Schoharie Watershed Turbidity Reduction Strategy

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1. Introduction

This report summarizes a 16 month planning project resulting in a watershed protection strategy that encompasses three counties and thirteen municipalities in the Schoharie basin. The project, which is the first of its kind in the New York City Watershed, was made possible by a NYS Department of State Enhanced Master Planning and Zoning Incentive Award.

The report contents include:

- project background
- overview of water quality in the watershed
- implementing a watershed approach
- organizational process to creating the strategy
- recommendations for addressing water quality and natural resource protection as identified through outreach with involved stakeholders, and
- a plan of action for implementing the recommendations

1.1 Project Summary

Under the guidance of the Greene County Soil & Water Conservation District (GCSWCD), communities in the Schoharie watershed worked together to create this action-based strategy to address turbidity in the basin. Using a grassroots approach, municipal officials and employees were engaged with county, state, and city agencies to identify sources of turbidity originating from the landscape as a result of human activities. Coupling local oversight with agency programs and support, the strategy addresses turbidity sources that are within local control. The project established a watershed-level working group, a steering committee of key agencies working in the basin, and focus groups that allowed for detailed discussion on common areas of interest. The inclusive process was designed to engage these parties to collectively develop the strategy, which not only benefits water quality, but instills a general watershed ethic and promotes cross-municipal and agency collaboration.

1. 2 Project background

The Schoharie watershed is 315 square miles and spans 13 municipalities and three counties in the northeast Catskill Mountains. Nestled in the heart of the Catskills, this region has long been a tourist destination for those seeking to enjoy the rural scenery, mountainous terrain and outdoor recreational activities. The watershed is also part of New York City's water supply system. As can be seen in Figure 1.1, the watershed is characterized by a small reservoir that is supplied by a rather large watershed. The Schoharie reservoir (Figure 1.2) is the smallest reservoir in NYC's West of Hudson water system, yet it has the third largest watershed (Smith, 2001).

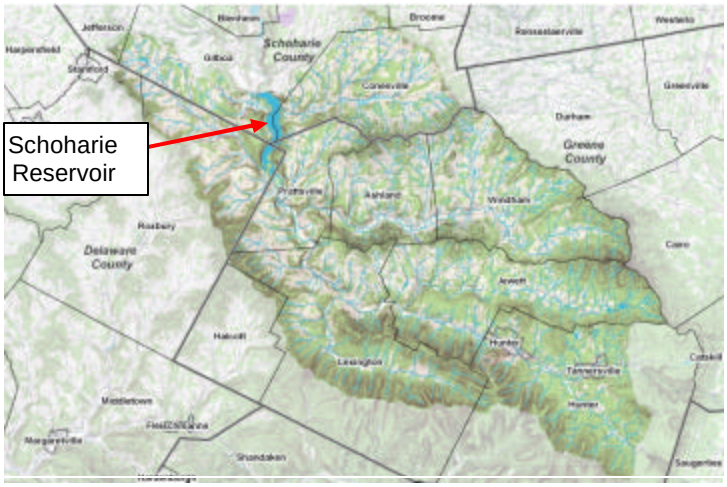


Figure 1.1 Schoharie watershed that drains into the Schoharie Reservoir

Figure 1.2 Photograph of the Schoharie Reservoir

The watershed is for the most part steep, and deep lacustrine clays underlie much of the watershed surface (Figure 1.3). Whether it is deep clays laid down in former glacial lakes, or the more compacted sand, gravel, and boulders that are also characteristic of the valley streams, even the most minor of disturbances results in significant impacts to water clarity and can interfere with disinfection processes for potable (drinking) water.

Figure 1.3 Glaciers created the mountainous Catskills terrain, along with the clay rich soils that blanket the region.

The Schoharie watershed is a relatively small area of New York City's 1,900 square mile water supply system (Figure 1.4), accounting for approximately 16% of New York City's annual water intake (NYC 2005 Drinking Water Supply & Quality Report). The quality of the watershed's streams as a natural and economic asset, however, is highly significant to both New York City and the local communities.

Watershed communities rely on outdoor-based tourism, second homeownership, and, to a lesser degree, agriculture to support their local economies. In addition to recreational activities, such as fishing, skiing, and hiking, the scenic beauty of the watershed attracts visitors from near and far contributing to these small rural economies.

Figure 1.4. Entire NYC Water Supply System including West and East of Hudson watersheds.

The Catskills' reputation as a haven for outdoor recreation, as well as a desirable area to live is integrally linked to the quality of its streams (Figure 1.5), and water quality is a reflection of natural conditions and human-induced activities that occur in the watershed. The focus of this project, therefore, is to better understand the human activities that affect water quality and what measures, such as improved stewardship practices, can be implemented to minimize adverse impacts to the watershed.

Figure 1.5 Fishing has always been a popular sport and pastime in the Catskills.

Using turbidity (cloudiness of water caused by suspension of organic and inorganic particles) as a water quality indicator, the project identifies land use changes and practices occurring in the Schoharie watershed that contribute sediment particles to waterways. When looked at collectively, patterns emerged as far as what practices and outreach methods could be coordinated better to minimize landscape sources that lead to turbidity. Even though turbidity is the project's primary focus, any management techniques that can reduce sediment from entering streams will also reduce other pollutants that are typically bound to suspended particles, such as pharmaceutical products[1], nutrients, phosphorus, and chemical contaminants.

1.3 Relevance to Stream Management Plans

The project originated with the Stream Management Program, one of dozens of watershed protection programs funded by the NYC Department of Environmental Protection (NYCDEP). Stream management planning involves analyzing the natural and built conditions of streams in relation to water quality and prioritizing management recommendations to minimize stream degradation. In Greene County, stream management plans (SMP) have been developed for four primary streams[2] draining to the Schoharie reservoir. SMPs have not yet been conducted on two northern tributaries to the reservoir, the Manor Kill and Bear Kill, located in Schoharie and Delaware Counties, respectively (Figure 1.6).

[1] Pharmaceutical and personal care products, or P.P.C.P.'s (e.g., shampoos, prescription medications) are receiving more attention for their potential impacts to humans and aquatic life (Cornelia Dean , NY Times Science, April 3, 2007 *Drugs Are in the Water: Does It Matter?)*

[2] Website links to the Batavia Kill, West Kill, East Kill and Schoharie Creek SMPs can be found on the GCSWCD's website at http://www.gcswcd.com/stream/

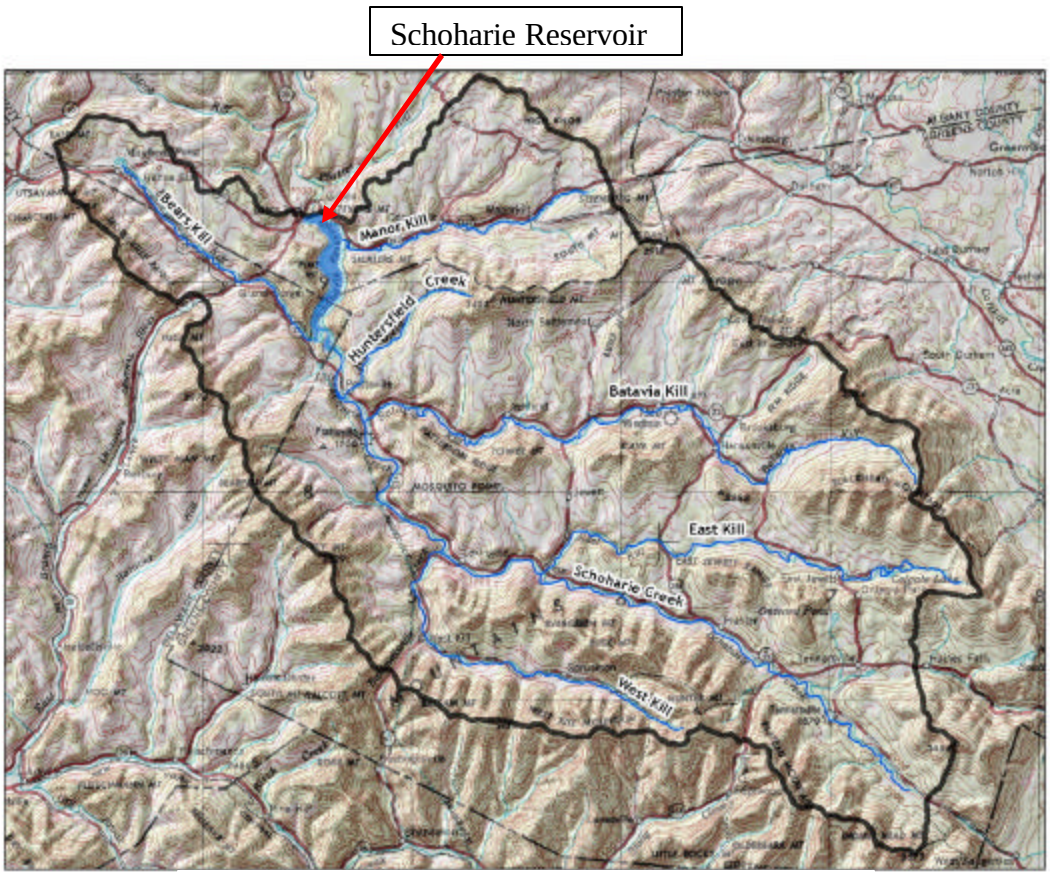


Figure 1.6 Main tributaries in the Schoharie watershed

Although SMP's focus mostly on unstable stream reaches and conditions within the immediate stream corridor, such as clay soils from eroding streambanks, each plan has a section on general recommendations that promote watershed stewardship practices in areas such as:

- ⇒ preventive stormwater planning
- ⇒ floodplain management and protection
- ⇒ public education on stream stewardship
- ⇒ roadside ditch maintenance that is compatible with stream functions, and
- ⇒ riparian protection and enhancement

Whereas NYC has funded detailed SMPs and in-stream restoration projects as a condition of Filtration Avoidance Determinations (FADs), there is no program or mechanism to comprehensively extend the general recommendations to all communities in the basin[3]. Recognizing this gap, the Greene County Soil & Water Conservation District (GCSWCD), through the Town of Windham, applied for and received a NYS Department of State Enhanced Master Planning & Zoning Incentive grant to initiate a basin-wide strategy on behalf of all the municipalities.

This basin-wide effort complements other initiatives undertaken by GCSWCD to advance sound management practices at the watershed-scale (e.g., Schoharie Basin Turbidity Reduction Project, September 2005). Moreover, it furthers the District's belief that by working proactively with local communities and residents, significant strides can be made towards maintaining both water quality and the scenic and outdoor resources watershed communities rely on to support their local economies.

The recommendations contained herein reflect the broad outreach that was conducted to bring diverse interests together to identify ways to improve watershed protection. They are intended to guide local efforts, in conjunction with regional, state and federal programs, to implement watershed stewardship practices, such as those identified above in stream management plans.

[3] Basin and watershed are used inter-changeably throughout the report.

1.4 Project Goals & Objectives

1. To identify land use activities that contribute to turbidity and other water quality problems
2. To integrate and coordinate stewardship practices across the 13-municipality, three-county basin to minimize water quality degradation and promote natural resource protection
3. To formalize a watershed protection plan that uses a ground-upward approach where local officials, municipal employees and residents spearhead the effort with support from government agencies and county departments
4. To utilize resources more efficiently and cost-effectively across the basin
5. To facilitate information sharing among local decision-makers, residents and watershed & regulatory agencies

The project's main tasks entailed:

- organizing a watershed-level working group and core steering committee to direct the strategy's goals and outreach methods
- investigating current studies and information on land use and water quality
- engaging numerous public officials, local decision-makers, property owners and watershed managers through focus groups (Figure 1.7), and
- conducting public educational forums to facilitate basin-level planning and information sharing

Figure 1.7 Highway superintendents & NYCDEP staff meet as part of a focus group discussion.

The planning process and strategy promotes a cohesive approach to watershed protection that transcends municipal and government borders and encourages local and regional interests to work together to coordinate stewardship practices. Protecting water quality as close to the source as possible benefits both the Schoharie basin communities and New York City's residents who rely on the health of the watershed as their drinking water source.

It is anticipated that each municipality will recognize the benefits of this watershed approach and formally adopt the plan. Furthermore, the strategy is intended to serve as a guide to establishing the institutional relationships, cooperation and communication that is essential for implementing the plan's recommendations.

2. Turbidity as a non-point source pollutant in the Schoharie basin

2.1 Overview of the problem

Turbidity is the presence of suspended particles (silt, clay, organic and inorganic matter) in water that reduces light transmission through scattering or absorption, causing water to look brown and muddy. In the Schoharie watershed, silt and clay deposits left from receding glaciers thousands of years ago are the principal source of suspended sediment that cause the water to turn reddish-brown after heavy precipitation events (NYCDEP, 2007). Turbidity is commonly used as a surrogate for visual clarity (NYCDEP, 2004) and is measured using an instrument called a turbidimeter, which measures the degree of light scattering by these particles. Turbidity is not a substitute for measuring suspended solids concentrations and water clarity, although it can be related to them (Smith, 2007).

Given its ubiquitous nature, turbidity is characterized as non-point source (NPS) pollution. NPS pollutants are difficult to quantify and control because they are widely dispersed in the environment. Landscape sources that contribute to turbidity are associated with a variety of human activities that cause changes in vegetative cover, soils, and flow paths that reduce the ability of the land to naturally

remove pollutants in stormwater (National Research Council, 2000). These sources are distinct from in-stream erosion and are the focus of this report. Example pollutants, sources and water impacts can be found in Table 2.1.

Table 2.1 Example land use sources resulting in non-point source pollution

Pollutant	**Source**	**Impact to water quality**
1. Nutrients (nitrogen, phosphorus)	Agriculture (fertilizer, manure) septic systems	Eutrophication of waterbody (excessive algal growth, low oxygen levels)
2. Sediment	Erosive soils (e.g., glacial clay) disturbed by land use practices, such as agriculture (Figure 2.1), silviculture (forestry, Figure 2.2), mining, construction, impervious surface	**Turbidity**, or suspended sediment/particles in water
3. Organic compounds	Vehicle fluids, underground storage tanks that leak	Underground and surface water contamination
4. Other compounds of concern	Pharmaceutical, personal care products leached through septic systems, sewage plants	Unknown to humans, hormonal changes observed in aquatic life

Figure 2.1 Compacted cropland can increase surface runoff causing waterways to become turbid

Figure 2.2 Logging operations can also lead to sediment loading of streams if not properly planned

Turbidity is one of the most pervasive sources of non-point source (NPS) pollution throughout the country, and this is especially true in the Catskill Mountains where the glacial geology, steep mountain slopes and high energy runoff are but some of the factors that contribute to erosion and movement of sediments in the water system. In the Catskills, turbidity is most pronounced in the Schoharie reservoir system, a basin that carries a turbidity-limited designation, meaning turbidity levels have exceeded acceptable concentrations for water uses. The Schoharie reservoir is listed on the NYS Department of Environmental Conservation's Priority Waterbody List, which tracks waterbodies that are impaired or suspected of impairment (NYSDEC, 2006 Section 303 (d) List).[4] The primary pollutant is sediment that

[4] The Priority Waterbody List can be found at http://www.dec.ny.gov/docs/303dlist06.pdf

enters the reservoir (Figure 2.3) from surrounding tributaries after heavy rainstorms. Figure 2.4 depicts a turbid Schoharie Creek that transports sediment downstream to the reservoir.

Figure 2.3 Turbid water permeates the Schoharie Reservoir Gatehouse a few days after Hurricane Floyd, a major storm event in September 1999

Figure 2.4 Turbidity from Schoharie Creek washes downstream into the reservoir

The presence of suspended solids in water impacts not only New York City's water supply, but also the immediate watershed communities. The next section highlights local and regional impacts of turbidity in the Schoharie basin.

2.2 Impacts to local communities and NYC's unfiltered water system

While NYC has a direct interest in protecting their water supply, local stakeholders have a shared interest as it is this same resource that provides drinking water for some municipalities and contributes to the local economy.

Elevated turbidity events are a serious public health concern for unfiltered surface water systems. Suspended sediment acts as a vector moving pathogens and bacteria throughout the watershed. The sediment provides nutrients for microbial growth and compromises the efficacy of the disinfection process (Birman & Tuneva, 2004). When turbidity levels reach 5 NTU's (nephelometric turbidity units) for source water reservoirs, such as New York City's, the water must be treated with Alum, an aluminum-based coagulant that causes the particles to lump together and sink so the water can be used for human uses (Safe Drinking Water Rule and Interim Enhanced Safe Drinking Water Rule filtration avoidance criteria). Although there have been no known neurotoxic impacts to humans, researchers are studying the potential effects in mice since aluminum has been associated with Alzheimer's disease and other brain disorders (Birman & Kamalov, 2006).

Locally, turbidity affects the Schoharie and Ashokan communities that rely on the pristine Catskill waterways for tourism. Popular recreational activities that are negatively impacted by turbid water are fishing, tubing and snowmaking for skiing. The impact of turbidity from the Schoharie basin on the aquatic habitat of the Esopus Creek has received widespread attention because of legal action taken by a coalition of watershed groups against NYC. Led by the Catskill Mountain Chapter of Trout Unlimited and Riverkeeper, the coalition sued NYCDEP for discharging turbid water from the Schoharie reservoir to the Esopus Creek via the Shandaken Tunnel, an aqueduct owned by NYC. The lawsuit resulted in a federal court ruling that the Shandaken Tunnel requires a State Pollution Discharge Elimination System (SPDES) permit because the discharge degrades water quality, fish habitat and recreational uses (Figure 2.5). A federal appeals court ruling in August 2006, defining the Tunnel as a point source, upheld NYC's penalty for not having a permit to discharge silt to the Esopus Creek (The Associated Press, 2006).

Figure 2.5. Transference of turbid water from the Schoharie basin to the Esopus Creek via the Shandaken Tunnel.

The significance of turbidity from the Schoharie basin also has major financial implications for NYC. If the city's unfiltered water source does not meet national safeguards, it would be required to build a filtration plant and estimates range from $ 6 – 8 billion with annual operation and maintenance costs estimated at $200 million (Mugdan, 2004). The Environmental Protection Agency (EPA) and NYS Department of Health (NYSDOH) consider the prevention, management, and control of turbidity in the Catskill system as a necessity to avoid building a costly filtration plant (USEPA, 2007). Speaking before the NYC Committee on Environmental Protection in April, 2006, Walter Mugdan, USEPA, noted the single most important concern for NYC's continued filtration avoidance for the Catskill/Delaware water supply is excess turbidity coming from the Catskill watershed, notably the "Schoharie reservoir basin, which is the basin of most concern."

In response to EPA's concerns, NYCDEP created the Catskill Turbidity Control Program (CTCP) to develop feasible structural alternatives to reduce periodic elevated turbidity levels in the Schoharie and Ashokan reservoirs (NYCDEP, 2004). Whereas this program is focused on reducing turbidity levels in the reservoirs, NYCDEP also funds a host of watershed protection programs to reduce upstream landscape sources that contribute sediment to streams (see section 3.3). Although the benefits of these upstream programs have not been quantified in relation to the CTCP alternatives, the potential exists for them to reduce influent particle loads to the reservoir, and therefore improve cost-effectiveness, and long-term performance of various [engineering] alternatives (NYCDEP, 2004).

Prior to developing an effective strategy to address landscape turbidity sources in the Schoharie basin, it is important to summarize or characterize the general watershed condition. Section 2.3 highlights the known features of the Schoharie basin.

2.3 Schoharie basin characterization

Using data and information obtained through research and the Stream Management Program, a summary of the known watershed condition is provided. More detailed information can be found in the stream management plans conducted in Greene County at http://www.gcswcd.com/stream.

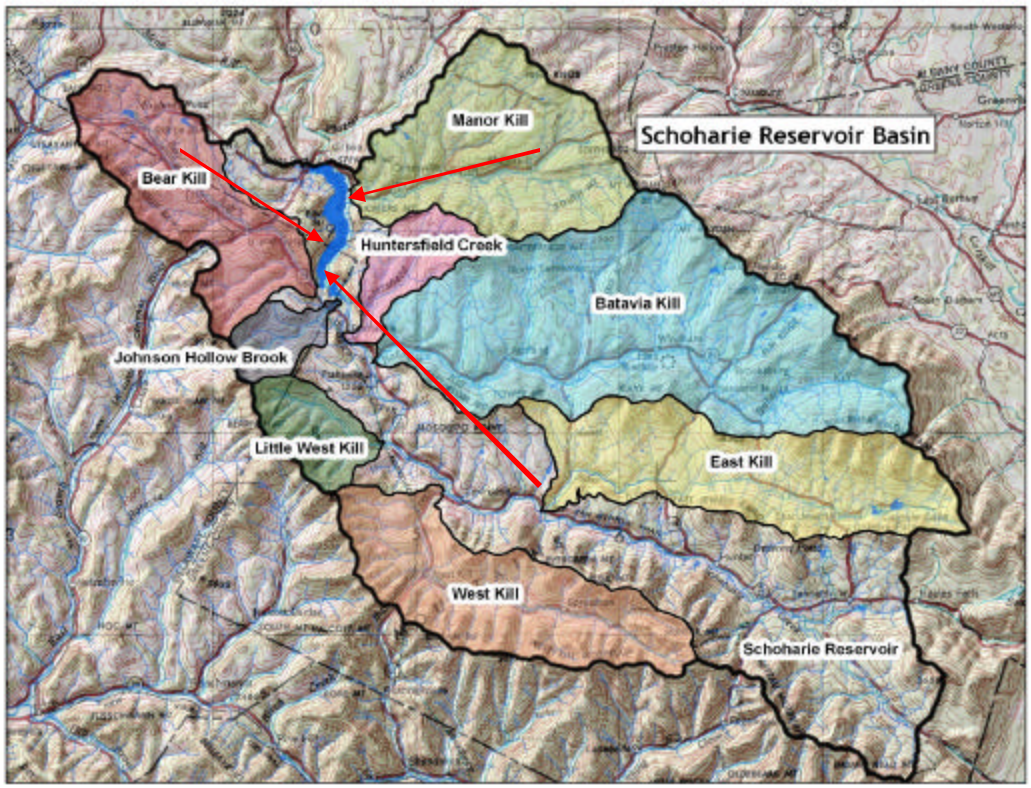
The municipalities by county in the Schoharie watershed and the percentage of their drainage area can be found in Table 2.2 (refer to Figure 1.1 in Introduction for map view). Collectively, the basin represents 13 local municipalities.

Table 2.2 Municipalities and counties in the Schoharie watershed by drainage area.

Percentage in basin by county	Municipalities
Greene 76%	Ashland
	Jewett
	Hunter (Town)
	Hunter (Village)
	Lexington
	Prattsville
	Tannersville (Village)
	Windham
Schoharie 16%	Conesville
	Gilboa
	Small area, Town of Jefferson
Delaware 8%	Grand Gorge (Town of Roxbury)
	Small area, Town of Stamford

There are three tributaries to the Schoharie reservoir – the Manor Kill, the Bear Kill and Schoharie Creek. Schoharie Creek is the largest tributary, accounting for approximately 76% of the total reservoir watershed area and approximately 75-80% of the total inflow volume to the Schoharie Reservoir (CAT 211, Phase 1, Final Report, 2004, pg. 2-4). The Schoharie basin encompasses approximately 315 square miles and includes Schoharie Creek, the Batavia Kill, East Kill, West Kill, Little West Kill, Manor Bill, Bear Kill, Johnson Hollow Brook, Huntersfield Creek and smaller tributaries (Figure 2.6).

Figure 2.6. Schoharie watershed and tributaries to the reservoir



Since being settled by the Dutch in the early 1700s, generations have managed the Catskills' streams to conform to human interests and uses. Streams in the Schoharie basin have been channelized, straightened, excavated, bermed, rip-rapped and other wise manipulated to serve human needs often to the detriment of the stream system (VanSchaack, 2007). Other human activities that have impacted stream function and flow over time include filling in floodplains and streamside wetlands, diverting water into floodplain ponds and pastures, and clearing stream banks and terraces. Practices like these ultimately reverberate throughout the stream system, causing property and infrastructure loss during flood events, and, during low flow periods, negatively impacting coldwater fishery when streams are over-wide and shallow in affected reaches. While some human activities have hampered the ability of streams to evolve naturally[5], the watershed's hydrology and topography further compound watershed management.

Heavy rain events coupled with the steep topography of the watershed can cause severe flooding resulting in significant turbidity events. The Schoharie Creek watershed averages approximately 46 inches of precipitation per year in the upper reaches (Hunter), 42" per year in the mid-sections (Lexington) and 38.5" per year near the reservoir (Prattsville). Average slope of the upper watershed is 22% (i.e., watershed elevation drops 22' feet for every 100 feet horizontal distance), 18% in the mid-section and 15% near the reservoir. Given the average drainage density (the amount of stream length available to transport runoff per unit area of watershed), steep mountainous slopes, and high precipitation, the Schoharie system is relatively flashy. A "flashy" watershed is characterized by stream levels that rise and fall quickly in response to storm events. This flashiness is somewhat mitigated by heavy forest cover throughout much of the watershed. Therefore, efforts to protect upland, as well as riparian, forest are important to reducing flooding impacts (Schoharie SMP, 2007).

Turbidity levels in the Schoharie Creek sub-basins vary throughout the watershed based on stream channel conditions. Schoharie Creek sub-basins (East Kill, West Kill, Batavia Kill) experience seasonally high turbidity caused by in-stream erosion (clay and silt) which contribute to degraded water quality. While there are occasional spikes in turbidity, the streams above Lexington generally have low levels of turbidity. Once the Batavia Kill and West Kill enter the Schoharie, turbidity values increase (NYCDEP, 2003). Exacerbating the problem are poor riparian buffer conditions throughout many of the streams in Greene County. Extensive colonies of invasive species, such as Japanese knotweed (Figures 2.7 and 2.8), replace native vegetation and undermine stream bank stability causing more sediment to enter the water during floods (Batavia Kill Stream Management Plan, 2004).

Figure 2.7 mature stalks of Japanese Knotweed

Figure 2.8 Japanese knotweed taking over native vegetation along the Schoharie Creek

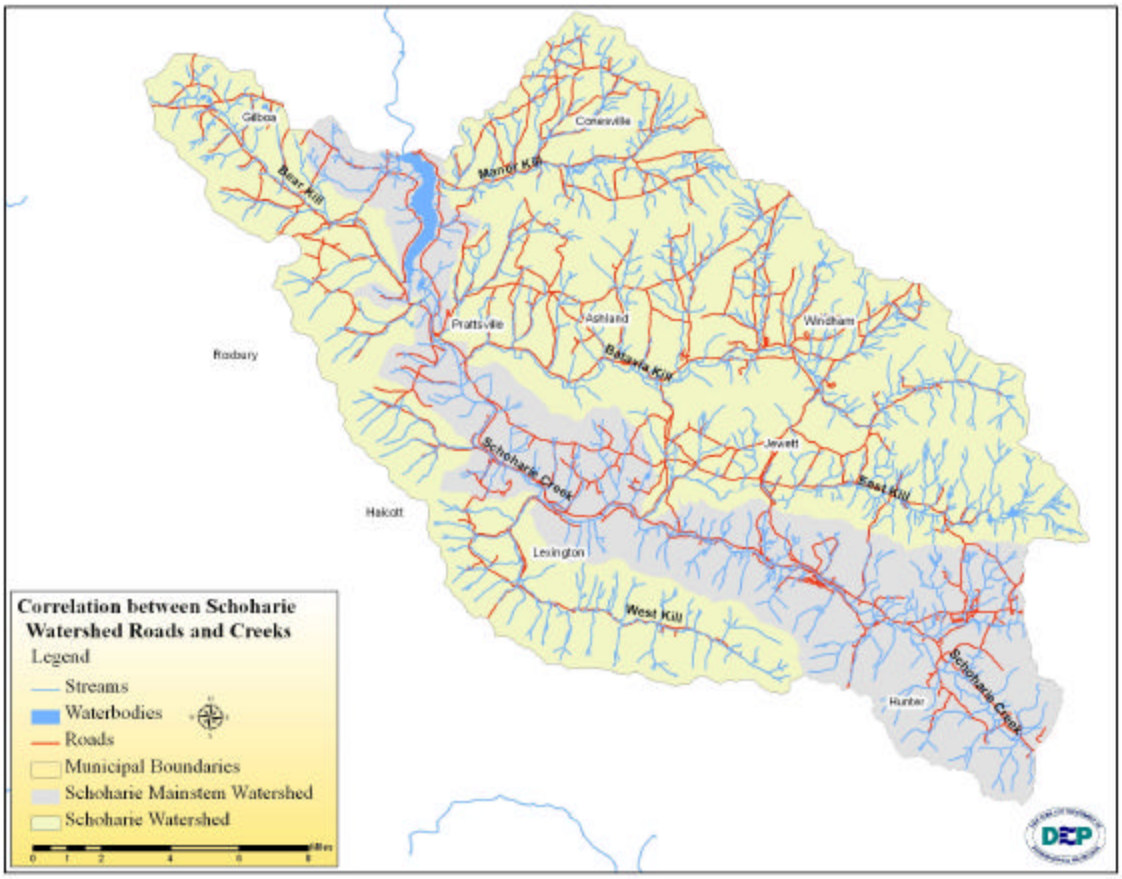
[5] Much as been learned over the years about stream formation and function using a multi-disciplined approach called fluvial geomorphology, which integrates hydraulics, soils, geology, plant science, engineering and other areas of study to understand how streams evolve by moving water and sediment supplied by the watershed.

The watershed's geology dates back tens of thousands of years to last ice age, the Wisconsin Glacier. The present-day water quality threats in the Schoharie basin originate primarily from this period as ice age deposits of glacial debris, particularly silt and clay particles, wash into local streams. These deposits are easily eroded into the stream and, after major storms, cause the streams to turn reddish-brown, which elevates in-stream turbidity. Although temporary, this increase in turbidity can degrade fish habitat (Newcombe and Jensen, 1996; Henley et al., 2000; Newcombe, 2003), act as a transport mechanism for other pollutants and pathogens (Birmin & Tuneva, 2004, LeChevallier et al., 1981) and cause changes in the operations of the NYC water supply (NYCDEP, 2004). Although a certain percentage of the erosion is natural, human alterations to the landscape can exacerbate the problem, such as disturbances to the basin's steep slopes and construction activity that lacks proper erosion controls (Figure 2.9).

Figure 2.9 Improper sediment controls during construction of a major subdivision

The built environment of the Schoharie basin has developed over the years like other watersheds resulting in expanded road networks. As shown in Figure 2.10, there are approximately 498 miles of road in the watershed as of 2006 (Schoharie Creek Stream Management Plan, 2007). Due to the steepness of Schoharie basin valleys, many roads have been built on the gentler slopes adjacent to streams. Hardened road embankments have encroached on the streams at many narrow points in the valleys, and bridges have also constricted the streams. In recent years, as homebuilders seek the mountainous viewscape, driveways have been cut on steeper slopes at times resulting in excessive runoff as shown in Figure 2.13, page 14.

Figure 2.10 The interface of roads and streams in the Schoharie basin



Research studying the impacts of roadside ditches on water quality has shown that ditches are a significant contributor to flooding and degraded water quality (Schneider, 2006). Large amounts of geologic material (boulders, cobbles, soils) are transported through ditches which discharge directly into streams. Scraped and exposed ditches in particular are a major source of suspended sediment and dissolved chemicals to downstream waters (Schneider, 2006). As shown in Figures 2.11 and 2.12, roads and ditches act as a conduit diverting water that would otherwise drain naturally over the landscape.

Figure 2.11 Flooding along State Route 296, Town of Windham

Figure 2.12 roadside ditch transporting water and sediment material downstream

Determining whether a stream has good or bad water quality often depends largely upon the end user. For purposes of the NYC water supply, the Schoharie watershed supplies good quality water, except following large storm events when in-stream turbidity and suspended solids are high. Although streams in the Catskills continue to move large amounts of suspended sediment during storms, watershed landowners and decision-makers have direct influence over land uses that also contribute to soil erosion and sedimentation of waterways. The next section briefly covers landscape sources that are within human control.

2.4 *Land use sources contributing to turbidity*

It is well documented that the watershed's geology is such that turbidity will always be problematic, especially after high flow events. The role human activities play in changing the natural landscape also has considerable influence over water quality[6]. Table 2.2 summarizes common landscape sources that contribute to non-point source pollution, all of which are occurring throughout the Schoharie basin in varying degrees.

Table 2.2 Common alterations to the landscape resulting in sedimentation of streams

Landscape alterations	**Sediment delivery**
Forestry/silviculture	Clearing land, creation of logging roads, stream crossings
Agriculture	Clearing and compacted land for crops
Building/Development/Construction	Runoff from impervious surfaces (rooftops, parking lots) and during construction
Roads & driveways	Runoff from roadside ditches, driveways & undersized culverts

Altering landscapes affects the land's ability to naturally remove contaminants from stormwater (National Research Council, 2000). Construction and agricultural activities, clearing of forests and development of roads are activities that precipitate soil erosion leading to water quality degradation. Whereas landscape alterations are inevitable to a point, the magnitude of soil erosion which follows human development does not have to be.

Improperly constructed driveways on steep slopes, for instance, was identified in most Schoharie basin communities as problematic. Runoff from driveways and ditches without proper mitigation measures (Figure 2.13) not only transports sediment into ditches and ultimately streams (Schneider, 2006), but water flowing down driveways can also be a safety hazard in the winter if it freezes on public roads (an issue raised by one of the local planning boards).

[6] *Humans impact on erosion 15 times greater than natural processes*, William Kates, Associated Press, Dec. 1, 2006, summarizing research conducted by sedimentary geologist, Bruce Wilkinson, Syracuse University. http://www.cbsnews.com/stories/2006/12/01/ap/tech/mainD8LO9ADO0.shtml

Figure 2.13 Improperly constructed driveways can add sediment to nearby waterways. The red arrow signifies the same location on this driveway.

Certain impacts from post development can influence water quality and quantity as local decision-makers and highway personnel noted. Diverting natural drainage flows, for example, to accommodate development was cited as a water quality concern, particularly the construction of individual residences which do not go through the same review as subdivisions or site plan reviews. Other aftereffects from development include increased runoff, reduced groundwater infiltration, and increased frequency and magnitude of floods (Schneider, 2007). It is estimated that between 9 % - 24 % of suspended sediment concentrations in the Greene County portion of the basin, measured at the Prattsville gauge, are from landscape sources occurring in the Schoharie Creek sub-basin (NYCDP, 2007). Figures 2.14 and 2.15 show example land use alterations where impervious surfaces, such as roads and homes, can change natural patterns of flowing water.

Figure 2.14 Flooding next to a home in Windham

Figure 2.15 Construction of a private road in a major subdivision, Hunter

A recourse to help control the effects of non-point source pollution involves using regulations.

2.5 Regulations governing impacts to water

In addition to the voluntary watershed protection programs noted in Section 3 on page 17, regulations are used to minimize water quality impacts from development activities that change the landscape. Local, county, state, federal and city governments all implement some form of land use control to safeguard against degrading natural resources, such as water.[7]

[7] A summary of common development activities requiring a permit can be found in Appendix C

Whereas regulations are needed to balance natural resource protection, improving networking opportunities, information-sharing, and coordination of practices can also effectively minimize adverse impacts to water quality. For example, it was suggested in a land use planners' focus group to attach educational material to building permit, site plan and subdivision applications alerting landowners to thresholds requiring a stormwater pollution prevention plan. Standardizing a practice like this across the basin would help educate landowners who may not know about this regulated activity. Getting more and consistent information to people will address situations where someone simply doesn't know what is required of them. The more proactive governments become in this regard, the less likely they are to be regulated by outside agencies, which has historically been a source of contention and a direct threat to home rule governance.

Regulation vs. enforcement
A number of local decision-makers emphasized they do not feel regulations are necessary where ones already exist, such as NYS and NYC stormwater regulations. Often times it is a matter of enforcing existing laws, officials noted. Some voiced concern about being overregulated and not having the resources to enforce laws, such as part-time code enforcement officers whose work loads vary with the building market. In some instances, however, strengthening local laws is advisable where gaps exist with regulations, such as performance standards for driveways that create runoff problems.

While there has been much debate on the solution to reducing turbidity, there is consensus amongst most parties that a holistic, watershed-based approach must be taken to effectively reduce landscape sources of turbidity, while giving due consideration to how communities grow in relation to their natural resources.

The next two sections highlight the benefits of implementing a watershed approach to addressing the negative impacts of altering the landscape and the process that was used to organize stakeholders in the development of this strategy.

Information and reports that were compiled on land use impacts and turbidity can be found in Appendix B.

3. Implementing a watershed approach to reducing non-point source pollution

3.1 Watershed planning

To effectively address non-point source pollution, comprehensive planning at the watershed scale is necessary. As noted in Section 1, an overarching strategy that integrates general recommendations from individual stream management plans was needed in the Schoharie watershed to coordinate local oversight efforts at protecting stream corridors. Working with municipal officials and property owners to identify land use practices that contribute to turbidity requires significant outreach at the local level where source problems originate.

Developing a watershed strategy can benefit communities in a number of ways. The process reinforces local control to safeguard water quality, encourages local governments to be proactive, and pools limited resources for implementation practices. Whether one lives in Gilboa or at the opposite end of the watershed in Tannersville or Hunter, impervious surfaces, diverted water paths, and inadequate sediment controls all contribute to water quality challenges. Standardizing best management practices at the local level, therefore, will improve the effectiveness of a watershed-based strategy, and this starts with promoting greater awareness and recognition of problems at the closest level to the resource.

In addition to maintaining water quality, other natural resource benefits can be realized by organizing stakeholders and implementing best management practices across the watershed.

Improving local protection of non-regulated wetlands, for instance, will benefit animal species that inhabit or use wetlands for breeding and migration. Working with property owners and officials on safeguarding forested lands for the ecological services they provide, such as carbon sequestration & habitat for biodiversity, complements water quality benefits derived from forests (We're Not Seeing the Forest for the Trees! Cornell Cooperative Ext. of Greene County, ARC brochure, M. Wyman, 2007).

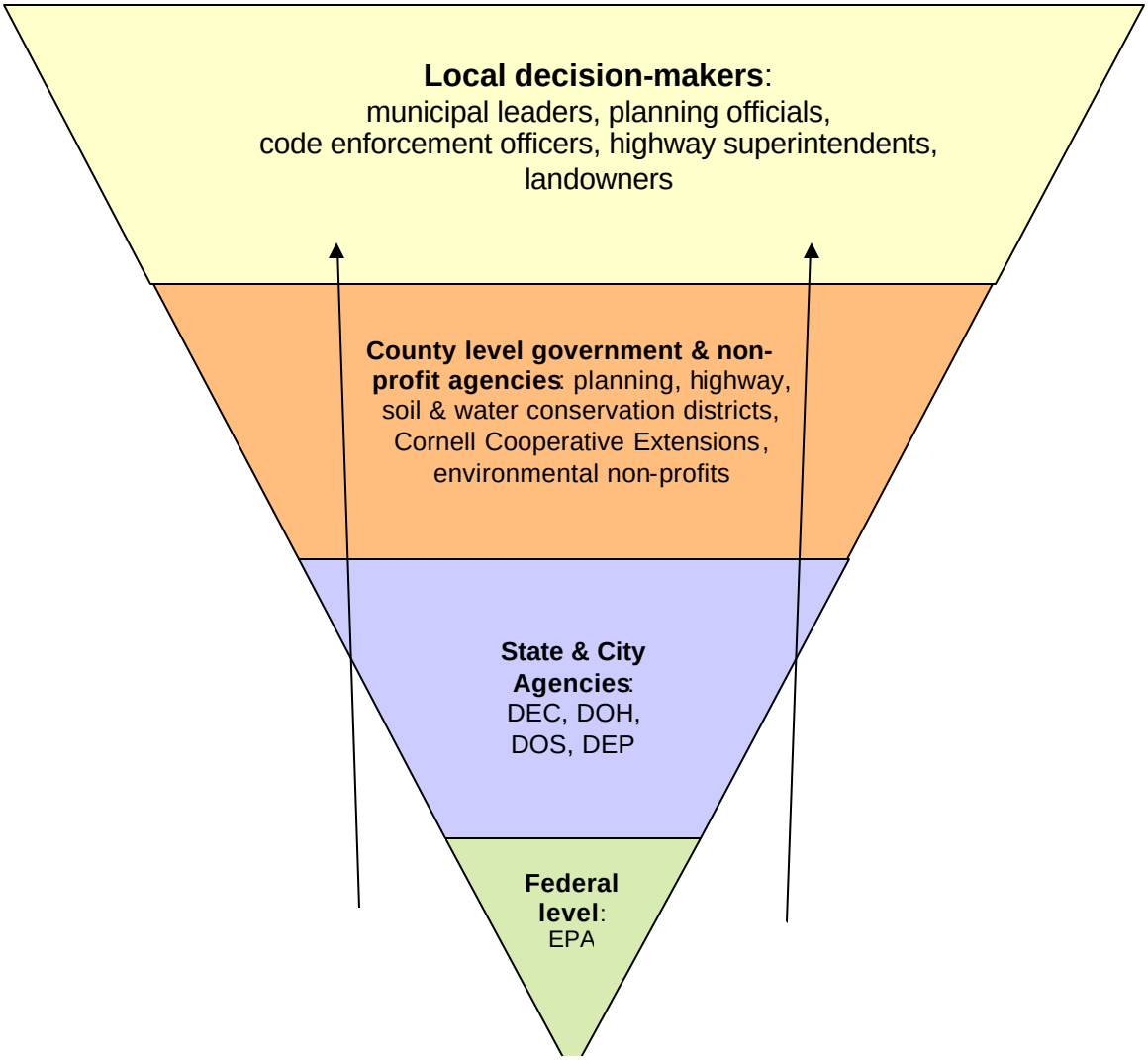
A key ingredient to developing a successful strategy among municipalities, government agencies and property owners that deals with water quality protection is local involvement and ownership.

3.2 Facilitating local involvement

Essential to the success of any strategy is the need to incorporate local stakeholders' interests and concerns. This is especially true where responsibility for water quality oversight and control oftentimes rests with local government and decision-makers in the policy decisions and practices that are implemented.

The planning process focused mainly on local municipal leaders, planning officials, highway superintendents, code enforcement officers, interested property owners, and companies and contractors working in the basin. Engaging these local participants with county, non-profit, city, state and federal management agencies allowed for exchanges of ideas and opinions on water quality concerns and potential solutions. Within this model (Figure 3.1), local decision-makers are supported by agencies through a series of information sharing sessions and networking opportunities. As input was obtained at the local level, patterns started to emerge regarding what type of assistance was needed and where, forming the basis for the recommendations.

Figure 3.1. Supporting local decision makers requires effective communication from all levels of government and involved agencies.



The inclusive approach opened the door to identifying opportunities for improving collaboration and inter-municipal and inter-agency networking, particularly in the areas of technical assistance, educational material, and standardizing best management practices. Focus groups provided an initial forum for dialogues to take place allowing connections to be made that did not exist before and ideas to be generated that will help advance watershed planning. (A detailed description of the organizational process is discussed in Section 4 below.)

Knowing what existing resources are available to watershed communities helped identify additional opportunities to bridge local and regional efforts at protecting water quality. A summary of key programs is provided below.

3.3 *Watershed programs serving the Schoharie basin*

There are a number of watershed protection programs that are available to Schoharie basin communities. Many are funded by NYCDEP as a condition of Filtration Avoidance Determinations and provided by county departments, non-profit organizations, and consulting firms. A sampling of programs that address turbidity and water quality in general are listed below in Table 3.1.

Table 3.1 Watershed Protection Programs that are available throughout the watershed.

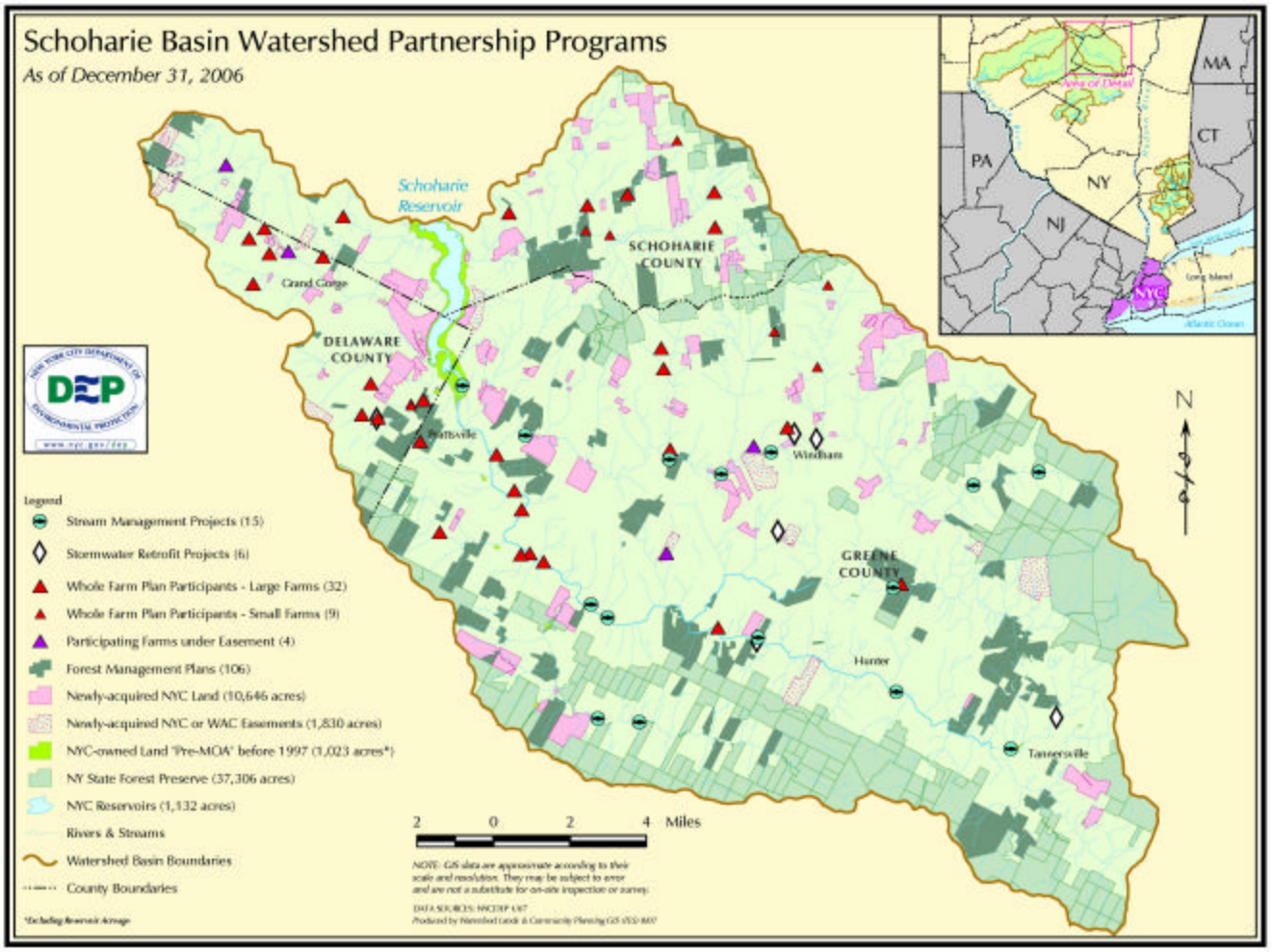
Program	Involved Agencies
Stream Management Planning Increases stability of stream corridors through development of stream management plans, stream restoration projects, and promotes working with watershed communities to facilitate long-term stewardship of stream networks.	Soil & Water Conservation Districts (SWCDs), Planning Departments, Cornell Cooperative Extensions
Watershed Agricultural Program Promotes best management practices on farms to control runoff and prevent pollution from animals from reaching waterways	SWCDs, Cornell Cooperative Extensions, Watershed Agricultural Council (WAC)
Stormwater Retrofit Program Corrects or reduces water quality problems associated with erosion or substandard stormwater management conditions existing on or before January 21, 1997 (MOA inception).	SWCDs, Engineering & Consulting firms (administered by the Catskill Watershed Corporation)
Future Stormwater Program Covers eligible costs exceeding what a watershed property owner would be required to pay to meet state and federal stormwater standards.	SWCDs, Engineering & Consulting firms (administered by CWC)
Watershed Forestry Program Promotes forestry practices that minimize non-point source pollution from logging activities.	Watershed Agricultural Council, Cornell Cooperative Extensions
Agroforestry Practices Promotes sustainable forestry & other crop practices that provide economic benefits to landowners and communities while preserving forested areas for ecological and public health benefits	Cornell Cooperative Ext. of Greene County
Critical Area Seeding Program Re-establishes vegetative stabilization of critical disturbed areas, such as road ditches, streambanks, and forestry operations. Initiated by GCSWCD.	SWCDs, local highway departments
Riparian Buffer Protection Program (new initiative in the 2007 FAD) Focuses on improving riparian buffer protections along privately-owned stream reaches and providing technical assistance to streamside owners for their particular needs.	SWCDs, Cornell Cooperative Extensions

In order to take advantage of these programs, municipalities often rely on the assistance of agencies, such as Soil & Water Conservation Districts (SWCDs), Cornell Cooperative Extension agencies, or engineering firms to identify mitigation projects that address local water quality problems. The Stormwater Retrofit program, for example, approved 19 projects in the Schoharie basin totaling $1,131,315 as of September 2007 (NYCDEP, 2007) including the purchase a hydroseeder by the GCSWCD to work with highway departments in Greene County on re-vegetating disturbed areas.

A program created by NYCDEP, as mandated in the SPDES permit for the Shandaken Tunnel (discussed on pg. 7), will allow seven communities in the basin to address stormwater impacts from existing and foreseeable development. The Schoharie Watershed Impact Studies program is available to municipalities in the Schoharie basin to conduct Generic Environmental Impact Statements (GEIS) to minimize turbidity caused by infrastructure impacts. The Towns of Windham, Jewett, Hunter (including the Villages of Hunter and Tannersville), Conesville, and Roxbury (for Grand Gorge) were approved to conduct GEIS-related studies and projects will commence in 2008.

A summary of the many watershed protection projects that have been implemented in the basin are highlighted in the map below (Figure 3.2).

Figure 3.2. Watershed Protection Projects implemented in the Schoharie Watershed.



The outreach that was conducted throughout the project helped identify program and resource gaps in addressing non-point source pollution throughout the basin. The following section highlights universal needs communities have, as well as some specific program gaps in the Delaware and Schoharie County communities in the watershed.

3.4 *Resource gaps limiting water quality protection*

Whereas a significant amount of funding for watershed programs and services has been funneled to basin communities, gaps still exist. Some of these gaps are common throughout the watershed, and others specific to Schoharie and Delaware municipalities are summarized in Table 3.2 below.

Table 3.2 Resource needs for Schoharie watershed communities

Land use planning
Educational material and technical support for local planning officials
Up to date comprehensive inventory of all state and federal wetlands
Enforcement coordination to ensure building codes and regulation are being followed
Performance standards for driveway construction to minimize erosion and runoff problems
Greater oversight of water quality impacts from individual home development
Protection of non-regulated wetlands
Highway department needs
Funding assistance for cleaner abrasives (winter de-icing) and planting material to ensure scraped ditches are re-vegetated regularly
Technical assistance with culvert sizing & placement, and processing state and federal permits involving stream work (Cornell Local Roads Program as possible resource[8])
Incorporate best management practices in driveway permit standards to minimize runoff
Watershed programs
Complete stream management plans for the two other major tributaries to the reservoir, the Bear Kill (Gilboa & Roxbury) and Manor Kill (Conesville)
Technical assistance for preventive stormwater planning for local contactors, municipalities
Funds to implement recommendations in existing stream management plans, and to complete identified stream bank stabilization in areas along the Bear Kill (conducted by DCSWC)
Continue Watershed Agricultural Program support to small and large farms in the basin

For Schoharie and Delaware County municipalities in the basin, program areas that are lacking include stream management planning and restoration, permitting assistance, designing and sizing culverts using hydraulic modeling, and additional agricultural support.

Agricultural assistance

The Whole Farm Program (WFP) has provided assistance to farmers in all three counties of the watershed. Water quality protection practices, such as Barnyard Water Management Systems, Milk House Waste Treatment, alternative water sources, conservation crop rotation, and fencing for livestock exclusion have been implemented on 11 farms in the Bear Kill sub-basin, eight farms in the Manor Kill sub-basin of Schoharie County, and 20 large and small farms in Greene County. Best management practices such as these help control nutrient loading and soil erosion from agricultural activities, such as compacted crop soil shown in Figure 3.4.

In Schoharie County, much of the old farmland within the watershed towns is being subdivided, bought and converted into small agricultural operations consisting of a few head of various animal types. Many of these operations can be significant sources of agricultural non point source pollution. Currently, the Watershed Agricultural Program has a small farms program to work with these farms, however, the new landowners need to be educated on proper nutrient management

[8] For more information, visit the website at http://www.clrp.cornell.edu/

and how the cumulative effect of these many small farms can have a significant effect on water quality.

Efforts by the Watershed Agricultural Program, under which the WFP operates, will continue as funds become available and common goals between cooperating farmers and the Program can be agreed upon.

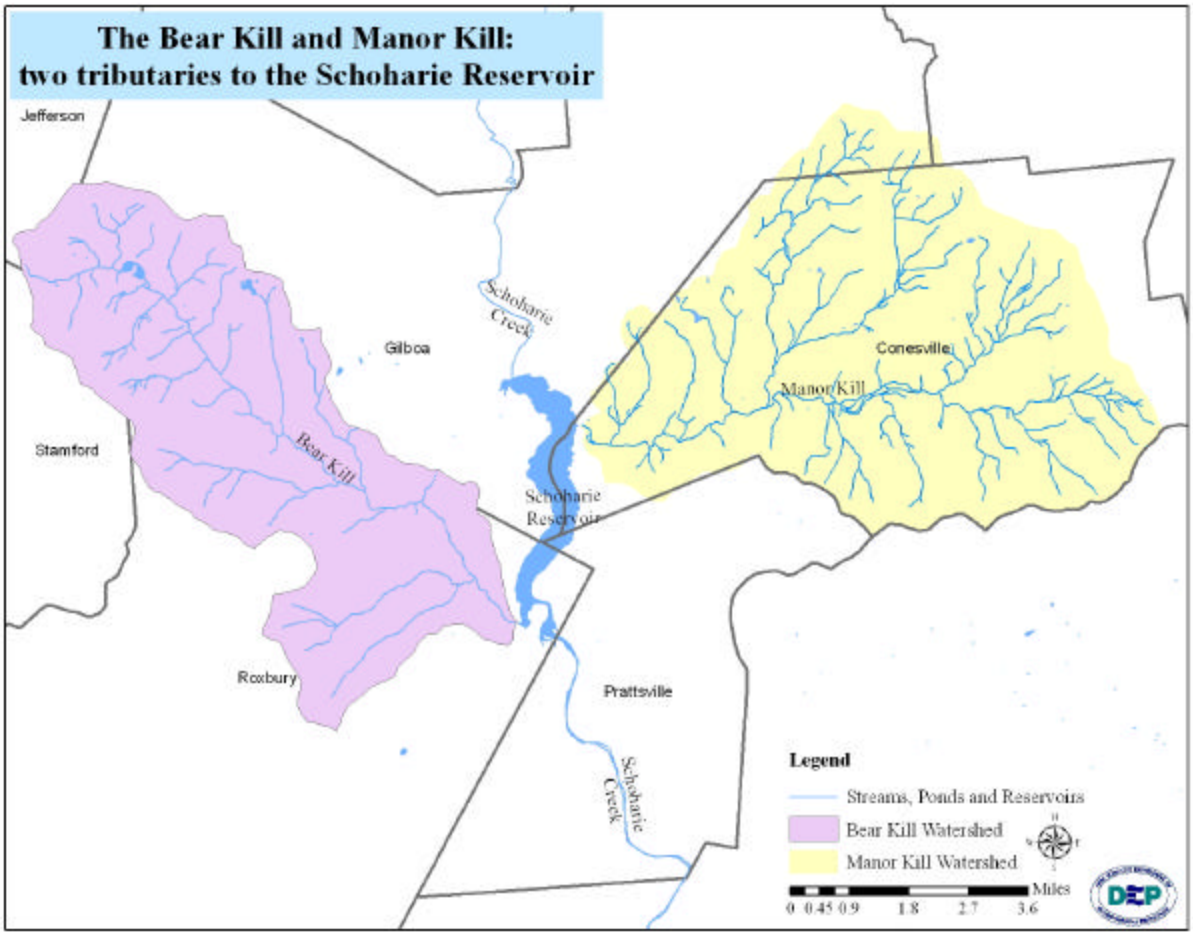
Figure 3.4 Agricultural practices that minimize areas of exposed soil help reduce sources of turbidity, such as the surface runoff shown here.

Stream management planning

Stream management plans are needed for the Manor Kill and Bear Kill (Figure 3.5), the two other source tributaries that drain into the Schoharie reservoir. For years, residents along these streams have reached out to county departments and NYCDEP for assistance to address erosion problems. A preliminary assessment of the Manor Kill by Greene County Soil & Water Conservation District (GCSWCD) with numerous streamside owners and planning officials detected bank erosion "hot spots" which could benefit from restoration and re-alignment of the natural channel. The NYCDEP has agreed to assist with funding of a stream management assessment along the Manor Kill, which will be done by staff from the GCSWCD in the Spring of 2008. Additionally, on the advice of the Schoharie County Soil & Water Conservation District, the Schoharie County Board of Supervisors agreed to create a stream manager position to assist with stream planning and management activities throughout the county.

In Delaware County, assessments conducted by the Delaware County Soil & Water Conservation District identified at least three stream bank stabilization projects for the Bear Kill sub-basin including Johnson Hollow Brook, but to date the work has not been implemented due to limited funding.

Figure 3.5 The Bear and Manor Kills are tributaries to the Schoharie Reservoir



Land use

The housing market continues to generate demand for second homes throughout the basin, most noticeably in some of the quieter rural communities, such as Gilboa and Conesville. Landscape changes are evident as subdivisions fragment large farms in Delaware and Schoharie Counties and forested land throughout the watershed. Managing stormwater runoff from new construction and ensuring codes and regulations are followed are support areas identified by most basin communities. Additionally, some local officials cited problems with poorly constructed driveways, resulting in additional, chronic stormwater runoff.

Supports for local officials involving land use planning and policy are provided primarily by county planning departments. In Delaware County, planning services are provided to communities through the Planning Department's Town Planning Advisory Service (TPAS), and Schoharie County provides a planner to work with the NYC watershed municipalities. In Greene County, assistance is provided by the Greene County Watershed Assistance Program (a program of the GCSWCD) and the county's planning department.

There is always a need for more education and outreach for local boards, county planning representatives note. Understanding regulations, knowing what resources are available, and keeping abreast of issues and changes involving the NYC watershed are but a few of the challenges confronting local officials. Any efforts geared towards keeping officials informed and updated on watershed protection measures would be beneficial.

Land use regulations vary with each municipality in the basin. The towns of Ashland, Gilboa, Roxbury, Conesville and Jefferson, for instance, do not have site plan review. All municipalities have subdivision regulations although some need to be updated. Out of the 13 municipalities, only three have zoning. All communities have a flood damage prevention law and those in Greene County will be updating theirs in early 2008 with the issuance of the new digital FEMA flood maps.

Infrastructure and Highway Maintenance

Most highway departments would benefit from technical assistance in areas of permit applications, culvert sizing, and stormwater retrofit projects. Having funds to help offset cleaner road abrasives and hydroseeding material is another need area for local highway departments, as well establishing a set schedule to ensure ditches are seeded immediately after exposure. In Greene County, some departments indicated re-vegetating scraped ditches is largely dependant on having proper material (seed, mulch) and freeing up staff to do the work. Schoharie and Delaware County communities do not have access to a hydroseeder, therefore reseeding ditches occurs based on available seed, mulch and manpower.

As the planning process unfolded, recommendations for dealing with these needs were identified. The next section covers the organizational steps to creating this watershed strategy.

4. The planning process, organizational steps to creating the strategy

The Schoharie basin drains through three counties, two villages, and eleven towns. In addition to the local municipalities and counties, there is a wide range of state, regional and federal agencies, and non-government organizations that have a direct stake or interest in non-point source pollution reduction. As turbidity is a diverse problem with a wide range of sources, any strategy must involve an equally diverse group of stakeholders. Creating a framework to engage these various interests to work together was essential to the planning process and is described below.

4.1 Identify watershed stakeholder participants

The first step involved identifying the key stakeholders at the local, regional and state level who have direct and indirect oversight over water quality. These include:

- Local participants representing 13 municipalities
  - i. Municipal town and village councils
  - ii. Highway Superintendents and personnel
  - iii. Municipal planning boards
  - iv. Local code enforcement officers, and

  } Collectively over 120 public officials

  - v. Interested property owners

- County level participants (Greene, Schoharie and Delaware)
  - i. Planning Departments
  - ii. Highway Departments
  - iii. Delaware County Watershed Affairs

- Non-profit Organizations
  - i. Catskill Watershed Coalition
  - ii. Cornell Cooperative Extension of Greene County
  - iii. Watershed Agricultural Council
  - iv. Catskill Center for Conservation & Development

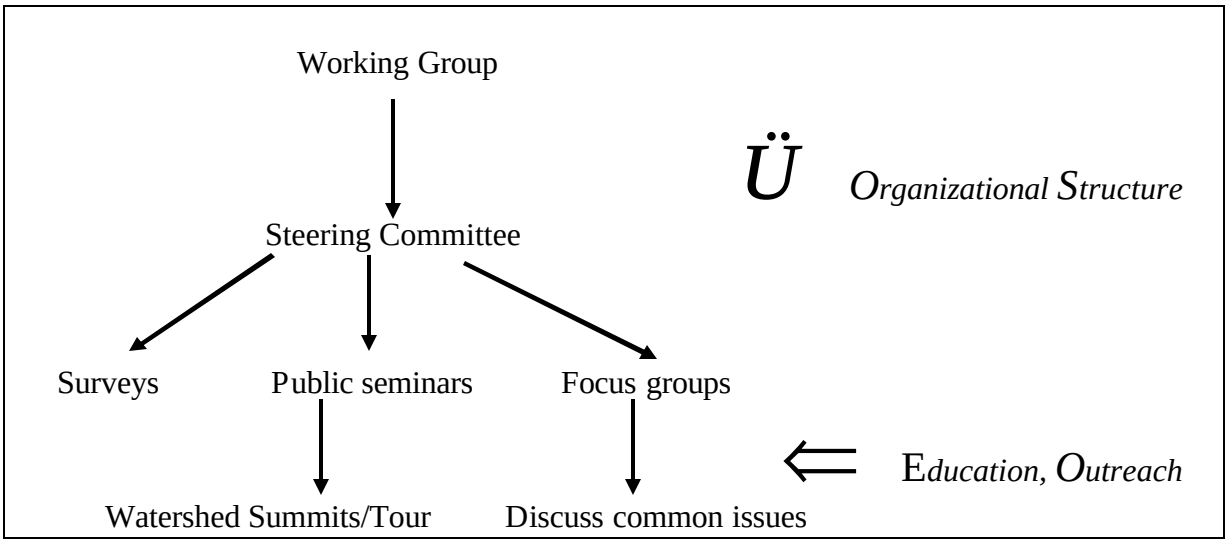
- State & Regulatory Agencies

i. NYS Department of Environmental Conservation
ii. US Environmental Protection Agency
iii. NYS Department of State
iv. NYS Department of Transportation
v. NYS Attorney General's Office, Environmental Protection Bureau
vi. NYC Department of Environmental Protection

Over 120 municipal officials and employees were approached to provide input into the strategy's development. Town and village councils make policy decisions that influence water quality, planning boards interpret and implement land use codes pertaining to development projects, code enforcement officers administer the NYS Building Code and are an important link to private property owners, and highway superintendents oversee the vast network of roads and infrastructure throughout the watershed. The decisions that local participants make in their civic and occupational duties impact water quality and the environment as a whole. Multiply the individual department decisions by 13 municipalities, and collectively the influence local officials have with respect to water quality is significant.

Bridging local oversight with state, city and federal regulatory agencies in the basin was the first step in the process. This entailed forming a basin level working group and a core steering committee, both which represent local and regional interests (Figure 4.1). Subsequent to forming the groups, outreach activities focused on educating local stakeholders on water quality impacts of turbidity and soliciting their input on how to address sources that are within local control. Outreach mechanisms included organizing focus groups, conducting public educational forums on watershed topics and surveying stakeholders.

Figure 4.1. Organizational structure of the planning process



4.2 Establishing a Basin Working Group and Steering Committee

Working Group

As participants were identified, key representatives from local government, county departments, non-profit organizations, and watershed management agencies (state, federal, NYC) were invited to serve on the Schoharie Basin Working Group (SBWG) – the committee that represents the broad spectrum of watershed interests.

The make-up of the SBWG followed a Delaware County model used to address phosphorus in the Cannonsville Reservoir watershed, also referred to as the Delaware County Action Plan, or DCAP[9]. This model emphasized local involvement at all levels in understanding and addressing the phosphorus problem. Facilitated by the Delaware County Watershed Affairs office, committees were formed representing local interests, agency managers and scientists to help design the strategy and its implementation. The success of DCAP is attributed to building local capacity with the regulatory community, which resulted in local institutional changes that enabled participants to take direct action to reduce phosphorus sources.

At the first SBWG meeting in August 2006, 31 people were in attendance, representing all of the targeted groups listed above under sub-section 4.1. Convening this broad coalition introduced everyone to the benefits of watershed planning and allowed participants to initiate the inter-disciplinary dialogue that would become central to the process. Proactively engaging municipal officials, code enforcement officers and highway personnel with agency regulators has been reflected in the activities described below and is built into the strategy's recommendations.

Steering Committee

A key recommendation that came out of the August 2006 working group meeting was to create a core steering committee that would manage the plan's development and direct the outreach efforts. The Steering Committee make-up reflects the diversity of the working group and is outlined below in Table 4.1, and pictured in Figure 4.2.

Table 4.1 Make up of SBWG Steering Committee

Affiliation	**Representative**
Local government	Municipal leaders
	Planning Board member
Highway Departments	Town highway superintendent
	Greene County highway dept.
Greene, Schoharie & Delaware County Departments	• Soil & Water Conservation Districts • Planning Departments • Delaware County Watershed Affairs
Regional Watershed Agency	Catskill Watershed Coalition
Non-government/non-profit Representative	Community Foundation of Windham
NYC Department of Environmental Protection	Project manager for the Stream Management Program
Natural Resource Conservation Service representative	
Department of State representative	

[9] DCAP can be found online at http://www.co.delaware.ny.us/depts/h2o/dcap.htm.

Figure 4.2 Steering Committee meets to plan the June 2007 Schoharie Watershed Day Tour

The Steering Committee evolved to became the working branch of the SBWG, organizing public seminars, soliciting input from involved parties, and providing direction on the project goals. Members also participated in smaller focus group meetings that allowed more detailed discussion to take place with decision-makers around specific topics and are described below. This committee was instrumental in guiding the community outreach efforts, particularly the public forums that were well received by local officials.

Summaries of meeting minutes for the SBWG and Steering Committee are available upon request.

4.3 Soliciting input from watershed stakeholders

Using a grassroots approach to engage local residents and officials, as well as agencies working in the basin, four methods were implemented to generate input from watershed stakeholders:

- public educational workshops
- anonymous surveys
- organized focus groups, and
- outreach to planning boards

Public education forums and workshops

Organizing public workshops on water quality protection was a significant component of the strategy's development and contributed to fostering a shared watershed stewardship approach. Three forums were organized to provide local officials and agency personnel an opportunity to network, learn about watershed protection programs, see actual projects in action, receive training relative to local needs and interests, and to preview the turbidity reduction strategy for final comments.

2007 Water Quality Watershed Summit

There were over 120 people at the first Watershed Summit in January 2007 (Figure 4.3). Participants represented all involved agencies and local officials from 12 out of the 13 municipalities. The purpose of the Summit was to bring together the diverse group for a series of presentations on non-point source pollution, and then break out into smaller groups

where participants discussed possible solutions to address landscape sources associated with turbidity. Morning presentations focused on various components of turbidity and on current watershed programs addressing the problem.

Figure 4.3. Attendees at the first Water Quality Summit, January 2007

Afternoon break out groups (Figure 4.4) generated discussions on the following topics:

- what approaches/practices participants felt were working
- what challenges need to be addressed
- what strategies from the morning presentations should be explored further, and
- what can be done to keep the group involved and engaged

A summary of comments from the break out sessions is provided in Table 4.3.

Table 4.3. Sample comments from break out groups

Current approaches and practices that are working and should be enhanced 1. Expanding public education and outreach initiatives, targeting streamside owners 2. Sharing information among agencies and with property owners through conferences like this 3. Promoting use of technical information that is available, e.g., mapping resources
Challenges to address 1. Identify and provide resources and educational material to planning boards and code enforcement officers to help them in their duties, e.g. interpreting flood maps, making rules and regulations governing water quality user-friendly 2. Find ways to make watershed protection compatible with tourism objectives and communicate those benefits to municipalities 3. Limited funding and manpower limits implementation of project ideas
Strategies from Summit to explore further 1. Develop ways to work with DEP to access City land (using NYS's model) for the benefit of local tourism 2. Find ways to get the actual decision makers (town boards, planning boards) and implementers of practices (highway crews) more hands-on exposure to the tools, such as regulatory agencies providing yearly training on their regulations. 3. Narrow down training to specific topics and engage regulatory agencies to provide, e.g., what is a wetland, distinction between federal and state regulated wetlands 4. Take advantage of existing resources, such as those described at the Summit, and connect them

5. Look for ways to be preventive, such as accessing existing programs and plans where they are available, e.g., stream management plans
What can be done to keep the group involved, engaged 1. Hold semi-annual meeting or update on progress in relation to Schoharie watershed goals, and continue to host conferences like the Water Quality Summit 2. Informal and formal updates, such as regular communication, conferences, workshops 3. Depending on needs, have resources go to towns, planning boards 4. Create subgroups (highway departments) to collaborate among themselves and then link up with planning and town boards

Figure 4.4 Andy Turner and Marilyn Wyman, Greene County Cornell Cooperative Extension, facilitate break out groups

The conference was very well received and participants strongly recommended holding more educational forums on a regular basis. A complete summary of the Summit's presentations and break out group notes and recommendations can be found in the Appendix D.

June 2007 Schoharie Watershed Tour

A follow–up to the successful January Water Quality Summit was another public forum designed to show participants actual project applications to mitigate water quality problems. The idea to sponsor a watershed tour originated with the Steering Committee and supported local officials' interest in wanting more educational opportunities as voiced at the Summit and in surveys.

The format was designed to introduce decision makers to the basics of hydrology and stream functions and to show them actual hands on projects dealing with stream erosion and stormwater management (Figures 4.6 and 4.7). Seventy-five people attended, reflecting a broad spectrum of stakeholder interest, particularly at the local level – municipal council members, planning board members, highway personnel, and property owners.

Figure 4.6 Big Hollow stream restoration site

Figure 4.7 GCSWCD Plant Material Center

Responses from participants who completed a post-tour survey reinforce the need and desire that watershed residents and officials are interested in learning about watershed issues, the agencies that work in the basin and how practices may apply to them.

A handout describing the site visits from the Watershed Tour can be found in the Appendix D.

Anonymous surveys

Using an online information tool, surveys were created prior to the Watershed Summit and after the Schoharie Watershed Tour. The surveys were anonymous and provided an opportunity for people to express their thoughts on water quality in general, where practices could be improved, what obstacles existed to promoting watershed planning, what outcomes they would like to see achieved through the strategy, and thoughts on future programming and education.

Forty-two people representing a wide variety of local officials and agency managers completed the survey prior to the Summit and a sampling of comments, provided in Table 4.2, clearly reflect the goals of this project.

Table 4.2 Relevant comments from Schoharie Turbidity Reduction Strategy Survey

Outcomes participants would like to see achieved through the strategy:
1. Improve communication between agencies & the public
2. More education for officials and the public in understanding Water Quality issues
3. Regulatory agencies & organizations do not engage local officials enough to address natural resource protection efforts
4. All levels of government need to improve outreach efforts
5. Ensure local decision makers are involved
6. Assist officials and the public in understanding regulations and rules
7. Provide more training and tools for landowners and officials to protect natural resources
8. People need more information, and understanding of different roles and responsibilities.
9. Commitment from regulators to work with and respond to local officials
10. Improve working relations across agencies and government, and share information and ideas on watershed management

Out of the 75 people who attended the Watershed Tour, twenty-one completed the after-tour survey and ranked the overall day, including morning presentation and handouts, very highly. More hands-on events like the tour were recommended as well as continued outreach efforts to local officials and agencies. A summary of the survey is in Appendix D.

In addition to surveys and public forums, focus groups were organized around similar interest and work areas, which allowed for effective communication and exchange of information and ideas on how to advance watershed protection.

Focus Groups

The focus groups provided an opportunity for detailed discussion on particular topics and decision-making. They were designed to represent a cross section of those working in similar capacities across the basin. Discussions focused on identifying common concerns and issues with respect to water quality, brainstorming ways to improve networking and information sharing, and in general, how to improve capacity building among the different stakeholders involved in water quality oversight. The meetings provided a perfect opportunity to learn from one another about what can be done to improve watershed planning and best management practices.

Agency and county representatives were invited to attend each focus group (outlined in Table 4.4) to continue the cross-collaboration initiated at the watershed summit and tour. This resulted in an open exchange of ideas and opinions on what could be done better and why.

Figure 4.7. This focus group comprised half of the highway superintendents throughout the basin, plus state DOT and NYCDEP. February 2007.

Table 4.4 Focus groups that were organized to discuss common concerns and generate ideas for improved watershed protection.

Focus Group	Participants
1. Highway Superintendents (Figure 4.7)	Superintendents and personnel from town, county and state transportation departments, and NYCDEP
2. Contractors, Consultants (Figure 4.8)	Local and regional contractors & consulting firms, and regulatory agencies (NYCDEP, NYSDEC)
3. Planning & Town Officials, CEOs	Municipal planning and town board members, local code enforcement officers

Figure 4.8. Consulting firms, regulatory agencies and small and large contracting outfits met to discuss issues pertaining to stormwater regulations and best management practices.

Recommendations that were generated from these groups are highlighted in Section 5.

Planning board outreach

As a follow up to the 2007 Watershed Summit, outreach to individual planning boards in the basin resulted in additional information on what local planning officials see as water quality threats and what they feel would help to address source problems at the local level.

Areas of concern throughout the basin noted by planning boards include:

- lack of enforcement of codes and regulations at the local and state level due to lack of manpower
- tighten local codes or have some oversight pertaining to single residential development as it relates to drainage problems (where state and city regulations do not adequately address)
- runoff problems associated with driveways, especially on steep slopes
- runoff problems associated with logging operations
- information on large projects can be overwhelming (e.g., stormwater management plans)
- inadequate culvert piping to handle runoff in some situations
- lack of uniformity in how planning boards interpret watershed rules and regulations and SEQRA law
- lack of coordination among overseeing agencies as it pertains to stormwater runoff, who does what

Once input was obtained through the above outreach methods, recommendations were developed that would allow local officials and watershed agencies to be more proactive in addressing water quality at the local level. The next section details these recommendations followed by the implementation plan.

5. Recommendations

5.1 Overview of recommendations based on information gathered

Using information gathered through the outreach methods, this section presents recommendations for reducing turbidity caused by landscape/land use activities by improving local oversight, coordination among agencies, education and outreach, technical assistance, and land use regulations. Moreover, new practices are offered that could enhance protection efforts. Recommendations are prioritized based on what has been learned from local decision makers and agency personnel throughout the planning process. In addition to these recommendations, specific projects are also included where relevant.

Support local oversight

The following recommendations are designed to improve oversight and monitoring at the local level and are geared toward local decision makers responsible for water quality oversight including highway personnel, code enforcement officers, planning boards, municipal boards, and property owners. Contractors and engineering firms are also included here.

i. Highway departments

Thirteen municipalities, three counties and the NYS department of transportation are responsible for highway maintenance and oversight of the vast rural road network in the basin. Recommendations for improving roadside ditch management and reducing stormwater runoff which in turn minimize sediment loading to streams are summarized below in Table 5.1.

Table 5.1 Recommendations for highway management in reducing water quality impacts from roads and related infrastructure

5.1 Highway Departments & Infrastructure
1. Develop a watershed-wide highway assessment strategy integrating local and regional highway departments' needs that address training, material and equipment in controlling runoff from infrastructure and highways. Provide strategy to NYCDEP and other potential funding sources for funding considerations.
2. Research inter-municipal agreements whereby resources and training can be shared to reduce costs
3. Apply for Catskill Watershed Corporation (CWC) funding to hire a seasonal crew to operate hydroseeder (Figure 5.1), vacuum truck and oversee roadside ditch management, in coordination with highway departments (county, town, state) • Develop a process that estimates annually the amount of hydroseeding materials to be used, including purchasing bulk material that can be stored in a central location
4. Identify funding sources to help offset costs to municipalities for equipment, stormwater projects and clean road abrasives material, e.g., Catskill Watershed Corporation (CWC) programs, municipalities pooling money to purchase equipment and materials, Schoharie basin contract to implement stream management plans
5. Prioritize highway and infrastructure needs that protect water quality and submit to the Schoharie Watershed Advisory Committee for funding consideration
6. Work more proactively with GCSWCD in using hydroseeder purchased for Greene County mountaintop highway departments • Develop a yearly flyer to disseminate to towns, county and state highway departments • Incorporate needs of Schoharie and Delaware County municipalities in the watershed as

time and resources allow
7. Track egregious problems where property owners divert natural drainage paths affecting public roads and neighboring parcels. a. Propose drainage ordinance to address these situations b. tie conditions to building permits so if violations occur a stop work order is issued c. develop educational material for landowners on problems associated with changing drainage flows
8. Strengthen driveway standards at the local, county and state level that incorporate sufficient erosion controls while minimizing the driveway footprint (also under land use oversight below)
9. Develop a list of approved engineering firms highway superintendents can go to for streamlined design and permitting assistance
10. Incorporate Recommendations Checklist for Improving Roadside Ditch Management (See Appendix A, pamphlet by Cornell University, 2007)
11. Research options to unload silt at select locations on the mountaintop (picked up by vacuum truck) • Determine if vacuum truck is adequate for highway needs based on recommended usage, compare against number of roads, miles/municipality.
12. Purchase snow and ice controls that allow greater control in material spreading and usage

Figure 5.1 Example of a hydroseeded ditch that should be done early in the season to allow sufficient growth.

ii. Code enforcement

Code enforcement officers

As implementers of the NYS Building Code, CEO's are responsible for enforcing state and local building and safety codes including standards for building construction and equipment therein, for materials used and for safety and sanitary conditions. Although CEO's do not have regulatory oversight of state and city regulations (e.g., pond construction, stormwater pollution prevention plans, wetlands), they serve as important liaisons to property owners and assist with identifying potential violations of water quality regulations.

Most of the basin municipalities share CEO's because the work load is minimal, or funding is lacking to hire more than a part-time officer. The main challenge for CEO's in communities were development is booming is monitoring all active projects for compliance.

Table 5.2 identifies suggestions to enhance CEO oversight in addressing water quality problems.

Table 5.2 Code Enforcement Recommendations
1. In municipalities where development is significant, increase CEO's time to match the demand of work required, or consider an inter-municipal cooperation agreement whereby municipalities can share costs.
2. Work proactively with agency regulators when potential water quality or code violations are known
3. Attach reader-friendly information to building permits for property owners and developers on stormwater regulations, water quality permits, best management practices for erosion reduction from individual site development (See NYSDEC Tip Strip, New Requirements for Small Construction, and building and regulations fact sheet, in Appendix A)
4. a. Hold bi-annual roundtable discussions for code enforcement officers to discuss common issues and concerns, and ideas for improving coordination and monitoring b. Host workshops with regulatory agencies and CEO's to further understanding of each other's roles in monitoring and following through on regulation and code enforcement
5. Enhance oversight of development in floodplain to ensure building requirements are being followed per local floodplain ordinances. Work with CEO's on understanding flood zones and standards to build within them. [Potential problems exist for municipalities where growth is limited to floodplains, e.g., villages and hamlets.]

iii. *Planning boards*

Volunteer planning boards serve an important function by reviewing and authorizing development proposals for their communities. They are charged with promoting the health, safety, convenience and general welfare of the community through the process of guiding the development of land based on land use policies.

Because there are no set criteria to be on a planning board, appointed members bring varying skills and abilities. Although no pre-requisite skills are required, a new law went into effect, January 1, 2007, that now requires planning and zoning board members receive four hours a year of training.

Table 5.3 highlights recommendations by planning boards that would help them in improving local oversight of water quality.

Table 5.3 Planning Board Recommendations
1. Hold regular educational workshops on issues relevant to planning boards' interests and what they are required to know, such as: • floodplain development/protection • stream management function and practices • wetland functions and regulations • stormwater basics • SEQRA law and obligations municipalities must follow • Watershed rules and regulations

Technical assistance in interpreting land use laws should be provided by skilled planners
2. As time allows, conduct site visits were runoff and drainage from building proposals may be problematic.
3. Conduct yearly training for mountaintop planning boards on SEQRA
4. In conjunction with municipal boards, evaluate efficacy of local codes dealing with landscape impacts from development (stormwater, steep slopes, floodplain, stream buffers) and recommend further controls were necessary, e.g., amending site plan and subdivision laws to incorporate best management practices for logging, driveway development, hillside development.[10]
5. Ensure planning boards have proper resources to make decisions, such as inventory of natural resources (maps), hamlet designation areas (for DEP land acquisition program only), information on SEQRA (State Environmental Quality Review Act)
6. Develop a universal checklist to guide planning boards in project reviews, e.g., what forms need to be completed, by when, whom to contact.

iv. Municipal boards

Municipal boards play an integral role in overseeing the water quality of their communities and have the authority to enact legislation that deals with natural resource protection. In the case of turbidity, local boards have the authority to ensure land use codes adequately consider impacts from landscape alterations resulting in erosion. The following recommendations deal primarily with local ordinances as a preventive tool for controlling runoff from land use activities and should be evaluated by each community for improving local oversight of landscape alterations leading to erosion and turbidity.

Table 5.4 Municipal board recommendations
1. Incorporate riparian buffer protections in site plan, subdivision and floodplain damage prevention laws
2. Investigate, and develop where feasible, inter-municipal compact agreements that extend wetlands and stream buffers protections beyond individual town borders
3. Incorporate performance standards for driveways in site plan and subdivision laws to minimize erosion and runoff problems, especially on steep slopes
4. Adopt new FEMA flood maps and the updated floodplain ordinance from NYSDEC which is consistent with the National Flood Insurance Program
5. Consider site plan review for individual residential development to help guide home builders with siting homes and driveways to minimize erosion and diversion of drainage paths
6. Participate in the Schoharie Watershed Project Advisory Committee (SWAC)

Watershed coordination

Effective coordination, communication and networking among municipalities, watershed agencies, and property owners is essential to the strategy's success and requires ongoing staff facilitation and agency support. A significant amount of time for the project was devoted to this including contacting stakeholders, soliciting their input, coordinating meetings, and keeping participants updated. Recommendations for maintaining and enhancing inter-municipal and agency collaboration that was started as a result of this project are listed below in Table 5.5

[10] Example model law can be found in the Conservation Area Overlay District publication by the Metropolitan Conservation Alliance http://www.wcs.org/media/file/MCA-WCS-TP3-CAOD.pdf

Table 5.5 Recommendations for improving watershed collaboration and communication

1. Continue focus group meetings on a basis set by each group so that watershed participants have an avenue to discuss common issues and concerns
2. Develop a Schoharie basin newsletter that focuses on watershed-wide planning with specific examples of coordination and networking across the basin
3. Standardize best management practices across the basin that are effective at minimizing erosion from development
4. Schedule regulatory training sessions for municipal officials at least yearly, with the appropriate regulatory agencies conducting the training, e.g., NYSDEC and NYCDEP on stormwater regulations, NYSDEC on state protected wetlands, ACOE on federal wetlands.

Education and Outreach

Training, educational resources and mentoring were mentioned frequently in surveys and the break out groups at the Summit in terms of what supports local officials feel they need to do their job better. The list below (Table 5.6) summarizes ideas generated from the surveys and break out and focus groups that were held throughout the project period.

Table 5.6 Outreach and education methods to promote watershed planning

1. Develop a Contractor's book highlighting local, state, city and federal regulations, Best Management Practices, and possible funding sources
2. Create a Planning Board Guidance Document on what to look for when approving site plans and subdivisions relating to proper drainage, stormwater run-off
3. Create an 'ABC' manual explaining different regulations for planning boards and project applicants.
4. Develop a universal guidance document for highway departments and property owners on culvert sizing and placement considerations incorporating slopes, soils, and drainage patterns
5. Conduct a minimum of three technical training sessions targeted at the following audiences:
    - Planning boards/code enforcement officers
    - Highway Superintendents
    - Property owners
    - Contractors/Developers
    - Regulatory agencies in conjunction with the above

   Workshops will focus on implementing best management practices (BMP), how to standardize practices, development of erosion control plans, and procedures for addressing turbidity from land use alterations.

6. Host public forums at least bi-annually. The Water Quality Summit and Watershed Tour were very well received by local decision makers, regulatory agencies and the general public. Conducting public educational forums is a great way to bring stakeholders together to talk about pressing issues and brainstorm possible solutions. Attendees at both events highly recommended conducting public workshops on a regular basis.
7. Create a centralized website of the watershed including each communities' land use codes, natural resource maps, community plans, other regulations governing land use (state, city, federal), and an inventory of land including unbuildable parcels. This could be especially helpful for potential property buyers and contractors building in the basin.
8. In addition to website outreach, develop a resource library of all municipal zoning and planning codes and make accessible to the public that does not use the internet.
9. Develop educational information on topics local officials feel would be useful for property owners and contractors and attach relevant material to building permits &/or as part of a packet planning boards can give out. Sample topics identified by focus groups include:
    i. invasive species

ii. overview of regulations and agencies in the watershed, what property owners should know before building
iii. driveway construction brochure for landowners and CEO's – tips for sound construction
iv. BMP guidelines to reduce runoff from individual site development, simple procedures to give to home builders and developers
v. regulatory thresholds for stormwater (NYS and NYC, and local if applicable)
vi. NYSDEC's New Requirements for Small Construction
vii. impacts from changing drainage patterns
viii. available programs to help fund costs of BMP's and municipal projects
ix. stream practices that result in unstable, eroding stream banks, as well as what streamside owners can do to help stabilize streams
x. vernal pools, the unprotected resource

10. Send educational material out with municipal tax mailings to save on postage
11. Host an annual stream festival that offers fun, educational activities for the public on the Catskills streams and other natural resources

Technical assistance

Some of the recommendations rely on the expertise of trained or support staff to provide assistance identifying and implementing projects. Table 5.7 highlights areas requiring technical assistance for municipal officials, contractors and highway departments.

Table 5.7 Technical assistance to local communities

1. Conduct stream management plans for the Bear and Manor Kills in Delaware and Schoharie Counties. Note: $25,000 has been proposed in the Schoharie Watershed contract for stream management on the Manor Kill in Schoharie County.
2. Provide assistance to highway departments with permitting, culvert design and placement, and identification of potential stormwater retrofit projects.
3. Research feasibility of purchasing a hydroseeder for Schoharie and Delaware Counties to maintain road ditches consistent with erosion prevention
4. Create a centralized program to oversee maintenance of stormwater retrofit projects after construction (could be funded by CWC).
5. Create a stormwater assistance liaison position to assist residents, municipalities, and contractors with designing stormwater projects (future or existing retrofits) and applying for CWC funding.
6. Fund identified streambank stabilization projects on farms in the Johnson Hollow basin

New approaches

The following recommendations identify new approaches that can be explored to address gaps where current resources and programs do not exist.

1. Require a performance bond, or licensure program for installation of new septic systems; create a funding incentive for landowners to use certified contractors.
2. Conduct graduate level research to replicate roadside ditch impacts in this watershed following Cornell University's model
3. Develop a certification program for contractors and engineers working on stream projects
4. Develop a master stream steward program, similar to Cornell's Master Gardener program
5. Explore accessing funds for training workshops through the Catskill Fund for the Future

6. Implementation and Action Plan

This section summarizes implementation actions for the turbidity reduction recommendations outlined in Section 5 and includes identification of possible lead and involved stakeholders, budget estimates where available, and a suggested timeline for implementation.

Resource/Program Recommendation	Task Leader (TL) and partners involved in implementation	Budget Estimates	Timeline LT – long-term goal (1 – 3+ years) ST – short-term goal (0 – 2 years) Ongoing
Highway – Infrastructure			
6.1 Develop a watershed-wide highway strategy that addresses water quality needs across local, county and state highway systems	Highway departments (TL) in conjunction with NYCDEP & GCSWCD	Personnel time	ST
6.2 Research inter-municipal highway agreements that offer cost-sharing incentives	Municipal boards (TL) SWCDs, NYSDOS County planning depts.	Personnel time	ST
6.3 Strengthen driveway standards that ensure sufficient erosion controls (see also land use regulations below)	Municipal boards and highway departments (TL) GCSWCD, County planning depts. (assist with research)		LT
6.4 Develop proposal to hire seasonal ditch maintenance crew to serve the entire watershed • Develop a process that estimates annually the amount of hydroseeding materials to be used, including purchasing bulk material that can be stored in a central location	GCSWCD & highway depts. (TL) SWCDs, CWC (funding partner) SWCDs (TL) Highway depts. NYCDEP Material suppliers		LT
6.5 Identify possible funding sources to help offset costs to municipalities for equipment, stormwater projects and clean road abrasives material	SWCDs & NYCDEP (TL) Highway depts. CWC		ST
6.6 Track egregious problems diverting natural drainage paths that negatively impact public roads or neighboring parcels • Propose drainage ordinance where	Highway personnel (TL) Municipal and planning officials GCSWCD Contractors, consulting firms		Ongoing – tracking

necessary to address these situations, and attach as a condition to building permits • Develop educational material for property owners on how to manage stormwater runoff	Regulatory agencies GCSWCD (TL)		ST – model ordinance
6.7 Work proactively with GCSWCD in scheduling hydroseeder • Send reminder notices to highway depts. • Incorporate needs of Schoharie & Delaware County watershed communities as time & resources allow	Highway departments (TL) GCSWCD		Ongoing Notice – yearly send out in March
6.8 Develop list of approved engineers to assist highway departments with permitting and infrastructure designs	GCSWCD Stormwater liaison (TL) NYCDEP NYSDEC Cornell Local Roads Program CWC Stormwater liaison Engineering firms	Personnel time	ST
6.9 Prioritize highway and infrastructure needs that protect water quality and submit to the Schoharie Watershed Advisory Committee (SWAC) for funding consideration	Highway superintendents Focus Gruoup (TL) GCSWCD, NYCDEP SWAC		ST
6.10 Incorporate *Recommendations Checklist for Improving Roadside Ditch Management* into highway projects (See Appendix A, pamphlet by Cornell University, 2007)	Highway departments (TL) Cornell Local Roads Program SWCDs Contractors Consulting firms		Ongoing
6.11 Purchase snow and ice controls that allow greater control in material spreading and usage. Example deicer: http://www.dickey-john.com/products/pw/product_detail.php?products_id=49	Highway departments (TL) Delaware County Public Works Department as resource CWC (possible funding source)	Approx. $3,000 depending on vehicle type	ST or LT depending on highway department budgets
6.12 a. Research options to unload silt at select locations on the mountaintop (picked up by vacuum truck) b. Determine if vacuum truck is adequate for highway needs based on recommended usage	Local, county and state highway departments (TL) GCSWCD	Personnel time	LT

Local officials and decision-makers			
6.13 Attach fact sheets to building permit, subdivision, & site plan applications on stormwater regulations & funding, best management practices to control runoff, wetland regulations	CEO's (planning boards for subdivision, site plan applications) (TL) GCSWCD NYSDEC, NYCDEP, ACOE CWC	Time and material	ST and ongoing
6.14 Work proactively with agency regulators when potential water quality violations are suspected	CEO's (TL) & regulatory agencies (NYCDEP, NYSDEC, NYSDOH) Highway departments Municipal officials SWCDs Contractors, consulting firms		Ongoing
6.15 Organize bi-annual roundtable discussions for code enforcement officers & regulators to discuss common issues, concerns, ideas for improving coordination and monitoring of regulations and code enforcement.	GCSWCD (TL) CEO's NYCDEP, NYSDEC, NYSDOH County planning depts.	Personnel time	ST and ongoing
6.16 a. Provide training workshops for CEO's on new flood maps (2008), flood zones, floodplain ordinance and development standards b. Ensure building standards are followed per local floodplain ordinances.	NYSDEC & FEMA (TL) SWCD'S County planning depts. NYCDEP CEO (TL)	Personnel time	ST Ongoing
6.17 Hold roundtable discussions for Planning Board Chairs to discuss common issues related to watershed management	GCSWCD in conjunction with County planning departments (TL) Local planning boards	Personnel time	ST
6.18 Schedule workshops on issues of interest to planning and municipal boards	County planning departments (TL) SWCDs, NYSDEC, NYCDEP CWC (annually, Local Govt Day)	Time and material	Ongoing
6.19 Conduct yearly training for mountaintop planning boards on SEQRA	County planning departments (TL) Municipal lawyers Local planning boards	Personnel time	Ongoing
6.20 Ensure planning boards have proper resources to make decisions, e.g., inventory	County planning depts. & SWCDs (TL)	Material and staff	ST

of natural resources (maps), county, state & federal regulations, SEQRA implementation	NYCDEP, NYSDEC, NYSDOS, USEPA Local planning boards	support	
6.21 Develop universal checklist to guide planning boards in project reviews, e.g., what forms need to be completed	Municipal boards (TL) County planning departments SWCDs Local planning boards	Time and material	ST Checklist may vary depending on type of municipal codes
6.22 Investigate inter-municipal compact agreements that extend wetlands and stream buffers protections beyond individual town borders	Municipal boards (TL) Municipal attorneys SWCDs, NYSDEC, NYSDOS, ACOE	Personnel time	LT
6.23 Participate in the Schoharie Watershed Advisory Committee	Municipal boards (TL) GCSWCD, Non-profit orgs. Regulatory agencies (NYCDEP, NYCDEC, ACOE)	Personnel time	ST
6.24 Evaluate efficacy of local codes to address landscape impacts on water quality and incorporate development standards were necessary, such as amending site plan and subdivision laws to incorporate best management practices for wetland protection, logging, driveway development, hillside development. (Sample model ordinance: http://www.wcs.org/media/file/MCA-WCS-TP3-CAOD.pdf). See sample Local Land Use Review matrix in Appendix A.	Municipal and planning boards (TL) County planning departments Municipal attorneys SWCD's, NYSDEC, NYCDEP	Personnel time	LT – initial individual review by each municipality followed by a county level review for comparison across the basin. Agencies and SWCD's available to provide guidance on adequacy of protection. Consider designating a county department to recommend the Land Use Review matrix be completed by each municipality
Local Land Use Ordinance/Regulations			
6.25 Incorporate performance standards for new driveways to minimize erosion and runoff problems, especially on steep slopes	Municipal boards (TL) Highway departments SWCDs County planning departments Landowners	Personnel time	LT
6.26 Incorporate riparian buffer protections in site plan, subdivision and floodplain damage prevention laws	Municipal boards (TL) SWCDs County planning departments Landowners		

6.27 Evaluate feasibility of implementing site plan review for individual lot development to help home builders with siting homes and driveways to minimize erosion and diversion of drainage paths	Municipal and planning boards (TL) SWCDs County planning depts. NYSDOS Landowners		LT
6.28 Adopt new FEMA flood maps and update floodplain ordinance according to the NFIP standards	Municipal boards (TL) NYSDEC, FEMA, GCSWCD County planning Departments		ST
Watershed Coordination			
6.29 Continue focus group meetings	GCSWCD (TL) Municipal officials (planning & municipal boards, CEO's), Contractors, consulting firms, Highway departments NYCDEP, NYSDEC, ACOE	Personnel time	Ongoing
6.30 Develop a Schoharie basin newsletter highlighting watershed stewardship efforts	GCSWCD (TL) Regulatory agencies, County planning departments, municipal officials, Schoharie Watershed Advisory Committee	Time and materials ~$750/yr.	Ongoing
6.31 Develop a schedule of regulatory training for watershed stakeholders with appropriate agencies, e.g., NYSDEC & NYCDEP on stormwater regulations, ACOE & NYSDEC on wetland regulations	County planning depts. & SWCDs (TL) Regulatory agencies Municipal officials Landowners and Contractors	Time and material	LT
6.32 Develop best management practices across the basin that are effective at minimizing erosion from development	SWCD's and engineering firms (TL) Municipal officials Regulatory agencies County planning Departments Landowners and Contractors	Time and material	LT
Education & Outreach			
6.33 Identify outreach efforts targeted at private contractors, CEO's, highway management, planning personnel	SWCDs (TL) Municipalities officials, landowners, County planning departments Regulatory agencies		LT
6.34 Develop a *Contractor's Book* highlighting local, state, federal regulations,	GCSWCD (TL) County planning departments		LT

BMP's, funding sources	Regulatory agencies Contractors, engineering firms		
6.35 Create a Planning Board Guidance Document on what to look for when approving site plans and subdivisions relating to proper drainage, stormwater run-off.	SWCDs in conjunction with County planning departments (TL) NYCDEP, NYSDEC Highway departments	Time and material	ST
6.36 Create an 'ABC' regulations manual for planning boards and project applicants	County planning departments & SWCD's (TL) Regulatory agencies Local planning boards, landowners	Time and material	ST
6.37 Develop a universal guidance document for highway departments, contractors, and property owners on culvert sizing and placement considerations incorporating slopes, soils, and drainage patterns	SWCDs (TL) NYCDEP NYSDEC Cornell Local Roads Program Engineering firms, Contractors	Time and material	LT
6.38 Conduct a minimum of three technical training sessions for local decision-makers	SWCDs (TL) NYCDEP, NYSDEC, NYSDOS County planning departments Municipal officials, highway depts., CWC Catskill Fund for the Future (funding source)	Time and material	LT
6.39 Host public forums at least bi-annually	SWCDs (TL) Municipal officials NYCDEP, NYSDEC, landowners, contractors, engineering firms, Schoharie Watershed Advisory Com.	Approx. $4,000 - $5,000/yr.	Ongoing
6.40 Create a centralized website of watershed communities' land use codes, regulations, tax parcel data, natural resources, etc. • create an interactive map of the above resources as funding allows	County planning departments (TL) SWCDs Local municipalities	Time and website hosting	LT
6.41 Develop a resource library of municipal zoning and planning codes & make accessible to those who do not use the internet	County Planning Depts. & GCSWCD (TL) Local municipalities	Time and material	LT
6.42 Develop one-page flyers of educational information on topics local	SWCDs (TL) County planning departments	Time and material	ST and ongoing

officials feel would be useful for property owners and contractors and attach to building permit, site plan and subdivision applications	Municipal officials (councils, local planning boards, CEO's) Regulatory agencies		
6.43 Send educational material out with municipal tax mailings to save on postage	Local municipalities		Ongoing
6.44 Host an annual stream festivals that offer fun, educational activities for the public on the Catskills streams and other natural resources	GCSWCD & NYCDEP (TL) Landowners Municipalities Non-profit organizations Watershed agencies	$7,000 - $10,000	Ongoing
Technical assistance			
6.45 Conduct stream management plans for the Bear and Manor Kills in Delaware and Schoharie Counties	Schoharie Co. SWCD & Planning Dept. (TL) Delaware Co. SWCD for Bear Kill GCSWCD, NYCDEP (funding partner) Landowners, Towns of Roxbury, Gilboa and Conesville		Manor Kill assessment – Spring 2008 Bear Kill – TBD, contingent on funding
6.46 Provide technical assistance to basin highway departments with permitting, culvert design and placement, and identification of potential stormwater retrofit projects	SWCDs (TL) Highway departments Cornell Local Roads Program CWC NYCDEP, NYSDEC Engineering firms		Ongoing, contingent on funding
6.47 Research feasibility of purchasing a hydroseeder for Schoharie and Delaware Counties to maintain road ditches consistent with erosion prevention	SCSWCD and DCSWCD (TL) GCSWCD, NYCDEP CWC Highway departments		LT
6.48 Create a centralized program to oversee maintenance of stormwater retrofit projects after construction	SWCDs (TL) CWC, NYCDEP, NYSDEC (funding partners) Contractors, consulting firms		LT
6.49 Fund identified streambank stabilization needs on farms in the Johnson Hollow basin	NYCDEP (TL) DCSWCD, Delaware County Planning Department, Landowners		Contingent on funding

6.50 Create a stormwater liaison position to assist residents, municipalities, and contractors with designing stormwater projects (future or existing retrofits) and applying for CWC funding	NYCDEP & GCSWCD (TL) CWC NYSDEC Landowners Local Municipalities Engineering firms, contractors		ST – 2008 (approved funding in 2007 FAD and Schoharie basin contract with GCSWCD)