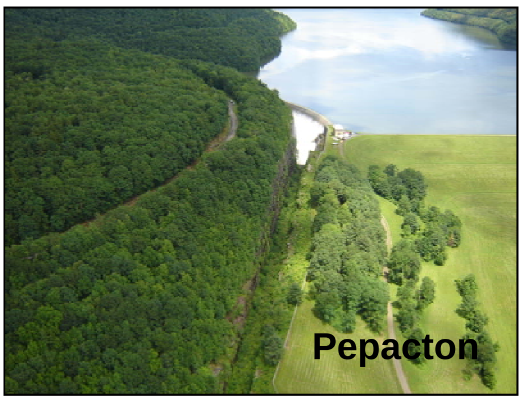
City of New York
West of Hudson Hydroelectric Project



Project No. 13287-000
Pre-Application Document
Volume 1 of 2 (Text and Tables)

Schoharie, Cannonsville, Pepacton, and Neversink Developments

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DEP

August 13, 2009

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LIST OF FIGURES

Note: All figures are located in Volume 2 of the PAD.

LIST OF TABLES

LIST OF ACRONYMS

ALP	Alternative Licensing Process
BGEPA	Bald and Golden Eagle Protection Act
BG	Billion gallons
BOCES	Board of Cooperative Education Services (New York State)
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfsm	Cubic feet per square mile
DLA	Draft License Application
DO	Dissolved Oxygen
DRBC	Delaware River Basin Commission
DRDSS	Delaware River Decision Support System
E	East
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FERC	Federal Energy Regulatory Commission (also the Commission)
FFMP	Flexible Flow Management Program
FPA	Federal Power Act
GIS	Geographic Information System
HPMP	Historic Properties Management Plan
IERQ	Interim Excess Release Quantity
ILP	Integrated Licensing Process
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt-hour
MG	Million gallons
MGD	Million gallons per day
msl	Mean sea level
MW	Megawatt
N	North
NEMA	National Electric Manufacturing Association
NEPA	National Environmental Policy Act
NGO	non-government organization
NGVD	National Geodetic Vertical Datum
NOI	Notice of Intent
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
NY	New York
NYCDEP	New York City Department of Environmental Protection
NYNHP	New York Natural Heritage Program
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health

LIST OF ACRONYMS (continued)

NYSEG	New York State Electric & Gas Corporation
NYSM	New York State Museum
OPRHP	New York State Office of Parks, Recreation and Historic Preservation
PAA	Public Access Areas
PAD	Pre-Application Document
PLP	Preliminary Licensing Proposal
RCNY	Rules of the City of New York
RTE	Rare, Threatened, and Endangered Species
S	South
SHPO	New York State Historic Preservation Office
SCORP	State Comprehensive Outdoor Recreation Plan
SHRI	Statewide Historic Resource Inventory
SD1	Scoping Document 1
SNTEMP	Stream Network Temperature Model
SWCD	Soil and Water Conservation District
THPDMP	Tailwaters Habitat Protection and Discharge Mitigation Program
TLP	Traditional Licensing Process
TNC	The Nature Conservancy
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
W	West
WPCF	Water Pollution Control Facility
WWQO	Watershed Water Quality Operations
WWTP	Wastewater Treatment Plant
7Q10	Seven-day, ten-year low flow (lowest seven consecutive-day mean stream flow with a recurrence interval of ten years)

1.0 INTRODUCTION

The City of New York ("City"), acting through the New York City Department of Environmental Protection ("NYCDEP") is filing with the Federal Energy Regulatory Commission ("FERC" or the "Commission") its Notice of Intent ("NOI") and this Pre-Application Document ("PAD") to develop hydroelectric generation at the following four developments that collectively comprise Project No. 13287-000 ("Project").

Development	Dam Name	River	Drainage Area
Cannonsville	Cannonsville	West Branch Delaware River	454 mi^2
Neversink	Neversink	Neversink River	92.6 mi^2
Pepacton	Downsville	East Branch Delaware River	372 mi^2
Schoharie	Gilboa	Schoharie Creek	316 mi^2

Each of the four hydroelectric development sites are located on portions of the City's water supply system located to the West of the Hudson River in Delaware, Greene Schoharie, and Sullivan Counties. Figure 1.0-1[1] depicts the locations of the four developments. The dams and reservoirs are owned by the City and operated by the NYCDEP to provide potable water for New York City and four nearby counties. The water supply system provides approximately 1.1 billion gallons of unfiltered high quality drinking water daily to approximately nine million New York State residents (approximately 50% of the State's total population), as well as the millions of tourists and commuters who visit the City of New York each year. It is important to note that the four developments proposed by the Project are located within the Catskill/Delaware Watershed area – the same area that provides more than 90 percent of the City's total water supply annually. The City seeks to develop hydroelectric power, while simultaneously maintaining the crucial water supply operations in accordance with long-term sustainable drinking water needs, conservation releases, directed releases, water quality standards, and various other conditions affecting the City's water supply system, including determinations by the U.S. Environmental Protection Agency ("EPA") and the Delaware River Basin Commission ("DRBC").

This PAD is a tool for providing engineering, operational, economic, and environmental information relative to the Project that is reasonably available at the time the NOI is filed. The PAD supplies information to help identify and evaluate potential impacts to the Project area resources resulting from the addition of hydropower facilities at the existing water supply dams. This evaluation will be documented in the license application to be prepared by the City and filed with the Commission.

In compliance with the Commission's regulations governing the content of the PAD, the NYCDEP contacted appropriate state and federal resource agencies that may be concerned with the Project's potential environmental impacts. The NYCDEP requested that these entities provide any relevant studies, data, and information they possess on topics such as water quality, fisheries, recreation, wildlife, wetlands, aesthetic, and cultural resources. Appendix A contains a copy of the letter sent to the resource agencies, public entities, Tribes, and other potentially interested stakeholders requesting information on the Project for incorporation into the PAD.

[1] Note: All figures referenced in this document are provided in Volume 2 of this PAD.

Appendix A also contains a list of the entities to which the letter was sent and the responses that were received from the following entities:

- Atlantic States Marine Fisheries Commission
- United States Department of the Interior, Fish and Wildlife Service
- United States Department of Commerce, National Oceanic and Atmospheric Administration
- New York Office of Parks, Recreation and Historic Preservation
- Oneida Indian Nation
- Stockbridge-Munsee Tribal Historic Preservation Office

Although it did not submit a written response, the New York Department of Environmental Conservation ("NYSDEC") met with the NYCDEP on June 29, 2009 to discuss the Project and provide information for the PAD.

Concurrent with the filing of this PAD, and in accordance with Section 5.3 of the Commission's regulations, 18 CFR § 5.3, the City is seeking approval from the Commission to use the Traditional Licensing Process ("TLP") in lieu of the Integrated Licensing Process to license the Project. In the event the Commission approves this request, and as set forth in 18 CFR § 4.38(b)(3)(ii)(A), a joint meeting must be held no earlier than 30 days, but no later than 60 days, following the date the Commission authorizes the use of the TLP. The site visit will provide stakeholders an opportunity to see the layout of each development site and hydroelectric facility, understand the existing conditions, operation of the water supply system and integration of the hydroelectric facilities into those operations, and participate in a question-and-answer session with the NYCDEP and its consultants regarding the Project.

The information contained in this PAD was assembled based on the requirements set forth in 18 CFR § 5.6 and is organized as follows:

- Section 1 – Introduction
- Section 2 – Proposed Communications Protocol and TLP Flow Chart [18 CFR § 5.6(d)(1)]
- Section 3 – General Description of the River Basins, Development sites, Facilities, and Operations [18 CFR § 5.6(d)(2)]
- Section 4 – Description of the Existing Environment and Resource Impacts [18 CFR § 5.6(d)(3)]
- Section 5 – Preliminary Resource Issues and Potential Studies or Information Gathering Needs [18 CFR § 5.6(d)(4)]
- Appendices:
    - Appendix A – Letter Requesting Information for the PAD, List of Entities to which the Letter Was Sent, and Copies of the Responses Received [18 CFR § 5.6(d)(5)]
    - Appendix B – PAD content cross reference table

- Appendix C – List of agents for the City [18 CFR § 5.6(d)(2)(i)]
- Appendix D – Pictures of the Development Sites
- Appendix E – Distribution List for the NOI and PAD [18 CFR §§ 5.5(c) and 5.6(a)]
- Appendix F – Discharge Versus Habitat Area Statistics for Study Sites in the Upper Delaware River
- Appendix G – Literature and Information Sources Cited in the PAD and Summaries of Existing Resource Data [18 CFR § 5.6(c)(2)]

2.0 PROPOSED COMMUNICATIONS PROTOCOL AND SCHEDULE

NYCDEP will document the licensing process, including any information received from the interested parties and records of communications. NYCDEP will make information related to the licensing of the Project available at its corporate offices at 59-17 Junction Boulevard, 19th Floor, Flushing, NY 11373 by special appointment.

2.1 Documents and Mailing Lists

A library of all mailing lists, announcements, notices, communications, and other documents related to the licensing of the Project will be maintained at 59-17 Junction Boulevard, 19th Floor, Flushing, NY 11373. Anyone may obtain documents from this library by contacting:

Ms. Zinnia Rodriguez
Principal Administrative Assistant
Bureau of Legal Affairs
New York City Department of Environmental Protection
59-17 Junction Boulevard, 19th Floor
Flushing, NY 11373
Phone: 718.595.6553
Fax: 718.595.6543
zinniar@dep.nyc.gov

Certain Project-related documents are considered to be Critical Energy Infrastructure Information ("CEII") and restricted from public viewing in accordance with Section 388.113 of the Commission's regulations, 18 CFR § 388.113. This information relates to the design and safety of the dams and appurtenant facilities. Anyone seeking information protected as CEII from the Commission must file a CEII request. FERC's website at http://www.ferc.gov/help/filing-guide/ceii-request.asp contains additional details related to CEII. The NYCDEP will allow limited access to documents containing sensitive information regarding specific cultural and/or environmental resources to authorized entities.

2.1.1 Mailing Lists

There are two categories of participation in a FERC licensing proceeding and each requires different notification or frequency and type of communication. Interested Parties are a broad group of individuals, governmental, and non government organizations that have an interest in the Project and/or licensing proceeding; this group is generally referred to as "stakeholders." The NYCDEP will maintain a mailing list of all Interested Parties. The list will include both standard U.S. Post Office addresses and available email addresses for distributing notices and documents for public review. After the NYCDEP files its License Application, the Commission will establish an official Service List for parties who formally intervene in the proceeding. Intervention is a formal legal process governed by the Commission's regulations. Additional information may be found on FERC's website at http://www.ferc.gov. Once the Commission establishes a Service List, any written documents filed with the Commission must be served on the Service List. A Certificate of Service must be included with each filed document.

2.1.2 Public Reference File

The NYCDEP will maintain a public reference file at its corporate office located at 59-17 Junction Boulevard, 19th Floor, Flushing, NY 11373. The public reference file is a compilation of important materials pertaining to the licensing proceeding for the Project. It includes background reference material, the consultation record, relevant studies and data collected during the development of the PAD, meeting summaries, notices, reports, and other Project-related documents. Hard copies of the PAD and other filings are available upon request.

2.2 Communications Protocols

2.2.1 Document Distribution

The NYCDEP will distribute, whenever possible, all documents electronically in PDF format. The NYCDEP may distribute hard copies of some documents for convenience or by request.

2.2.2 Providing Documents to the NYCDEP

NYCDEP prefers to receive all documents electronically, in an appropriate Microsoft Office format. Email electronic documents to Zinnia Rodriguez at zinniar@dep.nyc.gov, with copies to Kevin Lang at klang@couchwhite.com and Thomas Sullivan at tsullivan@gomezandsullivan.com. Hard copy documents may be mailed to Zinnia Rodriguez at 59-17 Junction Boulevard, 19th Floor, Flushing, NY 11373. In either case, all documents received become part of the consultation record and will be available for distribution to the public.

2.2.3 Meetings

The NYCDEP recognizes there are a number of agencies, groups, and individuals that may want to participate in the licensing process for the Project. The NYCDEP will work with all Interested Parties to develop meeting schedules that include locations and times which accommodate the majority of participants. FERC Scoping meetings will be publicly noticed and include at least one evening meeting. The NYCDEP will notify all Interested Parties at least two weeks in advance of each planned public meeting. The NYCDEP will provide a meeting agenda with each public notice.

2.2.4 Study Requests

In the development of the PAD, the NYCDEP collected and summarized the information available regarding the Project and its environmental setting. The PAD, however, may also indicate areas where there is limited or no information related to areas of potential critical concern. In those cases, Interested Parties may request additional studies or investigations to add to the information available about the Project. The Commission requires specific information from parties requesting studies. Draft study requests should follow the following format, which is based on Section 5.9(b) of the Commission's regulations, 18 CFR §5.9(b):

- Describe the goals and objectives of each study proposal and the information to be obtained;
- If applicable, explain the relevant resource management goals of the agency(ies) or Indian tribe(s) with jurisdiction over the resource to be studied;

- If the requestor is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- Describe existing information concerning the subject of the study proposal, and the need for additional information;
- Explain any nexus between Project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate filed season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge; and
- Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs. The requestor should also describe any available cost-share funds or in-kind services that the sponsor of the request may contribute towards the study effort.

Requestors should provide their draft study requests to the NYCDEP in the manner described in Section 2.2.2, above.

2.3 Proposed Schedule

The proposed schedule below is based on the FERC granting the City's request to utilize the TLP for this Project. However, if FERC does not grant the City's request to use TLP, the default Integrated Licensing Process (ILP) will be followed. Listed below is the proposed licensing schedule using the TLP, and if FERC does not grant the TLP, a proposed schedule for the ILP.

NOTE: More meetings than those listed below for both the TLP and ILP will likely occur to help expedite the process and enhance the level of consultation with the Interested Parties. Also note that both schedules assume one field season as a three-year permit does not allow for a second field season.

Proposed Schedule for TLP:

Responsible Party	License Application Schedule Milestone	Date
First Stage of Consultation		
City	Filing of NOI, PAD, and request to use the TLP	Aug 2009
FERC	Notice, Comments on use of TLP	Oct 2009
NYCDEP	Notification of Joint Meeting, Written Notice in Paper • *notice issued 15 days prior to Joint Meeting*	Nov 2009
NYCDEP, Stakeholders	Joint Meeting(s) • *to be held within 30 days, or no longer than 60 days after either issuing the PAD or obtaining approval from FERC to use the TLP* NOTE: If TLP is granted, NYCDEP must record the meeting(s).	Nov 2009
Stakeholders	Submit comments on PAD, Submit Study Requests	Dec 2009

Responsible Party	License Application Schedule Milestone	Date
	• *due within 60 days of Joint Meeting*	
NYCDEP	Develop study plans and circulate	Jan 2010
NYCDEP, Stakeholders	Meeting with Stakeholders to discuss study plans	Feb 2010
NYCDEP	Finalize study plans and circulate	Mar 2010
Second Stage of Consultation		
NYCDEP	Conduct Field Studies	Summer 2010
NYCDEP	Submit Draft License Application	Sep 2011
Stakeholders	Comments on proposal and additional studies • *due within 90 days of filing the Draft License Application*	Nov 2011
Stakeholders	Joint Meeting (if necessary) • *needed if there are disagreements* • *to be held within 60 days of the Disagreeing Parties Written Notice*	Feb 2012
NYCDEP	Notify FERC of Joint Meeting • *notice issued at least 15 days prior to Joint Meeting*	Feb 2012
NYCDEP	Submit Final License Application	Mar 2012
Third Stage of Consultation		
Stakeholders	Additional Study Requests	TBD
FERC	FERC Review, Deficiencies Resolved, Acceptance Letter, Intervention Notice	TBD
Stakeholders	Comments and Interventions Due	TBD
FERC	Scoping Document 1 Issued	TBD
Stakeholders	National Environmental Policy Act Scoping, Public Meetings	TBD
Stakeholders	Comments due on Scoping	TBD
FERC	FERC issues Additional Information Requests	TBD
NYCDEP	Additional Information Requests Field and Reviewed	TBD
FERC	Ready for Environmental Assessment	TBD
NYCDEP, Stakeholders	Comments, Final Conditions and Apply for 401 Water Quality Certification	TBD
FERC	FERC Issues Draft Environmental Assessment	TBD
Stakeholders	Comments	TBD
FERC	FERC Issues Final Environmental Assessment	TBD
FERC	Licensing Decision	TBD

Proposed Schedule for ILP

Responsible Party	Activity	Timeframe and Regulations	Deadline
NYCDEP	Filing of NOI and PAD	18 CFR § 5.5, 5.6	Aug 2009
FERC	Initial Tribal Consultation Meeting	18 CFR § 5.7	Sep 2009
FERC	Commission notices NOI/PAD and issues Scoping Document 1	Within 60 days of filing NOI & PAD 18 CFR § 5.8	Oct 2009
FERC	Commission holds Scoping Meetings/Site Visit	Within 30 days of NOI & PAD notice & issuance of SD1 18 CFR § 5.8(b)(viii)	Nov 2009
All Stakeholders	Comments on NOI, PAD, SD1, and Study Requests	Within 60 days of NOI & PAD notice & issuance of SD1 18 CFR § 5.9	Dec 2009
NYCDEP	Proposed Study Plan	Within 45 days following the deadline for filing comments on SD1 18 CFR § 5.11(a)	Feb 2010
FERC	Issue Scoping Document 2 (if necessary)	Within 45 days following the deadline for comments on SD1 18 CFR § 5.10	Feb 2010
NYCDEP	Study Plan Meeting(s)	Within 30 days of deadline for filing proposed Study Plan 18 CFR § 5.11(e)	Mar 2010
All Stakeholders	Comments on Proposed Study Plan	Within 90 days after Proposed Study Plan is filed 18 CFR § 5.12	May 2010
NYCDEP	Revised Study Plan (if necessary)	Within 30 days of deadline for comments on Proposed Study Plan 18 CFR § 5.13(a)	Jun 2010
All Stakeholders	Comments on Revised Study Plan	Within 15 days following Revised Study Plan 18 CFR § 5.13(b)	Jun 2010
FERC	Director's Study Plan Determination	Within 30 days following Revised Study Plan 18 CFR § 5.13(c)	Jul 2010
Stakeholders, FERC, NYCDEP	*Formal Study Dispute Resolution Process (if necessary)*	Initiated within 20 days of Study Plan Determination 18 CFR § 5.14	Jul 2010
NYCDEP	First Study Season (assume one field season)	18 CFR § 5.15(a)	Spring/Summer 2010
NYCDEP	Initial Study Report	365 days from Study Determination 18 CFR § 5.15(c)(1)	Jul 2011
All Stakeholders	Initial Study Report Meeting	Within 15 days from Initial Report 18 CFR § 5.15(c)(2)	Jul 2011
NYCDEP	Initial Study Report Meeting	Within 15 days of Study Results	Aug 2011

Responsible Party	Activity	Timeframe and Regulations	Deadline
	Summary	Meeting 18 CFR § 5.15(c)(3)	
NYCDEP	File PLP or Draft License Application	No later than 150 days before final application is filed 18 CFR § 5.16(a)	Oct 2011
All Stakeholders	Comments on Applicant's Preliminary Licensing Proposal, Additional Information Requests (if necessary)	Within 90 days of filing PLP or draft license application 18 CFR § 5.16(e)	Jan 2012
NYCDEP	License Application Filed	18 CFR § 5.17	Mar 2012

3.0 PROJECT LOCATION, FACILITIES, AND OPERATION

3.1 Project Locations

3.1.1 Gilboa Dam (Schoharie Development)

The Gilboa Dam is located on the Schoharie Creek at 42°23’28.82” N, 74°26’58.03” W in the Town of Gilboa, Schoharie County, New York (see Figure 3.1.1-1). The impoundment, known as the Schoharie Reservoir, is approximately six miles long, has a storage capacity of approximately 58,800 acre-feet, a surface area of 1,150 acres at the spillway crest elevation of 1,130 feet above mean sea level (“msl”), and a mean depth of approximately 57 feet.

3.1.2 Cannonsville Dam (Cannonsville Development)

The Cannonsville Dam is located on the West Branch of the Delaware River at 42°03’52.74” N, 75°22’26.26” W in the Town of Deposit, Delaware County, New York (see Figure 3.1.2-1). The impoundment, known as the Cannonsville Reservoir, is approximately 12 miles long and has a normal storage capacity of 300,000 acre-feet, a surface area of 4,800 acres at a spillway crest elevation of 1,150 feet above msl, and a mean depth of approximately 61 feet.

3.1.3 Downsville Dam (Pepacton Development)

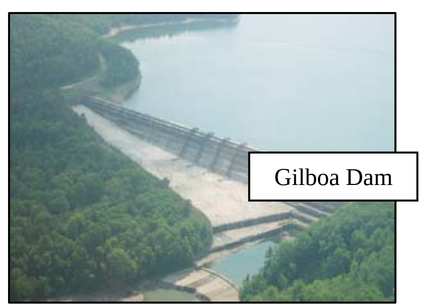
The Downsville Dam is located on the East Branch of the Delaware River at 42°04’29.49” N, 74°57’56.86” W in the Town of Downsville, Delaware County, New York (see Figure 3.1.3-1). The impoundment, known as the Pepacton Reservoir, is approximately 18 miles long, has a normal storage capacity of 441,000 acre-feet, a surface area of 5,700 acres at the spillway crest elevation of 1,280 feet above msl, and a mean depth of 67 feet. By volume (140.2 billion gallons), the reservoir is the largest of the City’s water supplies.

3.1.4 Neversink Dam (Neversink Development)

The Neversink Dam is located on the Neversink River, the longest tributary to the Delaware River, at 41°49’20.92” N, 74°38’30.49” W in the Town of Neversink, Sullivan County, New York (see Figure 3.1.4-1). The impoundment, known as the Neversink Reservoir, is approximately five miles long, has a normal storage capacity of 112,000 acre-feet, a surface area of 1,477.8 acres at the spillway crest elevation of 1,440 feet above msl, and a mean depth of 72 feet.

3.2 Project Facilities

The NYCDEP is conducting pre-feasibility studies, which are expected to be completed by the fall of 2009, at all four development sites. The proposed facilities described below are subject to modification based on the results of those and other studies and analyses described herein. Each of the “proposed facilities” sections include alternatives that are being considered at this juncture. The footprint of the civil works associated with each of the development sites is generally the same for all alternatives and total downstream releases are consistent with current NYCDEP water management practices. For most of the development sites, the



difference between alternatives involves the means of water conveyance and/or the number, size, and type of turbines.

3.2.1 Schoharie Development

Construction of the Gilboa Dam was completed in 1926. It is a mixed earthen, cyclopean concrete, and masonry dam approximately 2,273 feet long and 183 feet high with an overflow spillway to Schoharie Creek.

Spillway

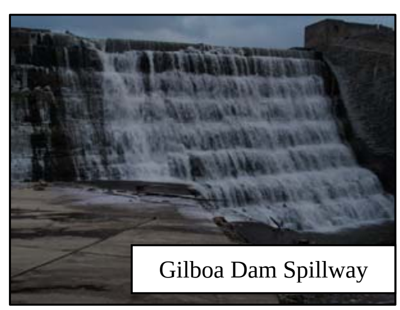
The dam is orientated in an east-west direction. The spillway is constructed of Cyclopean masonry and faced with cut stone (see photo). The spillway is 1,326 feet long with a crest elevation of 1,130 feet above msl.

Dam Reconstruction

After nearly 80 years of service, the Gilboa Dam and its appurtenances started to show signs of deterioration and needed reconstruction to extend its service life and to meet current NYSDEC Dam Safety Guidelines. In November of 2005, engineering analyses indicated that the structural stability of the spillway did not meet NYSDEC dam safety guidelines for existing concrete dams. Thus, in 2005-2006, modifications were made to the Gilboa Dam to improve its structural stability. The stabilization project consisted of the following four main stages to reinforce the dam while increasing its discharge capacity:

- A debris boom was added across the Schoharie Reservoir to keep debris off the dam (completed December 2005).
- A rectangular spillway notch was cut (5.5 feet deep x 220 feet long) in the spillway crest aligned with the plunge area to lower water levels, decrease pressure on the dam, and reduce the likelihood that water levels could rise to the point where the stability of the dam would be threatened (completed February 2006).
- Four siphons were temporarily installed over the dam to increase the amount of water that could be drained from the reservoir (completed March 2006).
- Eighty post tensioned anchoring cables were installed through the top and front of the dam. The cables were placed through holes drilled in the dam and down into solid bedrock beneath. They were then anchored in place and tightened, creating an anchoring system that will help to hold the dam in place (completed December 2006).

Further dam rehabilitation efforts are slated for 2009 and will include installation of inflatable crest gates,[2] rehabilitation and reconfiguration of the spillway steps, repairs to the side channel floor, extension of the west training wall and installation of a low level outlet, as well as several other repairs and improvements. This effort is expected to last through 2014. Given this, development of hydroelectric facilities at Gilboa



Gilboa Dam Spillway

[2] The inflatable crest gate will allow the reservoir to be drawn down from full pond (elevation 1,130 feet) to elevation 1,125 feet.

Dam would best be accomplished as a coordinated component of this rehabilitation effort.

Water Supply Withdrawals

Water withdrawals for Schoharie Reservoir occur via a diversion through the Shandaken Tunnel. The Shandaken Tunnel Intake is situated approximately three miles south (upstream) of the dam. The Shandaken intake can also be used to dewater the upper portion of Schoharie Reservoir (to elevation 1,050 feet based on the original construction). The 18-mile long tunnel connects Schoharie Reservoir to the Upper Esopus Creek. Withdrawals from the Schoharie Reservoir are made via a rock-cut channel that carries water into the Shandaken Tunnel Intake Chamber, where it flows into the Shandaken Tunnel. The water flows through the tunnel by means of gravity before discharging into Upper Esopus Creek. Once delivered, the water is carried by Esopus Creek for an additional 12 miles southeast into Ashokan Reservoir. From Ashokan Reservoir, water is transported to New York City via the Catskill Aqueduct, under the Hudson River, and is typically first released into the Kensico Reservoir located in Westchester County approximately 100 miles from the Schoharie Reservoir. The Schoharie Reservoir provides on-average 14% of the City's drinking water supply.

Outlet Works

There is a low-level outlet that discharges to the stilling pool located below the spillway section of the dam. Since the 1960s, the outlet has not been operated due to the accumulation of sediment over the inlet pipe in the reservoir (the inlet pipe is located upstream of the dam). In addition, the valving located in the gate control chamber just west of the spillway is in questionable condition. Therefore, new outlet works have been included in the proposed Gilboa Dam reconstruction project to facilitate reservoir drawdown as needed to suitably respond to dam safety emergencies and to allow for periodic maintenance of the dam.

Discharges from Gilboa Dam are, or will be, accomplished via the following conveyance structures:

- An approximately 220-foot-long by 5.5-foot-high notch cut in the dam spillway. The notch was cut to lower water levels to permit work on other sections of the dam. In the future, inflatable crest gates will be added to the notch to allow the reservoir to be drawn down to elevation 1,125 ft.
- A 1,326-foot long spillway with a crest elevation of 1,130 feet.
- The four siphons added in March 2006, which are temporary and will eventually be removed.
- A new low-level outlet, which is currently under evaluation, to permit further lowering of the reservoir water level. A preliminary invert elevation for the low level outlet is in the range of 980 to 1,000 feet.

Proposed Facilities

The proposed hydroelectric plant will receive water from a branch off the proposed low-level outlet from the reservoir to the Schoharie Creek. This low-level outlet is in the advanced planning stages with additional geotechnical investigations currently underway to select a final route. The current plan calls for the low-level outlet to be 120 inches in diameter (a 108 inch diameter outlet is also being evaluated) and consist of a combination of tunnel and pressure pipe. However, an alternative approach of constructing two smaller diameter tunnels is still being investigated.

Based on preliminary evaluations, the hydroelectric plant would be fed by a 120-inch by 120-inch wye, which would be trifurcated to provide separate penstocks leading to three turbines. A 10-foot-diameter control valve would be installed in the main line downstream of the wye. Each of the three units would be fitted with a butterfly valve designed to close against flow upstream of the unit.

The hydroelectric facility will provide a degree of redundancy to the new outlet works. Either the main discharge valve or the turbines may be utilized to discharge flow, thereby allowing maintenance at the other facility. The three separately valved turbines will provide up to 1,050 cubic feet per second ("cfs") of release capacity.

Each of the three units will have a rated flow of 350 cfs (total capacity of 1,050 cfs) at 158 feet of head and will operate at 360 rotations per minute (rpm). The lowest flow that one unit could operate is approximately 40% of 350 cfs or 140 cfs for a powerhouse flow range of 140 to 1,050 cfs. Each unit will produce 4.3 MW for a total station capacity of 12.9 MW. The turbine-generator units will be contained within a reinforced concrete powerhouse. A tailrace will be excavated within the river to accept discharge from the units.

The following figures show the site plan, powerhouse plan, and profile through the proposed hydropower facilities.

Figure 3.2.1-1: Schoharie Development Site Plan
Figure 3.2.1-2: Schoharie Development Powerhouse Plan
Figure 3.2.1-3: Schoharie Development Profile Through Turbines

A map of the proposed Project boundary for the Schoharie Development is shown in Figure 3.2.1-4.

Proposed Transmission Facilities

A switchyard including a step-up transformer will be constructed. An interconnection study will be commissioned to analyze the manner in which the units will be interconnected to the electric grid. Presently, it is anticipated that the units will be connected via an overhead transmission line to an existing 115 kV transmission line located within 15,000 feet of the powerhouse. Easements and/or rights-of-way will be acquired to allow construction and maintenance of those sections of the transmission line that are not located on City property. A preliminary single-line diagram of the interconnection is shown in Figure 3.2.1-5.

3.2.2 Cannonsville Development

The Cannonsville Dam was placed into service in 1964 for the purpose of providing water supply to New York City. It is the most recently constructed City-owned reservoir. The dam is a zoned earthen embankment with a 2,800-foot-long, 45-foot-wide crest rising 175 feet above the valley floor to an elevation of

1,175.0 feet above msl. The dam is orientated in a north-south direction and is formed by two embankment sections.

Spillway

The spillway (ungated), located at the right abutment on the north side of the valley, is a stone masonry side channel spillway (see photo). The overflow weir is a two-section split-level spillway with a total length of 800 feet. The lower section is 240 feet long with a crest elevation of 1,150 feet above msl. The upper section is 560 feet long with a crest elevation of 1,158.1 feet above msl.

Water Supply Withdrawals

The City's water supply withdrawal is drawn through a chamber consisting of a set of intakes located on the southern shoreline of the Cannonsville Reservoir. The West Delaware Tunnel conveys water from the Cannonsville Reservoir to the Rondout Reservoir. From Rondout Reservoir, the water is delivered to the City via the Delaware Aqueduct.

Outlet Works

Low-level outlet works provide conservation releases to the West Branch of the Delaware River downstream of the dam and are located in a separate chamber at the southerly end of the dam (see photo). Conservation releases are made through a concrete intake structure and then through a 17.6 foot diameter concrete diversion conduit that necks down to a 11'-11" release water conduit. The invert elevation of the outlet works is at elevation 999 feet. The diversion conduit is located on the south side of the valley under the dam and carried the river flow during dam construction. It is 1,280 feet long and terminates in a stilling pool that discharges into the river. A concrete plug was placed toward the end of construction to stop flow through this conduit at the gate tower. At this point, flow is diverted upward to an 11.9-foot-diameter release water conduit located immediately above the 17.5-foot-diameter conduit. A concrete gate tower rises above the diversion conduit through the embankment just upstream of the dam centerline. Two Broome-type wheel gates, gate frames, and guides were installed in the gate tower. These gates are used to control water entering the release water conduit, which is constructed on top of the abandoned stream diversion conduit, from the gate tower to the release water chamber. The release water conduit, an 11.9-foot-diameter cement mortar-lined steel pipe encased in reinforced concrete, terminates in an 8.8-foot-diameter manifold. The manifold feeds five primary release lines, ranging in size from 54 to 60 inches in diameter, and three smaller release lines, ranging in size from 12 to 18 inches in diameter. Flow control is achieved through selectively opening or closing various lines. Three primary release lines are each controlled by two dow-pivot 60-inch valves. The other two primary release lines are each controlled by a dow-pivot valve and a polyjet valve.

All lines terminate with an orifice plate downstream of the valves. Discharges are directed into a downstream stilling pool. Equipment can be moved into the valve chamber by removing concrete roof slabs, which are presently covered with sod.

Proposed Facilities

The proposed hydroelectric plant will include a new powerhouse at or adjacent to the Cannonsville Dam and four turbine-generator units with a total flow capacity of 1,130 cfs. Three of the turbines will be identical; each having a hydraulic capacity of 350 cfs, and the fourth will be a unit having a hydraulic capacity of 80 cfs. The smaller unit may operate at 40% of 80 cfs or approximately 32 cfs for a powerhouse flow range of 32 to 1,130 cfs. The larger units will have a rated capacity of 3,750 kW each and the smaller unit will be rated at 850 kW, for a total rated capacity output of 12.1 MW.

This option includes constructing a 78-inch-diameter steel penstock that would connect directly to the existing 78-inch-diameter blind flange on the end of the water release manifold. The penstock, at an elevation of 1,005 feet above msl, will exit through a brick wall perpendicular to the existing discharge lines.

Within the powerhouse, a 36-inch-diameter branch will serve the small turbine and beyond this point the 78-inch-penstock will be reduced to 72 inches in diameter and will turn 90 degrees to serve one of the large turbines.

A tap into the 11.9-foot-diameter conduit will be made upstream of the existing release water chamber to provide a second penstock 102 inches in diameter (or larger) to provide flow to the remaining two turbines.

Each branch serving each turbine will be fitted with a butterfly valve designed for closure under flow for emergency purposes due to wicket gate or Broome gate failure, as well as closure for routine maintenance.

The powerhouse will be located north and directly next to the existing release water chamber at the toe of the dam. The powerhouse will occupy an area of approximately 125 feet by 55 feet and will contain the turbine/generator units. The powerhouse floor will be at an elevation of 999 feet above msl and the roof will be at an elevation of 1,027 feet above msl, which affords the same level of protection against flooding provided by the existing structure. The centerline of the units is at an elevation of 1,005 feet above msl with the minimum tailwater at an elevation of about 1,000 feet above msl. The powerhouse will consist of reinforced concrete construction with removable hatches in the roof for equipment access. A stairway will be installed on the south wall of the powerhouse for personnel access.

The turbines will be horizontal-shaft, with Francis-type runners, each in a pressure case. The three larger turbines will have 4-foot (1,220 mm) runner diameters operating at 720 rpm and the smaller unit will have a 1.9-foot (580 mm) runner diameter and will operate at 360 rpm. The centerline of all turbine/generators will be at an elevation of 1,005.0 feet. The turbines will be direct-connected to synchronous generators, three-phase, and 60 hertz (Hz).

Discharge from the turbines will be released through steel draft tubes into separate concrete chambers beneath the powerhouse floor. The water from these chambers then will be discharged into the common tailrace channel. The release chambers and the outside walls of the powerhouse will be founded on rock. Bulkhead slots will be provided outside of the draft tube openings to enable bulkheads to be placed and the draft tube sections to be dewatered for maintenance.

The addition of the turbines will supplement and enhance the redundancy of the existing release water facilities in that additional options for release of water into the West Branch of the Delaware River will be available. The four separately valved turbines will provide up to 1,130 cfs of additional release capacity. The proposed design of these release works will facilitate compliance with temperature requirements mandated by conservation releases because cold water will be drawn from the lower portion of the water column.

An open channel tailrace will be excavated next to and parallel with the existing stilling basin retaining wall to enable powerhouse discharge to flow into the West Branch of the Delaware River. The invert of the channel will be at an elevation of 986 feet above msl and extend horizontally some 30 feet downstream from the powerhouse. From elevation 986 feet above msl, the channel bottom rises at a 10:1 slope until it matches the existing river bottom at an elevation of about 1,000 feet above msl. The channel bottom will be 110 feet wide with side slopes at 2:1 gradient.

The powerhouse will contain electrical equipment for control, operation, and protection of the powerhouse and generation units. Major equipment placement and subsequent removal for servicing will be performed using a mobile crane operating from the surface through the hatches.

The four generators will be connected to a single three-phase power transformer. The transformer and switchyard area will be located at elevation 1,027 feet adjacent to the north wall of the powerhouse. Access to the powerhouse and switchyard area will be provided by an existing roadway that leads off of State Route 10. The roadway provides access to the existing release water chamber and to the dam and spillway crest. The portion of the roadway leading to the release water chamber will be widened in the area immediately behind the proposed powerhouse to provide permanent access to the powerhouse and switchyard. The following figures show the site plan, powerhouse plan, and profile through the proposed hydropower facilities.

Figure 3.2.2-1: Cannonsville Development Site Plan
Figure 3.2.2-2: Cannonsville Development Powerhouse Plan
Figure 3.2.2-3: Cannonsville Development Profile Through Turbines

A map of the proposed project boundary for the Cannonsville Development is shown in Figure 3.2.2-4.

An additional option will be evaluated as part of a feasibility study. This includes constructing siphons that would convey water from the Cannonsville Reservoir to the powerhouse. Further exploration of this option will involve determining if the siphons have sufficient lift and whether the core wall of the earthen dam would be penetrated. If analysis shows that penetration of the core walls is needed, the siphon option will be eliminated due to dam safety practices.

Proposed Transmission Facilities

The Cannonsville Dam hydroelectric power generating facility is located in the NYSEG service territory. An existing 46 kV transmission line was identified as the point of interconnection. The transmission line is part of the existing NYSEG electrical distribution system that crosses the West Branch of the Delaware River downstream of the dam. The connection between the power station and transmission line will be made by constructing approximately 750 feet of 46 kV, three-phase overhead transmission line. The proposed transmission line route is shown on the site plan and will be on land owned by the City.

The transmission line will be of wooden pole-type using steel reinforced aluminum conductors. At each end of the line, switching and protective equipment will be provided. These will be constructed in accordance with NYSEG technical standards. A preliminary single-line diagram of the interconnection is shown in Figure 3.2.2-5.

3.2.3 Pepacton Development


Pepacton Reservoir and Spillway

The Pepacton Project was placed into service in 1954. The Pepacton Reservoir is a zoned earth embankment structure with a concrete core wall and an embankment height of 204 feet. The concrete core wall is founded on rock and was constructed to elevation 1,130 feet above msl in the center portion of the dam and slopes up to an elevation of 1,280 feet above msl at the top of the abutments. The dam is approximately 2,450 feet long with a maximum height of 204 feet. The top width of the dam is approximately 45 feet and the bottom width is approximately 2,000 feet.

Spillway

Downsville Dam Spillway


The major spillway is located near the north end of the dam. It is an uncontrolled side channel spillway with an ogee crest (see photo). The channel discharges into a 40-foot-diameter concrete-lined tunnel. The crest of the weir is approximately 800 feet long and the tunnel is approximately 1,530 feet long. The spillway crest is at an elevation of 1,280 feet above msl.

There is an above-ground emergency spillway channel located directly above the 40 foot diameter spillway tunnel adjacent to the northerly abutment, leading from the side channel spillway to the stilling basin. The purpose of the emergency spillway channel is to provide additional conveyance capacity to match the spillway capacity. When the spillway operates, water is first conveyed downstream through the tunnel. Once the tunnel fills, water spills into the above-ground emergency channel and is carried downstream.

Water Supply Withdrawals

Water supply withdrawals are directed to the East Delaware Tunnel through an intake located approximately 3.5 miles from the dam on the south shoreline of the reservoir. The East Delaware Tunnel conveys water from the Pepacton Reservoir to the Rondout Reservoir. From the Rondout Reservoir, water is delivered to the City via the Delaware Aqueduct. Water discharged through the East Delaware Tunnel is used to generate hydroelectric power at a station owned by the City and operated by the New York Power Authority.

Outlet Works

Water can be directed to the channel downstream (East Branch of the Delaware River), which eventually meets the main stem of the Delaware River. The concrete-lined tunnel is part of what was the diversion tunnel during construction. After entering the old diversion tunnel, water flows through the regulating works and returns to the diversion tunnel downstream of a diversion tunnel plug. In effect, the regulating works bypasses the diversion tunnel plug. The total horizontal length of the water conductors used to bypass the tunnel plug is approximately 520 feet.

An 8-foot-diameter tunnel approximately 140 feet long carries water from the diversion conduit to the valve chamber. Before entering the chamber, the 8-foot-diameter tunnel bifurcates into two 5-foot-diameter tunnels. Each tunnel connects to a short pipeline, a butterfly valve, a venturi, a cone valve, and a polyjet valve. Each line discharges into circular stilling chambers that are maintained full of water due to the presence of a siphon at the end of each chamber. There is also a 20-inch conservation release line running from a tee in the north conduit into the north stilling chamber. This arrangement allows operation of one release line without affecting the adjacent release line, which could be taken out of service and dewatered. The siphons located at the end of each stilling chamber join together to form a common 8-foot-diameter tunnel. This tunnel exists above the spring line of what was once the diversion tunnel and is presently the spillway tunnel.

The intake elevation of the diversion tunnel is approximately 1,100 feet above msl.

Proposed Facilities

Two generating units, one at 80 cfs and one at 190 cfs (total hydraulic capacity of 270 cfs) will be installed in a new chamber to be constructed under the existing valve chamber.

This option includes constructing new inlet and discharge waterways using tunneling methods to provide water from the existing tunnel. The supply tunnel will be 5.5 feet in diameter and approximately 90 feet long. Upstream of the powerhouse, the tunnel will be steel-lined and the pipe inside the powerhouse will tee with a 36-inch-diameter pipe branching off to serve the smaller unit and the primary pipe reduced to a 54-inch-diameter pipe to serve the larger unit.

The discharge from the turbines will be carried by a new 5.5-foot-diameter tunnel, approximately 100 feet long, connecting to the existing release water tunnel above and the existing stilling basins located downstream of the existing release water valves. The proposed design of these release works will facilitate compliance with temperature requirements mandated by conservation releases because cold water will be drawn from the lower portion of the water column.

The 80 cfs and 190 cfs turbines will be horizontal-shaft with Francis-type runners with diameters of 1.9 feet (580 mm) and 2.9 feet (885 mm), respectively, ,each in a pressure case. The lowest flow to safely spin the 80 cfs turbine is approximately 32 cfs (or 40% of 80 cfs). The turbines will be direct-connected to synchronous generators, three phase, 60 Hz, which will have a combined rated capacity of 3.1 MW. Operating speeds for the 80 cfs and 190 cfs turbines will be 720 rpm and 514 rpm, respectively.

Each branch serving the two turbines will be fitted with a butterfly valve designed to close under flow.

Access to the powerhouse and switchyard area will be provided by an existing roadway. The roadway provides access to the existing release water chamber and to the dam and spillway crest. The following figures show the site plan, powerhouse plan, and profile through the turbines for the proposed hydropower facilities.

Figure 3.2.3-1: Pepacton Development Site Plan
Figure 3.2.3-2: Pepacton Development Powerhouse Plan
Figure 3.2.3-3: Pepacton Development Profile Through Turbines

A map of the proposed project boundary for the Pepacton Development is shown in Figure 3.2.3-4.

Additional options will be evaluated as part of a feasibility study. These options include a siphon arrangement with a powerhouse located in the vicinity of the existing outlet channel as well as replacing one of the existing valves in the valve chamber with a turbine. Further exploration of the siphon option will involve determining if the siphons have sufficient lift and whether the core wall of the earthen dam would be penetrated. If analysis shows that penetration of the core walls is needed, the siphon option will be eliminated due to dam safety practices.

Proposed Transmission Facilities

A switchyard including a step-up transformer will be constructed. NYSEG provides electric service to the development site via three-phase, 4.8 kV, primary distribution facilities, and, at present, the City anticipates interconnecting the generating units to these distribution facilities. The City will commission an interconnection study to analyze and determine the manner in which the units will be interconnected to the electric grid. A new overhead interconnection line with a length of approximately 50 feet will be constructed.

A preliminary single-line diagram of the interconnection is shown in Figure 3.2.3-5.

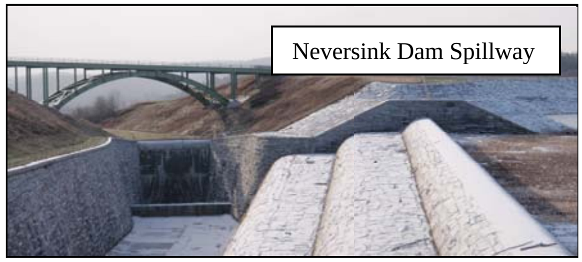
3.2.4 Neversink Development

The Neversink Project was placed into service in 1953. The dam is an earth embankment with a concrete cutoff wall. The concrete cutoff wall is founded on rock and extends from the rock foundation up to an elevation 110 feet below the top of the dam near the abutments. The structure is approximately 2,830 feet long and 195 feet high.

Neversink Reservoir

Spillway

The major spillway is located near the northeast end of the dam and is an uncontrolled side channel spillway with an ogee crest. The side channel discharges into a 30-foot-diameter concrete-lined tunnel. The crest of the waste weir is approximately 600 feet long, and the tunnel is approximately 1,435 feet long. The spillway elevation is 1,440 feet above msl, making it the highest City-owned reservoir.


Neversink Dam Spillway

The concrete-lined tunnel is part of what was once the diversion tunnel that was used during construction. The tunnel passes adjacent to the northeast abutment of the dam and is surrounded entirely by rock. A short inclined tunnel traverses from the spillway channel to the diversion tunnel. After the spillway, an inclined connecting tunnel was constructed; the diversion tunnel was plugged with concrete just upstream of the intersection with the inclined spillway tunnel and the diversion tunnel. The tunnel then leads to a stilling basin located on the east side of the river channel downstream from the dam.

An above-ground emergency spillway channel was excavated adjacent to the northeasterly abutment, leading from the side channel spillway to the stilling basin. The purpose of the emergency channel is to provide additional conveyance capacity to match the spillway weir capacity. When the spillway operates, water is first conveyed downstream through the tunnel. When the tunnel capacity is exceeded, the excess discharge spills into the above-ground channel and is carried downstream. The emergency channel is spanned by a steel arch bridge which carries State Route 55 across the channel to the dam (pictured above).

Water Withdrawals and Outlet Works

Water is withdrawn from the impoundment and is directed either through the Neversink Tunnel for water supply or through control valves and passed downstream. The intake works for both facilities are located north of the spillway weir. The intake works consist of a long submerged intake channel, a surface gatehouse structure, an intake structure, and control works. Water discharged through the Neversink Tunnel is used to generate hydroelectric power at a station owned by the City and operated by the New York Power Authority.

Releases made to the channel downstream of the Neversink Dam are controlled by three regulating valves located in an underground vault adjacent to the intake. Water that is withdrawn for release downstream is taken from a location at the bottom of the intake structure, upstream from the four-level opening arrangement for the tunnel. The intake elevation for water released to the Neversink River is 1285 feet above msl.

Water is withdrawn from the right side of the right intake through a short vertical shaft. The vertical shaft, open to the surface and serving as a maintenance shaft, leads a short distance down to a forebay. From the forebay, the water enters three regulating release lines (two with 36-inch diameters and one with a 12-inch diameter). The centerline of the large regulating conduits is at an elevation of 1,289 feet above msl. Each regulating line is equipped with a venturi meter, a cone valve, and a needle valve for flow regulation. The lines are located in an underground gate chamber approximately 25 feet in diameter. Each release line discharges into a circular stilling chamber that is approximately eight feet in diameter and 45 feet long. At the end of each chamber there is an arch-shaped gooseneck conduit. The conduits join together in a larger common tunnel. This arrangement allows operation of one release line without affecting the adjacent release line which could be taken out of service and dewatered. The tunnel flows to the spillway discharge tunnel discussed previously.

Proposed Facilities

The proposed hydroelectric generating facility at Neversink will include a new powerhouse located adjacent to the discharge from the 30-foot-diameter tunnel. The powerhouse will be a reinforced concrete structure approximately 40 feet by 75 feet in plan view.

This option would convey water to the powerhouse through an extension of the existing release water tunnel. The existing release water discharge tunnel to the 30-foot-diameter diversion tunnel will be plugged and a new 7-foot-diameter tunnel will start near this point and extend downstream approximately 700 feet to the new powerhouse. The new tunnel will run approximately parallel to the existing diversion tunnel, a design that will facilitate compliance with temperature requirements mandated by conservation releases because cold water will be drawn from the lower portion of the water column.

Two new turbine-generator units will be provided at the powerhouse and valved bypasses for each will be provided to maintain the release water discharge capacity if the turbines are out of service. Each turbine will have a flow capacity of 80 cfs for a total hydraulic capacity of 160 cfs, and a rating of 825 kW for a total rated capacity of 1.65 MW. The lowest turbine flow setting would be approximately 32 cfs or 40% of 80 cfs for a powerhouse flow range of 32-160 cfs. The turbines will be horizontal Francis units with runner diameters of 1.9 feet (580 mm). Each branch serving the two turbines will be provided with a butterfly valve designed to close under flow. The turbines will be directly connected to synchronous generators, three-phase, 60 Hz. Discharge from the turbines will be released through steel draft tubes into a tailrace to be constructed adjacent to the existing diversion tunnel outlet channel.

The hydroelectric turbine bypass valves will duplicate the configuration within the existing release water chamber. This will enhance the redundancy of the existing outlet works as well as providing the benefits of generating power through the turbines. The turbines will provide an additional release capacity of approximately 160 cfs.

The following figures show the site plan, powerhouse plan, and profile through the proposed hydropower facilities.

Figure 3.2.4-1: Neversink Development Site Plan
Figure 3.2.4-2: Neversink Development Powerhouse Plan
Figure 3.2.4-3: Neversink Development Profile Through Turbines

A map of the proposed project boundary for the Neversink Development is shown in Figure 3.2.4-4.

An additional option will be evaluated as part of a feasibility study. This includes constructing siphons that would convey water from the Neversink Reservoir to the powerhouse. Further exploration of this option will involve determining if the siphons have sufficient lift and whether the core wall of the earthen dam would be penetrated. If analysis shows that penetration of the core walls is needed, the siphon option will be eliminated due to dam safety practices.

Proposed Transmission Facilities

A switchyard including a step-up transformer will be constructed. NYSEG provides electric service to the development site via three-phase, 4.8 kV, primary distribution facilities, and, at present, the City anticipates interconnecting the generating units to these distribution facilities. The City will commission an interconnection study to analyze and determine the manner in which the units will be interconnected to the electric grid. A new overhead interconnection line with a length of approximately 2,400 feet will be constructed.

A preliminary single-line diagram of the interconnection is shown in Figure 3.2.4-5.

3.3 Project Location and Lands

There are no lands of the United States within the proposed Project boundary of any of the four developments.

There are no known areas within or in the vicinity of the proposed Project boundaries of any of the four developments that are included in or have been designated for study for inclusion in the National Wild and Scenic Rivers System or the National Trails System.

As depicted in Figures 3.2.1-4, 3.2.2-4, 3.2.3-4 and 3.2.4-4, all the lands within the Project boundaries are owned by the City. Moreover, the lands within the Project boundaries are all located within the area that comprises the City's water supply system, as depicted in Figure 1.0-1. Development and other activities within and in the vicinity of the City's water supply system are subject to regulation pursuant to the *Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York city Water Supply and Its Sources* (the "Watershed Regulations"), Title 10 New York Codes, Rules and Regulations ("NYCRR") Part 128 and Chapter 18 of Title 15 of the Rules of the City of New York ("RCNY").

The entire Pepacton Development Project boundary and the northern part of the Neversink Development Project boundary are within the Catskill Park – a patchwork of public 'Forever Wild' land and private lands established by the New York State Constitution. These project boundaries are all on lands owned by the City. The Cannonsville Development and Schoharie Development Projects are not known to be under the provisions of the Wilderness Act or designated as wilderness areas, recommended for designation as wilderness area, or designated as wilderness study.

3.4 Water Supply Needs – Delaware River Basin

In the 1920s, the States of New York and New Jersey and the Commonwealth of Pennsylvania were interested in the development of water supplies in the Delaware River Basin as a source for meeting their individual needs. Between 1924 and 1927, these States made two attempts to forge an agreement for coordinated development of water supplies. Both attempts, however, were unsuccessful. In 1928, faced with little prospect of a multilateral agreement, and confronted with water shortages and growth pressures, the City, which lies outside the Delaware River Basin, moved to develop new sources of water supply from within the Basin. This action resulted in a serious interstate conflict and, in 1930, the State of New Jersey brought an action in the U.S. Supreme Court to enjoin the City and State of New York from using the waters of any tributary to the Delaware River. On May 25, 1931, the Court issued a decree granting the City the right to withdraw 440 million gallons per day ("MGD") of water from two reservoirs the City planned to build on headwater tributaries feeding the mainstem of the Delaware River. New Jersey v. New York, 283 U.S. 805 (1931). The impoundments—Neversink on the Neversink River and Pepacton on the East Branch of the Delaware River—became fully operational in the late summer of 1955.

The 1931 decree controlled the States' and City's use of the Delaware River Basin waters for 23 years. In 1952, the City filed a petition with the Supreme Court seeking to increase its diversion of Delaware River Basin waters for water supply purposes. After a hearing before a Special Master, the Supreme Court issued a new decree which modified and superseded the 1931 decree. New Jersey v. New York, 347 U.S. 995 (1954). The 1954 decree permitted the City to increase its withdrawal rate to 800 MGD contingent upon its construction of a third in-basin water reservoir—the Cannonsville impoundment on the West Branch of the Delaware River. That reservoir was completed in 1967. The 1954 decree also required the City to release from its three upper basin reservoirs into the Delaware River a sufficient quantity of water to meet a flow objective of 1,750 cfs at Montague, New Jersey. The 1954 decree also permitted an out-of-basin diversion of 100 MGD to central and northeastern New Jersey. A River Master employed by the US Geological Survey ("USGS") was appointed by the Court to administer specific provisions of the decree. Subsequently, in 1961, the Decree Parties (the States of New York, New Jersey, and Delaware, the Commonwealth of Pennsylvania, and the City of New York) entered into a compact with the federal government which created the DRBC to manage this regional resource. The DRBC has codified the management of the Delaware River Basin in its Comprehensive Plan. The Water Code of the River Basin, a component of the Comprehensive Plan, prescribes requirements for diversions, releases, flow objectives, and water quality.

The DRBC Comprehensive Plan and Water Code has undergone several revisions since 1962. The last promulgation of the Water Code occurred in 1983. Since that time, the DRBC, with agreement of the Decree Parties, has adopted many resolutions that have temporarily modified the provisions of the Comprehensive Plan and Water Code on an experimental basis. Two of the main revisions include Resolution No. 2004-3, DRBC Docket D-77-20 CP (Revision 7) and Resolution No. 2006-18, DRBC Docket D-77-20 (Revision 9). Revision 7 included interim releases from the Delaware River Basin reservoirs to protect tailwater fisheries in each river. Revision 9 included a temporary spill mitigation program for the Delaware River Basin reservoirs. Revisions 7 and 9 were slated to terminate on May 31, 2007, with the goal of developing a comprehensive plan for meeting the various water interests. This collaborative effort resulted in the development of the Flexible Flow Management Program ("FFMP"), as further described in Section 3.5 below.

In addition to dispatching water through the tunnels and streams connecting the Delaware River Basin reservoirs to serve the City's water supply needs, the NYCDEP releases water from each of the reservoirs to the East and West Branches of the Delaware River for ecological and other purposes. These releases are categorized either as directed releases, which are ordered by the Delaware River Master or conservation releases, which were governed by the above Resolutions and are now governed by the FFMP.

3.5 Flexible Flow Management Program (FFMP)

3.5.1 General Overview of FFMP

The FFMP is a set of principles, rules, and procedures for the management of storage, diversions, conservation releases, and flow targets relating to the apportioning of water from the Delaware River Basin under the 1954 Decree. It replaces the interim fishery releases program (DRBC Docket D-77-20 CP [Revision 7]) and the temporary spill mitigation program (DRBC Docket D-77-20 CP [Revision 9]) on a temporary and experimental basis. The FFMP also modifies certain provisions of the Water Code relating to the Montague, New Jersey flow objective and the New Jersey diversion during drought operations.

The FFMP is intended to provide a more adaptive means for managing multiple and competing uses of storage with sustainable sources of water, while protecting water supply rights of the Decree Parties. The FFMP does the following:

- manages discharges (conservation releases) from the City's Delaware Reservoirs;
- assists in mitigating the impacts of flooding;
- provides flow in the mainstem and the Delaware Bay to help protect ecological health, and support withdrawal and non-withdrawal uses.

In relation to the Project, the FFMP applies only to the City's Delaware River Basin reservoirs—Cannonsville, Pepacton, and Neversink. It does not apply to Schoharie Reservoir. However, the 19 reservoirs comprising the City's water supply system are operated as a system and releases from the Delaware Basin reservoirs impacts the management of the Schoharie Reservoir along with the remaining reservoirs.

3.5.2 Current Status of the FFMP

The Decree Parties and the DRBC agreed that input from the public was necessary before the FFMP could be adopted as part of the Water Code. The DRBC therefore authorized its Executive Director to undertake a formal rulemaking process, including a public comment period, on proposed Water Code amendments implementing the FFMP. Numerous comments were offered at the public hearing and more than 1,900 written comments were submitted to the DBRC.

The DRBC is currently considering the public comments it has received and gathering additional information to determine the best way to advance this rule making process.

Note that since October 2008 and continuing until new regulations are adopted by DRBC or the Decree Parties modify the FFMP, operation will continue in accordance with the conditions in the FFMP.

3.5.3 Key Elements of the FFMP

3.5.3.1 NYCDEP Water Supply Diversions

In accordance with the decree, the maximum total quantity of water diverted by the City from June 1 to May 31 may not exceed 800 MGD (2,455 acre-feet/day; 107 million cubic feet/day). Thus, over a standard calendar year of 365 days, the maximum withdrawal volume may not exceed 292,000 million gallons (896,114 acre-feet; 39,035 million cubic feet).

3.5.3.2 Flow Objectives on Delaware River at Montague, New Jersey/Directed Releases

In accordance with the FFMP, releases from the City's Delaware River Basin reservoirs should be provided to maintain a minimum basic rate of flow during normal[3] conditions of 1,750 cfs at the USGS gage on the Delaware River at Montague, NJ from September 16 through June 14 and 1,850 cfs from June 15 through September 15. The Delaware River Master orders directed releases on a daily basis for the purpose of meeting the applicable flow objective at Montague, NJ. The City must comply with these directives but may use any of the three upper Delaware River Basin reservoirs to meet the flow target. The drainage area at the Montague USGS gage is 3,480 square miles.

3.5.3.3 Interim Excess Release Quantity

For an interim period ending May 31, 2011, an Interim Excess Release Quantity ("IERQ") is provided. The IERQ is computed as 83% of the difference between the highest year's consumption of the City's water supply system during the past five years of 1,257 MGD and the City's current estimate of continuous safe yield of the City's water supply system of 1,290 MGD obtainable without pumping. The difference equates to 33 MGD (83% of 33 MGD = 27.39 MGD or 42.37 cfs x 365 days ≈ 15,468 cfs-days). The IERQ is 15,468 cfs-days (except during a leap year when the IERQ is 17,125 cfs-days).

The City will release the IERQ at rates designed to increase the flow at the Montague USGS gage from 1,750 cfs to 1,850 cfs for the period June 15 through September 15, and to maintain a flow at the Trenton USGS gage of 3,000 cfs from June 15 and continuing through March 15, referred to as the "seasonal period." The IERQ required to be released in any seasonal period cannot exceed 70 billion gallons ("BG").

3.5.3.4 Drought Management

Figure 3.5.3.4-1 defines five zones (L1, L2, L3, L4 and L5) of combined reservoir usable storage for Cannonsville, Pepacton, and Neversink. Three of the zones are defined as Drought Watch (L3), Drought Warning (L4), and Drought Emergency (L5). Additionally, the Normal zone is defined by two zones (L1 and L2), as shown in Figure 3.5.3.4-2. Shown in Table 3.5.3.4-1 are the diversions, releases, and flow objectives based on the storage available in Delaware Basin reservoirs.

[3] Normal conditions are defined in Table 3.5.3.4-1 and Figure 3.5.3.4-1.

Table 3.5.3.4-1: Interstate Operation Formula for Diversions, Releases, and Flow Objectives

NYC Storage Condition	NYC Diversion (MGD)	NJ Diversion (MGD)	Montague Flow Objective (cfs)	Trenton Flow Objective (cfs)
Normal (Jun 15-Sep 15)	800	100	1,850*	3,000
Normal (Sep 16-Jun 14)	800	100	1,750	3,000
Drought Watch (L3)	680	100	1,650	2,700
Drought Warning (L4)	560	85	1,540	2,700
Drought Emergency (L5)	520	85	1,100-1,500**	2,500-2,900***
Severe Drought	(to be negotiated depending upon conditions)			

*To the extent supported by the IERQ, otherwise 1,750 cfs
**Varies with time of year
***Varies with time of year and location of salt front

In order to conserve water, the River Master is requested to utilize a balancing adjustment, based upon procedures agreed upon by the Decree Parties, when calculating the releases to be directed to meet the Montague flow objectives in Table 3.5.3.4-1. Additionally, during Drought Warning (L4), the amount of the conservation releases from the City's Delaware River Basin reservoirs that is greater than the basic conservation release rates as described in Table 3.5.3.4-1 above are considered directed releases for the purpose of calculating the balancing adjustments.

3.5.3.5 Controlled Releases below Dams (Conservation Releases and Discharge Mitigation Releases)

In 1977, the NYSDEC issued regulations that required minimum releases from the City's Delaware River Basin reservoirs for conservation purposes. These mandatory releases have been revised on a non-binding basis several times by unanimous consent of the Decree Parties.

The FFMP includes a Tailwaters Habitat Protection and Discharge Mitigation Program, which consists of: (a) conservation releases designed for the protection of ecology in the tailwaters below the Delaware River Basin reservoirs; and (b) designed to reduce discharges from the reservoirs during periods of high flow.

Under the FFMP, the NYCDEP makes controlled releases from the Delaware River Basin reservoirs in accordance with Figures 3.5.3.4-1 and 3.5.3.4-2 and Table 3.5.3.5-1. As shown in Table 3.5.3.5-1, conservation releases from the three reservoirs vary based on the time of year, and are also dependent on the available storage capacity (see storage zones defined in Figures 3.5.3.4-1 and 3.5.3.4-2). Generally, as reservoir storage declines, conservation releases also decline to preserve the drinking water supply.

Under the FFMP, the NYCDEP makes discharge mitigation releases from the Delaware River Basin reservoirs in accordance with the following:

- For the period June 16 through April 30, if combined reservoir usable storage is in Zone L1 in accordance with Figure 3.5.3.4-1, discharge mitigation releases shall be made based upon individual reservoir usable storage in accordance with Zones L1-a, L1-b and L1-c as provided in Figure 3.5.3.4-2 and Table 3.5.3.5-1. During the period October 1 through April 30, 50% of the water equivalent of snow pack in the watersheds above the reservoirs shall be included in the determination of combined and individual reservoir usable storage in relation to Figures 3.5.3.4-1 and 3.5.3.4-2.
- For the period April 1 through April 30, if combined reservoir usable storage including snow pack is in excess of 100%, discharge mitigation releases shall be made based upon individual reservoir usable storage in accordance with Zone L1-a as provided in Figure 3.5.3.4-2 and Table 3.5.3.5-1.
- For the period May 1 through June 15, Zones L1-a and L1-b shall not be applicable in accordance with Figure 3.5.3.4-2, and discharge mitigation releases shall be made in accordance with Zone L1-c as provided in Figure 3.5.3.4-2 and Table 3.5.3.5-1.

Note that flood stage elevations are established on each river below all three dams. The L2 to L5 release levels take effect when the downstream gages are within two feet (Hale Eddy/West Branch Delaware and Fishes Eddy/East Branch Delaware) or one foot (Bridgeville/Neversink) of flood stage, or are forecasted by the National Weather Service to reach these action levels within 48 hours.

Table 3.5.3.5-1: Schedule of Releases (cfs) with 0 MGD Available

Cannonsville Storage Zone	**Winter**		**Spring**	**Summer**			**Fall**	
	Dec 1-Mar 31	*Apr 1-Apr 30*	*May 1-May 31*	*Jun 1-Jun 15*	*Jun 16-Jun 30*	*Jul 1-Aug 31*	*Sep 1-Sep 30*	*Oct 1-Nov 30*
L1-a	1500	1500	*	*	1500	1500	1500	1500
L1-b	250	*	*	*	*	350	275	250
L1-c	110	110	225	275	275	275	140	110
L-2	58	58	157	190	190	190	84	58
L-3	51	51	73	128	128	128	69	51
L-4	40	40	55	95	95	95	40	44
L-5	37	37	37	88	88	88	37	37

Pepacton Storage Zone	**Winter**		**Spring**	**Summer**			**Fall**	
	Dec 1-Mar 31	*Apr 1-Apr 30*	*May 1-May 31*	*Jun 1-Jun 15*	*Jun 16-Jun 30*	*Jul 1-Aug 31*	*Sep 1-Sep 30*	*Oct 1-Nov 30*
L1-a	700	700	*	*	700	700	700	700
L1-b	185	*	*	*	*	250	200	185
L1-c	85	85	120	150	150	150	100	85
L-2	47	47	80	102	102	102	62	44
L-3	40	40	58	73	73	73	40	40
L-4	33	33	37	62	62	62	29	29
L-5	29	29	29	58	58	58	22	22

Neversink Storage Zone	Winter		Spring	Summer			Fall	
	Dec 1-Mar 31	*Apr 1-Apr 30*	*May 1-May 31*	*Jun 1-Jun 15*	*Jun 16-Jun 30*	*Jul 1-Aug 31*	*Sep 1-Sep 30*	*Oct 1-Nov 30*
L1-a	190	190	*	*	190	190	190	190
L1-b	100	*	*	*	*	125	85	95
L1-c	65	65	90	110	110	110	75	60
L-2	33	33	62	43	43	43	51	33
L-3	29	29	37	55	55	55	29	29
L-4	26	26	29	44	44	44	22	22
L-5	22	22	22	40	40	40	18	18

* Storage zone does not apply during this period. Releases will be made in accordance with zone L1-c

3.6 Current Operation – Water Level, Water Withdrawal, Conservation/Directed Release, and Total Discharge

Shown in Table 3.6-1 are the daily records maintained by the NYCDEP at each development.

Table 3.6-1: Daily Records of Variables Maintained by the NYCDEP

Variable	Schoharie	Cannonsville	Pepacton	Neversink
Daily Precipitation	X	X	X	X
Daily Reservoir Elevation	X	X	X	X
Daily Reservoir Storage Volume	X	X	X	X
Daily Draft (Water Supply Withdrawal)	X	X	X	X
Spill	X	X	X	X
Conservation Releases	N/A	X	X	X
Directed Releases	N/A	X	X	X

Although the NYCDEP possesses many years of records, the last 25 years (1982 through 2007) of daily data were evaluated to illustrate the operations at each facility. These operational records reflect primarily pre-FFMP operating conditions because the FFMP conditions were not instituted until October 2007. The following sections include several graphical displays showing water level operations, total project releases, water withdrawals (also called draft) and conservation/directed releases from 1982 through 2007.

Prior to reviewing the graphical displays an explanation is needed to understand how the graphs were developed; daily water level data will be used to explain the plots. For each day of the year (Jan 1, Jan 2… Dec 31), the minimum elevation, 10% exceedence elevation, 25% exceedence elevation, 50%, exceedence elevation, 75% exceedence elevation, 90% exceedence elevation and maximum elevation was computed using the 25 years of record. For example, the 10% exceedence elevation was determined using all 25 Jan 1st elevations. This was repeated for all 25 Jan 2's, Jan 3's.. and so on. The 10% exceedence elevation represents that elevation which is equaled or exceeded 10% of the time; 90% of the elevations are below the 10% exceedence elevation. Similarly, the 50% exceedence elevation represents the median elevation- half of the reservoir elevations are above and below this value.

The same process described above was applied to flow data as well. All flow data is presented in cfs, with the exception of water withdrawals, which has units of million gallons ("MG"). Note that 1 MGD = 1.547 cfs.

Note that for the three Delaware River Basin reservoirs, total daily discharges below the dams can be computed by summing spill, conservation releases and directed releases—all of which are recorded by the NYCDEP. For Schoharie, total discharges are equal to spill as there is no conservation/directed releases. Total discharges are also directly measured by the USGS gages located below all four dams. The total discharge as measured by the USGS gages compare very closely with the total discharge (spill, directed releases, conservation releases) from the NYCDEP-collected data. In the section below, total discharges for the Delaware River Basin reservoirs are presented as the sum of spill, directed releases and conservation releases.

Note that Section 4.3 (Water Resources) also contains monthly flow duration curves derived from the USGS gages.

3.6.1 Schoharie Reservoir

Shown in Figure 3.6.1-1 are elevation curves showing the minimum, 10%, 25%, 50%, 75%, 90% and maximum water levels for the 25 year period of record. As the plots show, the reservoir is typically drawn down in the fall/winter period. The extent of drawdown is driven by several factors including snowpack, water supply diversions, and runoff. Generally, the greater the moisture content of the snowpack, the larger the reservoir drawdown. The average maximum drawdown over the 25-year period is approximately 45.7 feet; the maximum drawdown of 61.8 feet occurred on November 25, 2001.

As noted above, at the Schoharie Reservoir there are no conservation releases or directed releases. Thus, the spill recorded at the dam is equivalent to the total project discharge. Shown in Figure 3.6.1-2 are the spill or total discharge curves showing the minimum, 10%, 25%, 50%, 75%, 90%, and maximum total discharges for the 25 years of record. As expected, the magnitude and frequency of spill events increases in the spring due to snowmelt and increased runoff, although some spill events have occurred in the fall as well.

Shown in Figure 3.6.1-3 is a bar chart showing the annual water withdrawal (draft) from 1982-2007. The greatest water withdrawal occurred in 2006 —161,151 MG; this was done to lower the impoundment to facilitate repairs of the Gilboa Dam.

3.6.2 Cannonsville Reservoir

Shown in Figure 3.6.2-1 are elevation curves showing the minimum, 10%, 25%, 50%, 75%, 90% and maximum water levels for the 25 year period of record. As the plots show, the reservoir is typically drawdown in the fall/winter period. Generally, the water level plots show a controlled drawdown in the fall/early winter, and refill in the spring due to increased runoff. The average maximum drawdown over the 25-year period is approximately 53.7 feet; the maximum drawdown of 98.2 feet occurred on November 27, 2001.

Shown in Figure 3.6.2-2 are total discharge (spill + conservation releases + directed releases) curves showing the minimum, 10%, 25%, 50%, 75%, 90%, and maximum total discharges for the 25 years of record. As expected, the total discharges increase in the spring when spill occurs due to the freshet. During the non-spill periods of the year, the total discharges are comprised of conservation and directed releases. As noted above, directed releases are required by the Delaware River Master to maintain 1,750 cfs or 1,850 cfs in the Delaware River at Montague, NJ. Directed releases occur more frequently during low flow conditions in the summer.

Shown in Figure 3.6.2-3 are the sum of conservation and directed releases for the same statistics- minimum, 10%, 25%, 50%, 75%, 90%, and maximum. As expected, higher releases occur during the summer.

Shown in Figure 3.6.2-4 is a bar chart showing the annual water withdrawal (draft) from 1982-2007. The greatest water withdrawal occurred in 1992 —105,536 MG.

3.6.3 Pepacton Reservoir

Shown in Figure 3.6.3-1 are elevation curves showing the minimum, 10%, 25%, 50%, 75%, 90% and maximum water levels for the 25 year period of record. Generally, the water level plots show a controlled drawdown in the fall/early winter, and refill in the spring due to increased runoff. The average maximum drawdown over the 25-year period is approximately 51 feet, although drawdowns can be as much as 66 feet, as occurred on January 24, 2002.

Shown in Figure 3.6.3-2 are the total discharge (spill + conservation releases + directed releases) curves showing the minimum, 10%, 25%, 50%, 75%, 90%, and maximum total discharges for the 25 years of record. Again, total discharges are higher in the spring due to spill.

Shown in Figure 3.6.3-3 are the sum of conservation and directed releases for the same statistics- minimum, 10%, 25%, 50%, 75%, 90%, and maximum. As expected, higher releases occur during the summer.

Shown in Figure 3.6.3-4 is a bar chart showing the annual water withdrawal (draft) from 1982-2007. The greatest water withdrawal occurred in 1987 —156,075 MG.

3.6.4 Neversink Reservoir

Shown in Figure 3.6.4-1 are elevation curves showing the minimum, 10%, 25%, 50%, 75%, 90% and maximum water levels for the 25 year period of record. Generally, the water level plots show a controlled drawdown in the fall/early winter, and refill in the spring due to increased runoff. The average maximum drawdown over the 25-year period is approximately 58 feet, although drawdowns can be as much as 90 feet, as occurred on November 22, 1991.

Shown in Figure 3.6.4-2 are the total discharge (spill + conservation releases + directed releases) curves showing the minimum, 10%, 25%, 50%, 75%, 90%, and maximum total discharges for the 25 years of record. Again, total discharges are higher in the spring due to spill.

Shown in Figure 3.6.4-3 are the sum of conservation and directed releases for the same statistics- minimum, 10%, 25%, 50%, 75%, 90%, and maximum. As expected, higher releases occur during the summer.

Shown in Figure 3.6.4-4 is a bar chart showing the annual water withdrawal (draft) from 1982-2007. The greatest water withdrawal occurred in 1996 —71,743 MG.

3.7 Proposed Operation– Water Level, Water Withdrawal, Conservation/Directed Release, and Total Discharge

The NYCDEP plans to operate the Cannonsville, Pepacton, and Neversink Reservoirs according to the conditions in the FFMP until such time as the Decree Parties modify said protocol. The water available for generation at Cannonsville, Pepacton, and Neversink will be comprised of conservation releases, directed releases, and water that would otherwise spill to the extent that such releases are consistent with discharge mitigation releases as outlined in the FFMP.

Relative to the Schoharie Development, the NYCDEP plans to maintain current operations, with water levels each year modified for snowpack management. The NYCDEP has decided to institute a snowpack-based reservoir management program, similar to the snowpack management program employed at other City water supply reservoirs (including Pepacton, Cannonsville and Neversink) located in the Delaware River Basin, to provide enhanced discharge mitigation downstream. Under this program, the Schoharie Reservoir would be maintained below full capacity during the winter months when sufficient snowpack is present in its watershed such that associated runoff produced by spring snowmelt could refill the reservoir to full storage capacity. The capture of inflows associated with spring storm events and snowmelt runoff in the reservoir would provide additional attenuation in downstream sections. The targeted reservoir level during the snowpack-based reservoir management period would be regularly adjusted based on snow water equivalent estimates of the watershed's regularly monitored snowpack.

The proposed hydropower facility at the Gilboa Dam is not designed to modify seasonal water level fluctuations or water supply diversions. The water available for generation at Schoharie will be comprised of water that would normally be "spilled" downstream.

OASIS Model

To evaluate operational changes associated with the FFMP, the NYCDEP developed a simulation model of its water supply system (*i.e.*, all 21 impoundments including the Cannonsville, Pepacton, Neversink and Schoharie Reservoirs). The model, called the New York City Water Supply OASIS (a proprietary version of the publicly available OASIS model and herein further referred to as OASIS), simulates the water supply demands, conservation releases, water level drawdowns, release mitigation needs, and other requirements as stipulated in the FFMP. Output from the OASIS model includes daily water levels, total discharge, hydropower discharge, conservation releases, water supply withdrawals, and spillage. The rules of the FFMP were incorporated into the model to simulate the estimated discharges from the three Delaware River Basin reservoirs using the historic inflow hydrology.

Historic inflow to each of the reservoirs was computed using existing USGS gage flow data for the projects - there are USGS gages on the main tributaries inflowing to each reservoir. The model includes a set of rules that dictate how a given reservoir will operate. For example, if flow drops below 1,750 cfs in Montague, the OASIS model will require releases from the Delaware River Basin reservoirs, as needed, to maintain the Montague prescribed flow. The model's period of record is from 1948 to 2008 (*i.e.*, 61 years). Note that some of the reservoirs were constructed after 1948. The purpose of the modeling effort is to determine how the reservoirs would operate under conditions in the FFMP based on using historic inflow information. The general premise is that the previous 61 years of inflow will be representative of future inflows.

The OASIS model was used to simulate the FFMP and to determine flows available for hydropower generation.

The benefits of OASIS modeling include:

- Estimated discharges available for hydroelectric generation from the Cannonsville, Downsville, and Neversink Dams were based on the conditions set forth in the FFMP. Conditions in the FFMP account for the balancing of water supply demands, reservoir levels, directed releases, and conservation releases below the Cannonsville, Downsville and Neversink Dams. Because the OASIS model reflects this balancing of flow and water level needs, the model results provide the best estimates of the expected discharges from the Cannonsville, Downsville, Neversink and Schoharie Dams.

- Simulating conservation releases and directed releases.

The next sections are laid out very similar to the Section 3.6. Duration curves (10%, 25%, 50%, 75%, 90%) and minimum and maximum data were developed for the same variables as above (elevation, total discharge, conservation releases, and water withdrawals), utilizing the January 1, 1948 to September 30, 2008 period of record.

3.7.1 Schoharie Reservoir

The Schoharie Reservoir is not subject to conservation or directed releases. Shown in Figure 3.7.1-1 are elevation curves showing the minimum, 10%, 25%, 50%, 75%, 90% and maximum water levels for the simulated 61 year period of record. As the plots show, the reservoir is drawn down in the fall/winter period. The average simulated maximum drawdown over the 61 year period is approximately 44.5 feet.

Spill recorded in the model output is equivalent to the total project discharge. Shown in Figure 3.7.1-2 are the total discharge curves showing the minimum, 10%, 25%, 50%, 75%, 90%, and maximum total discharges for the period of record.

Shown in Figure 3.7.1-3 is a bar chart showing the simulated annual water withdrawal in units of millions of gallons (MG) from 1948-2008.

3.7.2 Cannonsville Reservoir

Shown in Figure 3.7.2-1 are elevation curves showing the minimum, 10%, 25%, 50%, 75%, 90% and maximum water levels for the simulated period of record. Under the FFMP, the reservoir is drawn down in the fall/winter period. The average simulated maximum draw down over the period of record is approximately 71.5 feet.

Shown in Figure 3.7.2-2 are total discharge curves showing the minimum, 10%, 25%, 50%, 75%, 90%, and maximum total discharges for the same period. Total discharges increase in the spring when spill occurs due to the freshet. During the non-spill periods of the year, the total discharges are comprised of conservation and directed releases.

Shown in Figure 3.7.2-3 are conservation releases for the same statistics – minimum, 10%, 25%, 50%, 75%, 90%, and maximum. As expected, higher conservation releases occur during the summer.

Shown in Figure 3.7.2-4 is a bar chart showing the simulated annual water withdrawal (draft) from 1948-2008.

3.7.3 Pepacton Reservoir

Shown in Figure 3.7.3-1 are elevation curves showing the minimum, 10%, 25%, 50%, 75%, 90% and maximum water levels for the simulated period of record. Under the FFMP, the water levels are drawn down in the fall/early winter, and refill in the spring due to increased runoff. The average simulated maximum drawdown over the period of record is approximately 90.4 feet.

Shown in Figure 3.7.3-2 are the total discharge curves showing the minimum, 10%, 25%, 50%, 75%, 90%, and maximum total discharges for the period. Again, total discharges are higher in the spring due to spill.

Shown in Figure 3.7.3-3 are the conservation releases for the same statistics – minimum, 10%, 25%, 50%, 75%, 90%, and maximum. As expected, higher conservation releases occur during the summer.

Shown in Figure 3.7.3-4 is a bar chart showing the simulated annual water withdrawal (draft) from 1948-2008.

3.7.4 Neversink Reservoir

Shown in Figure 3.7.4-1 are elevation curves showing the minimum, 10%, 25%, 50%, 75%, 90% and maximum water levels for the simulated period of record. Under the FFMP, the water levels are drawn down in the fall/early winter, and refill in the spring due to increased runoff. The average simulated maximum drawdown over the period of record is approximately 83.3 feet.

Shown in Figure 3.7.4-2 are the total discharge curves showing the minimum, 10%, 25%, 50%, 75%, 90%, and maximum total discharges for the period. Again, total discharges are higher in the spring due to spill.

Shown in Figure 3.7.4-3 are the conservation releases for the same statistics – minimum, 10%, 25%, 50%, 75%, 90%, and maximum. As expected, higher conservation releases occur during the summer.

Shown in Figure 3.7.4-4 is a bar chart showing the simulated annual water withdrawal (draft) from 1948-2008.

3.8 Other Project Information

3.8.1 Current License Requirements

Since there is no current FERC License, this is not applicable.

3.8.2 Compliance History

Since there is no current FERC License, this is not applicable.

3.8.3 Current Net Investment

There is no current net investment relative to hydropower as the facilities have not been constructed.

3.8.4 Summary of Project Generation

Since there are no hydropower facilities in place, project generation data is unavailable. However, based on preliminary estimates, the average annual energy generation at each facility (excluding downtime) is shown in Table 3.8.4-1.

Table 3.8.4-1: Estimated Average Annual Generation at each Development

Development	Unit Capacities (cfs)	Average Annual Hydraulic Head (feet)	Station Hydraulic Capacity (cfs)	Installed Capacity (kW)	Average Annual Generation (kWh)
Cannonsville	(1) @ 80 cfs (3) @ 350 cfs	127.3 feet	1,130 cfs	12,100 kW	25,456,000 kWh
Neversink	(2) @ 80 cfs	166.9 feet	160 cfs	1,650 kW	7,786,000 kWh
Pepacton	(1) @ 80 cfs (1) @ 190 cfs	134.0 feet	270 cfs	3,100 kW	9,042,000 kWh
Schoharie	(3) @ 350 cfs	158.3 feet	1,050 cfs	12,900 kW	23,535,000 kWh

4.0 EXISTING ENVIRONMENT AND RESOURCE IMPACTS (18 CFR § 5.6 (d)(3))

4.1 General Description of the River Basin (18 CFR § 5.6 (d)(3)(xiii))

The Cannonsville, Downsville (Pepacton Reservoir), and Neversink Dams are all within the Delaware River Basin and are located on the West Branch of the Delaware, East Branch of the Delaware, and Neversink Rivers, respectively. The Gilboa Dam (Schoharie Reservoir) is within the Hudson River Basin, as Schoharie Creek is a tributary of the Mohawk River.

4.1.1 Schoharie Development

Encompassing approximately 315 square miles, the Schoharie Reservoir watershed is located primarily in Greene County, NY. Schoharie Creek drains eight Greene County municipalities, not including direct drainage to the reservoir, and includes large sections of the Towns of Prattsville, Lexington, Jewett, Hunter, Ashland, and Windham, and the villages of Hunter and Tannersville. The origin of Schoharie Creek is a large wetland complex in the Town of Hunter. Schoharie Creek flows generally in a northwest direction until the Town of Lexington where it turns and flows predominantly north until its confluence with the Mohawk River. Gilboa Dam is the first dam on Schoharie Creek and shortly below Schoharie Reservoir is the New York Power Authority's Blenheim-Gilboa Pump Storage Hydropower Project.

Traveling from east (Hunter) to west (Prattsville), the primary tributaries that drain into Schoharie Creek are the East Kill, West Kill, Little West Kill, Batavia Kill, Huntersfield Creek, and Johnson Hollow Brook. Those that drain directly into the reservoir are the Bear Kill and Manor Kill. The major streams within the Schoharie watershed tend to have long, narrow watersheds running east to west. This drainage pattern is controlled by the steep topography formed in large part during the last period of glacial activity. Streams in the Schoharie valley are primarily perennial streams; that is, they flow year-round except in extreme drought conditions.

Approximately 75% of the Schoharie Creek watershed is inside the Catskill State Park, a geographically defined checkerboard of public "forever wild" and private lands.

The length of Schoharie Creek from Gilboa Dam to the confluence with the Mohawk River is approximately 58 miles.

4.1.2 Cannonsville Development

The majority of the West Branch of the Delaware River lies in Delaware County, but its headwaters are actually in Schoharie County in the Town of Jefferson. The reservoir drains approximately 454 square miles. The West Branch of the Delaware River flows approximately 17.7 miles below the Cannonsville Dam before its confluence with the mainstem of the Delaware River. The river travels predominantly southwest until the Town of Deposit where the river turns southeast. The Little Delaware River is the largest tributary flowing into Cannonsville Reservoir; however there are numerous other smaller tributaries contributing as well.

The length of the West Branch of the Delaware River from Cannonsville Dam to confluence with the East Branch of the Delaware River is approximately 18 miles.

4.1.3 Pepacton Development

The East Branch of the Delaware River rises in eastern Delaware County near the hamlet of Grand Gorge and flows initially south-southwest through Roxbury, then west-southwest through Magaretville, forming part of the northern boundary of Catskill State Park; all of the proposed project boundary is in the Catskill State Park. The Pepacton Reservoir drains approximately 372 square miles from three counties and 11 townships. While the majority of the watershed is contained within Delaware County, sections of the headwaters are found in the western Catskill Mountains of Ulster and Greene Counties. The river and reservoir are fed by numerous tributaries. The East Branch of the Delaware River joins the West Branch of the Delaware River in Hancock, NY on the border with Pennsylvania to form the Delaware River.

The length of the East Branch of the Delaware River from Downsville Dam to confluence with the West Branch of the Delaware River is approximately 34 miles.

4.1.4 Neversink Development

Encompassing approximately 92.6 square miles, the Neversink Reservoir watershed is located in Ulster and Sullivan Counties. The Neversink River, including both its East and West Branches, drains 71 square miles; 22 square miles drain directly into the Neversink Reservoir through two dozen small tributaries. The Neversink watershed lies predominantly in the Towns of Denning and Neversink, with a small portion of its headwaters in the Town of Shandaken, and very small portions of the Towns of Liberty and Fallsburg. The northern portion of the reservoir lies within the Catskill State Park. The mainstem of the Neversink River divides approximately 5.4 miles upstream of the Neversink Reservoir into two major branches, East and West. The main inflowing tributaries have long narrow watersheds running northeast to southwest. This drainage pattern is controlled by steep topography, formed mostly during the last period of glacial activity. Streams in the Neversink valley are primarily perennial streams.

The length of the Neversink River from Neversink Dam to the confluence of the Delaware River is approximately 42 miles.

4.2 Geology and Soils (18 CFR § 5.6 (d)(3)(ii))

4.2.1 Topography

4.2.1.1 Schoharie Development

The general topography of the Schoharie Creek watershed in the vicinity of the Schoharie Reservoir is shown in Figure 4.2.1.1-1. Schoharie Creek begins in a large wetland complex where the surrounding landscape is mountainous and includes the high peaks (greater than 3,500 feet) of Indian Head, Twin, Kaaterskill High Peak, Sugarloaf, Plateau, Hunter, and Rusk Mountains (Greene Co. Soil and Water Conservation District ["SWCD"], 2007).

Elevations in the watershed vary from a high of approximately 4,040 feet above msl in the Town of Hunter at the West Kill-Schoharie Creek watershed boundary, to a low point of 1,130 feet at the Gilboa Dam spillway. The average elevation of the watershed is approximately 2,590 feet. The Schoharie Creek starts as a mountainous stream dropping approximately 520 feet in its first mile (within southeastern Hunter), then reduces in slope to an average of 36 feet per mile to its approximate midway point (at the intersection of Route 23A and Route 17). From this midway point to the reservoir, the stream slope drops approximately 24 feet per mile (Greene Co. SWCD, 2007).

4.2.1.2 Cannonsville Development

The general topography of the West Branch of the Delaware River in the vicinity of the Cannonsville Reservoir is shown in Figure 4.2.1.2-1. The watershed is located in the eastern portion of the Allegheny Plateau physiographic province, which is the northern part of the Appalachian Plateau that extends from southern New York to central Alabama. Locally, the Allegheny Plateau extends throughout southern New York and includes the Catskill Mountains and southern sections of the Mohawk River basin (Isachsen et al., 1991). Rivers and their tributaries have cut the originally level plateau into hilly uplands. The plateau surface is evident in the pattern of hilltops all tending to reach the same elevations in their respective locations in the watershed, creating a dissected plane that slopes gradually upward from northwest to southeast (Delaware Co. SWCD, 2004).

The West Branch of the Delaware River is the principal drainage channel for the basin and delivers flows from northeast to southwest through a relatively narrow, flat-floored valley. The valley is approximately one mile across at its maximum width, which is in the Village of Walton. Hillsides along the West Branch valley tend to be asymmetric with steeper slopes facing north and gentler slopes facing south. Tributary streams typically occupy very narrow valleys, or hollows, that generally intersect the West Branch at right angles (Delaware Co. SWCD, 2004).

4.2.1.3 Pepacton Development

The East Branch of the Delaware River is also located in the eastern portion of the Allegheny Plateau physiographic province. The East Branch of the Delaware River, along with eight additional sub-basins, contributes water to the Pepacton Reservoir. The entirety of the watershed is situated among rolling hills. The eastern portion of the watershed becomes rather steep, with portions of the Mill Brook and Dry Brook sub-basins bordering on the high peak region of the Catskills. Elevations within these sub-basins approach 3,500 feet above mean sea level (Delaware Co. SWCD, 2007). The general topography of the watershed of the East Branch of the Delaware River in the vicinity of the Pepacton Reservoir is shown in Figure 4.2.1.3-1.

4.2.1.4 Neversink Development

The Neversink River mainstem divides into the east and west branches approximately 5.4 miles upstream of the Neversink Reservoir. All three of these river channels (east, west, and mainstem) have long narrow watersheds running northeast to southwest. The general topography of the Neversink River watershed in the vicinity of the Neversink Reservoir is shown in Figure 4.2.1.4-1.

4.2.2 Geology

All four of the Project watersheds are located in the eastern portion of the Allegheny Plateau, which is a part of the Appalachian Plateau physiographic province within the Northeastern Highlands ecoregion. The Appalachian Plateau is a large natural region lying west of the Hudson lowlands and south of the Mohawk River valley and the Lake Ontario-Lake Erie plains. The Appalachian Plateau is underlain with nearly horizontal rock strata, and all of it was covered by a glacier as recently as 10,000 to 12,000 years ago. Ice and the force of rivers have dissected or cut into the bedrock, giving the whole region a rugged, hilly aspect. The Appalachian Plateau is highest in the eastern part of the state, where it forms the Catskill Mountains.

This region is characterized by nutrient-poor soils and successional communities comprised of northern hardwood and spruce-fir forests. The region consists of a deeply dissected plateau sloping gently to the southwest with the exception of Schoharie Creek that drains north and west (Greene Co. SWCD, 2007). The streams and rivers have cut this originally level plateau province into upland hills. The plateau surface is evident in the pattern of hilltops all tending to reach similar elevations in the respective locations in the watershed (Delaware Co. SWCD, 2004). The erosional characteristics of the sedimentary rock formations found in this region are responsible for the typical valley-ridge topography of the Catskill Mountains (Greene Co. SWCD, 2007).

Generally, the bedrock underlying the region is of sedimentary origin resulting from the erosion of an ancient high peaks Taconic mountain range that existed to the east approximately 370 million years ago in the Devonian Period. The sediments that form the Devonian Period bedrock are interpreted to be the deposits of a vast deltaic river system that are often referred to as Catskill Delta deposits. The Catskill Delta deposits were buried beneath younger sediments and then uplifted as a plateau. Prior to and during the uplifting, intersecting sets of vertical fractures formed. As the overlying rock was eroded away over time, streams incised multiple channels in the slowly rising plateau (Greene Co. SWCD, 2007).

The rivers deposited layers of sediment that eventually became the current sandstone, siltstone, and shale beds of the plateau valleys. Rock groups and some of their component formations include:

- The Genesee Group, including the Unadilla and Oneonta formations;
- The Sonyea Group, including the Lower Walton formation;
- The Moscow Group (hosts the famous Gilboa forest fossils); and
- The West Falls group, including the Slide Mountain and Upper Walton formations.

None of these formations include beds of limestone, but rather include silica. As such, they are considered acidic rocks and spring water rising through these layers tends to be low in calcium and magnesium carbonates (Delaware Co. SWCD, 2004).

4.2.3 Surficial Geology and Soils

Long periods of glaciation deposited varying layers of glacial till in the valleys and uplands of the project area. The most recent Laurentide ice sheet reached a maximum thickness over the Catskill region approximately 22,000 years ago and fully retreated only about 12,000 years ago. The retreating glaciers left ice deposits in the valleys, sometimes long after the uplands were relatively ice-free. Meltwater flowed around and beneath the remaining ice, removing much of the silt and clay from the sand and gravel. As a result, gravelly terraces and kame (ice-contact sand and gravel) deposits tend to occur along valley margins where they were left when the ice sheets began their retreat (Greene Co. SWCD, 2007).

Lakes impounded by ice and recessional moraines allowed silt and clay to settle and form thick deposits. Other areas were scoured by the glacial runoff. Individual soil series descriptions are presented below for each development and adapted from the USDA-NRCS Soil Survey Division Official Soil Survey Descriptions website (accessed 10 December 2008).

4.2.3.1 Schoharie Development

Dominant soil groups or types within the one-mile buffer surrounding the Schoharie Development project boundary are shown in Figure 4.2.3.1-1 and are listed below:

- Halcott, Mongaup, & Vly soils (18%)
- Lewbeach and Willowemoc channery silt loams (12%)
- Lordstown and Oquaga very stony soils (10%)
- Lordstown, Oquaga, and Nassau soils (7%)
- Schoharie and Hudson silty clay loams (7%)

A close-up of specific soil types in the vicinity of Gilboa Dam is shown in Figure 4.2.3.1-2.

Halcott: The Halcott series consists of shallow, somewhat excessively drained soils formed in till. They are nearly level to very steep soils on glaciated bedrock controlled uplands. Permeability is moderate or moderately rapid throughout. Thickness of the solum ranges from 6 to 20 inches. Depth to bedrock ranges from 10 to 20 inches. The Halcott series is the frigid analogue of the Arnot series.

Hudson: The Hudson series consists of very deep, moderately well drained soils formed in clayey and silty lacustrine sediments. They are nearly level to very steep soils on convex lake plains, on rolling to hilly moraines and on dissected lower valley side slopes. Permeability is moderately slow or moderate in the surface and subsurface layers and slow or very slow in the lower part of the subsoil and substratum. Hudson soils are nearly level to very steep on lake plains and lacustrine capped uplands and valley sides. Slope ranges from 0 to 60 percent. More sloping and dissected areas show evidence of slumping or mass slipping. The elevation ranges from 50 to 800 feet above msl.

Lewbeach: The Lewbeach series consists of very deep, well drained soils formed in till derived from sandstone, siltstone and shale. They are gently sloping through steep soils on hillsides and hilltops in the uplands. Permeability is moderate in the surface, moderately slow or moderate in the subsoil and very slow or slow in the fragipan. Slope ranges from 3 to 55 percent. Depth to bedrock is usually greater than 5 feet. Elevation ranges from 1750 to 2500 feet above msl. Lewbeach is proposed as the frigid equivalent of Lackawanna. As defined for Sullivan County, it is ranged to cover soils mapped as Swartswood in the frigid region.

Lordstown: The Lordstown series consists of moderately deep, well drained soils formed till and cryoturbated material derived from siltstone and sandstone on bedrock controlled landforms of glaciated dissected plateaus. They are nearly level to very steep soils on hillsides and hilltops in glaciated bedrock controlled uplands. Thickness of solum and depth to bedrock ranges from 20 to 40 inches. Lordstown soils are nearly level to very steep soils with slopes ranging from 0 to 90 percent. These soils formed in till and cryoturbated material derived from siltstone and sandstone on bedrock controlled landforms of glaciated dissected plateaus. Elevation ranges from 800 to 1800 feet above msl. Lordstown is the mesic equivalent of Mongaup.

Mongaup: The Mongaup series consists of moderately deep, well drained soils formed in till derived from sandstone, siltstone and shale. They are nearly level through very steep soils on hillsides and hilltops in glaciated, bedrock controlled uplands. Depth to hard bedrock is 20 to 40 inches. Slope ranges from 0 to 70 percent. Thickness of solum and depth to bedrock ranges from 20 to 40 inches. These soils formed in acid till on bedrock controlled uplands. Elevation ranges from 1000 to 2400 feet above msl.

Nassau: The Nassau series consists of shallow, somewhat excessively drained soils formed in till. They are nearly level to very steep soils on bedrock controlled glacially modified landforms. Bedrock is at a depth of 10 to 20 inches. Slope ranges from 0 to 70 percent. Thickness of the solum and depth to bedrock ranges from 10 to 20 inches. They formed in material derived mainly from local slate or shale similar to that of the R horizon. The elevation ranges from 150 to 900 feet above msl.

Oquaga: The Oquaga series consists of moderately deep, somewhat excessively drained soils formed in a thin mantle of till over sandstone, siltstone, and shale bedrock on nearly level to very steep uplands. Slope ranges from 0 to 70 percent. Permeability is moderate. Depth to bedrock ranges from 20 to 40 inches. Oquaga soils are in uplands and formed in a thin mantle of reddish till with lithology dominated by the local and underlying reddish sandstone, siltstone, and shale.

Schoharie: The Schoharie series consists of very deep, moderately well drained soils formed in clayey lacustrine sediments. They are on glacial lake plains and uplands mantled with lake sediments. Saturated hydraulic conductivity is moderately high or high in the mineral surface and subsurface and low through moderately high in the subsoil and substratum. Slope ranges from 0 through 60 percent. Depth to bedrock is more than 60 inches. Schoharie soils are on convex land forms and dissection forms of lake plains and of various glacial land forms that are mantled with lake sediments. The soils formed in reddish clayey lake sediment.

Vly: The Vly series consists of moderately deep, well drained or somewhat excessively drained soils formed in till. These soils are on glaciated bedrock controlled uplands. Slope ranges from 0 to 70 percent. Thickness of the solum and depth to bedrock ranges from 20 to 40 inches. Vly soils are on bedrock controlled till uplands. These soils formed in reddish till that is derived from reddish sandstone, siltstone and shale. Elevation ranges from 1750 to 4025 ft. above msl.

Willowemoc: The Willowemoc series consists of very deep, moderately well drained soils formed in till derived from sandstone, siltstone, and shale. They are nearly level through moderately steep soils on till plains and hillsides in the uplands. Permeability is moderate above the fragipan and slow or very slow in the fragipan. Slope ranges from 0 to 35 percent. Depth to bedrock is greater than 60 inches. The soils developed in firm, acid till high in sandstone with a smaller component of red shale. Elevation ranges from 1750 to 2500 feet above msl.

4.2.3.2 Cannonsville Development

Soil groups found in the watershed of the West Branch of the Delaware River are listed below in order of highest to lowest percentage. Only soil series not previously provided in Section 4.2.3.1

are described below. Dominant soil groups or types within the one-mile buffer surrounding the Cannonsville Development project boundary are shown in Figure 4.2.3.2-1 and listed below:

- Halcott, Mongaup, & Vly soils (23%)
- Lackawanna & Bath soils (22%)
- Oquaga, Lordstown, & Arnot soils (15%)

A close-up of specific soil types in the vicinity of Cannonsville Dam is shown in Figure 4.2.3.2-2.

Arnot: The Arnot series consists of shallow, somewhat excessively to moderately well drained soils formed in loamy till. Bedrock is at depths of to 10 to 20 inches. Slope ranges from 0 to 70 percent. Saturated hydraulic conductivity in the mineral soil is moderately high or high. Arnot soils developed in a thin mantle of till of Wisconsin age. The till is derived mainly from acid sandstone, siltstone, and shale. In some places the regolith is a mixture of till and residuum. Elevation ranges from 1000 to 1800 feet above msl. The Arnot series is considered to be the lithic analogue of the Lordstown and Oquaga series.

Bath: The Bath series consists of very deep, well drained soils formed in till. They are nearly level to steep soils on uplands. Slope ranges from 0 to 60 percent.

Lackawanna: The Lackawanna series consists of very deep, well drained soils on uplands. They formed in till derived from reddish colored sandstone, siltstone, and shale. A dense fragipan is present starting at a depth of 17 to 36 inches below the soil surface. Slope ranges from 0 to 55 percent. Depth to bedrock is greater than 60 inches. Lackawanna soils are on nearly level to steep glaciated uplands. The elevation of these soils ranges from 750 to 1800 feet above msl.

4.2.3.3 Pepacton Development

Soil groups found in the watershed of the East Branch of the Delaware River are described below in order of highest to lowest percentage (Delaware Co. SWCD, 2007). Dominant soil groups or types within the one-mile buffer surrounding the Pepacton Development project boundary are shown in Figure 4.2.3.3-1 and listed below:

- Halcott, Mongaup, & Vly soils (24%)
- Lackawanna & Bath soils (17%)
- Oquaga, Lordstown, & Arnot soils (14%)

A close-up of specific soil types in the vicinity of Downsville Dam is shown in Figure 4.2.3.3-2. For details regarding the soil types within the Pepacton Development please refer to Sections 4.2.3.1 and 4.2.3.2.

4.2.3.4 Neversink Development

Soil groups found in the Neversink River watershed are listed below in order of highest to lowest percentage. Only soil series not previously listed are described. Dominant soil groups or types within the one-mile buffer surrounding the Neversink Development project boundary are shown in Figure 4.2.3.4-1 and listed below:

- Willowemoc silt loam (20%)
- Wellsboro & Wurtsboro soils (13%)
- Swartswood & Lackawanna soils (10%)
- Arnot-Lordstown complex (5%)
- Arnot-Oquaga complex (3%)

A close-up of specific soil types in the vicinity of Neversink Dam is shown in Figure 4.2.3.4-2. For details regarding the soil types not described below please refer to Sections 4.2.3.1 and 4.2.3.2.

Swartswood: The Swartswood series consists of deep and very deep, well drained and moderately well drained soils formed in till derived primarily from gray and brown quartzite, conglomerate, and sandstone. Saturated hydraulic conductivity is moderately high or high in the mineral soil above the fragipan and moderately low or moderately high in the fragipan. Depth to bedrock ranges from 3 1/2 to 20 feet, or more. Swartswood soils are nearly level to very steep. Stones and boulders are common surface features in wooded areas.

Wellsboro: The Wellsboro series consists of very deep moderately well and somewhat poorly drained soils formed in till derived from red sandstone, siltstone, and shale. Slope ranges from 0 to 50 percent. Permeability is moderate in the surface and upper subsoil layers and slow or very slow in the lower subsoil and substratum. Depth to bedrock is 60 inches or more. Wellsboro soils are on nearly level to steep glaciated uplands.

Wurtsboro: The Wurtsboro series consists of very deep, moderately well drained and somewhat poorly drained soils formed in till derived from acid gray and brown quartzite, conglomerate and sandstone. Slope dominantly ranges from 0 to 25 percent. The saturated hydraulic conductivity is moderately low to high in the mineral soil above the fragipan and moderately high to low in the fragipan. Depth to bedrock is 4 to 20 feet or more. Wurtsboro soils are nearly level to moderately steep soils of glaciated uplands.

4.3 Water Resources (18 CFR § 5.6 (d)(3)(iii))

4.3.1 Climate

The climate of the Catskill Mountains is considered primarily humid continental, which tends to dominate the northeastern states. Cool, dry air masses generally move eastward through the area throughout the year, while warm, humid maritime air masses generally move northeastward in the summer (Delaware Co. SWCD, 2007).

The processes of up-sloping and down-sloping and the characteristics of the mountain topography can cause drastic differences in precipitation levels between basins. Up-sloping is the process where air is lifted over the mountains, expands, then cools and condenses, creating clouds and precipitation. Down-sloping is the process of air sinking within a dome of high pressure, or air that is forced down a mountain range, warms up, loses moisture, and creates a drop in relative humidity (Greene Co. SWCD, 2007).

Average annual rainfall estimates range from 41 inches in the Schoharie Creek basin to as much as 48 inches in the Neversink River basin (Greene Co. SWCD, 2007). Summers are typically considered cool, with a few hot days, while the winters can be cold when influenced by Arctic air masses (Delaware Co. SWCD, 2004). Shown in Table 4.3.1-1 is the average annual precipitation within each of the four basins. Shown in Table 4.3.1-2 is the average monthly air temperature in each of the four basins.

Table 4.3.1-1: Average Annual Precipitation in each Watershed

Watershed	Average Annual Precipitation (inches)
Schoharie Creek	41
West Branch Delaware River	47
East Branch Delaware River	45-47
Neversink River	48

Source: Schoharie Creek & West and East Branch Delaware River Stream Management Plans (Greene Co. SWCD, 2007; Delaware Co. SWCD, 2004 & 2007)

Table 4.3.1-2: Monthly and Annual Average Air Temperature for each Development

Month	Mean Monthly Temperature (°F)		
	Schoharie[1] (1894-2006)	Cannonsville and Pepacton[2] (1936-2006)	Neversink[3] (1896-2006)
January	22.06	21.79	23.43
February	22.57	23.70	24.31
March	31.67	31.88	33.74
April	43.39	43.67	45.53
May	54.51	54.59	56.60
June	63.06	63.04	65.13
July	67.63	67.44	69.90
August	65.69	65.84	67.91
September	59.48	59.24	60.74
October	48.52	48.27	50.45
November	37.75	37.57	38.91
December	26.37	26.72	27.76
Mean Annual Temperature	**45.23**	**45.31**	**47.04**

Source: US Historical Climatology Network Website
[1] Maryland 6SW station data was used
[2] Bainbridge 2E station data was used
[3] Mohonk Lake station data was used

4.3.2 Streamflow

4.3.2.1 Schoharie Development – Schoharie Creek

The drainage area of Schoharie Creek at the Gilboa Dam is approximately 315 square miles. The USGS currently operates two gaging stations in close proximity to the Schoharie Development as summarized in Table 4.3.2.1-1. One gaging station, located on the Schoharie Creek at Prattsville, NY, measures 75% of the inflow to Schoharie Reservoir. A second gage on Schoharie Creek is located just below Gilboa Dam, which measures the total discharge from the Gilboa Dam. The gage has been operational since October 1975. As there are no management releases from the Gilboa Dam, flows recorded at the gage are a function of leakage and spillage. Shown in Table 4.3.2.1-2 are monthly and annual maximum, minimum, median, and mean flows for the period of available streamflow record for both USGS gages.

Shown in Figures 4.3.2.1-1 through 4.3.2.1-4 are monthly flow duration curves, and shown in Figure 4.3.2.1-5 is an annual flow duration curve for the USGS Gage below the Gilboa Dam. Shown on these same figures are monthly flow duration curves as derived from the OASIS model. Note that the monthly flow duration curves representing past/current conditions include the USGS gages full period of record. The monthly duration curves representing proposed conditions (from the OASIS model) have a simulated period of record from January 1, 1948 to September 30, 2008.

Table 4.3.2.1-1: USGS Gages in Proximity to Schoharie Development

Gage No.	Gage Name	Period of Record	Drainage Area	Comments
01350000	Schoharie Creek at Prattsville, NY	Nov 1902-Dec 2007	237 mi^2	Measures 75% of the inflow to Schoharie Reservoir
01350101	Schoharie Creek at Gilboa Dam	Oct 1975-Dec 2008	316 mi^2	Measures discharge directly below Gilboa Dam

Table 4.3.2.1-2: Flow Statistics for USGS Gages in Close Proximity to Schoharie Development

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Schoharie Creek at Prattsville, NY, Drainage Area = 237 mi^2, Period of Record: Nov 1902-Sep 2007, USGS Gage Results													
Min	31	30	39	122	36	11	6	5	5	7	7	10	5
Max	22,000	8,660	20,500	17,300	9,120	9,070	8,570	21,200	14,900	26,200	13,100	16,100	26,200
Mean	491	448	878	1,106	588	317	159	126	197	331	497	535	472
Median	278	257	517	778	406	172	70	43	49	100	285	300	229
Schoharie Creek at Gilboa Dam, Drainage Area = 316 mi^2, Period of Record: Oct 1975-Sep 2007, USGS Gage Results													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
Max	27,300	7,290	15,300	17,900	8,960	11,000	6,870	2,760	15,900	14,700	11,100	7,670	27,300
Mean	341	265	790	1,256	572	269	60	30	4	247	319	312	381
Median	1	1	256	860	267	0	0	0	0	0	1	0	0

Note: Gilboa Dam constructed in 1926. All flows in cfs.

Shown in Table 4.3.2.1-3 are flow statistics at Schoharie Creek at Gilboa Dam based on the OASIS Modeling Results

Table 4.3.2.1-3: Flow Statistics at Schoharie Creek at Gilboa Dam based on OASIS Modeling Results

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Schoharie Creek at Gilboa Dam, Drainage Area = 316 mi^2, Period of Record: Jan 1948-Sep 2008, OASIS Modeling Results													
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
Max	19,974	11,152	10,442	20,464	15,103	16,641	4,526	10,680	14,697	34,817	12,390	8,854	34,817
Mean	328	269	531	1,139	728	313	68	31	82	220	290	340	362
Median	0	0	0	744	442	0	0	0	0	0	0	0	0

Below the Gilboa Dam is the New York Power Authority's Blenheim-Gilboa Pump Storage Project. This project is licensed by the Commission (Project No. 2685). The lower reservoir dam is equipped with spillway gates and low level valves that permit the release of water downstream. Discharges from the lower reservoir are typically made to equal inflow, with inflow comprised of releases from Gilboa Dam and natural runoff from the Mine Kill and Platter Kill.

The Schoharie Creek channel slope from just below Gilboa Dam to the confluence with the Mohawk River is approximately 0.0022 ft/ft.

4.3.2.2 Cannonsville Development – West Branch of the Delaware River

The drainage area of the West Branch of the Delaware River at the Cannonsville Dam is approximately 456 square miles. The USGS currently operates two gaging stations in close proximity to the Cannonsville Development as summarized in Table 4.3.2.2-1. One gaging station, located on the West Branch of the Delaware River at Walton, NY, measures 73% of the inflow to Cannonsville Reservoir. A second gage on the West Branch of the Delaware River is located just below Cannonsville Dam, which measures the total discharge from Cannonsville Dam. The gage has been operational since January 1976. Shown in Table 4.3.2.2-2 are monthly and annual maximum, minimum, median, and mean flows for the period of available streamflow record for both USGS gages.

Shown in Figure 4.3.2.2-1 through 4.3.2.2-4 are monthly flow duration curves, and shown in Figure 4.2.2.1-5 is an annual flow duration curve for the USGS Gage below the Cannonsville Dam. Similar to Schoharie, also shown on the monthly flow duration curves are curves representing proposed conditions which were obtained from the OASIS model under the FFMP conditions. The period of record representing current and proposed conditions varies as shown on the figures.

Table 4.3.2.2-1: USGS Gages in Proximity to Cannonsville Development

Gage No.	Gage Name	Period of Record	Drainage Area	Comments
01350000	West Br. Delaware River at Walton, NY	Oct 1950-Sep 2007	332 mi^2	Measures 73% of the inflow to Cannonsville Reservoir
01350101	West Br. Delaware River at Stilesville, NY	Jan 1964-Sep 2007	456 mi^2	Measures discharge directly below Cannonsville Dam

Table 4.3.2.2-2: Flow Statistics for USGS Gages in Proximity to Cannonsville Development

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
West Branch Delaware River at Walton, NY, Drainage Area = 332 mi^2, Period of Record: Oct 1950-Sep 2007													
Min	70	64	74	191	96	36	21	16	13	14	14	17	13
Max	14,500	10,300	16,000	14,500	7,390	22,400	5,430	8,650	11,700	8,860	13,300	10,700	22,400
Mean	669	665	1,117	1,281	669	396	213	162	231	366	643	739	595
Median	358	380	780	923	492	228	121	82	80	152	431	500	330
West Branch Delaware River at Stilesville, NY, Drainage Area = 456 mi^2, Period of Record: Jan 1964-Sep 2007													
Min	7	7	9	11	24	23	16	26	19	18	16	8	7
Max	7,730	7,340	12,500	13,300	6,780	27,700	7,430	2,340	9,620	6,570	9,230	7,760	27,700
Mean	382	411	821	1,260	701	573	619	628	600	550	355	412	640
Median	51	95	299	973	419	346	427	551	498	320	47	47	333

Note: Cannonsville Dam constructed in 1964. All flows in cfs.

Shown in Table 4.3.2.2-3 are flow statistics at the West Branch of the Delaware River just below the Cannonsville Dam based on the OASIS modeling results.

Table 4.3.2.2-3: Flow Statistics at West Branch Delaware River just below Cannonsville Dam based on OASIS Modeling Results

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
West Branch Delaware River at Cannonsville Dam, Drainage Area = 456 mi^2, Period of Record: 1948-2008, OASIS Modeling Results													
Min	50	50	50	50	50	120	130	120	50	50	50	50	50
Max	6,230	4,590	11,797	16,428	6,498	28,283	8,300	1,833	6,830	5,530	6,426	6,155	28,283
Mean	547	434	685	1,205	473	446	511	558	542	553	366	449	565
Median	250	250	250	893	240	260	349	361	401	266	110	110	260

The West Branch of the Delaware River's channel slope from just below Cannonsville Dam to the confluence with the East Branch of the Delaware River is approximately 0.0021 ft/ft.

4.3.2.3 Pepacton Development – East Branch of the Delaware River

The drainage area of the West Branch of the Delaware River at the Downsville Dam is approximately 372 square miles. The USGS currently operates six gaging stations in close proximity to the Pepacton Development as summarized in Table 4.3.2.3-1. Five of the gaging stations measure inflow on individual tributaries to Pepacton Reservoir. One gage, on the East Branch Delaware River at Margaretville upstream of the Pepacton Reservoir, measures approximately 44% of the drainage area at Downsville Dam. The remaining inflowing tributaries—Platte Kill, Mill Brook, Tremper Brook, and Terry Clove Kill—measure approximately 9%, 7%, 9%, and 2%, respectively, of the drainage area at Downsville Dam. Collectively, approximately 71% of the inflow to Pepacton Reservoir is measured by USGS gages. There is also a gage located directly below Downsville Dam on the East Branch of the Delaware River at Downsville, NY. The gage also has a drainage area of 372 square miles, and has operated since January 1955. Shown in Table 4.3.2.3-2 are the monthly and annual maximum, minimum, median, and mean flows for the period of available streamflow record for the East Branch Delaware River gages at Margaretville (upstream of reservoir) and directly below the dam[4].

Shown in Figure 4.3.2.3-1 through 4.3.2.3-4 are monthly flow duration curves, and shown in Figure 4.3.2.3-5 is an annual flow duration curve for the USGS gage below Downsville Dam. Shown on the monthly flow duration curves are curves representing proposed conditions which were obtained from the OASIS model under the FFMP conditions. The period of record representing current and proposed conditions varies as shown on the figures.

The West Branch of the Delaware River's channel slope from just below Cannonsville Dam to the confluence with the East Branch of the Delaware River is approximately 0.0021 ft/ft.

Table 4.3.2.3-1: USGS Gages in Proximity to Pepacton Development

Gage No.	Gage Name	Period of Record	Drainage Area	Comments
01413500	East Br. Delaware River at Margaretville, NY	Feb 1937-Sep 2007	163 mi^2	Measures 44% of the inflow to Pepacton Reservoir
01414000	Platte Kill at Dunraven, NY	Oct 1941-Sep 1962 Dec 1996-Sep 2007	34.9 mi^2	Measures 9% of the inflow to Pepacton Reservoir
01414500	Mill Brook near Dunraven, NY	Feb 1937-Sep 2007	25.2 mi^2	Measures 7% of the inflow to Pepacton Reservoir
01415000	Tremper Kill near Andes, NY	Feb 1937-Sep 2007	33.3 mi^2	Measures 9% of the inflow to Pepacton Reservoir
01415460	Terry Clove Kill near Lancey, NY	Aug 2008-Sep 2007	7.91 mi^2	Measures 2% of the inflow to Pepacton Reservoir
01417000	East Br. Delaware River at Downsville, NY	Jan 1955-Sep 2007	372 mi^2	Measures discharge directly below Cannonsville Dam

Table 4.3.2.3-2: Flow Statistics for USGS Gages in Proximity to Pepacton Development

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
East Branch Delaware River at Margaretville, NY, Drainage Area = 163 mi^2, Period of Record: Feb 1937-Sep 2007													
Min	35	38	36	120	62	16	11	9	6	9	8	13	6
Max	11,300	3,570	7,890	8,020	4,330	7,060	2,850	5,800	7,320	10,000	7,900	6,990	11,300
Mean	341	314	546	725	405	225	124	85	118	191	319	372	313
Median	192	190	365	527	305	146	71	42	38	77	224	240	177
East Branch Delaware River at Downsville, NY, Drainage Area = 372 mi^2, Period of Record: Jan 1955-Sep 2007													
Min	1	5	4	3	17	4	17	14	15	2	2	3	1
Max	6,680	4,510	6,390	16,600	9,340	16,600	5,030	2,810	12,400	7,330	4,390	8,980	16,600
Mean	145	116	137	554	402	237	121	123	186	167	189	179	213
Median	41	39	42	67	75	76	87	87	73	69	44	37	57

Note: Downsville Dam constructed in 1954. All flows in cfs.

[4] Flow statistics for the other inflowing tributaries is not shown, but can be provided if requested.

Shown in Table 4.3.2.3-3 are flow statistics at the East Branch of the Delaware River just below the Downsville Dam based on the OASIS modeling results.

Table 4.3.2.3-3: Flow Statistics at East Branch Delaware River just below Downsville Dam based on OASIS Modeling Results

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
East Branch Delaware River at Downsville Dam, Drainage Area = 372 mi^2, Period of Record: 1948-2008, OASIS Modeling Results													
Min	40	40	40	40	40	80	80	80	30	30	30	40	30
Max	6,566	3,713	7,550	14,692	8,633	16,707	4,371	1,304	1,500	8,740	6,290	8,151	16,707
Mean	305	265	340	896	503	302	192	170	141	144	184	250	308
Median	85	85	85	700	125	140	140	140	140	60	60	85	140

The East Branch of the Delaware River's channel slope from just below Downsville Dam to the confluence with the West Branch of the Delaware River is approximately 0.0011 ft/ft.

4.3.2.4 Neversink Development – Neversink River

The drainage area of the Neversink River at the Neversink Dam is 92.6 square miles. The USGS currently operates two gaging stations in close proximity to the Neversink Reservoir as summarized in Table 4.3.2.4-1. One gaging station, located on the Neversink River at Claryville measures 71% of the inflow to the Neversink Reservoir. A second gage on the Neversink River is located just below the Neversink Dam, which measures the total discharge from the Neversink Dam. The gage has been operational since October 1941 (the dam was placed in service in 1953). Shown in Table 4.3.2.4-2 are the monthly and annual maximum, minimum, median, and mean flows for the period of available streamflow record for both USGS gages.

Shown in Figure 4.3.2.4-1 through 4.3.2.4-4 are monthly flow duration curves, and shown in Figure 4.3.2.4-5 is an annual flow duration curve for the USGS gage below the Neversink Dam. Shown on the monthly flow duration curves are curves representing proposed conditions which were obtained from the OASIS model under the FFMP conditions. The period of record representing current and proposed conditions varies as shown on the figures.

Table 4.3.2.4-1: USGS Gages in Proximity to Neversink Development

Gage No.	Gage Name	Period of Record	Drainage Area	Comments
01435000	Neversink River near Claryville, NY	Nov 1937-May 1949 Jul 1951-Sep 2007	66.6 mi^2	Measures 71% of the inflow to Neversink Reservoir
01436000	Neversink River at Neversink, NY	Oct 1941-Sep 2007	92.6 mi^2	Measures discharge directly below Neversink Dam

Table 4.3.2.4-2: Flow Statistics for USGS Gages in Proximity to Neversink Development

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Neversink River near Claryville, NY, Drainage Area = 66.6 mi^2, Period of Record: Nov 1937-May 1949, Jul 1951-Sep 2007													
Min	28	27	37	56	53	20	13	10	8	10	10	16	8
Max	4,970	6,090	4,670	5,560	4,060	4,080	5,900	3,600	4,000	5,010	4,330	4,940	6,090
Mean	179	158	284	421	253	153	105	81	104	157	211	216	194
Median	110	106	179	296	189	105	62	46	49	83	152	140	118
Neversink River at Neversink, NY, Drainage Area = 92.6 mi^2, Period of Record: Oct 1941-Sep 2007													
Min	1	3	1	1	8	12	12	13	2	0	3	0	0
Max	2,530	976	2,010	6,920	2,726	4,740	2,750	876	1,880	1,970	722	2,090	6,920
Mean	32	25	26	102	75	82	62	59	54	40	28	31	51
Median	16	13	9	23	43	44	51	49	46	28	22	15	24

Note: Neversink Dam constructed in 1953. All flows in cfs.

Shown in Table 4.3.2.4-3 are flow statistics at the Neversink River just below the Neversink Dam based on the OASIS modeling results.

Table 4.3.2.4-3: Flow Statistics at Neversink River just below Neversink Dam based on OASIS Modeling Results

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Neversink at Neversink Dam, Drainage Area = 92.6 mi^2, Period of Record: 1948-2008, OASIS Modeling Results													
Min	30	30	30	30	30	55	55	55	25	25	25	30	25
Max	2,879	1,347	5,588	7,976	3,347	2,806	1,523	201	201	3,629	1,783	3,538	7,986
Mean	130	117	135	233	132	124	109	107	89	70	80	113	120
Median	100	100	100	65	90	100	100	100	85	45	45	65	100

The Neversink River's channel slope from just below Neversink Dam to the confluence with the Delaware River is approximately 0.0038 ft/ft.

4.3.3 Water Quality Standards

New York State water classifications and water quality standards apply to all four reservoirs and the riverine reaches below the Projects. Table 4.3.3-1 describes the NYSDEC fresh surface water classifications. Only Class AA and A waters are designated as suitable for drinking; however, other uses include primary and secondary contact, fishing, and recreational activities. This designation may also be given to waters that, upon treatment for naturally occurring impurities, meet New York State Department of Health ("NYSDOH") drinking water standards. Tables 4.3.3-2 through 4.3.3-5 identify the water quality classifications of Schoharie Creek, West Branch of the Delaware River, East Branch of the Delaware River, and Neversink River, respectively. Shown in Table 4.3.3-6 are the water quality criteria for the various water quality classifications.

Additional designations of 'T' or 'TS' may be added to the classifications if the watercourse contains sufficient dissolved oxygen to support trout (T) and/or trout spawning (TS). Watercourses that are designated as C(T), C(TS), B or A are protected streams, subject to additional regulations and require a state permit to disturb the bed or banks.

The surface and groundwater quality standards were amended January 17, 2008 and effective February 16, 2008. The water quality standards program is a state program with EPA oversight. It predates the federal Clean Water Act and protects both surface and groundwater. Standards and guidance values were developed to protect New York State's waters. Values were derived and continue to be revised according to scientific procedures identified in Title 6 of the New York Codes, Rules, and Regulations.

Table 4.3.3-1: New York Fresh Surface Water Quality Classifications

Class	Description and Designated Uses
AA	The best usages of Class AA waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival. This classification may be given to those waters that, if subjected to approved disinfection treatment, with additional treatment if necessary to remove naturally present impurities, meet or will meet New York State Department of Health drinking water standards and are or will be considered safe and satisfactory for drinking water purposes.
A	The best usages of Class A waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival. This classification may be given to those waters that, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to reduce naturally present impurities, meet or will meet New York State Department of Health drinking water standards and are or will be considered safe and satisfactory for drinking water purposes.
B	The best usages of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival.
C	The best usage of Class C waters is fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
D	The best usage of Class D waters is fishing. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the waters will not support fish propagation. These waters shall be suitable for fish, shellfish, and wildlife survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

Table 4.3.3-2: Surface Water Quality Classifications of Schoharie Creek and Tributaries to Schoharie Reservoir

Water Body	Classification	Standards	Notes
Schoharie Creek	A	A	Schoharie Creek as it enters the reservoir
Schoharie Reservoir	AA	AA (TS)	Main body of the reservoir
Schoharie Creek	B	B	From reservoir to Blenheim-Gilboa Reservoir
Schoharie Creek	B/C	B/C	From Blenheim Reservoir to Mohawk River (switches between B & C)
Johnson Hollow Brook	A	A(T)	Lower stream as it enters reservoir
Bear Kill	C	C(TS)	Entire length
Manor Kill	A	A(T)	Lower stream as it enters reservoir

Source: NYSDEC, 2008b

Table 4.3.3-3: Surface Water Quality Classifications of the West Branch Delaware River and Tributaries to Cannonsville Reservoir

Water Body	Classification	Standards	Notes
West Br. Delaware River	B	B(T)	As the river enters the reservoir
Cannonsville Reservoir	A	A(T)	Main body of reservoir
Cannonsville Reservoir	AA	AA(T)	Within 1 mile of intake
West Br. Delaware River	B	B(T)	NY-PA boundary to Cannonsville Dam
Chase Brook	A	A(TS)	Lower stream as it enters the reservoir
Fish Brook	A	A(T)	Lower stream as it enters the reservoir
Dryden Creek	A	A(TS)	Lower stream as it enters the reservoir
Chamberlain Brook	A	A(T)	Lower stream as it enters the reservoir
Loomis Creek	A	A(T)	Lower stream as it enters the reservoir
Trout Creek	A	A(TS)	Lower stream as it enters the reservoir
Sherruck Brook	A	A(TS)	Lower stream as it enters the reservoir
Dry Brook	A	A(TS)	Lower stream as it enters the reservoir
Johnny Brook	A	A(T)	Lower stream as it enters the reservoir

Source: NYSDEC, 2008b

Table 4.3.3-4: Surface Water Quality Classifications of the East Branch Delaware River and Tributaries to Pepacton Reservoir

Water Body	Classification	Standards	Notes
East Br. Delaware River	C	C(TS)	As the river enters the reservoir
East Br. Delaware River	A	A(T)	From reservoir to Delaware River mainstem
Pepacton Reservoir	A	A(T)	Main body of reservoir
Pepacton Reservoir	AA	AA(T)	Within 1 mile of intake
Delaware River	A	A(T)	New York State line to confluence of East and West branches of the Delaware River
Mill Brook	A	A(TS)	Lower stream as it enters the reservoir
Barkaboom Stream	A	A(TS)	Lower stream as it enters the reservoir
Tremper Kill	A	A(TS)	Lower stream as it enters the reservoir
Holliday Brook	A	A(TS)	Lower stream as it enters the reservoir
Fall Clove	A	A(TS)	Lower stream as it enters the reservoir
Coles Clove	A	A(TS)	Lower stream as it enters the reservoir

Source: NYSDEC, 2008b

Table 4.3.3-5: Surface Water Quality Classifications of the Neversink River and Tributaries to Neversink Reservoir

Water Body	Classification	Standards	Notes
Neversink River	A	A(T)	Neversink River as it enters the reservoir
Neversink Reservoir	AA	AA(T)	Main body of the reservoir
Neversink River	B	B(T)	From reservoir to confluence with Delaware River
Black Joe Brook	A	A(T)	Lower stream as it enters the reservoir
Conklin Brook	A	A(T)	Lower stream as it enters the reservoir

Source: NYSDEC, 2008b

Table 4.3.3-6: Summary of New York State Surface Water Quality Criteria

Parameter	Classes	Standard
Taste-, color-, and odor-producing, toxic and other deleterious substances	AA, A, B, C, D, SA, SB, SC, I, SD, A-Special, GA, GSA, GSB	None in amounts that will adversely affect the taste, color or odor thereof, or impair the waters for their best usages.
Turbidity	AA, A, B, C, D, SA, SB, SC, I, SD, A-Special	No increase that will cause a substantial visible contrast to natural conditions.
Suspended, colloidal and settleable solids	AA, A, B, C, D, SA, SB, SC, I, SD, A-Special	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.
Oil and floating substances	AA, A, B, C, D, SA, SB, SC, I, SD, A-Special	No residue attributable to sewage, industrial wastes or other wastes, nor visible oil film nor globules of grease.
Garbage, cinders, ashes, oils, sludge and other refuse	SA, SB, SC, I, SD	None in any amounts.

Parameter	Classes	Standard
Phosphorus and nitrogen	AA, A, B, C, D, SA, SB, SC, I, SD, A-Special	None in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages.
Radioactivity	A-Special	Should be kept at the lowest practicable levels, and in any event should be controlled to the extent necessary to prevent harmful effects on health.
Thermal discharges	GA, GSA, GSB	None in amounts that will impair the waters for their best usages.
Thermal discharges	AA, A, B, C, D, SA, SB, SC, I, SD, A-Special	See Part 704 of this Title.
Flow	AA, A, B, C, D, A-Special	No alteration that will impair the waters for their best usages.
pH	AA, A, B, C, AA-Special, A-Special, GA	Shall not be less than 6.5 nor more than 8.5.
	D	Shall not be less than 6.0 nor more than 9.5.
	SA, SB, SC, I, SD	The normal range shall not be extended by more than one-tenth (0.1) of a pH unit.
Dissolved oxygen (DO)	A-Special	In rivers and upper waters of lakes, not less than 6.0 mg/L at any time. In hypolimnetic waters, it should not be less than necessary for the support of fish life, particularly cold water species.
	AA, A, B, C, AA-Special	For trout spawning waters (TS), the DO concentration shall not be less than 7.0 mg/L from other than natural conditions. For trout waters (T), the minimum daily average shall not be less than 6.0 mg/L, and at no time shall the concentration be less than 5.0 mg/L. For non-trout waters, the minimum daily average shall not be less than 5.0 mg/L, and at no time shall the DO concentration be less than 4.0 mg/L.
Dissolved Solids	A-Special	Shall not exceed 200 mg/L.
	AA, A, B, C, AA-Special, GA	Shall be kept as low as practicable to maintain the best usage of waters but in no case shall it exceed 500 mg/L.
Odor	GA	Shall not exceed a threshold number of 3.
Color	GA	Shall not exceed 15 color units (platinum-cobalt method).
Turbidity	GA	Shall not exceed 5 nephelometric units.
Total Coliform (per 100mL)	AA	The monthly median value and more than 20 percent of the samples, from a minimum of five examinations, shall not exceed 50 and 240, respectively.

Parameter	Classes	Standard
	A, B, C, D, SB, SC	The monthly median value and more than 20 percent of the samples, from a minimum of five examinations, shall not exceed 2,400 and 5,000, respectively.
	A-Special	The geometric mean, of not less than five samples, taken over not more than a 30-day period shall not exceed 1,000.
Fecal Coliforms (per 100 mL)	A, B, C, D, SB, SC	The monthly geometric mean, from a minimum of five examinations, shall not exceed 200

Source: NYSDEC, 2008b

4.3.4 Water Quality Assessment and Data

The water quality of the City's water supply, its watershed streams, reservoirs, wastewater treatment plants, and aqueducts, is routinely monitored by the City's Watershed Water Quality Operations ("WWQO") group. West of the Hudson River, WWQO has a staff of 62 people, stationed in two laboratories (Grahamsville and Kingston), who are directly responsible for monitoring and maintaining the high water quality in the Catskill and Delaware water supply systems.

The WWQO staff includes facility managers, field and laboratory directors, chemists, microbiologists, laboratory support and sample collection personnel, scientists, technical specialists, and administrative staff. The Grahamsville and Kingston laboratories are certified by the NYSDOH Environmental Laboratory Approval Program for over 70 environmental analyses in the non-potable water and potable water categories. These analyses include physical parameters (e.g., pH, turbidity, color, conductivity), chemical parameters (e.g., nitrates, phosphates, chloride, chlorine residual, alkalinity), microbiological parameters (e.g., total and fecal coliform bacteria, algae), trace metals (e.g., lead, copper, arsenic, mercury, nickel), and organic parameters (e.g., organic carbon). Pathogens (e.g., *Giardia*, *Cryptosporidium*, and viruses) are assessed at the Kingston laboratory.

Water quality monitoring of the water supply is conducted for a host of reasons including regulatory compliance, meeting Filtration Avoidance Determination requirements, modeling, and surveillance. The rationale, analytes, sites, and frequencies are outlined for these and other specific objectives in a comprehensive Watershed Water Quality Monitoring Plan. The standard water quality data collected and a summary of the data for 2006 and 2007 are described below.

Reservoir Monitoring

Limnological surveys of the Schoharie, Cannonsville, Pepacton, and Neversink Reservoirs have historically been performed twice monthly from April through November. The surveys include dissolved oxygen and temperature profiles at various locations in each reservoir. Beginning in 2009, surveys will be conducted on a monthly basis.

Stream and Reservoir Release Monitoring

Stream monitoring stations are those located on tributaries entering each of the reservoirs. Release monitoring stations are located in the tailwater of each dam. Hydrology (stream and release) surveys of the Schoharie Creek, the East and West Branches of the Delaware River, and the Neversink River are performed monthly, with additional samples collected a second time during the month at the major stream inputs to each reservoir. Reservoir releases (tailwaters) are also monitored below the Cannonsville, Downsville, and Neversink Dams; the tailwater below Gilboa Dam is not monitored as there are no mandated releases. Monthly samples for a wide range of analytes (e.g., physicals, alkalinity, solids, nutrients, dissolved major metals, coliform bacteria) are taken from 12 stream sites near the Schoharie Reservoir, 12 near the Cannonsville Reservoir, 11 near the Pepacton Reservoir, and four near the Neversink Reservoir.

2006 and 2007 Water Quality Data

For purposes of this PAD, only water quality data collected by the NYCDEP in 2006 and 2007 are presented, although the NYCDEP has an extensive database of water quality data. Also note that reported in the following section is information on the DO and temperature profiles in the tailwaters. While only the reservoir sampling stations and data are presented, the NYCDEP has stream sampling sites as well. In addition, chemical, microbiological, and organic parameters have not been included but are available.

To put the climatological conditions of 2006 and 2007 into perspective, temperature and precipitation data were evaluated. Shown in Table 4.3.4-1 are monthly precipitation totals for 2006, 2007, the long term, and deviations from the long-term. Similarly, shown in Table 4.3.4-2 are average monthly air temperatures for 2006, 2007, the long term, and deviations from the long-term.

Table 4.3.4-1: Monthly Precipitation Totals (in inches) for 2006, 2007, and Long-Term

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1951-2007	2.53	1.82	3.11	2.97	3.32	5.44	4.10	3.45	4.07	4.05	3.55	2.93
2006	3.27	1.25	1.63	2.61	2.37	11.45	5.52	6.53	3.76	4.34	4.86	2.19
Diff	0.74	-0.57	-1.48	-0.36	-0.95	6.01	1.15	3.08	-0.31	0.29	1.54	-0.74
% Diff	29%	-31%	-48%	-12%	-29%	110%	28%	89%	-8%	7%	43%	-25%
2007	3.06	1.60	3.27	3.01	2.93	3.26	5.37	2.45	3.27	4.33	4.35	3.86
Diff	0.53	-0.22	0.16	0.04	-0.39	-2.18	1.27	-1.00	-0.80	0.28	0.80	0.93
% Diff	21%	-12%	5%	1%	-12%	-40%	31%	-29%	-20%	7%	23%	32%

Source: NOAA, 2008- at Binghamton, NY

Note: Precipitation does not include snowfall.

Table 4.3.4-2: Monthly Average Air Temperature (in °F) for 2006, 2007, and Long-Term

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1951-2007	22.9	24.1	32.1	45.1	55.5	64.9	68.7	68.9	60.8	49.0	39.9	30.9
2006	30.8	25.1	32.4	46.8	56.2	63.9	71.2	67.2	57.8	47.6	43.0	35.3
Diff	7.9	1.0	0.3	1.7	0.7	-1.0	2.5	-1.2	-3.0	-1.4	3.1	4.4
% Diff	34%	4%	1%	4%	1%	-2%	4%	-2%	-5%	-3%	8%	14%
2007	27.0	18.3	32.7	42.3	58.8	66.8	67.5	69.1	63.8	56.8	37.5	27.3
Diff	4.1	-5.8	0.6	-2.8	3.3	1.9	-3.7	0.2	3.0	7.8	-2.4	-3.6
% Diff	18%	-24%	2%	-6%	6%	3%	-5%	0%	5%	16%	-6%	-12%

Source: NOAA, 2008- at Binghamton, NY

In reviewing the precipitation and air temperature data, emphasis was placed on the summer period as water quality conditions are most sensitive during this period. Generally, the summer of 2006 was relatively wet during the months of June (110% greater than average), July (28%), and August (89%) as compared to the long-term. In fact, a review of spill data for all four reservoirs shows spill occurring in late June/early July 2006. Alternatively during the summer 2007, no spill occurred at any of the Cannonsville, Neversink, or Pepacton Reservoirs. When reviewing the water quality results presented below, spill includes reservoir surface waters, which are warmer than the cooler low-level releases in the summer.

Air temperatures during the summer of 2006 and 2007 were within a few degrees of the long-term. Note that the air temperatures are averages over a month, and thus there could be a few days of a heat wave that are not noticeable in the averages.

4.3.4.1 Schoharie Development

Schoharie Reservoir Monitoring – Dissolved Oxygen and Temperature Profiles

Although the NYCDEP has several years of DO and temperature data, only 2006 and 2007 data is presented herein. Shown in Figure 4.3.4.1-1 and listed in Table 4.3.4.1-1 are the DO and temperature sampling locations on the Schoharie Reservoir. The NYCDEP generally collects DO and temperature profiles twice a month starting in April and ending in November. There are four sampling sites on the Schoharie Reservoir. Each sampling site was visited 15 times in both 2006 and 2007. Thus, there are 30 DO profiles and 30 temperature profiles per sampling location. Because of the volume of data, DO and temperature profiles were developed only for the sampling site closest to the dam and outlet works. The sampling site closest to the dam generally represents the deepest location in the reservoir. DO and temperature profiles for all four reservoirs are provided in this document only for the sampling location closest to the dam, although all sampling sites are described and shown on the figures.

Table 4.3.4.1-1: Sampling Locations for Dissolved Oxygen & Temperature Profiles in the Schoharie Reservoir

Sample ID No.	Sample Location Description
1SS[5]	Schoharie Reservoir, site 1, near the Gilboa Dam
1.5SS	Schoharie Reservoir, site 1.5, halfway between Gilboa Dam & Intake at Manorkill
2SS	Schoharie Reservoir, site 2, halfway between dam and intake (over stream channel)
3SS	Schoharie Reservoir, site 3, intake
4SS	Schoharie Reservoir, site 4, influent to reservoir

Shown in Figure 4.3.4.1-2 and 4.3.4.1-3 are temperature profiles for Sample Site 1.5SS for 2006 and 2007, respectively. Also shown in Figure 4.3.4.1-4 and 4.3.4.1-5 are DO profiles for Sample Site 1.5SS for 2006 and 2007, respectively.

As the temperature profiles show, generally there was thermal stratification at the sampling site 1.5SS as there is a visible thermocline during the summer months. As expected, water temperatures in the epilimnion were higher than the temperatures in the hypolimnion, particularly during the heart of the summer. Near the proposed low-level outlet, the water temperatures ranged from 6-10ºC, which is much colder than the surface water temperatures (which could be as high as 25 ºC in the summer).

As the DO profiles show, there was less evidence of DO stratification within the impoundment in 2006 than in 2007. In the spring, the DO concentrations are relatively uniform throughout the water column. As summer begins, air temperatures warm, plant growth occurs, and DO concentrations become stratified, with lower concentrations in the lower depths of the reservoir.

Gilboa Dam Release Monitoring – Dissolved Oxygen and Temperature

Because there are no scheduled releases below the Gilboa Dam, DO and temperature data is not collected immediately below the dam. However, the NYCDEP collects DO and temperature data in the stream portion of the Schoharie Creek near the Town of Prattsville, just upstream of the reservoir near the USGS gage (Sample Site S51—see Figure 4.3.4.1-1). Samples are taken typically between 9:00 am and 11:00 am.

Shown in Figure 4.3.4.1-6 are the 2006 and 2007 temperature data, and shown Figure 4.3.4.1-7 are the 2006 and 2007 DO concentrations. As expected, Figure 4.3.4.1-6 shows that water temperatures of the inflowing Schoharie Creek rose in the summer to a peak of roughly 22-23ºC during both 2006 and 2007. As Figure 4.3.4.1-7 shows, DO concentrations were the highest during cooler times of the year, when plants remain dormant and do not impact DO levels. During the growing season, plants emit oxygen during the day (increase DO) and respire (take in DO) at night. DO concentrations were between 14 and 16 mg/L in the spring, and reached a low of 7.7 mg/L in the summer. DO concentrations were well above the water quality standards.

4.3.4.2 Cannonsville Development

NYSDEC guidelines have designated the majority of the West Branch of the Delaware River as trout habitat. This designation alone indicates generally good water quality. Another indicator of water quality is the composition of the macroinvertebrate and diatom communities. A water

[5] Note- no data was available in 2006 or 2007 for sample Site 1SS.

quality assessment based on these communities indicated that the West Branch was either non-impacted or only slightly impacted above the reservoir to the headwaters (NYSDEC, 2001). Additional studies by Bode near the Solid Waste Management Center in the Town of Walton indicated water quality was generally non-impacted with slight impacts in some parameters (Delaware Co. SWCD, 2004).

Cannonsville Reservoir Monitoring – Dissolved Oxygen and Temperature Profiles

Shown in Figure 4.3.4.2-1 and listed in Table 4.3.4.2-1 are the DO and temperature sampling locations in the Cannonsville Reservoir.

Table 4.3.4.2-1: Sampling Locations for Dissolved Oxygen & Temperature Profiles in the Cannonsville Reservoir

Sample ID No.	Sample Location Description
1WDC	Cannonsville Reservoir, Site 1, mid-channel at Cannonsville Dam
2WDC	Cannonsville Reservoir, Site 2, mid-channel at the spot from which Johnny Brook can be sighted, as approached from the west.
3WDC	Cannonsville Reservoir, Site 3, up Trout Creek arm, mid-channel between 2 hills on west bank
4WDC	Cannonsville Reservoir, Site 4, mid-channel across from the intake chamber.
5WDC	Cannonsville Reservoir, Site 5, mid-channel at widest part of the bay at Chamberlain Brook
6WDC	Cannonsville Reservoir, Site 6, mid-channel at the influent of the West Branch Delaware River

Shown in Figure 4.3.4.2-2 and 4.3.4.2-3 are temperature profiles for Sample Site 1WDC for 2006 and 2007, respectively. Shown in Figure 4.3.4.2-4 and 4.3.4.2-5 are DO profiles for Sample Site 1WDC for 2006 and 2007, respectively.

As the temperature profiles show, generally during May and June a thermocline develops. As the summer progresses, the thermocline moves lower in the reservoir and there are greater thermal differences between surface water temperatures and bottom temperatures. Near the low-level outlet, the water temperatures ranged from 6-10ºC, which is much colder than the surface water temperatures (which could be as high as 25ºC in the summer). As described below, the water temperatures in the West Branch of the Delaware River, just below the dam, are typically less than 10ºC when the flow is comprised only of the low-level outlet discharge.

As the DO profiles show, there was less evidence of DO stratification within the impoundment in 2006 than in 2007. In the spring, the DO concentrations are relatively uniform throughout the water column. As summer begins and air temperatures warm, DO concentrations become stratified, with lower concentrations in the lower depths of the reservoir. As described below, the DO concentrations in the West Branch of the Delaware River, immediately below the dam, are well above State water quality standards.

Cannonsville Dam Release Monitoring – Dissolved Oxygen and Temperature

Conservation flows are required below the Cannonsville Dam. The NYCDEP obtains DO and temperature data below the dam near the USGS gage (Sample Site CNB—see Figure 4.3.4.2-1).

Sampling is conducted monthly (at a minimum) throughout the year and the samples are generally collected between 9:00 am and 11:00 am. Note that the water quality station includes both the cooler low level releases, as well as spillage flows when water levels exceed the spillway crest.

Shown in Figure 4.3.4.2-6 are the 2006 and 2007 temperature data, while shown in Figure 4.3.4.2-7 are the 2006 and 2007 DO concentrations. Also shown on the temperature and DO figures are the total discharges on the dates that water quality data was collected as measured at the USGS gage. The reason for displaying discharge is that although there are times when the water temperature may rise, this is attributable to spillage where warmer temperatures from the reservoir surface water are mixing with the cooler low level releases. Note that, as of the date of this filing, the USGS has not published flow data for October, November, and December of 2007.

As Figure 4.3.4.2-6 shows, water temperatures at the USGS gage are cool throughout the year due to the low-level outlet works in the reservoir (the intake elevation is at 999 feet). The highest measured water temperature during the two years occurred on September 5, 2006 at 16.7ºC. However, releases were generally less than 10ºC throughout the year.

As Figure 4.3.4.2-7 shows, DO concentrations are relatively high in the spring and gradually decline to a low point in the early fall before rebounding again. This phenomenon was observed in 2006 and 2007. Generally, DO levels were well above State standards; however, the lowest reading, which occurred on October 1, 2007, was 5.6 mg/L (all other measurements were above 7 mg/L).

4.3.4.3 Pepacton Development

The East Branch of the Delaware River also has high quality water. As with the West Branch, the majority of the watershed is forested and most of the river and tributaries are designated trout habitat.

Shown in Figure 4.3.4.3-1 and listed in Table 4.3.4.3-1 are the DO and temperature sampling locations on Pepacton Reservoir.

Table 4.3.4.3-1: Sampling Locations for Dissolved Oxygen & Temperature Profiles in the Pepacton Reservoir

Sample ID No.	Sample Location Description
1EDP	Pepacton Reservoir, Site 1, mid-channel at Pepacton Dam
2EDP	Pepacton Reservoir, Site 2, mid-channel at the influent of Murphy Hill Brook
3EDP	Pepacton Reservoir, Site 3, mid-channel across from the intake chamber
4EDP	Pepacton Reservoir, Site 4, mid-channel at the influent of Flynn Brook
5EDP	Pepacton Reservoir, Site 5, mid-channel at the influent of Tremper Kill
6EDP	Pepacton Reservoir, Site 6, mid-channel at the influent of Mill Brook

Shown in Figure 4.3.4.3-2 and 4.3.4.3-3 are temperature profiles for Sample Site 1EDP for 2006 and 2007, respectively. Shown in Figure 4.3.4.3-4 and 4.3.4.3-5 are DO profiles for Sample Site 1EDP for 2006 and 2007, respectively.

As temperature profiles show, during May 2006 and 2007 the reservoir was nearly isothermal, as there was no evident thermocline. However, as the air temperatures warmed a thermocline developed during both years. Again, as the summer progresses, the thermocline moves lower in the reservoir as there are greater differences between surface water temperatures and bottom temperatures. Near the low-level outlet (approximate elevation of 1,100 feet), the water temperatures remain below 6ºC, far lower than the highest surface water temperature of 25.1ºC recorded in August 2007. As described below, the water temperatures in the East Branch Delaware River, just below the dam, are typically less than 8ºC when the flow is comprised only of the low-level outlet discharge.

As the DO profiles show, generally during April and early May the DO remains relatively constant throughout the water column, with DO concentrations over 12 mg/L. As air temperatures warm and plant growth begins, DO concentrations become stratified, with lower concentrations in the lower depths of the reservoir. In the fall, DO concentrations remain relatively high in the upper portions of the reservoir (2006 and 2007), but roughly one-third of the way down the water column, DO concentrations decline to less than 4 mg/L. However, the DO concentration increases again roughly halfway down the water column. As described below, the DO concentrations in the East Branch Delaware River, just below the dam, are above state water quality standards.

Downsville Dam Release Monitoring – Dissolved Oxygen and Temperature

Conservation flows are required below the Downsville Dam. The NYCDEP obtains DO and temperature data below the dam near the USGS gage (Sample Site PDB—see Figure 4.3.4.3-1). Sampling is conducted monthly (at a minimum) throughout the year and the samples are generally collected between 9:30 am and 10:30 am. The water quality station accounts for low level releases, but also spillage flows when water levels exceed the spillway crest.

Shown in Figure 4.3.4.3-6 are the 2006 and 2007 temperature data, while shown in Figure 4.3.4.3-7 are the 2006 and 2007 DO concentrations. Also shown on the temperature and DO figures are the total discharges on the dates that water quality data was collected as measured at the USGS gage. The reason for displaying discharge is that although there are times when the water temperature may rise, this is attributable to spillage where warmer temperatures from the reservoir surface water are mixing with the cooler low level releases. Note that, as of the date of this filing, the USGS has not published flow data for October, November, and December of 2007.

As Figure 4.3.4.3-6 shows, water temperatures at the USGS gage are cool throughout the year due to the low-level outlet works in the reservoir (the intake elevation is near 1,100 feet above msl). The highest measured water temperature during the two years occurred on June 12, 2006 at 11.3ºC; however, this included spill flow as well. Absent spill, temperatures were generally between 3 ºC and 6ºC.

As Figure 4.3.4.3-7 shows, DO concentrations were well above the water quality standard and ranged between 10 and 13.2 mg/L over the two-year sampling period.

4.3.4.4 Neversink Development

The NYSDEC will be conducting a thorough assessment of the Neversink River watershed, including a detailed water quality assessment and stream management plan that will be completed by 2011.

Shown in Figure 4.3.4.4-1 and listed in Table 4.3.4.4-1 are the DO and temperature sampling locations on the Neversink Reservoir.

Table 4.3.4.4-1: Sampling Locations for Dissolved Oxygen & Temperature Profiles in the Neversink Reservoir

Sample ID No.	Sample Location Description
1NN	Neversink Reservoir, Site 1, mid-channel at Neversink Intake Chamber
2NN	Neversink Reservoir, Site 2, mid-channel between the larger peninsula and the unnamed brook near the southern end of the reservoir/
3NN	Neversink Reservoir, Site 3, mid-channel across from the inlet just south of Aden Brook's outflow
4NN	Neversink Reservoir, Site 4, top end of reservoir in the narrows where the Neversink River enters. Mid-channel at the site determined by the bare rock 'cliffs' exposed on the west shore.

Shown in Figure 4.3.4.4-2 and 4.3.4.4-3 are temperature profiles for Sample Site 1NN for 2006 and 2007, respectively. Shown in Figure 4.3.4.4-4 and 4.3.4.4-5 are DO profiles for Sample Site 1NN for 2006 and 2007, respectively.

Similar to the other reservoir temperature profiles in April 2006 and 2007, the reservoir is virtually isothermal. However, as the air temperatures warmed a thermocline developed during both years; the thermocline deepens in the reservoir as the summer progresses. With the onset of fall and cooler air temperatures, the upper portion of the reservoir cools to a point where the reservoir is nearly isothermal. Near the low-level outlet (approximate elevation 1,285 feet above msl), the water temperatures remain below 6ºC, far lower than the highest surface water temperature of 25.7ºC, recorded in August 2006. As described below, the water temperatures in the Neversink River, just below the dam, are typically less than 11ºC.

As the DO profiles show, generally during April and early May the DO concentrations remain relatively constant throughout the water column and are over 11 mg/L. DO concentrations become stratified with the onset of warmer air temperatures and increased plant growth. In the late fall (September and October), DO concentrations remain relatively high in the upper portions of the reservoir (2006 and 2007), and drop to 4-6 mg/L about halfway down the profile. As described below, the DO concentrations in the Neversink River just below the dam are above state water quality standards.

Neversink Dam Release Monitoring – Dissolved Oxygen and Temperature

Conservation flows are required below the Neversink Dam. The NYCDEP obtains DO and temperature data below the dam near the USGS gage (Sample Site NB—see Figure 4.3.4.4-1). Data is obtained monthly (at a minimum) throughout the year and the samples are generally collected between 10:00 am and noon. The water quality station accounts for low level releases, but also spillage flows when water levels exceed the spillway crest.

Shown in Figure 4.3.4.4-6 are the 2006 and 2007 temperature data, while shown in Figure 4.3.4.4-7 are the 2006 and 2007 DO concentrations. Also shown on the temperature and DO figures are the total discharges on the dates that water quality data was collected as measured at the USGS gage. The reason for displaying discharge is that although there are times when the water temperature may rise, this is attributable to spillage where warmer temperatures from the reservoir surface water are mixing with the cooler low level releases.

As Figure 4.3.4.4-6 shows, water temperatures at the USGS gage are cool throughout the year due to the low-level outlet works in the reservoir (the intake elevation is near 1,285 feet above msl). The highest measured water temperature during the two years occurred on September 12, 2006 at 11.1ºC; this measurement did not include any spill.

As Figure 4.3.4.4-7 shows, DO concentrations were well above the water quality standard and ranged between 7.6 and 13.5 mg/L over the two-year sampling period.

4.3.5 Registered Discharges – National Pollutant Elimination System

4.3.5.1 Schoharie Development

There are four registered National Pollution Discharge Elimination System ("NPDES") facilities in the immediate vicinity of the Schoharie Reservoir as shown in Figure 4.3.5.1-1. At a site immediately below the reservoir there is a wastewater treatment plant ("WWTP") for the Ron De Voo Restaurant that was permanently decommissioned in 2004, although the permit did not expire until June of 2009. When this facility was operational it had an average quantity limit of 1,000 gallons per day. This site discharged into an unnamed tributary to the lower reservoir. Another of the sites is a seasonal outflow from Camp Oorah on an unnamed tributary to the lower reservoir. The Grand Gorge WWTP is located on the Bear Kill, which is a tributary to the upper reservoir. The Prattsville WWTP is located on the Schoharie Creek just upstream of the reservoir. There are several other WWTPs in the upper Schoharie Creek watershed, but not near the reservoir (NYCDEP, 2000).

4.3.5.2 Cannonsville Development

There are three registered NPDES facilities in the immediate vicinity of the Cannonsville Reservoir. The locations of these discharges are shown in Figure 4.3.5.2-1. The local BOCS has a WWTP on the Trout Creek, which flows into the middle portion of the reservoir. Two facilities are located on the West Branch of the Delaware River just upstream of the Cannonsville Reservoir. The Village of Walton maintains a WWTP that discharges into the river. Kraft, Inc. discharges non-contact cooling water only from a facility just upstream of the Walton WWTP. There are several other facilities considerably farther up in the Delaware River Basin (NYCDEP, 2000).

4.3.5.3 Pepacton Development

There are four registered NPDES facilities in the immediate vicinity of the Pepacton Reservoir. The locations of these facilities are shown in Figure 4.3.5.3-1. Camp Nubar operates a seasonal facility near Fall Clove, which flows into the lower portion of the reservoir. The facility was converted into a medium sized, sub-surface discharge sewage treatment facility. The Andes WWTP is located on the Tremper Kill, which flows into the upper portion of the reservoir. It is an active plant that was upgraded in 2006. Camp L'man Achai maintains a seasonal WWTP that overflows to Perch Lake, which eventually flows to the upper Pepacton Reservoir. The Village of Margaretville maintains a WWTP on the East Branch of the Delaware River above the reservoir. The facility was upgraded in October 1999. There are several other facilities located on tributaries to the East Branch of the Delaware River considerably farther up in the River Basin (NYCDEP, 2000).

4.3.5.4 Neversink Development

There are no registered NPDES facilities upstream of the Neversink Reservoir (NYCDEP, 2000).

4.4 Fish and Aquatic Resources (18 CFR § 5.6 (d)(3)(iv))

4.4.1 Fisheries Management

4.4.1.1 Schoharie Development

Upper River and Tributaries

The upper Schoharie Creek and many of its tributaries are primarily cold water streams, meaning they provide suitable water temperatures for organisms, such as brook trout and sculpins that require cold water (less than 72°F or 22°C). The Schoharie Creek is stocked annually with 19,250 brown trout from the Prattsville fish barrier dam to the mouth of the Roaring Kill (the Roaring Kill is upstream of the barrier dam). Below the Prattsville fish barrier, the primary sport fish species are smallmouth bass and walleye. The fish barrier dam was constructed in 1939 to restrict the movement of bass upstream, and seemed to have some effect, but in the 1960s smallmouth bass were still the most abundant sport fish downstream of the Schoharie-East Kill confluence (Keller and Fieldhouse, 1993). Smallmouth bass in the Schoharie Creek tended to grow very slow and were much smaller than other streams in the region (Keller and Fieldhouse, 1993). Trout were the most abundant species above the East Kill-Schoharie Creek confluence. Gooseberry Creek, a Schoharie Creek tributary near Tannersville, has been stocked exclusively with brook trout and may provide sanctuary for these native trout. Species collected since 1954 during NYSDEC fishery surveys upstream of the Prattsville fish barrier are shown in Table 4.4.1.1-1.

Reservoir

The Schoharie Reservoir is actively managed by the NYSDEC as a warmwater and coldwater fishery. Fish populations in the reservoir were assessed in 1934, 1965, 1969, 1970, 1971, 1975, 1976, 1995, and 1997, with an alewife hydroacoustic and vertical gillnet survey conducted in 1998 (McBride, 1998a and 1998b; Rudstam and Brooking, 2000).

The impoundment supports a variety of large-bodied and forage fish species (Table 4.4.1.1-2). Walleye dominated the warmwater fishery until their decline in the mid-1990s due to the unauthorized introduction of alewife. The cold water fishery consists of brown trout and cisco (McBride, 1998b). It appears that the walleye population rebounded briefly after the collapse of alewives in the impoundment due to a 1996 flood event (McBride, 1998a; Rudstam and Brooking, 2000). Spillage events at the Cannonsville and Pepacton Reservoirs result in documented movements of alewives out of these reservoirs, so it is speculated that the high flows experienced in the Schoharie Creek caused large numbers of these fish to move or be moved out of the reservoir. An additional factor that may have affected the alewife population along with the movement due to high flows is that turbidity levels remained high throughout 1996 due to the rain and flooding (McBride, 1998a). This can negatively affect fish populations by reducing growth and/or modifying behavior patterns. However, as the alewife population appears to be rebounding, the walleye population is declining once again (NYSDEC, 2007c).

The reservoir was first stocked in 1928 with 500,000 walleye fry and 1,000 yellow perch fingerlings by New York State. Historical records show that 1.75 million walleye fry and 3,500 yellow perch fingerlings were stocked from 1928 to 1932 (McBride, 1998b). In 1936, the state began stocking cisco fry and lake trout fingerlings. However, this was terminated in 1940. Brook trout and brown trout were stocked in the mid to late-1960s. A trout stocking policy was developed in 1973 and recommended a split stocking of brown and rainbow trout, since the brook trout stocking was unsuccessful. Returns from the rainbow trout stocking were poor, so the split stocking was changed to all brown trout in 1979 (McBride, 1998b).

The Schoharie Reservoir was part of the five-year Angler Diary Program that ended in 2008. Walleye catch and creel rates were lower in 2008 than in any other year of the survey and showed a sharp decline from 2007. Average sizes of all fish caught and of legal fish caught were lower as well. The likely cause of the decline was the rebound in the alewife population. Alewives tend to feed heavily on the juvenile walleye in their pelagic phase and can severely reduce or eliminate a year class of walleye. The NYSDEC has recommended a walleye fingerling stocking program to begin in 2010 and continue for five years, with a subsequent evaluation after the final stocking year (NYSDEC 2008a).

Statewide fishing regulations apply to the warmwater species in the reservoir. Trout are managed under special regulations that include 12-inch minimum size and three-fish creel limits. There are no seasons, size restrictions, or creel limits on other fish species.

Schoharie Creek below Gilboa Dam

The NYSDEC sponsored five-year Angler Diary Study was completed in 2008 and was the fifth and final year for lower Schoharie Creek. The reaches are shown in Table 4.4.1.1-3. The number of individuals that actually turned in their diaries was relatively low (8 of the 14 who agreed to participate) and resulted in the need to combine the only reaches fished into one for the evaluation. Out of the five reaches total (reach segments are listed below), only the upper three were fished by the eight participants. The same is true for the 2004-2007 studies. The results of the program showed that walleye fishing in lower Schoharie Creek was determined to be fair by NYSDEC standards. Smallmouth bass catch rates tended to be very good from either shore or boat, prompting a recommendation to adopt statewide bass regulation (NYSDEC 2008b).

Schoharie Creek is not part of the National Marine Fisheries Service Essential Fish Habitat (Personal Communication, Stan Gorski, NMFS).

Recent Stocking

The NYSDEC maintains stocking information on its website. Shown in Table 4.4.1.1-4 is the 2008 stocking information for the Schoharie Reservoir and in the Schoharie Creek. Additional stocking occurs within tributaries of the Schoharie Creek but is not indicated in the table. No trout stocking occurs below the Gilboa Dam.

Table 4.4.1.1-1: Fish Species Collected Since 1954 during NYSDEC Fishery Surveys Upstream of the Prattsville Fish Barrier on the Schoharie Creek

Common Name	Scientific Name	Common Name	Scientific Name
Creek chub	*Semotilus atromaculatus*	Longnose dace	*Rhinichthys cataractae*
Common Shiner	*Luxilus cornutus*	Tesselated darter	*Etheostoma olmstedi*
Pumpkinseed	*Lepomis gibbosus*	Largemouth bass	*Micropterus salmoides*
Golden shiner	*Notemigonus crysoleucas*	Slimy sculpin	*Cottus cognatus*
White sucker	*Catostomus commersoni*	Stone cat	*Noturus flavus*
Stone roller	*Campostoma anomalum*	Bluntnose minnow	*Pimephales notatus*
Cutlips minnow	*Exoglossum maxillingua*	Fallfish	*Semotilus corporalis*
Margined madtom	*Noturus insignis*	Northern hog sucker	*Hypentelium nigricans*
Brown trout	*Salmo trutta*	Brown bullhead	*Ameirus nebulosus*
Brook trout	*Salvelinus fontinalis*	Banded killifish	*Fundulus diaphanous*
Rainbow trout	*Oncorhynchus mykiss*	Smallmouth bass	*Micropterus dolomieu*
Blacknose dace	*Rhinichthys atratulus*	Yellow perch	*Perca flavescens*

Table 4.4.1.1-2: Fish Species Potentially Found in the Schoharie Reservoir

Common Name	Scientific Name	Common Name	Scientific Name
Brook trout	*Salvelinus fontinalis*	Brown bullhead	*Ameiurus nebulosus*
Rainbow trout	*Oncorhynchus mykiss*	Tessellated darter	*Etheostoma olmstedi*
Brown trout	*Salmo trutta*	White sucker	*Catostomus commersonii*
Cisco	*Coregonus artedi*	Alewife	*Alosa pseudoharengus*
Walleye	*Sander vitreus*	Spotfin shiner	*Cyprinella spiloptera*
Largemouth bass	*Micropterus salmoides*	Common carp	*Cyprinus carpio*
Smallmouth bass	*Micropterus dolomieu*	Common shiner	*Luxilus cornutus*
Yellow perch	*Perca flavescens*	Golden shiner	*Notemigonus crysoleucas*
Rock bass	*Ambloplites rupestris*	Emerald shiner	*Notropis atherinoides*
Bluegill	*Lepomis macrochirus*	Spottail shiner	*Notropis hudsonius*
Pumpkinseed	*Lepomis gibbosus*	Bluntnose minnow	*Pimephales notatus*
Chain pickerel	*Esox niger*	Blacknose dace	*Rhinichthys atratulus*
White perch	*Morone americana*	Creek chub	*Semotilus atromaculatus*

Note: Historical surveys conducted in 1934, 1965, 1969-1971, 1975-1976, and 1995

Table 4.4.1.1-3: Schoharie Creek below Gilboa Dam, Angler Diary Reach Names

Reach No.	Starting At	Ending At	Reach Name
1	Blenheim Gilboa Dam	Route 30	Breakabeen
2	Route 30	Interstate 88	Schoharie
3	Interstate 88	County Route 127A	Esperance
4	County Route 127A	Route 161	Lost Valley
5	Route 161	Mohawk River	Fort Hunter

Table 4.4.1.1-4: 2008 NYSDEC Trout Stocking in the Schoharie Reservoir and Creek

Water Body	Town	Number	Date	Species	Size
Schoharie Creek	Hunter, Upstream of Schoharie Res.	280 80	April May	Brown Trout Brown Trout	8-9 inches 8-9 inches
Schoharie Creek	Jewett, Upstream of Schoharie Res.	150 880 400	April April May-Jun	Brown Trout Brown Trout Brown Trout	12-15 inches 8-9 inches 8-9 inches
Schoharie Creek	Jewett, Hunter, Upstream of Schoharie Res.	450 3440 880 300 2080 480	April April May May April May	Brown Trout Brown Trout Brown Trout Brown Trout Brown Trout Brown Trout	12-15 inches 8-9 inches 8-9 inches 12-15 inches 8-9 inches 8-9 inches
Schoharie Creek	Lexington, Upstream of Schoharie Res.	5680 700 1440	April April May	Brown Trout Brown Trout Brown Trout	8- 9 inches 12-15 inches 8-9 inches
Schoharie Res.	Gilboa	1750	Spring	Brown Trout	8-9 inches

4.4.1.2 Cannonsville Development

Upper River and Tributaries

The West Branch of the Delaware River is generally separated into two areas—above and below the Cannonsville Reservoir. From its headwaters in Schoharie County to the Cannonsville Dam, the West Branch runs approximately 43 miles and passes through mostly farmland. Brown trout are stocked by the State in mid-April and again in mid-May. Approximately one-third of the brown trout residents are wild fish[6]. It has been reported that wild brook trout can be found in the tributaries that empty into the West Branch of the Delaware River as well as the lower sections of tributaries that empty into the Cannonsville Reservoir). Brook trout are not stocked by NYSDEC biologists and are not as abundant in the upper river as brown trout (Delaware Co. SWCD, 2004). Large and smallmouth bass, chain pickerel, and yellow perch also are present in the upper West Branch of the Delaware River.

Reservoir

The Cannonsville Reservoir supports both warm and coldwater fish communities. Fish species found in the reservoir are listed in Table 4.4.1.2-1. The NYSDEC manages the upper West Branch of the Delaware River as a coldwater trout fishery and has been monitoring trout populations in the reservoir through angler creel surveys and angler diaries. Brown trout were stocked in the reservoir from 2005 to 2008 to determine whether the population would respond to enhancement efforts. The results of the five-year study indicate that the population has responded well to the stocking and has provided additional opportunities to catch trout. Through angler diaries recorded since the inception of the reservoir stocking program, the trout fishery has been monitored and will continue to be monitored (NYSDEC 2005; 2007a; 2007b, 2008c). Additionally, trout continue to be stocked in the river above the reservoir and may utilize it at certain times of the year.

Statewide fishing regulations apply to the warmwater fisheries in Cannonsville Reservoir. However, there are special trout regulations that apply. The season begins April 1 and ends October 15. Minimum length for trout is 12 inches with a three fish creel limit.

West Branch Delaware River below the Cannonsville Dam

Cold water releases in the summer from the reservoir provide suitable temperatures for trout to reside in the entire 17.7 miles to the confluence with the East Branch of the Delaware River. Consequently, the West Branch of the Delaware River below the Cannonsville Reservoir supports a renowned trout fishery. Fish population sampling showed that brown trout are the most abundant species followed by rainbow trout and lastly a small component of brook trout. Additionally, trout abundance was higher in the upper reaches (near the dam) than in the lower 12 miles to the confluence (NYSDEC 2008a).

The NYSDEC conducted an Angler Diary Program within five reaches in the Delaware River Basin from 2002 through 2007 as listed in Table 4.4.1.2-2. The West Branch comprised 61% of the hourly angler effort. Additionally, the majority of trout were caught in the West Branch, with smaller proportions caught in the East Branch and mainstem of the Delaware River. Angler catches were dominated by wild brown trout with a small component of reservoir and Oquaga Creek hatchery brown trout. Small numbers of rainbow and brook trout were caught, but they did not comprise a large portion of the West Branch catch (NYSDEC 2007d).

The trout fishery in this section of the river is managed under special regulations. The entire section in New York has open season from April 1 through October 15. There is a 12-inch minimum length limit and a two fish creel limit with no fishing allowed outside the listed season dates. Additionally, fishing is prohibited in the 1.4 mile reach between the dam and the Town of

[6] Wild fish are defined as those fish that hatched in the stream in the wild and not raised in a fish hatchery.

Stilesville. The season dates for the section that borders New York and Pennsylvania are the first Saturday after April 11 to October 15. Fishing is allowed in this section outside the regular season, but there is an artificial lure, catch-and-release only restriction.

In 1992, a 2.2 mile reach of the West Branch in the Town of Deposit was designated with a "No Kill" regulation in an attempt to demonstrate the trout potential of the river. The regulation was popular among anglers and catch rates were higher immediately following implementation.

A 12-inch minimum size limit and three fish creel limit was implemented in 1991 as it was believed that the nine inch size limit did not make use of the excellent survival and growth potential of the river. Although catch rates did not improve with the implementation of these regulations, the mean length of creeled trout has increased (NYSDEC 2007d).

The West Branch of the Delaware River is not part of the National Marine Fisheries Service Essential Fish Habitat (Personal Communication, Stan Gorski, NMFS).

Recent Stocking
Shown in Table 4.4.1.2-3 is the 2008 stocking information for the Cannonsville Reservoir and the West Branch of the Delaware River. Additional stocking occurs within tributaries of the West Branch of the Delaware River, but it is not indicated in the table.

Stocking History
During the mid-1990s, trout stocking was eliminated in the West Branch and reduced in the East Branch to test the theory that the wild populations would increase due to the reductions in stocking. Catch and harvest rates declined in both rivers during the period of reduced or eliminated stocking. In retrospect, termination of trout stocking in the West Branch and the reduction in the East Branch stocking rate was probably premature (NYSDEC 2007d). The program was continued through 2003 as no evidence supported the theory that the trout populations would dramatically increase when trout stocking was discontinued (NYSDEC 2007d).

Table 4.4.1.2-1: Fish Species Potentially Found in the Cannonsville Reservoir

Common Name	Scientific Name	Common Name	Scientific Name
Brown trout	*Salmo trutta*	White sucker	*Catostomus commersonii*
Brook trout	*Salvelinus fontinalis*	Slimy sculpin	*Cottus cognatus*
Smallmouth bass	*Micropterus dolomieu*	Fallfish	*Semotilus corporalis*
Yellow perch	*Perca flavescens*	Creek chub	*Semotilus atromaculatus*
Alewife	*Alosa pseudoharengus*	Blacknose dace	*Rhinichthys atratulus*
Rock bass	*Ambloplites rupestris*	Longnose dace	*Rhinichthys cataractae*
Pumpkinseed	*Lepomis gibbosus*	Common shiner	*Luxilus cornutus*
Bluegill	*Lepomis macrochirus*	Golden shiner	*Notemigonus crysoleucas*
Chain pickerel	*Esox niger*	Tessellated darter	*Etheostoma olmstedi*
Brown bullhead	*Ameiurus nebulosus*	Goldfish	*Carassius auratus*
Common carp	*Cyprinus carpio*	Rudd	*Scardinius erythrophthalmus*
Black crappie	*Pomoxis nigromaculatus*		

Table 4.4.1.2-2: West Branch of the Delaware River below Cannonsville Dam, Angler Diary Reach Names

Reach No.	Starting At	Ending At	Reach Name
1	Cannonsville Dam	Stilesville Weir	Cannonsville Dam
2	Stilesville Weir	Route 17 Bridge, Deposit	Stilesville
3	Route 17 Bridge, Deposit	Lower Boundary No Kill Zone[1]	No Kill
4	Lower Boundary No Kill Zone[1]	NY-PA Border (Monument Pool)	Hale Eddy
5	NY-PA Border (Monument Pool)	Confluence with the Delaware River	Border Water

[1]No detailed information is provided in the literature regarding this reach.

Table 4.4.1.2-3: 2008 NYSDEC Trout Stocking in the Cannonsville Reservoir and Tributaries

Water	Town	Number	Date	Species	Size
Delaware River West Branch	Delhi, upstream of Cannonsville Dam	4400 640 1040	April April May	Brown Trout Brown Trout Brown Trout	8-9 inches 8-9 inches 12-15 inches
Delaware River West Branch	Hamden, Walton, upstream of Cannonsville Dam	480 3680 920	April April May	Brown Trout Brown Trout Brown Trout	12-15 inches 8-9 inches 8-9 inches
Delaware River West Branch	Harpersfield	1680 280 400	April April May	Brown Trout Brown Trout Brown Trout	8- 9 inches 12-15 inches 8-9 inches
Delaware River West Branch	Kortright	720 240	April May	Brown Trout Brown Trout	8-9 inches 8-9 inches

4.4.1.3 Pepacton Development

Upper River and Tributaries

Brook trout and brown trout are the primary cold water species in the East Branch of the Delaware River above the Pepacton Reservoir. Occasionally rainbow trout are caught, but they are not believed to be present in great numbers and are most likely remnants of past stockings in the reservoir and tributaries. The only species currently stocked is brown trout. Brown trout are stocked in both the spring and fall.

Reservoir

The Pepacton Reservoir and the East Branch of the Delaware River are managed as coldwater fisheries. Fish species found in the Pepacton Reservoir are listed in Table 4.4.1.3-1. Brook trout and rainbow trout have been stocked in the past, but are no longer stocked in favor of stocking brown trout. As with the Schoharie and Cannonsville reservoirs, a five-year Angler Diary Study was conducted for this area. The results of the study indicated that stocked brown trout are an important component of the Pepacton Reservoir fishery. Catch rates in 2008 were up compared to other years in the study (NYSDEC 2008c). Statewide fishing regulations apply to warmwater species in the Pepacton Reservoir. Special regulations apply to the trout fishery. The season opens April 1 and closes September 30. There is a 15-inch minimum length limit and a two fish creel limit with only one fish greater than 21 inches allowed.

East Branch of the Delaware River below the Downsville Dam

The section of the East Branch of the Delaware River below the Downsville Dam to the confluence with the West Branch of the Delaware River is approximately 32 miles long. Over its course, this section contains some of the most varying water types found in the region. The first section, from the Downsville Dam to the Town of East Branch (confluence with the Beaver Kill) is approximately 17 miles. Referred to as the tailwater, this section receives the most influence from the coldwater releases from the Pepacton Reservoir. The river averages 75 to 150 feet wide and is flat throughout most of this section. It contains a series of slow runs and short riffles that dump into even slower deep pools. The channel substrates throughout this section are comprised of mostly small gravel and silt in the runs while some of the deeper pools are filled with large boulders and ledge rock. Aquatic vegetation is present throughout most of this section. This section contains wild brook trout, wild and stocked brown trout, and the occasional wild rainbow trout. However, brown trout are the dominant fish in this section. Generally, most fish here are between 12-14 inches, but 18-inch fish are also common. The lower three miles of this section are believed to provide marginal trout habitat as indicated by low abundance in population (NYSDEC, 2008d).

The lower section of the East Branch of the Delaware River extends from the Town of Downsville to the confluence with the West Branch in Hancock, NY. The Beaver Kill, which is a major tributary, meets the East Branch of the Delaware River in the Town of East Branch and changes the river's character. It is believed that the downstream extent of the cold water reservoir releases extends to approximately the Beaver Kill confluence. In the lower section, the river doubles in size and is dominated by fast runs, riffles, pocket water, and long, deep pools that are more common in a steeper gradient river. This section supports a mix of brown and rainbow trout, most of which are wild, but this section does not receive any benefits from the coldwater releases. Brown trout dominate the fishery; however rainbow trout are present throughout this reach of the river as well. The coldwater releases are intended to make the 17 mile reach suitable for trout, but the lower three miles supports marginal habitat and low trout abundance (NYSDEC, 2008e).

Based on the Angler Diaries, the reach between the Downsville Dam and the Beaver Kill (Reaches 1-5, see Table 4.4.1.3-2) supported better fish catch rates than the reach between the Beaver Kill and the confluence with the West Branch of the Delaware River. As stated above, this is due to the cold water releases from the reservoir and more suitable habitat. All of the hatchery brown trout were caught in the upper East Branch (the reach between Downsville Dam and the Beaver Kill) and the majority of the rainbow trout were caught in the lower East Branch (Beaver Kill to confluence with West Branch). Rainbow, brook, and tiger trout made up a small portion of the catch in the East Branch (NYSDEC 2007d).

An experimental slot limit regulation was implemented in 1994 for the 4.6 mile Fishs Eddy reach. Additionally, tackle was limited to artificial lures only in an attempt to reduce hooking mortality. The slot limit was eventually discontinued as the fishery did not improve as a result of the regulations and proved to be confusing to the public.

In 1995, a 12-inch minimum size limit and a two fish creel limit regulation were implemented throughout the East Branch, with the exception of the slot limit section. A radio telemetry study indicated that trout typically migrated out of the Fishs Eddy during the summer when temperatures increased. Along with the other regulations, this gave no indication that the more restrictive regulations improved trout catch rates; however, it did improve the mean length of creeled trout. Catch rates are believed to have dropped during this time period as a result of the reduced stocking rates in the East Branch during this time.

The East Branch of the Delaware River is not part of the National Marine Fisheries Service Essential Fish Habitat (Personal Communication, Stan Gorski, NMFS).

Recent Stocking

Shown in Table 4.4.1.3-3 is the 2008 stocking information for the Pepacton Reservoir and the East Branch of the Delaware River. Additional stocking occurs within tributaries of the East Branch of the Delaware River but is not indicated in the table.

Table 4.4.1.3-1: Fish Species Potentially Found in the Pepacton Reservoir

Common Name	Scientific Name
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Rainbow trout	*Oncorhynchus mykiss*
Smallmouth bass	*Micropterus dolomieu*
Chain pickerel	*Esox niger*
Yellow perch	*Perca flavescens*
Rock bass	*Ambloplites rupestris*
Brown bullhead	*Ameiurus nebulosus*
White sucker	*Catostomus commersonii*
Alewife	*Alosa pseudoharengus*

Table 4.4.1.3-2: East Branch of the Delaware River below Downsville Dam, Angler Diary Reach Names

Reach No.	Starting At	Ending At	Reach Name
1	Downsville Dam	Route 30 Bridge	Downsville Dam
2	Route 30 Bridge	Corbett Bridge	Downsville
3	Corbett Bridge	Shinhopple Bridge	Corbett
4	Shinhopple Bridge	Harvard Bridge	Shinhopple
5	Harvard Bridge	Beaver Kill	Harvard
6	Beaver Kill	Fishs Eddy Bridge	Fishs Eddy
7	Fishs Eddy Bridge	Confluence with West Branch of the Delaware River	Peas Eddy

Table 4.4.1.3-3: 2008 NYSDEC Trout Stocking in the Pepacton Reservoir and East Branch of the Delaware River

Water	Town	Number	Date	Species	Size
Delaware River West Branch	Colchester, above Downsville Res.	400 600 600 370	April April May May	Brown Trout Brown Trout Brown Trout Brown Trout	12-15 inches 8-9 inches 8-9 inches 12-15 inches
Delaware River East Branch	Middletown, above Downsville Dam	2880	April	Brown Trout	8- 9 inches
Delaware River East Branch	Middletown, above Downsville Dam	680 500	May May-Jun	Brown Trout Brown Trout	8- 9 inches 12-15 inches
Delaware River East Branch	Middletown, Roxbury, above Downsville Dam	640 160 50	April May May-June	Brown Trout Brown Trout Brown Trout	8- 9 inches 8-9 inches 12-15 inches
Delaware River East Branch	Roxbury, above Downsville Dam	240 80 50	April May May-June	Brown Trout Brown Trout Brown Trout	8- 9 inches 8-9 inches 12-15 inches
Pepacton Reservoir	Colchester	8320	Spring	Brown Trout	8- 9 inches
Delaware River East Branch	Hancock, below Downsville Dam	920	April	Brown Trout	8- 9 inches

4.4.1.4 Neversink Development

Reservoir

The NYSDEC actively manages the reservoir for sport fishing opportunities. The reservoir supports both warm and coldwater fisheries and a variety of other large-bodied and forage species (Table 4.4.1.4-1). The landlocked Atlantic salmon program began in 1971 with the collection and planting of rainbow smelt eggs in order to establish a food base for the salmon. Salmon stocking was initiated in 1973 with the introduction of 3,000 eight-inch fish into the upper Neversink River. Survival of these fish was poor as indicated by creel surveys and netting by the NYSDEC. As these fish were a sea-run variety from the Gaspé Peninsula in Québec, the NYSDEC decided to raise and release a landlocked strain in 1975 (NYSDEC, 1997). The Neversink Reservoir now supports a naturally reproducing and hatchery augmented landlocked salmon fishery.

Statewide fishing regulations apply to the warmwater and landlocked salmon fisheries. However, special restrictions apply to trout fishing. The season begins April 1 and ends October 15 each year. The minimum length limit is 12 inches and there is a three fish creel limit. Rainbow smelt fishing is prohibited.

Neversink River below Neversink Dam

The lower Neversink River (below the Neversink Dam) begins above the Town of Hasbrouck. It can be described as a medium-sized trout stream with a slow gradient, creating shallow riffles and long, flat pools. The cold water releases from the Neversink Reservoir create a high-quality tailwater fishery. For approximately the first seven miles, the river maintains a very good population of wild brown trout, along with stocked fish. The average fish size ranges from nine to 13 inches. As the river flows towards the Town of Bridgeville, it starts to warm and collect more natural runoff. The river changes with the addition of pocket water and less vegetation. Approaching the gorge area, the river gradient increases and most of the fishing is done in pocket water. Below the gorge, the river maintains its pocket water appearance and for several miles the fishing is good.

Creel surveys were conducted in the Neversink River below the dam in 1999 and 2006 to evaluate fishing pressure, success, and population composition. In 1999, 95.5% of the 12,025 fish caught were brown trout with 64.5% of those being stocked fish. Rainbow and brook trout accounted for very small proportions of the overall catch. It is also estimated that 87.5% of the fish caught in 1999 were released back into the Neversink River (NYSDEC 1999).

In 2006, an estimated 7,686 trout were caught with 95.4% being brown trout. As with the previous creel survey, the majority (84.0%) of the fish were stocked. Rainbow and brook trout again was a very small proportion of the overall catch. In 2006, it is estimated that 79.7% of the fish caught were released back into the Neversink River (NYSDEC 2006).

The Neversink River is not part of the National Marine Fisheries Service Essential Fish Habitat (Personal Communication, Stan Gorski, NMFS).

Recent Stocking

Brook and brown trout have been periodically stocked throughout the years. Currently, brown trout are the only trout species stocked with the salmon (Table 4.4.1.4-2).

Table 4.4.1.4-1: Fish Species Potentially Found in the Neversink Reservoir

Common Name	Scientific Name	Common Name	Scientific Name
Brown trout	*Salmo trutta*	Pumkinseed	*Lepomis gibbosus*
Landlocked salmon	*Salmo salar*	Rainbow smelt	*Osmerus mordax*
Yellow perch	*Perca flavescens*	Chain pickerel	*Esox niger*
Brown bullhead	*Ameiurus nebulosus*	White sucker	*Catostomus commersonii*
Rock bass	*Ambloplites rupestris*	Alewife	*Alosa pseudoharengus*
Fallfish	*Semotilus corporalis*	Longnose sucker	*Catostomus catostomus*
Smallmouth bass	*Micropterus dolomieu*	Spottail shiner	*Notropis hudsonius*
Golden shiner	*Notemigonus crysoleucas*		

Table 4.4.1.4-2: 2008 NYSDEC Trout Stocking in the Neversink Reservoir and Tributaries

Water	Town	Number	Date	Species	Size
Neversink Reservoir	Neversink	3,080	April	Brown Trout	8-9 inches
Neversink River	Fallsburg	2,080 1,240	April May-June	Brown Trout Brown Trout	8-9 inches 8-9 inches
Neversink River	Thompsonville	1,200 680	April May-June	Brown Trout Brown Trout	8-9 inches 8-9 inches

4.4.1.5 Delaware River

The upper Delaware River forms the border between Pennsylvania and New York for 74 miles downstream of the confluence of the East and West Branches. Water temperatures are strongly influenced by the slightly warmer waters of the East Branch as compared to the West Branch. The East Branch side of the Delaware River can be up to 4 °C warmer than the West Branch side at the confluence of the two branches. The downstream extent of the tailwater on the Delaware River is believed to be 18 miles below the confluence of East/West Branch in the Town of Hankins (NYSDEC, 2008a). Rainbow trout dominate the trout fishery in the upper Delaware River, but brown trout are common as well. This section of river contains more cool and warm water fish species including walleye and smallmouth bass. American shad, American eel, and striped bass are also found at various times in the upper Delaware River (NYSDEC, 2008a).

Based on 2007 Angler Diaries (see reaches in Table 4.4.1.5-1), the mainstem of the Delaware River comprised the smallest proportion of trout caught, and 2007 was the second year in a row that the catch of brown trout outnumbered the catch of rainbow trout (32 vs. 30). As with the other sections, a small number of brook trout were caught as well. Wade angling was down in 2007 to its lowest level during the six-year study (NYSDEC 2007d).

Table 4.4.1.5-1: Delaware River, Angler Diary Reach Names

Reach No.	Starting At	Ending At	Reach Name
1	Confluence of East and West Branches	Buckingham Launch	Junction Pool
2	Buckingham Launch	Lordville Bridge	Buckingham
3	Lordville Bridge	Long Eddy	Lordville
4	Long Eddy	Hankins	Long Eddy
5	Hankins	Callicoon Bridge	Hankins

In 1995, regulations on the Delaware River were changed to a 14-inch minimum size limit and a one fish creel limit. The change apparently had no effect on catch rates at the time. A radio telemetry study in the same year indicated that four of the five radio tagged trout moved from the Delaware River to the West Branch as water temperatures increased, so no further restriction in regulations were warranted (NYSDEC 2007d).

The fishing season is from the first Saturday after April 11 through October 15. As with the portion of the West Branch that borders Pennsylvania and New York, catch and release fishing is allowed outside of the regular fishing season.

4.4.2 Diadromous Fish

The lack of dams on the mainstem of the Delaware River has allowed continued use of this river system by diadromous fish species. Spawning American shad ascend the Delaware River to Hancock (near the confluence of the East and West Branches of the Delaware Rivers) and the lower East Branch of the Delaware River each spring, with juveniles migrating out in the fall. Based on a review of the available data, no diadromous fish ascend to any of the four dams. The spawning run supports a popular recreational fishery.

American eels are widely distributed throughout the basin. The immature stages (yellow eels) spend varying numbers of years in streams and ponds, and eventually metamorphose into pre-spawning adults in the late summer and fall. These "silver eels" leave the river and migrate to the Sargasso Sea to spawn and die. There is a modest and historical weir fishery on the Delaware River for silver eels. Other diadromous species that enter the New York portion of the basin are sea lamprey, gizzard shad, American shad, and striped bass, but they are unlikely to travel far enough upstream as the proposed developments.

4.4.3 Mussel Studies

The Neversink River contains seven species of mussels (Strayer and Ralley, 1991; Strayer and Jirka, 1997). Populations of the endangered dwarf wedgemussel (*Alasmidonta heterodon*) and the threatened swollen wedgemussel (*Alasmidonta varicosa*) coexist with other unionid mussels in the Neversink River (Strayer and Ralley, 1991; Baldigo, Riva-Murray, and Schuler, 2003). The distribution of mussel populations is limited by dams. Mussel larvae develop in species-specific host fish; thus, barriers such as dams that restrict passage of these host fish also restrict the extent of mussels. The Neversink River is impounded by the Neversink Dam and was also impounded downstream by the Cuddebackville Dam until 2004, when the latter was removed to improve fish passage. The removal of this dam has provided previously unavailable habitat for diadromous and other fish species that act as hosts for rare mussel species.

In 1997, the USGS, in cooperation with The Nature Conservancy (TNC), began a six-year study along the Neversink River and its tributaries to (1) document the current distribution of each mussel species, (2) assess environmental factors in relation to mussel-species richness and distribution, and (3) identify the factors that most strongly affect mussel populations and develop an equation that relates environmental factors to mussel species richness. Surveys were conducted during the summers of 1997-2002 on the Neversink River and its tributaries to document mussel communities, water quality, habitat characteristics, bankfull discharge, and geomorphology at 28 sites ranging in length from 100 meters (for habitat assessments) to 600 meters (for geomorphology surveys).

The number of mussel species varied widely at sites surveyed in the Neversink River. Species richness was greatest in mainstem reaches in the lower basin (below the Neversink Dam); no mussels were found in seven of the 11 tributaries. No mussels were found in the three sample sites above the Neversink Dam or the first two sample sites below the dam. The most widely distributed species in the basin was the eastern elliptio (*Elliptio complanata)*, which is tolerant of a wide range of environmental conditions and habitat disturbances (Strayer and Jirka, 1997). In contrast, the dwarf wedgemussel (*Alasmidonta heterodon*) and the alewife floater (*Anodonta implicata*) were found only downstream from the Cuddebackville Dam; their sparse distribution indicates that both species either are intolerant of local environmental conditions, or were restricted by the inability of host-fish species to migrate upstream past the Cuddebackville Dam.

Relative abundance data indicate that the eastern elliptio was the most abundant mussel species at nearly all study sites. Relative abundance increased downstream and was generally greatest at mainstem sites in the lower basin. The eastern elliptio was moderately common at the other sites, but the swollen wedgemussel (*Alasmidonta varicosa*), the creeper (*Strophitus undulatus)*, and the triangle floater (*Alasmidonta undulata)* were uncommon or absent at most sites in the middle and upper basins.

No comprehensive mussel surveys have been completed in the East or West Branches of the Delaware River or Schoharie Creek. However, a population of wedgemussels was found in the mainstem of the Delaware River below the confluence of the East and West Branches.

4.4.4 Habitat and Stream Temperature Analysis

Background

The USGS received Congressional funding to study instream habitat needs in the upper portion of the Delaware River Basin, including its East and West Branches and the Neversink River. The tributaries (East Branch, West Branch, and Neversink) were studied from the City's Delaware River Basin dams to their confluences with the Delaware River. The project was proposed for federal funding by a coalition of non-profit groups (including TNC, Trout Unlimited, and the Delaware River Foundation) and was supported by the DRBC. The goal of the study was to provide information relating instream habitat characteristics and streamflow, integrated with the DRBC's reservoir operations and streamflow routing model - OASIS. The specific objectives of the study were:

- The quantification of habitat metrics over a range of discharges and seasons at selected locations in the three tributaries (East Branch, West Branch, and Neversink) and the mainstem of the Delaware River.
- Development and calibration of a network-wide temperature simulation model for the upper Delaware River Basin. The model used was the Stream Network Temperature ("SNTEMP").
- Development of a prototype Delaware River Decision Support System to assist the DRBC and stakeholders in analyzing and interpreting water management and reservoir operations alternatives.

The USGS report for the study is entitled *A Decision Support Framework for Water Management in the Upper Delaware River* and was published in 2007. It contains considerable information on the East and West Branches of the Delaware River and the Neversink River. It is not practical to replicate the full USGS study as part of this PAD. Instead, only the highlights of the study are discussed below. Please refer to the online version of the USGS report for further detail (Bovee, Waddle, Bartholow, and Burris, 2007).

Habitat Study

The East Branch, West Branch, and mainstem of the Delaware River and the Neversink River were segmented based on the following criteria, roughly in order of descending priority:

- The flow regime was relatively homogeneous from the top of segment to the bottom (example e.g. boundaries were placed at confluences of major tributaries)
- General temperature classification (example e.g. coldwater, transitional, or warmwater)
- Resource issues, target species, and species of concern

Shown in Figure 4.4.4-1[7] and described in Table 4.4.4-1 are the segment boundaries covering the West Branch, East Branch, and mainstem of the Delaware River and the Neversink River.

Table 4.4.4-1: Segment Boundaries and Resource Issues Associated with Upper Delaware River Basin

River	Segment	Location	Resource issues
West Branch	WB0 WB1	Cannonsville to Oquaga Creek Oquaga Creek to Hancock	Brown trout Rainbow trout Shallow-fast guild Shallow-slow guild
East Branch	EB0 EB1	Downsville to Shinhopple Shinhopple to Beaver Kill	Brown trout Rainbow trout Shallow-fast guild Shallow-slow guild
	EB2	Beaver Kill to Hancock	Brown trout Rainbow trout American shad Shallow-fast guild Shallow-slow guild
Delaware mainstem	DEL1 DEL2 DEL3	Hancock to Lordville Lordville to Hankins Hankins to Callicoon	Rainbow trout American shad Shallow-fast guild Shallow-slow guild
Neversink	NVR0 NVR1	Neversink Reservoir to Fallsburg Fallsburg to Bridgeville	Brown trout Shallow-fast guild Shallow-slow guild
	NVR2	Bridgeville to Port Jervis	Brown trout American shad Shallow-fast guild Shallow-slow guild

Source: Adapted from Bovee, Waddle, Bartholow, and Burris, 2007

Representative study sites were subsequently selected within each of the segments based primarily on planform. Within these representative sites more detailed data was collected.

[7] The quality of Figure 4.4.4-1 is not ideal; however, it replicates the same figure contained within the on-line USGS report.

Target Species

Also shown in Table 4.4.4-1 are the target species evaluated within each of the habitat segments. The target species were related primarily to production of brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*). The mainstem of the Delaware River from Hancock to the vicinity of Lordville, NY is very popular for sport fishing, and trout production was considered in this reach as well. Issues related to trout production in these segments include provisions for adequate riffle habitat for macroinvertebrates, flow stability during the spawning-incubation period and occasional high temperatures during the summer. In the mainstem and lower East Branch of the Delaware River and the lower Neversink River, factors affecting the recruitment and rearing of juvenile American shad (*Alosa sapidissima*) were added to the list of issues. Because American shad are anadromous, and because the juveniles rear in the Delaware system only from June until August or September, streamflow management in support of this species was considered seasonal, rather than year-round. Other species of interest included the bridle shiner (*Notropis bifrenatus*), blue spotted sunfish (*Enneacanthus gloriosus*), eastern mudminnow (*Umbra pygmaea*), American eel (*Anguilla rostrata*), margined madtom (*Noturus insignis*), fallfish (*Semotilus corporalis*), and cutlips minnow (*Exoglossum maxillingua*).

Habitat Suitability

Ranges of suitable depths and velocities for each of the target species and habitat use guilds were defined using the Delphi process, which is described in much greater detail in the USGS report (Bovee, Waddle, Bartholow, and Burris, 2007). The report contains the ranges of suitable depths and velocities for each target species as defined by the Delphi process.

Habitat Patch Metrics

Habitat patch metrics were derived from a combination of stream bathymetry, hydraulic model output, and spatially explicit patch morphometry utilizing ArcGIS (ESRI, Version 9.0). Development of this database involved seven steps: collection of bathymetric data, preparation of input to the hydraulic simulation model (River2D model), determination of boundary conditions, model calibration, simulation of unmeasured discharges, classification of habitat for target organisms and guilds, and geographic information system (GIS) operations to generate patch metrics as functions of discharge.

Habitat vs. Flow

Using the hydraulic modeling results, in addition to the suitable information as defined in the Delphi process, habitat versus flow relationships were developed for each target species at each of the segments listed in Table 4.4.4-1. Because of the number of habitat versus flow relationships, they have not been replicated in this PAD. However, as noted above, the full USGS report is available online (Bovee, Waddle, Bartholow, and Burris, 2007). In addition, please refer to Appendix F, which includes discharge versus habitat area statistics for all of the study sites and species. Note that habitat time series (where habitat area is matched with time-varying flow) were also conducted as part of the USGS study. Major points of the USGS report are outlined in the following paragraphs.

Generally, habitats in the shallow-slow habitat guilds were maximized at the lowest flows, while the shallow-fast habitat guild was maximized at slightly higher flows for all sampling sites on all rivers in the study. At a discharge of less than 0.4 cfs/mi^2, velocities are too slow for the shallow-fast guild, but at a discharge greater than 0.6 cfs/mi^2, depths were too great at all sites sampled on the East and West Branches of the Delaware River and on the Neversink River.

Juvenile trout and shad habitat showed an increasing trend at discharges up to 0.6 cfs/mi^2 and then a declining trend at discharges greater than 0.9 cfs/mi^2. Habitat availability for adult trout and shad showed a similar pattern, but it shifted with a maximization at discharges of 1-3 cfs/mi^2.

Pools tended to be the dominant mesohabitat type at low flows, but were replaced by fast runs at higher flows. The two sites on the West Branch of the Delaware River and the farthest upstream site on the Neversink River showed approximately the same amount of pool and run habitat across the entire range of discharges.

Due to the morphology of the rivers, there was little inundated aquatic vegetation at low flows and a positive correlation between increasing flows and amount of inundated aquatic vegetation. Even with this positive correlation, there was minimal inundated aquatic vegetation at discharges less than 3 cfs/mi^2.

The West Branch showed maximum persistent habitat with spawning flows for brown trout between 0.8-3.8 cfs/mi^2 and incubation flows between 0.8-1.6 cfs/mi^2. The East Branch showed maximum persistent spawning and incubation habitat at much lower discharges ranging from 0.4-0.8 to 0.8-2.7 cfs/mi^2 for spawning flows and 0.5-0.8 to 0.2-4 cfs/mi^2 for incubation flows. The Delaware River showed similar results to the West Branch and the lower East Branch. Generally, the Neversink River showed lower sensitivity to flow differential than the other rivers.

Temperature Analysis

Previous methods for predicting temperatures in the upper Delaware system have relied on a set of nomograms that had a tendency to overestimate the volume of water necessary to support thermal requirements at specific downstream locations. The goal of the USGS analysis was to test alternative approaches to temperature predictions as potential replacements for the currently employed nomograms. The upper Delaware study area was divided into two parts. The first portion included the West and East Branches from their respective reservoirs to their confluence at Hancock, and approximately 40 kilometers (25 miles) downstream to Callicoon, NY. The second portion included the Neversink River from the reservoir approximately 27 kilometers (17 miles) to Bridgeville, NY.

The SNTEMP model was used to estimate temperatures. There are three broad categories of data required by SNTEMP: meteorological data, hydrologic data, and stream geometry data. Measured water temperature data is also required to perform model calibration and validation. SNTEMP models for the Neversink River, and the East Branch, West Branch, and mainstem of the Delaware River were run with data available for the summers (May 1 through September 30) of 1997 through 1999.

The USGS report noted that the accuracy of the SNTEMP models did not meet the initial calibration criteria. Therefore, in the end, the USGS developed purely statistical models (based on a regression analysis) for several important locations. There was virtually no temperature modeling results in the USGS report.

The National Parks Service conducted a study to determine the flow and temperature relationships in dwarf wedgemussel beds in the mainstem of the Delaware River (Cole et al. 2008). The goal of the study was to determine the most vulnerable of three study sites based on flows at the USGS Callicoon stream gage on the Delaware River. The three sites stretch from Equinunk, PA downstream to Callicoon, NY. The study showed that site 3 was the most vulnerable of the sites and, if depth was maintained at this site, the other two sites showed sufficient depth. However, minimum flows required to provide sufficient depth did not necessarily provide thermal protection. A discharge of 1,059 cfs was required at the Callicoon gage to maintain temperatures within 2 °C of the mainstem of the Delaware River.

4.5 Wildlife and Botanical Resources (18 CFR § 5.6 (d)(3)(v))

The State's varied climate, geology, soil types, topography, and watersheds support a wide range of vegetative communities that provide diverse habitats for its wildlife. The distribution and abundance of the Catskill region's wildlife are directly related to the condition and location of wildlife habitats.

<u>*Botanical Resources*</u>

The four development sites of the Project area are within the Northeastern Highlands ecoregion and the Appalachian Plateau physiographic province. In general, this area is characterized by nutrient-poor soils and is blanketed by beech-birch-maple hardwood forests with the upper elevations transitioning to spruce-fir forests. Oak-hickory forests are also present in some of the low valleys. Though the land was typically heavily forested, it was cleared for farmland in the early nineteenth century. The forests have naturally re-grown as the farmland was abandoned beginning in the mid-1800s (USFWS, 1997).

The dominant species that comprise the northern hardwood forest are American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), and sugar maple (*Acer saccharum*). The shrub layer in this type of forest generally consists of hobblebush (*Viburnum lantanoides*), maple-leaved viburnum (*Viburnum acerifolium*), and raspberries (*Rubus spp.*). The oak-hickory low elevation forests are dominated by red oak (*Quercus rubra*), white oak (*Q. alba*), chestnut oak (*Q. prinus*), scrub oak (*Q. ilicifolia*), shagbark hickory (*Carya ovata*) and bitternut hickory (*C. cordiformis*). The shrub layer generally consists of flowering dogwood (*Cornus florida*), witch hazel (*Hamamelis virginiana*), shadbush (*Amelanchier arborea*), and choke-cherry (*Prunus virginiana*). The high elevation spruce-fir forests are generally dominated by red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) with the shrub layer dominated by huckleberry (*Gaylussacia buccata*), lowbush blueberry (*Vaccinium angustifolium*), and mountain laurel (*Kalmia latifolia*) on rocky outcrops (USFWS, 1997).

Several populations of the federally threatened northern monkshood (*Aconitum noveboracense*) occur in the Catskill high peaks and the globally rare Jacob's ladder (*Polemonium caeruleum*) may be found in similar areas. The moist woods of the Catskills support two of the only three known extant populations of nodding pogonia (*Triphora trianthophora*) in New York and the only populations of musk-root (*Adoxa moschatellina*). The Catskills are also home to other state-listed threatened or endangered plant species (USFWS, 1997).

Wildlife Resources

The Project areas are located in a section of the State that is sparsely populated and relatively remote. The large tracts of forested mountains support a wide variety of wildlife. Tables 4.5-1 through 4.5-4 list mammal, bird, amphibian, and reptile species potentially present in the development areas, respectively. Bald eagles use the Project area for nesting and wintering. The lower 42 miles of the Neversink River, including the reservoir, support 10-20 breeding pairs of bald eagles and the Mongaup and Delaware Rivers support the highest concentration of wintering bald eagles in the State and one of the highest concentrations in the northeast. Additionally, waterfowl likely use the stream corridors and reservoirs for nesting and feeding.

Species lists in Table 4.5-1 through 4.5-4 were generated from the *Schoharie Creek Watershed Management Plan* (Greene Co. SWCD, 2007), the *East* and *West Branch Delaware River Stream Corridor Management Plans* (Delaware Co. SWCD, 2007 and 2004), and the USFWS' *Significant Habitats and Habitat Complexes of the New York Bight Watershed* (USFWS, 1997). The lists include the vast majority of species likely to be found in the project area.

Rare, threatened, and endangered species are further discussed in Section 4.7, but are indicated in the species tables.

Table 4.5-1: List of Mammals Potentially Present in the Project Areas

Common Name	Scientific Name
Eastern Coyote	*Canis latrans*
Eastern Pipistrelle	*Pipistrellus subflavus*
Eastern Red Bat	*Lasiurus borealis*
Hoary Bat	*Lasiurus cinereus*
Indiana Myotis	*Myotis sodalis*
Silver-haired Bat	*Lasionycteris noctivagans*
Woodland Jumping Mouse	*Napaeozapus insignis*
Long-tailed Shrew	*Sorex dispar*
Southern Bog Lemming	*Synaptomys cooperi*
Porcupine	*Erethizon dorsatum*
Red Fox	*Vulpes vulpes*
Gray Fox	*Urocyon cinereoargenteus*
White-tailed Deer	*Odocoileus virginanus*
Black Bear	*Ursus americanus*
Fisher	*Martes pennanti*
Bobcat	*Lynx rufus*
Eastern Cottontail	*Sylvilagus floridanus*
Eastern Cougar[1,2]	*Felis concolor cougar*
River Otter	*Lutra canadensis*
Muskrat	*Ondatra zibethicus*
Beaver	*Castor canadensis*
Mink	*Mustela vison*
Striped Skunk	*Mephitis mephitis*

Common Name	Scientific Name
Raccoon	*Procyon lotor*
Virginia Opossum	*Didelphis virginiana*
Cinereus Shrew	*Sorex cinereus*
American Water Shrew	*Sorex palustris*
Smoky Shrew	*Sorex fumeus*
American Pygmy Shrew	*Sorex hoyi*
Northern Short-tailed Shrew	*Blarina brevicauda*
North American Least Shrew	*Cryptotis parva*
Hairy-tailed Mole	*Parascalops breweri*
Eastern Mole	*Scalopus aquaticus*
Star-nosed Mole	*Condylura cristata*
Little Brown Bat	*Myotis lucifugus*
Keen's Myotis	*Myotis kenii*
Small-footed Myotis	*Myotis leibii*
Big Brown Bat	*Eptesicus fuscus*
Eastern Red Bat	*Lasiurus borealis*
New England Cottontail	*Sylvilagus transitionalis*
Snowshoe Hare	*Lepus americanus*
European Hare	*Lepus europaeus*
Eastern Chipmunk	*Tamias striatus*
Woodchuck	*Marmota monax*
Eastern Gray Squirrel	*Sciurus carolinensis*
Eastern Fox Squirrel	*Sciurus niger*
Red Squirrel	*Tamiasciurus hudsonicus*
Southern Flying Squirrel	*Glaucomys volans*
Northern Flying Squirrel	*Glaucomys sabrinus*
North American Deermouse	*Peromyscus maniculatus*
White-footed Mouse	*Peromyscus leucopus*
Eastern Woodrat	*Neotoma floridana*
Southern Red-backed Vole	*Myodes gapperi*
Meadow Vole	*Microtus pennsylvanicus*
Rock Vole	*Microtus chrotorrhinus*
Woodland Vole	*Microtus pinetorum*
Northern Bog Lemming	*Synaptomys borealis*
Roof Rat	*Rattus rattus*
Brown Rat	*Rattus norvegicus*
House Mouse	*Mus musculus*
Meadow Jumping Mouse	*Zapus hudsonius*
American Marten	*Martes americana*
Ermine	*Mustela erminea*
Long-tailed Weasel	*Mustela frenata*
Moose	*Alces americanus*

[1]Federally Endangered

[2]State Endangered

Table 4.5-2: List of Birds Potentially Present in the Project Areas

Common Name	Scientific Name
Acadian Flycatcher	*Empidonax virescens*
Alder Flycatcher	*Empidonax alnorum*
American Black Duck	*Anas rubripes*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Carduelis tristis*
American Kestrel	*Falco sparverius*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*
American Woodcock	*Scolopax minor*
Bald Eagle	*Haliaeetus leucocephalus*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*
Barred Owl	*Strix varia*
Belted Kingfisher	*Megaceryle alcyon*
Bicknell's Thrush[4]	*Catharus bicknelli*
Black-and-white Warbler	*Mniotilta varia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Blackburnian Warbler	*Dendroica fusca*
Black-capped Chickadee	*Poecile atricapillus*
Blackpoll Warbler	*Dendroica striata*
Black-throated Blue Warbler	*Dendroica caerulescens*
Black-throated Green Warbler	*Dendroica virens*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Blue-headed Vireo	*Vireo solitarius*
Blue Jay	*Cyanocitta cristata*
Blue-winged Warbler	*Vermivora pinus*
Bobolink	*Dolichonyx oryzivorus*
Broad-winged Hawk	*Buteo platypterus*
Brown Creeper	*Certhia americana*
Brown-headed Cowbird	*Molothrus ater*
Brown Thrasher	*Toxostoma rufum*
Canada Goose	*Branta canadensis*
Canada Warbler	*Wilsonia canadensis*
Cedar Waxwing	*Bombycilla cedrorum*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Chimney Swift	*Chaetura pelagica*
Chipping Sparrow	*Spizella passerina*
Cliff Swallow	*Hirundo pyrrhonota*
Common Grackle	*Quiscalus quiscula*
Common Merganser	*Mergus merganser*
Common Raven	*Corvus corax*
Common Yellowthroat	*Geothlypis trichas*
Cooper's Hawk[4]	*Accipiter cooperii*
Dark-eyed Junco	*Junco hyemalis*
Downy Woodpecker	*Picoides pubescens*

Common Name	Scientific Name
Eastern Bluebird	*Sialia sialis*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Meadowlark	*Sturnella magna*
Eastern Phoebe	*Sayornis phoebe*
Eastern Screech Owl	*Megascops asio*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Wild Turkey	*Meleagris gallopavo*
Eastern Wood -pewee	*Contopus virens*
European Starling	*Sturnus vulgaris*
Field Sparrow	*Spizella pusilla*
Golden-crowned Kinglet	*Regulus satrapa*
Golden-winged Warbler[4]	*Vermivora chrysoptera*
Grasshopper Sparrow[4]	*Ammodramus savannarum*
Gray Catbird	*Dumetella carolinensis*
Great Blue Heron	*Ardea herodias*
Great Crested Flycatcher	*Myiarchus crinitus*
Great Horned owl	*Bubo virginianus*
Hairy Woodpecker	*Picoides villosus*
Hermit Thrush	*Catharus guttatus*
Hooded Merganser	*Lophodytes cucullatus*
House Finch	*Carpodacus mexicanus*
House Sparrow	*Passer domesticus*
House Wren	*Empidonax minimus*
Indigo Bunting	*Passerina cyanea*
Killdeer	*Charadrius vociferus*
Least Flycatcher	*Empidonax minimus*
Louisiana Waterthrush	*Seiurus motacilla*
Magnolia Warbler	*Dendroica magnolia*
Mallard	*Anas platyrhynchos*
Mourning Dove	*Zenaida macroura*
Mourning Warbler	*Oporomis philadelphia*
Nashville Warbler	*Vermivora ruficapilla*
Northern Bobwhite	*Colinus virginianus*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Northern Goshawk[4]	*Accipiter gentiles*
Northern Oriole	*Icterus spurius*
Northern Rough-winged Swallow	*Steldidopteryx serripennis*
Northern Saw-whet Owl	*Aegolius acadicus*
Northern Waterthrush	*Seiurus noveboracensis*
Olive-sided Flycatcher	*Contopus cooperi*
Ovenbird	*Seiurus aurocapillus*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Siskin	*Carduelis pinus*
Pine Warbler	*Dendroica pinus*
Prairie Warbler	*Dendroica discolor*

Common Name	Scientific Name
Purple Finch	*Carpodacus purpureus*
Red-bellied Woodpecker	*Melanerpes carolinus*
Red-breasted Nuthatch	*Sitta canadensis*
Red-eyed Vireo	*Vireo olivaceus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-shouldered Hawk[4]	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
Red-winged Blackbird	*Agelaius phoeniceus*
Rock Pigeon	*Columba livia*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ruby-throated Hummingbird	*Archilochus colubris*
Ruffed Grouse	*Bonasa umbellus*
Savannah Sparrow	*Passerculus sandwichensis*
Scarlet Tanager	*Piranga olivacea*
Sharp-shinned Hawk[4]	*Accipiter striatus*
Snowy Owl	*Bubo scandiacus*
Song Sparrow	*Melospiza melodia*
Spotted Sandpiper	*Actitis macularius*
Swamp Sparrow	*Melospiza georgiana*
Swainson's Thrush	*Catharus ustulatus*
Tree Swallow	*Tachycineta bicolor*
Tufted Titmouse	*Baeolophus bicolor*
Turkey Vulture	*Cathartes aura*
Veery	*Catharus fuscescens*
Vesper Sparrow	*Pooecetes gramineus*
Warbling Vireo	*Vireo gilvus*
Whip-poor-will[4]	*Caprimulgus vociferous*
White-breasted Nuthatch	*Sitta carolinensis*
White-throated Sparrow	*Zonotrichia albicollis*
Willow Flycatcher	*Empidonax traillii*
Winter Wren	*Troglodytes troglodytes*
Wood Duck	*Aix sponsa*
Wood Thrush	*Hylocichla mustelina*
Worm-eating warbler	*Helmitheros vermivorus*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-rumped Warbler	*Dendroica coronata*
Yellow-throated Vireo	*Vireo flavifrons*
Yellow Warbler	*Dendroica petechia*

[3]State Threatened, [4]State Special Concern

Table 4.5-3: List of Amphibians Potentially Present in the Project Areas

Common Name	Scientific Name
Allegheny Mountain Dusky Salamander	*Desmognathus ochrophaeus*
Jefferson Salamander	*Ambystoma jeffersonianum*
Spotted Salamander	*Ambystoma maculatum*
Dusky Salamander	*Desmognathus fuscus*
Redback Salamander	*Plethodon cinereus*
Slimy Salamander	*Plethodon glutinosus*
Spring Salamander	*Gyrinophilus porphyriticus*
Northern Two-lined Salamander	*Eurycea bislineata*
Longtail Salamander	*Eurycea longicauda*
Four-toed Salamander	*Hemidactylium scutatum*
Common Mudpuppy	*Necturus maculosus*
Northern Red Salamander	*Pseudotriton ruber ruber*
Northern Leopard Frog	*Rana pipiens*
Wood Frog	*Rana sylvatica*
Bullfrog	*Rana catesbeiana*
American Toad	*Bufo americanus*
Gray Treefrog	*Hyla versicolor*
Green Frog	*Hyla cinerea*
Spring Peeper	*Pseudacris crucifer*
Pickerel Frog	*Rana palustris*

Table 4.5-4: List of Reptiles Potentially Present in the Project Areas

Common Name	Scientific Name
Wood Turtle	*Clemmys insculpta*
Eastern Box Turtle	*Terrapene carolina*
Common Snapping Turtle	*Chelydra serpentina*
Northern Painted Turtle	*Chrysemys picta*
Spotted Turtle	*Clemmys guttata*
Common Gartersnake	*Thamnophis sirtalis*
Timber Rattlesnake[3]	*Crotalus horridus*
Eastern Hognose	*Heterodon platirhinos*
Brownsnake	*Storeria dekayi*
Smooth Greensnake	*Opheodrys vernalis*
Red-bellied Snake	*Storeria occipitomaculata*
Milksnake	*Lampropeltis triangulum*
Northern Copperhead	*Agkistrodon contortrix*
Ring-necked Snake	*Diadophis punctatus*
Northern Watersnake	*Nerodia sipedon*

[3]State Threatened

4.6 Wetlands, Riparian, and Littoral Habitat (18 CFR § 5.6 (d)(3)(vi))

Wetlands play a key role in the filtration of dissolved inorganic nutrients and suspended sediments and preventing the excess nutrients from entering streams and lakes. They also tend to trap and store excess phosphorous and promote die-off of fecal coliform bacteria (Greene Co. SWCD, 2007). Riparian zones occur as transitional areas between aquatic and upland terrestrial habitats and can generally be described as long strips of vegetation adjacent to inland aquatic systems. Riparian zones typically comprise a small percentage of the landscape, yet they frequently harbor a high diversity of wildlife species and perform various important ecological functions when compared to most upland habitats.

Wetlands are defined by the USFWS as lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained or poorly drained, hydric soil; or (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of the year. The USFWS classifications for wetlands include palustrine emergent ("PF01"), palustrine scrub-shrub ("PSS1"), and palustrine emergent ("PEM").

In New York, the Freshwater Wetlands Act (New York Environmental Conservation Law §24-0107) contains a comprehensive definition of wetlands. Briefly, they comprise those areas of land and water that support a preponderance of aquatic or semi-aquatic vegetation and lands that formally contained vegetations and are seasonally submerged to no more than a limited depth. They must have an area of at least 12.4 acres, unless they are deemed to have "unusual local importance" or provide certain enumerated benefits. The NYSDEC classifies wetlands as Classes I through IV based on their function, value and benefit. Class I wetlands are deemed the most important and are subject to the most stringent standards.

A Class I wetlands must have one of the following seven characteristics (6 NYCRR § 664.5(a)):

- It is a classic kettlehole bog;
- It is the resident habitat of an endangered or threatened animal species;
- It contains an endangered or threatened plant species;
- It supports an animal species in abundance or diversity unusual for the state or major region in which it is found;
- It is tributary to a body of water which could subject a substantially developed area to significant damage from flooding or from additional flooding should the wetland be modified, filled, or drained;
- It is adjacent or contiguous to a reservoir or other body of water that is used primarily for public water supply, or it is hydraulically connected to an aquifer which is used for public water supply; or
- It contains four or more of the enumerated Class II characteristics (determined not to be duplicative of each other).

A Class II wetlands must have one of the following 17 characteristics (6 NYCRR § 664.5(b)):

- It is an emergent marsh in which purple loosestrife and/or reed (phragmites) constitutes less than two-thirds of the covertype;
- It contains two or more wetland structural groups;
- It is contiguous to a tidal wetland;

- It is associated with permanent open water outside the wetland;
- It is adjacent or contiguous to streams classified C(t) or higher under article 15 of the environmental conservation law
- It is traditional migration habitat of an endangered or threatened animal species;
- It is resident habitat of an animal species vulnerable in the state;
- It contains a plant species vulnerable in the state;
- It supports an animal species in abundance or diversity unusual for the county in which it is found;
- It has demonstrable archaeological or paleontological significance as a wetland;
- It contains, is part of, owes its existence to, or is ecologically associated with, an unusual geological feature which is an excellent representation of its type;
- It is tributary to a body of water which could subject a lightly developed area, an area used for growing crops for harvest, or an area planned for development by a local planning authority, to significant damage from flooding or from additional flooding should the wetland be modified, filled, or drained;
- It is hydraulically connected to an aquifer which has been identified by a government agency as a potentially useful water supply;
- It acts in a tertiary treatment capacity for a sewage disposal system;
- It is within an urbanized area;
- It is one of the three largest wetlands within a city, town, or New York City borough; or
- It is within a publicly owned recreation area.

A Class III wetlands must have one of the following 15 characteristics (6 NYCRR § 664.5(c)):

- It is an emergent marsh in which purple loosestrife and/or reed (phragmites) constitutes two-thirds or more of the covertype;
- It is a deciduous swamp;
- It is a shrub swamp;
- It consists of floating and/or submerged vegetation;
- It consists of wetland open water;
- It contains an island with an area or height above the wetland adequate to provide migration habitat of an endangered or threatened animal species;
- It has a total alkalinity of at least 50 parts per million;
- It is adjacent to fertile upland;
- It is resident habitat of an animal species vulnerable in the major region of the state in which it is found, or it is traditional migration habitat of an animal species vulnerable in the state or in the major region of the state in which it is found;
- It contains a plant species vulnerable in the major region of the state in which it is found;
- It is part of a surface water system with permanent open water and it receives significant pollution of a type amenable to amelioration by wetlands;
- It is visible from an interstate highway, a parkway, a designated scenic highway, or a passenger railroad and serves a valuable aesthetic or open space function;
- It is one of the three largest wetlands of the same covertype within a town;
- It is in a town in which wetland acreage is less than one percent of the total acreage; or
- It is on publicly owned land that is open to the public.

A Class IV wetlands does not have any of the characteristics of Class I through III wetlands and includes areas such as wet meadows and coniferous swamps (6 NYCRR § 664.5(d)).

Wetland delineations and classification information in the vicinity of the Project areas was obtained from the USFWS National Wetland Inventory ("NWI"). It is important to note that the NWI coverage is developed from aerial photography. As indicated in Section 4.2.1, the land surrounding the reservoirs is generally not conducive to supporting wetlands. The wetlands present tend to be associated with the areas where tributary streams feed the reservoirs. The areas around the developments are generally rocky and fairly steep and the reservoirs do not support large littoral zones.

Included in the following sections are a series of maps showing NWI wetlands within or very near the project boundaries for each development site. Wetlands mapped by the NYSDEC are also shown for comparison. Note that because the wetlands are shown at a scale covering the entire reservoir areas, many of the smaller wetlands may be hard to distinguish due to their size relative to the impoundment.

4.6.1 Schoharie Development

NWI and NYSDEC wetlands within or near the Schoharie Development Project boundary are shown in Figure 4.6.1-1. A close-up of NWI wetlands in the vicinity of the Gilboa Dam is shown in Figure 4.6.1-2.

The Schoharie Reservoir is classified by the NWI as a palustrine limnetic, permanently flooded impoundment with an unconsolidated bottom. The upper end of the Schoharie impoundment has several moderate-sized wetlands. The largest is approximately 73 acres and is classified as PFO1Ah, which is a freshwater, deciduous forested/shrub wetland. The second largest is an 11-acre wetland that is classified as PFO4Eh, which is a freshwater, evergreen forested, seasonally impounded wetland. The last one of note, mapped at the upper end of the reservoir, is a 4-acre PEM1Ch, which is a freshwater, emergent, persistent (*i.e.*, plants will remain until at least the next growing season), seasonally flooded impoundment. There are several other very small wetlands at the upper end of the impoundment. According to the NWI survey, there are no wetlands near the Gilboa Dam.

Vegetation surveys near the Gilboa Dam were conducted as part of the Environmental Assessment for the Gilboa Low Level Outlet Works. The surveys were completed in September 2005, May, June, July, August, and November 2006, and January 2007. No threatened or endangered plant species were found during the vegetation surveys. The ecological communities found onsite were classified according to the New York State Natural Heritage Program's ("NYNHP") Ecological Communities of New York State, Second Edition (Reschke, et al. 2002). Thirteen primary vegetative communities were identified on the site. The upland communities consist of a successional southern hardwood forest, successional northern hardwood forest, hemlock-northern hardwood forest, floodplain forest, conifer plantation, successional southern hardwood/conifer plantation, successional northern hardwood/conifer plantation, successional red cedar woodland/conifer plantation, and mowed lawn. The wetland communities consist of a red map hardwood swamp, shrub swamp, shallow emergent marsh, and vernal pool habitat.

The estimated acres of wetland habitat shown in Figure 4.6.1-1 is 117 acres.

4.6.2 Cannonsville Development

NWI and NYSDEC wetlands within or near the Cannonsville Development project boundary are shown in Figure 4.6.2-1. A close-up of NWI wetlands in the vicinity of the Cannonsville Dam is shown in Figure 4.6.2-2.

The Cannonsville Reservoir is classified as a palustrine limnetic, permanently flooded impoundment with an unconsolidated bottom. There are several small wetlands near the upper end of the Cannonsville impoundment. A few larger wetlands are present at the upper tip of the large north-facing finger bay of the reservoir. The largest is a 52-acre freshwater emergent, seasonally flooded wetland classified as PEM1E. The next largest is a 12-acre deciduous, scrub-shrub, semi-permanent wetland located at the mouth of trout creek classified as PSS1/EM1E.

The estimated acres of wetland habitat shown in Figure 4.6.2-1 is 113 acres.

4.6.3 Pepacton Development

NWI and NYSDEC wetlands within or near the Pepacton Development project boundary are shown in Figure 4.6.3-1. A close-up of NWI wetlands in the vicinity of the Downsville Dam is shown in Figure 4.6.3-2.

The Pepacton Reservoir is classified as a lacustrine, limnetic, permanently flooded impoundment with an unconsolidated bottom. The upper portion of Pepacton Reservoir includes several small wetlands. On the south shore at the head of the reservoir is a 4-acre freshwater emergent, temporarily flooded wetland with persistent vegetation classified as PEM1/UBF. One of the most downstream (towards the dam) identified wetlands is located on the south shore of the reservoir and is associated with a small peninsula. This is a 3-acre, deciduous/scrub-shrub, seasonally flooded wetland classified as PSS1Ch. There are several very small wetlands in the vicinity of the reservoir, most of which are associated with tributaries and intermittent drainages and are outside of the project boundary.

The estimated acres of wetland habitat shown in Figure 4.6.3-1 is 52 acres.

4.6.4 Neversink Development

NWI and NYSDEC wetlands within or near the Neversink Development project boundary are shown in Figure 4.6.4-1. A close-up of NWI wetlands in the vicinity of the Neversink Dam is shown in Figure 4.6.4-2.

As with the Schoharie and Cannonsville Reservoirs, the Neversink impoundment is classified as palustrine, limnetic, permanently flooded impoundment with an unconsolidated bottom. Near the upper end of the reservoir is a 12.5-acre freshwater, emergent, semi-permanently flooded wetland with persistent vegetation on the north shore classified as PEM1Fh. In the lower section of the impoundment is a 2-acre freshwater emergent, seasonally flooded wetland with persistent vegetation classified as half PEM1Eh and half PEM1Fh. There are several other very small wetlands associated with tributaries to the reservoir that are not within the project boundary.

The estimated acres of wetland habitat shown in Figure 4.6.4-1 is 23 acres.

4.7 Rare, Threatened and Endangered Species (18 CFR § 5.6 (d)(3)(vii))

The Neversink River contains populations of the state- and federally listed endangered dwarf wedgemussel (*Alasmidonta heterodon*) and the state-listed threatened brook floater (*Alasmidonta varicose*). It is believed that the dwarf wedgemussel population in the Neversink watershed is the largest remaining population in its current distribution in North America (New York Natural Heritage Program "NYNHP"], 2008a). This population is extremely important in that it may need to be utilized in the future to re-seed areas where this species has been extirpated. The Neversink River once had one of the healthiest populations of brook floater until the mid-1990s when the population declined by an estimated 38,000 individuals. Only one live individual was found in the Susquehanna River Basin in surveys conducted during the early 1990s, so any remaining populations in the nearby Delaware River Basin would be of great importance to the survival of the species regionally (NYNHP, 2008b).

The Project areas are home to a breeding population of bald eagles as described above. The following are bald eagle nests near the Project sites: six nests near Cannonsville Dam, one near Gilboa Dam, five near Downsville Dam and one near Neversink Dam. The Bald Eagle was removed from the Endangered Species List on June 5, 2007. However, protection was ensured by the Bald and Golden Eagle Protection Act (BGEPA). There are still restrictions in activity near a Bald Eagle nest that will have to be considered as part of this Project development. It is also possible that peregrine falcons use the Neversink basin as a migration corridor, but nesting has not been confirmed (NYSDEC, 1997).

The USFWS' website was consulted to obtain a list of federally rare, threatened and endangered species. In addition, the NYNHP website was consulted to obtain the same information for state listed species. The identified species and their habitat requirements are listed below.

- Dwarf wedge mussel (federally listed Endangered)
  Typical habitat for this mussel includes running waters of all sizes, from small brooks to large rivers. Bottom substrates include silt, sand and gravel, which may be distributed in relatively small patches behind larger cobbles and boulders. The river velocity is usually slow to moderate. Dwarf wedge mussels appear to select or are at least tolerant of relatively low levels of calcium in the water.

- Indiana bat (federally listed Endangered)
  In New York, knowledge of the Indiana bat's distribution is limited to known wintering locations-caves and mines in which they hibernate. There are eight hibernacula currently known in Albany, Essex, Warren, Jefferson, Onondaga and Ulster Counties. It is certain that the summer range of this species extends well beyond these counties since the animals disperse to breeding areas and other habitats to feed and raise their young.

- Bog turtle (federally listed Threatened)
  Bog turtles are semi-aquatic species, preferring habitat with cool, shallow, slow-moving water, deep soft muck soils, and tussock-forming herbaceous vegetation. In New York, the bog turtle is generally found in open, early successional types of habitats such as wet meadows or open calcareous boggy areas generally dominated by sedges (*Carex spp.*) or

sphagnum moss. Like other cold-blooded or ectothermic species, it requires habitats with a good deal of solar penetration for basking and nesting.

- Northern wild monkshood (federally listed Threatened)

The northern wild monshook habitat includes shaded or partially shaded cliffs and talus slopes in Ohio, Iowa, and Wisconsin, and at high-elevation headwaters and in crevices along streams in New York. There seems to be no rock substrate favored by the species overall. The most significant common habitat factor appears to be the cold soil environment associated with these cliff, talus slope, and spring/headwater stream situations. In most of the habitats occupied by northern wild monkshood there is either active and continuous cold air drainage or cold ground water flowage out of the nearby bedrock. The year-round soil temperatures average from 11 to 18 degrees Celsius. Local distribution of the species is also closely associated with areas where ground water or subterranean air is emanating, which contributes to a local microclimate with high relative humidity.

- Brook floater (state listed Threatened)

The Brook Floater is strictly a running water species favoring gravelly riffles in creeks and small rivers. Considered to be a species of creeks and small rivers where it is found among rocks in gravel substrates and in sandy shoals, the brook floater inhabits flowing-water habitats. Although typically found in riffles and moderate rapids, this species can be found a range of flow conditions but is usually not found in very slow flow conditions. The species has no consistent substrate preference but it is thought to prefer stable habitats such as coarse sand and gravel.

- Bicknell’s thrush (state-listed Special Concern)

In New England and New York, Bicknell’s thrush inhabit montane forests, primarily areas dominated by stunted balsam fir and red spruce at elevations above 3000 ft. The species usually breeds at higher elevations, normally nesting above 3,000 ft. Nests generally are situated close to the trunk in the upper half of a small-to-medium-sized fir or spruce, typically in conifer thickets, often on steep slopes.

- Timber rattlesnake (state-listed Threatened)

Timber rattlesnakes are generally found in deciduous forests in rugged terrain. In the summer, gravid (pregnant) females seem to prefer open, rocky ledges where temperatures are higher, while the males and non-gravid females seem to prefer cooler, thicker woods where the forest canopy is more closed. Rattlers generally migrate from 1.3 to 2.5 miles (2 to 4 km) from their den each summer, with a maximum movement of 4.5 miles (7.2 km) observed.

- Jefferson salamander (state-listed Special Concern)

The species is often found in well-shaded deciduous forests; hides in rodent burrows and beneath leaf litter, logs, stumps, and other surface objects; and hibernates underground or in rotting logs. Eggs are attached to sticks and plant stems in ponds and pools with an adjacent forest. The presence of fishes and newts reduces their reproductive success.

- Longtail salamander (state-listed Special Concern)

> Transformed individuals and adults are found in moist or wet terrestrial situations, usually along the borders of streams, swamps, seeps, marshes, etc. Individuals may disperse into wooded terrestrial habitats in wet weather or hide in rock crevices and under rocks, logs, and other debris. Eggs are laid in underground crevices associated with springs, temporary pools, and streams; under rocks in streams; in woodland ponds; or are attached to objects in or above water in caves.

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service ("NMFS") has jurisdiction over marine species and migratory fish, working within the Endangered Species Act to promote marine species and habitat stewardship. The NMFS was contacted to determine if any rare, threatened, or endangered species under its jurisdiction are found near any of the development sites or would be affected by any of the proposed hydroelectric units. The NMFS responded that there are no jurisdictional, listed or proposed endangered or threatened species or critical habitats in the Delaware River or Schoharie Creek, and therefore, that no further coordination with the NMFS would be required. A copy of the NMFS' complete response is included in Appendix A.

Note that based on the USFWS Critical Habitat Mapper (http://crithab.fws.gov/), there is no federally-designated critical habitat in the Project area for any of the four developments.

4.8 Recreation and Land Use (18 CFR § 5.6 (d)(3)(viii))

4.8.1 Recreation

General information on boating, fishing, hiking and scenic overlooks are summarized below. Tables listing the NYCDEP recreation areas for all four reservoirs are provided within the individual sections below.

Boating

Boats used for fishing are permitted with the appropriate NYCDEP permits. Traditionally, boat access was limited to johnboats that range in length from a minimum of 11'6" to a maximum of 16' and have a width of at least 42". However, a three year pilot program was initiated in May of 2009 to permit rowboats, kayaks, canoes, sculls, and small sailboats on the Cannonsville Reservoir. All boats must be stored at the designated reservoir after they are registered and steam cleaned by a NYCDEP authorized vendor. Boat storage and interbasin transfer is controlled very closely to prevent the introduction of zebra mussels and other non-native species into the water supply system. Tables listing the number of boats in each storage area are provided below.

Hunting and Fishing

Hunting for deer, turkey, and small game is permitted throughout most of the City-owned lands around the reservoirs, but all hunters must first obtain a NYCDEP Access Permit ("Access Permit"). Hunting, fishing, hiking, and trapping are permitted in Public Access Areas ("PAAs") without an Access Permit. PAAs include City lands that are across a public road but within a few hundred feet of a reservoir shoreline but do not include lands that are immediately adjacent to the reservoirs. The majority of reservoir shorelines are open for fishing from shore. Many people park along the public roads and walk to the waters' edge. Hunters, trappers, and anglers must have valid and appropriate NYSDEC licenses.

Hiking

Hiking is permitted only in PAAs. The topography is "rolling" to steep, and there are no designated trails. Therefore, hikers must "bushwhack" and/or follow previously used logging roads.

Overlook/Scenic Vistas

There are a number of designated parking areas for scenic vistas or overlooks, as follows:

Reservoir	Parking Areas	Capacity
Cannonsville	3	3, 6, and 10 vehicles, respectively
Neversink	1	8-12 vehicles
Pepacton	1	8-10 vehicles
Schoharie	4	2-4 vehicles each

4.8.1.1 Schoharie Reservoir

The Schoharie Reservoir is approximately 150 miles from New York City and 50 miles from Albany. As of July 1, 2009, the City owned about 12,305 acres within the Schoharie Creek watershed, 7,505 acres of which are available for public recreation. Property access and other recreation features in the vicinity of the Schoharie Reservoir are shown in Figure 4.8.1.1-1. Recreation features include a parking area and kiosk near the dam, and boat storage areas.

A Scenic Public Overlook Area is positioned on the eastern edge of the spillway and consists of several parking spaces, a platform for viewing the reservoir and spillway, and a kiosk that presents the Town of Gilboa history. The area is overgrown with vegetation. The NYCDEP is working to shift the existing parking area slightly north from its current position. General landscaping will be done, new and improved fencing will be installed, and the platform will be reinforced to ensure continued safety. In addition, the NYCDEP would investigate the feasibility of using recovered bluestone facing in the Scenic Public Overlook Area. The proposed changes to the Scenic Public Overlook Area would greatly improve its visual aesthetics and provide the opportunity to view the improved aesthetic appearance of the dam and its associated structures after reconstruction.

Shown above is an example of one of the kiosks and is representative of the kiosks located at each reservoir. In addition to the above features, there is also a trail, called the Long Path that passes close to the northeastern part of the Schoharie Reservoir. The Long Path is a 326-mile-long hiking trail that extends from the George Washington Bridge in New Jersey to Whiteface

Mountain in the Adirondack Mountains. Public access (permit required) is provided primarily along the northeastern shoreline of the reservoir.

The Schoharie Reservoir provides fishing opportunities for walleye, bass, trout, perch, and panfish. The nearby Catskill State Park and surrounding areas provide many outdoor recreational opportunities for locals and visitors. Outdoor activities in the Catskill State Park include camping, hiking, fishing, canoeing, hunting, mountain biking, cross-country skiing, snowmobiling, horseback riding, picnicking, swimming, and bird watching. Other protected lands in the vicinity of the Schoharie Reservoir include:

- Huntersfield State Forest
- Bates State Forest
- Leonard Hill State Forest
- High Knob State Forest
- Scott Patent State Forest
- Ashland Pinnacle State Forest
- Mount Pisgah State Forest
- South Mountain State Forest
- Bearpen Mountain State Forest
- Relay State Forest
- Plattekill State Forest
- Blenheim Hill State Forest
- Windham High Peak Wild Forest

Areas open for hunting with an Access Permit are shown in Figure 4.8.1.1-2 and listed below.

Reservoir	**Recreation Unit**	**Use**	**Acres**
Schoharie	Road Seven	Hunting	148
		Total	148

Shown below is the number of permitted boats in each zone (zones are shown in Figure 4.8.1.1-2) on the Schoharie Reservoir.

Zone	No. of Boats
(S-1) - GATE 1	28
(S-2) - GATE 2	16
(S-8) - GATE 8	1
(S-9) - GATE 9	7
(S-10a)	4
(S-12) - GATE 12	6
(S-13) - GATE 13	35
(S-14a)	1
(S-15) - GATE 15	3
(S-21a)	8
(S-22) - GATE 22	75
(S-23) - GATE 23	3
TOTAL	187

4.8.1.2 Cannonsville Reservoir

The Cannonsville Reservoir is approximately 150 miles from New York City and 120 miles from Albany. As of July 1, 2009, the City owned about 23,631 acres within the West Branch of the Delaware River watershed, 16,835 acres of which are available for public recreation. Public access to property owned by the City and other recreation features in the vicinity of the Cannonsville Reservoir are shown in Figure 4.8.1.2-1. There are several large tracts of public land that border the impoundment (a NYCDEP permit is required on some of these lands as noted on the figure).

The Cannonsville Reservoir provides fishing opportunities for trout, bass, carp, perch, pickerel, panfish, and bullhead. Brown trout are the primary sought-after species, but brook trout and rainbow trout are occasionally caught as well. As discussed previously, the West Branch of the Delaware River and the reservoir are actively managed fisheries. The West Branch and tributaries above the reservoir are renowned for their trout fishery.

The area around the West Branch of the Delaware River offers four managed trail systems for year-round recreation. The Catskill Scenic Trail lies on the old Ulster-Delaware railroad bed and parallels the West Branch for about 19 miles, crossing it at several points. Another trail system, including the Utsayantha Trail, has stunning views of the West Branch of the Delaware River. Also, the West Branch Preserve, which was donated to The Nature Conservancy in 1973, consists of two short trails (Delaware Co. SWCD, 2004). Other protected areas in the vicinity of the Cannonsville Reservoir include:

- Oquaga Creek State Park
- Chenango Valley State Park
- Hunt’s Pond State Park
- Salt Spring State Park
- Bear Spring Mountain Wildlife Management Area

Recreational activities in the area include camping, hiking, fishing, canoeing, kayaking, hunting, mountain biking, cross-country skiing, snowmobiling, horseback riding, picnicking, swimming, and bird watching.

Cannonsville Reservoir Recreational Boating Pilot Project

In 2008, the NYCDEP began developing a pilot program to expand recreational boating opportunities at the Cannonsville Reservoir. A committee was formed consisting of NYCDEP staff, the Delaware County Chairman of the Board of Supervisors, the Town Supervisors of the Towns of Tompkins and Deposit, the Delaware County Watershed Affairs Commissioner, representatives from the EPA, NYSDEC, NYSDOH, and the Catskill Center for Conservation and Development. The committee used a collaborative, consensus building approach as it studied the issues and constructed the program. Ultimately, the committee decided to pursue a program that allows several different types of watercraft (kayaks, canoes, sculls, rowboats, johnboats, and sailboats) to be used. Most of the watercraft can be launched from several specified sites around the reservoir, and small sailboats can be launched from a single site. The launch sites were coordinated with the NYSDEC to prevent conflicts with nesting eagles and with the New York State Department of Transportation for public safety for access along NYS Route 10. The program includes requirements for participants to obtain Access Permits and Recreational Boat Tags which are given to boaters after they have their vessels and appurtenant devices (oars, paddles, sails) steam cleaned. Boaters will be able to secure temporary (seven days or less) or seasonal boat tags. The program runs from Memorial Day weekend through Columbus Day each year for three successive years starting in 2009. The Rules for the Recreational Use of Water Supply Lands and Waters have been amended to include this program and became effective May 15, 2009.

PAA's and areas open for hunting with an Access Permit are listed below and shown in Figure 4.8.1.2-2.

Reservoir	**Recreation Unit**	**Use**	**Acres**
Cannonsville	Johnny Brook	Hunting	3,791
	Speedwell Mountain	PAA	3,908
	Beerston	Hunting	816
	Barbour Brook	PAA	344
	Fletcher Hollow	PAA	358
	Sands Creek	Hunting	2,011
		Total	11,228

Shown below is the number of permitted boats in each zone (see Figure 4.8.1.2-2) on the Cannonsville Reservoir.

Zone	No. of Boats
Unassigned	3
ZONE 1	51
ZONE 2	53
ZONE 3	69
ZONE 4	5
ZONE 5	57
ZONE 6	35
ZONE 7	6
ZONE 8	10
ZONE 9	108
ZONE 10	39
Total	**436**

4.8.1.3 Pepacton Development

The Pepacton Reservoir is approximately 135 miles from New York City and 105 miles from Albany. As of July 1, 2009, the City owned 17,895 acres within the East Branch of the Delaware River watershed, 10,822 acres of which are available for public recreation. Public access to property owned by the City and other recreation features in the vicinity of the Pepacton Reservoir are shown in Figure 4.8.1.3-1. There are numerous parking areas along the periphery of the impoundment and a kiosk. In addition, there is a large trail network just south of the impoundment. The Catskill Scenic Trail passes near the headwaters of the East Branch of the Delaware River (Delaware Co. SWCD, 2007). NYCDEP boat storage areas are located along sections of the impoundment. Public access (with Access Permits) is provided along the central northern shoreline of the impoundment.

The East Branch of the Delaware River and the Pepacton Reservoir are renowned for trout fishing opportunities. The primary target species is brown trout; however, rainbow trout and brook trout are caught in smaller numbers as well. Popular recreational activities in the area include camping, hiking, fishing, canoeing, kayaking, hunting, mountain biking, cross-country skiing, snowmobiling, horseback riding, picnicking, swimming, and bird watching.

Other protected areas in the vicinity of the Pepacton Reservoir include:

- Catskill State Park
- Plattekill State Forest
- Bearpen Mountain State Forest
- Bear Spring Mountain Wildlife Management Area
- Vinegar Hill Wildlife Management Area
- Halcott Mountain Wild Forest
- Dry Brook Range Wild Forest
- Big Indian Wilderness
- Shandaken Wild Forest

PAAs and areas open for hunting with an Access Permit are shown below. Areas open for fishing with an Access Permit are shown in Figure 4.8.1.3-2.

Reservoir	**Recreation Unit**	**Use**	**Acres**
Pepacton	Flynn Brook	Hunting	2,200
	Cat Hollow	PAA	175
	Pepacton Ledges	PAA	222
	Raynor Brook	Hunting	220
	Murphy Hill	PAA	520
		Total	3,337

Shown below is the number of permitted boats in each zone (see Figure 4.8.1.3-2) on the Pepacton Reservoir.

Zone	No. of Boats
Unassigned	29
ZONE 1	198
ZONE 2	235
ZONE 3	201
ZONE 4	95
ZONE 5	130
ZONE 6	49
ZONE 7	197
ZONE 8	201
ZONE 9	71
ZONE 10	398
Total	**1804**

4.8.1.4 Neversink Development

The Neversink Reservoir lies to the south of the Catskill State Park; however, its headwaters and upper watershed are inside the Park boundaries. It is located nearly between Albany and New York City as it is 100 and 110 miles from each, respectively. As of July 1, 2009, the City owned about 5,527 acres within the Neversink River watershed, 2,607 acres of which are available for public recreation. Public access to property owned by the City and other recreation features in the vicinity of the Neversink Reservoir are shown in Figure 4.8.1.4-1.

The Neversink Reservoir supports an extremely popular landlocked salmon and brown trout fishery, while the Neversink River supports a well-known brown trout fishery.

Trails near the reservoir include the Seager West Branch Trail, Vernooy Falls Trail, and Peenpack Trail. Popular recreational activities in the area include camping, hiking, fishing, canoeing, kayaking, hunting, mountain biking, cross-country skiing, snowmobiling, horseback riding, picnicking, swimming, and bird watching. Other protected areas in the vicinity of the Neversink Reservoir include:

- Catskill State Park
- Minnewaska State Park
- Lake Superior State Park

Areas open for hunting with an Access Permit are listed below. Areas open for fishing with an Access Permit are shown in Figure 4.8.1.4-2.

Reservoir	**Recreation Unit**	**Use**	**Acres**
Neversink	Neversink West	Hunting	1,194
		Total	1,194

Shown below is the number of permitted boats in each zone (see Figure 4.8.1.4-2) on the Neversink Reservoir.

Zone	No. of Boats
Unassigned	4
ZONE 1	2
ZONE 2	26
ZONE 3	36
ZONE 4	25
ZONE 5	68
ZONE 6	19
ZONE 7	10
ZONE 8	2
ZONE 9	3
Total	**195**

4.8.1.5 Catskill Park State Land Master Plan

As noted in Section 3.3, the entire Project boundary for the Pepacton Development and the northern portion of the Project boundary for the Neversink Development are within the Catskill Park. The recreational uses of the Catskill Park are guided by the NYSDEC *Catskill Park State Land Master Plan (August 2008)*.[8] It is important to note that the Catskill Master Plan does not apply to the lands owned by the City within the Catskill Park, including those comprising the Project boundaries for both the Pepacton and Neversink Developments.[9] However, with respect to all lands compromising the Project vicinity for these two developments located in the Catskill Park and not owned by the City, the Catskill Master Plan generally encourages a variety of recreational uses including camping, hunting, hiking, and fishing. Moreover, certain of these Project vicinity lands located within the Catskill Park and not owned by the City, have been classified by NYSDEC as "Wild Forest" indicating that snowmobiling, motor boating, and bicycling may also be permitted in such areas.[10]

4.8.2 Land Use

As the developments sites are in relatively close proximity, historical land use has been similar for the entire project area. In the early settlement days, the entire area was covered by forests. As a result, forest materials were used for construction of equipment and housing. Certain trees were utilized for making fine furniture, while the bark of other trees was used in tanneries. Sugar maple trees were tapped for syrup and sugar (Greene Co. SWCD, 2007). The NYCDEP allows agricultural uses of the City lands in certain cases, including tapping sugar maple trees for sap used to produce maple syrup.

[8] NYSDEC, *Catskill Park State Land Master Plan (August 2008)*, available at: http://www.dec.ny.gov/docs/lands_forests_pdf/cpslmp.pdf (hereinafter, "Catskill Master Plan").

[9] *Id*. at 1.

[10] Appendix J of the Catskill Master Plan includes a map delineating the NYSDEC land classifications within the Catskill Park.

As the forests were cleared, the rocks and stumps were pulled to make way for farmland. The shallow, infertile soil proved not to be conducive to sustained grain farming; however, the abundance of cold-hardy grasses and water supported dairy farming (Delaware Co. SWCD, 2007). Dairy farming and forestry remain the dominant land uses. Table 4.8.2-1 lists the land cover associated with each watershed.

Table 4.8.2-1: Land Cover Types in the Project Areas

Cover Type	Watershed (expressed as percentage)			
	Schoharie Creek	West Branch Delaware River	East Branch Delaware River	Neversink River
Forest	85.6	68.8	82.3	98
Shrubland	3.4	11.3	7.7	<1
Grassland	3.8	N/A*	3.8	<1
Urban*	2.9	6.7	2.5	<1
Water	0.8	1.8	2.4	<1
Wetland	1.6	1.2	0.8	<1
Agricultural Land	2.2	10.1	0.4	2
Roads	N/A*	N/A*	0.2	<1

*Roads were not separated from the urban cover type for the Schoharie and West Branch watersheds. Grasslands were not separated from the agricultural land cover type for the West Branch watershed.

4.9 Aesthetic Resources (18 CFR § 5.6 (d)(3)(ix))

It is important to note that the City has a Design Commission that reviews permanent works of art, architecture, and landscape architecture proposed in, on, or over City-owned property. Design Commission review is required on all projects involving construction, renovation, or restoration of buildings, creation or rehabilitation of parks and playgrounds, installation of lighting and other streetscape elements, and design, installation and conservation of artwork. Thus, all of the structures associated with the Project would have to be reviewed and approved by the Design Commission.

The Catskill State Park was designated in 1904 and, like the Adirondack Park, is a unique mix of public ”Forever Wild” and private land. It is the dominant feature in the vicinity of all four development sites. A unique characteristic of the region is that it is within the 2,000-square-mile New York City watershed that is the largest unfiltered water supply in the United States (Greene Co. SWCD, 2007). The region is largely rural, but it is relatively close to Albany, metropolitan New York City, and upper New Jersey.

Another aesthetic resource in the region is the Neversink River Unique Area, also known as Neversink Gorge. The Unique Area also includes the Wolf Brook Multiple Use Area. TNC designated the Neversink River as one of the “75 Last Great Places” in the United States, Latin America, and the Pacific. This area was designated as unique because it satisfied one or more of the following criteria (NYSDEC, 1997):

- Special natural beauty
- Wilderness character

- Geological significance
- Ecological significance (including areas essential for the conservation of threatened or endangered species)
- Character suitable for inclusion in the State Nature or Historical Preserve and be located outside the Adirondack or Catskill State Parks

The upper 73.4 miles of the Delaware River are designated under the National Wild and Scenic Rivers System as the Upper Delaware Scenic and Recreational River; however, the majority of land in that corridor is privately owned.

4.10 Cultural Resources (18 CFR § 5.6 (d)(3)(x))

In considering whether to issue a license for the Project and the license conditions to be imposed, the Commission must fulfill its obligation under Section 106 of the National Historic Preservation Act. The Commission has established a set of guidelines to accomplish this and consider the effect of the proposed projects on historic properties. At present, the City intends to enter into a Memorandum of Agreement with the Advisory Council on Historic Preservation ("Council") and the State Historic Preservation Office ("SHPO") to address the effects on historic properties from the construction, operation, and continued maintenance of the Project through a Historic Properties Management Plan ("HPMP"). The HPMP will conform to the Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects,* issued May 2, 2002. The draft HPMP will be prepared and filed along with the license application. The City expects the final HPMP to be referenced in the license for the Project, although it is likely to be issued as a separate, stand-alone document.

The HPMP establishes the Project's Area of Potential Effects and considers the concerns of interested stakeholders, which may include, for example, the SHPO, Indian tribes, local governments, and the Council. The HPMP integrates the management of historic properties within the City's decision making process for the Project and will be consistent with other planning and management documents for the Project. The implementation of the HPMP will be the responsibility of the NYCDEP through continued consultation with the SHPO. The HPMP will be prepared by a qualified professional according to the Secretary of Interior's standards for archeologists, architects, and architectural historians, and it will be developed in close consultation with Commission Staff, the SHPO, and the Council.

4.10.1 Schoharie Reservoir

Known Cultural Resources

OPRHP and NYSM Identified Archeological Sites

The New York State Museum ("NYSM") and New York State Office of Parks, Recreation and Historic Preservation ("OPRHP") files contain 19 reported sites within three miles of the Gilboa Dam and three reported sites outside of the three mile search radius but within or immediately adjacent to the Schoharie Reservoir. These sites include 17 historic sites and five precontact sites. The nearest site is an early 20th-century hydro-electric power plant located at the base of the Gilboa Dam that was identified through an industrial resource survey that relied primarily upon historic maps to identify historic sites. Three other historic sites are also located within 1,000 ft of the Gilboa Dam. The three sites, which consist mainly of early through mid 19th-century architectural and domestic scatters, are located north of the dam and were identified during a cultural resource survey for the Shandaken Tunnel Intake Dredging project in 2005. Two of the sites identified during the dredging survey are considered eligible for listing on the National Register of Historic Places. The location, brief description, and National Register status of each of the 22 sites identified during the pre-screening as within three miles of the Gilboa Dam and within and immediately adjacent to the Schoharie Reservoir are provided below in Table 4.10.1-1.

Table 4.10.1-1: OPRHP/NYSM Archeological sites within three miles of the Schoharie Reservoir Dam and within or immediately adjacent to the Schoharie Reservoir.

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
02515.000014		Gristmill (SCO-101)	Mid 19th-century map documented industrial site	Unevaluated	3.7 miles (5.9 km) south (now within reservoir boundary)
02515.000017		Gleason Sawmill (SCO-105)	Remains of foundation and dam associated with a mid 19th-century mill	Unevaluated	3 miles (4.8 km) southwest
02515.000018		Sawmill (SCO-106)	Masonry and rubble associated with a mid 19th-century sawmill	Unevaluated	2.5 miles (4.0 km) southwest
02515.000020		Hardenburgh Gristmill (SCO-106B)	Foundation remains and wheel pier of a 19th-century mill	Unevaluated	3.7 miles (5.9 km) south
09505.000009		Brown & Post Sawmill (SCO-116)	Mid 19th-century map documented industrial site	Unevaluated	2 miles (3.2 km) southeast
09505.000010		Brown & Post Gristmill (SCO-117)	Arched masonry dam associated with a mid 19th-century mill	Unevaluated	1.9 miles (3.0 km) southeast
09505.000011		A. Walker/D. Bassett/N. Richtmyer/ A. Brown Sawmill (SCO-118)	Mid 19th-century map documented industrial site	Unevaluated	1.7 miles (2.7 km) southeast
09505.000012		Playman/L.H. Stevens/J.T. Benham/Wm. Mabie Sawmill (SCO-119)	Masonry dam and foundation remains associated with mid 19th-century mill	Unevaluated	1.4 miles (2.2 km) southeast
09505.000013		John Walker Woolen Factory (SCO-120)	Mid 19th-century map documented industrial site	Unevaluated	1.7 miles (2.7 km) southeast
09508.000005		Morse & Reed Gristmill (SCO-121)	Mid 19th-century map documented industrial site	Unevaluated	1,000 ft (304 m) south (now within reservoir boundary)

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
09508.000006		Morse, Reed & Co. Cotton Factory (SCO-122)	Mid 19th-century map documented industrial site	Unevaluated	1,700 ft (518 m) north
09508.000007		Tri-County Light & Power Co. (SCO-123)	Early 20th-century hydro-electric power plant	Unevaluated	Immediately adjacent to the base of the dam
09508.000009		Harvey Bliss Gristmill (SCO-126)	Masonry dam and foundation remains associated with mid 19th-century mill	Unevaluated	1.8 miles (2.8 km) northeast
09508.000010		J. Dice SM mill (SCO-127)	Mid 19th-century map documented industrial site	Unevaluated	1.6 miles (2.5 km) northeast
09508.000011	4778	Unnamed Site	Precontact village site	Unevaluated	3 miles (4.8 km) north
09508.000012	4777	Unnamed Site	Traces of precontact period occupation	Unevaluated	1.4 miles (2.2 km) north
09508.000013	4776	ACP SCHO 22	Precontact workshop	Unevaluated	4,770 ft (1,453 m) southeast
09508.000032	4777	Unnamed Site	Chert flakes, biface tip, rough stone, faunal remains; traces of occupation	Unevaluated	1 mile (1.6 km) north
09508.000062		J. Reed Site (SUBi-2531)	Mid 19th-century architectural and domestic scatter	Eligible	680 ft (207 m) north
09508.000063		Gilboa #1 Site (SUBi-2532)	Early through mid 19th-century architectural and domestic scatter	Eligible	850 ft (259 m) north
09508.000064		Gilboa #2 Site (SUBi-2533)	Mid 19th-century architectural and domestic scatter	Not Eligible	850 ft (259 m) north
	7344	No Information	Traces of precontact period occupation	Unknown	4 miles (6.4 km) south (portions are within reservoir boundary)
09508.000071		J.Cronk #1 Site (SUBi-2666)	19th and 20th century architectural and domestic scatter	Eligible	1082 ft (330m) north of dam
09508.000072		J. Cronk #2 Site (SUBi-2667)	19th and 20th century architectural and domestic scatter	Eligible	787 ft (240m) north of dam
09508.000073		Vroman Site (SUBi-2668)	19th and 20th century architectural and domestic scatter	Eligible	689 ft (210m) north of dam
09508.000074		Riverside Quarry Site (SUBi-2669)	20th century quarry used for construction of dam	Eligible??	1378 ft (420m) north of dam
09508.000068		Gilboa #3 Site (SUBi-2597)	19th and 20th century architectural and domestic scatter	Not Eligible	279 ft (85m) north of dam

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
09508.000069		Gilboa #4 Site (SUBi-2598)	19th and 20th century architectural and domestic scatter	Eligible	840 ft (256m) north of dam
09508.000070		Gilboa #5 Site (SUBi-2599)	19th and 20th century architectural and domestic scatter	Eligible	1122 ft (342m) north of dam
09508.000065		Mackey 1 Site (SUBi-2595)	19th and 20th century architectural and domestic scatter	Not Eligible	465 ft (142m) north of dam
09508.000066		Mackey 2 Site (SUBi-2596)	19th and 20th century architectural and domestic scatter	Not Eligible	564 ft (172m) north of dam
09508.000067		Buckingham Site (SUBi-2594)	19th and 20th century architectural and domestic scatter	Not Eligible	295 ft (90m) north of dam

State and National Register of Historic Places

A review of the OPRHP computer inventory identified the Gilboa Dam (09508.000001) as eligible for listing on the State and National Registers of Historic Places.

4.10.2 Cannonsville Reservoir

Known Cultural Resources

OPRHP and NYSM Identified Archeological Sites

The NYSM and OPRHP files contain 33 reported sites within three miles of the Cannonsville Dam and 14 reported sites outside of the three mile search radius but within or immediately adjacent to the Cannonsville Reservoir. These sites include 39 historic sites and eight precontact sites. The nearest site, a mid 19th century sawmill, was identified during a 1979 historic industrial resources survey and is located immediately adjacent to the east side of the Cannonsville Dam. Thirty-four of the historic sites located within three miles of the Cannonsville Dam or within and adjacent to the reservoir were identified over the course of the 1979 historic industrial resources survey by utilizing historic maps rather than subsurface archeological investigation. All of those sites identified during the 1979 survey represent 19th century industrial complexes that were once located along the Delaware River or its contributing tributaries; many of which are now located within the boundary of the Cannonsville Reservoir. The location, brief description, and National Register status of each site are provided below in Table 4.10.2-1.

Table 4.10.2-1: OPRHP/NYSM Archeological sites within three miles of the Cannonsville Reservoir Dam and within or immediately adjacent to the Cannonsville Reservoir.

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
02506.000001		Cider mill (WBD-139)	Mid 19th-century map documented industrial site	Unevaluated	1.5 miles (2.4 km) northeast (now within reservoir boundary)
02506.000002		Sawmill (WBD-141)	Mid 19th-century map documented industrial site	Unevaluated	Immediately adjacent to the east side of dam
02506.000003		Sawmill (WBD-142)	Mid 19th-century map documented industrial site	Unevaluated	1.3 miles (2 km) northwest
02506.000009		H. Hess Sawmill (WBD-156)	Remains of stone foundation and dam associated with mid 19th-century sawmill	Unevaluated	2.4 miles (3.8 km) northeast
02506.000010		Sawmill, Wagon Shop (WBD-157)	Mid 19th-century map documented industrial site	Unevaluated	2.1 miles (3.3 km) north
02506.000011		Blind Manufacture (WBD-158)	Mid 19th-century map documented industrial site	Unevaluated	2.2 miles (3.5 km) northwest
02506.000012		Ira Snyder Carding Mill (WBD-159)	Mid 19th-century map documented industrial site	Unevaluated	1.4 miles (2.2 km) northwest
02506.000013		Ira Snyder Axe Factory (WBD-160)	Mid to late 19th-century map documented industrial site	Unevaluated	1.4 miles (2.2 km) northwest
02506.000014		Ira Snyder Sawmill (WBD 161)	Mid to late 19th-century map documented industrial site	Unevaluated	1.4 miles (2.2 km) northwest
02506.000015		Southern NY Power Co. (WBD-160A)	Foundation remains as well as smokestack, sills, and exterior waterwheel associated with early 19th-century power plant	Unevaluated	1.4 miles (2.2 km) northwest
02506.000016	5851	Briggs Site (SUBi-1124)	Late Archaic and Woodland period camp site	Unevaluated	1.3 (2.0 km) miles northwest
02506.000017		Site 2	Late Archaic camp site	Not eligible	1.7 miles (2.7 km) west
02506.000018		DEL-186	Historic quarry	Unevaluated	1.5 miles (2.4 km) south
02506.000019		DEL-187	Historic quarry	Unevaluated	2.1 miles (3.3 km) southeast
02506.000020		DEL-189	Historic quarry	Unevaluated	2.5 miles (4.0 km) southeast
02506.000024		DEL-9932	Undated stone foundation; possibly a barn	Unevaluated	4,900 ft (1,493 m) southwest
02506.000026		Deposit Airport I Site (SUBi-2048)	Late Archaic, Middle Woodland, and Late Woodland components: chert flakes, fire-cracked rock, points, biface, pottery fragments	Unevaluated	2.5 miles (4.0 km) southwest

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
02506.000027		Deposit Airport II Site (SUBi-2049)	Archaic through Late Woodland: biface, points, pottery fragments, flakes, and an adze	Unevaluated	2.4 miles (3.8 km) southwest
02506.000028		Wheeler Historic Site (SUBi-2070)	Architectural and domestic deposits dating to the mid-19th century	Unevaluated	2.4 miles (3.8 km) southwest
02518.000002		Sawmill (WBD-97)	Mid 19th-century map documented industrial site	Unevaluated	9.5 miles (15.2 km) northeast
02518.000004		Sawmill (WBD-99)	Mid 19th-century map documented industrial site	Unevaluated	7 miles (11.2 km) northeast (now within reservoir boundary)
02518.000009		N. Boyd Sawmill (WBD-103)	Mid 19th-century map documented industrial site	Unevaluated	6.9 miles (11.1 km) northeast (now within Dryden Brook inlet of reservoir boundary)
02518.000010		Sawmill (WBD-104)	Mid 19th-century map documented industrial site	Unevaluated	6.4 miles (10.2 km) northeast (now within reservoir boundary)
02518.000011		Gregory Sawmill (WBD-105)	Early through mid 19th-century map documented industrial site	Unevaluated	6.1 miles (9.8 km) northeast (now within reservoir)
02518.000012		Sawmill (WBD-106)	Early 19th-century map documented industrial site	Unevaluated	5.5 miles (8.8 km) northeast (now within reservoir boundary)
02518.000013		W.H. Sprague Lumber Manufactory (WBD-107)	Mid 19th-century map documented industrial site	Unevaluated	3.6 miles (5.7 km) northeast (now within reservoir boundary)
02518.000014		E.B. & M.W. Owens Wagon Shop, Blacksmith Shop (WBD-109)	Mid 19th-century map documented industrial site	Unevaluated	3.5 miles (5.6 km) northeast (now within reservoir boundary)
02518.000025		J. Tillotson Sawmill (WBD-128)	Mid 19th-century map documented industrial site	Unevaluated	7.9 miles (12.7 km) northeast (now within reservoir boundary)
02518.000026		W. Huggins/W.B. McGibbon Sawmill (WBD-130)	Early through mid 19th-century map documented industrial site	Unevaluated	5.5 miles (8.8 km) northeast (now within reservoir boundary)

OPRHP #	NYS M #	Identifier	Description	National Register Status	Location in Relation to Dam
02518.000028		Sprague/Ogden & Leal/Jester/Deposit Milling Co./McLaughlin Gristmill (WBD-132)	Early through late 19th-century map documented industrial site	Unevaluated	3 miles (4.8 km) northeast (now within reservoir boundary)
02518.000029		J.A. Kenyon Tannery (WBD-133)	Mid through late 19th-century map documented industrial site	Unevaluated	3 miles (4.8 km) northeast (now within reservoir boundary)
02518.000030		Sawmill (WBD-134)	Early through mid 19th-century map documented industrial site	Unevaluated	3 miles (4.8 km) northeast (now within reservoir boundary)
02518.000031		Huntington Sawmill (WBD-135)	Early through late 19th-century map documented industrial site	Unevaluated	2.1 miles (3.3 km) east (now within reservoir boundary)
02518.000033		E. Boyd Sawmill (WBD-137)	Mid 19th-century map documented industrial site	Unevaluated	2.9 miles (4.6 km) northeast
02518.000034		Burr Map Sawmill (WBD-138)	Early 19th-century map documented industrial site	Unevaluated	1.5 miles (2.4 km) northeast (now within reservoir boundary)
02519.000032		E. Beers/W. Beers/O. Hanford Sawmill (WBD-96)	Mid 19th-century map documented industrial site	Unevaluated	9.4 miles (15.1 km) northeast
02544.000003		Tannery (WBD-162)	Mid 19th-century map documented industrial site	Unevaluated	2 miles (3.2 km) west
02544.000004		Deposit Steam Mill (WBD-163)	Mid 19th-century map documented industrial site	Unevaluated	2 miles (3.2 km) west
02544.000005		R. H. Evans Cottage D Sawmill (WBD-164)	Mid 19th-century map documented industrial site	Unevaluated	1.9 miles (3.0 km) west
02544.000006		W. Evans/B.E. Hadley Sawmill (WBD-165)	Mid 19th-century map documented industrial site	Unevaluated	1.9 miles (3.0 km) west
02544.000007		Hadley Steam Mill (WBD-167)	Late 19th-century map documented industrial site	Unevaluated	2.1 miles (3.3 km) west
02544.000008		N.K.W. Sash Factory (WBD-168)	Mid 19th-century map documented industrial site	Unevaluated	2.2 miles (3.5 km) west
02544.000009		Organ Factory and Wagon Shop (WBD-169)	Mid 19th-century map documented industrial site	Unevaluated	2.3 miles (3.7 km) west
02544.000013		Deposit Airport III Site	Chert flakes, cortical chunk, chert shatter fragments	Unevaluated	2.4 miles (3.8 km) west
	761	No information	One fluted projectile point identified as a stray find	Unknown	3 miles (4.8 km) northeast (now within reservoir boundary)

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
	3131	No information	Reported location of a precontact village burial site	Unknown	1.4 miles (2.2 km) west
	8407	No information	Reported traces of precontact occupation	Unknown	2 miles (3.2 km) west

State and National Register of Historic Places

A review of the OPRHP computer inventory did not identify any properties listed on the State and National Registers of Historic Places or eligible for such a listing immediately adjacent to the Cannonsville Dam.

4.10.3 Pepacton Reservoir

Known Cultural Resources

OPRHP and NYSM Identified Archeological Sites

The NYSM and OPRHP files contain 22 reported sites within three miles of the Downsville Dam and 29 reported sites outside of the three mile search radius but within or immediately adjacent to the Pepacton Reservoir. These sites include 47 historic sites and four precontact sites. The nearest site is a mid 19th century sawmill located approximately 3,200 ft east of the dam that was identified through a 1979 industrial resource survey, which relied primarily upon historic maps to identify historic sites. Of the 47 documented historic sites located within three miles of the Downsville Dam or within and adjacent to the Pepacton Reservoir, 45 were identified during the 1979 historic industrial resources survey representing several 18th and 19th century industrial complexes that were once located along the Delaware River or its contributing tributaries. Many of these industrial sites are now located within the boundary of the Pepacton Reservoir. The location, brief description, and National Register status of each site are provided below in Table 4.10.3-1.

Table 4.10.3-1: OPRHP/NYSM Archeological sites within three miles of the Downsville Dam and within or immediately adjacent to the Pepacton Reservoir.

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
02501.000002		Sawmill (EBD-59)	Mid 19th-century map documented industrial site	Unevaluated	11.5 miles (18.5 km) northeast (now within reservoir boundary)
02501.000003		L.D. Jackson Sawmill (EBD-61)	Mid 19th-century map documented industrial site	Unevaluated	11.2 miles (18.0 km) northeast (now within reservoir boundary)

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
02501.000004		L.D. Jackson Gristmill (EBD-62)	Mid 19th-century map documented industrial site	Unevaluated	11.2 miles (18.0 km) northeast (now within reservoir boundary)
02501.000005		Sawmill (EBD-64)	Mid 19th-century map documented industrial site	Unevaluated	10.5 miles (16.8 km) northeast
02501.000006		T. Gregory Sawmill (EBD-65)	Mid 19th-century map documented industrial site	Unevaluated	9.5 miles (15.2 km) northeast (now within reservoir boundary)
02501.000010		H. Hawver/Leander Barnhart & Anson Jenkins Sawmill (EBD-69)	Mid 19th-century map documented industrial site	Unevaluated	6.7 miles (10.7 km) east (now within reservoir boundary)
02501.000011		J. Dickson Sawmill (EBD-71)	Mid 19th-century map documented industrial site	Unevaluated	7.5 miles (12.0 km) northeast (now within reservoir boundary)
02501.000021		James and L.B. McCabe Sawmill (EBD-96)	Mid 19th-century map documented industrial site	Unevaluated	8 miles (12.8 km) northeast
02501.000022		Andrew Hawver Sawmill (EBD-97)	Mid 19th-century map documented industrial site	Unevaluated	7.8 miles (12.5 km) northeast (now within reservoir boundary)
02501.000023		Samuel McCabe & Sons/ Andrew Hawver Tannery (EBD-99)	Early to mid 19th-century map documented industrial site	Unevaluated	7.8 miles (12.5 km) northeast (now within reservoir boundary)
02501.000024		W.B. Shafer Sawmill (EBD-101)	Early to mid 19th-century map documented industrial site	Unevaluated	7.3 miles (11.7 km) northeast (now within reservoir boundary)
02501.000025		George Wilson Sawmill (EBD-102)	Mid 19th-century map documented industrial site	Unevaluated	7.6 (12.2 km) miles northeast (now within reservoir boundary)
02501.000026		James Wilson Sawmill (EBD-103)	Mid 19th-century map documented industrial site	Unevaluated	6.5 (10.4 km) miles northeast (now within reservoir boundary)

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
02501.000027		Alfred Shaver Sawmill (EBD-105)	Mid 19th-century map documented industrial site	Unevaluated	6.5 miles (10.4 km) east (now within reservoir)
02501.000033		William Shaver Sawmill (EBD-111)	Mid 19th-century map documented industrial site	Unevaluated	6.7 miles (10.7 km) east (now within reservoir boundary)
02503.000004		H.S. Shaver Sawmill (EBD-112)	Mid 19th-century map documented industrial site	Unevaluated	4.5 miles (7.2 km) northeast (now within reservoir)
02503.000005		Shaver Tannery (EBD-113)	Mid 19th-century map documented industrial site	Unevaluated	4.5 miles (7.2 km) northeast (now within reservoir boundary)
02503.000008		Philip Allen Sawmill (EBD-116)	Mid 19th-century map documented industrial site	Unevaluated	4 miles (6.4 km) east (now within reservoir boundary)
02503.000009		Sawmill (EBD-117)	Mid 19th-century map documented industrial site	Unevaluated	4 miles (6.4 km) east (now within reservoir boundary)
02503.000011		A.C. Biggar Sawmill (EBD-121)	Mid 19th-century map documented industrial site	Unevaluated	4.8 miles (7.7 km) northeast
02503.000012		Anthony Lloyd Gristmill (EBD-122A)	Late 18th-century map documented industrial site	Unevaluated	4 miles (6.4 km) northeast (now within reservoir boundary)
02503.000014		Cidermill (EBD-124)	Mid 19th-century map documented industrial site	Unevaluated	4 miles (6.4 km) northeast (now within reservoir boundary)
02503.000015		H. Hurlburt Sawmill (EBD-125)	Mid 19th-century map documented industrial site	Unevaluated	4 miles (6.4 km) northeast (now within reservoir boundary)
02503.000016		David Wilson Sawmill (EBD-127)	Mid 19th-century map documented industrial site	Unevaluated	2.7 miles (4.3 km) east (now within reservoir boundary)
02503.000017		John Merit Sawmill (EBD-128)	Mid 19th-century map documented industrial site	Unevaluated	2.4 miles (3.8 km) northeast
02503.000018		Sawmill (EBD-129)	Remains of a masonry dam and foundation associated with a mid 19th-century sawmill	Unevaluated	2.2 miles (3.5 km) northeast
02503.000019		John Holmes Sawmill (EBD-130)	Mid 19th-century map documented industrial site	Unevaluated	1.6 miles (2.5 km) northeast (now within reservoir boundary)

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
02503.000020		Hiram More Sawmill (EBD-131)	Mid 19th-century map documented industrial site	Unevaluated	1.5 miles (2.4 km) northeast
02503.000021		Miller Sawmill (EBD-133)	Mid 19th-century map documented industrial site	Unevaluated	1.7 miles (2.7 km) southeast
02503.000022		Sawmill (EBD-134)	Mid 19th-century map documented industrial site	Unevaluated	3,200 ft (975 m) east
02503.000026		S. Hotchkiss Sawmill (EBD-140)	Stonework remains associated with a mid 19th-century sawmill	Unevaluated	2.1 (3.3 km) miles north
02503.000027		N. Elwood Sawmill (EBD-141)	Remains of foundation and dam associated with a mid 19th-century sawmill	Unevaluated	1.7 miles (2.7 km) north
02503.000029		J. S. William Sawmill (EBD-143)	Mid 19th-century map documented industrial site	Unevaluated	2.5 miles (4.0 km) northwest
02503.000030		Robert Beates Sawmill (EBD-144)	Mid 19th-century map documented industrial site	Unevaluated	1.3 miles (2.0 km) northwest
02503.000036		Sawmill (EBD-150)	Mid 19th-century map documented industrial site	Unevaluated	2.6 miles (4.1 km) northwest
02503.000037		Sawmill (EBD-151)	Mid 19th-century map documented industrial site	Unevaluated	2.4 miles (3.8 km) northwest
02503.000038		William Rose Gristmill (EBD-152)	Revolutionary War period map documented industrial site	Unevaluated	1.7 miles (2.7 km) northwest
02503.000039		George Downs/J.D. Downs Tannery (EBD-153)	Mid 19th-century map documented industrial site	Unevaluated	1.4 miles (2.2 km) northwest
02503.000040		J.D. Downs & Elwood Gristmill (EBD-154)	Mid 19th-century map documented industrial site	Unevaluated	1.3 miles (2.0 km) northwest
02503.000041		Steam Sawmill (EBD-154A)	Late 19th-century map documented industrial site	Unevaluated	2.2 miles (3.5 km) southwest
02503.000042		Downs & Elwood Sawmill (EBD-155)	Remains of dam and laid stone foundation associated with a mid 19th-century sawmill	Unevaluated	1.7 miles (2.7 km) southwest
02503.000043		J. & H. & P. Radeker Sawmill (EBD-156)	Remains of dam associated with a mid 19th-century sawmill	Unevaluated	2.2 miles (3.5 km) southwest
02503.000044		A. Campbell Sawmill and Gristmill (EBD-157)	Remains of dam associated with a mid 19th-century sawmill/gristmill	Unevaluated	2.4 miles (3.8 km) southwest
02503.000045		H. Radeker Sawmill (EBD-158)	Remains of a stone dam associated with a mid 19th-century sawmill	Unevaluated	2.8 miles (4.5 km) southwest

OPRHP #	NYSM #	Identifier	Description	National Register Status	Location in Relation to Dam
02503.000067		14-81-4	Mid to late 19th-century house foundation with cellar hole	Unevaluated	5,000 ft (1,524 m) southeast
02514.000041		N. Tompkins Sawmill (EBD-58)	Mid 19th-century map documented industrial site	Unevaluated	12 miles (19.3 km) northeast
	3124	ACP DELA 6	Apple orchard associated with historic village	Unknown	3 miles (4.8 km) east (now within reservoir boundary)
	3125	ACP DELA 7A	Precontact village site fortified with earthworks and "abundant in arrowheads"	Unknown	12.5 miles (20.11 km) northeast (now within reservoir boundary)
	7316	ACP DELA 7B	Precontact village site fortified with earthworks and trees; trees date fort to approximately 1000 years old	Unknown	11.5 miles (18.5 km) northeast (now within reservoir boundary)
	7317	ACP DELA 7C	Stone battle axe and "abundant arrowheads" uncovered in immediate locality of NYSM 3125 and 7316	Unknown	11.5 miles (18.5 km) northeast (now within reservoir boundary)
	8014	No Information	Precontact village site	Unknown	3.4 miles (5.4 km) northeast (now within reservoir boundary)

State and National Register of Historic Places

A review of the OPRHP computer inventory did not identify any properties listed on the State and National Registers of Historic Places or eligible for such a listing immediately adjacent to the Downsville Dam.

4.10.4 Neversink Reservoir

Known Cultural Resources

OPRHP and NYSM Identified Archeological Sites

The NYSM and OPRHP files contain only one reported site, NYSM 8643, within three miles of the Neversink Dam. NYSM 8643 is described as an "Indian trail" that extends along the entire length of the eastern half of the Neversink Reservoir, including the area now occupied by the dam. No other sites were reported within or immediately adjacent to the reservoir.

State and National Register of Historic Places

A review of the OPRHP computer inventory did not identify any properties listed on the State and National Registers of Historic Places or eligible for such a listing immediately adjacent to the Neversink Dam.

4.11 Socio-Economic Resources (18 CFR § 5.6 (d)(3)(xi))

4.11.1 Demographics

The majority of the Schoharie Reservoir is in Schoharie County. Schoharie County is largely rural with 83.1% of the population residing in non-urban areas. The population of the county was estimated to be 31,489 in 2001 and 32,318 in 2007.

The Cannonsville and Pepacton Reservoirs are located within Delaware County. Delaware County is 85.2% rural composed mainly of small communities. The population of the county was estimated to be 48,055 in 2000 and 48,425 in 2007.

The Neversink Reservoir is located in Sullivan County. Sullivan County is 71.7% rural. The population of the county was estimated to be 73,996 in 2000 and 80,096 in 2007.

4.11.2 Economic Patterns

The NYCDEP employs approximately 74 individuals from the counties that comprise the watersheds for the four reservoirs and dams. These employees consist primarily of operation and maintenance personnel, but also include engineering, health and safety, and administrative personnel.

Schoharie County

Through three quarters of 2008, Schoharie County showed unemployment greater than the national rate (5.6%) with 6.0%. Schoharie County supports 575 farms with 125 acres in farmland, 76,000 acres in cropland, and 105,850 acres in the New York Agricultural district. According to the Schoharie Chamber of Commerce, the average farm size is 230 acres.

Table 4.11.2-1 lists the employment breakdown for Schoharie County.

Delaware County

Through the first half of 2008, the unemployment rate in Delaware County was slightly above the national average at 6.2%. In 2000, 2.6% of the population of Delaware County resided on farms. In 2003, the U.S Census of Agriculture reported that there were 780 farms totaling 190,300 acres in the county.

Tourism has become an integral part of the Delaware County economy. Trout fishing is renowned and the area offers ample outdoor activities. New York State maintains 354 miles of snowmobile trails and skiers and snowboarders enjoy the local ski areas (Delaware Co. SWCD, 2007). Table 4.11.2-2 lists the employment breakdown of Delaware County.

Economics of Delaware Tailwaters Trout Fishery

As indicated above, trout fishing in the West Branch, East Branch, and mainstem of the Delaware River is very important to the local economies. This river system is a popular fishing destination for people from outside of the local area as well as other states. In the West Branch, approximately 57% of the annual anglers are from New York State, 17% are from Pennsylvania, 16% are from New Jersey, and the remainder are from other states and countries (NYSDEC 2003).

In the East Branch, about 65% of the annual anglers are from New York State, 23% are from New Jersey, 7% are from Pennsylvania, and the remainder are from other states and countries. Approximately 23% of the anglers resided in Delaware County and 5% are from New York City (NYSDEC 2003).

In the mainstem of the Delaware River, approximately 48% of the annual anglers are from Pennsylvania, 26% are from New York State; 20% are from New Jersey, and the remainder are from other states and countries. (NYSDEC 2003).

Sullivan County

Through three quarters of 2008, Sullivan County was above the national average unemployment rate at 8.5%. In 2003, the U.S. Census of Agriculture reported that there were 380 farms totaling 63,500 acres in the county. Table 4.11.2-3 lists the employment breakdown of Sullivan County.

Table 4.11.2-1: 2008 Percent Employment Breakdown in Schoharie County, NY

Industry	2008 Employment	Percent
Government	2,933	35.9%
Retail Trade	1,178	14.4%
Health Care and Social Assistance	1,118	13.7%
Accomodation and Food Services	559	6.8%
Construction	430	5.3%
Other Services	357	4.4%
Manufacturing	286	3.5%
Finance and Insurance	271	3.3%
Professional and Technical Services	231	2.8%
Wholesale Trade	166	2.0%
Arts, Entertainment, and Recreation	143	1.8%
Agriculture, Forestry, Fishing, and Hunting	124	1.5%
Information	112	1.4%
Administrative and Waste Services	61	0.8%
Management of Companies and Enterprises	53	0.7%
Mining	48	0.6%
Real Estate and Rental and Leasing	44	0.5%
Utilities	39	0.5%
Educational Services	9	0.1%
Schoharie County Total	**8,162**	**100%**

Source: New York State Department of Labor, 2008

Table 4.11.2-2: 2008 Percent Employment Breakdown in Delaware County, NY

Industry	2008 Employment	Percent
Government	4,495	27.3%
Manufacturing	4,326	26.3%
Health Care and Social Assistance	1,895	11.5%
Retail Trade	1,784	10.8%
Accomodation and Food Services	973	5.9%
Construction	545	3.3%
Other Services	484	2.9%
Finance and Insurance	442	2.7%
Wholesale Trade	329	2.0%
Information	235	1.4%
Professional and Technical Services	192	1.2%
Transportation and Warehousing	179	1.1%
Agriculture, Forestry, Fishing, and Hunting	141	0.9%
Arts, Entertainment, and Recreation	119	0.7%
Real Estate and Rental and Leasing	104	0.6%
Administrative and Waste Services	102	0.6%
Mining	90	0.5%
Management of Companies and Enterprises	36	0.2%
Unclassified	8	0.1%
Delaware County Total	**16,479**	**100%**

Source: New York State Department of Labor, 2008

Table 4.11.2-3: 2008 Percent Employment Breakdown in Sullivan County, NY

Industry	2008 Employment	Percent
Government	6,415	24.8%
Health Care and Social Assistance	5,016	19.4%
Retail Trade	3,242	12.6%
Accomodation and Food Services	2,207	8.6%
Manufacturing	1,319	5.1%
Other Services	1,273	4.9%
Construction	1,075	4.2%
Finance and Insurance	884	3.4%
Wholesale Trade	620	2.4%
Arts, Entertainment, and Recreation	605	2.3%
Administrative and Waste Services	565	2.2%
Professional and Technical Services	525	2.0%
Transportation and Warehousing	510	2.0%
Real Estate and Rental and Leasing	429	1.7%
Management of Companies and Enterprises	287	1.1%
Agriculture, Forestry, Fishing, and Hunting	284	1.1%
Information	218	0.8%
Educational Services	168	0.7%
Mining	134	0.5%
Unclassified	40	0.2%
Sullivan County Total	**25,816**	**100%**

Source: New York State Department of Labor, 2008

4.12 Tribal Resources (18 CFR § 5.6 (d)(3)(xii))

It is unknown if there are Indian tribal lands within the Project boundary. There are no Indian reservation lands within the project boundary (Ref: http://nationalatlas.gov/printable/images/pdf/fedlands/ny.pdf). There are seven federally-recognized Indian tribes in New York:

- Cayuga Nation of Indians
- Oneida Indian Nation
- Onondaga Nation
- St. Regis Band of Mohawk Indians;
- Seneca Nation
- Tonawanda Band of Seneca Indians
- Tuscarora Nation

5.0 PRELIMINARY ISSUES AND STUDIES LIST (18 CFR § 5.6 (D)(4))

The NYCDEP plans to continue operating the four reservoirs and dams in the same manner as current operations. Specifically, the discharges from the four dams and water level operations at the four impoundments will be managed in the same manner as current operations. The NYCDEP's reservoir operations focus on meeting the water supply needs of the City and surrounding counties and complying with the Decree, Water Code, and FFMP. Because the NYCDEP is not proposing to modify existing reservoir operations for hydropower purposes, the proposed studies listed below relate to only those resources that may be impacted due to hydropower operations. Most of these impacts are construction-related activities in the proposed powerhouse locations and along proposed transmission lines.

The NYCDEP is conducting pre-feasibility studies for each development site and hydroelectric unit. These studies are expected to be completed by the fall of 2009. The proposed facilities could be modified in the future pending further evaluation and study. Generally the footprint of the civil works associated with each of the facilities is the same for all alternatives and total downstream releases are consistent with current NYCDEP water management. The difference between alternatives, typically, involves means of water conveyance and/or the number, size and type of turbines. As noted above, one of the options being considered is siphons. Impacts from project discharges on thermal requirements will be considered in evaluating design options.

This section identifies preliminary issues pertaining to the City's development of the four sites for hydroelectric generation. The list of issues is not final, given that the agencies and other interested parties have not had the opportunity to review this PAD or visit the sites. During the public scoping process, federal and state resource agencies, Indian tribes, non-governmental organizations, and individuals will be invited to participate in refining the resource issues to be analyzed as part of this Project.

5.1 Issues Pertaining to the Identified Resources

Geology and Soils Issues

- Effects of construction of the hydroelectric units on geologic and soil resources.

Water Resources Issues

- Effects of construction of the hydroelectric units and operation of the water supply system on water quality in Schoharie Creek, West Branch, East Branch, and the Neversink River as well as each of the corresponding reservoirs.
- Effects of operations on the thermal regimes below all four dams.

Fish and Aquatic Resources Issues

- Effects of construction of the hydroelectric units on aquatic habitat below the four dams and in each of the four reservoirs.

Wildlife and Botanical Resources Issues

- Effects of construction of the hydroelectric units on wildlife and botanical resources.

Wetlands, Riparian, and Littoral Habitat Issues

- Effects of construction of the hydroelectric units on wetlands and riparian vegetation.

Rare, Threatened and Endangered Species Issues

- Effects of construction of the hydroelectric units on rare, threatened, and endangered species.

Recreation and Land Use Issues

- The nature and extent of public recreational access and facilities.
- Effects of construction of the hydroelectric units on recreational access and facilities.

Aesthetic Resources Issues

- Effects of construction of the hydroelectric units on aesthetic resources.

Cultural Resources Issues

- Effects of project construction on fossil beds found below the Gilboa Dam.
- Effects of construction of the hydroelectric units on cultural resources.

Socio-Economic Resources Issues

- Effects of construction and operation of the hydroelectric units on socio-economic resources.

Tribal Resources Issues

- Effects of construction of the hydroelectric units on tribal resources.

5.2 Potential Studies or Information Gathering

This section identifies potential studies or information gathering that may be needed to analyze the preliminary resource issues identified in Section 5.1.

Geology and Soils Issues

- No study is proposed.
- The NYCDEP is compiling geotechnical data and may conduct geotechnical explorations based on the assessment of the data collected. In addition, the NYCDEP will develop an erosion and sedimentation control plan for construction activities.
- The NYCDEP may conduct geotechnical exploration based on the assessment of the data collected.

Water Resources Issues

- No water quality study is proposed as there is considerable water quality information already available for each development site and associated river basin.
- The NYCDEP will develop an erosion and sedimentation control plan to minimize turbidity in the reservoirs and downstream rivers for construction activities.

Fish and Aquatic Resources Issues

- No habitat based studies are proposed below Cannonsville, Downsville and Neversink Dam as the USGS has already quantified flow versus habitat relationships.
- Habitat versus flow relationships are needed for the Schoharie Creek between the Gilboa Dam and the backwater from the New York Power Authority's lower reservoir for the Blenheim-Gilboa pump storage project.
- The NYCDEP will develop an erosion and sedimentation control plan to minimize turbidity in the reservoirs and downstream rivers for construction activities.

Wildlife and Botanical Resources Issues

- The NYCDEP will conduct an inventory of wildlife and botanical resources at each development site and assess the impact on such resources due to construction activities.

Wetlands, Riparian, and Littoral Habitat Issues

- The NYCDEP will assess the impacts on wetlands, riparian and littoral resources at each development site due to construction activities.

Rare, Threatened and Endangered Species Issues

- The NYCDEP will conduct an inventory of rare, threatened and endangered species resources at each development site and assess the impacts on such resources due to construction activities.

Recreation and Land Use Issues

- The NYCDEP will assess construction-related impacts on recreation and land uses in the development sites.

Aesthetic Resources Issues

- Aesthetic studies may be proposed, depending on how water is conveyed from the reservoirs to the powerhouses. Specifically, if siphons are used to convey water to any powerhouse, an aesthetic study will be undertaken.

Cultural Resources Issues

- Phase IA Literature Reviews and Archaeological Assessments are proposed at the Cannonsville Dam, Downsville Dam, and Neversink Dam. The geographic scope for the Phase 1A Assessments will be focused on those areas impacted by construction activities.

Socio-Economic Resources Issues

- A socio-economic study is proposed to evaluate the economic and other benefits, if any, of the four developments, as well as any socio-economic impacts associated with the construction and operation of the hydroelectric units.

Tribal Resources Issues

- Tribal resource studies will be undertaken within the areas impacted by construction activities.

5.3 Relevant Comprehensive Waterway Plans

Section 10(a)(2)(A) of the Federal Power Act ("FPA"), 16 USC § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with Federal or state comprehensive plans for improving, developing, or conserving a waterway affected by the project.

Order No. 481-A, issued on April 27, 1988, established that the Commission will accord FPA § 10(a)(2)(A) comprehensive plan status to any Federal or state plan that:

- Is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
- Specifies the standards, the data, and the methodology used; and
- Is filed with the Secretary of the Commission.

Based on the Commission's April 2008 revised list of comprehensive plans for the State of New York, three of the 20 plans pertain to the project area:

- New York State Department of Environmental Conservation. 1985. New York State Wild, Scenic, and Recreational River System Act. Albany, New York. March 1985.
- New York State Department of Environmental Conservation. 1986. Regulation for administration and management of the wild, scenic, and recreational rivers system in New York State excepting the Adirondack Park. Albany, New York. March 26, 1986.
- Soil Conservation Service. 1977. Watershed plan and environmental impact statement - Deposit watershed in Broome, Chenango, and Delaware Counties, New York. Department of Agriculture, Syracuse, New York. September 1977.

In addition to comprehensive plans listed in New York, the comprehensive plan in Delaware that is applicable to this project is listed below.

- Delaware River Basin Commission. 1967. Delaware River Basin compact. Trenton, New Jersey. January 1967. 51 pp.

5.4 Relevant Resource Management Plans

The following resource management plans were identified:

Adirondack Park Agency. 1985. Adirondack Park state land master plan. Ray Brook, New York. January 1985.

Adirondack Park Agency. Undated. New York State wild, scenic, and recreational rivers system field investigation summaries. Albany, New York. 21 reports.

Atlantic States Marine Fisheries Commission. 1992. Fishery management plan for inshore stocks of winter flounder. (Report No. 21). May 1992.

Atlantic States Marine Fisheries Commission. 1995. Interstate fishery management plan for Atlantic striped bass. (Report No. 24). March 1995.

Atlantic States Marine Fisheries Commission. 1996. Interstate fishery management plan for weakfish. (Report No. 27). May 1996.

Atlantic States Marine Fisheries Commission. 1998. Amendment 1 to the Interstate Fishery Management Plan for Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*). (Report No. 31). July 1998.

Atlantic States Marine Fisheries Commission. 1998. Interstate fishery management plan for Atlantic striped bass. (Report No. 34). January 1998.

Atlantic States Marine Fisheries Commission. 1999. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. (Report No. 35). April 1999.

Atlantic States Marine Fisheries Commission. 2000. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. February 9, 2000.

Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for American eel (*Anguilla rostrata*). (Report No. 36). April 2000.

National Marine Fisheries Service. 1998. Final Recovery Plan for the shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. December 1998.

National Park Service. 1982. The nationwide rivers inventory. Department of the Interior, Washington, D.C. January 1982.

New York State Department of Environmental Conservation. 1985. New York State Wild, Scenic, and Recreational River System Act. Albany, New York. March 1985.

New York State Department of Environmental Conservation. 1986. Regulation for administration and management of the wild, scenic, and recreational rivers system in New York State excepting the Adirondack Park. Albany, New York. March 26, 1986.

New York State Executive Law. 1981. Article 27 - Adirondack Park Agency Act. Albany, New York. July 15, 1981.

New York State Office of Parks, Recreation, and Historic Preservation. 2003. New York Statewide Comprehensive Outdoor Recreation Plan, 2003-2007. Albany, New York. January 2003.

Soil Conservation Service. 1977. Watershed plan and environmental impact statement - Deposit watershed in Broome, Chenango, and Delaware Counties, New York. Department of Agriculture, Syracuse, New York. September 1977.

U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.

U.S. Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

Appendix A – Summary of Contacts

The following letter and attachments were sent to the contacts listed (after the letter) in an effort to develop a comprehensive PAD. Response letters are also included.

The City of New York

DEPARTMENT OF ENVIRONMENTAL PROTECTION

59-17 Junction Boulevard
Flushing, New York 11373

Steven W. Lawitts
Acting Commissioner

May 19, 2009

Re: West of Hudson Hydroelectric Project, FERC No. 13287

Dear Sir/Madam:

The New York City Department of Environmental Protection (NYCDEP) filed a preliminary permit application with the Federal Energy Regulatory Commission (FERC) on September 15, 2008 to develop the West of Hudson Hydroelectric Project. On March 20, 2009, the FERC issued a preliminary permit to the NYCDEP. The preliminary permit provides the City three years in which to study the West of Hudson Hydroelectric Project.

The West of Hudson Hydroelectric Project consists of four developments at existing dams and reservoirs that comprise integral components of the City of New York's water supply system. The dams and reservoirs are owned by the City of New York and operated by the NYCDEP. The four developments are listed in Table 1.

Table 1: Proposed Hydropower Developments, West of Hudson Hydroelectric Project

Development Name	Dam Name	River	Drainage Area at Dam (sq mi)	Station Hydraulic Capacity (cfs)	Proposed Installation Capacity (kW)
Cannonsville	Cannonsville	West Branch Delaware River	454 mi^2	1,130	12,100
Neversink	Neversink	Neversink River (tributary to Delaware)	92.6 mi^2	160	1,650
Pepacton	Downsville	East Branch Delaware River	372 mi^2	270	3,100
Schoharie	Gilboa	Schoharie Creek	316 mi^2	1,050	12,900

The location of each development is shown on the map attached to this letter.

As part of the licensing process, the NYCDEP is developing a Pre-Application Document (PAD), which summarizes the available background information on the project. The information in the PAD is presented under the following topic areas:

1. Description of the Project Location, Facilities, and Operations
2. Description of Existing Environment and Resource Impacts
   - Geology & Soils
   - Water Quantity & Quality Resources

- Wetlands, Riparian, Littoral Habitat
- Rare, Threatened, & Endangered Species
- Recreation & Land Use
- Aesthetic Resources
- Cultural Resources
- Socio-Economic Resources
- Tribal Resources
- General Description of Basin

3. Preliminary List of Issues and Studies
4. Summary of Contacts

Because the four developments have been managed and operated by the NYCDEP for water supply needs for decades, the NYCDEP already has a significant amount of background information on the facilities. However, **we need your help.** We would appreciate receiving any information your organization may have collected on the environmental, recreational, and/or historical/archeological resources at these four developments. Listed below are specific areas addressed in the PAD. If you have data that is relevant to these focus points we would appreciate you forwarding that information to us:

- Fisheries - any stocking records, regulation and management plans, population surveys, creel surveys, target fish community, diadromous fish information (if applicable), etc.
- Water Quality - any water quality data collected within the project area including temperature and dissolved oxygen studies in the reservoirs and below the dams.
- Wetlands - any known wetlands that occur within the project area (*e.g.*, impoundment down to the project tailrace);
- Any historical, archeological or cultural resources in the project area;
- Any rare, threatened or endangered species in the project area;
- Any recreational information in the project area; and
- Any other relevant information.

We would be most appreciative if you could provide us with any pertinent additional information by June 12, 2009. If needed, we can visit your office to retrieve and copy any pertinent information. Please let us know if a visit to your office works best for you so we can coordinate accordingly.

We appreciate your assistance in providing background information so we can prepare our Pre-Application Document.

Sincerely,

Anthony J. Fiore
Director of Planning & Sustainability

cc: Mark Wamser, Gomez and Sullivan
Kevin Lang, Couch-White

Attachments: Figure 1, Contact List

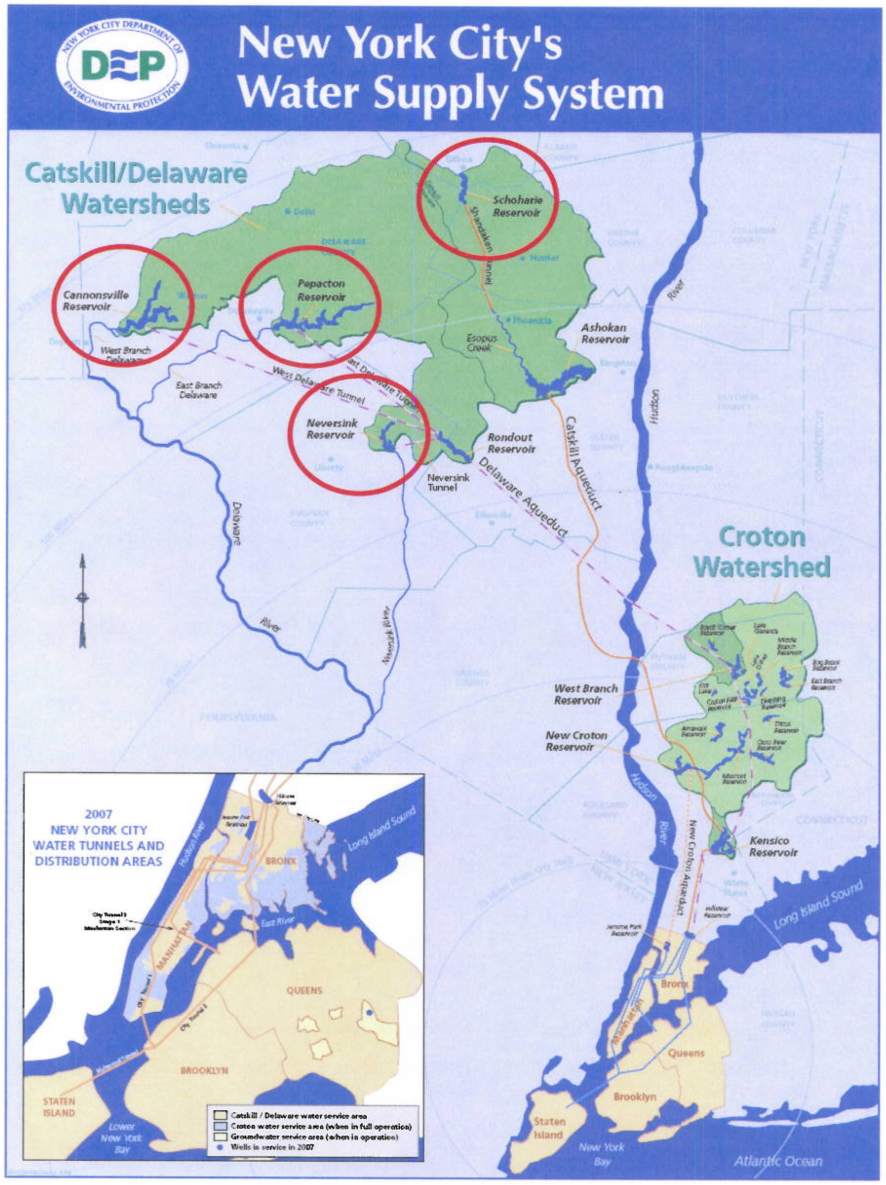


Figure 1: Location of West of Hudson Proposed Hydroelectric Projects

Federal Agencies

Atlantic States Marine Fisheries Comm.
1444 Eye Street, NW - 6th Floor
Washington, DC 20005

Julie Crocker
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930-2298

NOAA Fisheries Northeast Regional Office
55 Great Republic Drive
Gloucester, MA 01930-2298

NOAA's National Marine Fisheries Service
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543-1026

Kevin Mendik
National Park Service
15 State Street
Boston, MA 02109

Cynthia Wilkerson
National Park Service
Northeast Region-US Custom House
US Custom House
200 Chestnut Street, 5th Floor
Philadelphia, PA 19106-2816

Dennis Reidenbach
Regional Director
National Park Service, Northeast Region
U.S. Custom House
200 Chestnut St., Fifth Floor
Philadelphia, PA 19106

Steve Patch
US Fish and Wildlife Service
3817 Luker Road
Cortland, NY 13045

David Stillwell
US Fish and Wildlife Service
3817 Luker Road
Cortland, NY 13045

Grace Musumeci
Environmental Protection Agency
290 Broadway, Fl 25
New York, NY 10007-1823

Myron Elkins
Bureau of Land Management
7450 Boston Boulevard
Springfield, VA 22153-3121

U.S. Army Corps of Engineers
Jacob K. Javits Federal Building
26 Federal Plaza, Room 2109
New York, NY 10278-0090

Environmental Protection Agency
Regional Office
290 Broadway
New York, NY 10007-1866
Federal Emergency Management Agency
Regional Office
26 Federal Plaza
Suite 1337
New York, NY 10278

Native American

Mohawk National Council of Chiefs
398 State Route 37
Hogansburg, NY 13655

A. Francis Boots
St. Regis Mohawk Tribe
82 Indian Village Road
Akwesasne, NY 13655

Mr. Loran Thompson
St. Regis Mohawk Tribe
412 State Route 37
Akwesasne, NY 13655

Arnold L. Printup, THPO
St. Regis Mohawk Tribe
412 State Route 37
Akwesasne, NY 13655

Sherry White
Cultural Resources Coordinator
Stockbridge-Munsee Community
PO Box 70
N8510 Moh-He-Con-Nuck Rd.
Bowler, WI 54416

Mr. Robert Chicks
President
Stockbridge-Munsee Community
PO Box 70
N8510 Moh-He-Con-Nuck Rd.
Bowler, WI 54416

Mr. Raymond Halbritter

Oneida Indian Nation of New York
5218 Patrick Road
Verona, NY 13478

Ray Halbritter
Nation Representative
Oneida Indian Nation
5218 Patrick Road
Verona, NY 13498

Irving Powless
Chief
Onondaga Indian Nation
RR#1, Box 319 B
Nedrow, New York 13120

Mr. Brian Patterson
Oneida Indian Nation
PO Box 1
Route 5
Vernon, NY 13476

Jesse Bergevin
Historic Resources Specialist
Oneida Indian Nation
Member Legal Services
PO Box 1, Route 5
Vernon, NY 13476

Ms. Kathleen Mitchell, THPO
Seneca Nation Tribal Historic Preservation
467 Center Street
Salamanca, NY 14779

Seneca Nation of New York
Cattaraugus Reservation
William Seneca Building
12837 Route 438
Irving, NY 14081

Mr. Barry E. Snyder
Seneca Nation of Indians
1490 Route 438
Irving, NY 14081

Mr. Clint HalfTown
Cayuga Nation of New York
PO Box 11
Versailles, NY 14168-0011

Emerson Webster
Tonawanda Band of Senecas
7027 Meadville Road
Basom, NY 14013

Mr. Kevin Jonathan
Tonawanda Band of Senecas
7027 Meadville Road
Bason, NY 14013

Mr. Kenneth Poodry
Tonawanda Band of Senecas
7027 Meadville Road
Bason, NY 14013

Leo R. Henry
Tuscaraora Nation
2006 Mt. Hope Road
Lewiston, NY 14092

Tuscarora Nation
5616 Walmore Road
Lewiston, New York 14092

Mr. Irving Powless, Jr.
Onondaga Indian Nation
RR1, Box 319-B
Nedrow, NY 13120

Anthony Gonyea
Onondaga Nation Historic Preservation Office
716 East Washington Street, Suite 104
Syracuse, NY 13210-1502

Bureau of Indian Affairs
1849 C Street, NW
Washington, DC 20240

James Kardatzke
Bureau of Indian Affairs
Eastern Regional Office
711 Stewarts Ferry Pike
Nashville, TN 37214

State Agencies

NYSDEC-DFWMR
NY Natural Heritage Program
625 Broadway, 5th Floor
Albany, NY 12233-4757

Mark S. Woythal
NYS DEC
625 Broadway
Albany, NY 12233

William C. Janeway, Regional Director
NYS Department of Environmental
Conservation Region 3
21 South Putt Corners Road
New Paltz, NY 12561

Eugene Kelly, Regional Director
NYS Department of Environmental Conservation
Region 4
1130 North Westcott Road
Schenectady, NY 12306-2014

Ms. Kathleen LaFrank
New York State Historic Preservation Office
Peebles Island
PO Box 189
Waterford, New York 12188-0189

Mr. Travis Bowman
New York State Historic Preservation Office
Peebles Island
PO Box 189
Waterford, New York 12188-0189

New York State Office of Parks, Recreation, and Historic Preservation
Agency Building 1, Empire State Plaza
Albany, New York 12238

William Nechamen
NYS Department of Environmental Conservation
Chief, Flood Plain Management
625 Broadway
Albany, NY 12233-3507
Phone: (518) 402-8146

Mark Klotz, P.E.
NYS Department of Environmental Conservation
Chief, Water Quantity Section
625 Broadway
Albany, NY 12233-3504
Phone: (518) 402-8098

Philip Bein, Watershed Inspector General
NYS Office of the Attorney General
The Capitol
Albany, NY 12233

Other:

Delaware River Basin Commission
25 State Police Drive
P.O. Box 7360
West Trenton, NJ 08628-0360

Stephen F. Blanchard
Delaware River Master
US Geological Survey
National Center, MA-415
Reston, VA 20192

Gary N. Paulachok, P.G.
Deputy Delaware River Master
US Geological Survey
Milford Professional Park
10 Buist Road, Suite 304
Milford, PA 18337

Roger Sokol, Ph.D.
Bureau of Water Supply Protection
NYS Department of Health
Flanigan Square, 547 River Street
Troy, NY 12180-2216

Atlantic States Marine Fisheries Commission

1444 Eye Street, N.W., Sixth Floor
Washington, D.C. 20005
(202) 289-6400
(202) 289-6051 (fax)
www.asmfc.org

George D. Lapointe (ME), Chair
Robert H. Boyles, Jr. (SC), Vice-Chair

John V. O'Shea
Executive Director

Working towards healthy, self-sustaining populations for all Atlantic coast fish species, or successful restoration well in progress, by the year 2015

May 29, 2009

Anthony J. Fiore
Director of Planning and Sustainability
The New York City Department of Environmental Protection
59-17 Junction Boulevard
Flushing, New York 11373

Dear Mr. Fiore,

This responds to your letter of 19 May 2009 requesting information to support the development of a Pre-Application Document (PAD) for the West of Hudson Hydroelectric Project (FERC No. 13287). The Atlantic States Marine Fisheries Commission (Commission) has developed a number of documents containing data relevant to the compilation of the PAD.

The documents include fishery management plans, stock assessments, and habitat source documents for the diadromous species managed by the Commission. A list of the relevant documents and the links to the Commission's website is attached.

We are sending copies of your letter and this response to the marine fishery management agencies in New York, New Jersey, Pennsylvania, and Delaware as they may hold additional background information.

Thank you for the opportunity to provide information to support the development of the PAD.

Sincerely,

John V. O'Shea

Cc: Jim Gilmore, New York DEC
Tom McCloy, New Jersey DEP
Leroy Young, Pennsylvania FBC
Roy Miller, Delaware DNREC

CONNECTICUT, DELAWARE, FLORIDA, GEORGIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, RHODE ISLAND, SOUTH CAROLINA, VIRGINIA

Atlantic State Marine Fisheries Commission documents relevant to the Pre-Application Document for the West of Hudson Hydroelectric Project.

Fishery Management Plans

Amendment 1 to the Interstate Fishery Management Plan for Shad and River Herring (1999)
http://www.asmfc.org/speciesDocuments/shad/fmps/shadam1.pdf

Addendum I to Amendment 1 and Technical Addendum #1 to the Interstate Fishery Management Plan for Shad and River Herring (2002)
http://www.asmfc.org/speciesDocuments/shad/fmps/addendumI.pdf

Interstate Fishery Management Plan for American Eel (1999)
http://www.asmfc.org/speciesDocuments/eel/fmps/eelFMP.pdf

Addendum I to the Interstate Fishery Management Plan for American Eel (2006)
http://www.asmfc.org/speciesDocuments/eel/fmps/addendumI.pdf

Addendum II to the Interstate Fishery Management Plan for American Eel (2008)
http://www.asmfc.org/speciesDocuments/eel/fmps/addendum%20II_AmericanEel_FINAL.pdf

Fishery Management Plan for Atlantic Sturgeon (1990)
http://www.asmfc.org/speciesDocuments/sturgeon/fmps/fmps/sturgeonFMP.pdf

Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon (1998)
http://www.asmfc.org/speciesDocuments/sturgeon/fmps/fmps/sturgeonAmendment1.pdf

Amendment 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass (2003)
http://www.asmfc.org/speciesDocuments/stripedBass/fmps/sbAmendment6.pdf

Stock Assessments

American Shad Terms of Reference and Advisory Report (2007)
http://www.asmfc.org/speciesDocuments/shad/stockassmtreports/2007ShadTOR&AdvisoryReport.pdf

American Shad Stock Assessment Report for Peer Review: Volume 1- Stock Assessment Overview (2007)
http://www.asmfc.org/speciesDocuments/shad/stockassmtreports/2007ShadStockAssmtReportVolumeI.pdf

American Shad Stock Assessment Report for Peer Review: Volume 2 – State Specific Assessments for Maine to Delaware River and Bay (2007)
http://www.asmfc.org/speciesDocuments/shad/stockassmtreports/2007ShadStockAssmtReportVolumeII.pdf

American Shad Stock Assessment Report for Peer Review: Volume 3 – State Specific Assessments for Maryland to Florida (2007)
http://www.asmfc.org/speciesDocuments/shad/stockassmtreports/2007ShadStockAssmtReportVolumeIII.pdf

Terms of Reference and Advisory Report for the American Shad and Atlantic Sturgeon Stock Assessment Peer Review (1998)
http://www.asmfc.org/speciesDocuments/sturgeon/stockassmtreports/shadandsturgeonadvisoryreport.pdf

Atlantic Sturgeon Stock Assessment Peer Review (1998)
http://www.asmfc.org/speciesDocuments/sturgeon/stockassmtreports/sturgeonPeerReview.pdf

Terms of Reference and Advisory Report to the American Eel Stock Assessment Peer Review (2006)
http://www.asmfc.org/speciesDocuments/eel/annualreports/stockAssmts/eelAdvisoryReport06.pdf

Atlantic Striped Bass Assessment Summary Report (2008)
http://www.asmfc.org/speciesDocuments/stripedBass/reports/stockassmts/07SummaryReport.pdf

Atlantic Striped Bass Assessment Report (2008)
http://www.asmfc.org/speciesDocuments/stripedBass/reports/stockassmts/07AssessmentReport.pdf

Atlantic Striped Bass Assessment Report Appendices (2008)
http://www.asmfc.org/speciesDocuments/stripedBass/reports/stockassmts/07AssessmentReportAppendices.pdf

Habitat/Fish Passage Documents

Atlantic Coast Diadromous Fish Habitat: A Review of Utilization, Threats, Recommendations for Conservation, and Research Needs (2009)
http://www.asmfc.org/diadromousSpeciesDocument.htm

ASMFC Workshop on Fish Passage Issues Impacting Atlantic Coast States (2008)
Workshop Proceedings:
http://www.asmfc.org/researchStatistics/habitat/fishPassage/fishpassageWorkshopProceedings.pdf
Workshop Presentations:
http://www.asmfc.org/researchStatistics/habitat/fishPassage/fishpassageWorkshopPresentations.pdf

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

MAY 26 2009

Anthony J. Fiore
The City of New York
Department of
Environmental Protection
59-17 Junction Boulevard
Flushing, New York 11373

Re: West of Hudson Hydroelectric Project, FERC No. 13287

Dear Mr. Fiore,

This is in response to your letter dated May 19, 2009 regarding the New York City Department of Environmental Protection's West of Hudson Hydroelectric Project. On March 20, 2009, the Federal Energy Regulatory Commission (FERC) issued a preliminary permit to the NYCDEP, which provided the City three years to study the West of Hudson Hydroelectric Project. The Project consists of four developments at existing dams and reservoirs that comprise integral components of the City of New York's water supply system. The waterways associated with these dams and reservoirs are the Delaware River, and its associated tributaries, and the Schoharie Creek.

While a population of the federally endangered shortnose sturgeon (*Acipenser brevirostrum*) is recognized to exist in the Hudson River, no shortnose sturgeon occur within the proposed project site. No other federally listed or proposed threatened or endangered species and/or designated critical habitat for listed species under the jurisdiction of the NOAA's National Marine Fisheries Service (NMFS) are known to exist in the Delaware River or Schharie Creek. Therefore, no further coordination with NMFS is required. Should project plans change or new information become available that changes the basis for this determination, further coordination should be pursued. If you have any questions about these comments, please contact Danielle Palmer at (978)282-8468.

Sincerely,

Mary A. Colligan
Assistant Regional Administrator
for Protected Resources

File Code: Sec 7 no species present 2009

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New York Field Office
3817 Luker Road
Cortland, NY 13045
Phone: (607) 753-9334 Fax: (607) 753-9699
http://www.fws.gov/northeast/nyfo

Project Number: 90042

To: Anthony Fiore

Date: Jun 3, 2009

Regarding: West of Hudson Hydro, Catskill / Delaware Watersheds and Croton Watershed

Town/County: Delaware, Greene, Sullivan, and Ulster Counties

We have received your request for information regarding occurrences of Federally-listed threatened and endangered species within the vicinity of the above-referenced project/property. Due to increasing workload and reduction of staff, we are no longer able to reply to endangered species list requests in a timely manner. In an effort to streamline project reviews, we are shifting the majority of species list requests to our website at http://www.fws.gov/northeast/nyfo/es/section7.htm. Please go to our website and print the appropriate portions of our county list of endangered, threatened, proposed, and candidate species, and the official list request response. Step-by-step instructions are found on our website.

As a reminder, Section 9 of the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) prohibits unauthorized taking* of listed species and applies to Federal and non-Federal activities. Additionally, endangered species and their habitats are protected by Section 7(a)(2) of the ESA, which requires Federal agencies, in consultation with the U.S. Fish and Wildlife Service (Service), to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. An assessment of the potential direct, indirect, and cumulative impacts is required for all Federal actions that may affect listed species. For projects not authorized, funded, or carried out by a Federal agency, consultation with the Service pursuant to Section 7(a)(2) of the ESA is not required. However, no person is authorized to "take"* any listed species without appropriate authorizations from the Service. Therefore, we provide technical assistance to individuals and agencies to assist with project planning to avoid the potential for "take," or when appropriate, to provide assistance with their application for an incidental take permit pursuant to Section 10(a)(1)(B) of the ESA.

Project construction or implementation should not commence until all requirements of the ESA have been fulfilled. If you have any questions or require further assistance regarding threatened or endangered species, please contact the Endangered Species Program at (607) 753-9334. Please refer to the above document control number in any future correspondence.

Endangered Species Biologist: Robyn A. Niver

*Under the Act and regulations, it is illegal for any person subject to the jurisdiction of the United States to ***take*** (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import or export, ship in interstate or foreign commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any endangered fish or wildlife species and most threatened fish and wildlife species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. "Harm" includes any act which actually kills or injures fish or wildlife, and case law has clarified that such acts may include significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife.

New York State Office of Parks, Recreation and Historic Preservation
Historic Preservation Field Services Bureau • Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

David A. Paterson
Governor

Carol Ash
Commissioner

June 9, 2009

Anthony J. Fiore
Director of Planning & Sustainability
New York City
Dept. of Environmental Protection
59-17 Junction Blvd.
Flushing, NY 11373

Re: FERC,CORPS PERMITS, DEC, SEQRA
West of Hudson Hydroelectric Projects
4 NYC DEP Dam Sites/FERC No. 13287
Colchester & Deposit Delaware Co., Gilboa,
Schoharie Co., Neversink, Sullivan Co.
09PR03088

Dear Mr. Fiore:

Our office is in receipt of a request by your agency for general information regarding the presence or absence of historic/cultural resources in the vicinity of your project area.

Since March 2005 the general information that you have requested can be found at the On-Line Resources portion of our web site (see attached information sheet).

Based on the generic project information submitted, the noted web site should provide your agency with a general assessment of historic/cultural resources associated with your project area. Once a more refined Area of Potential Effect is established for the undertaking and site specific information regarding new construction and ground disturbing activities can be submitted we will be better able to provide more comprehensive information and comments on the potential impacts that your undertaking may have on historic/cultural resources.

Please be aware that if your project requires state or federal permits this office will be reviewing the undertaking with those agencies under Section 14.09 (NYSPRHPL) or Section 106 of the National historic Preservation Act.

If I can be of any further assistance do not hesitate to contact me at (518) 237-8643, ext. 3263.

Sincerely,

John A. Bonafide
Historic Preservation Services
Coordinator

Attachments

NOTICE OF RETURN OF MATERIALS SUBMITTED TO THE NEW YORK STATE HISTORIC PRESERVATION OFFICE

In an effort to better serve the public and other agencies, the New York State Historic Preservation Office (SHPO) is introducing its **On Line Resource Center**. This tool is part of our new web site. Simply go to **http://nysparks.state.ny.us** and select **Historic Preservation**. Once at the SHPO web site select **On Line Resources** from the menu. Here users will discover links to three new web based programs:

Geographic Information System (GIS)
A map based program that allows the user to select a community and view the boundaries of properties listed in the State and National Registers of Historic Places in New York State. The site also allows the user the ability to see a graphic depiction of areas that may be archeologically sensitive. These two components will provide most users with a comprehensive initial overview of the cultural resources of a specific location within the state.

National Register Document Imaging Program
This program contains the images of New York's more than 4,400 State and National Registers of Historic Places documents. An easy search program allows the user to select listed resources by community, type, style, materials, or historic use.

SPHINX (**S**tate **P**reservation **H**istoric **I**nventory **N**etwork E**x**change)
This system provides access to the State Historic Preservation Office's program-wide database for bureau records. This database includes information on more than 250,000 addresses in the state.

We are requesting that you utilize these applications to determine the ***general*** presence or absence of cultural resources in your community or project area **prior** to submitting a request for this data to our office. It is expected that these on-line tools should eliminate your need to submit information queries where only the State Environmental Quality Review Act (SEQRA) is involved. Consultation with the SHPO is mandatory when there is any state or federal involvement in a project.

If you should have questions regarding these new programs please do not hesitate to contact John Bonafide at (518) 237-8643, ext. 3263

Thank you for your assistance in helping us to streamline our process and to better meet your needs.

ATTENTION

Please find attached a REVISED *Project Review Cover Form*. This new version replaces the one currently in circulation. Please include this form with ALL submissions to this office. This form is also available in our Environmental Review Section under Forms.

http://nysparks.state.ny.us

Follow link to **HISTORIC PRESERVATION** then select **On-Line Resources**

Rev. 5-05

New York State Office of Parks, Recreation and Historic Preservation
Historic Preservation Field Services Bureau
Peebles Island Resource Center, PO Box 189, Waterford, NY 12188-0189 (Mail)
Delaware Avenue, Cohoes 12047 (Delivery) (518) 237-8643

PROJECT REVIEW COVER FORM

Rev. 1-07

*Please complete this form and attach it to the top of **any and all information submitted to this office** for review.*
Accurate and complete forms will assist this office in the timely processing and response to your request.

This information relates to a previously submitted project. ☐ If you have checked this box and noted the previous Project Review (PR) number assigned by this office you do not need to continue unless any of the required information below has changed.

PROJECT NUMBER 09PR03088

COUNTY ____________

2. This is a new project. ☐ If you have checked this box you will need to complete ALL of the following information.

Project Name ____________

Location ____________
You MUST include street number, street name and/or County, State or Interstate route number if applicable

City/Town/Village ____________
List the correct municipality in which your project is being undertaken. If in a hamlet you must also provide the name of the town.

County ____________
If your undertaking* covers multiple communities/counties please attach a list defining all municipalities/counties included.

TYPE OF REVIEW REQUIRED/REQUESTED (Please answer both questions)

A. Does this action involve a permit approval or funding, now or ultimately from any other governmental agency?

☐ No ☐ Yes

If Yes, list agency name(s) and permit(s)/approval(s)

Agency involved	Type of permit/approval	State	Federal
		☐	☐
		☐	☐
		☐	☐

B. Have you consulted the NYSHPO web site at **http://nysparks.state.ny.us to determine the preliminary presence or absence of previously identified cultural resources within or adjacent to the project area? If yes: ☐ Yes ☐ No

Was the project site wholly or partially included within an identified archeologically sensitive area? ☐ Yes ☐ No

Does the project site involve or is it substantially contiguous to a property listed or recommended for listing in the NY State or National Registers of Historic Places? ☐ Yes ☐ No

CONTACT PERSON FOR PROJECT

Name ____________ **Title** ____________

Firm/Agency ____________

Address ____________ **City** ____________ **STATE** ______ **Zip** ______

Phone (____) ______ **Fax** (____) ______ **E-Mail** ____________

http://nysparks.state.ny.us then select **HISTORIC PRESERVATION then select **On Line Resources**

The Historic Preservation Review Process in New York State

In order to insure that historic preservation is carefully considered in publicly-funded or permitted undertakings*, there are laws at each level of government that require projects to be reviewed for their potential impact/effect on historic properties. At the federal level, Section 106 of the National Historic Preservation Act of 1966 (NHPA) directs the review of federally funded, licensed or permitted projects. At the state level, Section 14.09 of the New York State Parks, Recreation and Historic Preservation Law of 1980 performs a comparable function. Local environmental review for municipalities is carried out under the State Environmental Quality Review Act (SEQRA) of 1978.

regulations on line at:
http://nysparks.state.ny.us then select **HISTORIC PRESERVATION** then select **Environmental Review**

Project review is conducted in two stages. First, the Field Services Bureau assesses affected properties to determine whether or not they are listed or eligible for listing in the New York State or National Registers of Historic Places. If so, it is deemed "historic" and worthy of protection and the second stage of review is undertaken. The project is reviewed to evaluate its impact on the properties significant materials and character. Where adverse effects are identified, alternatives are explored to avoid, or reduce project impacts; where this is unsuccessful, mitigation measures are developed and formal agreement documents are prepared stipulating these measures.

ALL PROJECTS SUBMITTED FOR REVIEW SHOULD INCLUDE THE FOLLOWING MATERIAL(S).

☐ **Project Description**

Attach a full description of the nature and extent of the work to be undertaken as part of this project. Relevant portions of the project applications or environmental statements may be submitted.

☐ **Maps Locating Project**

Include a map locating the project in the community. The map must clearly show street and road names surrounding the project area as well as the location of all portions of the project. Appropriate maps include tax maps, Sanborn Insurance maps, and/or USGS quadrangle maps.

☐ **Photographs**

Photographs may be black and white prints, color prints, or color laser/photo copies; standard (black and white) photocopies are NOT acceptable.

-*If the project involves rehabilitation*, include photographs of the building(s) involved. Label each exterior view to a site map and label all interior views.

-*If the project involves new construction*, include photographs of the surrounding area looking out from the project site. Include photographs of any buildings (more than 50 years old) that are located on the project property or on adjoining property.

NOTE: Projects submissions will not be accepted via facsimile or e-mail.

***Undertaking** is defined as an agency's purchase, lease or sale of a property, assistance through grants, loans or guarantees, issuing of licenses, permits or approvals, and work performed pursuant to delegation or mandate.

ONEIDA INDIAN NATION

JESSE J. BERGEVIN
HISTORIC RESOURCES SPECIALIST

DIRECT DIAL: (315) 829-8463
FACSIMILE: (315) 829-8473
E-MAIL: jbergevin@oneida-nation.org

ONEIDA NATION HOMELANDS

June 10, 2009

Anthony J. Fiore
Director of Planning & Sustainability
The City of New York
Department of Environmental Protection
59-17 Junction Boulevard
Flushing, New York 11373

Re: West of Hudson Hydroelectric Project, FERC No. 13287

Dear Mr. Fiore,

Thank you for notifying the Oneida Indian Nation of the New York City Department of Environmental Protection's plans to develop a Federal Energy Regulatory Commission Pre-Application Document concerning the West of Hudson Hydroelectric Project. Our concerns would be with the portions of this project that are tied into the Cannonsville Reservoir and any downstream impacts along the West Branch and East Branch of the Delaware River as these areas fall within the Oneida aboriginal territory. At this time we are not able to point to any specific cultural concerns as the area of potential effect of this proposed project is not fully know.

The Oneida Indian Nation requests to be apprised of this project as further studies help to identify the full area of potential effect of this project. As the area of potential effect is better delineated we would be better able to identify specific historic and cultural concerns. Please notify us in the event of the inadvertent discovery of human remains or if Native cultural materials are encountered during any later phases of the projects.

Very truly yours,

ONEIDA INDIAN NATION

Jesse J. Bergevin
Historic Resources Specialist

1256 Union Street PO Box 662 • Oneida, New York 13421-0662

Stockbridge-Munsee Tribal Historic Preservation Office

Sherry White - Tribal Historic Preservation Officer
W13447 Camp 14 Road
P.O. Box 70
Bowler, WI 54416

July 8, 2009

Anthony J. Fiore
Director of Planning & Sustainability
59-17 Junction Boulevard
Flushing, NY 11373

RE: West of Hudson Hydroelectric Project, FERC No. 13287

Dear Mr. Fiore:

Thank you for contacting the Stockbridge-Munsee Tribe regarding the above referenced project. The Tribe is committed to protecting archaeological sites that are important to tribal heritage, culture and religion. Furthermore, the tribe is particularly concerned with archaeological sites that may contain human burial remains and associated funerary objects.

As described in your correspondence, the proposed ground disturbing activity of this project does not appear to endanger archaeological sites of interest to the Stockbridge-Munsee Tribe, therefore, the tribe will defer to your State Archaeologist and your state's Office of Historical Preservation regarding the need for archaeological surveys of further investigation. Should either of these agencies recommend an archaeological survey of the proposed construction site, we ask that the Stockbridge-Munsee Tribe be informed of the results of the survey should they uncover any Native American artifacts, including copies of site forms and reports. Also, any changes to the above referenced project should be resubmitted to the Historic Preservation Office.

Should this project inadvertently uncover an archaeological site, even after an archaeological survey, we request that you immediately contact the appropriate state agencies, as well as the Stockbridge-Munsee Tribe. Also, we ask that you halt all construction and ground disturbing activities until the Tribe and these state agencies are consulted.

We appreciate your cooperation in notifying the Historic Preservation Office. Should you have any questions, feel free to contact me.

Sincerely,

Sherry White /gj

Sherry White,
Tribal Historic Preservation Officer

(715) 793-3970 Email: sherry.white@mohican-nsn.gov

Appendix B – Pre-Application Document Content Cross Reference Table

PAD Content Requirement	18 CFR § 5.6(d)	PAD Section
Process plan and schedule	(1)	2.0
Project location, facilities and operations	(2)	3.0
Description of existing environmental and resource impacts	(3)	4.0
General requirements	(3)(i)	4.0
River Basin Description	(3)(xiii)	4.1
Geology and soils	(3)(ii)	4.2
Water resources	(3)(iii)	4.3
Fish and aquatic resources	(3)(iv)	4.4
Wildlife and botanical resources	(3)(v)	4.5
Wetlands, riparian and littoral habitat	(3)(vi)	4.6
Rare, threatened, and endangered species	(3)(vii)	4.7
Recreation and Land Use	(3)(viii)	4.8
Aesthetic resources	(3)(ix)	4.9
Cultural resources	(3)(x)	4.10
Socio-economic resources	(3)(xi)	4.11
Tribal resources	(3)(xii)	4.12
Preliminary issues and studies	(4)	5.0
Summary of contacts	(5)	Appendix A

Appendix C – Agents for City of New York

Pursuant to 18 CFR § 5.6(d)(2)(i), the exact name and business address, and telephone number of each person authorized to act as agent for the applicant are as follows:

Anthony J. Fiore
Director of Planning & Sustainability
New York City Department of Environmental Protection
59-17 Junction Boulevard, 19th Floor
Flushing, NY 11373-5108
(718) 595.6576

Paul V. Rush, P.E.
Deputy Commissioner, Bureau of Water Supply
New York City Department of Environmental Protection
7870 Route 42
P.O. Box 358
Grahamsville, NY 12740
(845) 340-7800

Robert Loughney, Esq.
Kevin Lang, Esq.
Couch White, LLP
540 Broadway
P.O. Box 22222
Albany, NY 12201
(518) 426-4600

Thomas Sullivan, P.E.
Principal
Gomez and Sullivan Engineers, P.C.
55 North Stark Highway
Weare, NH 03281
(603) 529-4400

Appendix D – Pictures of the West of Hudson Hydroelectric Project

<u>Schoharie Reservoir, Gilboa Dam</u>

Water passing over spillway

Aerial View of Dam and Spillway

Cannonsville Reservoir and Dam

Looking at Overflow Spillway

Looking at Spillway and Reservoir Drawn Down

Pepacton Reservoir, Downsville Dam

Looking at Reservoir and Spillway

Water passing over spillway

Neversink Reservoir and Dam

Looking at entrance to discharge tunnel

Looking at spillway

Appendix E – Distribution List of NOI and PAD

Federal Agencies

Atlantic States Marine Fisheries Comm.
1444 Eye Street, NW, 6th Floor
Washington, DC 20005

Ms. Julie Crocker
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930-2298

NOAA Fisheries Northeast Regional Office
55 Great Republic Drive
Gloucester, MA 01930-2298

NOAA National Marine Fisheries Service
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543-1026

Mr. Andrew L. Raddant
Regional Environmental Officer
United States Department of the Interior
Office of Environmental Policy and Compliance
408 Atlantic Avenue – Room 142
Boston, MA 02210-3334

Mr. Duncan Hay
National Park Service
15 State Street
Boston, MA 02109

Mr. Kevin Mendik
National Park Service
15 State Street
Boston, MA 02109

Mr. Dennis Reidenbach
Regional Director
National Park Service, Northeast Region
U.S. Custom House
200 Chestnut Street, 5th Floor
Philadelphia, PA 19106

Ms. Cynthia Wilkerson
National Park Service, Northeast Region
US Custom House
200 Chesnut Street, 5th Floor
Philadelphia, PA 19106

Robyn Niver
U.S. Fish and Wildlife Service
New York Field Office
3817 Luker Road
Cortland, NY 13045

Mr. Steve Patch
US Fish and Wildlife Service
3817 Luker Road
Cortland, NY 13045

Mr. David Stillwell
US Fish and Wildlife Service
3817 Luker Road
Cortland, NY 13045

Ms. Grace Musumeci
Environmental Protection Agency
290 Broadway, 25th Floor
New York, NY 10007-1823

Environmental Protection Agency
Regional Office
290 Broadway
New York, NY 10007-1866

Mr. Myron Elkins
Bureau of Land Management
7450 Boston Boulevard
Springfield, VA 22153-3121

US Army Corp of Engineers
Jacob K. Javits Federal Building
26 Federal Plaza, Room 2109
New York, NY 10278-0090

Federal Emergency Management Agency
Regional Office
26 Federal Plaza
Suite 1337
New York, NY 10278

Bureau of Indian Affairs
1849 C Street, NW
Washington, DC 20240

Mr. James Kardatzke
Bureau of Indian Affairs
Eastern Regional Office
711 Stewarts Ferry Pike
Nashville, TN 37214

Native American

Cayuga Indian Nation
Vernon Isaac, Chief
P.O. Box 11
Versailles, NY 14168-0011

Oneida Indian Nation
Mr. Raymond Halbritter
5218 Patrick Road
Verona, NY 13478

Mr. Brian Patterson
P.O. Box 1
Route 5
Vernon, NY 13476

Mr. Jesse Bergevin
Historic Resources Specialist
1256 Union Street
P.O. Box 662
Oneida, NY 13421-0662

Onondaga Nation
Leon Shenandoah, Sr., Head Chief
RR 1, Box 270A
Nedrow, NY 13120

Mr. Anthony Gonyea
Onondaga Nation Historic Preservation Office
716 East Washington Street
Suite 104
Syracuse, NY 13210-1502

St. Regis Band of Mohawk Indians
Norman Tarbell, Chief
Akwesasne Community Building
Route 37
Hogansburg, NY 13655

Mr. Arnold L. Printup
Tribal Historic Preservation Officer
412 State Route 37
Akwesasne, NY 13655

Seneca Nation of Indians
Dennis Bowen, Sr., President
P.O. Box 231
Salamanca, NY 14779

Ms. Kathleen Mitchell
Tribal Historic Preservation Officer
467 Center Street
Salamanca, NY 14779

Stockbridge-Munsee Band of Mohican Indians
Robert Chicks, President
Stockbridge-Munsee Community
N8476 Moh-He-Con-Nuck Road
PO Box 70
Bowler, WI 54416

Ms. Sherry White
Tribal Historic Preservation Officer
W13447 Camp 14 Road
P.O. Box 70
Bowler, WI 54416

Tonawanda Band of Senecas
Bernie Parker, Chief
7027 Meadville Road
Basom, NY 14013

Tuscarora Nation
Arnold Hewitt, Chief
5616 Walmore Road
Lewiston, NY 14092

State Agencies

NYSDEC-DFWMR
NY Natural Heritage Program
625 Broadway, 5th Floor
Albany, NY 12233-4757

Mr. Chris Hogan
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233

Mark Klotz, P.E.
Chief, Water Quantity Section
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233-3508

Mr. William Nechamen
Chief, Flood Plain Management
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233-3507

Mr. Peter Nye
Endangered Species Unit
NYSDEC
625 Broadway
Albany, NY 12233

David Sampson, Esq.
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233

Mr. Charles Vandrei
625 Broadway
NYS Department of Environmental Conservation
Albany, NY 12233

Mr. Mark S. Woythal
NYS Department of Environmental Conservation
625 Broadway
Albany, NY 12233

William Janeway, Regional Director
NYS Department of Environmental Conservation
Region 3
21 South Putts Corners Road
New Paltz, NY 12561

Robert Angyal
NYS Department of Environmental Conservation
Region 3
21 South Putts Corners Road
New Paltz, NY 12561

Eugene Kelly, Regional Director
NYS Department of Environmental Conservation
Region 4
1130 North Westcott Road
Schenectady, NY 12306-2014

Mr. Norm McBride
NYS Department of Environmental Conservation
Region 4
65561 State Highway 10
Stamford, NY 12167

Mr. Travis Bowman
New York State Historic Preservation Office
Peebles Island
PO Box 189
Waterford, New York 12188-0189

Ms. Kathleen LaFrank
New York State Historic Preservation Office
Peebles Island
PO Box 189
Waterford, New York 12188-0189

New York State Office of Parks, Recreation, and Historic Preservation
Agency Building 1
Empire State Plaza
Albany, New York 12238
Philip Bein, Esq.
Watershed Inspector General
NYS Office of the Attorney General
The Capital
Albany, NY 12233

Roger Sokol, Ph.D.
Bureau of Water Supply Protection
NYS Department of Heath
Flanigan Square
547 River Street
Troy, NY 12180-2216

Other:

Delaware River Basin Commission
25 State Police Drive
P.O. Box 7360
West Trenton, NJ 08628-0360

Mr. Stephen F. Blanchard
Delaware River Master
US Geological Survey
National Center, MA-415
Reston, VA 20192

Gary N. Paulachok, P.G.
Deputy Delaware River Master
US Geological Survey
Milford Professional Park
10 Buist Road, Suite 304
Milford, PA 18337

Counties

Delaware County
Hon. James E. Eisel, Sr.
Chairman, Board of Supervisors
111 Main Street
Delhi, NY 13753

Schoharie County
Hon. Earl Van Wormer III
Chairman, Board of Supervisors
County Office Building
284 Main Street
Schoharie, NY 12157

Sullivan County
Hon. David P. Fanslau
County Manager
100 North Street
PO Box 5012
Monticello, NY 12701

Greene County
Hon. Daniel Frank
County Administrator
411 Main Street
PO Box 467
Catskill, NY 12414

Towns

Town of Fallsburg
Hon. Steven Levine
Town Supervisor
19 Railroad Plaza South
Fallsburg, NY 12779

Town of Liberty
Hon. John E. Schmidt
Town Supervisor
120 North Main Street
Liberty, NY 12754

Town of Rochester
Hon. Carl Chipman
Town Supervisor
50 Scenic Road
PO Box 65
Accord, NY 12404

Town of Thompson
Hon. Anthony P. Cellini
Town Supervisor
4052 Route 42
Monticello, NY 12701

Town of Walton
Hon. John W. Meredith
Town Supervisor
129 North Street
Walton, NY 13856-1217

Town of Wawarsing
Hon. Edward Jennings
Town Supervisor
108 Canal Street
PO Box 671
Ellenville, NY 12428

Town of Andes
Hon. Martin A. Donnelly
Town Supervisor
580 Main Street
Andes, NY 13731

Town of Deposit
Hon. Stanley E. Woodford
Town Supervisor
3 Elm Street
Deposit, NY 13754

Town of Conesville
Hon. Donald Brandow
Town Supervisor
1306 State Route 990V
Gilboa, NY 12076

Town of Middletown
Hon. Leonard Utter
Town Supervisor
42339 State Hwy 28
PO Box 577
Margaretville, NY 12455

Town of Gilboa
Hon. Anthony Van Glad
Town Supervisor
373 State Route 990V
Gilboa, NY 12076

Town of Colchester
Hon. Robert A. Homovich
Town Supervisor
72 Tannery Road
PO Box 321
Downsville, NY 13755

Town of Neversink
Hon. Greg J. Goldstein
Town Supervisor
273 Main Street
PO Box 307
Grahamsville, NY 12740

Town of Prattsville
Hon. Kory O’Hara
Town Supervisor
14517 Main Street
Prattsville, NY 12468

Town of Roxbury
Hon. Thomas S. Hynes
Town Supervisor
53690 State Hwy 30
PO Box 189
Roxbury, NY 12474

Town of Tompkins
Hon. William Layton
Town Supervisor
148 Bridge Street
PO Box 139
Trout Creek, NY 13847

Town of Ashland
Hon. Richard E. Tompkins
Town Supervisor
Route 23
PO Box 14
Ashland, NY 12407

Town of Bethel
Hon. Daniel Sturm
Town Supervisor
3454 Route 55
PO Box 300
White Lake, NY 12786

Town of Blenheim
Hon. Robert H. Mann, Jr.
Town Supervisor
2123 State Route 30
North Blenheim, NY 12131

Town of Bovina
Hon. Tina B. Mole
Town Supervisor
Bovina Center, NY 13740

Town of Broome
Hon. Marie Campbell
Town Supervisor
PO Box 969
Middleburgh, NY 12122

Town of Delhi
Hon. Peter J. Bracci
Town Supervisor
5 Elm Street
Delhi, NY 13753

Town of Denning
Hon. Bill Bruning
Town Supervisor
PO Box 277
Claryville, NY 12725

Town of Franklin
Hon. Donald M. Smith
Town Supervisor
12480 County Highway 21
Franklin, NY 13775

Town of Hamden
Hon. Wayne Marshfield
Town Supervisor
6754 Basin Clove Road
Hamden, NY 13782

Town of Hardenburgh
Hon. Jerry Fairbairn
Town Supervisor
51 Rider Hollow Road
Arkville, NY 12406

Town of Harpersfield
Hon. James E. Eisel
Town Supervisor
25399 State Highway 23
Harpersfield, NY 13786

Town of Jefferson
Hon. Richard Kuhn
Town Supervisor
162 Allen Road
Jefferson, NY 12093

Town of Masonville
Hon. Craig Dumond
Town Supervisor
Route 206
Masonville, NY 13804

Town of Rensselaerville
Hon. Jost Nickelsburg
Town Supervisor
87 Barger Road
Rensselaerville, NY 12120

Town of Rockland
Hon. Stanley J. Martin
Town Supervisor
95 Main Street
PO Box 964
Livingston Manor, NY 12758

Town of Shandaken
Hon. Peter DiSclafani
Town Supervisor
PO Box 134
Allaben, NY 12480

Town of Sidney
Hon. Joseph A. Maddelone
Town Supervisor
Civic Center
21 Liberty Street
Sidney, NY 13838

Town of Stamford
Hon. Michael Triolo
Town Supervisor
188 Main Street
PO Box M
Hobart, NY 13788

Town of Windham
Hon. Thomas P. Meehan, Jr.
Town Supervisor
PO Box 96
Hensonville, NY 12439

<u>Non Government Organizations</u>

Neversink River Program/The Nature Conservancy
P.O. Box 617
Cuddebackville, NY 12729

The Nature Conservancy
195 New Karner Rd, Suite 200
Albany, NY 12205

Upper Delaware Chapter Trout Unlimited
PO Box 100
Long Eddy, NY 12760

New York Council Trout Unlimited
PO Box 815
146 Bayard Street
Port Ewen, NY 12466

The Catskill Watershed Corporation
PO Box 569, Main Street
Margaretville, NY 12455

New York State Electric & Gas Corporation
P.O. Box 5224
18 Link Drive
Kirkwood Industrial Park
Binghamton, NY 13902-5224

<u>Intervenors</u>

Jeff Genzer, Esq
Joshua Adrian, Esq
Duncan, Weinberg, Genzer & Pembroke, P.C.
1615 M Street, NW Suite 80
Washington, DC 20036

Mr. Gregory J Starheim
CEO & General Manager
Delaware County Electric Cooperative, Inc
PO Box 471
Delhi, NY 13753-0471

Mr. James Besha
President
Albany Engineering Corporation
5 Washington Sq
Albany, NY 12205-5512

Mr. John Osinski
Executive Director
New York Power Authority
30 South Pearl Street
10th floor
Albany, NY 12207

Mark Malone, Esq.
Principal Attorney I
New York Power Authority
123 Main St
White Plains, NY 10601

John Zimmerman, Esq.
Zimmerman & Associates
13508 Maidstone Lane
Potomac, MD 20854

Ms. Elaine Reichart
Aquatic Conservation Unlimited, LLC
284 CR 519
Belvidere, NJ 07823

Mr. Dan Plummer
Friends of the Upper Delaware River, Inc.
1645 Bump Road
East Branch, NY 13756

Ms. Diane Tharp
North Delaware River Watershed
Conservancy, Ltd.
RR21 Box 6117
East Stroudsberg, PA 18301

Appendix F – Discharge Versus Habitat Area Statistics for Study Sites in the Upper Delaware River

Table F-1. Habitat versus discharge relations for segment 0 West Branch Delaware River (WB0).

Discharge		Brown trout adult		Brown trout juveniles		Shallow-fast guild		Shallow-slow guild[1]	
$Q(ft^3/s)$	$Q(ft^3/s/mi^2)$	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km
9	0.02	1.09	2,786	2.23	5,720	0.09	218	3.48	8,913
14	0.03	1.26	3,242	2.75	7,047	0.27	686	3.65	9,364
21	0.05	1.49	3,826	3.27	8,395	0.59	1,505	3.74	9,587
32	0.07	2.10	5,375	4.17	10,686	1.10	2,830	4.05	9,983
53	0.11	3.04	7,790	5.38	13,785	2.44	6,264	4.48	10,379
81	0.17	4.08	10,460	7.20	18,451	3.96	10,159	4.70	11,486
124	0.27	5.11	13,091	10.78	27,647	6.14	15,734	4.76	12,059
191	0.41	7.70	19,751	15.16	38,871	7.88	20,202	3.96	12,196
297	0.64	11.72	30,041	19.13	49,048	8.92	22,870	3.10	10,160
462	0.99	18.83	48,283	19.91	51,040	4.90	12,557	2.40	7,946
717	1.54	23.11	59,255	16.40	42,046	1.90	4,877	1.68	6,158
1,112	2.39	23.06	59,119	10.81	27,710	1.56	4,011	1.37	4,304
1,730	3.72	18.57	47,611	5.56	14,263	1.15	2,937	1.29	3,523
2,683	5.77	12.07	30,938	3.67	9,418	0.65	1,675	1.09	3,302
4,165	8.96	6.90	17,688	2.60	6,666	0.26	659	0.00	2,792

[1]Constrained by 5-m shoreline buffer.

Table F-2. Habitat versus discharge relations for segment 1 West Branch Delaware River (WB1).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild[1]	
$Q(ft^3/s)$	$Q(ft^3/s/mi^2)$	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km
46	0.08	40.39	17,410	61.24	26,399	0.01	6	26.07	11,235
64	0.11	45.72	19,706	69.05	29,765	9.10	3,923	29.11	12,547
88	0.15	52.29	22,537	79.88	34,429	14.65	6,316	30.01	12,934
125	0.21	61.75	26,618	90.57	39,041	20.66	8,904	29.79	12,842
177	0.30	73.47	31,670	103.67	44,685	27.31	11,772	29.22	12,594
247	0.42	89.91	38,756	116.92	50,398	30.97	13,349	28.38	12,233
353	0.59	110.98	47,835	128.78	55,511	28.88	12,447	26.10	11,251
494	0.83	132.19	56,978	133.01	57,331	22.80	9,827	23.14	9,973
706	1.19	153.12	66,000	123.96	53,433	15.10	6,507	18.11	7,805
953	1.60	170.43	73,459	96.25	41,488	6.14	2,648	13.52	5,827
1,341	2.25	174.09	75,040	66.27	28,563	1.98	853	10.44	4,499
1,906	3.20	153.29	66,075	42.51	18,322	1.30	558	9.90	4,265
2,683	4.51	123.01	53,024	30.01	12,933	1.95	841	9.53	4,107
3,777	6.35	88.13	37,986	26.44	11,395	2.76	1,189	9.90	4,266
5,330	8.96	71.82	30,959	26.02	11,216	3.12	1,346	6.43	2,773

[1]Constrained by 5-m shoreline buffer.

Table F-3. Habitat versus discharge relations for segment 0 East Branch Delaware River (EB0).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild[1]	
Q(ft^3/s)	Q(ft^3/s/mi^2)	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km
7	0.02	11.10	9,096	9.85	8,071	0.08	63	11.56	9,477
11	0.03	11.83	9,700	11.05	9,053	0.25	208	11.60	9,511
18	0.05	13.12	10,755	13.05	10,699	0.71	585	11.64	9,542
25	0.07	14.28	11,703	14.48	11,866	1.12	917	11.82	9,687
39	0.10	16.70	13,691	17.79	14,586	1.95	1,597	11.85	9,716
56	0.15	18.95	15,531	21.73	17,808	2.81	2,305	11.86	9,720
88	0.24	22.13	18,142	25.90	21,229	3.85	3,154	10.74	8,805
131	0.35	28.66	23,493	28.90	23,685	4.33	3,553	10.58	8,675
201	0.54	36.48	29,898	32.42	26,570	2.32	1,905	8.38	6,867
304	0.82	42.53	34,862	32.89	26,961	1.06	867	6.90	5,657
462	1.24	46.70	38,278	29.82	24,443	0.68	558	5.67	4,645
702	1.89	49.55	40,617	20.82	17,067	0.73	599	5.48	4,493
1,070	2.88	50.66	41,526	14.06	11,523	1.39	1,141	5.84	4,790
1,627	4.37	49.06	40,216	15.14	12,414	1.61	1,323	6.43	5,274
2,471	6.64	50.97	41,778	19.11	15,665	1.73	1,421	5.52	4,524

[1]Constrained by 5-m shoreline buffer.

Table F-4. Habitat versus discharge relations for segment 1 East Branch Delaware River (EB1).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-fast guild[1]	
Q(ft^3/s)	Q(ft^3/s/mi^2)	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km
38	0.08	7.17	24,615	30.53	20,221	2.31	1,527	11.70	7,748
53	0.12	40.00	26,490	33.33	22,074	3.54	2,347	11.67	7,727
74	0.16	43.15	28,575	35.95	23,807	4.76	3,152	11.39	7,543
103	0.22	46.76	30,967	38.10	25,231	5.39	3,569	10.96	7,257
143	0.31	51.89	34,362	39.62	26,237	4.74	3,137	10.60	7,017
199	0.43	56.43	37,372	40.50	26,819	3.63	2,402	10.18	6,741
277	0.60	61.14	40,492	39.41	26,098	2.06	1,361	9.40	6,223
385	0.84	63.68	42,175	37.77	25,016	1.36	898	8.56	5,667
537	1.17	66.44	44,003	34.46	22,821	0.77	513	8.22	5,443
746	1.63	65.89	43,638	29.10	19,274	0.78	514	8.03	5,317
1,039	2.27	67.22	44,517	24.36	16,133	1.28	847	7.90	5,230
1,446	3.16	67.03	44,391	21.32	14,117	2.32	1,537	7.40	4,901
2,012	4.39	63.75	42,220	20.17	13,355	2.81	1,864	7.06	4,678
2,802	6.12	58.49	38,736	23.87	15,811	3.29	2,179	6.96	4,611
3,901	8.52	58.17	38,524	33.36	22,090	8.88	5,883	7.03	4,658

[1]Constrained by 5-m shoreline buffer.

Table F-5. Habitat versus discharge relations for segment 2 East Branch Delaware River (EB2).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild[1]	
$Q(ft^3/s)$	$Q(ft^3/s/mi^2)$	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km
100	0.13	77.55	30,292	77.74	30,366	13.73	5,364	21.81	8,519
150	0.19	85.28	33,313	82.97	32,411	17.04	6,657	21.63	8,447
200	0.25	91.92	35,908	85.31	33,325	18.15	7,089	21.04	8,218
300	0.38	104.82	40,947	85.69	33,473	17.36	6,782	18.90	7,382
450	0.57	118.20	46,170	83.68	32,687	15.69	6,130	16.87	6,589
700	0.89	131.09	51,206	76.43	29,855	11.82	4,616	14.09	5,502
1,000	1.28	139.34	54,430	65.34	25,524	7.02	2,744	11.35	4,435
1,399	1.78	140.32	54,812	51.67	20,185	3.41	1,331	10.35	4,045
1,539	1.96	143.28	55,967	49.72	19,424	2.27	887	10.35	4,042
2,099	2.68	127.04	49,623	35.34	13,804	1.07	418	8.78	3,428
3,199	4.08	100.25	39,159	23.74	9,274	0.86	336	8.06	3,149
4,598	5.87	65.68	25,656	20.27	7,919	0.76	298	8.63	3,369
6,697	8.54	49.51	19,338	21.72	8,484	0.49	193	9.70	3,787
9,896	12.62	48.71	19,028	28.87	11,279	0.25	98	10.47	4,090
21,191	27.03	73.87	28,855	42.89	16,753	0.12	48	12.15	4,748

[1]Constrained by 5-m shoreline buffer.

Table F-6. Habitat versus discharge relations for segment 2 East Branch Delaware River (EB2) – Continued.

Discharge		American shad juvenile		American shad spawning	
$Q(ft^3/s)$	$Q(ft^3/s/mi^2)$	Ha	m^2/km	Ha	m^2/km
100	0.13	84.58	33,038	9.31	3,636
150	0.19	91.86	35,884	19.69	7,690
200	0.25	97.95	38,263	30.36	11,858
300	0.38	105.93	41,377	60.60	23,673
450	0.57	110.72	43,250	83.21	32,503
700	0.89	110.25	43,067	96.55	37,716
1,000	1.28	98.42	38,445	97.06	37,914
1,399	1.78	75.53	29,506	84.93	33,176
1,539	1.96	77.25	30,175	85.74	33,490
2,099	2.68	50.26	19,632	56.64	22,123
3,199	4.08	36.37	14,206	32.79	12,808
4,598	5.87	29.65	11,582	22.32	8,719
6,697	8.54	27.54	10,759	21.06	8,226
9,896	12.62	31.17	12,176	22.99	8,982
21,191	27.03	51.77	20,224	38.07	14,870

Table F-7. Habitat versus discharge relations for segment 1 Delaware River main stem (DEL1).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild[1]	
Q(ft^3/s)	Q(ft^3/s/mi^2)	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km
344	0.22	107.70	72,285	88.74	59,555	5.70	3,828	18.09	12,142
426	0.27	118.24	79,355	97.15	65,201	7.38	4,955	16.74	11,234
568	0.36	130.34	87,475	104.20	69,931	9.64	6,472	14.91	10,004
746	0.47	146.05	98,019	107.20	71,944	7.73	5,187	14.21	9,540
959	0.60	160.33	107,607	107.41	72,085	4.25	2,855	13.62	9,141
1,243	0.78	171.07	114,810	102.51	68,800	2.07	1,388	13.04	8,752
1,598	1.00	179.58	120,526	93.54	62,780	0.75	506	11.12	7,464
2,095	1.32	185.92	124,779	79.78	53,544	1.10	737	9.65	6,476
2,698	1.70	190.73	128,004	60.87	40,851	1.50	1,007	8.12	5,449
3,515	2.21	194.99	130,866	45.84	30,768	1.52	1,021	7.70	5,167
4,544	2.86	197.91	132,824	38.27	25,686	1.69	1,136	7.46	5,007
5,893	3.71	189.00	126,843	40.36	27,084	1.23	828	7.60	5,103
7,597	4.78	177.78	119,318	48.36	32,457	0.80	536	7.35	4,933
9,869	6.21	176.79	118,653	56.94	38,216	2.52	1,690	5.94	3,989
12,780	8.04	176.06	118,163	64.34	43,182	0.27	181	3.50	2,349

[1]Constrained by 5-m shoreline buffer.

Table F-8. Habitat versus discharge relations for segment 1 Delaware River main stem (DEL1) – Continued.

Discharge		American shad juvenile		American shad spawning	
Q(ft^3/s)	Q(ft^3/s/mi^2)	Ha	m^2/km	Ha	m^2/km
344	0.22	109.52	73,505	31.53	1,163
426	0.27	119.34	80,092	43.29	29,056
568	0.36	130.70	87,718	64.02	42,969
746	0.47	140.62	94,373	89.16	59,837
959	0.60	144.41	96,918	109.30	73,355
1,243	0.78	143.68	96,427	123.69	83,010
1,598	1.00	135.79	91,137	132.97	89,244
2,095	1.32	124.12	83,304	137.40	92,215
2,698	1.70	110.12	73,909	133.57	89,641
3,515	2.21	90.82	60,953	113.43	76,125
4,544	2.86	78.96	52,992	91.08	61,126
5,893	3.71	70.55	47,348	76.91	51,618
7,597	4.78	67.45	45,268	68.70	46,106
9,869	6.21	73.77	49,508	72.20	48,460
12,780	8.04	82.60	55,435	84.22	56,521

Table F-9. Habitat versus discharge relations for segment 2 Delaware River main stem (DEL2).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild[1]	
$Q(ft^3/s)$	$Q(ft^3/s/mi^2)$	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m2/km
466	0.28	95.35	55,758	58.95	34,476	100.23	6,898	12.46	6,441
597	0.36	99.94	58,445	57.13	33,410	108.08	6,765	12.23	9,405
762	0.46	104.11	60,884	54.55	31,900	117.15	6,185	11.95	11,885
974	0.58	107.93	63,118	50.78	29,697	125.80	5,745	11.42	13,104
1,243	0.74	110.74	64,761	48.12	28,143	134.33	5,509	10.75	13,836
1,585	0.95	114.57	67,000	44.99	26,308	144.52	4,165	10.38	14,460
2,023	1.21	117.90	68,950	40.17	23,490	155.00	2,133	9.57	14,660
2,577	1.54	116.63	68,207	34.56	20,208	161.68	1,589	9.79	13,404
3,297	1.98	114.98	67,241	29.26	17,110	168.35	1,466	8.86	10,232
4,208	2.52	107.75	63,009	25.82	15,101	175.28	1,288	8.67	7,459
5,373	3.22	90.36	52,839	22.66	13,252	181.96	1,062	8.85	5,640
6,855	4.11	72.83	42,589	21.13	12,359	189.35	1,091	8.90	4,645
8,751	5.25	62.12	36,328	20.63	12,067	199.07	1,485	8.96	4,016
11,172	6.70	62.93	36,799	21.13	12,356	210.90	2,181	8.70	4,497
14,261	8.55	57.39	33,559	17.67	10,332	222.47	2,381	7.40	4,116

[1]Constrained by 5-m shoreline buffer.

Table F-10. Habitat versus discharge relations for segment 2 Delaware River main stem (DEL2)

Discharge		American shad juvenile		American shad spawning	
$Q(ft^3/s)$	$Q(ft^3/s/mi^2)$	Ha	m^2/km	Ha	m^2/km
466	0.28	77.03	47,917	11.80	19,969
597	0.36	75.98	49,255	11.57	29,156
762	0.46	74.28	49,822	10.58	36,845
974	0.58	71.82	49,080	9.82	40,624
1,243	0.74	68.20	47,903	9.42	42,892
1,585	0.95	64.58	47,155	7.12	44,826
2,023	1.21	56.52	43,229	3.65	45,446
2,577	1.54	49.79	35,338	2.72	41,552
3,297	1.98	43.02	29,567	2.51	31,721
4,208	2.52	36.30	25,347	2.20	23,122
5,373	3.22	31.36	22,408	1.82	17,484
6,855	4.11	28.14	20,771	1.87	14,401
8,751	5.25	28.33	20,429	2.54	12,449
11,172	6.70	28.67	21,547	3.73	13,939
14,261	8.55	23.75	17,409	4.07	12,760

Table F-11. Habitat versus discharge relations for segment 3 Delaware River main stem (DEL3).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild[1]	
Q (ft^3/s)	Q($ft^3/s/mi^2$)	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m2/km
505	0.28	90.42	89,632	83.19	78,648	0.25	9,616	17.87	13,671
650	0.36	102.83	101,955	82.78	82,072	9.00	8,919	13.85	11,834
833	0.46	113.78	112,806	86.01	85,280	9.24	9,164	13.57	11,595
1,059	0.58	123.76	122,705	88.18	87,425	8.71	8,640	13.21	11,289
1,377	0.76	133.47	132,326	87.64	86,890	7.56	7,499	12.24	10,460
1,779	0.98	143.03	141,805	81.59	80,888	5.76	5,707	10.57	9,035
2,291	1.26	148.64	147,369	70.45	69,846	2.84	2,812	8.76	7,484
2,951	1.62	149.26	147,980	56.07	55,590	1.27	1,255	7.71	6,592
3,798	2.09	145.95	144,705	38.16	37,837	1.16	1,154	6.85	5,858
4,889	2.69	136.23	135,066	24.66	24,445	1.17	1,162	6.37	5,441
6,294	3.46	113.46	112,489	17.66	17,511	0.97	961	6.05	5,171
8,105	4.45	91.62	90,842	15.90	15,767	1.08	1,067	6.13	5,242
10,435	5.73	67.99	67,408	16.26	16,118	1.52	1,504	6.54	5,586
13,435	7.38	54.46	53,994	16.64	16,493	1.68	1,664	6.57	5,612
17,297	9.50	44.30	43,922	16.87	16,725	2.22	2,201	6.58	5,624

[1]Constrained by 5-m shoreline buffer.

Table F-12. Habitat versus discharge relations for segment 3 Delaware River main stem (DEL3)

Discharge		American shad juvenile		American shad spawning	
Q(ft^3/s)	Q($ft^3/s/mi^2$)	Ha	m^2/km	Ha	m^2/km
505	0.28	114.55	91,086	97.72	42593
650	0.36	78.13	98,197	99.04	54535
833	0.46	74.04	103,348	104.24	69793
1,059	0.58	68.30	106,551	107.47	86566
1,377	0.76	59.22	107,856	108.79	98783
1,779	0.98	43.01	100,496	101.36	107196
2,291	1.26	32.63	88,923	89.69	105451
2,951	1.62	27.03	76,806	77.47	94660
3,798	2.09	23.01	62,344	62.88	78693
4,889	2.69	18.81	46,805	47.21	58188
6,294	3.46	16.80	35,255	35.56	37469
8,105	4.45	17.69	33,698	33.99	30722
10,435	5.73	19.93	31,471	31.74	27913
13,435	7.38	17.22	25,411	25.63	23804
17,297	9.50	13.71	20,891	21.07	19517

Table F-13. Habitat versus discharge relations for segment 0 Neversink River (NVR0).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild[1]	
$Q(ft^3/s)$	$Q(ft^3/s/mi^2)$	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km	Ha	m^2/km
14	0.12	13.01	10,084	15.11	11,709	13.01	711	9.43	7,311
18	0.16	13.42	10,400	15.58	12,080	13.42	1,060	9.72	7,534
25	0.22	14.17	10,985	16.75	12,987	14.17	1,708	9.68	7,505
32	0.28	14.87	11,531	18.43	14,284	14.88	2,298	9.62	7,458
42	0.37	15.83	12,270	19.68	15,259	15.84	2,995	9.25	7,168
56	0.50	17.17	13,312	20.70	16,048	17.20	3,896	8.79	6,811
74	0.66	19.34	14,996	22.33	17,312	19.41	4,434	7.98	6,189
99	0.87	22.22	17,225	23.18	17,965	22.34	3,784	6.96	5,393
134	1.19	24.62	19,085	23.73	18,396	24.80	3,482	6.09	4,720
177	1.56	27.26	21,130	22.99	17,824	27.63	2,783	4.93	3,820
233	2.06	29.64	22,974	21.89	16,969	30.74	1,811	4.33	3,356
307	2.72	30.69	23,791	19.89	15,415	33.32	1,235	4.06	3,145
406	3.59	30.11	23,339	17.18	13,320	35.43	969	3.98	3,082
540	4.78	29.71	23,030	13.99	10,846	37.13	1,219	3.95	3,063
713	6.31	29.17	22,614	11.53	8,937	38.88	2,004	4.33	3,356

[1]Constrained by 5-m shoreline buffer

Table F-14. Habitat versus discharge relations for segment 1 Neversink River (NVR1).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild[1]	
$Q(ft^3/s)$	$Q(ft^3/s/mi^2)$	Ha	m^2/km	Ha	m2/km	Ha	m^2/km	Ha	m2/km
28	0.17	24.39	9,380	37.46	14,408	3.35	1,288	17.00	6,538
39	0.23	27.96	10,752	41.44	15,938	4.97	1,911	16.75	6,443
54	0.32	34.36	13,214	46.27	17,798	6.28	2,416	16.39	6,303
76	0.44	40.48	15,571	51.27	19,720	8.35	3,211	15.44	5,938
105	0.62	47.54	18,286	55.78	21,455	8.38	3,224	14.04	5,401
146	0.85	55.93	21,510	59.11	22,733	7.89	3,035	10.91	4,198
203	1.19	64.85	24,943	58.63	22,551	4.58	1,761	8.53	3,282
282	1.65	71.24	27,399	54.83	21,087	1.89	728	6.47	2,489
393	2.30	73.69	28,343	47.31	18,196	0.81	310	5.72	2,202
545	3.19	73.82	28,391	34.03	13,090	0.67	258	5.52	2,125
758	4.43	74.96	28,830	20.85	8,019	0.79	302	6.40	2,463
1,053	6.16	68.65	26,402	14.66	5,639	1.32	506	6.40	2,463
1,463	8.55	65.71	25,275	15.02	5,777	1.03	398	6.64	2,556
2,032	11.88	104.13	40,048	32.93	12,665	0.92	352	6.59	2,536
2,824	16.51	47.30	18,194	17.87	6,872	0.38	146	6.56	2,525

[1]Constrained by 5-m shoreline buffer

Table F-15. Habitat versus discharge relations for segment 2 Neversink River (NVR2).

Discharge		Brown trout adult		Brown trout juvenile		Shallow-fast guild		Shallow-slow guild*	
Q(ft3/s)	Q(ft3/s/mi2)	Ha	m2/km	Ha	m2/km	Ha	m2/km	Ha	m2/km
70	0.23	36.96	15,597	40.63	17,145	8.62	3,637	18.28	7,715
90	0.29	40.42	17,056	43.62	18,405	10.14	4,276	19.02	8,023
117	0.38	44.88	18,938	46.01	19,414	11.19	4,720	17.25	7,277
151	0.49	49.27	20,788	47.59	20,079	12.55	5,293	16.77	7,076
195	0.63	53.59	22,610	46.70	19,704	14.07	5,937	16.17	6,823
252	0.82	59.83	25,246	46.26	19,520	12.36	5,214	15.66	6,609
325	1.06	63.51	26,797	43.83	18,494	11.28	4,761	14.53	6,130
420	1.37	64.81	27,345	40.90	17,255	10.47	4,418	13.62	5,746
543	1.77	63.42	26,758	37.05	15,632	9.92	4,184	12.59	5,311
701	2.28	61.46	25,932	29.70	12,533	10.67	4,503	10.80	4,557
905	2.95	59.83	25,246	25.91	10,932	10.06	4,243	9.56	4,032
1,169	3.81	54.71	23,084	22.72	9,585	6.90	2,909	8.50	3,585
1,511	4.92	46.97	19,817	19.54	8,245	4.09	1,724	7.90	3,335
1,951	6.36	38.52	16,253	17.22	7,264	2.37	1,000	7.44	3,141
2,859	9.31	29.61	12,492	15.25	6,434	3.04	1,282	6.54	2,760

*Constrained by 5-m shoreline buffer.

Table F-16. Habitat versus discharge relations for segment 2 Neversink River (NVR2) – Continued.

Discharge		American shad juvenile		American shad spawning	
Q(ft3/s)	Q(ft3/s/mi2)	Ha	m2/km	Ha	m2/km
70	0.23	47.33	16,503	10.92	3,809
90	0.29	51.06	17,806	14.99	5,228
117	0.38	54.92	19,152	21.20	7,394
151	0.49	57.37	20,006	28.22	9,839
195	0.63	56.31	19,638	33.73	11,761
252	0.82	56.90	19,842	40.90	14,263
325	1.06	55.24	19,262	44.48	15,509
420	1.37	52.47	18,295	48.10	16,773
543	1.77	44.21	15,416	47.18	16,453
701	2.28	39.70	13,844	40.89	14,258
905	2.95	34.32	11,969	37.20	12,971
1,169	3.81	29.06	10,134	31.38	10,942
1,511	4.92	24.89	8,681	22.66	7,902
1,951	6.36	22.85	7,969	17.61	6,142
2,859	9.31	21.30	7,427	13.57	4,733

Appendix G- Literature and Information Sources Cited

Baldigo, B., Riva-Murray, K., and Schuler, G. (2003). *Effects of environmental and spatial features on mussel populations and communities in a North American river.* Walkerana, 14 (31), 1-32.

Bovee, K., Waddle, T., Bartholow, J., and Burris, L. (2007). *A decision support framework for water management in the Upper Delaware River* (Open File Report 2007-1172). Reston, VA: US Geological Survey. Available from: http://www.mesc.usgs.gov/Products/ProdPointer.asp?AltID=46.

Cole, J. C., P. A. Townsend, and K. N. Eshleman. (2008). *Predicting flow and temperature regimes at three Alasmidonta heterodon locations in the Delaware River*. Technical Report NPS/NER/NRTR—2008/109. National Park Service. Philadelphia, PA.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. (1979). *Classification of Wetlands and Deepwater Habitats of the United States.* U.S. Fish and Wildlife Service, FWS/OBS-79/31, Washington, D.C.

Delaware County Soil and Water Conservation District. (2004). *West Branch of the Delaware River draft stream corridor management plan*. New York: New York City Department of Environmental Protection Stream Management Program.

Delaware County Soil and Water Conservation District. (2007). *East Branch of the Delaware River draft stream corridor management plan*. New York: New York City Department of Environmental Protection Stream Management Program.

Federal Energy Regulatory Commission. (2004). *Evaluation of mitigation effectiveness at hydropower projects: Fish passage*. Washington, D.C.: Division of Hydropower Administration and Compliance, Office of Energy Projects.

Greene County Soil and Water Conservation District. (2007). *Schoharie Creek management plan*. New York: New York City Department of Environmental Protection Stream Management Program.

Isachson Y.W., E. Landing, J.M. Lauber, L.V. Rickard and W.B. Rogers (eds.) (1991). *Geology of New York: A simplified account.* Educational Leaflet 28. New York State Museum, Albany, NY.

Maharaj, V., McGurrin, J., and Carpenter, J. (1998). *The economic impact of trout fishing on the Delaware River tailwaters in New York*. Washington, DC.: American Sportsfishing Association & Trout Unlimited.

McBride, N.D. (1995). *Summary of 1993 and 1994 trout population studies on the Upper Delaware tailwater*. Stamford, NY: New York State Department of Environmental Conservation.

McBride, N.D. (1998a). *Schoharie Reservoir fisheries management: Walleye and alewife abundance in 1997 (summary report)*. Stamford, NY: New York State Department of Environmental Conservation.

McBride, N.D. (1998b). *Schoharie Reservoir fisheries management: Summary of 1995 survey*. Stamford, NY: New York State Department of Environmental Conservation.

Keller, W.T. and Fieldhouse, R.D. (1993). *A management plan for the trout fisheries of Upper Schoharie and Gooseberry Creeks*. Stamford, NY: New York State Department of Environmental Conservation.

National Oceanic and Atmospheric Administration. 2008. *Local climate information: Binghamton, NY.* National Weather Service Internet Services Team. Available from: http://www.erh.noaa.gov/bgm/climate/bgm.shtml. Accessed 15 January 2009.

New York City Department of Environmental Protection. (2008). *Wastewater treatment plants in the NYC watersheds (GIS dataset)*. New York: NYCDEP Bureau of Water Supply.

New York City Department of Environmental Protection. (July 2008), *Final Environmental Assessment for the Gilboa Dam Reconstruction*.

New York Natural Heritage Program. (2008a). *Online conservation guide for* Alasmidonta heterodon. Available from: http://www.acris.nynhp.org/guide.php?id=8375. Accessed 4 December 4 2008.

New York Natural Heritage Program. (2008b). *Online Conservation Guide for* Alasmidonta varicosa. Available from: http://www.acris.nynhp.org/guide.php?id=8378. Accessed 4 December 2008.

New York State Department of Environmental Conservation. (1997). *Neversink River unique area unit management plan*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (1999). *Neversink River creel census*. New Paltz, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2001). *West Branch Delaware River biological assessment*. Bureau of Watershed Assessment and Research Stream Biomonitoring Unit.

New York State Department of Environmental Conservation (2003). *Study VIII: New York State freshwater angler creel census project*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2005). *Pepacton/Cannonsville Reservoirs 2007 angler diary summary*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2006). *Neversink River creel census*. New Paltz, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2007a). *Delaware tailwaters 2007 angler diary summary*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2007b). *Pepacton/Cannonsville Reservoirs 2007 angler diary summary*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2007c). *Schoharie Reservoir 2007 angler diary summary*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2007d). *Delaware Tailwaters 2008 angler diary program*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2008a). *Delaware River tailwater monitoring final report.* Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2008b). *Surface water and ground water quality standards and groundwater effluent limitations.* Available from: http://www.dec.ny.gov/regs/4590.html#16133. Accessed 15 December 2008.

New York State Department of Environmental Conservation. (2008c). *Schoharie Reservoir 2008 angler diary program*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2008d). *Lower Schoharie Creek 2008 angler diary program*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Deprtment of Environmental Conservation. (2008e). *Pepacton/Cannonsville Reservoir 2008 angler diary program*. Stamford, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. (2008f). *Catskill Park State Land Master Plan*. Albany, NY: New York State Department of Environmental Conservation.

New York State Department of Labor. (2008). *Quarterly Census of Employment and Wages – 2008 Annual Report*, available at: http://www.labor.state.ny.us/workforceindustrydata/lsqcew.shtm. Note that according to the New York State Department of Labor, the employment statistics for 2008 are, at this time, considered subject to further revision.

Rudstam, L.G. and Brooking, T.E. (2000). *Hydroacoustic survey of Schoharie Reservoir (Summer 1998)*. Ithaca, NY: Cornell University Biological Field Station Warmwater Fisheries Unit.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. (2009) *Official Soil Series Descriptions*. Available URL: "http://soils.usda.gov/technical/classification/osd/index.html" USDA-NRCS, Lincoln, NE. Accessed 10 December 2008.

Stein, W.E., Mannolini, F., VanAller H.L., Landing, E., and Berry, C.M. (2007). Giant cladoxylopsid trees resolve the enigma of the Earth's earliest forest stumps at Gilboa. *Nature*, 446, 904-907.

Strayer, D.L., and Ralley, J. (1991). The freshwater mussels (Bivalvia: Unionidea) of the upper Delaware River drainage. *American Malacological Bulletin*, 9(1), 21-25.

Strayer, D.L., and Jirka, K.J. (1997). *The pearly mussels of New York State*. Albany, NY: The State University of New York.

US Fish and Wildlife Service. (1997). Significant habitats and habitat complexes of the New York Bight watershed. Catskill High Peaks Complex #34. Southern New England-New York Bight Coastal Ecosystems Program.

Williams, C.N. Jr., M.J. Menne, R.S. Vose, and D.R. Easterling. (2005). Historical climate data website. Available from: http://cdiac.esd.ornl.gov/epubs/ndp019/ndp019.html. National Climatic Data Center, National Oceanic and Atmospheric Administration. Accessed 15 January 2009.