2003. Impacts of Impervious Cover on Aquatic Systems. Watershed Protection Research Monographs No.1 pp158

Ecology and Environment, Inc. 2008. Columbia County Multi-Jurisdictional Hazard Mitigation Plan. Columbia County Emergency Management Office, 85 Industrial Tract Hudson, NY 12534. pp127. http://www.columbiacountyny.com/documents/misc/columbia_hazard_mitigation_plan.pdf

Environmental Protection Agency, Office of Sustainable Communities Smart Growth Program. 2006. Protecting Water Resources with Higher-Density Development. pp 45
http://www.epa.gov/dced/pdf/protect_water_higher_density.pdf

EPA Green Communities document, Creating Open Space Networks: http://www.epa.gov/greenkit/pdfs/envdev1.pdf

EPA Greenkit toolbox: http://www.epa.gov/greenkit/index.htm

Greater Stockport Creek Watershed Alliance: http://www.stockportwatershed.org/

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

NYSDEC Bureau of Watershed Assessment and Management, Division of Water. 2007. The Lower Hudson River Basin Waterbody Inventory and Priority Waterbodies List. 238 pp plus Appendices

Impervious Cover

Cunningham M.A., C.M. O'Reilly, K.M. Menking,, D.P. Gillikin, K.C. Smith, C.M Foley, S.L Belli, A.M. Pregnall, M.A. Schlessman, and P. Batur. 2009. The Suburban Stream Syndrome: Evaluating Land Use and Stream Impairments in the Suburbs. Physical Geography. 30, 3, pp 269-284.

EPA. 2009. Protecting Water Quality with Smart Growth Strategies and Natural Stormwater Management in Sussex County, Delaware. EPA-NOAA Smart Growth Implementation Assistance for Coastal Communities for Sussex County, Delaware. http://www.epa.gov/dced/pdf/2009_0106_sussex_county.pdf

National Research Council, Committee on Reducing Stormwater Discharge Contributions to Water Pollution. 2008. Urban Stormwater Management in the United States. Water Science and Technology Board, Division of Earth and Life Studies of the National Research Council. National Academies Press, Washington D.C., pp 529. http://www.epa.gov/npdes/pubs/nrc_stormwaterreport.pdf

Walsh C.J., A.H. Roy, J.W. Feminella, P.D. Cottingham, P.M Groffman, and R.P Morgan III. 2005 The Urban Stream Syndrome: Current Knowledge and the Search For A Cure. Journal o f the North American Benthological Society, 24(3):706-723 pp18

Forest Cover

Center for Watershed Protection's Watershed Forestry Resource Guide (http://www.forestsforwatersheds.org/forests-and-drinking-water/

Cornell Cooperative Extension's Forest Connect (http://www2.dnr.cornell.edu/ext/forestconnect/

EPA Economic Benefits of Healthy Watersheds
(http://water.epa.gov/polwaste/nps/watershed/upload/economic_benefits_ factsheet2.pdf

The Municipal Official's Guide to Forestry in New York State
(http://www2.dnr.cornell.edu/ext/info/pubs/management/MunicipalOfficialsGuide ToForestry.pdf

NYSDEC Division of Lands and Forests' Forest Stewardship Program
(http://www.dec.ny.gov/lands/45934.html

NYSDEC SPDES general permit frequently asked questions:
http://www.dec.ny.gov/docs/water_pdf/constrfaq.pdf

Agricultural Lands

Agricultural Environmental Management (http://www.nys-soilandwater.org/aem/index.html

Columbia County Soil and Water Conservation District (http://www.ccswcd.org/

Farmscape Ecology Program (http://hawthornevalleyfarm.org/fep/

NYSDEC Bureau of Watershed Assessment and Management, Division of Water. 2007. The Lower Hudson River Basin Waterbody Inventory and Priority Waterbodies List. 238 pp plus Appendices

Aquifers

Dutchess County Aquifer Recharge Rates & Sustainable Septic System Density Recommendations:
http://www.co.dutchess.ny.us/CountyGov/Departments/Planning/16891.htm

New York Rural Water Association (http://www.nyruralwater.org/

NYSDEC Division of Water and USGS's Ambient Groundwater Monitoring Program
(http://www.dec.ny.gov/lands/36117.html

PACE Land Use Law Center's Gaining Ground database entries on Aquifer Protection in New York:
http://landuse.law.pace.edu/SPT--BrowseResources.php?ParentId=410

USGS's New York Water Science Center (ny.water.usgs.gov), and a map of Hudson Valley places with finer-scale aquifer information can be found at ny.water.usgs.gov/projects/bgag/aquifer.maps/ aquifer1.maps.html

Floodplains and Buffers

ACOE National Flood Risk Management Risk Reduction Program – Army Corps of Engineers
http://www.nfrmp.us/index.cfm

The Association of State Floodplain Managers http://www.floods.org/

Catskill Streams – (great primer on Riparian Buffer and links to more in-depth information)
http://www.catskillstreams.org/stewardship_streamside_rb.html

Columbia County Multi-Jurisdictional Hazard Mitigation Plan, May 2008, ECOLOGY AND ENVIRONMENT, INC. http://www.columbiacountyny.com/documents/misc/columbia_hazard_mitigation_plan.pdf (accessed August 2012)

Emergency Watershed protection program –NRCS (floodplain easements and funding towards repair of watershed impairments) http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp)

EPA links to Life at the Water's Edge, Living in Harmony with Your Backyard Stream: http://www.epa.gov/ecopage/aquatic/lifedge.pdf

Flood Smart- the Official Site of the NFIP: http://www.floodsmart.gov/floodsmart/

Hudson Estuary Trees for Tribs (offers free trees and shrubs for streamside planting)- http://www.dec.ny.gov/lands/43668.html

New York State Floodplain and Stormwater Managers Association - http://ny.floods.org/

NYSDEC (helps to implement state floodplain mapping and assists communities with the NFIP): http://www.dec.ny.gov/lands/24267.html

Stream Processes, A Guide to Living in Harmony with Streams (Chemung County Soil and Water Conservation District 2006), on the Chemung County Soil and Water Conservation District: http://www.chemungcountyswcd.com/

Stream stewardship information at CatskillStreams.org

Water Quality Standards and Assessments

Waterbody Classification

American Rivers: Where Rivers Are Born: The Scientific Imperative for Defending Small Streams and Wetlands http://www.americanrivers.org/assets/pdfs/reports-and-publications/Where_Rivers_Are_Born804d.pdf

NYSDEC Conserving Natural Areas and Wildlife in Your Community http://www.dec.ny.gov/lands/50083.html

NYSDEC information about water classifications: http://www.dec.ny.gov/chemical/23853.html

NYSDEC information about best uses for waterbodies: http://www.dec.ny.gov/regs/4592.html

NYSDEC information on surface water and groundwater quality standards: http://www.dec.ny.gov/regs/4590.html

NYSDEC information on the Protection of Waters Program (Article 15): http://www.dec.ny.gov/permits/6042.html

NYSDEC information on protection for streams, wetlands and other waterbodies: http://www.dec.ny.gov/regs/4438.html#15885

Waterbody Assessment

Diet for a Small Lake: The Expanded Guide to New York State Lake and Watershed Management (http://www.dec.ny.gov/chemical/82123.html

Hudson Basin River Watch's Watershed Report Cards from 2006 and 2011 for the Greater Stockport Creek watershed: http://www.stockportwatershed.org/resources.html

NYSDEC Stream Biomonitoring Unit (http://www.dec.ny.gov/chemical/23847.html

NYSDEC information on regional trends from 30 years of biomonitoring data (1972-2002): http://www.dec.ny.gov/chemical/78979.html

NYSDEC information about the WAVE (Wadeable Assessments by Volunteer Evaluators) program: www.dec.ny.gov/lands/72898.html

Waterbody Impairment

NYSDEC Waterbody Inventory/Priority Waterbody List for the Lower Hudson River Basin: http://www.dec.ny.gov/chemical/36740.html

Water Infrastructure

Stormwater Management

Columbia County Soil and Water Conservation District: http://www.ccswcd.org/

Cornell Cooperative Extension for Columbia and Greene Counties http://www.ccecolumbiagreene.org/

EPA information on the MS4 regulatory program: http://cfpub.epa.gov/npdes/stormwater/munic.cfm.

Hudson River Estuary Program green infrastructure example: http://www.dec.ny.gov/lands/58930.html

NYSDEC information on the MS4 program: http://www.dec.ny.gov/chemical/43150.html

NYSDEC information about stormwater: http://www.dec.ny.gov/chemical/8468.html

NYSDEC information on the stormwater permit for construction activities: http://www.dec.ny.gov/chemical/43133.html

NYSDEC information on where post-construction stormwater management is required: http://www.dec.ny.gov/docs/water_pdf/gpsconspmt10.pdf (Appendix B)

NYSDEC Standards and Specifications for Erosion and Sediment Control: http://www.dec.ny.gov/chemical/29066.html

NYSDEC Stormwater Management Design Manual: http://www.dec.ny.gov/chemical/29072.html

SPDES Permits and Wastewater

EPA Enforcement and Compliance History Online (ECHO): http://www.epa-echo.gov/echo/

New York Water Environment Association (NYWEA): www.nywea.org

NYSDEC information on State Pollution Discharge Elimination System: http://www.dec.ny.gov/permits/6054.html

NYSDEC, US EPA Region 2, and Environmental Finance Center at Syracuse University. 2007. Handbook on Wastewater Management for Local Representatives. pp. 128 plus Appendices. Can be accessed at http://www.dec.ny.gov/chemical/33879.html

NYSDEC information dealing with wastewater treatment at the municipal level, Handbook on Wastewater Management for Local Representatives: (http://www.dec.ny.gov/chemical/33879.html

Dams and Other Aquatic Barriers

Anderson, M.G. and Olivero Sheldon, A. 2011. Conservation Status of Fish, Wildlife, and Natural Habitats in the Northeast Landscape: Implementation of the Northeast Monitoring Framework. The Nature Conservancy, Eastern Conservation Science. 289 pp.

NYSDEC Inventory of Dams is available at: http://www.dec.ny.gov/lands/4991.html

NYSDEC information on stream crossing guidelines: http://www.dec.ny.gov/permits/49066.html

NYSDEC information for dam owners: http://www.dec.ny.gov/lands/66952.html

NYSDEC dam owners guidance manual: http://www.dec.ny.gov/lands/4991.html

NYSDEC New York Barrier Mitigation Forum of the New York State Nonpoint Source Hydrologic and Habitat Modification Workgroup. 2010. Dam Removal and Barrier Mitigation in New York State, Preliminary Guide for Dam Owners and Project Applicants. 50pp.

NYSDEC, Nonpoint Source Coordinating Committee—Hydrologic and Habitat Modification Workgroup. 2008. A strategy for removing or mitigating dams in New York State and lessons learned in the Upper Susquehanna Watershed. Prepared by USFWS, 3817 Luker Road Cortland, New York 13045. 37pp.

NYSDOT TNC draft final report 2011

University of New Hampshire, New Hampshire Stream Crossing Guidelines, May 2009, http://www.unh.edu/erg/stream_restoration/nh_stream_crossing_guidelines_unh_web_rev_2.pdf

Appendix1: Mapping and Background Information

Landcover

The National Land Cover Dataset (NLCD, http://www.mrlc.gov/) has land cover and land use information for the entire United States at a 30 square meter resolution. Each 30X30m square is given a land cover/land use class. For impervious cover, the values of each square represent the proportion of urban impervious surface estimated for that cell. Accuracy assessments are underway for the 2006 dataset (used in this summary), but the 2001 NCLD was found to have a country-wide accuracy of about 80%, with variations by geography and by identified class. **It is critical to note that the NLCD dataset is most reliable at regional scales and has important limitations at our subwatershed scale. It should not be used for site planning and is not a viable substitute for on-the-ground knowledge and site visits**—the data is not necessarily accurate at particular locations in the town, and does not collect information on many important habitat types. Read more about the applications and limitations on the NLCD factsheet (http://pubs.usgs.gov/fs/2012/3020/). Used in an appropriate manner, the land cover/land use data can be a useful tool to understand patterns of land use in towns and to identify areas of concern where land use could be impacting our water resources.

Aquifers

Aquifers were mapped by the USGS in partnership with the NYSDEC in New York State in the mid-1980s. They show significant unconsolidated aquifers: those that consist of sand and gravel and yield large supplies of water to wells. Bedrock aquifers, although significant in some areas, were not addressed. Because the scale of the original aquifer maps is 1:250,000, these maps indicate only the general location of the unconsolidated aquifers; **they are not intended for detailed site evaluations**. Determination of the precise location of aquifer boundaries or of well yields may require additional data, according to authors of the source maps. Figure 4 is included as a general indication of where aquifers have been identified.

Figure 4 shows two classes of aquifers:

- UNCONFINED AQUIFER, Mid Yield (10 to 100 gallons per minute) - Sand and gravel with saturated zone generally less than 10 ft thick. Thicker deposits with less permeable silty sand and gravel may also be included. Yields in areas adjacent to streams may exceed 100 gal/min through pumping-induced infiltration, but these areas are too small to show at 1:250,000 scale.
- UNCONFINED AQUIFER, High Yield (More than 100 gallons per minute) - Sand and gravel of high transmisivity with saturated thickness greater than 10 ft. Many such areas are associated with a surface water source that can provide pumping-induced recharge

There are a limited number of places in the Hudson Valley where aquifers have been mapped at a 1:24000 scale, a much finer scale. Information on these locations and this project can be found on the USGS's New York Water Science Center (ny.water.usgs.gov) website, and a map of these locations can be found here: ny.water.usgs.gov/projects/bgag/aquifer.maps/aquifer1.maps.html.

Impervious Cover

NLCD impervious cover information is not fine-scale enough to be useful at the site plan scale, determining impervious cover amounts and locations on particular parcels or projects. It is

possible to collect impervious cover information at a more useful scale for planning at the subwatershed or finer scale. Several counties have undertaken their own, fine-scale, impervious cover mapping that will enable them to direct watershed management actions to the parts of our communities that need it most. Contact a watershed specialist at the Hudson River Estuary Program for more information.

Stream Assessments-Biomonitoring

The Stream Biomonitoring Unit chooses sample sites to meet several goals: characterizing regional reference sites, monitoring long-term sites, assessing unassessed waters, and monitoring sites that are of departmental, regional and/or public interest. Sites are also selected randomly within a region to provide a more unbiased dataset. Targeted sites make up approximately 60% of sites, while random sites comprise 40%.

Conservation Principles

for Protecting the Hudson River Estuary's Water, Wildlife, and Future

As a local government, you can use home rule authority to protect natural areas. The following are general conservation principles that you can use in land use planning and decision-making to conserve important natural resources that create a sustainable, resilient future for the Hudson River Estuary and its watershed. The 2010-2014 Hudson River Estuary Action Agenda identifies specific natural resources as critical for local protection, including areas important for fish and wildlife, clean water, scenery, the local economy, recreational opportunities and adaptation to climate change. For more information on the Action Agenda, visit www.dec.ny.gov/lands/4920.html.

The principles are intended to be broad guidelines that can be tailored to your local situation. In general, concentrated development that is sited to avoid important resources and leaves large undisturbed areas intact is better than low density development for protecting water quality and quantity, wildlife, and habitat. When development is sited in this way, your community is better prepared for floods, droughts, sea level rise and other environmental issues. As you apply the principles, consider natural resources at all scales: site-scale (e.g., project review), municipal-scale (e.g., comprehensive plans, zoning codes, open space plans) and regional scale (e.g., watershed plans, county plans), and remember that natural systems cross political and property boundaries. For help applying the principles in your community, contact the Hudson River Estuary Program.

1. **Protect natural areas throughout the watershed** to support the Estuary and provide community benefits. Key resources identified in the Hudson River Estuary Action Agenda:
    - **Hudson River tidal wetlands, shoreline, and plant beds** are filters for pollution, nurseries for the River's fish, and habitats for rare plants and animals.
    - **Wetlands** throughout the watershed clean water, store flood water, feed streams and groundwater, and are important habitat for fish, plants, and wildlife.
    - **Streams, floodplains, and stream corridors** store flood water, recharge ground water, clean water, and are important fish and wildlife habitat.
    - **Forests** clean air, keep water clean and abundant, provide timber and carbon storage and are important habitat for fish and wildlife.
    - **Shrublands and grasslands,** including working farms, are an important part of rural character, store carbon, and provide important habitat for plants and wildlife, especially birds.
    - **Broad connections between natural areas** across property and political boundaries allow for movement of water and wildlife.

2. **Identify natural areas early in the planning process**, including site-based project review and local planning, as well as intermunicipal and regional efforts. Use existing local and regional science-based information where available, and collect new information where appropriate.

3. **Protect large, contiguous, undisturbed areas** wherever possible. Larger areas are better able to adapt to disturbances such as fire, floods, blowdowns, invasive species and climate change. Protect contiguous areas in large, circular or broadly-shaped configurations within the larger landscape.

4. **Preserve farmland potential and working forests** wherever possible. These rural land uses are scenic and economic resources that can support the health of the Estuary and natural resources in its watershed when local farmers and woodland owners use best management practices.

5. **Maintain, create, or restore broad buffer zones** between natural areas and human-dominated land uses, including development and agriculture. Buffers of natural vegetation along streams, around water bodies and wetlands, and at the perimeter of sensitive natural areas are important for clean water, healthy habitats and flood damage prevention.

6. **Avoid and minimize disturbance to natural areas** before, during, and after construction. Locate and plan new development in ways that protect natural resources and habitats and provide buffers between sensitive natural areas and intensive use areas).
    - Don't fill wetlands, and protect their buffers.
    - Preserve vegetation.
    - Direct human uses toward the least sensitive areas.
    - Preserve and create connections among natural areas on and off site.
    - Promote clustered development within parcels and within the town wherever appropriate, to maximize the extent of unaltered land.
    - Avoid construction and development on floodplains, stream corridors and steep slopes.

7. **Minimize disruption to storage and movement of water** across and through the landscape to protect water quality and quantity, reduce flooding, recharge ground water and preserve fish habitat.
    - Avoid poorly designed culverts, bridges, and dams, which can create barriers for aquatic organisms and high flows.
    - Avoid transferring drinking and wastewater across watershed boundaries.
    - Avoid construction and development on floodplains, stream corridors and steep slopes.
    - Avoid straightening, rerouting, or covering up streams

8. **Encourage the use of green infrastructure to manage stormwater in developed areas**, utilizing practices such as rain gardens, street trees, and green roofs that allow runoff to infiltrate into the soil. Green infrastructure reduces runoff, improves water quality, provides natural cooling, and beautifies neighborhoods.
    - Reduce the amount of impervious surface cover where possible.
    - Maximize the on-site infiltration of stormwater runoff.

9. **Promote infill development and adaptive reuse** of existing structures and **promote compact development along existing roads**. New development should enhance existing neighborhoods instead of being isolated and requiring new roads or expanded vehicle use. Encourage development that features mixed uses, mass transit, and pedestrian mobility and access.

10. **Restore degraded habitats and water quality** wherever possible and practical, particularly river habitats and riparian vegetation, but do not use restoration projects as a "license" to destroy existing habitats. Restore the Hudson River Estuary's connections to tidal wetlands and backchannels, and restore stabilized shorelines to more natural states.

11. **Increase all our communities' resilience to environmental changes coming from global climate change**. Make sure new development and retrofits plan for increases in the height of the Hudson River Estuary, more precipitation during large storms, increases in peak flow in our streams, heat, and more extreme droughts.

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