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Upper Esopus Creek Management Plan

Aquatic Ecosystem Research & Assessment Strategy

A collaborative research agenda developed to inform stream management efforts in the Upper Esopus Creek watershed

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For more information about the Upper Esopus Creek Management Plan and the Aquatic Ecosystem Working Group, please visit http://www.esopuscreek.org. More information about Cornell Cooperative Extension of Ulster County's role in watershed management coordination and education can be found at http://counties.cornell.edu/ulster. Comments, suggestions, or other inquiries can be directed to:

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Preface

In 1997, New York City was granted a Federal Safe Drinking Water Act filtration waiver by the U.S. Environmental Protection Agency (EPA). The waiver, which has since been renewed every five years (including 2007), is known as the Filtration Avoidance Determination or "FAD," and includes a requirement that the City develop management plans for streams that carry drinking water to New York City reservoirs. Cornell Cooperative Extension of Ulster County (CCE) was contracted by the NYC Department of Environmental Protection (DEP) to facilitate development of a stream management plan for Upper Esopus Creek in 2004.

A multi-stakeholder stream management planning process was initiated that identified 5 goal areas: Flooding & Erosion Management; Water Quality Protection; Recreation Improvement; Ecosystem Enhancement; and Management Coordination. Watershed assessments were carried out through 2006. CCE facilitated a Project Advisory Committee and several working groups, including the Aquatic Ecosystem Working Group to advise the assessment and recommendation process. Recommendations for each of the goal areas were produced and delivered to the U.S. EPA in draft form in January 2007.

As part of this process, Walt Keller - retired New York State Department of Environmental Conservation (DEC) Region IV Fisheries Manager - was contracted by CCE to compile and review all existing data and literature pertaining to upper Esopus Creek. Analysis and iteration by Keller and the Aquatic Ecosystem Working Group on the current state of knowledge of aquatic habitat conditions, outstanding data gaps, and limitations in the existing data provides the basis for additional studies and actions proposed in this document.

The purpose of the aquatic ecosystem working group and this implementation plan are fourfold: (1) to share the most up-to-date knowledge of Upper Esopus Creek ecosystem management issues and relate that information to others; (2) to consolidate that knowledge into recommendations that will inform future stream management actions; (3) to provide a research mechanism for interested parties to scope studies that satisfy those recommendations; and (4) to provide a forum for parties to coordinate on mutually beneficial next-steps.

The document will be revisited on an annual basis in order to assess results and update proposed actions. Per the 2007 FAD, the DEP must submit biennial "Ashokan Basin Action Plans" to U.S. EPA that detail progress on stream management planning and implementation efforts in the Ashokan Reservoir watershed. It is anticipated that CCE will be contracted by DEP to facilitate the development of an Ashokan Basin-wide steering committee in order to prioritize stream management implementation through 2012, and to assist stakeholders in leveraging allocated funding to implement projects that meet multiple objectives.

Aquatic Ecosystem Working Group Participants

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Setting & Background

The Upper Esopus Creek watershed covers a 192 mi^2 area in the south-central Catskill Mountain Region of southeast New York State. The rugged watershed terrain includes 21 peaks greater than 3,000 feet above sea level (ft asl) that are drained by a network that includes at least 330 miles of stream. Forested lands exceed 95% of the total watershed land cover, and mean annual precipitation is among the highest in the northeast. Remnant glacial lake deposits makes streams susceptible to erosion and are the main contributor to turbidity in Catskill streams. There is no large-scale agricultural land use in the watershed

The entire 26 mile course of the Esopus Creek flows "clockwise" from the headwaters at Winnisook Lake on Slide Mountain to the Ashokan Reservoir through the Ulster County Towns of Shandaken and Olive Slopes ranges from 13% in the cascading headwater reaches down through 3% – 0.5%. Residential and commercial development is largely restricted to the stream valleys, with several areas of relatively concentrated residential and commercial development. At least 238 existing streamside landowners own and manage property along its course, about half of which are part-time residents; and more than 9 miles of roads and many more miles of railroad are within 300 feet of the channel.

Upper Esopus Creek is regulated by an inter-basin transfer of water. The Shandaken Tunnel is a handmade aqueduct that connects the Schoharie Reservoir (18 miles north) to the Upper Esopus Creek – which conveys the water to Ashokan Reservoir. Approximately 40% of the City's average water supply demand is provided by this system. Shandaken Tunnel discharges are subject to state regulation and a discharge (SPDES) permit that specify thresholds for stream flow, temperature, and turbidity in the discharged waters to protect aquatic habitat. State regulations also allow for up to 4 releases for whitewater recreation, pending DEC approval and drinking water availability. Regulated creek flows support a mature "tubing" industry with about 15,000 average annual users, and the cold-water delivered via the Tunnel sustains a renowned trout fishery with one of the longest open seasons in the state (April 1^{st} – November 30^{th}).

Suspended sediment entering the creek from landscape sources and from the Shandaken Tunnel is the primary concern for drinking water and recreation in the Esopus Creek watershed, and is the primary focus of New York City's filtration avoidance efforts. In 1997, DEP funded a stream restoration project on Esopus Creek to demonstrate natural channel design principles and bioengineering stream bank stabilization practices. This restoration, which took place near the confluence with Woodland Valley creek, was completed in 2003 and has since withstood several high-flow events.

In 2007, DEP consultants completed Phase II of the Catskill Turbidity Control Study. The study assessed data from several years monitoring and modeling by Upstate Freshwater Institute to evaluate structural and/or operational modifications at the Shandaken Tunnel intake structure on Schoharie Reservoir. The study recommends development of an Operational Support Tool, and enhanced operability of the existing intake structure (rather than build a new multi-level intake structure), to assist DEP reduce turbid water transfers and conserve cold-water when conveying drinking water through the Tunnel.

Keller identifies the Upper Esopus Creek watershed as having four distinct aquatic macro-habitats: (1) the west-basin of Ashokan Reservoir; (2) the regulated portion of Esopus Creek (downstream of Shandaken Tunnel); (3) the unregulated portion of the creek (upstream of the Tunnel); and (4) tributaries to Esopus Creek and Ashokan Reservoir (see Keller's report attached). This habitat diversity presents a unique opportunity for resource managers, researchers, and watershed educators to further explore and refine the influence that human stream management actions have on this dynamic ecosystem.

Watershed Assessments Performed and Anticipated Next Steps

A three-page Executive Summary of the Upper Esopus Creek Management Plan is attached that synthesizes findings related to Flooding & Erosion, Water Quality, Recreation, Ecosystem, and Community assessments. Complete documents detailing the assessment findings can be accessed in the full Upper Esopus Creek Management Plan documents at http://www.esopuscreek.org. Stream management plans have also been developed for Broadstreet Hollow Creek and Stony Clove Creek (both tributaries to Esopus Creek) in 2004 and 2005, respectively.

Below is a brief description of the different assessments performed and available for further examination via the link above, along with any updated activities.

Watershed Characterization

DEP developed a three-phased watershed assessment, starting at the watershed scale and then refining focus to the corridor and stream channel scale. Upper Esopus Creek was divided into 23 distinct reaches based valley slope, valley width, and tributary influence. Activities included: the development of a stream feature inventory and geodatabase; A two-tiered riparian classification of vegetation land cover in the main-stem corridor was also performed, along with a complete inventory and characterization the watershed setting, geology, hydrology, water quality, stream channel, riparian corridor, and aquatic ecology conditions.

In a cooperative research agreement with Dr. Craig Fischenich, P.E. from the U.S. Army Corps of Engineers – Engineer Research Development Center (ERDC) hydraulic modeling using HEC-RAS to evaluate flooding hazards; an erodibility analysis on pro-glacial lake and glacial till deposits; and sediment sampling and budget analysis to evaluate the characteristics, transport, and fate of fine sediment in the Esopus Creek system.

Several locations meriting further long-term monitoring and/or further evaluation and implementation of applied geomorphology practices, bio-engineering, and where needed traditional stream management practices have been identified. Cross-sections on several long-term monitoring sites were installed in 2007, and conceptual stream restoration designs are currently (or soon will be) under development. Watershed assessments on Esopus Creek tributaries are also planned, starting with a preliminary assessment of Woodland Valley.

Community and Stream Use Characterization

CCE researched and compiled information on the historical, social, geographic and policy issues of the Esopus Creek watershed, documenting, among other things: population growth and land use trends; Construction and operation histories, specifications, and regulations for the Shandaken Tunnel and Ashokan Reservoir; User statistics, characteristics, and management issues related to angling, kayaking, and tubing; and Interests and information needs related to Esopus Creek landowners.

The latter survey was performed by Cornell University Human Dimensions Research Unit. Combined with focus group and other survey instruments, CCE is developing a strategy for stream management related education and outreach needs. A regular group of watershed volunteers now meet quarterly and a community stream vegetation planting project is under development for fall 2007 after receiving a grant from the NYS DEC Hudson River Estuary "Trees for Tribs" program.

Aquatic Ecosystem Assessment Findings

A review of existing literature, data sources, and observations on Upper Esopus Creek aquatic ecosystem issues (which includes sub-basins to Esopus Creek) was performed by Principle Investigator Walt Keller in 2006-2007 and provided the basis for stream management recommendations related to the aquatic ecosystem. Keller's summary and analysis, along with a complete annotated bibliography are attached as Attachment #3. Concurrent to this time period, a rapid bioassessment protocol was also conducted by ERDC and is attached as Attachment #4. A quick synopsis of Keller's findings is provided below:

- How trout and other biota respond to regulated stream conditions resulting from Shandaken Tunnel discharges is largely unknown. Enhanced knowledge of baseline environmental conditions and habitat suitability in the watershed might assist regulators and water system operators to provide improved habitat conditions - in balance with water supply, recreation, and other needs placed upon the diverted water.

- A myriad of public agencies, not-for-profit groups, universities, and citizen stewards perform varying levels of monitoring, research and education in the watershed. Information exchange, data-sharing, and mutually-agreed upon data acquisition protocols could enhance overall knowledge and foster improved stewardship.

- Many ecological interactions in the watershed remain poorly understood. Further research that supports improved stream management decision-making by regulators, municipal officials, and landowners should be supported.

- No comprehensive inventory of spring seep locations exists, making these seeps susceptible to culvert outfall placement or other stream management actions that could compromise these thermal refuges.

- Other than what was available on the National Wetlands Inventory (NWI) and DEC wetlands inventories, the locations and relative ecosystem contributions of wetlands along the Esopus Creek corridor have not been adequately studied.

Recommendations and Proposed Actions

The following recommendations and proposed actions have been advised and/or proposed by participants in the Aquatic Ecosystem Working Group, and are thus open to further addition, revision, and evolution as additional knowledge is gained.

Recommendation #1: Identify stream conditions optimal for aquatic biota in order to assist with operation of the Shandaken Tunnel

Studies proposed below seek to gain further scientific understanding of the relationships between discharged waters from the Schoharie Reservoir and biota in the Esopus Creek as it relates to temperature, flow, turbidity, and other parameters. Proposals seek to better define the habitat and environmental needs of biota in order to provide DEP and DEC with further criteria to assist management of water transfers through the Shandaken Tunnel.

Studies/Actions Proposed (listed in no particular order)

1. A telemetry study to better understand movement of trout in the system (Ashokan Reservoir, main-stem Esopus Creek and tributaries) in response to changes in environmental conditions, and their use of thermal and physical refuges.

2. Quantify differences in periphyton colonization at different watershed locations, emphasizing total biomass, species diversity and rates of colonization.

3. Measure the Index of biological integrity (IBI) at different watershed locations with an emphasis on May, Stone and Caddis population fluctuations associated with changes in environmental conditions (flow, turbidity, temperature).

4. Analyze historical trout scale samples and correlate growth findings to available environmental data (flow, temperature, turbidity).

5. Measure the direct effects of Shandaken Tunnel discharged waters on the survival of various trout life stages through the use of caged experiments.

6. Further investigate the success of spawning at different watershed locations by examining ova and sac fry survival.

7. Conduct caged experiments on macroinvertebrates and other native species in different parts of the watershed.

8. Develop and conduct a main-stem Esopus and tributary sampling design to generate a snapshot of the existing basin-wide productivity and ecosystem condition.

9. Conduct sampling to assist with development or refinement of local habitat suitability indexes or models for salmonids (trout).

10. Develop a study to assess effects on Schoharie Reservoir coldwater fishery under different Shandaken Tunnel release strategies.

Recommendation #2: Support identification and characterization of spring seeps (and other thermal refugia) that provide critical habitat to trout and other biota

Proposals seek to identify naturally occurring thermal refuges in the Esopus Creek aquatic ecosystem and relay information to stream managers and permitting authorities to ensure they are not disturbed.

Studies/Actions Proposed

1. Thermal imaging and trout temperature-telemetry data could be collected and used to document the availability and utilization of thermal refuges.

2. Volunteer monitoring to identify thermal refuges, plotting coordinates in GIS for use by permitting agencies and other authorities.

3. The use of Topographic Index (TI) modeling to predict flow paths for shallow-groundwater through watersheds and to predict locations of groundwater upwelling in aquatic systems.

Recommendation #3: Enhance coordination and information sharing among regulators, scientists, educators and the public

NYS DEC and NYC DEP both (bio)monitor select locations in the watershed to assess drinking water quality and resource condition. The U.S. Geological Survey (USGS) conducts biomonitoring at stream restoration projects. Non-profit entities like Catskill Center for Conservation and Development and Cornell Cooperative Extension of Ulster County sponsor volunteer stream biomonitoring (leaf-pack) training to interested residents. While the Zen Environmental Studies Institute, Olive Natural Heritage Society, Trout Unlimited, SUNY Ulster and SUNY New Paltz all partake in education-based research on area streams.

Proposals below seek to encourage future data driven policy development and coordination by the participating entities.

Studies/Actions Proposed

1. Develop a physical or electronic information/data clearinghouse for easy access to previous studies by researchers. Formalize relationships and/or data sharing agreements under a collaborative research effort as necessary.

2. Identify existing protocols or develop a mutually agreed upon framework that could be used for consistent sampling and data sharing between entities. This protocol could be supplied to outside contractors as well.

3. Encourage increased participation by affiliated and non-affiliated researchers and citizens in the Aquatic Ecosystem Working Group. Continue personalized information sharing via meetings, conferences, symposiums, or other venues.

4. Continue to support identified research activities through pooled resources such as funding, grant partnerships, volunteer networks, and equipment sharing.

Recommendation #4: Support further biomonitoring, and studies of other wildlife, their habitats, and interactions to inform stream management actions

Data and observations from multiple sources provided the basis for recommendations by Keller. Those entities performing research or wishing to perform further research into ecosystem relationships (or infrastructure-ecosystem relationships) with potential stream management implications should be supported. Potential stream management actions with habitat-related consequences include: the alteration of stream bed and banks, and introduction or removal of streamside vegetation, among many others.

Studies/Actions proposed

1. Stream restoration and other habitat management actions should be monitored to evaluate effectiveness.

Recommendation #5: Further inventory and characterize wetlands in the upper Esopus Creek watershed, emphasizing those along the main-stem Esopus Creek corridor.

Proposals seek to identify wetlands eligible for additional protection, and characterize their relative contributions to ecosystem conditions in the watershed.

Studies/Actions proposed:

1. A 3-phased identification, classification and assessment of the wetlands in the riparian corridor of the main channel of Upper Esopus Creek.

Listing of Attachments

1 Map of Upper Esopus Creek Watershed

2 Executive Summary from Upper Esopus Creek Management Plan

3 Aquatic Ecosystem Condition of Upper Esopus Creek – Walter Keller, New York State DEC Region IV Fisheries Manager (Retired)

   a) Bullet Summary of Suggested Findings, Public Observations and Data Gaps

   b) An Annotated Listing of Reports, Data Sets, Correspondence, and other Resources Pertinent to Understanding the Upper Esopus Creek Aquatic Ecosystem

   c) The Fishes of Upper Esopus Creek and the West Basin of the Ashokan Reservoir

4 Environmental Assessment of Esopus Creek, New York - Performed by U.S. Army Engineer Research Development Center – Environmental Laboratory

5 Aquatic Ecosystem Working Group – Meeting Work Product Documents