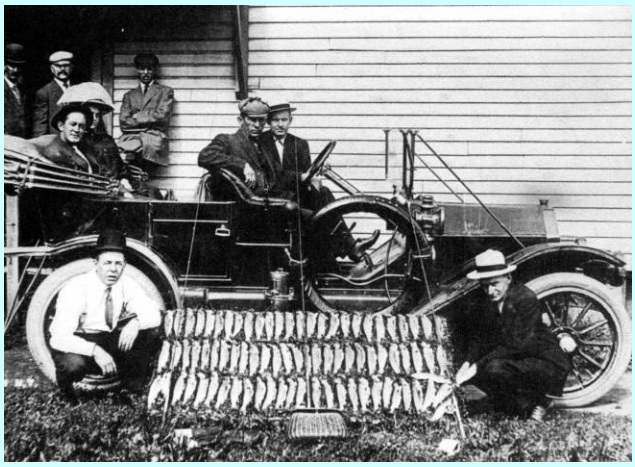
UPPER ESOPUS CREEK MANAGEMENT PLAN

Volume II DRAFT

Community and Stream Use Characterization



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Introduction

Volume II is a compilation of the social and cultural aspects related to management of Upper Esopus Creek including: a brief overview of the watershed history and demographics, an overview of the Catskill District water supply structure and operations, a community assessment and recommendations for Education, Outreach and Coordination, and an assessment and recommendations for Angling and Recreation issues.

Section 1: History and Demographics

The history and demographics of the Upper Esopus Creek Watershed heavily shape the social-cultural context that will influence any stream management efforts. The Creek has been a centerpiece of the local tourist economy and culture. For over a century, communities in the watershed have relied on the beauty and bounty of the Esopus Creek and watershed for their life blood. At the same time, community attitudes toward public agencies are still strongly flavored by the history of entire towns being removed for placement of the reservoirs. This section is intended to give a brief snapshot of the history and social makeup the watershed.

Section 2: NYC Catskill Water Supply System

The Upper Esopus is very unique in that it conducts an inter-basin transfer of drinking water supply for eighteen miles to the Ashokan Reservoir. This section provides a brief overview of the Shandaken Tunnel structure and operational regulations for tunnel flows. More detailed information on the Shandaken Tunnel's impacts on visual turbidity and the questionable impacts of erosion and flooding are addressed in the Angling and Recreation Section.

Section 3: Education, Outreach and Coordination

Over the past year, a community assessment has been carried out along with initial coordination activities (Project Advisory Council and Working Groups) to determine the best ways to provide education, outreach and coordination for stakeholders in this stream management plan. Multiple community assessment methods have provided detailed information on the attitudes and opinions of the community. A streamside landowner's survey conducted by Cornell University has been a particularly useful asessment tool. Erosion and flooding, fish and wildlife habitat and turbidity top the charts for issues raised by the community. Key recommendations for education and outreach focus on development of a riparian buffer enhancement program, youth involvement, technical assistance and "how-to" workshops for streamside landowners. Coordination recommendations center on developing a sustainable local organizational structure, funding and resources for stream management, emergency preparedness education, and promotion of stream stewardship principles and policies.

Section 4: Angling and Recreation

As the birthplace of tourist fishing , a destination stream for paddlers from as far away as New Jersey, a whitewater tubing mecca, and a working scenic railroad, the Esopus has a strong recreational legacy. This section reviews that legacy along with current angling and recreation issues. Turbidity, Shandaken Tunnel flows and user education are key socio-economic issues. Recommendations focus on addressing: woody debris in the stream, Shandaken Tunnel flows and turbidity, user-conflicts through developing and promoting a stream users' code of conduct, incorporating input in future stream restoration work, and many other issues.

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- Historical angling photo courtesy of Mark Loete Photography (www.loetephoto.com)
- 1980 American Canoe Association Championship Race photo courtesy of Keech LeCLair.

1.0 Community Demographics

Photo 2.1: Aerial view of Hamlet of Phoenicia

Demographics and history of the upper Esopus Creek Watershed provide context for management issues on Esopus Creek. The area is rural and yet half of its residents live in the area part time, many with primary residences in the New York Metropolitan area. The history of the watershed and how it was developed for water supply through the use of eminent domain continues to strongly flavor relationships between the public and government agencies. The Esopus' history as a major fishing and tourist destination is a legacy many hope to preserve or revive. Yet, the demographic and historical elements of the watershed have also made the watershed a beautiful and interesting place to live.

1.1 Population and Upper Esopus Creek Landowner Statistics

According to the U.S. Census of 2000 (as cited in the Town of Shandaken Comprehensive Plan, 2005), the Town of Shandaken has 2,666 housing units. In the Town of Olive there are 2,306 housing units; however only a handful of Olive's residents reside along the banks of the Esopus Creek above the Ashokan Reservoir. Most of the 238 landowners who own property on Upper Esopus Creek landowners are located in the Town of Shandaken. Of these, approximately 55 percent are occupied by full-time residents. Based on Ulster County tax parcel address list, there are approximately 1,200 households on the main roads adjacent to the streams in the entire Upper Esopus Creek Watershed. In the 2000 Census, Shandaken ranked 21st in the county for both household and family median income.

Table 1.1: Population Data

Place	Population	Median Age	Average Household Size	Median Household Income ($)
Shandaken (Town)	3,235	45.0	2.17	31,566
Olive (Town)	4,579	42.2	2.43	45,409
Ulster County	177,749	38.2	2.47	42,551
New York State	18,976,457	35.9	2.61	43,393

Age of the population is also an important factor in the Esopus Creek Watershed. The median age of people in the Town of Shandaken is approximately 45.7 years as compared to a statewide average of 35.9. A significant portion of adults are distributed in the 40-55 and 65-75 year-old range.

Important differences exist between part-time residents and full-time residents in the watershed. Part-time residents tend to have a permanent residence in the larger New York City Metropolitan area and own a second home in the Catskills as vacation homes. Many come to the area for weekends or stay for longer periods in the summer, enjoying the natural surroundings and recreational opportunities. Part time residents are more difficult to reach through local advertising, weekday, and non-summer activities. Full-time residents tend to be more available and have a more rural-oriented lifestyle. In some cases these groups interact, but there is sometimes friction. With the population split between full-time and part-time residents, it is challenging to schedule education programs for all groups.

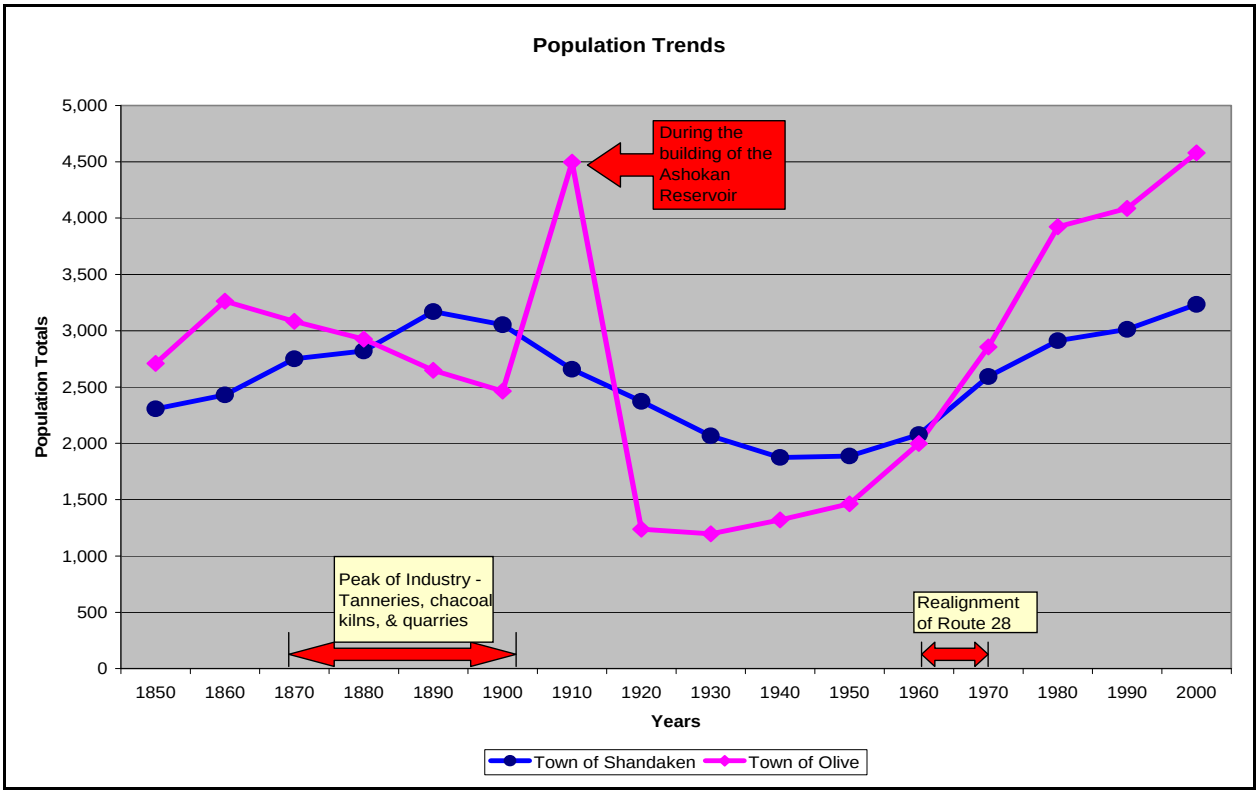


Figure 1.1: Population Trends

1.2 Major Events in the Upper Esopus Creek Watershed

There are a few major events that have affected the watershed, and therefore the Esopus Creek, as a whole throughout history. Resource extraction in the watershed began in the mid-1800s. Tanneries, charcoal kilns, and quarries became the new technology, and the Catskills had the resources to house these industries. Unfortunately, this unchecked technology wrecked havoc on the natural resources of the area. The construction of the railroad along Esopus Creek to Phoenicia around 1870 facilitated the transport of resources to market, but also brought vacationers and tourists to the watershed. As the resource extraction industries began closing in the late 1800's and early 1900's, tourism began to occupy a significant place in the local economy. The establishment of the Catskill Forest Preserve in 1904 marked a new beginning for the Catskills as a destination (see Section 4 for more detail about angling, tubing, kayaking and canoeing, and the railroad).

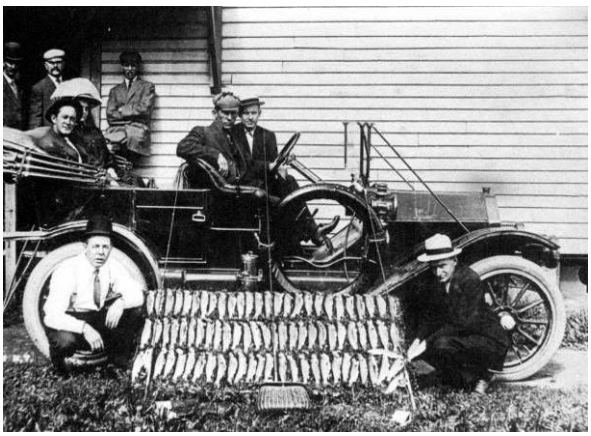


Photo 1.2: (Left) Postcard of Boaters in Esopus Creek; Photo 1.3: (Right) Another day in the stream. Both photographs courtesy of Mark Loete.

By the end of the 19th century, New York City was a bustling port city that was growing in population each day from a wave of immigration. The population of New York City began to overwhelm the amount of fresh water coming into the City. Major droughts in 1895 and 1896 further stressed the fresh water supply for the City's residents. Over the next 10 years the City began to investigate other various options for a water source.

In 1905 New York City had chosen the Esopus Valley as the site for the next big watershed to supply water to its city. By 1907, construction had begun on the Ashokan Reservoir, and as shown in Figure 1.1, the population of the Town of Olive almost doubled in size. When the reservoir was completed (Calhoun, 1997):

- 10,000 acres of land were claimed by New York City
- 2,000 people had been moved
- 500 homes were relocated or destroyed
- 35 stores were relocated or destroyed
- 10 churches were relocated or destroyed
- 11 schools were relocated or destroyed
- 5 railroads were relocated
- 2,720 bodies were exhumed and removed from 40 different cemeteries

Engineer John Freeman told the City that the solid bedrock promised protection from leakages, so he decided to build the high dam at Bishop Falls - once a famous landmark in the Esopus Valley. What was once Bishop Falls now lays ¼ mile out from the main dam, under approximately 180 feet of water at the deepest point of the west basin. It is also a mark where the Esopus Creek was stopped on September 9th, 1913 and water storage began. (Calhoun, 1997)

Photo 1.4: Bishop Falls on Esopus Creek (*Calhoun, 1997)*

Photo 1.5: Dam built over Bishop Falls at Ashokan Reservoir (*Calhoun, 1997)*

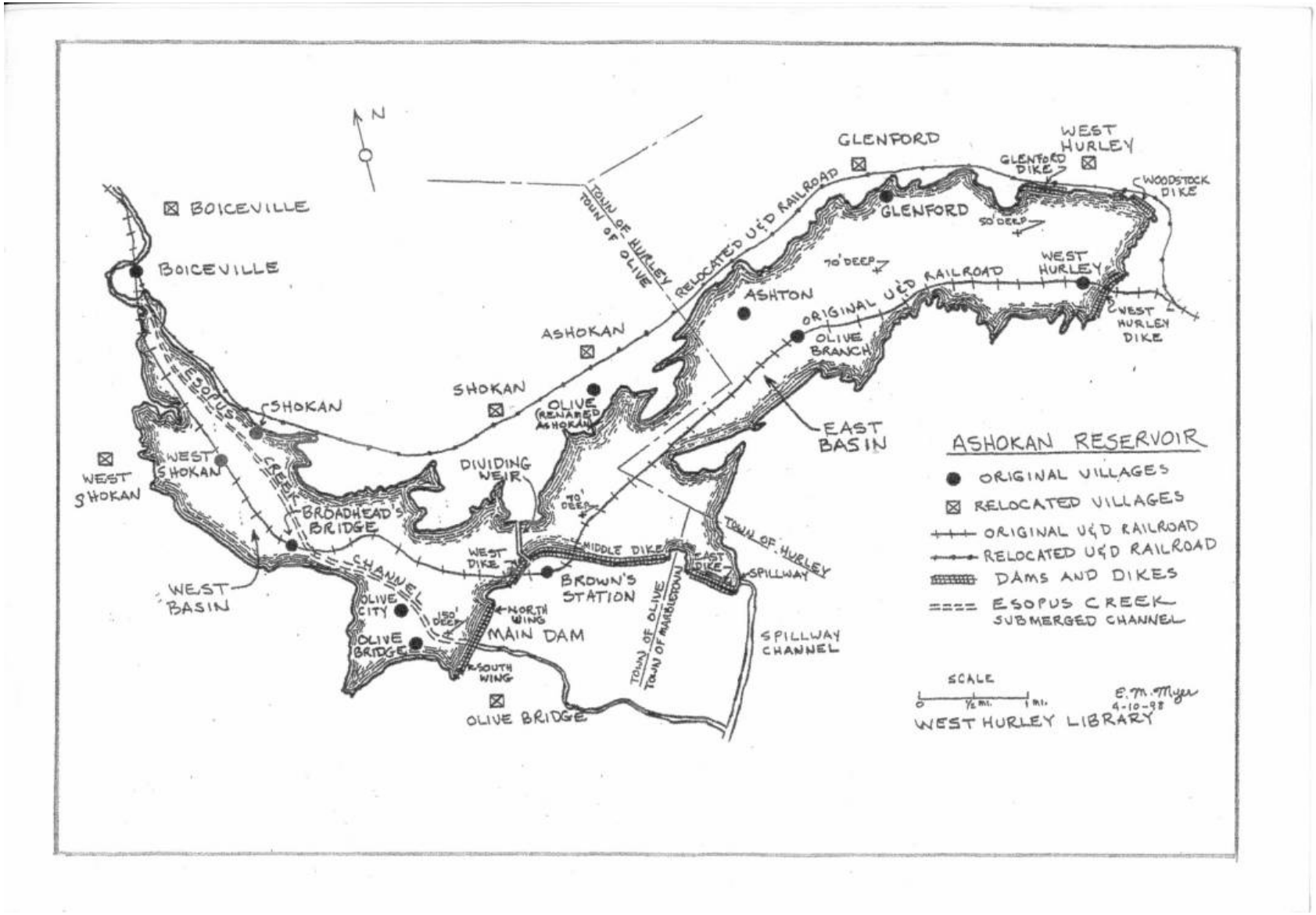


Figure 1.2: Diagram of Ashokan Reservoir ***Courtesy of West Hurley Library***

The Esopus Creek had been separated, what is now called the Upper Esopus Creek connects to the Ashokan Reservoir by the Upper Basin (A.K.A. the West basin) and stretches to its headwaters at the top of Slide Mountain.

The Lower Esopus Creek exits the Ashokan Reservoir under the Main Dam of the West Basin, joined later by the Spillway channel that comes from the overflow of reservoir water from the East Basin of the Ashokan. The Esopus Creek channel that runs under the Main Dam of the Reservoir is the original channel of the Esopus and continues down past the towns of Kingston and Saugerties, eventually flowing directly into the Hudson River.

Photo 1.6: Spillway Channel connecting to the Lower Esopus Creek

More detail on the NYC Water Supply system can be found following this section.

1.3 Listing of Historical Events in Upper Esopus Creek Watershed

(Information from *Kudish, 1979* and *Shandaken Comprehensive Plan, 2005*)

- Late 1700's – Mid- 1800's European Settlement of the Esopus watershed
- 1804 – Town of Shandaken was established
- 1820's – A landslide gives Slide Mountain its name
- 1823 – Town of Olive was established
- 1850's – Minimum acreage of forest due to agriculture
- Mid-1800's the tannery industry peaked
- 1870 – 1871 – Completion of Ulster & Delaware Railroad
- 1870-1900 – Charcoal kilns were located around Winnisook Lake, Pine Hill & Big Indian near the railroad
- 1870 – 1900 –Bluestone quarries were a major industry during this time in the Esopus Valley from West Hurley to Shandaken and from the Ashokan northeast
- Late 1800's - Much of the accessible Catskill forest had been cut for settlement or industry
- 1881 – Grand Hotel was built in Highmount
- 1885 – An estimated 80 to 90% of the original first growth Catskill forest was no longer in existence
- 1885 – Forest Preserve created to preserve the ecology of the area and protect the valuable water supplies for NYC
- 1887 – Land acquisition by the state began
- 1890's – Charcoal kiln industry peaked
- 1900 – Tannery industry disintegrated
- 1904 – Catskill Park was established as an ecological preserve
- 1905 – The Ashokan Reservoir was in the works for the Esopus Valley
- 1915 – A survey indicated hemlock damage from bark peeling near the Esopus; abundant in the area of McKinley Hollow
- 1917 – Construction had begun on the Shandakan Tunnel
- 1928 – Shandaken Tunnel began operating
- 1935 – Panther Mountain Range land acquisitioned and state owned
- 1946 – Opening of the Highmount Ski Center
- 1949 – Highmount ski center changes to the Belleayre Ski Center
- 1950's – Logging in Fleischmann's
- 1960's West side of Slide mountain logged
- 1960's – Route 28 was realigned
- 1966 – Small forest fire on Panther mountain claims ~10acres
- Early 1970's- Logging on Eagle and Big Indian Mountains
- 1970's or 1980's – Winnisook area logged
- Early 1980's – Logging in Fleischmann's
- 1980's – Area of Slide Mountain close to the Esopus is logged
- Mid-1980's – Logging on Eagle and Big Indian
- 1990-1992 – Logging on Halcott (Bearpen Mountain Range)
- 1996 – 40% of Catskill Park was publicly owned

2.0 Catskill District Water Supply System

Photo 2.1: Aerial view of Shandaken Tunnel (Portal)

Photo 2.2: Aerial view of Ashokan Reservoir

The Catskill District of New York City's West-of-Hudson water supply system is one of three systems that supply water to New York City and includes the Schoharie Reservoir, Shandaken Tunnel, Ashokan Reservoir and the Catskill Aqueduct west of the Hudson River (Figure 2.1). Approximately 40% of the City's average water supply demand is provided by the Catskill System; the Delaware and Croton systems supply 50% and 10%, respectively. See Figure 2.2. for the complete NYC Water Supply System.

The Shandaken Tunnel is a handmade aqueduct that connects the Schoharie Reservoir to the Upper Esopus Creek. The 18 mile long aqueduct used to be the longest handmade aqueduct in the world (the Helsinki Tunnel in Finland which was built in 1982 and is approximately 75 miles long now holds the record) ("The World's Longest Tunnels," 2003). Although it is no longer the longest tunnel in the world, the Shandaken Tunnel still remains as one of the last tunnels to be built by hand.

Withdrawals from the Schoharie Reservoir are made via a rock-cut channel that carries water into the Schoharie Reservoir Intake Chamber, where it flows into the Shandaken Tunnel. The water flows naturally down the tunnel by means of gravity, with seven shafts that are open to the air along the way serving as a means to keep oxygen in the water throughout its 18 mile journey to Upper Esopus Creek. Once delivered, the Esopus carries the Schoharie Reservoir water an additional 12 miles southeast into Ashokan Reservoir. From Ashokan, water is transported to New York City via the Catskill Aqueduct and is typically first released into Kensico Reservoir before continuing to Hillview Reservoir, from which it is delivered to New York City.

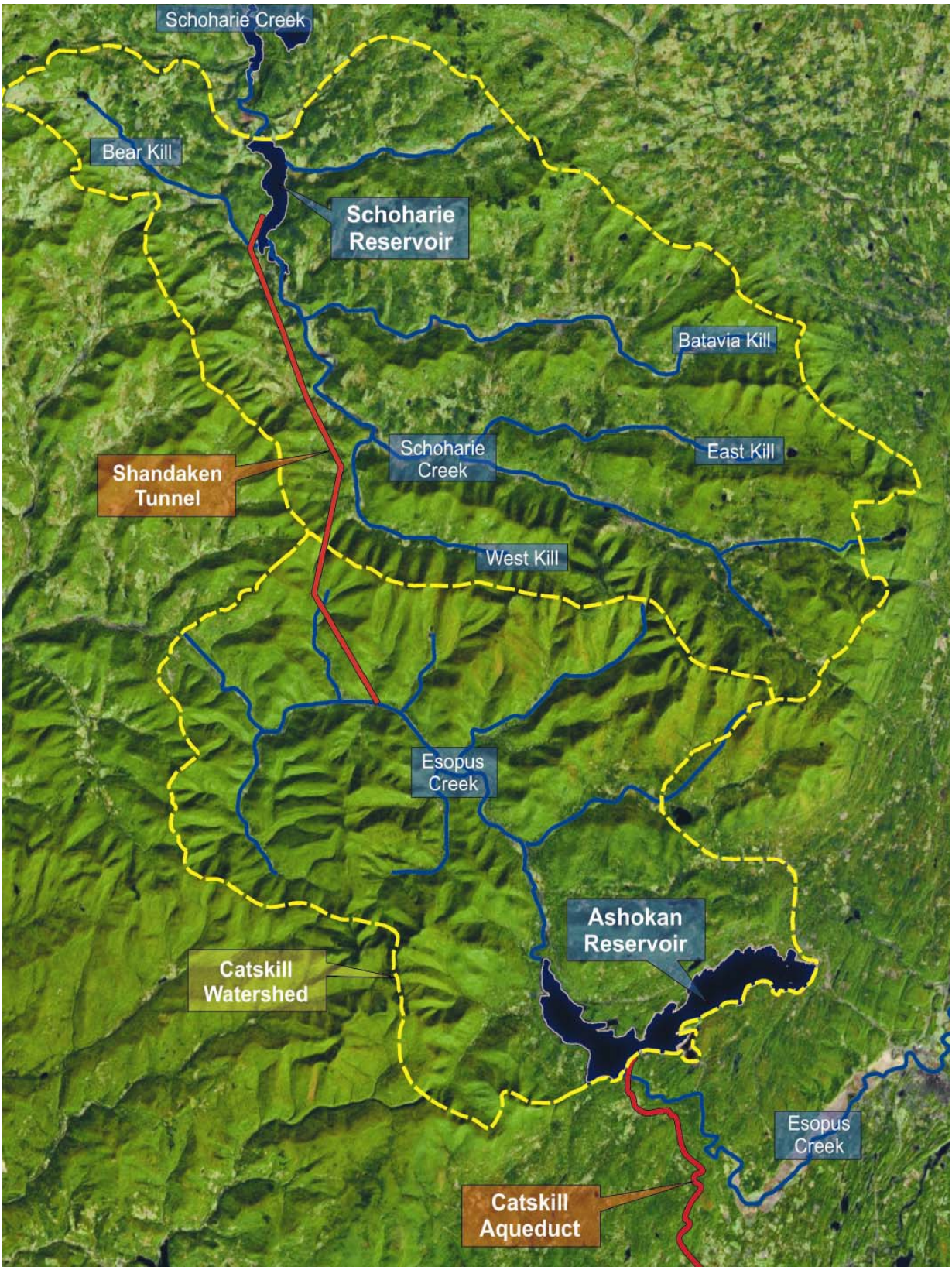


Figure 2.1: Catskill District of NYC West-of-Hudson Water Supply System

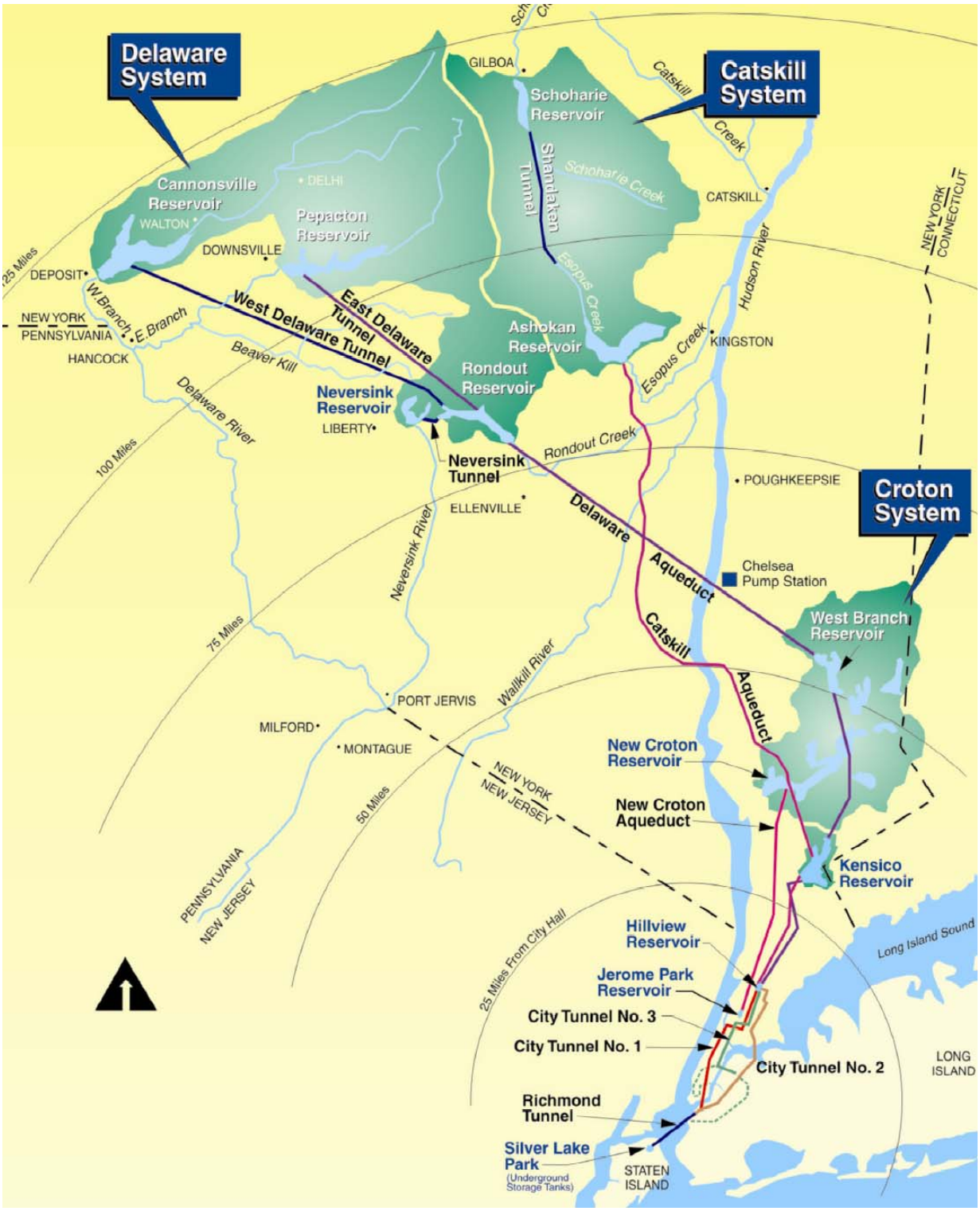


Figure 2.2: NYC Water Supply System

2.1 Specifications

The Ashokan Reservoir is the oldest New York City-owned reservoir in the Catskill Mountains, being placed into service in 1915. It is located at the eastern end of Ulster County, about 13 miles (20.8 km) west of Kingston, New York, and approximately 73 miles (116.8 km) north of New York City. The reservoir is one of NYC's largest according to its surface area and volume. At full capacity, the reservoir can hold 122.9 billion gallons (465.2 million m^3) of water, has a 255-square-mile (408-km^2) drainage basin, and is over 180 feet (54.9 m) deep at its deepest point, making it the city's deepest reservoir. A contract was awarded for the building of the Shandaken Tunnel on Nov. 9, 1917. Construction was completed in 1924 and water delivery began soon after.

2.1.1 Shandaken Tunnel Dimensions

The dimensions of the tunnel were very important to its construction. The tunnel had to be built to go through and around the mountains leading down to the Esopus Creek, and was done so by the hands of about 800 men. It was specifically designed so that it would have designated open air shafts that would allow oxygen to circulate into the water, therefore keeping the water health for fish and other organisms.

There are eight sluice gates that control the amount of water entering the tunnel from the intake chamber. Currently, only five of the eight are able to be opened, but NYC is currently rehabilitating the intake chamber to make all of the gates operable. The maximum amount of water able to be diverted through the Shandaken Tunnel is approximately 620 million gallons per day (MGD).

Table 2.1: Tunnel Descriptors

Tunnel Descriptors	Dimensions
Length	18.1 miles
# Of Open Air Shafts	7 shafts
Tunnel Slopes	4.4 ft/mile
Deepest Shaft	630 feet
Diameter (first 3-1/2 mi.)	14 feet
Height	11 ft. 6 in.
Width	10 ft. 3 in.
Material	Concrete lined in bedrock

Table 2.2: Schoharie Reservoir & Shandaken Tunnel Intake Chamber Descriptors

Intake Chamber Descriptors	Dimensions
# of Sluice Gates	8 gates
Size of Sluice Gates	3 ft. x 7 ft.
Tunnel Maximum Flow	620 MGD (million gallons/day)
Location of the Intake Chamber	3 miles South of Gilboa Dam
Schoharie Reservoir Watershed Area	314 sq. miles
Available Storage in Schoharie Reservoir	19,580 Million Gallons (MG)
Storage Capacity	62 MG / sq. mile
Schoharie Reservoir Max. Depth	57 feet

Photo 2.3: Schoharie Reservoir, August 2006

Photo 2.4: Intake Channel for Schoharie Reservoir

Photo 2.5: Intake House at Schoharie Reservoir

Photo 2.6: Close-up of the Shandaken Tunnel Discharge

Photo 2.7: Discharge into Upper Esopus Creek

Photo 2.8: Upper Esopus Creek entering Ashokan Reservoir
Courtesy of Aaron Bennett, Catskill Center for Conservation & Development

2.2 Shandaken Tunnel Operations Regulations

New York City must abide by two regulatory documents administered by the New York State Department of Environmental Conservation (DEC) when operating the Shandaken Tunnel: 6 NYCRR Part 670 "RESERVOIR RELEASE REGULATIONS: SCHOHARIE RESERVOIR - SHANDAKEN TUNNEL - ESOPUS CREEK and a State Pollution Discharge Elimination System (SPDES) permit, described in more detail below.

2.2.1 NYSDEC Part 670 Reservoir Release Regulations

Title 6, Part 670 of the New York Codes, Rules and Regulations (NYCRR) regulates the volume and rate of change in the discharge of water from the Schoharie Reservoir through the Shandaken Tunnel into Esopus Creek.

Implemented in 1977, the stated purpose of Part 670 is to "protect and enhance the recreational use of waters in the Esopus Creek…while ensuring and without impairing an adequate supply of water for power production or for any municipality which uses water from such reservoirs for drinking and other purposes."

Part 670 was the result of combined efforts from state resource protection managers who wanted to ensure that operation of the Tunnel would be done in such a way as to protect the aquatic organisms in Esopus Creek from extreme variations in habitat conditions created by the Tunnel flows. Whitewater recreation enthusiasts also organized and succeeded in having "recreational releases" allowable under the statute.

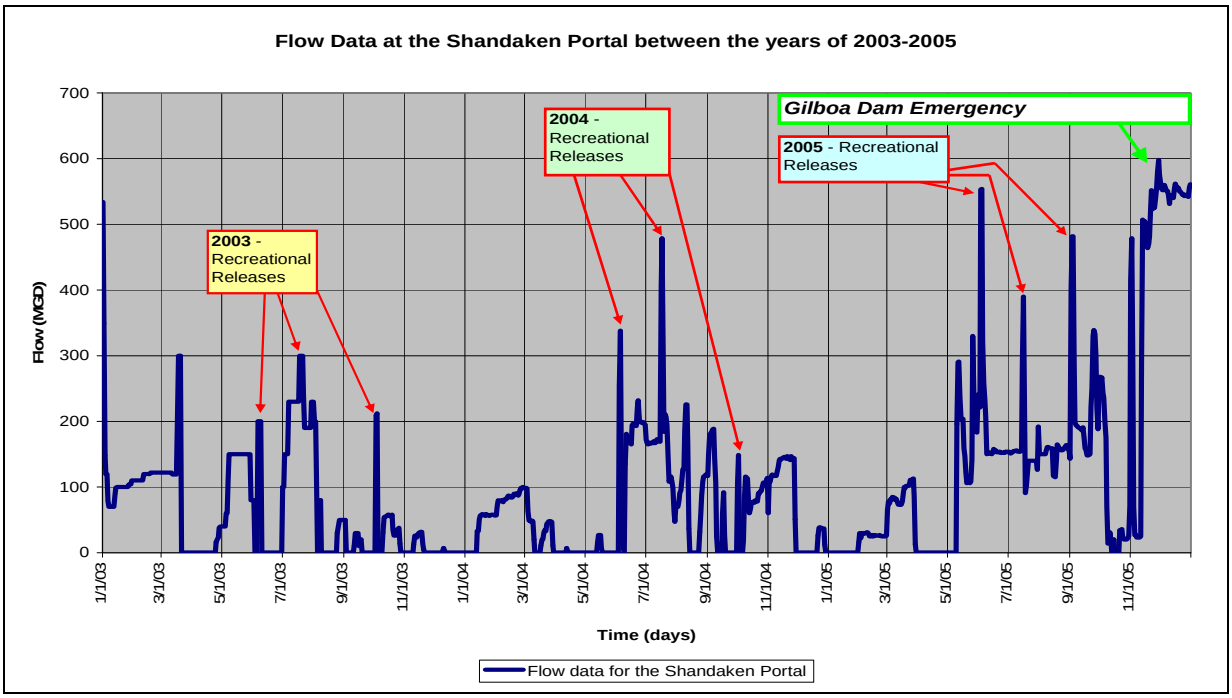


Figure 2.3: Shandaken Tunnel Flow Data from 2003-2005 (DEP, 2006)

Major provisions of Part 670 are summarized in Table 2.3. The core requirements of Part 670 are minimum and maximum flow limits for the combined flow in Esopus Creek ("combined flow").

The combined flow rate is calculated as the sum of the flow measured at the Shandaken Tunnel Intake chamber plus the flow measured at the Esopus Creek monitoring station at Allaben (just upstream of the Tunnel outlet). Compliance with these flow limits is calculated on an average daily basis.

The minimum combined flow rate is 160 MGD (million gallons/day) year-round, except when insufficient water is present in the Schoharie Reservoir or when Ashokan Reservoir is spilling. The maximum combined flow rate is 300 MGD from June through October, except when the void in the Schoharie Reservoir is less than 5 BG (Billion Gallons) and the void in the Ashokan Reservoir is greater than 5 BG. From November through May, there are no Tunnel flow restrictions whenever the flow in the Esopus Creek exceeds 300 MGD.

Table 2.3: Schoharie Reservoir Release Regulations (6 NYCRR Part 670)

Time Period	Provision	Exceptions
Year Round	Minimum combined flow of 160 MGD	When sufficient water is not present in Schoharie Reservoir; OR When Ashokan Reservoir is spilling.
	Maximum rate increase of 40 MGD /hr Maximum rate decrease of 20 MGD /hr	No rate restrictions from November Through May, when Esopus flow > 300 MGD.
June – October	No releases when Esopus flow > 300 MGD	None
	Combined flow cannot exceed 300 MGD	When the void in Schoharie Reservoir is < 5 BG; AND When the void in Ashokan Reservoir is > 5 BG.
November – May	When Esopus flow > 300 MGD, no restrictions on discharge or rates	

*MGD = Million Gallons per Day
** BG = Billion Gallons

In addition to minimum and maximum combined flow limits, Part 670 specifies maximum rates of increase (40 MGD/hr) and decrease (20 MGD/hr) for Shandaken Tunnel flows. These limits apply year-round, except from November through May when the Esopus Creek flow exceeds 300 MGD. This "ramping" provision was instituted so that habitat conditions in Esopus Creek from the Tunnel discharge would adjust slowly, thus lessening impacts on aquatic biota.

The above flow and flow ramping provisions do not apply when there is a threat to the safety or safe operation of the Schoharie Reservoir, Shandaken Tunnel, or Ashokan Reservoir or their appurtenant structures; to the public health and safety; or to the maintenance of a satisfactory level of water quality in the Ashokan Reservoir. In addition, New York City Department of Environmental Protection (NYCDEP) may request approval by New York State Department of

Environmental Conservation (NYSDEC) for actions that do not meet the Part 670 flow and flow rate provisions.

Photo 2.9: Emergency Reconstruction at the Gilboa Dam on Schoharie Reservoir began in fall of 2005. During the emergency repairs, NYCDEP has operated Shandaken Tunnel at maximum capacity in accordance with the emergency provisions of Part 6 NYCRR § 670.7

Finally, Part 670 authorizes NYSDEC to request that NYCDEP release water from the Schoharie Reservoir for the purposes of monitoring, testing, or research; protecting the fishery or other natural resources of Esopus Creek, Schoharie Reservoir or Ashokan Reservoir; for the benefit of existing recreational uses of such reservoirs, or for special recreational events on Esopus Creek. Specifically, NYSDEC DEC may grant up to four (4) recreational releases per year (one per month) between the months of May and October provided that requests be made to the department reservoir releases manager in writing not later than April 15th of any year.

> *Between January 1, 1982 and December 31, 2005, the Shandaken Tunnel has delivered over 1.5 Trillion gallons of water to Upper Esopus Creek (DEP, 2006)*

2.2.2 SPDES Permit

Turbidity in the Schoharie Reservoir, Esopus Creek, and Ashokan Reservoir were elevated for many months following the January 19, 1996 flood. In 2000, the Catskill Mountain Chapter of Trout Unlimited (CMC-TU) and other organizations brought a citizen suit under the federal Clean Water Act against the NYCDEP, arguing that a discharge permit for the Shandaken Tunnel's turbid waters was needed under the National Pollutant Discharge Elimination System (NPDES) program. See Volume III, Section 2.7 for a detailed discussion of turbidity in the Esopus Creek watershed.

Based on the October 2001 decision of the U.S. Court of Appeals in the litigation, NYCDEP applied for a SPDES (the New York State implementation of the NPDES program) permit from NYS Department of Environmental Conservation (DEC). Although NYC continues to dispute

the applicability of the NPDES program to water transfers such as the Shandaken Tunnel in the litigation, NYCDEP is now operating the Tunnel in accordance with the SPDES permit that became effective on September 1, 2006[1]

The SPDES Permit for the Shandaken Tunnel includes standards for flow, turbidity, temperature, and phosphorus levels in the Tunnel's "diversions" to Esopus Creek. In addition, the permit contains numerous requirements for monitoring, reporting, and notification, as well as specified programmatic compliance actions.

Flow Provisions
The SPDES permit establishes average daily and maximum flow limits for the combined flow of Esopus Creek plus the Shandaken Tunnel discharge that correspond to those established under Part 670. The permit establishes exemptions from these limits that mirror those contained in Part 670.

Finally, the permit states that, during low stream flow conditions in Esopus Creek, water quantity is more important than water quality, and to this end establishes a combined flow threshold (110% of the minimum combined flow requirement, or 176 MGD) below which the temperature and turbidity discharge standards described below do not apply.

Turbidity Limits
The permit establishes a requirement for continuous turbidity monitoring for the Shandaken Tunnel discharge and for Esopus Creek upstream of the Shandaken Tunnel outlet to measure the following:

- The turbidity of the Shandaken Tunnel discharge; and
- The increase in turbidity between the Shandaken Tunnel discharge and the Esopus Creek flows just upstream of the Tunnel outlet.

In addition, the permit establishes both interim action levels and interim and final effluent limits:

- Type I Action Level, exceedence of which requires reducing the Shandaken Tunnel flows until the Action Level is met or until the flow is the minimum necessary to achieve a combined flow of 160 MGD; and
- Effluent Limits, exceedence of which would be a violation of the permit.

Interim Limits
During the first seven years after the effective date of the Permit (September 1, 2006), the Shandaken discharge is subject to interim turbidity limits and Action Levels. From June – October, discharged turbidity from Shandaken Tunnel may be no more than 15 NTU greater than Esopus Creek turbidity. From November – May, discharged turbidity may be no more than 20 NTU greater than Esopus Creek turbidity. In addition, discharged turbidity greater than 100 NTU triggers a tunnel shutdown as shown below in Table 2.4.

Final Turbidity Limits

[1] For more detail on the history of this legal action see Eastern Water Law & Policy Reporter, August/September 2006. Also, the Administrative Law Judge Decision is available on the NYS DEC website: http://www.dec.state.ny.us/website/ohms/decis/shandakenir.html

When the final turbidity limits become effective, seven years after the effective date of the permit, the Shandaken discharge will be subject to year-round turbidity effluent limits.

- "Turbidity Increase" between Shandaken discharge and Esopus Creek flow shall not exceed 15 NTU
- Shutdown Trigger is 100 NTU

Temperature Limit
The Permit establishes a daily maximum effluent temperature limit of 70°F.

Exemptions
In addition to safety and security exemptions similar to those contained in Part 670, the Permit establishes that under low flow conditions in Esopus Creek, water quantity is more important than water quality, and establishes temperature and turbidity exemptions for combined flows less than 176 MGD. In addition, among other things, the Permit establishes an exemption from the 100 NTU shutdown trigger under drought conditions.

Table 2.4: SPDES Permit Action Levels and Compliance Limits

Parameter	Compliance List		Type I Action Level	Sampling Frequency	Sample Type
	Daily Average	Daily Maximum			
INTERIM TURBIDITY LIMITS (Effective September 1, 2006)					
Turbidity, Shutdown		100 NTU		Continuous	Recorder
Turbidity Increase (June – October)			15 NTU	Daily	Calculated
Turbidity Increase (November – May)			20 NTU	Daily	Calculated
FINAL TURBIDITY LIMITS (Begin 7 Years after September 1, 2006)					
Turbidity, Increase		15 NTU		Daily	Calculated
Turbidity, Shutdown		100 NTU		Continuous	Recorder
OTHER FINAL PERMIT LIMITS (Effective September 1, 2006)					
Combined Flow (June – October)		300 MGD		Daily	Calculated
Minimum Combined Flow		160 MGD		Daily	Calculated
Temperature (May – September)		70˚F		Continuous	Recorder
Phosphorus, as P (12-month RAA)	8,962 kg/yr			Monthly	Calculated

*MGD = Million Gallons per Day
*NTU = "nephelometric turbidity units." For more detail on turbidity in Esopus Creek, please refer to the Water Quality section of Volume III.

3.0 Education, Outreach, and Coordination

3.1 Introduction

Many people, from small landowners to engineers and Town supervisors, are involved in one way or another in influencing or "managing" Esopus Creek. For this management plan to be effective, the various "stakeholders" (anyone with an interest in the stream) need to be well informed of both the physical stream processes as well as the stream planning processes. Education and outreach programs build a shared understanding among these groups for better coordination of actions that manage the Creek.

Given the multitude of people and diversity of the local community involved in stream management planning, a social assessment was carried out for residents of the upper Esopus Creek Watershed. The community assessment addressed the problem of how to develop education and outreach strategies that would be the most useful and effective to the local community and other stakeholders. From results of the assessment, program objectives were developed for implementation of the Esopus Creek Management Plan.

The community assessment included multiple qualitative and quantitative methods: a streamside landowner survey, community meetings, focus groups, pilot projects, and input through the Cooperative Extension Field Office. Recommendations for Education and Outreach as well as Coordination were then developed from the community assessment results and input received through coordination meetings including the Project Advisory Council and Working Groups.

Participants in the community assessment included a broad set of stakeholders such as community members at large, streamside landowners, local officials, professional resource managers, recreational enthusiasts and others. Streamside landowners played a strong role in the community assessment through the streamside landowner survey conducted by the Human Dimensions Research Unit at Cornell University.

Results across different methods of assessment showed patterns in the community's perceived priorities of stream management issues as well as solutions and preferred methods for educational programs. Flooding and erosion damage to private property was consistently the strongest issue followed by fish and wildlife habitat and turbidity. The community's most commonly supported solutions to management issues were: improved coordination of public agencies, education programs, especially "how-to" trainings and direct technical assistance, bank stabilization and improving or maintaining streamside vegetation, landowner incentives for conservation and/or restoration of banks and riparian buffers including tax incentives and landowner grants for professional assistance. Part-time residents, which represent approximately

half of streamside landowners and the watershed as a whole, are less understood in how to reach as a group and will require additional outreach efforts due to their limited time availability.

3.2 Problem Identification and Assessment Questions

The community assessment addressed the problem of how to develop education and outreach strategies that would be the most useful and effective to the local community and other stakeholders.

The Community Assessment addressed four specific questions:

1. What are the driving forces and needs behind stakeholder motivation for stream management?
2. What current knowledge do stakeholders have regarding stream dynamics?
3. What type of community involvement programs would the communities be the most interested in and available for?
4. What formal and informal resources exist in the local communities to engage the public in stream management and education activities?

3.3 Audience Characterization for Education and Outreach

Two major audience groups can be drawn from Esopus Creek Stakeholders that are key audiences for Education and Outreach.

1) Streamside landowners and other general community groups. Examples of this group would include:
   a) Streamside landowners
   b) Anglers
   c) Whitewater sports
   d) Youth
   e) Outdoor enthusiasts
   f) Community members at large

2) Professionals and elected officials involved in land use planning and policy actions. This group would include examples such as:
   i) Transportation planners – local and state highway departments
   ii) Town Planning Boards, Town Councils
   iii) Agency personnel – DEC, DEP
   iv) Soil and Water Conservation District Staff

v) Professional Stream Restoration Consultants
vi) General Landscape Contractors
vii) Electric and Gas Corporations

3.4 Community Assessment Methods

To assess the Education and Outreach needs for the Esopus Creek Management Plan, several tools were used to gather information about the needs, interests and current knowledge of the community and stakeholders. Some of these methods can be expressed in numbers (quantitative methods) and some can be expressed through themes and ideas (qualitative methods).

Table 3.1: Esopus Creek Assessment Methods

Qualitative Methods:	Quantitative Methods:
Focus Groups	**Mail survey of streamside landowners on Esopus Creek**
Community Meetings	**Number of participants at education and outreach events**
Feedback via phone calls, office visits	**Number and type of site visits**
Property Site Visits and Observations	
Reasons for office walk-ins	

Additionally, focus groups and stakeholder meetings were completed for whitewater and angling recreation groups as discussed in the Angling and Recreation section.

In addition to specific assessment tools, pilot education programs helped assess interest and utility of programs by collecting participation numbers and observations at events.

Table 3.2: Year One Pilot Education and Outreach Programs

Year One Pilot Education and Outreach Programs
An open house at the project office
Community meetings
Public speakers on topics of local general interest (geology, NYC water system)
A Stream “Walk & Talk” with experts
A stream hike and wetland tour
Training on monitoring stream macro invertebrates
Booths at public events
Stream cleanups
4-H Youth Japanese knotweed eradication project

3.5 Education and Outreach Issues and Opportunities

In several of the different assessment methods used, residents provided lists of priority stream issues they perceived as the most important. One way to rank stream issues is to consider which issues were raised most often across all the assessment methods. Table 3.3 shows that Erosion

and flooding, fish and wildlife habitat, and turbidity were listed as top issues most often by landowner and general community groups.

Community Perception of Top Stream Issues by Frequency

	Erosion or Flooding and Property Conservation	Fish & Wildlife Habitat	Turbidity	White Water Recreation	Socio-Economic Losses	Flooding (assessed separately from erosion)
Community Focus Groups	✓	✓		✓ *(Tied for third)*	✓	
Landowner Survey	✓	✓	✓			✓
Community Meeting	✓	✓	✓			✓

Table 3.3: Community's Top Stream Issues by Frequency

Top Stream Management Issues as Ranked in Community Assessment Methods (numerated where ranked by participants)

Community & Landowner Focus Groups:	Community Meeting:	Streamside Landowner Survey (based on Question #5)	Site Visits:
1. Erosion	Erosion and Flooding	1. Erosion on private property	1. Erosion
2. Socio-Economic losses	Turbidity	Flood Damage	2. Flooding
3. Recreation and Wildlife Issues	Fish & Wildlife Habitat	Aquatic habitat for trout and other fish	
Individual vs. Community Cooperation perspectives		Loss of streamside trees and vegetation	
Emergency Management		Management of Portal Flows	
Waste Water		Turbidity	

Another way to rank issues is to look at how they were ranked within the methods used. Table 3.4 shows the detail of how the stream issues were raised as top issues for each assessment methods. Some of the methods allowed for ranking of the issues by vote and are numerated below. Some of the items were listed by participants but were not ranked.

3.6 Quantitative Assessment Methods

3.6.1 Esopus Creek Streamside Landowner Survey

A separate survey report was prepared by Cornell University Human Research Dimensions Unit (HDRU). Please see the report under Appendix 1.1 for a more detailed review of survey results. Some of the survey highlights are included below.

Cornell University's HDRU mailed 237 surveys to streamside landowners on the Esopus Creek using addresses from the Ulster County property tax database. Of these, 101, or 46%, were returned usable.

Demographically, half of the respondents reside on the stream part-year and half are full time residents. Approximately 47% of respondents have another residence in the Greater New York City Metropolitan Region. Also, 56% live downstream of the Shandaken Portal. The mean age of respondents was 62. Forty-four percent work full time and 45% were retired. 68% of respondents were male.

Survey Question #5 shows which stream management issues are of most importance to respondents. While nearly all of the issues scored high, erosion, flood damage, riparian and aquatic habitat issues are seen as top issues by landowners.

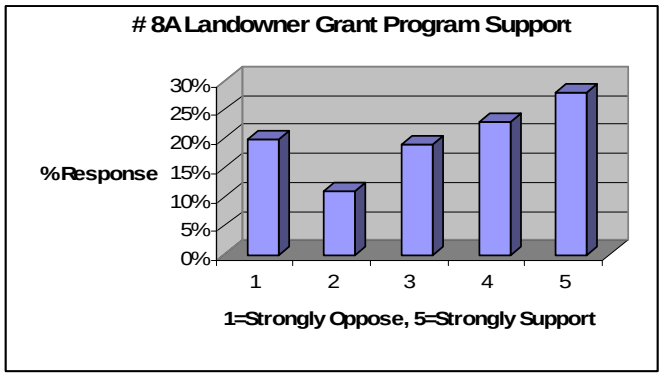
#5 "Please rate how important you think each of the following issues are for the upper Esopus Creek (upstream of the Ashokan Reservoir)"	
Top Issues	
• **Erosion of stream banks on private property**	Top Issue
• **Flood damage to homes and buildings**	Tied for Second
• **Management of flows from the Shandaken Tunnel or "Portal"**	
• **Loss of streamside trees and vegetation**	
• **Loss of habitat for trout and other aquatic species**	
• **The turbid or muddy appearance of the water**	Third highest

#7 "Please rate your need for more information about the following streamside management topics"
Top three responses:
• "Best ways to protect my property from flooding"
• "Specific Strategies for stream bank repair'
• "How the Stream Management Plan can help me"

The survey also discovered that at least half of streamside landowners are willing to participate in some form of stream organization. Question 19 found that 52% would join an Esopus Creek Landowners' Association to address systemic stream problems. Question 21 also shows that 65% would attend an annual forum on Esopus Creek and 52% would be willing to attend quarterly meetings

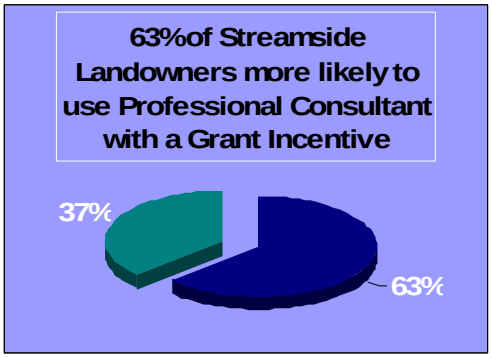
Survey Question #8 asked respondents to indicate how much they would support or oppose three different conservation incentives as presented below.
(On a scale of 1-5, where 1=strongly oppose, 5=strongly support)

Question 8A:
"Applying for a grant program to pay for your eroding stream bank if it required you to contribute to a portion of the repair cost."



Strongly Oppose	1	2	3	4	5	*Strongly Support*
	20%	11%	19%	23%	28%	

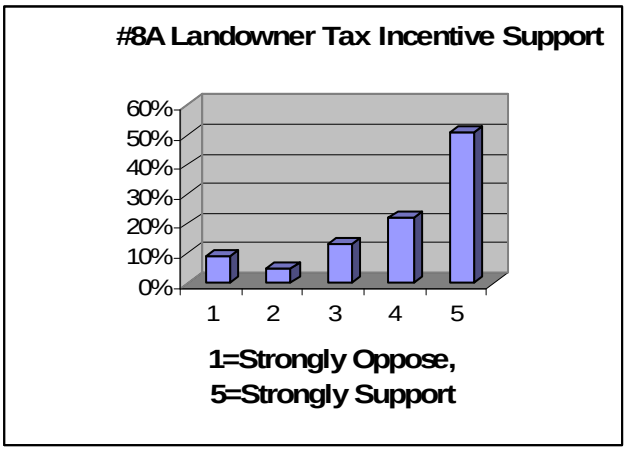
Figure 3.1: Results on Landowner Grant Program Support



Survey Question 14:
63% would be *"more likely to seek a professional consultant for stream bank repair if a modest grant program was available."*

Figure 3.2: Landowners Likely to Use Professional Consultant with Incentive

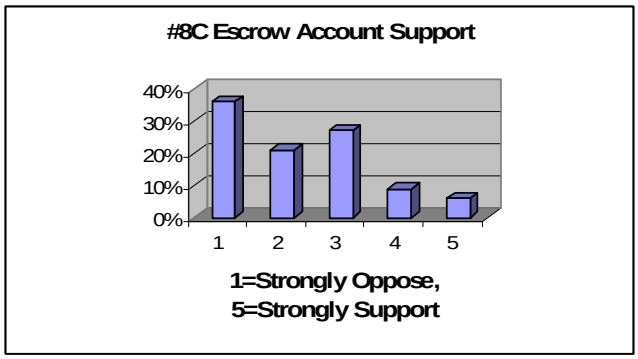
Question 8B: Landowner Tax Incentives
"Tax incentives for streamside landowners who adopt approved practices on Esopus Creek."



Strongly Oppose	1	2	3	4	5	*Strongly Support*
	9%	5%	13%	22%	51%	

Figure 3.3: Results for Landowner Tax Support

Question #8C: Landowner Community Escrow Account
"Streamside landowners contributing to an escrow account for stream bank repair projects by the local Soil and Water Conservation District, which would also seek funds from other sources."



Strongly Oppose	1	2	3	4	5	*Strongly Support*
	36%	21%	27%	9%	6%	

Figure 3.4: Results for Escrow Account Support

3.6.2 Participation Counts at Pilot Events

Participation at Education and Outreach events varied depending on the amount and type of advertising, who was speaking, type of event and other factors. Generally, participation in events shows that local residents have a strong interest in issues for the Esopus Creek and natural history of the area. It is significant, by reviewing sign-in sheets, that most of the participants in year I are full time rather than part-time residents from the Greater New York City Metropolitan area. Events with well-known speakers tended to be a good draw for larger participation. Tying other educational topics to popular speakers was for developing interest in topics newer to the audience.

Participation Counts at Pilot Education and Outreach Events 2005-2006

Event:	Open House	History of NYC Water System	Catskill Geology	Community Mtg	Stream Clean up	Stream Talks
# Attending	60+	21	106	15	15	8/15
Event Time:	Weeknight	Weeknight	Weeknight	Weeknight	Weekend	Saturday

Event:	Wetland Tour	Site Visits	Landowner Focus Group	Shandaken Day Booth	Community Mtg Oct '06	Leaf Pack Training
# Attending	7	9	7	60	63	8
Event Time:	Saturday	By Appt.	Weeknight	Saturday	Weeknight	Saturday

Event:	4H Knotweed Project	Stream Planting-HS for the Env't	Elder Stream History Day	Office Visits	Whitewater Focus Group	**TOTAL: (Includes duplicate participants)**
# Attending	10	50	35	75	13	**574**
Event Time:	Weeknight	Weekday	Weekday	Tues/Thurs 10am-4pm	Weeknight	

Table 3.5: Participation at Pilot Education and Outreach Events 2005-2006

3.6.3 Site Visits

In 2006, project staff visited eight properties at the request of the owners. While there were relatively few site visits, the fact that all of the requests were for bank erosion issues is striking. Often, poor buffer maintenance and lack of information on streamside buffers was likely to play a role in the extent of the erosion problem. Japanese Knotweed was also present at more than half of the sites visited.

Reason for requested visit:	
Bank Erosion	9
Flooding-inundation threats	3

Onsite Observations/notes:	
Japanese Knotweed Present	6
Poor buffer maintenance	6
Difficulties with FEMA or flood insurance	2

Initial Site Visit Recommendations:	
Bank Stabilization (hardening or bioengineering)	4
Contact SWCD	6
Improve Riparian Buffer	6

3.7 Qualitative Assessment Methods

3.7.1 Streamside Landowner Focus Group

Event Date: Thurs., Feb. 2, 2006, 6:30-8:30pm
Number of Participants: 8 people participated from a reasonably wide distribution along the Esopus.
Process Summary: The group was an open-invitation focus group advertised through the newsletter, flyers and some newspapers. Presented with opening questions, the group brainstormed issues and solutions related to stream-side landowners on post-it notes. They then categorized and prioritized the ideas into groups through a facilitated voting process. A short survey was also completed by the group.

Results:
Participants first brainstormed comments on yellow memo sticky-notes and then grouped their comments into common categories on the wall. The group saw erosion and turbidity as underlying issues driving the majority of concerns (Detailed responses in Appendix 1.2).

Focus Group Question #1: "As a stream-side landowner, what do you see as issues or problems related to the Esopus Creek?"
Categories & voting:

- Physical Losses: (6 votes)
- Socio-Economic Impact: (4 votes)
- Recreation and Wildlife: (2 votes)
- Individual vs. "Common Good" Perspectives
- Emergency Management Planning
- Waste Water
- Flood Hazards

Focus Group Question #2: "What do you see as possible solutions or ways to resolve to these issues?"

- Education/Public Outreach
- Physical Solutions – bank stabilization, conservation and restoration measures

Conclusions:
Erosion and bank stabilization are seen as the major issue to be dealt with and also the one that the group sees the greatest need for information on. The group sees the health of the stream and associated wildlife as directly related to the local economy and sense of community – primarily through fishing and whitewater recreation. Better information and/or local organization seems to be needed in regard to flood risk/hazards, emergency management planning, and waste water treatment.

However, some proposed solutions reflect a lack of knowledge of basic stream processes and channel evolution. Some knowledge of the need to protect properly functioning streamside buffers is clear.

At the same time, some solutions do show moderate understanding of the need for adjacent landowners to work together systematically to care for the stream. Many suggestions were made toward neighborhood-type stream stewardship activities. This group also sees the need for collaboration between local landowners, local government, and New York City, and State agencies. It was clear that many participants generally do not feel listened to by the New York City Department of Environmental Protection nor the New York State Department of Environmental Conservation.

3.7.2 Community Meetings

October 5, 2006, 7pm
Phoenicia Fish and Game Club

Number of Participants: 63 adults attended.

Process Summary: The group was an open-invitation community meeting advertised through the word of mouth, website, newsletter, flyers and an interview with Craig Fischenich in the Phoenicia Times. (The meeting happened to fall on the night of a major Town Board meeting on a contentious local issue).
A general overview of the project was given with a feature presentation by Dr. Craig Fischenich.

Break-Out Groups followed the presentations. The break out groups covered the following topics in separate groups:

- Erosion and Flooding Hazards – (two groups in different areas)
- Turbidity and water quality
- Recreation

General Community Questions:
Given two major floods in recent years, many people were concerned over flooding issues and were hoping that something could be done through this plan to decrease damage from flood waters on property adjacent to the creek.

One pointed question (which may or may not have reflected the opinion of more people in the room) was, (paraphrased) "why should we, the community, be interested in this plan if DEP is the sole funder of Cornell Cooperative Extension of Ulster County and the primary impetus for the plan is NYC drinking water quality in response to the FAD?" While the question shows a continued lack of trust by some of even a third party coordinating the stream management plan, discussion followed regarding the plan's goals for multi-objective stream management and why management of water quality has overlap with other management objectives for landowners, aquatic habitat, and other objectives.

Break-Out Group Results:

Erosion and Flooding Hazards:
Several landowners, who had not yet contacted Cooperative Extension, raised issues of flooding and erosion across multiple properties in the Mt. Tremper and other areas. Storm water runoff and interaction with previous flood control projects were cited. Phone numbers were traded to set up property site visits for documentation of the problems.

Turbidity and Aquatic Habitat:
Several members of Trout Unlimited and local residents raised concerns over turbidity impacting fish habitat. This break out group mainly provided an opportunity for dialogue between concerned citizens and DEP staff and Dr. Fischenich.

Discussion and Conclusions:
Clearly, flooding, erosion, turbidity and habitat are found to be key issues as perceived by the community. Comments from some streamside landowners also showed that there are many

common misperceptions about localized causes of flooding and erosion including the role of the portal, trends in precipitation, and stream and floodplain function.

The break-out groups were a refreshing, often unused format in this local area, providing a highlight of the event for the following reasons:

- Staff was able to interact with many people at one time rather than have one person hold the attention of 60 people.
- People who would not speak in front of a crowd were more willing to ask questions and provide comments.
- Residents were able to meet each other based on common locations on the creek, discuss issues over a map, and draw or write down information.
- Break-out groups diffused the polarity of an expert-to-public presentation and provided a more participatory atmosphere. People stayed well past 9:30pm, excitedly discussing stream issues.

3.7.3 Phoenicia Field Office Visits

The Cornell Cooperative Extension Field Office for the Esopus Creek Stream Management Plan is conveniently located at the Phoenicia Plaza on Route 28 just east of the Hamlet of Phoenicia. Office hours were generally set at Tuesdays and Thursdays from 10am-4pm, although staff were often at the office on other days for appointments, work group meetings or other business. Generally, at least one or two people would stop in each day, often making a special point to visit with a question or to provide information. Over time, the field office has allowed staff to have significant one-to-one contact with a significant portion of the community. The table below lists some of the typical reasons for field office visits. While not all of the visits were recorded, the visits do provide some sense of local interest.

Reasons for Field Office Visits

Stream-related reasons for office visits:	Other reasons for office visits:
Scheduling a streamside property site visit	Household hazardous waste disposal question
Interest in volunteering	Trail hiking question
Providing suggestions for stream management	Gardening or plant identification questions
Requests for a watershed map copy	Tent caterpillar and other insect questions
Inquiries about the Schoharie Dam	
Information on upcoming events	
Requests for a soil or water pH test	
Providing photos for the plan	
Japanese Knotweed questions	
Pick up a copy of the newsletter	
Request for GIS or aerial photo of property	

Generally, from the above office visits, several conclusions can be drawn:
- ✓ Primarily full-time residents visit the office. Part-time residents visit occasionally.
- ✓ Local residents read and respond to the quarterly newsletter
- ✓ Cooperative Extension is recognized as having a significant role on the Esopus Creek
- ✓ Local residents are interested in the Esopus Creek
- ✓ Local residents like to have and use maps, GIS images and aerial photos

3.7.4 Pilot Events

In addition to focus groups and other events, eleven educational events were held or promoted in the Esopus Creek watershed with varying levels of success. A pilot event report for "Shandaken Day" is included in Appendix 1.3.

1. Open House for Field Office at Phoenicia Plaza- February 10, 2006, 4pm-7pm
2. "Liquid Assets: The Story of New York City's Water Supply System" presented by Diane Galusha on Feb. 22, 2006, 6:30pm – 8pm
3. "Voyages and Catskill Geology" by Dr. Bob Titus, March 29, 2006, 7pm-8:30pm
4. Volunteer Stream Cleanup on Esopus in Oliverea - June 10-11, 2006.
5. "Banks & Buffers" by Greene County Soil & Water Conservation District and Cornell Cooperative Extension of Greene County *(promoted attendance at this Greene County event),* Sat., April 22, 2006, 1pm-5pm. (13 people from the Esopus Creek watershed attended)
6. "Stream Walk and Talk with the Experts" – Sat., June 17, 2006, 9am-12pm
7. "Testing the Waters" – Zen Environmental Studies Institute, Sat., July 22, 2006 9am-12pm *(Cancelled due to low participation)*
8. "Esopus Creek Headwaters Hike" with Dan Davis, NYCDEP geologist and co-sponsored with the Catskill Mountain Club, Sat. July 8, 2006 – 10am-3pm.
9. "Wetlands Guided Exploration" with Spider Barbour, Zen Environmental Studies Institute, Sat. Aug. 5, 2006, 9am-11am.
10. "Shandaken Day" Sat., Aug. 26, 2006, 12pm-4pm
11. Community Meeting -Esopus Creek Management Plan – Thurs., Oct. 5, 7pm-9pm
12. Leaf Pack Training – Kickoff of Volunteer Stream Team, Sat., Oct. 21 & Sat., Nov. 11, 9am-3:30pm

More people were drawn to attend events with well-known speakers. Smaller hands-on events also showed success in terms of interest and developing knowledge of stream processes. Continued evaluation is needed as no formal evaluations were successfully completed for most events. Evaluation tools were developed but not completed by enough participants for meaningful evaluation. However, a few elements of successful events can be drawn by observation, and participant feedback from these events.

Pilot Events "Learnings"
✓ **Develop and use evaluation tools and provide incentives for completion.**
✓ **Consider holding some events at multiple times, including summer Saturdays to include part-time residents**
✓ **Use popular speakers to draw in audiences and provide interactive formats to engage participants in the stream management process**
✓ **Use email and word of mouth to connect with part time residents**
✓ **Advertising with through local schools and providing family-oriented content**
✓ **Small, hands-on events need to reflect direct needs of participants, not only agency objectives.**

3.8 Summary and Recommendations

Perception of Stream Issue Priorities
The following three issues arose as the most significant topics of concerns of streamside landowners and community members.

✓ Erosion and Flood damage to property
✓ Fish and Wildlife Habitat – (as impacted by Portal flows, turbidity and large woody debris issues)
✓ Turbidity

Table 3.6: Community's Perception of Top Three Stream Issues by Frequency

	Erosion or Flooding and Property Conservation	Fish & Wildlife Habitat	Turbidity	White Water Recreation	Socio-Economic Losses	Flooding (when mentioned separately from erosion)
Community Focus Groups	✓	✓		✓ *(Tied for third)*	✓	
Landowner Survey	✓	✓	✓			✓
Community Meeting	✓	✓	✓			✓
Site Visits	✓					✓
	4	3	2	1	1	*3*

Additional issues also seen as important included
(In no particular order of priority):

- Large woody debris management
- Needed information or assistance with FEMA flood insurance process.
- Emergency Management Planning
- Whitewater Recreational Access Issues (see whitewater focus group)
- Socio-Economic Losses
- Water Quality
- Individual vs. community perspectives

The community and streamside landowners consider the following solutions helpful:

- ✓ Education programs- especially "how-to" trainings and direct technical assistance
- ✓ Bank stabilization and improving or maintaining streamside vegetation – (through volunteer and/or agency support)
- ✓ Tax incentives to landowners for conservation/restoration of banks and riparian buffers.

It is also notable through site visit observations that lack of riparian buffer maintenance seems to play a significant role in the degree of erosion occurring on individual private properties. This suggests a focus of programming on active enhancement of riparian buffers.

Recommendations

Landowner survey results provide clarity as to the specific types of Education and Outreach Programs likely to be most successful. Combined with results from all community assessment methods, the following program recommendations are indicated. Additional Program Delivery Strategies for Education Programs are included in Appendix 1.4.

Education and Outreach Recommendations

I. ***Backyard Banks and Buffers Program***

A. <u>Community Education Program</u>: Develop and implement a community education program for the maintenance and restoration of stream banks and back yard buffers including hands-on, how-to workshops for streamside landowners.

B. <u>Technical Assistance</u>: Provide a staff position and coordinate with Ulster County Soil and Water Conservation District (UCSWCD), contractors, nurseries and other stream restoration resources to provide technical assistance to streamside landowners for streamside assessment, maintenance and restoration.

C. <u>Fund Landowner Incentives</u>: Develop a funding mechanism to provide landowner incentives for use of best practices in bank and buffer maintenance and restoration.

Education and Outreach Recommendations **(Continued…)**	
II.	***Direct Involvement Stream Activities*** ***A. <u>Youth Programs</u>: Develop and implement a pilot youth stream stewardship program including active stream restoration work.*** ***B. <u>Volunteer Stream Monitoring - "Stream Team:</u>" Develop and implement a volunteer "stream team" to actively monitor stream macro invertebrates, organize stream cleanups and photo monitoring of erosion sites to engage citizen leadership.***
III.	***Flood Emergency Preparedness*** ***Develop and promote a flood emergency preparedness program for watershed residents in partnership with existing programs.***
IV.	***Stream Recreation Safety*** ***Develop and provide a community education campaign regarding safety issues on the Esopus Creek in partnership with local businesses and government agencies. Consider appropriate local policies for safety regulation.***
V.	***Education Materials*** ***Continue development and dissemination of educational materials for streamside landowners and the general public in the upper Esopus Creek Watershed, including a newsletter, a homeowner information packet, information sheets, and a completed, maintained website.***
VI.	***Community Education on Stream Processes*** ***Develop and implement a community education to develop understanding of basic stream processes and functions of floodplains.***
VII.	***Training for Resource Managers*** ***Organize and conduct trainings in stream management for highway department staff and other resource managers.***

Table 3.7: Education and Outreach Recommendations

3.9 Education and Outreach Logic Model

The program logic model (included in Appendix 1.6) uses a format from the National Oceanic and Atmospheric Administration Coastal Services Center 2006 training materials for Project Design and Evaluation. Watershed management teams throughout the West-of-Hudson Watershed have received this training. It is likely that this format will continue to be used

throughout the NYC watershed in other sub-basins. The logic model provides a planning map to show the elements of the project that need to be achieved first before reaching an ultimate, larger goal.

The model flows generally from left to right. Starting on the left, objectives provide a basic program framework. Available resources are used to perform activities that will achieve the short term outcomes. By using "if-then" statements, the model progresses from one column to the next. For example, if we have volunteer stream activities, community education workshops, stream clean-ups, then the community will be educated and enthusiastically engaged in plans for watershed stewardship. "Long-term" does not always mean that it will take a large amount of time, but rather that it requires the short and mid-term outcomes to occur first. This logic follows through to the long-term outcomes. An evaluation plan for the objectives and outcomes will be completed with a work plan immediately in the first year of implementation.

3.10 Esopus Creek Management Coordination

3.10.1 Esopus Creek Project Advisory Council (PAC)

Formation of the Project Advisory Council

Focus Group 2004:
Process:
Dan Davis, DEP Project Manager for the Esopus Creek Stream Management Plan (SMP) convened a meeting of diverse Esopus Creek corridor stakeholders. Early stakeholder engagement at the very beginning of the Esopus Creek planning process was proposed so that the project scope would be based on stakeholder goals identified by this focus group. A consultant from the *Consensus Building Institute*, of Cambridge, MA, facilitated the discussion and made recommendations for further stakeholder engagement and project implementation. Although many specific goals were identified during these meetings, the overarching goals of the process were to:

- Summarize the benefits and problems of the Esopus Creek corridor (upstream of Ashokan Reservoir) as they relate to Water Quality, Ecological Health, Flooding & Erosion Threats, and Recreation.
- Inform the public about the stream's conditions.
- Prioritize needed action and provide recommendations for long-term stream stewardship.
- Identify avenues to implement agreed-upon recommendations.

Focus Group 2005
Meeting Dates: May 3, May 24, and June 7, 2005
Process:
While devastating, the April, 2005 flooding event once again focused stakeholder and public attention on the need for coordinated study and management of the Esopus Creek corridor. Cornell Cooperative Extension of Ulster County (CCE) convened three meetings of the Focus Group. The Focus Group made recommendations for the creation of a Project Advisory Council (PAC). Since the scope of the project was so large, working groups were proposed to focus on the areas of hazard mitigation, education and outreach, cultural resources (angling and

whitewater recreation), and watershed assessment. Much of the stakeholder/public participation was anticipated to be through the working groups, and that these groups would both inform and be advised by the PAC.

Project Advisory Council PAC Meetings 2005-2006
Meeting Dates: July 19, 2005 November 10, 2005, February 15, 2006, April 19, June 21, October 3, 2006, December 13

Highlights and Accomplishments of the PAC through December, 2006 included:
• Increased sharing of stream management activities and information on a regular basis.
• Increased knowledge of stream processes and portal operations through presentations to the group by speakers including.
o Project consultant Dr. Craig Fischenich of the U.S. Army Engineer Research and Development Center presented on stream processes on February 15, 2006 and study findings October 3, 2006.
o Paul V. Rush, former Director of West of Hudson Operations Division for NYC DEP Bureau of Water Supply (on operations of the Shandaken Portal during emergency repairs to the Gilboa Dam on December 13, 2005 and June 21, 2006.
o Dan Davis, DEP Stream Management Team – provided a virtual tour of the Esopus Creek via helicopter video footage on April 19, 2006. The presentation provided excellent reach-by-reach input from the PAC members and opportunity for education.
o A tour of the Gilboa Dam repairs and construction on August 30, 2006 (See Report in Appendix A.8).
• Oversight and broad stakeholder input for working group projects.
• PAC Members gained understanding of multi-objective nature of stream management and their roles in coordinating stream management.
• Input, review and approval of stream management plan and recommendations.

Summary and Recommendations:
The PAC structure has provided a useful group that includes a broad set of key stakeholders connected to the Esopus Creek. (Current Roster of PAC and Working Group Members are found in Appendix 1.7). The PAC was initiated in 2004 by DEP through a series of focus group meetings with these stakeholders. Much of the initial organizing effort has been a two-way dialogue to develop common understanding of the management issues by listening to input from the PAC as well as providing stream-oriented presentations to the PAC. Through presentations, several members of the PAC have gained a better understanding of possible negative impacts of stream management methods that have been used in the past without considering fluvial geomorphologic assessments. For example, “gravel dredging,” is better understood by the PAC to have possible negative results as well as benefits. The PAC members also have a better understanding of the inherent conflicts when managing a stream for multiple outcomes and uses. That being said, providing additional education for PAC members will continue to be useful.

These shared learning experiences are likely to have developed much greater trust among PAC members than at the start of the project, setting the stage for success in implementation of management recommendations (See report on PAC field trip to the Gilboa Dam in Appendix 1.8).

In any community organizing effort, planning for long term sustainability of the project should be built into the early development of the program. Organizational structure that is rooted in local leadership is a key component of long term sustainability. Currently, stream management on the Esopus is an agency-based model, funded through the New York City Department of Environmental Protection as required by the Filtration Avoidance Determination. Given the long-term investment in the watershed as a source of drinking water, the DEP will obviously continue to play a key role in funding and leading stream management into the future. However, for long-term viability, locally-driven capacity for stream management would be likely to improve continued, higher quality resource management.

Many models exist for locally-led watershed organizations. A key question to be answered is how to shift from the current agency-based program to a locally-led program (or some combination). It would be useful for the PAC to see presentations from existing, stable watershed organizations and be able to ask questions about the development of these programs.

3.10.2 Esopus Creek Management Project Working Groups

Education and Outreach Working Group

Meeting Dates: Monthly on second Wednesdays from October, 2005- December, 2006

Process
The Education and Outreach Coordinator from Cornell Cooperative Extension of Ulster County facilitated meetings and prepared minutes. Members included community volunteers as well as local community agency employees and DEP representatives. Individual members developed some of their own projects and implemented them.

Highlights and Accomplishments of the Education and Outreach Working Group:
• **Youth Mural: Received $2,000 grant from the Catskill Watershed Council for a Watershed Youth cut-out Mural to be shown in Phoenicia and area hamlets.**
• **Outreach Materials: Assisted with planning, production and review of quarterly newsletter and other publications including the watershed-wide "Catskill Streams" streamside living guide, and website development.**
• **Community Education Events: Developed and assisted in advertising and producing educational events and workshops as listed in Education and Outreach Section, including: Community meetings, neighborhood potlucks, stream walks, 4-H Knotweed Control Project.**
• **Landowner Survey: Assisted in development and review of survey questions**

Highlights and Accomplishments of the Education and Outreach Working Group (Continued):

- **Stream Clean up: Coordinated and involved local residents in a stream clean up for the upper reaches of the Esopus. Coordinated with DEP for trash pickup.**
- **Developed and produced a "Know Knotweed" refrigerator magnet based on 4-H youth design**
- **Macro invertebrate Monitoring Training: In partnership with Catskill Center for Conservation and Development, held initial "Stream Team" training for volunteers to learn the "Leaf-Pack" Stream Monitoring technique from the Stroud Water Research Center.**

Discussion:
The Education and Outreach Working Group has been an outstanding group of committed volunteers and agency partners that has met monthly and provided initiative and local community perspective to all outreach efforts. This group has been fundamental to all successes in the community during this first year.

One dynamic of the working group has been balancing individual interests and motivation with a coordinated Education and Outreach effort. Members bring many diverse talents and interests to the group from an artist to a retired DEC ranger. One challenge has been to bring individual initiatives together into a cohesive plan.

The working group has generally met during daytime hours, limiting participation by people who work. Contributions from other community members have been included through other forms of communication such as emailing minutes and phone conversations. However, the group may wish to consider meeting at other times or finding other additional methods for incorporating other community volunteers.

Hazard Mitigation Working Group

Meeting Dates: June 6, June 28, 2005

Process:
This working group was formed to explore producing and adopting a Hazard Mitigation Plan (HMP) for the Towns of Olive and Shandaken. After the April 3, 2005 flooding, the NYS Emergency Management Office set aside funding dedicated solely to helping damaged areas prepare Hazard Mitigation Plans. This funding was used to hire SEMO agency planners to assist in producing the plans.

Discussion:
The Town of Shandaken was initially interested in producing a HMP with assistance from SEMO and CCE through Esopus Creek Management Plan funding. This support came from Mike Malloy, former Zoning and Floodplain Officer (since left office). The working group and project planners met with Art Snyder, Director of Ulster County Emergency Management Office, and Mark Ferrari and Nadine Macura of the SEMO Region II (Poughkeepsie). Project planners

also met informally with Rad Anderson, Director, SEMO Albany and Dick Doucette, Hazard Mitigation Planner out of SEMO Albany.

Since then, Town officials have been hesitant to pursue another planning process (at the time there was a Town comprehensive plan up for adoption, and the Esopus Creek Management Planning process was beginning) without the known benefits, since rural areas usually are at a disadvantage in FEMA cost/benefit analysis that are used to fund emergency projects. The breadth and cost of the producing HMP's lends itself better to be done on a larger scale. Ulster County attempted to begin the planning process several years earlier, but talks failed. Neighboring Delaware County has a county-wide HMP.

Watershed Assessment Working Group

Process and Discussion:
The Watershed Assessment Working Group met once on July 11, 2005 to discuss and comment upon the geomorphic assessment planning approach proposed by Dan Davis (DEP) and Craig Fischenich, U.S. Army Engineer Research Development Center (ERDC). The group also discussed and agreed upon a scope of work for assessing riparian and aquatic habitat in the Esopus Creek Management Plan. It was agreed to limit the scope of study of the aquatic ecosystem to compiling, analyzing, and synthesizing known information to understand the current state of knowledge and identify gaps in the available data. The Aquatic Ecosystem working group was formed to follow up on that study.

Aquatic Ecosystem Work Group

Process and Discussion:
The Aquatic Ecosystem Working Group met twice to discuss and comment upon draft reports by Walt Keller on the current state-of-knowledge of the aquatic ecosystem. Participants had decade's worth of combined experience in direct study of the Esopus Creek and its tributaries. Important feedback from the work group assisted Keller in:

- Delineating physical study boundaries (including the west-basin of Ashokan Reservoir; identifying the portal outlet as reflective of watershed conditions in the Schoharie Reservoir watershed;
- Signifying major habitat zones (4) as reflected in report;
- Supplicating field observations; and
- Identifying important areas for further study; among many other things.

This work group included agency and non-profit and citizen investigators, and identified the need for further collaboration in developing standardized methodologies for future study to facilitate data sharing. It is anticipated that this group will remain active in developing an implementation plan, where many participants will have active roles going forward.

3.11 Management Coordination Recommendations

Based on the above working groups and community assessment results, the following recommendations have been developed:

Management Coordination Recommendations	
I.	***Organizational Development*** ***A. <u>Organizational Structure</u>: PAC members and other work groups continue to meet and develop a locally sustained form of watershed management organization. Expand involvement to include tributaries.*** ***B. <u>Identify Roles and Responsibilities</u> of the respective Ulster County agencies for coordinated implementation of the SMP, including UCSWCD, Environmental Management Council, Cornell Cooperative Extension of Ulster County, UC Planning Department and other appropriate agencies.*** ***C. <u>Funding and Technical Resources</u>: Develop and implement a strategy for drawing technical and financial resources into the Upper Esopus Creek to compliment and expand upon existing funding from NYC DEP.***
II.	***Annual Action Plans*** ***Develop Annual Action Plans for updating stream management priorities each year as conditions and priorities change.***
III.	***Stream Stewardship Principles and Policies*** ***Develop and promote a set of Stream Stewardship Principles for all entities carrying out stream management activities in the Upper Esopus. Guidelines should emphasize natural channel stability and function based on fluvial geomorphology principles.***
IV.	***Promote Policy Adoption*** ***Present the Draft Esopus Creek Management Plan and stream stewardship principles to the Towns of Olive and Shandaken encouraging adoption of the Esopus Creek Management Plan and Stream Stewardship Principles.***
V.	***Enhance Public Agency Coordination*** ***Develop an information clearinghouse and local coordinating process for stream management actions of relevant public agencies including DEC Permits and flood control project maintenance. Promote adoption of Stream Stewardship Principles by relevant agencies.***
VI.	**Post-Flood Streamwork Protocol** **Develop a coordinated post-flood response streamwork protocol or plan to prevent exacerbation of stream instability through post-flood responses.**

Table 3.8: Management Coordination Recommendations

3.12 Conclusion

Recommendations for Education, Outreach and Coordination have been developed based on a community assessment carried out for the Esopus Creek Management Plan. A broad set of community and professional stakeholders, including 634 recorded person-interactions (includes duplication of individuals), provided detailed input resulting in the plan recommendations.

Key issues for the community, particularly streamside landowners, include flooding and erosion damage to private property, protecting fish and wildlife habitat and reducing turbidity. The community's most commonly supported solutions to management issues were: improved coordination of public agencies, providing "how-to" trainings and direct technical assistance, bank stabilization and improving or maintaining streamside vegetation, landowner incentives for conservation and/or restoration of banks and riparian buffers such as tax incentives and landowner grants for professional assistance. The survey showed a continued need for further understanding of stream processes. The role of reaching families through school and community youth programs also played a significant role in pilot outreach efforts. Part-time residents represent approximately half of watershed residents and will require additional outreach efforts due to their limited time availability. Overall, the assessment shows that a large percentage of the community is interested in learning about and collaborating in stream stewardship activities given some additional incentives and opportunities.

Accordingly, education and outreach recommendations focus on educating the community on basic stream processes, a riparian buffer enhancement program, direct technical assistance, and "how-to" workshops for landowners, flood emergency preparedness, and developing funding incentives for streamside landowners. Providing training for resource managers, especially highway departments, is recommended for enhancing stream management coordination and use of best management practices.

The Project Advisory Council and Working Groups have provided an initial organizational structure for coordination efforts; however, sustainability of local stream management coordination will likely require an enhanced structure. Coordination recommendations are focused on development of a sustainable, long-term organizational structure and complimentary funding sources to bring additional needed stream management resources to the Esopus Creek. Recommendations also include creating annual action plans, development and promotion of stream stewardship principles and policies for local adoption, and developing processes for coordinating stream management actions and post-flood streamwork protocols.

Angling & Recreation

This section is organized into four categories, each focusing on the Railroad, Angling, Tubing, and Kayaking/Canoeing, respectively. A brief history of each activity is presented, followed by a description of Use and Access, Issues and Opportunities, and Discussion and Recommendations.

4.1 Railroad

Photo 4.1: Picture of train coming in at Phoenicia Station *Courtesy of Catskill Mountain Railroad*

4.1.1 History & Description

In 1866, a man named Thomas C. Cornell chartered the Rondout and Oswego (R&O) Railroad to bring supplies from Western New York to his hometown of Rondout, New York. By 1870, Cornell's first train made its way along the tracks extending to the town of Phoenicia along the Esopus Creek.

Soon after, another railroad was built to start at the Ulster and Delaware (U&D) station in Phoenicia and extend along the Stone Clove Creek to Hunter named the Stony Clove and Catskill Mountain (SC&CM) Railroad. Construction for this railroad started in 1881 and served the Hunter, Chichester, and Greene Country area.

Photo 4.2: Catskill Mountain "Scenic" Train Tour *Courtesy of Catskill Mountain Railroad*

In 1892 however, the SC&CM Railroad became part of the U&D railroad, along with many other smaller railroads throughout the Catskills that were added too the U&D railroad system. This included 6 stations that were along the Esopus Creek, which in 1908 had to be moved due to the New York Cities purchase of the Esopus Valley for the building of the Ashokan Reservoir. In the end the U&D railroad received $1,500,000 from the City and had to relocate 12.45 miles of track. (Ham, Bucenec, 2003)

The railroad went bankrupt in 1932. After the collapse of the U&D railroad, the railroad system of the Catskills was bought by the New York Central Railroad, which later became Conrail. Conrail abandoned the Phoenicia station in 1976 (Ham, Bucenec, 2003). Ulster County saved the old railroad tracks from being scrapped, and now leases the tracks from Kingston to Highmount to the Catskill Mountain Railroad Inc. In 1985 the Phoenicia Station was purchased by the Empire State Railway Museum and the Shandaken Area Revitalization Project (SHARP) committee. The Station was turned into a museum, and efforts have been in effect to restore the railroad right-of-way along the Esopus to working condition, and create a working station once again. (Empire State Railway Museum)

Photo 4.3: Catskill Mountain Railroad Museum Property

4.1.2 Use & Access

In 1983, the tracks near and at the Phoenicia station became used as an Esopus Creek Shuttle for local businesses during peak tourist seasons and businesses like the Town Tinker Tube Rental for "tuber transport." Currently scenic tours from the Boiceville Station to the Phoenicia Station are in operation from Memorial Day to the end of October. The Catskill Mountain Railroad Committee indicates that the scenic train is in its second stage of the implementation for trying to re-open the entire Catskill Mountain Rail Line which would involve connecting the station in Kingston and rehabilitating the tracks along the reservoir and Esopus Creek to the rail station in Highmount. The long range plan is to then connect the Highmount and Arkville stations thus opening up opportunity for expanded railroad tours. (Catskill Mountain Railroad, 2006)

4.1.3 Issues & Opportunities

- Four Railroad Bridge crossings along upper Esopus Creek may undergo reconstruction and replacement in the future.
- Floodplain restriction due to proximity of railroad tracks to Esopus Creek.
- Track maintenance and resulting impacts on localized stream stability, flooding, and habitat.
- Culverts from steady and intermittent streams that cross underneath the tracks to enter Esopus Creek.
- Flooding and erosion at the railroad museum property.
- Catskill Mountain Railroad is an active volunteer organization with its own equipment and quarry (rock supply) to maintain the tracks.

4.1.4 Discussion & Recommendations

Many of the topics discussed below, such as stream crossings and bank erosion were researched in-depth by our stream geomorphic assessment (see Volume III), but given the timeline of putting this draft report together, cross-referencing of information was not possible. The authors look forward to further meetings with the railroad to identify opportunities for addressing issues and opportunities on a site-specific basis and in a multi-objective manner.

Bridge Crossings

There are four bridge crossings along upper Esopus Creek and its tributaries: in Boiceville, Woodland Valley, Fox Hollow, and Big Indian.

- Boiceville: This Bridge is a historic structure and the railroad plans to restore it to original form. According to the CMRR president, the bridge footing is being undermined and work is needed to prevent collapse.
- Woodland Valley Bridge – This railroad crossing over the mouth of Woodland Valley Creek was washed out in the 1996 flood.
- Fox Hollow Bridge – This bridge is closed and in need of rehabilitation. Active maintenance of stream banks along Fox Hollow to protect the footings has occurred upstream of the bridge (see pictures below – note Esopus Creek downstream of bridge).

Photo 4.4: RR Bridge over Fox Hollow

Photo 4.5: Stabilization work upstream bridge.

Big Indian Bridge – Currently closed and in need of rehabilitation.

The railroad's long range plan includes reconstruction and maintenance of the crossings. CMRR should explore opportunities for technical assistance during the planning stages of bridge (re)construction in consultation with the stream assessment data obtained in this plan. The Catskill Watershed Corporation is also a potential source of funding for these initiatives.

Floodplain Restriction

In some locations, there may be opportunity to reconnect portions of Esopus Creek to its floodplain, using the assessment data collected during this planning process.

Track and Stream Bank Maintenance

The railroad runs parallel to Upper Esopus Creek. How the railroad maintains its tracks and encroaching stream banks has a big impact on localized stream stability and flooding.

Photo 4.6: Railroad between Esopus Creek and Route 28

Photo 4.7: Vegetation covering RR tracks

In some locations, such as the railroad bed upstream of the Bridge St. bridge in Phoenicia (pictured above right), local residents attribute the April 2005 bank erosion and undermining of the tracks, and resulting flooding on High Street on the fact that this portion of the railbed and stream bank had not been maintained in recent years. In other areas west of Phoenicia, the railroad right-of-way (ROW) has not been used for some time and thus has begun to re-vegetate with secondary vegetation (small trees and shrubs).

Photo 4.8: Historical maintenance of Railroad right-of-way along Esopus Creek – opposite present-day Phoenicia Plaza location. Photo Courtesy of Lonnie Gale.

Catskill Mountain Railroad maintains the tracks with their own equipment. They own and mine rock from their own quarry near the confluence of Esopus Creek and Broadstreet Hollow, and have the ability and machinery to transport and install the material. CMRR might benefit from assistance in stream bank restoration design going forward, utilizing the assessment data

collected for this plan. Opportunity exists to design stabilization techniques to accomplish multiple erosion/flood protection, habitat enhancement, and other objectives.

Culverts and Stormwater Flows

Many culverts deliver runoff from steady and intermittent streams to Esopus Creek, sometimes delivering turbid water. CMRR may benefit from technical assistance in the form of design and placement of future replacement culverts.

Photo 4.9: Culvert

Funding may also be available from the Catskill Watershed Cooperation (CWC) Stormwater Retrofit or related programs.

Railroad Museum

The CMRR Railroad Museum received extensive flooding from the April 2005 event, and according to several of its representatives, the 18-acre property it rests upon has been seen an increase in erosion since the construction of the Village of Phoenicia Water Treatment Plant – located on the opposite bank from the property.

Photo 4.10: Flood damage to Phoenicia Rail Station 1933.

Photo 4.11: Flood damage to same building (now Museum), 2005.
Pictures courtesy of Lonnie Gale.

The museum property rests just downstream of the confluence of Esopus and Stony Clove Creek's, which is one of the Phase 3 Best Management Practice sites undergoing further study. For more information on that location, please refer to Volume III.

4.2 Angling

Photo 4.12: Men fishing in the Esopus with Train in background *Courtesy of Mark Loete*

4.2.1 History & Description

In 1879 a man named Fred Happy is said to have pulled over 200 trout out of a stream near Woodstock. (Carey et al, 2002) This story and others gave birth to the angling-based tourism to Catskill streams, and soon after, anglers from across the country were riding the railroad up Esopus Creek to fish its banks.

While the railroad facilitated the development of angling-based tourism to Esopus Creek, it also allowed for tanneries, charcoal kilns, sawmills, chair factories, and bluestone quarries to deliver products to market, thus precipitating their extensive timber and resource extraction activities. These industries had about ceased by the early 1900s but not before significantly altering the ecological integrity and water quality in the Esopus watershed.

The deteriorated water quality led brook trout to retreat to the high headwater tributaries that had been spared from human activity. Tourist fishing was impacted by their absence. To reinvigorate trout fishing in the region in the late 1800's, two types of trout were imported and introduced from other regions of the country: the warmer-water tolerant Brown Trout from Europe and the Rainbow Trout from the west coast. The Rainbow Trout adapted to the Catskill Mountains very quickly and even began to spawn naturally in the Esopus Creek waters (Menard, 2002)

In the early 20th century, the construction of the Ashokan Reservoir and Shandaken Tunnel created a unique cold-water trout fishery that benefited angling-based tourism on the Esopus Creek. (Menard, 2002). Currently there are two active chapters of Trout Unlimited, the Ashokan-Pepacton Chapter and the Catskill Mountain Chapter, both of which play an active role in policy recommendation and stewardship of streams in the watershed.

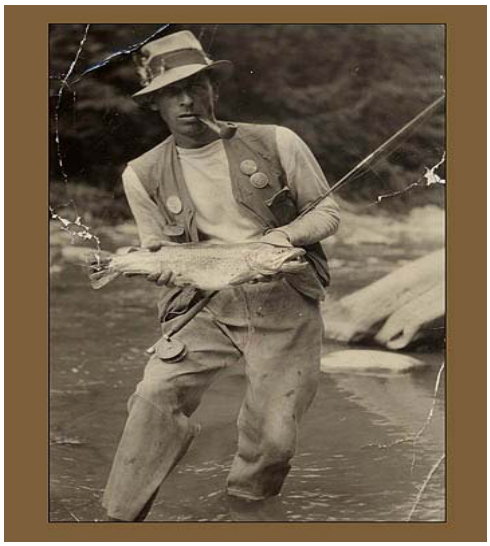


Photo 4.13: Ray Smith

"The Esopus…the most cantankerous and egalitarian of all the Catskill streams…had as its central figure during the classic era of Catskill fly-fishing, a man well-suited to its personality. Ray Smith of Phoenicia, New York, was a woodsman, dairy farmer, baseball player, town justice, road construction grade foreman, bear hunter, guide, and, most notably, a superb angler and fly-tier. He personified the Esopus…" (Finger, 2005)
Photo Courtesy of Jerry Bartlett Angling Collection, Phoenicia Library

The upper Esopus Creek boasts one of the longest open fishing seasons in New York State. According to NYS DEC Region 3 Bureau of Fisheries, the season was extended to November 30th (beyond the October 15th statewide deadline) because most brown trout spawning that occurs from mid-October to November is done in Esopus Creek tributaries. So an extension of the season along the main-stem provides anglers the opportunity to catch big fish coming out of Ashokan Reservoir to spawn, without directly interfering with the spawning.

Table 4.1: Fishing Regulations for UEC

Table 4.1: NYS 2004-2006 Fishing Regulations for upper Esopus Creek

Stream	Open Season	Creel Limit	Size Limits	Methods
Upper Esopus Creek (above Ashokan Reservoir)	April 1 through November 30	5 trout per day	Any size	Bait or lures as method of take.

The 5-fish creel limit is a statewide limit that is applied to Esopus Creek; however, DEC Region 3 Bureau of Fisheries has expressed its flexibility in modifying the creel limit if the necessary supporting data can be obtained. DEC actively manages this fishery by stocking brown trout and monitoring fish populations and their habitats. No rainbow trout are stocked because they are successfully reproducing, and DEC has denied requests from organizations to stock rainbows to avoid the genetic alteration of future resident rainbow trout.

4.2.2 Access and Use

Angler use and trends are difficult to accurately measure. A statewide angler survey conducted in 1996 did not separate between upper and lower Esopus Creek (below Ashokan Reservoir). DEC aerial angler count estimates of angling pressure indicated an average diminishment of angler trips both upstream and downstream of the Portal between the 1960's and 1990's although this data too has its limitations.

Table 4.2: Public Fishing along UEC

Table 4.2 Public Fishing along the Upper Esopus Creek		
	Angler Parking Areas	**Public Fishing Rights (miles)**
Upper Esopus Creek	5	8.51

Records from Trout Unlimited (T.U.) Angler Diary programs indicate that brown trout and rainbow trout were caught at an average rate of over 1 trout per hour with average total lengths of 9.1 and 8.9 inches, respectively; while the DEC creel survey's show that the average rate is about ½ a trout per hour (Flaherty, 1992). A ½ trout per hour catch rate is average for Catskill streams. It is thought that TU's catch rate per hour is higher due to the experience level of their fisherman. Others have estimated the density of fish at 47 trout for every 10 yards of stream, with 75-80% of rainbow trout being wild (not stocked) (Caposella, 2006). But the validity of these figures is uncertain.

Photo 4.14: Craig Fischenich U.S. Army ERDC, Principal Investigator of Esopus Creek Watershed Assessment, and Norman Turner, Ashokan-Pepacton Chapter of Trout Unlimited (TU), inspect the fish passage constructed by TU volunteers on a highway culvert on Birch Creek, tributary to Esopus Creek. Assistance from the U.S. Fish & Wildlife Service was also provided for the project.
Photo 4.15: Photo at right shows close-up. A similar fish passage has since been constructed on the left-side of the culvert.

4.2.3 Issues & Opportunities

Forward: These issues and comments were raised by interested parties through multiple personal contacts, feedback at two community meetings and CCE staff presentations at two Trout Unlimited chapter meetings, angler representatives on the project advisory council and through public documents as referenced.

- Turbidity impacts on aesthetics & recreation from the Shandaken Tunnel
- The wade-ability of Esopus Creek below Shandaken Tunnel during high velocity discharges.
- Litter and noise from tubers (and other fisherman).
- Too many kayakers.
- Tubers take away from fishing quality and experience
- Tubing not a disruption because it takes place in the middle of day when the fish are not biting anyway.
- Concern that large woody debris removal for whitewater recreation impacts fish habitat.
- The section of Esopus Creek just below Broadstreet Hollow should be returned to the historical channel "Greeny Deep."

4.2.4 Discussion and Recommendations

Turbidity impacts to Aesthetics & Recreation

The primary issue raised by anglers is that the sometimes muddy or "turbid" water released from the Shandaken Tunnel negatively impacts the aquatic habitat conditions for trout (discussed in Volume III, Aquatic Section) and negatively impacts recreational opportunities (discussed in this section). A detailed discussion on the factors controlling turbidity in the Esopus Creek watershed and the associated water quality sampling record is in Volume III Section 7.

Trout Unlimited recently testified that the upper Esopus Creek had the reputation of being a noted trout fishing stream, but due to increased turbidity, "the stream often has limited clarity making it less desirable for fishermen. The fishermen cannot see where they are wading, making conditions potentially hazardous and lessening the Creek's aesthetic appeal. In these circumstances, the fish are less likely to be able to see bait, making successful fishing unlikely" (DEC Administrative Law Judge Hearing Report, 2006).

Photo 4.16: An aerial view of the Shandaken Tunnel and Esopus Creek under turbid conditions.
Photo 4.17: Esopus Creek under turbid conditions (close-up).

Turbidity Impacts on Recreational Use

The relationship between water clarity, turbidity, and water hue to human requirements is a relatively new field of research in which scientists at the NYC DEP Division of Water Quality have contributed. Studies indicate that both human perception and the individual visual clarity characteristics of the stream play important roles on recreational impacts:

Human Perceptions:

- A field study using a questionnaire approach measured the human perception of visual water clarity suitable for aesthetics and bathing to be 1.2 meters (1.2 meters was perceived to be "just-suitable" for these activities while 90% of the field panel respondents preferred a visual clarity of 2.2 meters for these activities (Smith et al, 1995).
- With respect to water user safety, a separate study established that at a water depth of 1 meter, the visual clarity for safe wading (for bathing and fishing) and shallow diving would need to be at least 1.35 meters (Davies-Colley & Smith, 1990).

Stream-specific Visual Water Clarity:

- A study of streams in the NYC water supply watershed shows how the visual clarity of the water is highly dependent on the turbidity (caused here by suspended sediment) characteristics in the individual stream. For instance, Table 4.3 below compares visual clarity (measured in meters using the Horizontal Black Disk method) for two different sites: the Upper Esopus Creek and East Branch Delaware River at Margaretville. At a turbidity value of 5 NTU, the visual clarity in Esopus Creek was measured to be 1.23 meters, while the visual clarity in East Branch was 1.86 meters.

Table 4.3: Values of Visual Clarity at Esopus Creek

TABLE 4.3. Values of Visual Clarity at Esopus Creek (Allaben) and East Branch Delaware River in Margaretville (Smith et. al, 2007) [A Hach 2100 AN nethalometer in these measurements]

	Visual clarity (m)			
Site	**@ 1 NTU**	**@ 5 NTU**	**@ 10 NTU**	**@ 25 NTU**
Upper Esopus Creek (Allaben)	3.81	1.23	0.75	0.40
East Branch Delaware River (Margaretville)	5.16	1.86	1.20	0.67

How often has turbidity impacted recreational use in Esopus Creek?

Revisiting the section above, the general public perceptions for aesthetics and bathing are 1.2 meters visual clarity, and for safe wading in 1 meter of water is 1.35 meters visual clarity. For the Upper Esopus Creek, these two values correspond to roughly 5 NTU of turbidity.

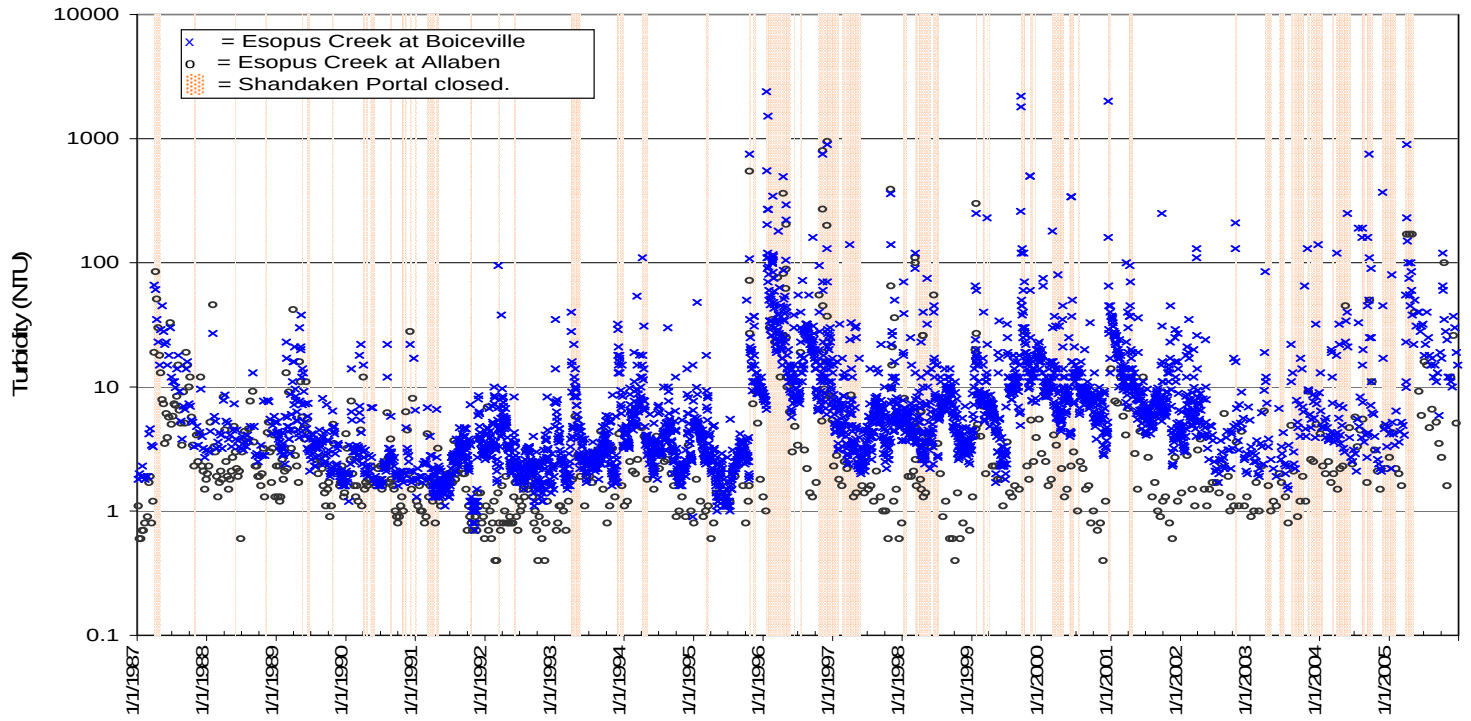


Figure 4.1: Turbidity Charts at Boiceville and Allaben Gages from 1987 - 2005

"Maximum daily turbidity at the Esopus Creek at Allaben (above the portal) and the Esopus Creek at Boiceville (below the portal), 1987-2005. The data are from routine samples and storm event samples (only several storms in a year were sampled and storm events were not sampled every year), so that most of the data points are based on a single sample for the day, but during storm events up to 24 samples/day were collected. Also, for the period of record shown, the routine sample collection varied from 2 samples/month to from 4 samples/month the Esopus Creek at Allaben site and from 4 samples/month to 5 samples/week at the Esopus Creek at Boiceville site. Finally, the instrumentation used to measure turbidity also changed during this period as follows: Jan. 1, 1987 - Jan. 31, 1994, Hach Model 2100A Turbidimeter; Feb. 1, 1994 - March 3, 1997, Hach Ratio X/R Turbidimeter; March 4, 1997 - Dec. 31, 2005, Hach 2100AN Turbidmeter." - Figure and Text courtesy of the NYCDEP

As discussed in Section 2, as of September 1, 2006 NYC is operating under a draft discharge permit that limits the amount of additional turbidity the Tunnel can deliver to Upper Esopus Creek to 15 NTU under most conditions. DEC derived the turbidity difference limit using "best professional judgment" to balance the Tunnel's need to deliver drinking water supply and sustain aquatic habitat flow and temperature conditions. The permit also requires NYC to continue monitoring turbidity and provide detailed proposals for structural turbidity reduction measures. NYC is also required to install a turbidity monitoring location upstream of the Shandaken Tunnel to verify compliance with the SPDES and is required to report sampling measurements to the DEC for permit compliance. A copy of the SPDES permit is attached in Volume 3 Appendices.

In accordance with the SPDES permit and the 2002 Filtration Avoidance Determination, NYC has recently issued Phase II of its Catskill Turbidity Control study on September 30, 2006 that provides more detail on control measures, and a follow-up report on structural turbidity control methods is due by Dec. 31, 2007, in which specific operational or structural control measures will be decided upon. **NYC should engage the stakeholders in the upper Esopus Creek watershed in this turbidity reduction planning process**.

User-conflicts from Multiple User Groups

A majority of other comments received were related to user-conflict issues between anglers, tubers, and kayakers/canoers. Issues related to litter control, noise, and disruption of the other's activities. **The multiple user-groups would benefit from collectively developing written materials on appropriate codes of conduct on the stream through an education and outreach program.**

Large Woody Debris: Habitat Value and Removal

The big trees that periodically fall in the upper Esopus Creek provide habitat for trout and other biota. Large woody debris can also cause debris jams that result in flooding and erosion. Debris is also a significant issue for whitewater recreation users and outfitters, who work with the community to actively keep navigation hazards clear from whitewater sections of the stream. In July 2002 two individuals (a tuber and kayaker) drowned in separate instances on Esopus Creek after getting pinned underwater by a fast current against a woody debris jam. For a detailed discussion, see Section 2.4.3 of this volume for Tubing.

Photo 4.18 & Photo 4.19: Large Woody debris provides important habitat for aquatic and terrestrial biota.

Stream Restoration for Angling & Recreation

Many an angler has requested that a section of the stream be re-routed back to the "old-channel" to the historically renowned "Greeny Deep" fishing hole. This area has been identified as an Phase III Best Management Practice study site. The NYC DEP and U.S. Army ERDC are proposing management options for this reach of stream in Volume III.

4.3 Tubing

Photo 4.20: Tubers in Esopus (Courtesy of F&S Tubes)

4.3.1 History and Description

Floating down Esopus Creek on an inner-tube has been a past-time enjoyed by residents and vacationers since the middle 20th century. Early "tubers" (like some present day proprietors) acquired their own inner-tubes (hereinafter referred to as "tubes") from truck tires. Stories abound of children "tubing" down the Esopus to meet up with a friend or explore new areas, all done with the assurance that they could hitch a ride back upstream from an automobile on Route 28.

Two local businesses still in operation began renting tubes and transporting tubers upstream in 1975 and 1980 respectively. The number of tubing customers steadily increased along with the competition among the various proprietors. In 1983, the Catskill Mountain Scenic Railroad dedicated a "tube train" to transport tubers back upstream to Phoenicia from the take-out location and the New York Times ran a full-page story. According to one tube rental agent, at least 12,000 tubers descended on Phoenicia that year (Catskill Region Guide, 2006). [2] With the expanded tourism market, local campgrounds began renting tubes and shuttling their guests upstream, and some residents even began renting tubes from the beds of pickup trucks along Route 28. Not all were excited about the increased tubing, however.

Anglers in general were opposed to the increased "creek traffic" and litter; streamside residents now had tubers floating by – some of them stopping on their properties for various reasons; and parking in Phoenicia was now overflowing with tubing customers. Elected officials from state, county, and local governments, and local not-for-profit agencies sought to have the tubing activity regulated through a state DEC permit.

In September 1983, the Shandaken Town Board cited that the tubing was producing unfavorable conditions relating to litter and lack of public restrooms, village and road congestion, added taxpayer costs for police and rubbish removal, numerous trespasses on private property, and hazardous conditions and needed safety conditions for tubers on roadways. The Town Board drafted and proposed a "Tubing Law" that would have restricted tubing to between Phoenicia and Mt. Tremper between the hours of 10 am – 5 pm, required toilet facilities and signage, and collected a $0.10 per tube town surcharge to pay for services, among other things (Shandaken Town Board Minutes 09/14/83). The proposed law was not adopted.

In 1984 the Esopus Recreation Advisory Committee (ERAC) was formed by the Shandaken Town Board to evaluate the tubing issues and set future policy on the matter. ERAC began addressing elements of the proposed law by advocating trash receptacles, river cleanups, signage, and parking; and the DEC Environmental Conservation Officers began enforcement of tubers

[2] Catskill Region Guide August 2006 "Town Tinker Tube Rental is Ready. Are You?"

caught littering. These actions, according to one committee member, eliminated a majority of the problems.

Working closely with the public and DEC, ERAC produced a report outlining ways to regulate the tubing business and address in-stream hazards such as debris clean-up in the creek, and other tubing issues[3]. ERAC brought forth a new proposed local law, the "Esopus Creek Utilization Ordinance" on March 18, 1985 that addressed these issues but that was tabled by the Town Board for "risk and potential litigation" reasons, among others. The members of ERAC resigned later that same meeting.

Soon after, the Shandaken Town Planning Board began requiring that tube rental agents obtain a yearly special permit which specified that they be located in a commercial zone, provide life jackets, and hold appropriate insurance, among other requirements. In the mid-1990's one tube rental company challenged the need to obtain the yearly permit and the Town dropped the requirement. Since then, tube rentals on upper Esopus Creek in the Town of Shandaken have been self-regulated entities and tubing has generally been embraced by local businesses and residents as an important tourist attraction upon which many in the local economy benefit.

4.3.2 Use and Access

The inner-tube rental industry on Esopus Creek is largely dependent on two factors: weather and stream flow. The warmer the air temperature – the more people seek water recreation. Because the Esopus Creek flows in summertime are enhanced by discharges from the Shandaken Tunnel, a combination of sunny weather and adequate stream flow for whitewater recreation is available.

Table 4.4: Upper Esopus Creek Tubing Statistics

Table 4.4: Upper Esopus Creek Tubing Statistics	
Tube Rental Companies	Four Seasons (F&S) Tubes Town Tinker Tube Rental, Inc. Campgrounds
Estimated Average total tube rentals (annual basis)	15,000 [4]
Period of Operation	May - September (actual dates are weather dependent)
Hours of Operation	9 am – 6 pm

Town Tinker Tubes stops rentals at 4pm to ensure that customers are returned to Phoenicia by 6 pm. Town Tinker also reported that weekends of recreational flows are historically the most popular for tube rental customers, followed by traditional holiday weekends.
There are two "tubing courses" an upper course and the lower course highlighted on the attached map; each is approximately 2.5 miles in length. Both tube rental operators utilize the same courses.

[3] Cornell Cooperative Extension of Ulster County was unable to obtain a copy of this document.
[4] Based on actual and estimated tube rentals from the 2 existing rental companies.

Stream Flow Conditions

Town Tinker self-regulates for safety of its clients by only providing rentals when Esopus Creek flows fall between 4 feet and 6 feet at the USGS Cold Brook Stream Gage and by evaluating the athletic ability of the individual. Town Tinker staff checks real-time flow data at the stream gage via the Internet each morning. The stream flow also affects the travel time for tubers down the river. The higher the stream flow, the faster the tubing trip downstream. Specific operating conditions for F & S Tubes were not obtained but are likely to be similar.

Table: 4.5: Stream Flow Conditions

Table 4.5: Stream Flow Conditions for Tubing on Esopus Creek Town Tinker Tube Rentals, Inc.			
Stream Height (feet)	**Approximate Stream Flow**	**Tubing Conditions**	**Approximate Travel Time (for 2.5 mile course)**
4.0 feet	~250 cfs	Minimum flows required for tubing. Tubers must portage across periodic shallow sections.	2 hours 10 minutes
4.5 feet	~400 cfs	Minimum flow not requiring portage across shallow sections.	1 hour 45 minutes
5.0 feet	~700 cfs	Optimum flow for tubing with some restrictions	1 hour 25 minutes
5.5 feet	~850 cfs	Increased restrictions for those under age 14 and below average athletic ability.	1 hour 10 minutes
6.0 feet	~1100 cfs	Maximum stream flow for safe tubing. Most Restricted to those with athletic ability.	1 hour

An examination of median daily discharge values at the USGS Cold Brook Gauge between 1932 and 2005 (period of flow record) between May 1 and September 30 shows that median flows range from about 800 cfs in early May to about 250 cfs as September ends. Daily median values during the peak tube rental period between Memorial Day to Labor Day range from approximately 600 cfs to less than 300 cfs, respectively. These flows fall within the flow range needed for the tubing activity.

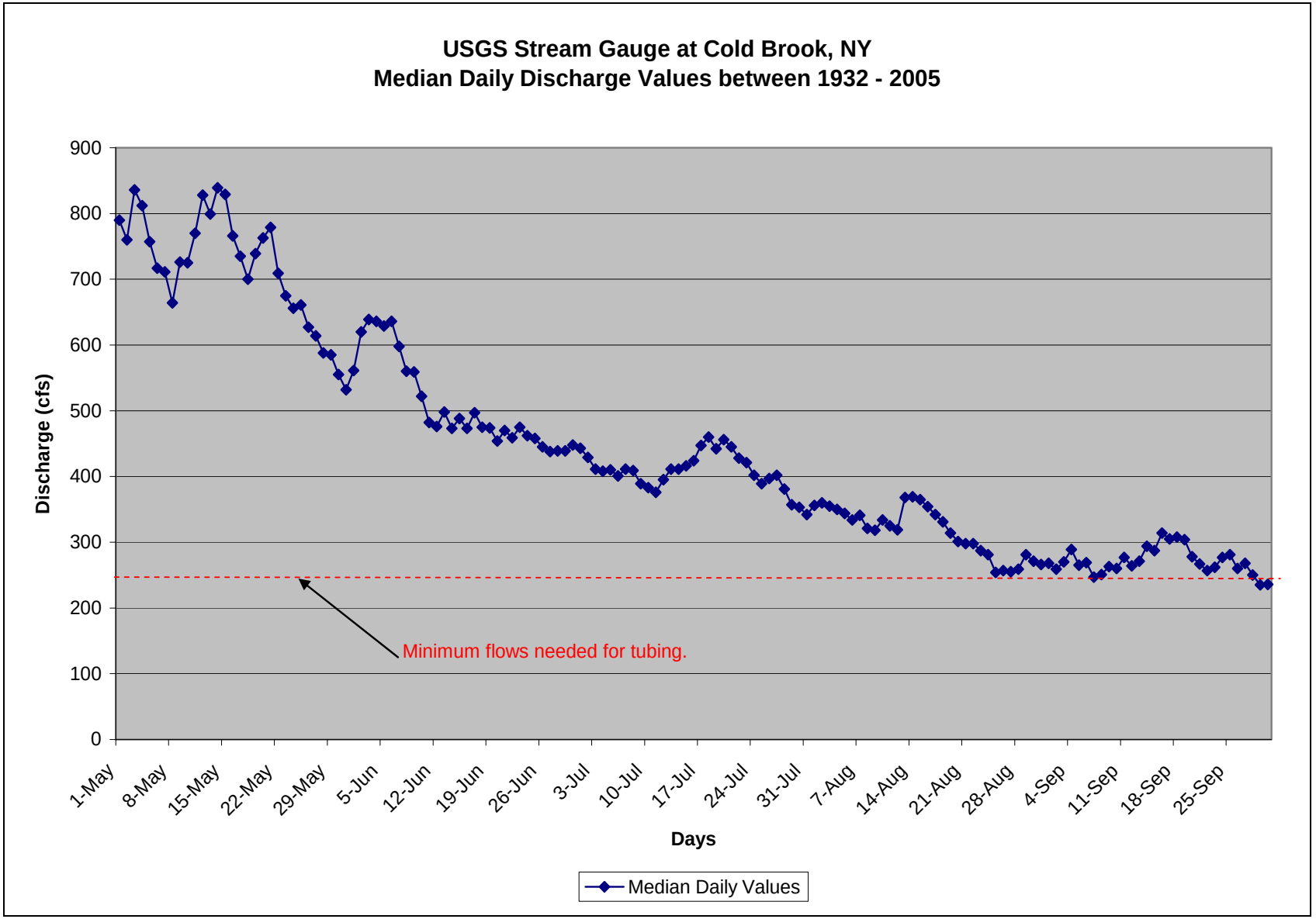


Figure 4.2: Median Daily Values Graph

4.3.3 Issues & Opportunities

These issues and potential opportunities were articulated at the Whitewater Focus Group meeting on February 28, 2006, tubing representation on the Project Advisory Council, community meetings, and through multiple personal contacts:

- Flows from the Shandaken Tunnel sustain the tubing industry
- Large Woody Debris and other navigational hazards
- Stream restorations along tubing courses
- Access Issues
- Conflicts with streamside property owners, anglers, and other stream users

4.3.4 Discussion & Recommendations

Flows from Normal Operation of the Shandaken Tunnel Sustain the Tubing Industry

The tube rental industry on upper Esopus Creek relies on flows from normal operation of the Shandaken Tunnel to maintain adequate stream flow for the activity. As discussed in Volume II Section 2, the Tunnel is operated according to 2 regulations: Part 670 and a SPDES permit. With some exceptions, Part 670 requires that the Tunnel discharge sufficient water year-round to maintain a minimum combined flow in Esopus Creek (measured at the Cold Brook USGS Gauge) of 160 MGD (which corresponds to roughly 250 cfs). This flow level provides for about 4.0 feet of stream as measured at Cold Brook, which is the minimum height needed for tubing in the Esopus Creek, according to Town Tinker.

Part 670 also limits maximum discharges to 300 MGD (about 470 cfs) of combined stream and Shandaken Tunnel flows between June and October, which is close to optimal tubing conditions, and allows for up to four (4) recreational releases. The SPDES permit for Shandaken Tunnel establishes temperature and turbidity limits for discharges, but average daily and maximum flow limits for combined Esopus Creek flows correspond to Part 670.

An important exception to Part 670 is an emergency provision for needed repairs on water supply infrastructure. During the summer of 2006, the Gilboa Dam at Schoharie Reservoir was in the midst of emergency repairs, and the Shandaken Tunnel was allowed to discharge at maximum capacity (about 950 cfs) as needed to drain Schoharie Reservoir and repair the dam.

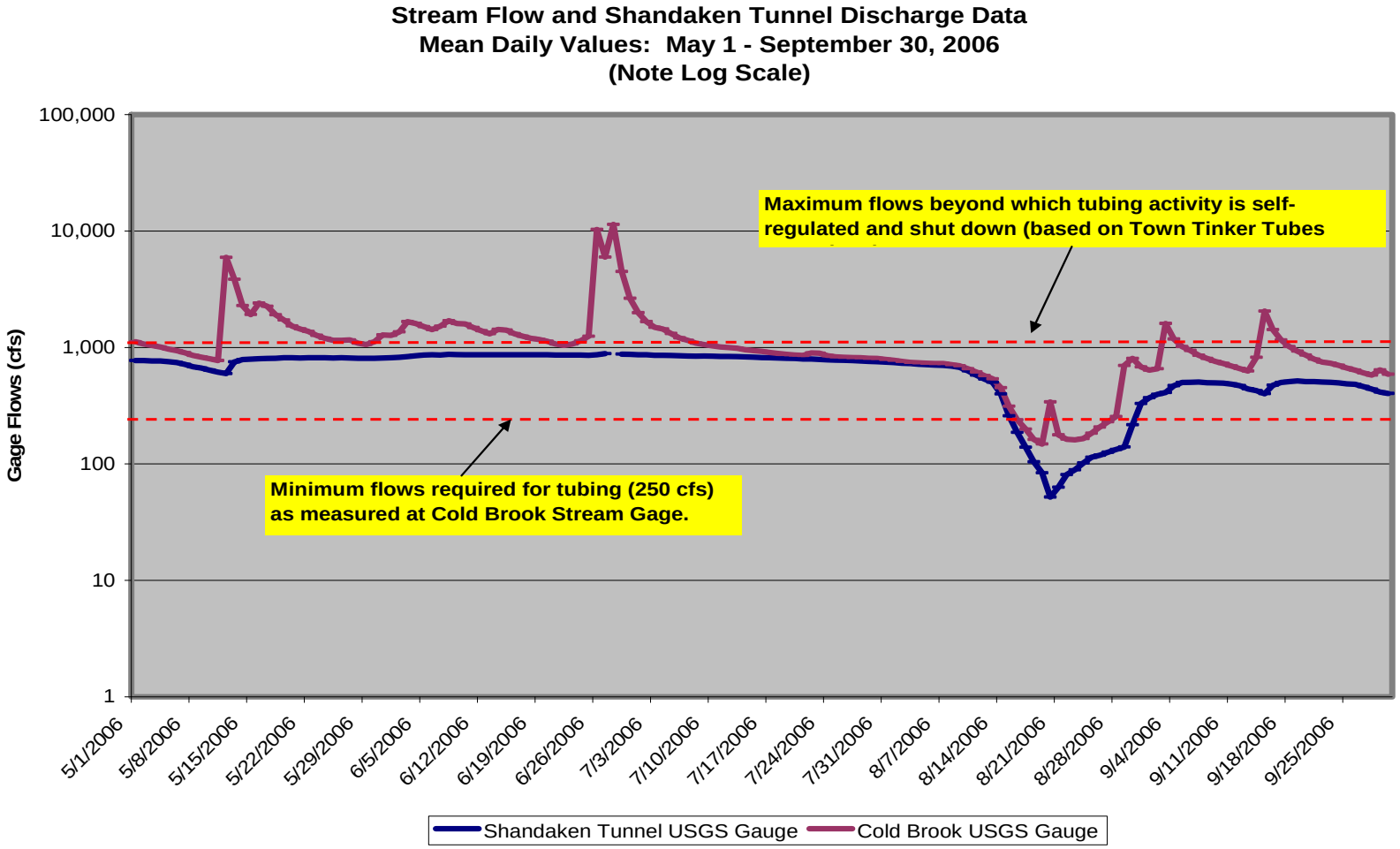


Figure 4.3: Mean Daily Values for Tunnel and Cold Brook flows for 2006 Tubing Season

Operations of Schoharie Reservoir and the Shandaken Tunnel that optimize compliance with normal operating conditions under Part 670 provide the most benefit to the tubing industry. Flows <u>most preferable</u> for the tubing activity are between 400 cfs and 700 cfs, and recreational release flow weekends are the most popular weekends for the tubing activity.

Large Woody Debris and Other In-Stream Hazards

The fallen trees and other debris in, along, and across Esopus Creek is an important issue for flooding, habitat, and navigational hazard concerns. There have been two whitewater recreation fatalities in recent history, one involving a tuber and one a kayaker. Both occurred in summer 2002, occurred in the same general vicinity (upstream of the "upper tubing course", and were the result of entanglement in woody debris sunken just below the water surface, often referred to as "strainers." The location of the strainer was upstream of the upper tubing course.

> **"*We market to the masses and the masses arrive…. People come up here and just have no idea. The amusement park people. This is not a controlled environment, this is a real river, with real rocks and real trees,"***
> – Harry Jameson, Town Tinker Tubes (Catskill Region Guide, 2006)

On upper Esopus Creek, like many smaller water bodies in NYS, streamside property owners' property boundaries extend to the center of the stream channel (Brown, no date), and questions about landowner liability for large woody debris hazards on their properties were articulated as of paramount concern during this planning process. The pivotal question remains: "who is responsible for large woody debris when it falls into the Esopus Creek?" The answer to that question, like other legal issues, may rest on a case-by-case basis (**This document is not intended as a substitute for legal advice that can best be provided by your attorney about your specific situation).**

Attached in Appendix 2 is a document summarizing recreational access and owner liability from the Cornell University Department of Natural Resources (Brown, no date) which goes into detail about this issue from a legal perspective. Important issues that factor into liability along waterways includes whether the Upper Esopus Creek is a "navigable" water way – a designation made by the NYS Legislature (Brown, 2006). Other important notes from Brown include the fact that the New York State Legislature passed a regulation (General Obligations Law (GOL) 9-103) in 1956 that limits the liability of landowners who allow hunting, fishing, trapping, and dog training on their properties "when no fee was charged and the landowner receives no other consideration from the recreationist." Since then, numerous other recreation activities have been added to the list, including canoeing and boating. The statute does not exclude liability, and courts are supposed to decide individual cases on the basis of "foreseeability" among other things.

Currently along the tubing course, outfitters and boaters work closely with private property owners to mitigate dangerous navigation hazards. In general, a DEC permit is required if machinery is needed (in the stream) to remove the debris. The DEC permit application requires an approved site plan, and a signed affidavit from the property owner.

Photo 4.21: LWD in Esopus Creek that may pose recreational boating hazard.

Photo 4.22: Large Woody Debris (LWD) around bridge pier.

After high flow events, large woody debris piles up against bridge footings. Removing this debris usually involves the use of heavy equipment. At times Ulster County Highways and Bridges and Town of Shandaken co-apply for the DEC permit (the latter supplying the heavy machinery) to remove the debris.

Throughout this two-year planning process, local outfitters have expressed a desire for the mitigation (sometimes referred to as removal, or "maintenance") of in-stream hazards to be undertaken by an agency or other regulated entity. In the 1990's, Town Tinker Tubes and the Kayak and Canoe Club of New York (KCCNY) both sought expanded authority to remove in-stream debris under a formal DEC process, but stopped short due to fear of increased liability from that expanded authority.

According to American Whitewater[5] (AW), removal of in-stream hazards in whitewater recreation streams is almost always performed by local users and outfitters. A few exceptions where government becomes involved in debris maintenance occur on rivers located in federally designated Wilderness Areas or National Forests. When discussing policies for debris maintenance, AW advised looking at the issue from two key questions: 1) Does the policy create liability? and 2) Does the policy keep people alive?

Continued exploration into liability questions surrounding large woody debris and recreational boating along Esopus Creek may provide further insight. But if legal standing on the issue can only be determined on case-by-case basis, then further research may not provide all the answers. What is known is that the impact of the uncertainty of "who is liable" may be currently compromising the ability to respond to the issue in a way that is of most benefit to stakeholders and the stream. Legal decisions on 2002 drowning incidents on Upper Esopus Creek may also find facts and set precedent on this complicated issue.

[5] Personal communication with Kevin Colburn, Stewardship Director, American Whitewater.

Access Issues

Both tubing rental businesses utilize the angler access parking area in Shandaken as a primary put-in location. A secondary put-in is located downstream of the angler access area and utilizes well-traveled pull-off on the shoulder of Rte 28 (not shown on the map because it may be private property). The Shandaken Tunnel was initially used a tubing put-in but most rental transports stopped using the location in the late 1980's due to increased head injuries at that location.

Photo 4.23: The stream access from the DOT rest area in Mt .Tremper (left and right pictures.)

Photo 4.24: Picture at right above shows ascent tubers make out of stream to the DOT rest area and awaiting transport

Another put-in and popular take-out access is beneath the Bridge Street Bridge in Phoenicia. The furthest downstream take-out is the DOT rest area adjacent to the Catskill Mountain Scenic Railroad Station in Mt. Tremper. The tubers ascent up the rocky slope of the stream bank at this location and board the busses back, or at-times the "tube train" back to Phoenicia. The closed Mt. Tremper bridge had been utilized in the past before coming into disrepair. This location may be an opportunity to plan for a future take-out location should the bridge be removed in the future.

Impact of Stream Restorations on the Tubing Industry

Any activities that take place in the stream along the tubing courses in the summer has the potential to impact the activity. For instance, during construction of the Woodland Valley Demonstration Project, tubers were passing in close proximity to heavy equipment.

Photo 4.25: Tubers travel downstream on Esopus Creek while construction crews begin work on the Woodland Valley Demonstration Project

In order to minimize impacts to the industry, construction managers should liaison with the tubing companies to provide for adequate safety and minimal impact on the activity.

Conflict with Private Property Owners and Other Creek Users

Some streamside property owners have expressed unfavorable feelings about the tubers, which sometimes stop on their property to rest or attend to clothing and equipment. Some have complained about tubers utilizing the "natural restroom" in their backyards. Other property owners have shown stranded tubers guest-like treatment, with refreshments and a ride back to town.

Anglers and kayakers have also expressed mixed feelings. Some anglers credit the tubers with ruining the fishing in the reaches along the tubing course. Others articulate that because most tubers recreate on Esopus Creek between 11 am and 5 pm, which correspond to periods of high temperatures and low fishing activity, the tubing doesn't impact Esopus Creek's "fishability" all that much. Kayakers generally tolerate the "tubing traffic," often referring to them as "moving slalom gates."

Both Town Tinker and F&S Tubes are both located within walking distance to Esopus Creek in the hamlet of Phoenicia, and have restroom facilities available for customer use. In addition, the Town of Shandaken installed two portable toilets in Phoenicia in 2006. Town Tinker restricts any food, drinks, and disposable containers that customers attempt to take on their tubing trips, and customers are instructed only to use the designated public access locations and to avoid private properties along the tubing courses.

4.4 Kayaking & Canoeing

Photo 4.26: Courtesy American Whitewater website showing wave produced from Shandaken Tunnel discharge into Esopus Creek.

4.4.1 History and Description

The Upper Esopus Creek has likely been used for transportation long before the arrival of European settlers. The completion of the Shandaken Tunnel and Ashokan Reservoir in 1927 marked the beginning of a new era on the creek – one in which stream flow can be regulated by humans and stream use became more recreational in nature. Accordingly, much of the whitewater recreation occurs in the reaches of stream below the Shandaken Tunnel, which releases water specifically for whitewater recreation up to 4 weekends per year.

According to American Whitewater and the Whitewater Classification System, and depending on specific flow conditions for any given day, the upper Esopus Creek is rated as a Class II-III stream. This dual rating is an indication that much of the creek is appropriate for beginners, with some more challenging intermediate sections. During times of high flow, parts of the Esopus may take on the characteristics of a Class III stream (an attachment of the stream classification system is included in Appendix 3).

The Housatonic River in Connecticut is comparable to upper Esopus Creek as suitable for beginner paddling and introductory whitewater training. The 2006 decision by the Federal Energy Regulatory Commission to end periodic dam-controlled water releases to the Housatonic River due to water quality issues has increased the importance of upper Esopus Creek as a regional whitewater resource for beginners and intermediates. According to American Whitewater, upper Esopus Creek represents 11 miles of the total 37 miles (29.7% of the total) Class II-III dam controlled whitewater in New York State.

Participants in our Whitewater Recreation Focus Group emphasized that upper Esopus Creek is recognized over a wide region as a high quality recreational whitewater stream for the following key qualities:

- Easy access and emergency takeout along Route 28.
- Sense of community and quality travel venues.
- Quality boating for beginners and intermediate training.
- Quality of wildlife and preserved nature of being in the Catskill Park; and
- Recreational release flows.

4.4.2 Use and Access

Aside from the local individual paddlers who have the flexibility to paddle the creek when the weather delivers high flows, much of the whitewater recreation on Esopus Creek – for races, club trips, club whitewater training, and paddles by non-affiliated individuals, are scheduled to coincide with recreational releases. Please refer to the attached map in this volume for known access locations.

Club Trips

The following whitewater clubs have annually scheduled outings to paddle the upper Esopus Creek during recreational releases. Also listed are guide companies who utilize the releases for customers seeking to develop beginner and intermediate whitewater navigation skills.

Table 4.6: Recreational Clubs and Organization

Table 4.6: Recreation Clubs and Outfitters that Utilize the Upper Esopus Creek	
Sponsored Clubs	**Tour Guides & Instructors**
Appalachian Mountain Club – NY/NJ Chapter and other chapters	Katskill Kayak Instruction
Adirondack Mountain Club – Schenectady Chapter	The River Connection
Ahwaga Canoe and Kayak Club	Catskill Outback Adventures
American Canoe Association	Atlantic Kayak Tours
Cornell University Outdoor Education	
Columbia University Kayak Club	
Lehigh Valley Canoe Club	
Kayak & Canoe Club of New York	
Metropolitan Kayak and Canoe Club	
Sebago Canoe and Kayak Club	

Races

Two slalom races are held annually on upper Esopus Creek and sponsored respectively by the Kayak and Canoe Club of New York (KCCNY), and the American Canoe Association (ACA). Both races utilize the reach of Esopus Creek that starts at the Woodland Valley Bridge crossing approximately 1 mile above the center of Phoenicia. The total race length is approximately 400 meters.

Photo 4.27: KCCNY Esopus Slalom Course, June 3, 2006.

Photo 4.28: KCCNY Esopus Creek Slalom

KCCNY Esopus Slalom

The *KCCNY Esopus Slalom* has been held on the first weekend in June since its inception in 1964, making it one of the oldest continuously held races of its kind in the eastern United States. KCCNY reports that a number of boaters who have participated in the event have later represented the United States in international competition, including the Olympics (KCCNY, 2006). In 2006, 40 racers entered the competition on both days, some traveling from Atlanta, Washington D.C., Boston, New Hampshire, and central Pennsylvania (King, 2006). Most competitors use "closed-boat" kayaks in this competition.

Photo 4.29: Pictures from the KCCNY Esopus Slalom, June 3, 2006.

Photo 4.5: Racer in Esopus Slalom

ACA Esopus Slalom

The *ACA Esopus* Slalom has been held since 1979 and is the Atlantic Division Championship race of the American Canoe Association. In 1980, Upper Esopus Creek was host to the United States Open Canoe Championship race which included both a slalom course and a downriver event. The attendance has averaged about fifty paddlers per year except for 1980 when above two hundred paddlers participated in the National Championships. (LeClair, 2006) Historically this race has been held in September, but was moved to early October in the 1980's because of increased recreational tubing.

Photo 4.31: 2006 ACA race.

Photo 4.32: 1980 Championship race

Both pictures courtesy of Keech LeClair, ACA.

Whitewater Training:

Three whitewater safety and rescue workshops have been held annually for about the last 10 years on upper Esopus Creek by the Appalachian Mountain Club. Two of the courses are Basic; the other is advanced and each workshop historically draws between 12-15 students. According to the AMC trainers, the workshop uses the rapid near Sleepy Hollow Campground for the training. The workshops are always held on non-release weekends when there is less boater and tuber traffic on the river. AMC has also observed fire departments using the creek for rescue training (AMC, 2006).

Photo 4.33: Whitewater Rescue Techniques practiced in the Esopus

Photo 4.34: Rescue Training with AMC

Photos Courtesy of Lenny Grefig and Martin Plante, Appalachian Mountain Club.

Flow Levels and Recreational Releases

The Upper Esopus, according to local paddlers, becomes too shallow in most reaches for paddling if the flow conditions are below 800 cubic feet per second (cfs) as measured at the Cold Brook USGS Stream Gauge. Most paddlers preferred a stream height of 5'3" to 6'0 feet (~800 cfs - ~1100 cfs) measured at Cold Brook for paddling.

KCCNY and the Town Tinker Tube outfitter in Phoenicia jointly make formal requests to the NYS DEC for summer recreational releases the preceding winter. DEC measures the coldwater volume in Schoharie Reservoir in mid-June and assesses whether coldwater volume will be sufficient to safely make the July high water release and not run out of cold water by mid-

September (to satisfy the temperature requirement of not discharging water above 70 degrees Fahrenheit in Part 670 and preserve coldwater trout habitat (Flaherty, 2006).

According to KCCNY, "many" recreational releases have been cancelled or have delivered lower volume flows than requested due to cited environmental conditions or drinking water supply availability. (KCCNY, 2005) Further exploration revealed that out of a total of 56 requested releases intervals between 1993 and 2006, 30 of the requests resulted in sub-optimal (below 800 cfs) flow for kayaking and canoeing (see Table 4.7 attached). Most of the low-flow days occurred in July and September when Esopus Creek base-flow was low (below 100 cfs), and Schoharie Reservoir releases through the Shandaken Tunnel were restricted to maintain cold-water and comply with Part 670. The data also exemplifies that without contributing flows from the Shandaken Tunnel, the upper Esopus would be too dry for many activities on those summer dates, including tubing.

4.4.3 Issues & Opportunities

The kayak and canoe community articulated the following issues and potential opportunities to be addressed during the Whitewater Focus Group, community meetings, and through multiple personal contacts::

- Large Woody Debris and other navigational hazards
- The long-term viability and reliability of recreational release flows
- Impacts of stream restorations on stream hydraulics
- Better information at put-in and take-out locations
- Lack of river "rest stops" and bathroom facilities
- Conflicts with anglers, tubers, and other stream users

4.4.4 Discussion and Recommendations

Large Woody Debris and Other in-Stream Hazards

The fallen trees and other debris in, along, and across Esopus Creek is an important issue for flooding, habitat, and navigational hazard concerns. There have been two whitewater recreation fatalities in recent history, both occurred in summer 2002, occurred in the same proximity, and were the result of entanglement in woody debris sunken just below the water surface, often referred to as "strainers." The kayaking and canoeing community benefit play active roles in debris removal (please refer to Section 4.3 on Tubing for more discussion on this topic).

Whitewater folks use the Esopus Creek during all seasons, however, and access other sections of the creek outside the tubing course. **The placement of bulletin boards at put-in and take-out locations was recommended by paddlers as a means to share information about the location of in-stream hazards**.

Photo 4.35 This newly constructed kiosk at the confluence of Woodland Valley will provide a bulletin board for the community.

Long-Term Viability and Reliability of Recreational Release Flows

The organized whitewater recreation activities on Esopus Creek depend greatly on the releases from the Shandaken Tunnel.

In 1976 KCCNY, American Whitewater and others organized their efforts to lobby for recreational releases (technically referred to as "transfers") to be incorporated into 6 NYCRR Part 670, which resulted in the regulation allowing up to four (4) transfers (one per month) during the months of June through October. These transfers are only authorized if requested, and then only the NYS DEC determines that enough cold-water storage exists in Schoharie Reservoir to sustain flow and temperatures for aquatic life in Esopus Creek through the summer months. These releases can also be refused during water supply shortages.

In the 2005 public hearings about the establishment of a SPDES permit to regulate flow, turbidity, and temperature from the Shandaken Tunnel, KCCNY testified that it was “concerned that as the Shandaken Tunnel is operated to reduce turbidity loading to the Esopus Creek while providing minimum flow and temperatures for aquatic life through the SPDES permit, there will be less availability and certainty of recreational releases originally provided for in Part 670. KCCNY and NYRU have considerable, and we believe legitimate, concern that in practice the SPDES permit will be used as a justification to deny, abridge or diminish whitewater recreational releases…” (KCCNY, 2005)

The current draft SPDES permit makes no reference to recreational releases but references the need to comply with Part 670 which allows DEC to grant them. Because NYC has been operating under a SPDES since September 1, 2006, and because there are currently operating under emergency conditions and a waiver of Part 670 requirements, it is too early to evaluate the SPDES impact on granting recreational releases.

According to DEC Region 3 Bureau of Fisheries, beginning in 1995 and extending through 2004, the whitewater enthusiasts changed their August request to later in September when cold-water issues would be less likely to cancel events. DEC notes that in 2005, however, the Town of Shandaken began requesting a three day recreational release over Labor Day called Shandaken

Whitewater Weekend. According to DEC Region 3 Fisheries, "this high release in the latter part of summer could easily use the last of the coldwater and result in a warm water release. This could occur when day time air temperatures can be high enough to raise stream temperatures to lethal levels for trout." (Flaherty, 2006).

KCCNY and other whitewater groups support the angling community in its demands that NYC construct a multi-level intake at Schoharie Reservoir in order to transfer the highest quality water through the Tunnel (including the ability to avoid transferring cold water until it's critically needed in the summer months). NYC is currently evaluating this option as part of its Catskill Turbidity Control study.

Outing and race managers have articulated their need for more clear communication about the reliability of release flows in two aspects:

a) The ability to get a clear answer on whether the release is authorized (even if it is "no"), and
b) The knowledge of the quantity of discharge (how many cubic feet per second). The discharge rate changes the stream water elevation. When setting up races, elevation is necessary to plan around under-water obstacles and to set gate heights properly.

Opportunity exists for a coordinated dialogue between release requestors, the DEC, and DEP prior April 15 of each year to discuss water quantity and quality conditions in Schoharie Reservoir and plan releases according to the multiple needs served by the Tunnel discharges.

Impacts of stream restorations on stream hydraulics

Boaters raised the issue that the angle of repose of the whitewater feature "railroad rapids" has lessened since the construction of the Woodland Valley stream restoration project. Others involved in the restoration project believe that the April 2005 flood and local hydraulics around the bridge had the most changing impact on the feature

Photo 4.36: Before picture at Restoration site at Woodland Valley

Photo 4.37:Woodland Valley Site during reconstruction

Others note that the rock vanes installed upstream of railroad rapids as part of the restoration project are good, new whitewater features.

Photo 4.38: Local kayaker in front of rock vanes installed at Woodland Valley demonstration project site.

Photo 4.39: Close Up of Rock Vane

One kayaker felt that these rock vane features could be improved upon slightly to make the feature amenable to "freestyle" kayaking. Other areas of the country are creating whitewater parks with features for freestyle kayaking, such as Lock 32, Erie Canal, NY below:

Photo 4.40: Courtesy American Whitewater website

Stream hydraulics for whitewater recreation should be addressed during future stream restorations as they can both positively and negatively impact whitewater features.

Better Information at Put-In and Take-Out Locations

One popular creek access location is a DEC designated "angler parking area." Whitewater-related information at these locations would help to diffuse the "turf" issues about whether the parking areas are for "anglers only." Boaters also voiced their concern over the disparate amount of attention paid on the NYS DEC website between angling and whitewater recreation.

The whitewater community would benefit from increased safety and information through signage at put-in and take-out locations.

Access, River "Rest Stops" and Bathroom Facilities

A lack of access to Esopus Creek below Phoenicia and the popular Elmer's Rapids has become an issue, now that the previous location (now the Phoenicia Water Supply property) is off limits. Several boaters remarked that the quality of the experience would be enhanced through the creation of river pull-offs where boaters could picnic. The absence of public restroom facilities

in and around the creek was also noted. There are several locations where NYS, Ulster County, or the Town of Shandaken owns land along the Esopus along the primary whitewater recreation route where such facilities could be established. The attached map shades state, county, and municipally owned land along the Esopus Creek.

Photo 4.41: Portable toilets are brought in for KCCNY Esopus Slalom

Photo 4.42: The road pull-off along railroad rapids currently serves as a parking and staging area for the races

Conflicts with Anglers, Tubers, and Other Stream Users

Several instances of conflict between different user groups have been reported during the year preceding this document. One involved a property owner stringing fishing-line across a small side-channel of stream to covertly inform boaters that they are not welcome. Others involved verbal exchanges from anglers frustrated by kayakers interfering with their fishing (and scaring off the fish).

> *"Paddlers, by the nature of the sport, tend to focus on and react to what's in the river in front of them. When we're in rapids, anything on shore, especially people standing there talking to each other, usually won't get a second glance. …no one should have to risk physical danger in a strainer or a keeper hydraulic to avoid hurting someone's feelings."*
> *-Lauren Cook, KCCNY*

Both angling and whitewater boating in the Esopus Creek require intense concentration, increasing the likelihood of encroaching on another's activities unexpectedly. **All parties would benefit from development of agreeable codes of conduct for stream activities through an outreach and education program.**

Table 4.7: Recreational Release Dates and Stream Flows from 1993 – 2006

Year	Requested Release Date	Portal Release (ft^3/s)	Stream Flow (ft^3/s)	Requested Release Date	Portal Release (ft^3/s)	Stream Flow (ft^3/s)	Requested Release Date	Portal Release (ft^3/s)	Stream Flow (ft^3/s)	Requested Release Date	Portal Release (ft^3/s)	Stream Flow (ft^3/s)
1993	Jun. 5-6	N/A	983	Jul. 17-18	N/A	758	Aug. 21-22	N/A	176	Oct. 2-3	N/A	172
1994	Jun. 4-5	N/A	851	Jul. 8-9	N/A	812	Aug. 13-14	N/A	383	Oct. 1-2	N/A	878
1995	Jun. 3-4	N/A	918	Jul. 8-9	N/A	154	Sept. 16-17	N/A	178	Sept.30-Oct.1	N/A	170
1996	Jun. 1-2	N/A	728	Jul. 13-14	N/A	3,240	Sept. 14	N/A	935	Oct. 5-6	N/A	933
1997	Jun. 7-8	610	761	Jul. 12-13	710	726	Sept. 20-21	636	696	Oct. 4-5	715	727
1998	Jun. 6-7	834	857	Jul. 18-19	794	848	Sept. 12-13	830	724	Oct. 3-4	789	744
1999	Jun. 5-6	709	855	Jul. 17-18	132	251	Sept. 11-12	153	273	Oct. 2-3	433	767
2000	Jun. 3-4	746	1,020	Jul. 15-16	547	2,200	Sept. 9-10	746	766	Sept.30-Oct.1	665	686
2001	Jun. 2-3	609	1,300	Jul. 14-15	765	761	Sept. 15-16	194	239	Sept. 29-30	558	587
2002	Jun. 1-2	733	999	Jul. 20-21	528	555	Sept. 14-15	160	198	Oct. 5-6	424	525
2003	Jun. 7-8	347	973	Jul. 19-20	456	558	Sept. 13-14	65	868	Oct. 4-5	339	1,020
2004	Jun. 5-6	511	893	Jul. 17-18	704	741	Sept. 19-20	3.8	3,200	Oct. 2-3	208	868
2005	Jun. 4-5	820	933	Jul. 16-17	611	739	Sept. 3-5	752	789	Oct. 1-2	461	491[P]
2006	Jun. 3-4	851[P]	1,670[P]	Jul. 15-16	827[P]	938[P]	Sept. 2-4	470[P]	1,610[P]	Sept.30-Oct.1	403[P]	1,260[P]

Above are the requested recreational release dates from 1993 to 2006, and the recorded flows at the USGS Stream Gages at Shandaken Tunnel and Cold Brook (the highest mean value from the 2 days is reflected). Highlighted are the dates when it was recorded that the stream flows at the Coldbrook gage were below 800 cubic feet per second, which are considered sub-optimal for canoeing and kayaking.

***P = Provisional data subject to revision**

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