

# A Strategy for Removing or Mitigating Dams in New York State and Lessons Learned in the Upper Susquehanna Watershed

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### **DEDICATION**

This report is dedicated to U.S. Fish and Wildlife Service Biologist Dave Bryson, who was the principal investigator for this project through 2006 but unexpectedly passed away during its development. His foresight in promoting fish passage and aquatic ecosystem restoration throughout New York State will be remembered by many. His passion for environmental protection and the art of fishing inspired us all. We will miss him.

## Foreword

This report was prepared under contract for the New York State Department of Environmental Conservation (NYSDEC) through collaboration of members of the Hydrologic and Habitat Modification Workgroup (HHM), which is chaired by the NYSDEC Division of Water's Nonpoint Source Management Section Chief. The guidance is for stream professionals, as well as individuals, agencies, and communities that have interests in evaluating dams to identify opportunities for improving fish passage and restoring river dynamics.

## Acknowledgements

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## **List of Acronyms**

ACHP	Advisory Council on Historic Preservation
ASMFC	Atlantic States Marine Fisheries Commission
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
ECL	Environmental Conservation Law
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FEMRF	Fisheries Enhancement, Management, and Research Fund
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System
HHM	Hydrologic Habitat Modification Workgroup
HREP	Hudson River Estuary Program
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NFWF	National Fish and Wildlife Foundation
NHPA	National Historic Preservation Act
NOAA-F	National Oceanic and Atmospheric Administration-Fisheries
NOAA-ORI	National Oceanic and Atmospheric Administration-Open Rivers Initiative
NPS	Nonpoint Source
NRDAR	Natural Resource Damage Assessment and Restoration
NY/NYS	New York/New York State
NYCRR	New York Codes, Rules, and Regulations
NYGL	New York Great Lakes
NYRU	New York Rivers United
NYSARC	New York State Association of Regional Councils
NYSDEC	New York State Department of Environmental Conservation
NYSEG	New York State Electric and Gas
NYSNPSCC	New York State Nonpoint Source Coordinating Committee
NYSOGS	New York State Office of General Services
SEQRA	State Environmental Quality Review Act
SHPO	State Historic Preservation Office
SWCD	Soil and Water Conservation District
THPO	Tribal Historic Preservation Office
USACE	U.S. Army Corps of Engineers
USDA-NRCS	U.S. Department of Agriculture-Natural Resources Conservation Service
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey

## TABLE OF CONTENTS

Page No.

LIST OF ACRONYMS .....	IV
EXECUTIVE SUMMARY .....	VI
SECTION 1 - PROJECT DEVELOPMENT .....	1
A. Introduction .....	1
B. Project Background .....	1
C. Project Scope.....	2
SECTION 2 - DAM ASSESSMENT TOOLS AND PROFESSIONAL RESOURCES.....	3
A. Project Working Group Considerations .....	3
B. Related Activities in New York State .....	4
C. Dam Mitigation Site Assessment Tools .....	6
D. Strategy for Identifying Candidate Dams for Removal or Mitigation .....	6
Guidance for Using Site Assessment Tool .....	6
Next Steps for Stream Professionals.....	7
Recognizing Ecological Benefits of Dam Mitigation .....	8
The Importance of Building Consensus Through Partnerships .....	8
E. Regulatory Considerations .....	9
Federal Jurisdictions .....	10
State Jurisdictions .....	11
Municipal Permits.....	13
F. Funding Guide.....	14
G. Key References .....	14
SECTION 3 – UPPER SUSQUEHANNA WATERSHED PILOT STUDY .....	16
A. Site Visits and Additional Research on Selected Dams .....	16
B. Objectives for Dam Mitigation in the Upper Susquehanna Watershed .....	18
C. Upper Susquehanna Dams with Greatest Mitigation Potential .....	20
D. Dam Mitigation Recommendations for Upper Susquehanna Watershed.....	25
E. Upper Susquehanna Watershed Pilot Study Dam Mitigation Matrices by County.....	28
Dam Mitigation Matrix: Broome County .....	28
Dam Mitigation Matrix: Chemung County .....	30
Dam Mitigation Matrix: Chenango County.....	31
Dam Mitigation Matrix: Cortland County .....	33
Dam Mitigation Matrix: Delaware County.....	33
Dam Mitigation Matrix: Madison County.....	34
Dam Mitigation Matrix: Tioga County.....	35
LITERATURE CITED .....	36
APPENDICES	
A. Dam Mitigation Site Assessment Tool New York State	
B. NYSDEC HREP Dam Inventory and Characterization Field Sheet	
C. Summary of NYRU Review of Potential Dam Removal and Mitigation Opportunities in New York’s Great Lakes Basin	
D. Dam Mitigation Funding Guide for New York State	
E. Dam Removal/Mitigation References	

## EXECUTIVE SUMMARY

This study was conceived through the collaboration of agency, academic, and non-governmental partners within the New York State Nonpoint Source Coordinating Committee's Hydrologic and Habitat Modification Workgroup (HHM). This project was one of several selected by the HHM using Federal nonpoint source Section 319 funding to improve water quality and ecological conditions of streams and rivers. The HHM supports the development of tools and methods to address the impacts of hydrologic and habitat modifications, such as can be caused by culverts, dams, bridges, riprap, and stream channel modification, affecting the health of streams, rivers, and riparian corridors. This evaluation was performed under a contract with the New York State Department of Environmental Conservation (NYSDEC), with the objectives of: (1) developing tools for identifying dam removal and mitigation opportunities and (2) testing the procedure for evaluating potential candidate dams in a watershed. The upper Susquehanna River watershed was selected for this pilot project.

Section 1 of this report provides background information on the impact of dams, the genesis and scope of this project, including partnerships that have supported the work, and a few noteworthy technical and outreach resources for the stream professional.

Section 2 provides information regarding the tools and resources that stream professionals can use to identify potential projects for dam removal or mitigation and a Strategy for using them. It reviews considerations of the HHM, a group that represents a wide variety of professional disciplines. Related on-going activities in the State are discussed as a source of information on similar projects.

The Strategy in Section 2 identifies practical suggestions for using the dam assessment tool and the companion geographic information system (GIS) compact disk, and recommends future steps once candidate dams are selected. The importance of building project consensus among partnerships is emphasized. Also, information is included on Federal, State, and local regulatory requirements, potential funding sources and contacts for dam mitigation, and references for more study on the effects of barriers on river systems, dam removal, and fish passage.

Section 3 of this document summarizes the U.S. Fish and Wildlife Service (USFWS) pilot evaluation of dams within the upper Susquehanna River watershed to determine if there are opportunities for implementing fish passage, boat portage or passage, or dam removal. Key findings were that dam mitigation in the upper Susquehanna Basin can provide ecological benefits for diadromous and riverine fish, improve recreational opportunities for boaters and anglers, and improve water quality. Of the 94 dams evaluated in 7 counties of the 18 county-watershed, 9 dams were determined to have a medium to high potential for implementing a fish and/or boating passage or dam removal project. More detailed information on these 94 dams is available in electronic files in this report's companion compact disk that link each dam location with the dam assessment information that was collected in the office, through inquiries and meetings, and during field surveys.

Finally, this document has five appendices. These are: the Dam Mitigation Site Assessment Tool (Appendix A); information pertaining to "Related Activities in New York", which is discussed in Section 2 (Appendices B and C); the Funding Guide (Appendix D); and the comprehensive List of References (Appendix E). Appendices A, D, and E were developed as part of this project.

## SECTION 1 - PROJECT DEVELOPMENT

### A. Introduction

Dams have been and continue to be built for a variety of reasons, including power generation, water supply, recreation, navigation, irrigation, and flood control. Unfortunately, dams can adversely impact fish and wildlife resources by blocking the passage of fish and other aquatic organisms (e.g., mussels), altering sediment, nutrient, and temperature regimes, and converting riverine habitat to littoral habitat. The adverse impacts dams impose on anadromous fish species, that require access to freshwater habitats for spawning and juvenile survival, have been well documented. Dams can also impede migration of the catadromous American eel, a species that spends much of its non-spawning life in freshwater habitat. Dams negatively impact riverine fish such as walleye, perch, northern pike, and sunfish, by limiting access to historical spawning areas, isolating populations, or inundating spawning habitats upstream of dams (Partnership for Saginaw Bay 2005).

Dams impact water quality by interrupting downstream sediment transport, increasing temperature and decreasing oxygenation within the impoundments, and delivering water downstream that may pose thermal stress (cold or hot, depending on location of release from the dam) on organisms. Although dams, in conjunction with locks, can enhance navigation, many dams negatively influence navigation and recreational boat use. Many river ecologists regard dams as the single largest threat to river ecosystems (The World Commission on Dams 2000).

The U.S. Fish and Wildlife Service (USFWS) estimates that there are an estimated 75,000 dams greater than 6 feet in height and 2.5 million small fish passage barriers in the United States ([http://www.fws.gov/fisheries/CD/Programs/National\\_Fish\\_Passage.pdf](http://www.fws.gov/fisheries/CD/Programs/National_Fish_Passage.pdf)). There have been 500 documented dam removals in the United States (CRS 2006). The New York State Department of Environmental Conservation (NYSDEC) dam safety inventory indicates that there are over 5,500 dams in New York State. This is an approximation since there are existing dams (generally small structures) that are not documented in the inventory, as well as dams listed in the inventory that may no longer exist or have never been constructed.

### B. Project Background

The idea to develop a strategy for stream professionals considering dam removal or mitigation was conceived through the collaboration of members of the Hydrologic and Habitat Modification Workgroup (HHM). The HHM, representing a coalition of over 15 Federal, State, and municipal agencies, academic institutions, and non-governmental organizations from across the state, reports to the New York State Nonpoint Source Coordinating Committee (NYSNPSCC) three or four times per year. The NYSNPSCC established “Working Groups” through the New York State Nonpoint Source (NPS) Management Program at NYSDEC in 2000 for the four priority NPS categories. One priority NPS category is “hydrologic and habitat modification” (the other priority sources are: agriculture, stormwater, and on-site wastewater treatment systems).

By definition, hydrologic and habitat modification is caused by an activity (e.g., the construction of an improperly designed dam, bridge, or culvert) that physically alters a stream channel, stream corridor, floodplain, or surrounding watershed. Sometimes these modifications interfere with the water cycle, disrupt the natural flow of water, or result in a loss of fish and wildlife habitat. For those interested in learning more about hydrologic and habitat modification, the United States

Environmental Protection Agency (USEPA) has released new guidance titled *National Management Measures to Control Nonpoint Source Pollution from Hydromodification*, which you can download for free from the following webpage: <http://www.epa.gov/nps/hydromod/>.

The HHM was established and charged with identifying policy and program changes, and acts as a primary interagency forum for the exchange of ideas. The HHM partners collaborate to pool resources and work together to support initiatives to protect and restore New York rivers and streams from the impacts of hydrologic and habitat modification, and to improve water quality and ecological life in river and stream corridors and habitats across the state.

In this vein, the HHM issued a Request for Proposals in 2000 for suitable projects that would further its objectives. Several projects, including the one reported in this document, were chosen by the HHM for funding. Other related projects that may benefit stream professionals are:

1. The United States Geological Survey (USGS) Regional Curves - Stream reference data for the physiologic regions of the state that professionals can use to plan stream restoration projects, particularly to check their work when stream gage data are not available. Additional information is available on the USGS website - <http://ny.cf.er.usgs.gov/nyprojectsearch/projects/2457-A29-1.html>.
2. Greene County Soil and Water Conservation District (SWCD) stream restoration training - A series of classroom and practical in-field training sessions for stream professionals applying fluvial geomorphology techniques when planning and designing stream restoration projects. The SWCD has undertaken a significant number of stream restoration projects in the Hudson River region and maintains a website (<http://www.gcsxcd.com/index2.html> and click on stream restoration) illustrating progress on these projects.
3. The Chemung County SWCD report, "Stream Processes - A Guide to Living in Harmony with Streams" - Material for outreach and workshops with local officials, highway superintendents, landowners, or the public at-large. The guide is an excellent primer on activities that can damage streams, and for recommending more stream-friendly alternatives. The guide can be requested from your county SWCD, or downloaded by clicking "stream guide" or "stream powerpoint" from their website - <http://www.chemungcountyswcd.com/Tire%20Page.htm>.

Stream professionals are encouraged to keep abreast of these and related HHM activities.

### **C. Project Scope**

The USFWS submitted a proposal to NYSDEC for the "Development of a Strategic Plan for Selective Dam Removal in New York" in 2000. The overall goal of the project was to develop a strategy for stream conservation, focusing on the assessment and possible removal or mitigation (such as installation of fish ladders) of non-Federally regulated dams throughout New York State. The HHM selected the project for Section 319 USEPA funding in 2001. The USFWS was authorized to begin the "Phase I" project in 2004 under a NYSDEC contract with the New York State Association of Regional Councils (NYSARC) (C302276 Task C-6a USFWS). The strategy and funding guide, plus the experience gained, would help form the objectives of a future "Phase II" project (not yet funded), which conceptually would:



1. Complete the assessment of dams across the state,
2. Identify sites with high potential benefits and support for action,
3. Continue to build consensus and partnerships,
4. Monitor dam mitigation projects (possibly using physical, chemical, and biological parameters) and evaluate (pre- and post-removal) project success, and,
5. Document 1-2 case studies of actual projects in New York State.

Phase I was originally intended to inventory Category 1 watershed dams in NYS to evaluate potential removal; however, refinements were made to the Scope of Work to focus pilot project work on a single Category 1 watershed and evaluate dam mitigation opportunities in general and not just dam removal. Category 1 watersheds are defined by the United States Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS) and NYSDEC, under guidance from the USEPA, as watersheds in need of restoration (NYSDEC and USDA-NRCS 1998). The upper Susquehanna watershed has been identified as one of the Category 1 watersheds in New York and was selected by the Project Working Group as the watershed in which to perform the Phase I dam inventory. The Scope of Work developed for this project included the following tasks:

#### **Site Assessment Process**

- Coordinate working group - delegated to New York Rivers United (NYRU)
- Compile annotated reference materials
- Develop assessment criteria and screening tool
- Conduct pilot of assessment criteria and screening tool in the upper Susquehanna watershed
- Conduct site visits and assessments on dams in assessment area
- Conduct additional research and mapping of studied dams

#### **Document Preparation**

- Prepare strategy document
- Prepare funding guide

## **SECTION 2 - DAM ASSESSMENT TOOLS AND PROFESSIONAL RESOURCES**

### **A. Project Working Group Considerations**

The working group for this project was convened by the USFWS and NYRU on June 29, 2004. Working group members represented USFWS, NYRU, USDA-NRCS, Upper Susquehanna Coalition, NYSDEC (Divisions of Water, and Fish, Wildlife, and Marine Resources), and New York State Department of State. The group developed criteria for the “Site Assessment Tool” and periodically reported its progress to the HHM (which served in an advisory capacity) as well as to the NYSNPSCC.

The working group first developed criteria for evaluating potential removal or mitigation of dams in New York State. Checklists from other states were reviewed, most notably the New Hampshire Department of Environmental Services, “Procedure to Assist in the Prioritization of Dam Removal Projects.”

Members emphasized the need to develop a companion Geographic Information System (GIS) component that would display “pop up” information and photos of dam sites to reflect how a site

was located in the landscape. Viewing a dam site within a watershed-based GIS was considered key because the GIS could guide a stream professional's decisions on the preferred order of work in a specific tributary. For example, it may be advisable to address a barrier in the headwaters after downstream barriers are mitigated. On the other hand, depending on the project objective and the source of available funds, work may be preferred in the upper headwaters first to focus on restoring wetlands or re-connecting streams.

The working group met several times to refine the Phase I criteria and address the use of appropriate Dam Safety Inventory data in the assessment tool. Key considerations were:

1. Criteria must be simple and fair so that anyone gathering information would replicate the same values - whenever possible, data would be gathered as a pre-screening, desktop exercise using available website sources.
2. Criteria must be attributes that lead to categorizing potential projects, and not to limit future candidates. For example, projects could be sorted on available funding sources either for the willing community that wants to take action, or the willing dam owner's individual objectives (fish passage or dam safety). Clearly, the screening tool must not impede a locality from implementing a project that is desirable to that locality.
3. Criteria must guide selection of projects and include information on natural resource priorities/issues, as well as the interests of landowners.
4. Criteria must reflect statewide and regional interests, where appropriate, while recognizing that priorities of project sponsors and sources of funding can differ.

Finally, members recognized the importance of communicating and building consensus on projects. Partners have continued to network on a variety of activities since the inception of this project. These are highlighted below.

## **B. Related Activities in New York State**

This project has fostered several noteworthy activities. Progress was made on a variety of fronts by HHM and its other partners. Stream professionals can contact these stakeholders to learn from their experiences on actual projects in New York State. Activities worthy of note are as follows:

- The Hudson River Estuary Program (HREP) held a Hudson River Roundtable on barrier mitigation and removal in March 2005 to gather feedback on the proposed "A Three Tiered, Nested Approach, to Barrier Assessment." The HREP reviewed the draft USFWS site assessment tool to produce its field sheets. The HREP sheets address barriers such as culverts and bridges, and not just dams. On August 11, 2005, the USFWS assessment tool (Appendix A) and the HREP field sheets (Appendix B) were tested in the field by a group of stream professionals and volunteers. Three dam sites in the Fish Kill Watershed of the Hudson River estuary, in the City and Town of Beacon, Dutchess County, were chosen for the on-site reviews, and refinements to both tools were made. The "NYSDEC HREP Stream Barrier Inventory and Characterization Methodology and Training Manual" and barrier characterization worksheets for dams and other stream barriers were published in December 2005. The unique difference between the USFWS and HREP tools are the respective target audiences: stream professionals and volunteer watershed groups, respectively. A report on the Fishkill inventory and characterization has been prepared.

- The NYRU led a Hudson River Tributary Barrier Task Force in prior years to gain experience in barrier mitigation assessment, and coordinated this project's Working Group. It was awarded a separate USEPA grant to assess potential dam removal or mitigation sites in the Great Lakes Basin of New York State (Summer 2005) using a draft of the Site Assessment Tool. Appendix C contains a summary of the NYRU study.
- The HREP watershed groups in the Moodna and Woodbury Creek watersheds of the Hudson River estuary in Orange County, New York, piloted the use of the HREP screening tools (Appendix B) to produce the "GIS and Field-Based Stream Barrier Inventory and Assessment of the Moodna Creek Watershed" (October 2006). Engineering design and permit application development for a first barrier dam removal on Moodna Creek is in process.
- The Long Island South Shore Estuary Reserve Program is utilizing the USFWS Site Assessment Tool (Appendix A) as part of its watershed-based assessment of candidate barrier mitigation projects.
- In January 2006, the HHM established a Barrier Mitigation Forum representing multiple NYSDEC divisions/regions, the New York State Department of Transportation, the Thruway Authority/Canal Corps, USFWS, and non-governmental organizations, such as, American Rivers, NYRU, The Nature Conservancy, Trout Unlimited, and Environmental Defense. As a result, a working copy of "Barrier Mitigation Guidance for Project Applicants and Dam Owners" is anticipated by the end of 2008 as a guide through the dam removal process. The guide will be updated as more experience is gained in the permitting of barrier mitigation projects, which are subject to NYSDEC and other regulations.

Also, the Barrier Mitigation Forum expects to work on a sequel document or "barrier mitigation checklist" to address more in-depth, site-specific project information for parameters such as stream flow regime, sediment characteristics, fish and wildlife assessments, dam designs, preliminary cost estimates, required permits, and public outreach. The checklist would be developed after formal promulgation of the revised NYSDEC Dam Safety regulations.

- The New York State Legislature recognized NYSDEC needed more resources to operate an effective Dam Safety program. The NYSDEC hired additional Dam Safety inspectors in 2006.
- In 2007, NYSDEC Dam Safety Staff made presentations on Long Island and along the Hudson Valley on fundamentals and safety considerations when implementing fish passage at dams. Articles on dam safety were published in 2007 in the Clearwater magazine.
- Also, NYSDEC held several informational meetings on a preliminary draft of the Dam Safety regulations in late 2006. A formal rulemaking commenced in February 2008, with formal hearings scheduled. Dam safety guidance for owners and operators of dams subject to Dam Safety regulations can be expected to follow promulgation of the rules.

In general, recent storm events have caused property damage and safety concerns due to flooding episodes in the Catskills, Adirondacks, and Southern Tier regions of the state. There is growing awareness that dam structures across the state are aging and in need of proper maintenance and repairs. Since repairs and replacements can be extremely expensive, dam owners may consider dam removal or mitigation as alternatives to repair or replacement, management, and maintenance.

### **C. Dam Mitigation Site Assessment Tools**

The “Dam Mitigation Site Assessment Tool” in Appendix A is a field data sheet that can serve as a screening tool for assessing a dam’s potential fish passage, dam removal, or other measures to mitigate dam impacts. It was developed as part of the project and intended to identify the greatest priorities for mitigation as well as the potential constraints to mitigation such as expense, conflicts between dam purpose and mitigation, or public disapproval. As reviewed in Section 3 of this document, the Site Assessment Tool was piloted by the USFWS to assess 94 dams in 7 counties of the upper Susquehanna watershed. Drafts of the tool have been used by other partners to assess New York dams in the Great Lakes Basin, Hudson River, and Long Island Sound South Shore Estuaries (see “Related Activities in New York State” - Section 2B).

The stream professional would use the Site Assessment Tool to compile information on dams during desktop and office research and field visits. Investigations would address the dam’s purpose, available or needed fish passage, wetland habitat, invasive species, river or stream characteristics, and recreational use. The data sheets in the Site Assessment Tool also contain instructions, footnotes, and web links to enable the user to compile the information efficiently.

A companion tool developed during the project is an interactive CD that contains a base map of watersheds statewide as well as certain dam safety data to complete the Site Assessment Tool for dams across the state. The CD also contains data on the 94 dams that were evaluated in the upper Susquehanna watershed during the USFWS pilot study (Section 3). Clicking on an individual dam in GIS ArcReader launches information from the Site Assessment Tool as well as pictures taken during the pilot study. Stream professionals may contact the NYSDEC Division of Water - Nonpoint Source and General Permits Section to obtain the companion CD (518-402-8249) or the USFWS New York Field Office (607-753-9334: Anne Secord, [anne\\_secord@fws.gov](mailto:anne_secord@fws.gov)).

Other tools or resources discussed in this document for the stream professionals interested in barrier mitigation projects are discussed later in this section. These include regulatory considerations, the funding guide, and references for more study on experiences and technical advances being made across the country. The Strategy below provides excellent insight on how to assess potential candidate sites using the Site Assessment Tool in Appendix A. The technical and outreach tools already discussed in “Project Background” (Section 1) are noteworthy as well.

### **D. Strategy for Identifying Candidate Dams for Removal or Mitigation**

#### **Guidance for Using Site Assessment Tool**

The Site Assessment Tool in Appendix A is useful for developing screening information on dams. The level of effort expended to complete the tool should be commensurate with the likelihood of a dam mitigation opportunity. Footnotes, websites, and other aides appear in

Appendix A to help complete data sheets. The stream professional may well take the following guidance into consideration:

- Use applicable data from the NYSDEC Dam Safety Inventory to fill in as many portions of the data sheet as possible, including GPS coordinates (which should be verified in the field). Information that can be obtained through the NYS Dam Safety Inventory Database is highlighted in bold type on the Site Assessment Tool in Appendix A. It is also important to understand that the NYSDEC Dam Safety Inventory may not have information on all dams, particularly smaller structures. These “undocumented” dams may have considerable impacts on streams.
- Search topographic maps, aerial photographs, and any GIS information and available information from the NYSDEC Dam Safety Inventory prior to the site visit to locate the dam, and prepare a map that overlays the watershed’s USGS topographic stream data on an orthophoto map in ArcGIS. Maps will aid in finding the dam in the field and assessing site surroundings.
- It may not be appropriate to contact a landowner about mitigation opportunities until all desktop and pre-screening analyses are completed and the site is identified as a possible candidate for dam mitigation. We advise using judgment in obtaining permission to enter private property to acquire in-field information. Please do not trespass.
- It would be helpful to coordinate site visits with the Regional NYSDEC Biologists familiar with the site-specific fish and wildlife resources and any existing land management plans.
- Experienced and informed professional judgment will be needed to answer questions regarding issues such as reservoir sedimentation, the dam’s structural condition, the dam’s potential hazards to the public, and riverine ice issues. These issues may be difficult to address with confidence during pre-screening stages.
- Take digital photographs of the dam from several angles, as well as digital photographs of upstream and downstream habitat. Establishing permanent photographic locations is helpful.
- Over time, assemble assessments of individual watersheds state-wide to identify key watersheds and sub-watersheds which have the greatest potential for mitigation.

### **Next Steps for Stream Professionals**

Once candidate dams have been evaluated, using the Site Assessment Tool and this guidance, certain dams can be selected for more in-depth study. The stream professional would want to develop a network of professionals and volunteers from a variety of disciplines (hydrologists, biologists, design engineers, etc.) and decision-makers (agency, land-use) to discuss regulatory considerations, technical standards, local objectives, and sources of funding and assistance for implementing a potential barrier mitigation project. Stream professionals can expect more guidance on such projects as experience with barrier mitigation projects in New York State grows. This Strategy provides a review of “Regulatory Considerations” and sources of funding

(“Funding Guide” in Appendix D) that may be appropriate to consider as part of project implementation.

Also, as discussed under the heading “Related Activities in New York State”, the HHM Barrier Mitigation Forum expects to release its “Barrier Mitigation Guidance for Project Applicants and Dam Owners” in 2008. Stream professionals could use the guidance, and share it with dam owners of potential projects, to better understand the agencies and non-governmental organizations that can be consulted in New York State for technical and regulatory assistance. There is a wealth of other information available to review (Appendix E). In addition, the Forum and the NYSDEC Dam Safety Section plan to produce additional guidance after formal promulgation of the state’s revised dam safety rules.

### **Recognizing Ecological Benefits of Dam Mitigation**

While project site assessment for implementing dam mitigation will need to address any structural deficiencies, dam safety, and stream disturbance requirements, this Strategy for stream professionals would be remiss without mentioning ecological and other benefits of successful dam mitigation projects. These include:

- Restoration of fish and other aquatic species:
  - Diadromous species, such as American shad (*Alosa sapidissima*) and American eel (*Anguilla rostrata*)
  - Riverine species, such as walleye (*Sander vitreous vitreous*), suckers (*Catostomus spp.*), smallmouth bass (*Micropterus dolomieu*), and brook trout (*Salvelinus fontinalis*)
  - Freshwater mussels, such as the dwarf wedge mussel (*Alasmidonta heterodon*) and clubshell (*Pleurobema clava*)
- Recreational use
- Improved sediment/nutrient transport and water quality

These are reviewed more specifically with regard to the upper Susquehanna Watershed pilot study in Section 3 of this document.

The point to be made is that healthy rivers are valued not only by the fish and wildlife species that live in and along them, but also by the people in our state’s communities that draw drinking water, recreate (boating, fishing, hunting, bird watching, etc.), and simply enjoy New York’s abundant water-based natural resources. Projects that would improve water quality and restore habitat for fish and wildlife have real significance to human users of those resources.

### **The Importance of Building Consensus Through Partnerships**

The need is great in New York for stream restoration projects that improve habitat and water quality, restore natural stream processes, and enhance opportunities for river-based recreation. Dam removal and other mitigative measures are being explored across the state, notably in the Great Lakes, Susquehanna, and Hudson River watersheds. It is important for stream professionals, communities, and dam owners to increase their dialogue to share information on all aspects of dam mitigation, including natural resource and recreational benefits to be derived, mechanics of developing a dam mitigation project, and funding sources.

This project has generated extensive communication among regulatory agencies and stream professionals. The dialogue, since the inception of this project, has fostered the development of the tools and guidance compiled throughout this document, and the preliminary recommendations on dam mitigation projects that are of moderate to high priority for the upper Susquehanna Watershed (Section 3).

It is recommended that stakeholders continue the momentum at the local project and state levels. Stream professionals must be informed about stream restoration activities, including dam mitigation, in New York State and elsewhere. Activities of HHM partners, as addressed earlier, provide a vehicle for fostering communication and for sharing resources and expertise to carry out local projects as well as for future guidance.

At the local level, stream professionals can help dam owners seek appropriate assistance from not-for-profit organizations (e.g., American Rivers, The Nature Conservancy, New York Rivers United), agencies (e.g., USFWS, NYSDEC, NYSDOS), and local government offices (e.g., county Soil and Water Conservation Districts and land-use planning departments). These organizations often share common interests in sustaining healthy rivers. Watershed and river recreational groups can be advocates in restoring river corridors for aquatic and wildlife habitat and improving water quality for recreational and drinking water purposes. Building consensus with partners locally can foster the selection of an alternative approach most suited to the community and open up options for funding that may not be otherwise realized.

Finally, it is critical that there be a central, state-level entity from which dam mitigation proponents can obtain information. This entity should be available to help them through the process of developing the dam removal or passage proposal, obtaining any necessary permits and seeking sufficient sources of funding. The USFWS recommends that the NYSNPSCC's HHM and Barrier Mitigation Forum continue to investigate appropriate mechanisms for providing this service. Recommendations include:

1. A state level contact should be established for information, either in the NYSDEC's Division of Water, Nonpoint Source and General Permits Section or the NYSDEC's Division of Fish and Wildlife and Marine Resources – Landscape Conservation Section.
2. Consistency and efficiencies in the review and permitting of projects should be instituted within NYSDEC Regional and Central offices and by other regulatory stakeholders in New York State.

These actions would diffuse project sponsor confusion and promote more successful projects as dam owners, stream professionals, and the NYSDEC and other regulatory stakeholders gain experience in implementing projects in New York State.

## **E. Regulatory Considerations**

There are a number of regulatory requirements associated with dam removal or mitigation. The requirements below may or may not apply to a specific project proposal depending on its location in, or distance from, designated or sensitive resources in New York State. These requirements are listed under three agency jurisdictional categories: Federal, State, and

municipal. Most requirements would result in a permit, but some are approvals, from the administering agency<sup>1</sup>.

### **Federal Jurisdictions**

Clean Water Act (CWA) Section 404 - Permit for the Discharge of Dredged or Fill Material into U.S. Waters: No discharge of dredged or fill material may be permitted if a practicable alternative exists that will be less damaging to the environment or if the action would result in significant degradation of the Nation's waters. The U.S. Army Corps of Engineers (USACE) issues a Section 404 permit if dam mitigation requires fill to be placed in regulated water or requires significant dredging that may result in significant fallback of sediment into waters of the United States.

Endangered Species Act - Consultation on Threatened or Endangered Species: If Federally-listed threatened or endangered species may be affected by the dam mitigation project (positively or negatively), the action agency is to consult with the USFWS and/or National Oceanic and Atmospheric Administration – Fisheries (NOAA-F) regarding the project impacts.

Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) - Permit for Floodplain Development: Approximately 1,470 local communities in New York State participate in the FEMA NFIP. The NFIP requires participating communities to regulate activities within mapped Flood Hazard Areas. In many cases, local floodplain permits will be required. Guidance on activities in the floodplain and required permits (local, State, or Federal - FEMA) can be found at <http://www.dec.ny.gov/lands/24281.html>.

Federal Energy Regulatory Commission (FERC) - Approval to Surrender License: If the dam to be removed or altered is a FERC-regulated hydropower dam, the dam owner will have to apply for surrender of the FERC license or issuance of a non-power license. Mitigation is currently required for all existing FERC-regulated dams.

Magnuson-Stevenson Act - Consultation on Fishery Management Plans: To issue a CWA Section 404 permit, the USACE may need to consult with the NOAA-F regarding the impact of the dam mitigation on any fishery management plan developed by a regional fishery management council [16 United States Code Section 1801 et seq.]. This consultation is performed to ensure that dam mitigation activities will not adversely impact any essential fish habitat established under the fishery management plan.

National Environmental Policy Act (NEPA) - Review of Environmental Impacts: The NEPA requires Federal agencies to consider potential environmental impacts before taking major actions, such as issuing permits or making decisions that affect Federal lands. If significant impacts are likely, the action agency must prepare an environmental impact statement (EIS); lesser impacts may be addressed with an environmental assessment or categorical exclusion. If a

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<sup>1</sup> Under each category, the Federal and State jurisdictions are ordered alphabetically by the enabling law - - for example, a Federal Act or NYSDEC Environmental Conservation Law (ECL) - - with a brief explanation. Note that cited regulations in brackets for NYSDEC begin with 6 NYCRR because NYSDEC regulations are compiled in book 6 of the New York Code, Rules and Regulations (NYCRR). Most NYSDEC regulations can be viewed on their website: <http://www.dec.ny.gov/regulations/regulations.html>.



Federal agency is involved in the dam mitigation activities, including issuing permits or providing funding, conduct a NEPA review.

National Historic Preservation Act (NHPA) Section 106 - Review of Historic Properties: As a Federal agency with permitting jurisdiction, the USACE must take into account the effects of proposed activities on historic properties [16 U.S.C. S 470f] during any permit application review. Federal agencies must take into account the effects of activities (e.g., funding, permitting, approval) on historic properties, and afford the Advisory Council on Historic Preservation (ACHP) with a reasonable opportunity to comment on the undertaking. Section 106 is a procedure to assist in decision-making for a project, activity, or program under direct or indirect jurisdiction of the Federal agency. The lead Federal agency determines eligibility of the historic resource, submits a review to consulting parties, and seeks consensus with the State/Tribal Historic Preservation Office (SHPO/THPO). If there is no consensus, the lead agency must request and consider the opinion of the ACHP. The Federal agency must then assess adverse effects and collaborate with parties, the public, and SHPO/THPO to resolve issues. A memorandum of agreement must be prepared to document consensus. If there is failure to agree, the agreement is submitted to the ACHP for comment, before the Federal agency's response and decision (see [www.achp.gov/training](http://www.achp.gov/training)).

Rivers and Harbors Act of 1899 Section 10 - Construction In/Over Navigable U.S. Waters: The USACE may require a permit under Section 10. This Act requires authorization from the USACE for the construction of any structure in or over any navigable water of the United States, the excavation/dredging or deposition of material in these waters, or any obstruction or alteration in navigable water. Any proposal for dam alteration should be reviewed by the USACE to determine whether they have jurisdiction under this law or CWA Section 404.

### **State Jurisdictions**

CWA Section 401 [6 NYCRR Part 608] - NYSDEC's Federal Certification of Water Quality with New York State Permit for Stream Disturbance: A CWA Section 401 permit may be needed if the USACE or the FERC are issuing permits or licenses. This certification, issued by the NYSDEC, affirms that the proposed activity will not result in the violation of State water quality standards. The State may issue conditions regarding any dam alteration project under this certification.

Coastal Zone Management Act (CZMA) - Certification of Coastal Consistency: If the dam is located in the coastal zone (see map by referring to Footnote 6 in Site Assessment Tool – Appendix A), in order for the USACE to issue a permit or the FERC to issue a license surrender order or non-power license, the New York State Department of State must issue a CZMA Certification (16 U.S.C. Sections 1451 et seq.). This Certification affirms that the proposed activity is consistent with the State-approved Coastal Zone Management Program.

ECL Article 8 [6 NYCRR Part 617] - State Review of Environmental Impacts: New York's State Environmental Quality Review Act (SEQRA) requires all levels of government in New York State to consider environmental impacts equally with social and economic factors during discretionary decision-making. This means that these agencies must assess the environmental significance of any action they have discretion to approve, fund, or directly undertake, except if the action is specifically exempted or excluded. This law is administered by the lead agency, as designated during the SEQRA lead agency review process for each project.

If an action is determined not to have significant adverse environmental impacts, a determination of non-significance (negative declaration) is prepared. If an action is determined to have potentially significant adverse environmental impacts, an EIS is required.

Environmental Conservation Law (ECL) Article 11, Title 1; General Provision for Fish Access: While Article 15 of the ECL (below) is the primary legal basis for barrier mitigation, ECL Article 11 (specifically Section 11-0105) pertains as well. While the text of this section does not contain any specific language on the impairment of fish movement, there is within the accompanying Notes of Decisions, Item 3, a citation for a decision fishway, 1909, 131 App. Div. 403, 115 N.Y.S. 745, which includes the statements: "The people of the state have, as an easement in the streams, the right to have fish inhabit its waters and freely pass to their spawning beds and multiply....and no riparian proprietor upon a stream has the right to obstruct the free passage of the fish to the detriment of other proprietors or of the public." Thus, the State of New York can require owners of existing structures, which block fish movement, to install fishways or to modify or remove the structure. Likewise, the NYSDEC can require similar measures for new structures.

ECL Article 15, Title 5 [6 NYCRR Part 608] – Use and Protection of Waters: Article 15 of the Environmental Conservation Law and its implementing regulations found at 6NYCRR Part 608 apply to most projects that require a physical disturbance to a stream or water body in New York State. A Use and Protection of waters permit is required by 6 NYCRR Part 608.2 (a) whenever there is to be a change, modification or disturbance of any protected stream; the bed or bank of a protected stream in the state will be disturbed; or sand, gravel or other material is to be removed. Part 608.5 also requires a permit for the excavation or placement of fill directly or indirectly into navigable waters. This includes marshes, estuaries, tidal marshes and wetlands that are adjacent to and contiguous at any point to any of the navigable waters of the state, and that are inundated at mean high water level or tide.

Dam Safety permits are obtained with a Supplement D-1 application as part of a Joint Application for Permit, issued by a NYSDEC Regional Permit Administrator. This permit is required for work beyond maintenance on all dams, including modification and removal, except those that are:

1. Less than 15 feet high and maximum impoundment volume is less than 3 million gallons,
2. Less than 6 feet high regardless of impoundment size, or
3. Less than 1 million gallon impoundment regardless of height.

Applying these criteria sometimes requires engineering judgment, and the NYSDEC should be contacted for a determination. For more information, see footnote 1 in the Site Assessment Tool, Appendix A.

ECL Article 15, Title 5 [6 NYCRR Part 673] - Dam Safety Regulations: The law and implementing rules give the NYSDEC enforcement authority over dams equal to or greater than ten feet tall, dams with an impoundment capacity of 1,000,000 gallons or more, dams on drainage areas greater than or equal to one square mile and any size dam that is considered a significant hazard to public health, safety, property or natural resources. The NYSDEC has proposed a rulemaking to revise the regulations. One of the provisions would make the size thresholds in Part 673 consistent with those in the Part 608 permitting rules.

ECL Article 15, Title 27 [6 NYCRR Part 666] - Review of Impacts to State Wild, Scenic, and Recreational River Corridors: requires a review of the impacts of any change to the land or uses in areas within ½ of a mile of a water body or river designated as part of the Wild, Scenic, and Recreational River System of New York State. This Act is administered by the Adirondack Park Agency in the Adirondack Park, and the NYSDEC for the rest of the state (determine eligible rivers by referring to Footnote 4 in the Site Assessment Tool, Appendix A).

ECL Article 24 [6 NYCRR Part 663] - Permit to Protect Freshwater Wetlands: This NYSDEC permit may be required for activities outside the Adirondack Park affecting New York State-regulated wetlands. These wetlands are mapped and generally exceed 12.4 acres in size. Almost any activity which may adversely impact the natural values of the wetlands or their adjacent areas is regulated (determine subject wetlands by referring to Footnote 2 in the Site Assessment Tool, Appendix A).

ECL Article 25 [6 NYCRR Part 661] - Permit to Protect Tidal Wetlands: Under the Tidal Wetlands Act, NYSDEC regulates activities in tidal wetlands and their adjacent areas. In general, tidal wetlands consist of all the salt marshes, non-vegetated as well as vegetated flats, and shorelines that are subject to tides. The adjacent areas extend up to 300 feet inland from the wetland boundary (up to 150 feet inland within New York City). The NYSDEC requires a permit for almost any activity that will alter wetlands or the adjacent areas. The NYSDEC website <http://www.dec.state.ny.us/website/dfwmr/marine/twcat.htm> lists a number of tidal wetland categories and definitions.

Freshwater Wetlands in New York State's Adirondack Park - Permit to Protect Freshwater Wetlands within the Adirondack Park: The Adirondack Park Agency is responsible for administering the State of New York's ECL Article 24 Freshwater Wetlands Act within the Adirondack Park. Within the Park protected wetlands can be as small as 1 acre in size. Other regulatory measures are substantially similar to those administered by NYSDEC across the rest of New York State.

New York State Historic Preservation Act of 1980 - Review of Historic and Other Significant Properties: This Act was established as a counterpart to the NHPA (discussed earlier) and declares historic preservation to be the public policy and in the public interest of the State. The Act also requires State agencies to consult with the SHPO with the New York State Office of Parks, Recreation and Historic Preservation, if it appears that any projects being planned may or will cause any change, beneficial or adverse, in the quality of any historic, architectural, archeological, or cultural property that is listed on the National Register of Historic Places, or listed on the State Register, or that is determined to be eligible for listing on the State Register.

NYSOGS - Authorization for Activities in New York State-Owned Underwater Lands: In many instances, the State of New York owns the land beneath coastal waters and the waters of large lakes and rivers. These underwater lands are managed by the NYSOGS. The NYSOGS may need to authorize activities that involve these lands.

### **Municipal Permits**

Permits may be needed from local authorities for demolition or construction activities associated with dam mitigation. Any permit in a FEMA Designated Special Flood Hazard Area (Zone A)

must receive a floodplain development permit from the local municipality (see FEMA maps by referring to Footnote 9 in the Site assessment Tool, Appendix A).

## **F. Funding Guide**

The New York State Dam Mitigation Funding Guide (Appendix D) presents information on potential sources of funding that are particularly relevant for dam removal and mitigation projects in New York State. These funding sources are largely sponsored by Federal agencies or private non-profit agencies. The table on the next page matches potential funding sources with the type of project under consideration. For example, the Corporate Wetlands Restoration Partnership may offer funding opportunities for riverine or stream restoration of a variety of aquatic species in a variety of ecosystems, whereas the National Fish Habitat Initiative Brook Trout Habitat Restoration Program would only offer funding for projects involving brook trout. The Funding Guide also directs the reader to other funding guides prepared by American Rivers and the Commonwealth of Massachusetts (American Rivers 2000).

## **G. Key References**

A wealth of information and guidance is available from the experience of projects across the United States. A stream professional will want to keep abreast of the experience and technical advances being made to remove and mitigate dams across the country. Appendix E contains many references that would be beneficial to review. These were compiled by the USFWS and American Rivers. Websites and contact information are provided for many of these references.

**Typical Sources of Funding Dam Mitigation Projects in New York State (see Appendix D for supporting information)**

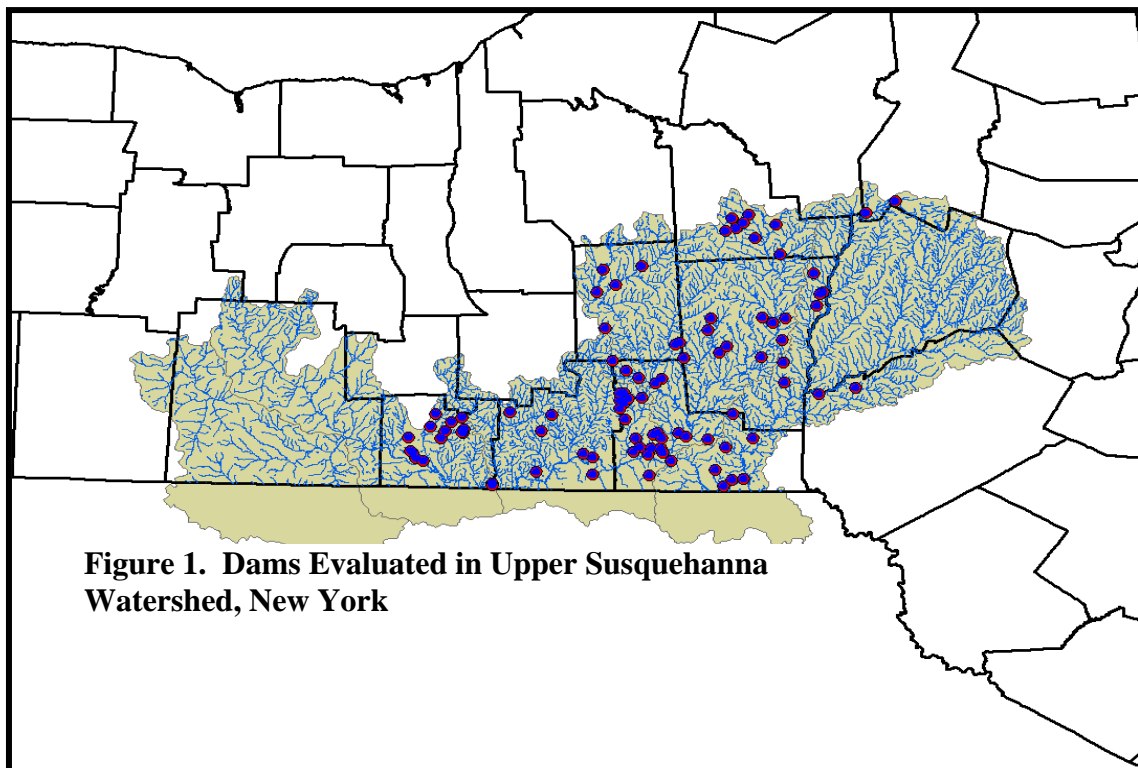
Funding Source	Type of Dam Mitigation Project								
	Diadromous Fish Passage	Riverine Fish Passage	FW Mussels	Great Lakes	Water Quality	Ecosystem Restoration	Coastal Ecosystem Restoration	Recreational Fishing	Recreational Boating
USACE	X	X	X	X	X	X	X	X	
USFWS	X	X	X	X		X	X	X	
NFHI Brook Trout		X							
NFWF General	X	X	X	X	X	X	X		
CWRP	X	X	X	X	X	X	X		
FEMRF		X		X		X St. Lawrence & Lake Ontario	X St. Lawrence & Lake Ontario		
NOAA - The Nature Conservancy	X				X Marine		X Marine		
NOAA - Trout Unlimited	X Trout & Salmon	X Trout & Salmon					X Trout & Salmon	X Trout & Salmon	
NOAA – Open Rivers Initiative	X				X Coastal only	X Coastal only	X		
NOAA - Great Lakes	X GL only	X GL only	X GL only	X	X GL only	X GL only	X GL only	GL only	
NOAA - American Rivers	X						X Diadromous and Marine		
NOAA – FishAmerica	X					X	X	X	
NRDAR –multiple agencies	X	X	X	X	X	X	X	X	X
FishAmerica Foundation	X	X		X	X	X	X	X	
Great Lakes Protection Fund	X GL only	X GL only	X GL only	X	X GL only	X GL only	X GL only		

## SECTION 3 – UPPER SUSQUEHANNA WATERSHED PILOT STUDY

### A. Site Visits and Additional Research on Selected Dams

The USFWS used the Site Assessment Tool in Appendix A to evaluate non-Federal dams with drainage areas (watersheds) exceeding 1 square mile in the upper Susquehanna River watershed. The upper Susquehanna watershed involves small parts (in upper headwaters) of 9 counties, sizeable portions of 2 counties (again in the upper headwaters of the watershed), and most, if not all, of 7 counties; a total of 18 counties of New York State affect the watershed. Using the project's size criteria for screening candidate sites, dams for further evaluation were identified in Broome, Chemung, Chenango, Cortland, Delaware, Madison, and Tioga Counties according to State Dam Safety Inventory data screening. Ninety four (94) dams were selected for further evaluation from these 7 upper Susquehanna watershed counties. It is noted that not all dams in the upper Susquehanna watershed with drainage areas exceeding 1 square mile were surveyed. There may be dams that met this criterion, but for which the New York State Dam Safety database does not provide a drainage area size (and, therefore, the drainage area could not be readily screened). Additionally, the USFWS did not survey applicable dams in Herkimer, Otsego, Schuyler, Steuben, or Tompkins Counties.

The purpose noted for most of the dams evaluated was flood control, followed by recreational, with a small number of dams with a noted purpose of wildlife, water supply, or hydroelectric power generation. Note that this distribution of dam types differs from the nationwide statistics on dam purpose listed in the U.S. Army Corps of Engineers (USACE) National Inventory of Dams [cited in American Rivers (1999)]. The National Inventory of Dams identifies recreation as the most prevalent dam purpose, followed by fire and farm ponds, flood control, irrigation, water supply, hydroelectric, and navigation. This composition of dams is true of the New York State Dam Safety Inventory as well.



Dams were given a mitigation rank - a screening assessment of whether the opportunity for mitigation is high, medium, or low. These ranks are to be used as an initial screening tool. They are strictly qualitative, open to interpretation, and subject to change, as new information becomes available. For example, we are not suggesting that dam mitigation projects that would provide significant benefits to natural resources, but are experiencing public opposition, should not be given serious consideration by resource agencies, dam owners and others. General criteria used for ranking based on need, feasibility, and opportunity for mitigation are as follows:

#### HIGH POTENTIAL

- Significant need identified for fish passage, water quality improvement, or boating/public access
- Dam owner amenable to mitigation
- Minimal impact on public uses; public interest in mitigation

#### MEDIUM POTENTIAL

- Aquatic ecosystem habitat improvements can be achieved
- Dam has limited functionality for intended purpose
- Dam has negative aesthetic impacts
- Public interest in mitigation exists or is unknown

#### LOW POTENTIAL

- No need for passage or boating (stream small or passage exists)
- Dam has high functionality for intended purpose
- Dam has minimal impact on riparian habitat, water quality, sediment transport
- Public opposition to mitigation

The matrix below is a summary of county data and dam rankings from the “Upper Susquehanna Watershed Pilot Study Dam Mitigation Matrixes by County” located at the end of this Section of this report. The latter provides general information from the field visits for all 94 dams that were evaluated for the pilot study.

County Of New York State	All Dams Evaluated by USFWS <sup>1</sup>					Potential Candidates <sup>2</sup>
	Low	Medium	High	Other <sup>3</sup>	Total	Total
Broome	23	3	1	6	33	4
Chemung	7	0	1	6	14	1
Chenango	14	1	0	1	16	1
Cortland	5	2	0	0	7	2
Delaware	2	0	0	0	2	0
Madison	9 <sup>4</sup>	0	0	1	10	0
Tioga	8	1	0	3	12	1
Totals	68	7	2	17	94	9

<sup>1</sup> Dams with a specified drainage area > 1 square mile were selected for further evaluation

<sup>2</sup> Potential candidate dams for further study ranked medium or high

<sup>3</sup> Locations of proposed dam projects that were not built

<sup>4</sup> Three Madison County dams and one Chenango County dam were ranked Low-Med

## **B. Objectives for Dam Mitigation in the Upper Susquehanna Watershed**

Although certain dam safety data were screened as part of the upper Susquehanna watershed pilot evaluations, the physical condition of dams with respect to safety was not evaluated during in-field dam visits. The watershed-scale objectives for dam mitigation in this study include objectives to benefit:

- Diadromous species, such as American shad and American eel
- Riverine species, such as walleye, suckers, smallmouth bass, and brook trout
- Freshwater mussels
- Recreational use
- Improved sediment/nutrient transport and water quality

Diadromous Fish – According to historical newspaper and anecdotal sources, the Susquehanna River in New York supported spawning runs of American shad and river herring, with fish migrating as far upstream as Cooperstown, New York. Four hydroelectric facilities constructed in the early 1900's in the lower Susquehanna River blocked this passage for decades until fish passage measures began to be implemented. Restoration of American shad to their historic ranges requires regulation of harvest, improving and restoring stream habitat, constructing fish passage facilities, and restocking depleted habitats, all goals of the Chesapeake Bay Alosid Management Plan (1989). Fish passage facilities have since been constructed at Conowingo, Maryland, as well as Holtwood, Safe Harbor, and York Haven, Pennsylvania. The remaining significant barrier to passage is an inflatable dam at Shikellamy State Park, near Sunbury, Pennsylvania. The operators of this dam have been working with the Commonwealth of Pennsylvania to develop fish passage for shad and other species (Pennsylvania Fish and Boat Commission 2000; PPRP 1999).

Once these Pennsylvania barriers are mitigated, the next significant barriers on the mainstem Susquehanna River are the Willow Point and Rock Bottom Dams, and on the Chemung River, the Chase Hibbard Dam. There are now increasingly more important reasons to provide passage at New York State dams in the Susquehanna watershed to facilitate passage of American shad, and potentially river herring species, such as alewife (*Alosa pseudoharengus*) and blueback herring (*A. aestivalis*). These smaller herring species benefit from access to Susquehanna tributaries that may provide suitable spawning habitat.

In addition, it is important to provide upstream habitat for American eel, a species that has been experiencing declines in portions of its range. A goal of the ASMFC 2000 Interstate Fishery Management Plan for American eel is to restore American eel to waters where they had historical abundance by providing access for juvenile stages, including glass eels, elvers, and yellow eels (ASMFC 2000).

Riverine Fish - Riverine fish also benefit from increased access to habitat that is provided if dams are removed or altered to provide for fish passage. Dams and other barriers have been cited as major factors limiting the establishment of sustainable riverine fish populations (Partnership for Saginaw Bay 2000; Lake Erie Committee 2005). Fishing for riverine species is a popular activity in the upper Susquehanna watershed, particularly in the Susquehanna River, Chemung River, Chenango River, Tioughnioga River, and at Whitney Point Reservoir. The recreational importance of riverine fish is evidenced by the development of angling groups such



as Southern Tier Bassmasters, the Cohocton Valley Chapter of Trout Unlimited, the Twin Tiers Five Rivers Chapter of the Federation of Fly Fishers, and the Susquehanna River Smallmouth Club.

Freshwater Mussels - Freshwater mussels may ultimately benefit from dam removals or fish passage projects that enhance movements of host fish or improve habitat quality by increasing oxygenation or restoring more suitable substrates. However, dam removals or alterations must evaluate the potential to adversely impact freshwater mussels by stranding those within impoundments or releasing impounded sediments to downstream reaches ([ftp://ftp-fc.sc.egov.usda.gov/WHMI/WEB/pdf/TechnicalLeaflets/NativeFreshwater\\_%20MusselsJan16.pdf](ftp://ftp-fc.sc.egov.usda.gov/WHMI/WEB/pdf/TechnicalLeaflets/NativeFreshwater_%20MusselsJan16.pdf).)

Recreational Use - Recreational activities occur on upper Susquehanna rivers such as the Chemung River, Tioughnioga River, Chenango River, and the Susquehanna River itself. The annual Susquehanna River Sojourn has been held for the last 15 years. These week-long paddling and camping trips celebrate the historical and ecological significance of the Susquehanna River and its tributaries and have featured New York waterways, including the upper Susquehanna River from Cooperstown to Binghamton, and the Chenango River. The Tioughnioga River Trail will extend from Cortland to Marathon when completed and will provide outstanding opportunities for fishing, boating, hiking, bicycling, and other recreation along this river, which is a major part of the Susquehanna watershed. Cortland County has developed a Waterfront Development Commission to focus on economic development, environmental conservation, tourism promotion, and community revitalization along the river's 30 mile corridor.

The City of Elmira is promoting the Chemung River Futures Project, an effort designed to bring an integrated system of recreational, environmental, and other benefits to the riverine community. Portage and fish passage facilities have been designed at the Chase Hibbard Dam as part of this project (Bergmann Associates 2006). The Chemung River also supports a river basin trail and an annual river festival.

The Oneonta Susquehanna Greenway is a proposed bicycle and pedestrian trail which will follow the Susquehanna River for approximately 6 miles in the City and Town of Oneonta, NY. There are many recreational possibilities for the Oneonta Susquehanna Greenway, including walking, running, bicycling, rollerblading, cross country skiing, and snowshoeing. These organizations and activities illustrate the public interest in improving the quality of river-based recreation in the upper Susquehanna watershed.

Improved Sediment/Nutrient Transport and Water Quality - Dam removal in many instances restores the natural flowing character of a stream and restores essential ecological processes in the river. It may restore natural sediment and nutrient transport that will benefit downstream food chain dynamics, as well as wetland development. Restoration of more free-flowing water enhances oxygenation and lowers stream/river temperatures to support a broader array of fish species and other aquatic species.

### C. Upper Susquehanna Dams with Greatest Mitigation Potential

Nine candidate dams were chosen using the Site Assessment Tool in Appendix A and the Strategy discussed in Section 2 of this document. The following information is based on the USFWS assessments and limited telephone interviews with dam owners and others.

Center Village Dam, Broome County - The Center Village Dam is on the upper portion of the Susquehanna River, north of Windsor, near the Chenango County line. It is of timber crib construction, built in 1904, 610 feet long and 18 feet tall. It is partially breached, blocks only a portion of the river and, therefore, does not provide a complete barrier to fish passage. A representative with the current owner, New York State Electric and Gas (NYSEG), indicated that this is an old hydroelectric dam that was decommissioned about 50 years ago. It is not used for power generation or to alter river flows. The owner may be receptive to discussions about dam removal. Dam removal would marginally improve fish passage and boat use, although the western open channel currently affords fish and boat passage, and this river reach may be too shallow to allow for boat access.



**Center Village Dam, Broome County**

M. Robert Beach Dam, Broome County – This earthen dam is located near the Town of Chenango Bridge on Thomas Creek, a tributary to the Chenango River. It was constructed in 1933, is 333 feet long and 8 feet tall and has a listed purpose of recreation. There may be enhanced passage for brook trout and other riverine species along Thomas Creek {classified C(t)} if this dam were modified. The dam is in need of repairs.



**M. Robert Beach Dam, Broome County**

Rock Bottom Dam, Broome County - The Rock Bottom Dam is located about 7 miles upstream of the Willow Point Dam (see below) and is the first Susquehanna River barrier in New York State that is believed to be almost completely impassable to fish. This dam was constructed in 1936 and is 460 feet long and 9 feet tall. This dam provides an important water supply function to the City of Binghamton. The next dam upstream of Rock Bottom on the Susquehanna River is located at Oakland, Pennsylvania, just south of the New York State border near Binghamton. The NYSDEC and USFWS developed a plan to construct a natural channel to bypass fish around this dam. Passage was intended for riverine and anadromous fish species such as walleye and American shad. Funding was acquired by the NYSDEC and USFWS and permits were being explored prior to learning that the City of Binghamton (dam owner) is evaluating the development of a whitewater park at this dam. The whitewater proposal would coincidentally provide fish passage. Natural channel bypass plans are on hold until the City decides on the whitewater park.



**Rock Bottom Dam, Broome County**

Willow Point Dam, Broome County - This dam is located on the Susquehanna River near the City of Vestal. It was formerly owned by NYSEG, but was sold to AES Westover, along with the associated power generation facility. It was constructed in 1948 and is 640 feet long and 10 feet tall. The dam functions to provide a source of cooling water for the power plant. This is the first barrier on the Susquehanna River in New York State. This dam is not believed to be a completely impassable fish barrier in that walleye have been known to migrate past it (D. Lemon, NYSDEC, personal communication 2006). However, it may be a barrier to other species of fish and to certain life stages of fish and present more of a barrier during some flow conditions than others. Prior to selling the dam, NYSEG had contemplated removing it, but performed repairs to maintain it. Fish passage may be an option here.



**Willow Point Dam, Broome County**

Chase Hibbard Dam, Chemung County – This water supply dam is located on the Chemung River in the City of Elmira. It was constructed in 1826 and is 6 feet tall (unspecified length). The NYSDEC, USFWS, and City of Elmira have been working toward modifications at the Chase Hibbard Dam to facilitate fish passage, as well as recreational access. Projects have been proposed as part of the Chemung River Futures Project to bring an integrated system of recreational, environmental, and other benefits to the community. The resource agencies are interested in developing upstream passage for American shad, walleye, and white sucker (*Catostomus commersonii*). The NYSDEC currently stocks the Chemung River with American shad, walleye, and tiger muskellunge (*Esox lucius masquinogy*). Fish passage at this dam would provide access to approximately 200 miles of upstream habitat on the Chemung River, Tioga River, Cowanesque River, Canisteo River, Cohocton River, Hoffman Brook, Seeley Creek, and Canacadea Creek. The City of Elmira is interested in improving access to the river, providing a portage route, and potentially developing public parking for river access and whitewater rafting opportunities. The USFWS has provided preliminary designs for a Denil fishway to the City of Elmira and is proposing to complete the final design by the end of 2008. Additional information on the proposed fish passage and recreational enhancement can be found in the September 8, 2006, “Final Report - Chase Hibbard Dam Fish Ladder and Portage Study” (Bergmann 2006).



**Chase Hibbard Dam, Chemung County**

American Legion Pool Dam, Chenango County – This dam was removed as this report was being prepared. It was constructed on Canasawacta Creek within the City of Norwich in 1933. It was 6 feet high and served to form a recreational impoundment. The City of Norwich, with an interest in removal of this dam, began the permitting process in 2006. The small impoundment routinely filled with sediment and was dredged annually. Canasawacta Creek supports smallmouth bass and brook trout and discharges less than a mile downstream of the dam to the Chenango River.

Dam removal is expected to improve habitat accessibility for riverine fish, including brook trout. Since the habitat of Canasawacta Creek is impaired both upstream and downstream of this dam due to channelization, effective fish passage and stream restoration should include habitat improvements in adjacent stream reaches. The dam infrastructure was removed in 2007 as the first step in stream and fish passage restoration in this reach of Canasawacta Creek.



**American Legion Dam, Chenango County – Before (left) and after (right) infrastructure removal**

Newton Fish Line Dam, Cortland County - The Newton Fish Line Dam is a 225 foot long by 9 foot tall dam constructed in 1916 along the Tioughnioga River near the City of Cortland. Its purpose is not specified in the NYSDEC dam inventory. It is currently owned by Albany International, is partially breached and does not create an impassable barrier to fish. A river trail is proposed along this section of the Tioughnioga River. The owner has expressed an interest in dam removal. There may be contaminant issues to be addressed related to historical land use adjacent to the river (i.e., auto salvage yard).



**Newton Fish Line Dam, Cortland County**

East River Mill Dam, Cortland County - The East River Mill Dam is located on the East Branch of the Tioughnioga River just northeast of the City of Cortland. It is described in the NYSDEC dam inventory as 180 feet long, with an unspecified height and purpose. The dam is largely breached and does not impede fish passage. The current purpose of the dam is unknown and the owner's interest in potential dam removal is unknown.



**East River Mill Dam, Cortland County**

Upper Candor Dam, Tioga County - This dam is located on Catatonk Creek in the Village of Candor. It was constructed in 1920 and is 280 feet long and 7 feet tall (purpose: other). Some homes exist along the shoreline of the impoundment. Mitigation would improve habitat accessibility for a variety of riverine fish species, such as walleye, smallmouth bass, and suckers, with a remote possibility of opening up habitat for American shad. The dam face was recently rehabilitated by the Town of Candor, the current dam owner.



**Upper Candor Dam, Tioga County**

## D. Dam Mitigation Recommendations for Upper Susquehanna Watershed

### Watershed Size

One criterion for prioritizing the evaluation of dams in New York for mitigation opportunities is watershed size. Dams that influence larger watersheds, in general, frequently have more significant impacts on aquatic habitat than dams in smaller watersheds. The table below identifies the drainage area for the selected priority dam mitigation candidates selected by USFWS in the upper Susquehanna watershed pilot study. The USFWS notes that of the 9 dams which have the greatest potential for mitigation in the upper Susquehanna watershed, all but 1 dam is within a watershed greater than 20 square miles. We also note that dams on watersheds smaller than one square mile were not evaluated.

<b>Dam</b>	<b>Drainage Area</b>
East River Mill	not listed, East Branch Tioughnioga (drainage area at Cortland gauging station - 292 square miles)
Newton Line	not listed, West Branch Tioughnioga (drainage area at Cortland gauging station - 292 square miles)
Chase Hibbard	2,170 square miles
American Legion	20 square miles
Willow Point	3,880 square miles
Rock Bottom	2,300 square miles
Upper Candor	122 square miles
Center Village	3,700 square miles
M. Robert Beach	8 square miles

### Anadromous/Catadromous Fish Species

For restoration of passage of anadromous and catadromous species, such as American shad and American eel, it may be valuable to focus on removing downstream obstructions first. In the upper Susquehanna watershed, this entails establishing or improving passage at the Willow Point and Chase Hibbard Dams, followed by the Rock Bottom Dam. Ultimately, diadromous fish (including stocked American shad) may benefit from passage at the Upper Candor Dam.

### Riverine Fish Species

For riverine fish, focus on mitigating barriers that open up the greatest amount or highest value habitat. Just as with diadromous fish species, the maintenance and enhancement of these species depends on access to healthy riverine and/or wetland habitat. Upstream passage, as well as safe downstream passage, may be needed. Riverine fish species that may benefit the most from fish passage at dams in the upper Susquehanna watershed include the walleye, white sucker, smallmouth bass, largemouth bass, northern pike (*Esox lucius*), channel catfish (*Ictalurus punctatus*), brown trout (*Salmo trutta*), and brook trout.

## Species Considerations in Designing Fish Passage

It is generally important to implement fish passage projects that promote passage for a variety of fish species. When dam removal is not an option, it may be possible to design fish passage structures (fishways) or dam modifications, such as notches, weirs, or breaches to facilitate fish passage. Fishway designs are variable, depending on the swimming speed (sustained and burst), jumping ability and other behaviors of fish species of interest. A notch or breach in a dam may allow fish passage (at least for some species under certain flow conditions) without requiring dam removal or the installation of a fishway.

Passage through or past in-water structures by fish via a fishway or other type of dam modification is dependent on a number of factors, including species and life stage of fish, migratory motivation of the fish, water turbulence, in-water structure and amount of light. These factors should be considered in any dam removal or modification project<sup>2</sup>.

When designing fish passage or considering dam removal, consideration should be given to excluding invasive or nuisance species, in particular the sea lamprey (*Petromyzon marinus*). Although native to the Atlantic Ocean and its tributaries, this species is frequently considered detrimental to fisheries in the Great Lakes and elsewhere in New York State. A variety of exclusionary methods may be available, including weirs, electrical barriers, velocity barriers, barrier dams, lampricides, and baiting and trapping (Partnership for Saginaw Bay 2005). There are also more recent concerns about the impacts of fish passage on the spread of the fish disease, viral hemorrhagic septicemia (VHS). VHS has been found in the New York waters of Lake Ontario, Lake Erie, Conesus Lake, the Niagara River and the St. Lawrence River. It has caused mortality in species including muskellunge, smallmouth bass, northern pike, yellow perch, redhorse sucker and walleye. VHS may be spread through a variety of means, not all of which are known and could potentially be spread by natural movements of fish (<http://www.dec.ny.gov/animals/25328.html>).

Any dam removal or alteration project should evaluate the effects of the proposed action on freshwater mussels both upstream and downstream of the impoundment. Particular consideration should be given to Federally and State listed mussel species, such as the dwarf wedge mussel (*Alasmidonta heterodon*), clubshell (*Pleurobema clava*), Federal candidate species such as the rayed bean (*Villosa fabalis*) [also State endangered], State listed species such as the pink mucket (*Lampsilis abrupta*), and fat pocketbook (*Potamilus capax*), and State threatened species such as the brook floater (*Alasmidonta varicosa*), wavy-rayed lampmussel (*Lampsilis fasciola*), and green floater (*Lasmigona subviridis*).

## Look for Opportunities and Build Consensus and Partnerships

Consider dam mitigation projects that may not rank high in terms of providing significant benefits to fish, recreation, or water quality, but that may be easy to implement and have both

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<sup>2</sup> There is considerable variability among fish species and life stages of fish with respect to sustained swimming speed, one of the measures of a fish's ability to effectively swim against river/stream flow. For example, the sustained swimming speeds of adult eel and adult salmon may be in the range of 5.2 – 9.1 and 5 – 8.8 feet/second, respectively. Juvenile eel have a slower sustained swimming speed than adults at 0.8 – 2.6 feet/second. Adult white sucker have sustained swimming speeds of 1.2 – 2.1 feet/second and adult shad have sustained swimming speeds of 2.3 – 7.2 feet/second (Maine DOT 2004).



public support and available funding. These projects may provide a learning experience to help with future, more complicated, dam mitigation projects.

Keep abreast of New York State guidance to help dam owners and stream professionals implement successful dam mitigation projects. Suggestions are discussed in the Strategy in Section 2 of this document.

## E. Upper Susquehanna Watershed Pilot Study Dam Mitigation Matrices by County

The Dam Mitigation Matrices below are county tables with site assessment comments and ranking for the 94 dams that were evaluated during the pilot study. For each dam, the name and Federal identification number is provided, as well as the dam type, subject waterway, in-field comments, and the Overall Mitigation Rank. The latter incorporates a qualitative assessment of ecological benefits, public acceptance, and technical feasibility. Matrices are only included for selected New York State counties that are in the upper Susquehanna watershed with dams meeting the drainage area threshold of > 1 square mile.

### Dam Mitigation Matrix: Broome County

Dam	Dam Purpose	Waterway	Comments	Overall Mitigation Rank
Center Village NY00351	Other	Susquehanna River	Dam is partially breached, only blocks part of the river and migratory fish can likely pass; dam owner may be amenable to removal; dam currently not used for hydroelectric or other purposes	Med
White Birch Lake NY00358	Recreation	Tributary of Susquehanna River	Impoundment is used for recreation and surrounded with homes	Low
Greenwood Lake NY00549	Recreation	Tributary of Nanticoke Creek	Impoundment has public swimming and park; good fishing for rainbow trout, largemouth bass, panfish	Low
Nanticoke Creek #9A NY00567	Flood Control	Nanticoke Creek	PL 566 Project; Nanticoke Creek with good fishing for smallmouth bass, panfish; put and take fishery for brown trout <b>Note: all PL 566 dams in Broome County with largemouth bass, panfish, some rainbow trout</b>	Low
Nanticoke Creek #8 NY00573	Flood Control	Tributary of Nanticoke Creek	PL 566 Project; Nanticoke Creek with good fishing for smallmouth bass, panfish; put and take fishery for brown trout	Low
Nanticoke #9E NY00575	Flood Control	Tributary of Nanticoke Creek	PL 566 Project; Nanticoke Creek with good fishing for smallmouth bass, panfish; put and take fishery for brown trout	Low
Little Choconut #1A NY00578	Flood Control	Little Choconut Creek	PL 566 Project	Low
Nanticoke # 9C NY00628	Flood Control	Nanticoke Creek	PL 566 Project	Low
Finch Hollow Site #1 (Cliff Lake) NY00697	Flood Control	Tributary of Little Choconut Creek	PL 566 Project; reservoir has excellent fishing for rainbow trout	Low
Patterson Brixius Grey #1 (Toronto Reservoir) NY00698	Flood Control	Patterson Creek	PL 566 Project; good fishing for rainbow trout	Low

**Dam Mitigation Matrix: Broome County (Continued)**

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Nanticoke #10 NY00713	Flood Control	E. Br. Nanticoke Creek	PL 566 Project; Nanticoke Creek with good fishing for smallmouth bass, panfish; put and take fishery for brown trout	Low
Finch Hollow #2 (Savin) NY00719	Flood Control	Little Choconut Creek	PL 566 Project	Low
Little Choconut #2B NY00721	Flood Control	Tributary of Little Choconut Creek	PL 566 Project	Low
Little Choconut #2C NY00722	Flood Control	Little Choconut Creek	PL 566 Project	Low
Little Choconut #2E NY00723	Flood Control	Tributary of Little Choconut Creek	PL 566 Project	Low
Finch Hollow#3C NY00724	Flood Control	Trout Brook	PL 566 Project	Low
Patterson Brixius Grey #2 NY00725	Flood Control	Brixius Creek	Possible PL 566 Project	Low
Nanticoke #13 NY00777	Flood Control	Bradley Creek	PL 566 Project; Nanticoke Creek with good fishing for smallmouth bass, panfish; put and take fishery for brown trout	Low
Nathaniel Cole Park (Cole Park Recreation Lake) NY00931	Recreation	Still Creek	Regional park used for recreation; good fishing for smallmouth bass, panfish	Low
Joseph Torch Lake NY01029	Recreation	Honey Hollow Creek	Unable to access dam – appears to be private recreational lake	Low
Faith Association (Trade Winds Lake) NY01040	Recreation	Tributary of Wylie Brook	Private recreational lake; outlet structure is eroding	Low
Rock Bottom Dam NY01054	Water Supply	Susquehanna River	Fish passage identified as needed; dam interferes with navigation; natural channel bypass or whitewater park with fish passage under consideration	High
Nanticoke #7A NY01550	Flood Control	Tributary of Nanticoke Creek	PL 566 Project; Nanticoke Creek with good fishing for smallmouth bass, panfish; put and take fishery for brown trout	Low
Beaver Pond NY01552	None listed	Culver Creek	Private recreational club	Low
M Robert Beach NY11989	Recreation	Thomas Creek	Stream C(T) with Brook Trout	Med

**Dam Mitigation Matrix: Broome County (Continued)**

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Willow Point NY11990	Water Supply (Cooling)?	Susquehanna River	Dam does not provide complete barrier –small breach may provide some passage; dam is first obstacle for American shad in New York State	Med
Lepak Wetland NY14956	Wildlife	Unnamed Tributary	Impoundment constructed as wildlife habitat	Low
High Mountain Retention Basin NY14881	Flood Control		Dam is listed in Chemung County; coordinates place it in Broome County; no dam apparent at the location	
Kaskey Wildlife Marsh Dam NY14703	Wildlife	Trowbridge Creek	Dam never built per data sheet, but dam shows on aerial photo; should be re-checked.	
New York Transit Co. NY11988	Hydroelectric		Dam does not exist	
Luigi Casella Farm Pond NY12173	Recreation		Dam does not exist	
Edwards NY00340	Irrigation		Dam does not exist – 1850 construction date – timber crib	
Viehweger NY00343	Recreation		Dam does not exist – 1951 earthen dam	

**Dam Mitigation Matrix: Chemung County**

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Newtown Hoffman #1 (Marsh Dam) NY00547	Flood Control	Tributary of Newtown Creek	PL566 Dam	Low
Newtown Hoffman #3A NY00617	Flood Control; Recreation	Newtown Creek	Public park with camping, swimming; boat launch	Low
Hoffman Creek (Elmira Reservoir) NY00463	Water Supply	Hoffman Brook	Public water supply	Low
Newtown Hoffman #18 (Harris Hill Dam) NY00700	Flood Control	Hoffman Brook	PL 566 Dam; downstream Elmira Reservoir blocks all passage	Low

**Dam Mitigation Matrix: Chemung County (continued)**

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Newtown Hoffman #12E (Sullivanville Dam) NY01578	Flood Control	North Branch of Newtown Creek	PL 566 Dam	Low
Chase Hibbard NY11370	Water Supply	Chemung River	Fish passage (American shad) and portage objectives identified; City of Elmira commissioned report 9/06 to investigate passage and portage	High
Chemung County Flood Control #3 NY11487	Flood Control	Latta Brook	Very small impoundment, possibly used for livestock	Low
Newtown Hoffman #5A (Stanley Benjamin Sr. Memorial Dam) NY15054	Flood Control	Jackson Creek	PL 566 Dam	Low
Newtown Hoffman #2 NY00613	Flood Control		Dam does not exist	
Chemung County Flood Control #5 NY00903	Flood Control		Dam does not exist	
Wheaton Road #6 NY11486	Flood Control		Dam does not exist	
Jackson Creek #2 NY11488	Flood Control		Dam does not exist	
Beecher Creek Flood NY15070	Flood Control		Dam does not exist	
Lowes of Big Flats NY15077	Flood Control		Dam does not exist	

**Dam Mitigation Matrix: Chenango County**

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Norwich Reservoir #2 NY00349	Water Supply	Ransford Creek	Municipal water supply	Low
Mill Brook Site #1 NY00715	Flood Control	Tributary of Unadilla River	Dry dam on small stream; functions for flood control	Low

**Dam Mitigation Matrix: Chenango County (continued)**

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Lake Ludlow Club NY00350	Recreation	Ludlow Creek	Private cabins around impoundment; lake association maintains dam; important fishing lake; Ludlow Creek with good fishing for brown trout	Low
Genegantslet Creek Dam 2A NY00716	Flood Control, Recreation	Pond Brook	NYSDEC owned; flood control, fishing, picnicking; Genegantslet Creek has good fishing for brown trout and brook trout	Low
Glenn Lake Pond NY00730	Recreation	Lyon Brook	Private recreation; home built on impoundment	Low
Genegantslet Lake Dam NY00846	Recreation	Tributary of Genegantslet Creek	Homes around lake – owned by Genegantslet Lake Owners Association	Low
Bainbridge Reservoir NY00998	Water Supply	Yaleville Creek	No longer used as water supply; new house on impoundment	Med
Balsam Swamp NY01006	Other	Balsam Creek	NYSDEC owned, open to public for recreation	Low
Spencer I Shirdon Recreational Dam NY01019	Recreation	Gilmore Brook	Homes becoming established on impoundment	Low
Trestle Lake NY01445	Recreation	Eddy Brook	Dam is privately owned; impoundment used for fishing	Low
Guilford Lake NY01483	Water	Guilford Creek	Used as a water supply; houses and camps surround impoundment; NYSDEC fishing access; has good fishing for largemouth bass, pickerel, rainbow trout, walleye, and panfish	Low
Hunts Pond NY01496	Recreation	Tributary of Unadilla Creek	Dam owned by New York State Parks and Recreation; fishing, swimming, boating, and camping at impoundment; good fishing for largemouth bass, pickerel, panfish	Low
Mill Brook Site 2 NY01559	Flood Control	Tributary of Unadilla River	PL 566 Dam	Low
American Legion Pool NY12128	Recreation	Canasawacta Creek	City of Norwich interested in dam removal; Canasawacta Creek smallmouth bass and brook trout fishery; dam removal initiated in 2007	Med
Leafland Inc. Recreational Pond NY14315	Recreation	Center Brook	Dam does not exist	
George and Karen Low NY15025	Recreation	Keydron Brook	Recently built with house overlooking impoundment	Low

**Dam Mitigation Matrix: Cortland County**

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Little York (Upper Little York Lake) NY01023	Recreation	West Brook Tioughnioga River	Impoundment surrounded by homes and used for boating, other recreation; good fishing for brown trout, rainbow trout, largemouth bass, pickerel, panfish	Low
Stump Pond NY00746	Recreation	Willet Creek	Impoundment used for fishing and boating	Low
Crains Mill NY14251	None Listed	East Brook Tioughnioga River	Dam remnant is barely visible and not a barrier	Low – no mitigation needed?
Greek Peak (Hope Lake) NY01596	Recreation	Tuller Creek	Impoundment used for recreation	Low
Melody Lake (Ellis Lake) NY 00748	Recreation	Tributary of Willet Creek	Impoundment is privately owned and used for swimming, boating, and fishing	Low
East River Mill NY 14250	None Listed	East Brook Tioughnioga River	Dam is breached and serves no purpose as a dam; not an obstruction for fish passage; may interfere with boating.	Med
Newton Fish Line Factory NY11753	None Listed	Tioughnioga River	Dam is partially breached and dam owner is in favor of removal; may be sediment and contaminant issues	Med

**Dam Mitigation Matrix: Delaware County**

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Sidney Reservoir #2 NY14733	Water Supply	Collar Brook	Owned by Village of Sidney	Low
East Sidney Dam NY01211	Flood Control, Recreation	Oulcote Creek	USACE Owned – Federal	Low

### Dam Mitigation Matrix: Madison County

<b>Dam</b>	<b>Dam Purpose</b>	<b>Waterway</b>	<b>Comments</b>	<b>Overall Mitigation Rank</b>
Eaton Brook Reservoir NY00352	Navigation	Eaton Brook	NYSDEC identifies as excellent fishing reservoir for variety of species, including year-round trout season; boating; owned by New York State Canal Corp.	Low
Kingsley Brook Reservoir NY00353	Recreation	Kingsley Brook	Owned by New York State Canal Corp.; boating, fishing, swimming; homes around impoundment	Low
Lake Moraine Dam (Madison Reservoir) NY00354	Navigation	Payne Brook	Owned by New York State Canal Corp.; NYSDEC identifies as excellent fishing for variety of species, esp. largemouth bass, pickerel, crappie; boating	Low
Torpy Pond NY01014	Recreation	Tributary of Otselic River	Small impoundment owned by Torpy Pond Outdoor Club	Low
Claytons Dam NY01460	Recreation	Eaton Brook	Small privately owned impoundment	Low
Hatch Lake Dam NY01497	Recreation	Bradley Brook	Owned by New York State Canal Corp.	Low
Earlville Reservoir NY12082	None Listed	Tributary of Sangerfield River	Spillway eroded; non-functional dam; tributary to Sangerfield River; dam owner not in favor of removal (river with good fishing for variety of species, including brown trout)	Low-Med
Ozzie Roberts Recreational Lake NY12114	Recreation		Dam does not exist	
Earlville Upper Reservoir NY12124	Water Supply	Tributary of Sangerfield River	Need more information; tributary to Sangerfield River; dam owner not in favor of removal (river with good fishing for variety of species, including brown trout)	Low – Med
Lyons Pond Dam NY12274	Other	Oriskany Creek	Dam is in poor condition; deteriorating concrete	Low-Med



### Dam Mitigation Matrix: Tioga County

Dam	Dam Purpose	Waterway	Comments	Overall Mitigation Rank
Nanticoke Creek Site 7B NY00605	Flood Control	Ketchumville Brook	PL 566 Project; Nanticoke Creek with good fishing for smallmouth bass, panfish; put and take fishery for brown trout. <b>Note: all PL 566 dams in Tioga County with largemouth bass, panfish, some rainbow trout</b>	Low
Upper Waverly Dam NY00622	Water Supply	Dry Brook	Public water supply	Low
Waverly Lower Reservoir NY00623	Water Supply	Dry Brook	Public water supply	Low
Barnes Creek NY00876	Recreation	Barnes Creek	Could not access; aerial photograph shows reservoir that appears dewatered	Low
Owego Contracting Company NY00933	Recreation	Pipe Creek	Private pond	Low
Upper Candor Dam NY00938	Other	Catatonk Creek	Low head dam with no stated purpose; Catatonk Creek fishing for smallmouth bass and largemouth bass; passage would enhance fish access to habitat; some homes around impoundment	Med
Spencer Lake NY00941	Recreation	Catatonk Creek	Lake used for recreation, several homes. Proposal to build Art and Environmental Education Center	Low
Spencers Lake Dam NY01425	Recreation	East Branch Nanticoke Creek	Homes around small impoundment, fishing, boating	Low
Wilburt Widell NY01548	Recreation	Deerlick Creek	Dam does not exist	
Catatonk Mill Dam NY11628	Hydro-electric	Catatonk Creek	Dam does not exist	
Lower Candor dam NY11629	None Listed	Wilseyville Creek	Dam removed in 2005	
Lyon Wetland NY14984	Wildlife	Not listed	This is a USFWS Partners for Fish and Wildlife Project, constructed at a former beaver dam	Low

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