

Proposal

Maranacook Lake

Watershed Hydrologic Study



Towns of Winthrop & Readfield, Maine | September 26, 2014



September 26, 2014

Mr. Jeffrey Woolsten
Town Manager
Town of Winthrop
17 Highland Avenue
Winthrop, ME 04364

**Re: Request for Proposal
Maranacook Lake Watershed Hydrologic Study
Winthrop and Readfield, Maine
MMI #4347-02-0**

Dear Mr. Woolsten:

Milone & MacBroom is pleased to submit our qualifications and proposal to perform a hydrologic study of Maranacook Lake. We have assisted communities, lake associations and dam owners throughout the northeast by developing hydrology models to predict runoff patterns and evaluate lake storage. As your Project Manager, I will rely on the experience of our skilled hydrologists, as well as my personal expertise to identify solutions that will optimize lake levels. This will require reviewing not only historic lake operations, but in my opinion, should also include discussions of climate change and potential changes to rainfall and flooding patterns, as these changes will effect lake levels and future dam operations.

While my expertise lies in hydrologic analysis and model development, there seems little point in modeling dam scenarios that for one reason or another cannot be constructed. To that end, the Milone & MacBroom project team includes design engineers with expertise in design of new and modifications to existing dams. Once lake levels are optimized, property owners will need to stabilize the shorelines that have been damaged by the higher than normal lake levels. While you do not need bank stabilization expertise in this current phase of work, I have included some of our experience in this area to show the review committee that we have a holistic and well-rounded experience base that I believe will serve you well.

We are excited about this opportunity to work with town staff, the Maranacook Lake Dam Outlet Committee, and property owners to evaluate alternatives and identify solutions to enhance the enjoyment of this critical recreational resource in central Maine. If you have any questions about our proposal or qualifications, please do not hesitate to e-mail me at nicolleb@miloneandmacbroom.com or call me at (860) 690-1341.

Very truly yours,

MILONE & MACBROOM, INC.

A handwritten signature in black ink, appearing to read "Nicole" followed by a stylized flourish.

Nicolle Burnham, P.E., CFM
Senior Project Manager, Water Resources

Table of Contents

Maranacook Lake Watershed Hydrologic Study

Letter of Transmittal

Section 1	Summary of Qualifications	
	• Firm Overview	1
	• Relevant Capabilities	2
	• Key Staff Summary	3
Section 2	Technical Proposal	
	• Project Understanding	5
	• Scope of Services	6
	• Professional Fees	7
Section 3	Project Team	
	• Organization Chart	8
	• Professional Resumes	9
Section 4	Relevant Experience	
	• Project Sheets	34



Summary of Qualifications

Maranacook Lake Watershed Hydrologic Study

FIRM OVERVIEW

Milone & MacBroom is a multidisciplinary firm that over the last three decades has been offering services in water resource and civil engineering; dam inspection, repair, and removal; hydrologic and hydraulic analysis; stream restoration; geomorphic assessment; environmental science; land use analysis and community planning; environmental planning; regulatory permitting; construction inspection and management; landscape architecture; land survey; and mapping. Our employee-owned firm supports a staff of approximately 135 people, representing previous employment in government, academia, and private industry, as well as professional experience in the various design disciplines.

Milone & MacBroom accepts projects only in disciplines in which its principals and senior personnel are experienced, thus assuring a high quality of professional services. Our staff includes engineers, environmental scientists, land use planners, landscape architects, construction inspectors, and surveyors. The size of the firm enables us to provide a wide range of technical capabilities and, at the same time, allows senior personnel to be intimately involved in each project we undertake. The firm combines the expertise of environmental, water resource, and civil engineers with that of our environmental scientists, landscape architects, and support staff to apply a collaborative approach to all of our projects. Our areas of expertise include the following:

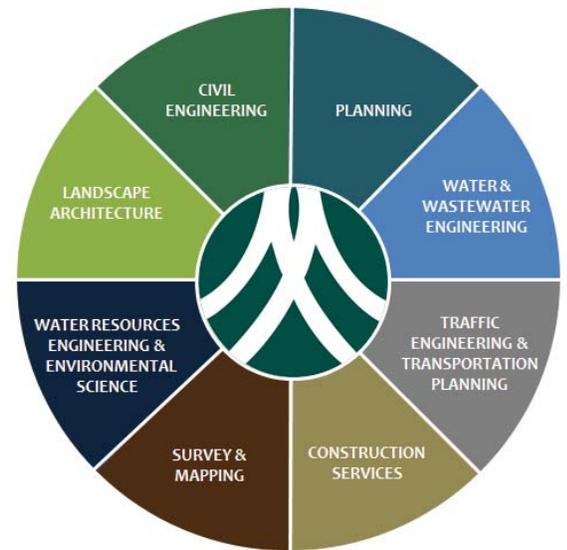
- Hydraulics and Hydrology Analysis – Licensed Professional Engineers
- Dam Safety Engineering – Licensed Professional Engineers
- Civil and Structural Engineering – Licensed Professional Engineers
- Landscape Architecture – Licensed Landscape Architects
- Environmental Assessment – Certified Professional Wetland Scientists and Wildlife Biologists
- Fish Passage Assessment and Design – Licensed Professional Engineers, Designers, and Fisheries Biologists

Milone & MacBroom has a regional office located in Portland, Maine, and nearby offices in Waterbury, Vermont; Springfield, Massachusetts; and Cheshire, Connecticut. Our project experience includes numerous dam assessments, rehabilitations, and removal projects located throughout New England. The majority of the work will be performed by staff in our Maine office with support from our Waterbury, Vermont office and that staff will draw upon specialized expertise and additional resources from our Cheshire, Connecticut office. The Project Manager for this assignment is **Nicolle E. Burnham, P.E., CFM**. Nicolle oversees the Portland Maine office and divides her time between our Portland, Maine and Cheshire, Connecticut offices where she successfully serves clients in both regions. Her contact information is listed below.

Nicolle E. Burnham, P.E.
Milone & MacBroom
nicolleb@miloneandmacbroom.com
(860) 690-1341

Maine Coast Survey

We will be using Maine Coast Survey for field survey for this project. Maine Coast Surveying was founded in 1979 and quickly grew to be one of Lincoln County's largest surveying firms. It has become a statewide leader in surveying excellence and has provided highly specialized survey services in support of Milone & MacBroom's water resource projects in the past. Maine Coast Surveying enjoys an excellent reputation for providing professional services and for representing its clients in court and before state and local permitting agencies. They have performed hundreds of boundary surveys, as well as subdivisions, site plans, flood hazard surveys, mortgage loan inspections, route surveys, construction stakeout, and topographic mapping. Maine Coast Survey equip their field crews with state-of-the-art equipment and are fully capable of



Summary of Qualifications

Maranacook Lake Watershed Hydrologic Study

performing any type of surveying. They own and use Trimble single phase GPS receivers for survey control purposes and “Pathfinder” units for GIS mapping.

RELEVANT CAPABILITIES

Our project team has extensive experience working with hydrologic and hydraulic models to assess dams, lakes and river systems. Not only do we have the experience to handle complex and challenging projects, but we love working with our clients to assess and develop the most innovative and feasible solutions. Following is a summary of our expertise that will be relevant to the Maranacook Lake Dam Outlet Evaluation. While not all of this expertise is needed for this current phase of work, we believe that our well rounded project team will allow us to develop dam improvement scenarios that will be constructable in future work phases.

Complex Hydrology

Milone & MacBroom is a recognized expert in river flow modeling and a leader in analyzing watersheds and riverine systems using TR-20, HEC-1, and HEC-HMS. We have worked on hydrology models that involve complex structures, diversions and analysis of impoundments. Our staff routinely develop models for large complex watersheds such as the 12 square mile Harbor Brook watershed; as well as to support dam modification projects.

In addition to providing the basis for design, our models are developed to meet the technical standards and permitting requirements necessary to comply with FEMA as well as other state and federal agencies. Many of our past projects have involved complex hydrologic and hydraulic analysis, structural analysis, and regulatory permitting.

Dam Improvement Design

Milone & MacBroom has a long track record of experience in the planning, design, and construction of improvements for earthen, masonry, and concrete dams and their associated spillways. Typical improvements have included surveys, borings, seepage control, hydrology, spillway design, concrete and masonry repair, erosion control, gate house repairs, blow-off improvements, permits, cost estimates, construction administration, and construction inspection. Staff is proficient in dam breach analysis, HEC-RAS, emergency response planning, and PMF analysis. In addition to dam analysis, design, and repair, Milone & MacBroom is a recognized leader in dam alterations for fish passage. The firm provides structural engineering services through our in-house engineers, including structural analysis of dams and spillways.



Fish Passage at Dams

Milone & MacBroom offers a unique experience in the areas of fish passage design. We have been involved in project scoping; conducted feasibility analysis for dam removal, bypass channel, and fish ladder studies; prepared preliminary/final design plans and specifications; developed construction cost estimates; led regulatory permitting efforts; and provided construction administration and inspection services.

Shoreline Stabilization Design

Our wetland scientists, landscape architects and water resource engineers routinely collaborate on the planning and design of shoreline stabilization projects. This has ranged from design and permitting of complex projects on high velocity river systems such as the Noroton River stabilization to development of the first of its kind shoreline stabilization manual for Candlewood Lake. This lake is FERC regulated and our manual is intended to provide homeowners a guide for the establishment and maintenance of vegetated buffer zones. The guides addresses the requirements of the Federal Energy Regulatory Commission, as well as the goals of FLP to develop a more ecologically and environmentally sensitive and proactive approach to preserving impoundments.

Summary of Qualifications

Maranacook Lake Watershed Hydrologic Study

Climate Change Adaptation

The firm's water resource engineers have been at the forefront for guiding our clients to make design decisions based on both current and potential future trends in the climate of the northeastern United States. We educate our clients about the history of rainfall and runoff patterns in their watersheds and help them make informed decisions about how these patterns affect design. Our goal is to ensure our recommended improvements and designs are able to stand the test of time and meet both current and future environmental conditions.

Wetland Biology

Milone & MacBroom has in-house wetland delineation, functional assessment, and field survey capabilities, as well as wildlife and up-land vegetation survey and analysis capabilities. Our certified wetland scientists and wildlife biologist have performed comprehensive surveys and field investigations on thousands of acres of undeveloped land, including vernal pool assessments, studies of threatened and endangered species, macro benthic analysis, and functions and values evaluations.



Stream Corridor Habitat Improvements and Stream Restoration

Milone & MacBroom has developed the reputation of being a leading firm in restoration work, having received the Governor's Environmental Award and design awards from the American Fisheries Society; National Endowment for the Arts; the National Trust for Historic Preservation; the Trust for Historic Preservation; and the American Society of Landscape Architects. The firm offers its clients technically sound design solutions that are aesthetically pleasing and environmentally sensitive. The project team has led many stream corridor habitat restoration projects, working with local municipalities, watershed management groups, and the regulatory agencies. Our approach to these types of projects considers natural river forms and processes from both physical and biological perspectives. The resulting projects address the restoration and stabilization concerns, as well as providing opportunities to protect or enhance the existing natural resources.

Graphic Rendering and Photo Augmentation Capabilities

Project team planners and landscape architects are at the forefront of graphic photo-simulations, comparing existing and future proposed conditions by digitally enhancing photographs. We have also developed conceptual illustrations working with our in-house artists on site and stream restoration and development projects. The team routinely prepares artistic graphic renderings for our conceptual designs. These have been invaluable to public outreach efforts.

KEY STAFF SUMMARY

The project team represents professional experience and educational backgrounds in water resources engineering; civil engineering; wetland ecology, fisheries biology, and environmental management. All project teams are led by carefully selected project managers who combine the necessary management in addition to their scientific or engineering expertise. We believe that the project team brings together a unique combination of experience and specialized skills required to successfully complete the Maranacook Lake Watershed Hydrologic Study. A brief summary of key staff qualifications follows.

Nicolle E. Burnham, P.E., CFM has served in the Water Resource Engineering group at Milone & MacBroom for over 17 years. Her background includes development of complex hydrology models for various sized watersheds and providing analysis of historic and future conditions to facilitate design improvements. Nicolle divides her time between our Portland Maine and Cheshire Connecticut offices where she successfully serves clients in both regions. She will serve as the Project Manager and will be the primary contact to the Maranacook Lake Dam Outlet Committee.

James G. MacBroom, P.E. has over 30 years of experience in hydrology; hydraulics; fluvial geomorphology, flood control; dams; and the restoration of streams, lakes, and wetlands. He has been at the forefront of fish passage and stream restoration projects throughout New England, the east coast, and in the Midwest. Jim is the author of "The River Book." This educational manual was published to help guide local communities and design professionals in understanding

Summary of Qualifications

Maranacook Lake Watershed Hydrologic Study

riverine functions and establishing management strategies. He is recognized as a national expert on dam removal, and has taught and presented at venues throughout the country. Jim is actively involved in the production arm of projects on a daily basis and would be intimately involved with the field assessment and engineering design aspects of this project.

Dustin Roma, P.E. is a Lead Engineer in the firm's Portland office and will provide technical expertise and oversight for this project. He will be responsible for data collection and evaluation as well as reviewing the modeling and improvement scenarios for consistency with Maine's regulatory standards. Dustin's current workload includes assisting SAPPI with management of their seven dams on the Presumscot River and compliance with FERC and state of Maine requirements for managing these structures.

Roy Schiff, Ph.D., P.E. brings a background and formal education that spans both environmental science and classical water resource engineering. He has researched and performed field work in various aspects of aquatic ecosystem and watershed studies including stream restoration, fluvial geomorphology, stream biology, hydrology/hydraulics, aquatic chemistry, and land use analysis. Most recently, Dr. Schiff led the firm's efforts on the Briggsville Dam, and Dufresne Pond Dam. He has been a major contributor on many of the firm's guideline documents and has lectured extensively on stream restoration.

Edward Hart, P.E. has over 30 years of experience spanning various areas of civil engineering with an emphasis on dam design and restoration. His recent work includes improvements at the Lydall Reservoir Spillway, Harvey's Lake Dam improvements and design and construction oversight of the Bunnells Pond Dam. Ted is experienced with dam safety regulations, dam breach analysis, hydrologic analysis, inundation mapping and design of earth and concrete structures. He will lend expertise to the team in evaluating potential improvement scenarios.

Professional resumes are located in Section 3 of this submittal.

Technical Proposal

Maranacook Lake Watershed Hydrologic Study

PROJECT UNDERSTANDING

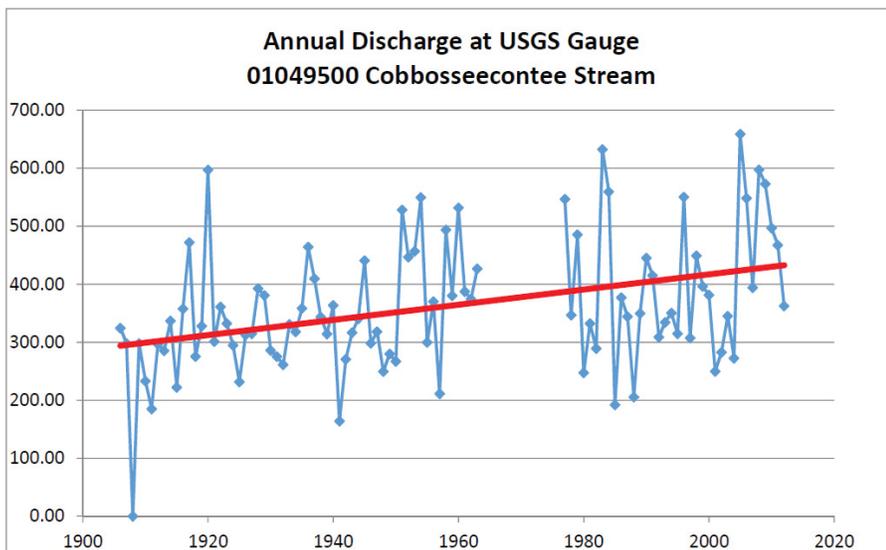
Maranacook Lake is comprised of two basins totaling approximately 1,700-acres and is located in the Towns of Readfield and Winthrop, Maine. The 700-acre north basin is located in Readfield and has a maximum depth of 42-feet. The south basin is primarily located in Winthrop and is approximately 1,000-acres with a maximum depth of 118-feet. The Maranacook Lake Outlet Dam is located on the southern tip of the south basin downstream of the Bowdoin Street bridge and is jointly owned by both Towns. The watershed area upstream of the lake is approximately 22 square miles.

The original dam was owned by Carleton Woolen Mills and was rebuilt in 1995 to include a single spillway and gate. In an attempt to better regulate lake levels, a second spillway was added. Following the towns' acquisition of the dam in 2006, the original spillway was cut down 15-inches to further attempt to achieve the desired lake levels on a regular basis. Despite the previous efforts, lake levels in the impoundment continue to reach undesired levels too frequently.

Design issues with the 1995 spillway and dam are exacerbated by the changes in rainfall and runoff patterns observed in the state of Maine and throughout the northeast over the past 100 years. Past trends in stream flows through Maranacook Lake are reflected in stream flows recorded at the USGS gauge station on the Cobboseecontee River in Gardiner. The graph below depicts average annual stream flows over the life of the gauge station (Note that there is a gap in data from 1963 to 1977). Annual stream flow is measured by determining the average flow for each calendar day and then averaging those over the 365 days of the calendar year. The blue line depicts the average stream flow for the given year in cubic feet per second. The red line shows the trend of the data. Based on this we can clearly see that average flow in the river has increased from approximately 300 cubic feet per second to over 400 CFS. While flows would be less at Maranacook Lake, we would expect to see a similar trend of increasing flows. Without knowing the details of the 1995 design it is not clear if the spillway and dam were appropriately sized for the stream flows at that time. Regardless, if the towns are planning to undertake modifications to the spillway to regulate lake flows more effectively we believe it is critical to consider not only this historic data, but also its implications for future streamflows.



Existing Maranacook Lake Dam and Spillway



Technical Proposal

Maranacook Lake Watershed Hydrologic Study

During the 1970's and 1980's, full pond elevation of Maranacook Lake was set seasonally. Data collected during the past eight years by the Cobbossee Watershed District indicates during the spring the pond water elevation has been exceeded by approximately one-foot each year. During the summer months typical water levels drop to one-foot below the desired full pond elevation; however, as of recently, this has not been happening and even with the gate being continuously open, the fall draw down of the lake has not been adequate to prepare for spring runoff.

The Maranacook Lake Outlet Dam Committee has been appointed to make recommendations to the Towns regarding maintenance needs or modifications needed at the dam to achieve the water level goals in the lake. Before making recommended structural changes to the existing dam, a hydrologic model of the watershed will need to be prepared and analyzed to run several different scenarios to determine the best alternative to achieve lower lake levels from extreme events and drawdown capability.

A TR-20 or HEC-HMS model will need to be developed to model the 27 square mile Maranacook Lake Watershed. The model will be calibrated using the existing structure, the provided precipitation data, and lake level data. This will also include water level and dam operation data from the Torsey Pond Watershed located upstream of Maranacook Lake. Utilizing the model to represent lake levels and outlet runoff from the dam for the 100%, 50%, 10%, 4%, 2% and 1% annual chance events will be critical for the analysis of the current dam configuration, as well as other hypothetical dam configuration scenarios which may include longer spillways, lower spillways, larger pipes, etc. moving forward. It will be important to discuss with the Committee the target lake levels during different seasons to aid in the evaluation of the various scenarios.

The final product of our work will be a report that describes the undertaken tasks, alternatives evaluated, and a recommended action plan. This will include data results with regard to specific modeled storms' impact on water levels with current and hypothetical dam modifications. We will also include instructions and guidance for the Committee's future use of the model when the study is complete.

SCOPE OF SERVICES

Task 1 – Project Coordination and Meetings

- 1.1 Prepare for and attend one meeting of the Maranacook Lake Outlet Dam Committee. The purpose of this meeting will be to communicate the project analysis and results.
- 1.2 Throughout the project duration, coordinate with the Committee to provide project updates and technical information.

Task 2 – Data Collection and Field Verification

- 2.1 Compile and review existing available mapping and aerial photography of the watershed and the structures that control flow. The following data, mapping, reports, and information will be sought:
 - Available construction drawings and hydraulic modeling of the bridge crossings;
 - Maine Department of Transportation (DOT) bridge inspection reports;
 - Available aerial photogrammetry, topographic mapping, and/or GIS data of the watershed area. It is assumed that watershed mapping will be compiled from Maine GIS LIDAR data;
 - Soil and surficial and bedrock geologic mapping from publicly available Geographic Information Systems data; and
 - Reports of lake water levels and precipitation data that have been compiled and documented.

Technical Proposal

Maranacook Lake Watershed Hydrologic Study

Task 3 – Field Survey

- 3.1 Using the services of a survey subcontractor perform field survey of the existing dam structure, the Bowdoin Street bridge, the railroad bridge that separates the north and south basin, and Torsey Pond outlet. Elevations will be developed in the North American Vertical Datum of 1988.

Task 4 – Existing Conditions Hydrologic Model

- 4.1 Develop a hydrologic model of the watershed using the U.S. Army Corps of Engineers' HEC-HMS modeling software. Development of this model will include delineation of the overall watershed and appropriate subwatersheds, determination of land use and soil types to develop runoff curve numbers, and calculation of time of concentration for each subwatershed. The model will be used to predict peak runoff rates and water surface elevations at the Maranacook Lake Dam for the 1, 2, 5, 10, 25, 50 and 100-year events.
- 4.2 Evaluate future rainfall scenarios and estimate lake water levels and discharge rates under such scenarios.
- 4.3 Analyze available precipitation and lake level data provided by the Committee and use such data to calibrate the HMS model to the extent practicable.

Task 5 – Evaluate Mitigation Alternatives

- 5.1 Evaluate potential alternatives to the spillway and dam to provide water surface elevations in the Committee's target range for operation of the dam and use of the lake. Alternatives may include full replacement of the dam and spillways or modification of the existing structure.

Task 6 – Engineering Report

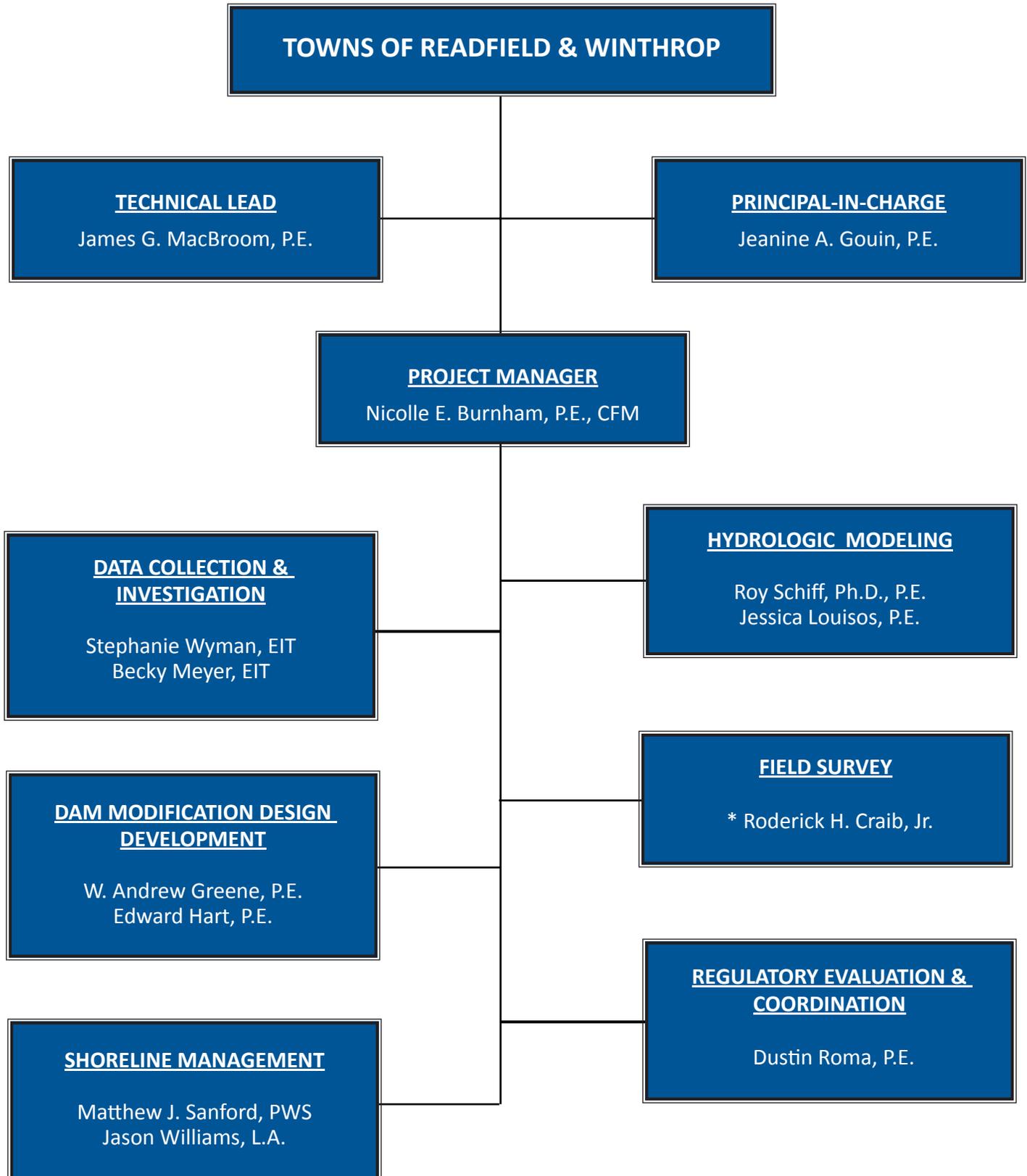
- 6.1 Document the results of the data collection, mapping, and hydrologic modeling efforts in a written report. The report will include documentation of the development of the HEC-HMS model and associated backup data, as well as results of analysis of various storm events. Results of proposed conditions modeling efforts will be described for the various potential dam configurations and their effect on water surface elevations in the lake presented.
- 6.2 Provide the draft report to the Committee for review and comment.
- 6.3 Modify and revise the report based on comments from the Committee and provide the final report in paper and electronic format for its future use. Modeling computer files will also be provided electronically.

PROFESSIONAL FEES

The work described in Tasks 1 through 6 above will be completed for the lump sum fee of \$29,500, plus direct expenses. Direct expenses include reproduction costs, mileage from our Portland, Maine office, etc.

Organization Chart

Maranacook Lake Watershed Hydrologic Study



* Subconsultants - Maine Coast Survey

Jeanine Armstrong Gouin, P.E., Vice President

Director of Water Resources Engineering & Environmental Science

Years of Experience:

With This Firm: 20
With Other Firms: 7

Education:

B.S., Civil Engineering (Magna Cum Laude)
University of Connecticut
Storrs, CT

License/Certification:

Professional Engineer
- Connecticut

Professional Affiliations:

American Society Civil Engineers, Member
Advisory Board Member, University of Connecticut School of Environmental and Civil Engineering
USDA Natural Resource Conservation Service Advisory Committee for its Rapid Watershed Assessment in Southeastern Connecticut



Ms. Gouin is a Vice President and Managing Director of the firm and has been practicing in the field of water resources engineering for over 25 years. Ms. Gouin is well versed in many different aspects of environmental resource assessment, including groundwater and surface water hydrology, instream flow analysis, inland wetlands, wildlife habitat, and fisheries biology. She routinely applies this expertise in evaluating, and often avoiding environmental impacts. Ms. Gouin has conducted Environmental Assessments (EAs), Environmental Impact Evaluations (EIEs), and Environmental Impact Reports (EIRs) under CEPA, NEPA, and MEPA for a variety of project types. She oversees the firm's Water Resources Engineering & Environmental Science Division.

Highlights of Ms. Gouin's project experience follow:

Howland Dam Bypass Channel Howland, Maine

Researched the design and performance of fish bypass channels and evaluated alternative passage opportunities at the 730 foot long Howland Dam. Subsequently led the project team during engineering design and regulatory permitting efforts.

Harbor Brook Flood Control Meriden, Connecticut

Project Manager for this major flood control project which included a comprehensive watercourse inventory of over four miles of stream corridor, hydrologic and hydraulic evaluations, and evaluation of alternatives to improve flooding problems in downtown Meriden.

Jordan Brook Flood Control Meriden, Connecticut

Project Manager for the conduit assessment, including inspection, hydrologic and hydraulic analysis, and preliminary design of repairs in a collapsed section of the brook.

Fish & Kayak Passage Willimantic, Connecticut

Conducted feasibility assessment, hydraulic modeling, and conceptual design of this dam removal and kayak passage project, working with numerous technical volunteers and multiple project stakeholders.

Spicket River Inventory and Plan Lawrence, Massachusetts

Conducted resource assessment and developed recommendations for the Spicket River corridor through the Town of Lawrence. Priority concerns for the inventory included erosion and unstable banks, in-stream habitat, water quality, hydrology/hydraulics (stormwater flow impediments, etc.), and invasive species.

Water Street Bridge over Town Brook Plymouth, Massachusetts

Principal-in-Charge and Technical Advisor overseeing the engineering analysis, regulatory permitting, and preliminary and final design of a weir removal and bridge replacement over Town Brook. The project combined fish passage at the tidal interface near Plymouth Harbor with replacement of an aged bridge. The design included a single span three-sided box culvert structure, weir removal, and a fish passable rock ramp. Integral to the project was hydraulic modeling, scour analysis, and a complex water control plan.

**Wallace Dam Fishway
Wallingford, Connecticut**

Project Manager responsible for the design of a Denil fishway for passage of anadromous fish past the Wallace Dam on the Quinnipiac River in Wallingford, Connecticut.

**Cannondale Dam Removal Fish Bypass Channel
Norwalk, Connecticut**

As part of a project team, developed restoration plans for construction of a bypass channel around this low head dam in Norwalk, Connecticut. Project plans were developed in coordination with Trout Unlimited, the Natural Resource Conservation Service, and the Department of Energy and Environmental Protection. The project was subsequently constructed.

**Tingue Dam Instream Fishway
Seymour, Connecticut**

Part of the design and permitting team for this major fish bypass channel around the Tingue Dam near State Route 8, working with extensive coordination with the State Departments of Energy and Environmental Protection and Transportation.

**Ball Pond Brook Analysis and Permitting
New Fairfield, Connecticut**

Project Manager for hydraulic analysis and preparation of a Connecticut Flood Management Certification for construction of a new pedestrian bridge adjacent to a State roadway, working with the Town, the Department of Energy and Environmental Protection, and the Department of Transportation.

**West River Restoration
New Haven, Connecticut**

Conducted a preliminary engineering study of upper West River tidal marshes to evaluate the restoration potential. Provided preliminary and final design phase engineering and regulatory permitting support for the proposed hydraulic modifications to the existing tide gate and the resulting marsh restoration.

**Lower Bronx River Fish Passage
Bronx, New York**

Evaluated fish passage at three dams along the Lower Bronx River for habitat restoration and developed design plans for three fishways. Dam inspection and repair design was also completed for one of the three dams.

**Tompkins County Watershed Management Study
Ithaca, New York**

Project Manager and Technical Specialist for this watershed needs assessment in Tompkins County as part of a planning and mitigation effort to enable individual restoration projects to be assessed and evaluated based on their merit and function within the framework of the overall watershed needs.

**Farmington Environmental Resource Inventory and Plan
Farmington, Connecticut**

Project Manager for a townwide natural resource assessment. The study included mapping and analysis of critical and unique wetland and watercourse systems, evaluation of habitat for unfragmented natural areas, analysis of water quality and benthic habitat in critical locations, formulation of a policy to address the management of stormwater runoff, and examination of carrying capacity in areas of sewer avoidance.

**Inventory and Plan and Removal of Invasive Plant Species
Farmington, Connecticut**

Served as Project Manager for development of an inventory and management plan for the control and/or removal of invasive species on 13 open space parcels encompassing over 400 acres of land.

James G. MacBroom, P.E.

Senior Vice President

Years of Experience:

With This Firm: 29
With Other Firms: 12

Education:

M.S., Civil Engineering
University of Connecticut
Storrs, CT
B.S., Civil Engineering
(Cum Laude)
University of Connecticut
Storrs, CT

License/Certification:

Professional Engineer
- Connecticut
- Massachusetts
- New York
CTDOT Approved Hydraulic
Engineer



Mr. MacBroom has been practicing civil engineering since 1973 and is a nationally recognized expert in water resources engineering and environmental planning. He has developed a reputation for his extensive experience in natural channel design for both river restoration / dam removal and for flood mitigation. He serves on two national committees involved in setting policy related to sediment management in natural systems. One of these, the ASCE National Sedimentation Committee is responsible for supporting technical research and developing and implementing ASCE policy on sediment transport, scour, and bank erosion among other things. He is an adjunct lecturer at Yale University and for the University of Wisconsin. Mr. MacBroom is a founding partner of Milone & MacBroom, Inc. and serves as one of its Managing Directors. Mr. MacBroom was previously a FERC-approved hydraulic engineer.

Mr. MacBroom has led and participated in numerous large scale watershed plans encompassing entire drainage basins, preparing to evaluate runoff, sediment loads, land use, or water quality. Early 1970's watershed plans focused on stormwater runoff and flooding issues. Watershed plans in Tompkins County, New York and for the Regional Water Authority have concentrated on urban sprawl, channel degradation, sediment sources, and water quality.

Highlights of Mr. MacBroom's project experience follows:

Scour Analysis Training

Maine Department of Transportation

Developed and presented a training program on scour analysis protocols for Maine DOT staff. This one day session covered topics ranging from collection of field data, the importance of understanding the overall morphologic setting of the structure, sediment stability and transport, FHWA HEC-18 and HEC-23 protocols and limitations and next generation methods of scour evaluation.

Hitchcock Lake Dam Emergency Operation Plan

Wolcott, Connecticut

Project Director for the preparation of an emergency operations plan for the Hitchcock Lake Dam in Wolcott. Reviewed dam breach inundation mapping, delineated inundation areas on base maps with overlay parcel mapping and FEMA-designated flood zones, tabulated names and addresses of property owners in the inundation areas, mapped evacuation areas and routes, conducted a reconnaissance-level inspection, and compiled emergency contact information.

Heishmann Dam Fish Bypass

Carlise, Pennsylvania

Provided engineering services for the construction of a bypass channel for a 140-foot long structure located on Conodoguinet Creek. Also performed site surveys, reviewed hydrology data, conducted a geomorphic analysis, and then analyzed the bypass channel with a HEC-RAS computer model to verify flow depths, velocity, and stability.

Darien Flood Mitigation Strategy

Darien, Connecticut

Technical Director for town-wide studies of flood issues and hazard mitigation strategies. Developed hydrology data, river inspections, and hydraulic RAS computer models. Participated in a series of public meetings for Noroton River, Stoney Brook, Goodwives River, and Five Mile River.

Professional Affiliations:

American Rivers, Scientific
Advisory Committee
ASCE River Restoration
National Committee
Association of State Dam
Officials
Association of State
Floodplain Managers
CTDEP Hydrology
Committee
CTDEP River Advisory
Committee
Heinz Foundation Panel on
Dam Removal
New York Academy of
Science
Riverfront Recapture, Inc.
CTDEP – Committee on
Climate Change

**Dam Emergency Operations Plans, Norwich Public Utilities
Norwich, Connecticut**

Project Director for the preparation of emergency operations plans for the Stony Brook, Deep River, Fairview, Bog Meadow, and Taftville Reservoirs #1 and #3. Reviewed dam breach inundation mapping; delineated inundation areas on base maps with overlay parcel mapping and FEMA-designated flood zones to characterize the populations and number of structures in these areas; tabulated names and addresses of property owners in the inundation areas; mapped evacuation areas and routes; conducted reconnaissance-level inspections of each dam and the downstream inundation areas; and compiled emergency contact information for NPU, municipal officials, and State agencies.

**Morris Creek and Tidegate
East Haven, Connecticut**

Project Manager for a multi-year study of tidal and freshwater flooding plus marsh restoration associated with an industrial park and airport. Conducted extensive tide gauging, hydrology, soil tests, vegetation inventories, and a 2-D model.

**Bronx River Dam Safety Assessment
Bronx, New York**

Project Director for a study to assess anadromous fish restoration and passage along the Bronx River. The project focus was on the 182nd Street Dam, Bronx Zoo Dam, and the Snuff Mill Dam in the renowned New York Botanical Gardens. The dams range from 8 to 12 feet high and all are in public parks. Also developed a HEC-RAS hydraulic computer model to evaluate river water profiles, velocity, and stability. Dam inspection and repair design was also completed for one of the three dams.

**Mixville Pond Dam Emergency Operations Plan
Cheshire, Connecticut**

Project Director for the preparation of an emergency operations plan for a public Class C dam in Cheshire. Reviewed dam breach inundation mapping; delineated inundation areas on base maps with overlay parcel mapping and FEMA-designated flood zones to characterize the populations and number of structures in these areas; tabulated names and addresses of property owners in the inundation areas; mapped evacuation areas and routes; conducted reconnaissance-level inspections of each dam and the downstream inundation areas; and compiled emergency contact information for dam operators, municipal officials, and State agencies.

**Spicket River Natural Resource Inventory
Lawrence, Massachusetts**

Conducted resource assessment and developed recommendations for the Spicket River corridor through the Town of Lawrence. Priority concerns for the inventory included erosion and unstable banks, in-stream habitat, water quality, hydrology/hydraulics (stormwater flow impediments, etc.), and invasive species.

**Farmington River Trail over Rattlesnake Brook
Canton, Connecticut**

Responsible for the completion of scour analysis at former railroad bridge over Rattlesnake Brook in preparation for rehabilitating the structure for use as part of a linear trail. This DOT-funded project required scour analysis in accordance with FHWA's HEC-18. Work included evaluating existing structure, including assigning appropriate NBIS rating, field investigation including geomorphic assessment and survey, determination of hydrology for the 3.1 square mile watershed, and development of hydraulic model.

Nicolle E. Burnham, P.E., CFM, Principal

Senior Project Manager, Water Resources Engineering

Years of Experience:

With This Firm: 17
With Other Firms: 3

Education:

M.B.A., Business
Administration
University of Connecticut
Storrs, CT
B.S., Civil Engineering
Worcester Polytechnic Institute
Worcester, MA

License/Certification:

Professional Engineer
- Connecticut
- Maine
- New Hampshire
- New York
- Vermont

Certified Floodplain Manager
(CFM)
FEMA Benefit-Cost Analysis
Certification

Professional Affiliations:

Certified Professional in
Stormwater Quality
American Public Works
Association
Association of State Floodplain
Managers (ASFPM)



Ms. Burnham is a Principal of Milone & MacBroom, Inc. and a member of the Board of Directors. Her expertise is in the areas of water resources, with specific expertise in hydrologic and hydraulic modeling, flood mitigation planning, stormwater management, watershed management, and environmental permitting. Ms. Burnham's project experience includes computer modeling and the design of flood control projects, state and federal regulatory permitting, and stormwater planning, management, and design.

The following is a sampling of Ms. Burnham's project experience:

Penobscot River Restoration Veazie, Old Town, & Howland, Maine

Assisted with the evaluation of fish passage and restoration of the lower Penobscot River. The work included topographic surveys, bathymetry, sediment probes and tests, utilities, hydraulic analysis, construction methods, and cost estimates.

Scour Analysis Training Maine Department of Transportation

Assisted in the development and presentation of a training program on scour analysis protocols for the Maine Department of Transportation staff. This one day session covered topics ranging from collection of field data, the importance of understanding the overall morphologic setting of the structure, sediment stability and transport, FHWA HEC-18 and HEC-23 protocols and limitations, and next generation methods of scour evaluation.

Harbor Brook Flood Control Study Meriden, Connecticut

Serves as Project Manager for all elements of this project including design development of hydraulic improvements along the channel to mitigate flooding. Work includes development of HEC-1 hydrology model of a 13 square mile urban watershed, field investigation of watershed boundaries, delineation of subwatersheds, calculation of runoff curve numbers, and times of concentration and evaluation of four separate rainfall scenarios.

Stony Brook Flood Mitigation Darien, Connecticut

Project Manager for hydrologic and hydraulic flood mitigation evaluation of a 3.81 square mile watershed. Work included stream assessment, identification of flooding problems, public outreach to affected residents, identification of cross-section survey locations, development of a HEC-HMS model area, and overseeing development of a dynamic HEC-RAS model. Analysis included existing conditions, as well as evaluation of potential flood mitigation strategies.

Pine Gutter Brook Assessment Branford, Connecticut

Completed an assessment of a 3,400 foot long incised channel on town-owned open space. The assessment included an evaluation of areas of bank erosion and reach by reach recommendations for stabilizing the channel banks and bed. An assessment of the 96-acre contributing watershed was also completed, including development of a hydrologic model, a HEC-RAS model, and sediment transport analysis. Recommendations were made for correcting extensive bank erosion along the Pine Gutter Brook Channel.

Five Mile River Flood Study

New Canaan, Connecticut

Project Manager for the hydrologic and hydraulic analysis of the 3.9 square mile watershed area. Project work included stream assessment, identification of flooding problems, public outreach to affected residents, identification of cross-section survey locations, development of a HEC-HMS model area and overseeing development of a dynamic HEC-RAS model. Analysis included existing conditions as well as evaluation of potential flood mitigation strategies.

Far Mill River Hydraulic Analysis

Shelton, Connecticut

Project Manager for preparation of hydraulic analysis of the Far Mill River from the Housatonic River to Bridgeport Avenue. Analysis was completed to evaluate floodplain and floodway impacts associated with placement of fill to support construction of an electric substation. Modeling was completed in a manner consistent with CTDEEP and FEMA protocols. The result of this work was used to prepare state and federal permit applications for the proposed work.

Pequabuck River Restoration, Dutton Avenue and Tulip Street Bridges over Pequabuck River

Bristol, Connecticut

Completed scour analysis in accordance with FHWA's HEC-18 of two structures of the Pequabuck River as part of a \$6M park improvement project. Work included evaluating existing structure, field investigation including geomorphic assessment, survey, determination of hydrology for the 14 square mile watershed, development of hydraulic model, and recommendations for scour countermeasures.

Jordan Brook Condition Assessment

Meriden, Connecticut

Analyzed the Jordan Brook watershed using the HEC-1 hydrology model to determine capacity of the brook. Information developed in this model was used to present an alternative analysis for rerouting of the stream and sizing a new culvert for the realignment.

Goodwives River Flood Mitigation Assessment

Darien, Connecticut

Project Manager for the hydrologic and hydraulic analysis of this seven square mile watershed area. Work included stream assessment, identification of flooding problems, public outreach to affected residents, identification of cross-section survey locations, development of a HEC-HMS model area and overseeing development of a dynamic HEC-RAS model. Analysis included existing conditions, as well as evaluation of potential flood mitigation strategies.

Noroton River Flood Mitigation Assessment

Darien, Connecticut

Project Manager for the hydrologic and hydraulic analysis of the Noroton River watershed area. Project work included stream assessment, identification of flooding problems, public outreach to affected residents, identification of cross-section survey locations, development of a HEC-HMS model area and overseeing development of a dynamic HEC-RAS model. Analysis included existing conditions, as well as evaluation of potential flood mitigation strategies.

Hempstead Brook Watershed Study

Groton, Connecticut

Project Manager for development of a watershed assessment of this tributary to a water supply reservoir. Work included stream channel assessment, development of a WinTR-20 model, mapping of drainage systems, analysis of drainage systems with recommendations for improvements, and evaluation of potential future watershed storage areas. Final report included an action plan with priorities for making improvements to correct deficiencies in the drainage system.

Roy Schiff, Ph.D., P.E.

Water Resource Scientist and Engineer

Years of Experience:

With This Firm: 9
With Other Firms: 2

Education:

Ph.D., Stream Restoration and Aquatic Ecosystems
Yale School of Forestry and Environmental Studies
New Haven, CT
M.S., Environmental Science and Engineering
University of Washington
Seattle, WA
B.S., Engineering
University of Rochester
Rochester, NY

License/Certification:

Professional Engineer
- Vermont

Certified Soil Evaluator
University of Massachusetts
Amherst, MA

Professional Affiliations:

American Fisheries Society
American Rivers
American Society of Civil Engineers (ASCE)
American Water Resources Association (AWRA)
Trout Unlimited (TU)
MadDog Chapter
Montpelier Conservation Commission



Dr. Schiff is a Water Resource Scientist and Engineer specializing in river and floodplain restoration, geomorphic and habitat assessment, flood mitigation, hydrology and hydraulics, and sediment transport analysis. In addition to applied restoration work such as channel creation, bank stabilization, and dam/levee removal, Dr. Schiff has been involved in several research projects improving protocols for habitat assessment and creating guidelines for channel restoration. Other experience includes biomonitoring, dam assessment and failure analysis, and floodplain management.

Highlights of Dr. Schiff's relevant project experience include:

Bronx River Fish Passage & Restoration Bronx, New York

Performed dam safety inspections at three structures, developed a HEC-1 flood hydrographic model, and modeled dam breach alternatives to assess downstream hazards.

Keowee Mountain Dam Breach Analysis Pickens County, South Carolina

Conducted dam failure analyses using HEC-RAS to create inundation maps of downstream flood hazard areas on three small streams with earthen embankment dams.

Gresham Park Subdivision Dam Breach Analysis Greenville, South Carolina

Conducted dam failure analyses using HEC-RAS to create inundation maps of downstream flood hazard areas on three small streams with earthen embankment dams.

Dam Breach Analysis Greenville County, South Carolina

Conducted dam safety assessments that included preparation of hydraulic computer models for potential failure evaluations and delineation of downstream flood hazard areas.

Roaring Branch Flood Recovery Bennington, Vermont

Performed a hydrology, hydraulic, and sediment transport analysis to analyze existing conditions and alternatives to reduce flood and erosion hazards. Assisted with FEMA Benefit-Cost Analysis and performed bid management.

Winooski River Floodplain Restoration Berlin & Montpelier, Vermont

Assisted with hydrology and hydraulics to identify flood reduction alternatives. Participated in conceptual design of floodplain restoration, assisted with FEMA BCA and HMGP application, coordinated with town and landowners, and presented findings to the town and state.

The HUB Redevelopment/ Harbor Brook Restoration Meriden, Connecticut

Performed HEC-1 hydrology and HEC-RAS hydraulic analysis to design and verify flood control components including channel day-lighting, development of a new park, floodplain creation, and adjusting the geometry of several bridges and culverts.

Conducted biologic assessments of potential flood water storage areas.

**Vermont Route 116 Culvert Assessment AOP
Starksboro & Hinesburg, Vermont**

Led project to assess all of the culverts passing under Route 116 to improve conveyance, geomorphic compatibility, and aquatic organism passage. Project tasks included assist with field data collection, alternatives analysis, assisted with hydrology and hydraulic modeling, and culvert prioritization.

**Windsock Street Bridge Restriction/Flood Study
Waterbury, Vermont**

Led project to identify flood reduction alternatives in Waterbury and Duxbury Villages. Assisted with data collection, hydrology and hydraulic modeling, conceptual design of floodplain restoration, FEMA BCA and HMGP application. Coordinated with town and landowners, and presented findings to the town and state.

**River Corridor Vulnerability Screening
State of Vermont**

Developed a GIS tool to map flood risks based on potential for erosion and deposition based on geophysical setting. Analysis included consideration of stream power, valley width, confinement due to roads, crossings, and land use. This collaborative project has included a host of river managers and conservationists.

**Patrick Brook Floodplain Study
Hinesburg, Vermont**

Assisted with hydrology and hydraulic modeling to create a FEMA floodway and floodplain for Patrick Brook.

**Jeffersonville Hazard Mitigation Study
Jeffersonville, Vermont**

Coordinated data collection, assisted with hydrology and hydraulic modeling, assisted with the alternatives analysis, and assisted with reporting. Presented findings to the project team and Village.

**Five Mile River Flood Evaluation
New Canaan, Connecticut**

Assisted with hydrology and hydraulic modeling to understand flood patterns and flood mitigation options in developed river corridor.

**Middlebury River Flood Study
East Middlebury, Vermont**

Performed data collection assisted with hydraulic modeling, assisted with sediment transport modeling, and developed flood reduction alternatives to reduce flood risks in the Village of East Middlebury, Vermont.

**Stony Brook and Goodwives Watershed
Darien, Connecticut**

Assisted with hydrology and hydraulic modeling to understand flood patterns and flood mitigation options in developed river corridor.

**New York City Department of Environmental Protection HEC-RAS Training
Kingston, Vermont**

Prepared training materials and taught courses to teach hydraulic modeling and the basis for flood reduction alternatives analyses.

**Roaring Branch Floodplain Restoration
Bennington, Vermont**

Conducted site assessment and sediment transport analysis to evaluate alternatives. Coordinated survey and assisted with hydraulic modeling to remap floodplains following flooding and flood recovery. Designed the floodplain restoration project, performed permitting, and oversaw construction.

Jessica C. Louisos, M.S., P.E.

Water Resource/Civil Engineer

Years of Experience:

With This Firm: 5

Education:

M.S., Environmental Engineering
University of Vermont
Burlington, VT

B.S., Civil & Environmental
Engineering
University of Vermont
Burlington, VT

License/Certification:

Professional Engineer
- Vermont

FEMA Benefit-Cost Analysis
Certification

Professional Affiliations:

American Society of Civil
Engineers, Vermont Section,
President

American Water Resources
Association

Society of Woman Engineers

American Geophysical Union

American Society of
Ecological Engineering

South Burlington Planning
Commission, Chair



Ms. Louisos's experience is in civil and environmental engineering with a strong focus on water resources. She has experience in experimental design, geomorphic and habitat assessment techniques, land surveying, and leading field crews, as well as in the creation and calibration of hydrologic and one and two-dimensional hydraulic models. Ms. Louisos has performed and published research combining field work, hydraulic modeling, and geostatistical analysis to form links between the geomorphic condition of small streams and the hydraulic fish habitat available. Her project experience includes river restoration, stream hydrology, fluvial geomorphology, instream habitat assessment, ecological wastewater and stormwater treatments, watershed and floodplain management, and aquatic organism passage design.

Highlights of Ms. Louisos's project experience include:

Penobscot River Restoration

Old Town, Maine

Conducted gage analysis and created flow frequency distribution curves describing hydrologic regime for use in hydraulic modeling of multiple dams.

Main Street (Route 5) Bridge Culvert Assessment

Lyndonville, Vermont

Performed alternatives analysis at a bridge structure and overflow culverts to explore flood mitigation options. Reviewed FEMA and past hydraulic studies, compared hydraulic model results, and provided recommendations to reduce flooding.

Roaring Branch Flood Recovery

Bennington, Vermont

Assisted with hydraulic modeling, floodplain delineation, field survey, and design plans for floodplain reconnection project to reduce flood and erosion hazards including berm removal and reconstruction and channel sediment management plan. Assisted with construction inspections.

Aquatic Organism Passage Restoration

Stannard/Walden, Vermont

Completed final design for the replacement or retrofit of three culverts to improve fish passage and geomorphic compatibility. Assessed existing conditions, completed site survey, modeled hydraulic conditions, and evaluated multiple options to maximize fish passage at each location.

Trombley Aquatic Organism Passage Restoration & Fish Passage

Swanton, Vermont

Performed field assessment and survey, and low-slope final design for improving fish passage at an undersized farm crossing on a tributary of the Missisquoi River.

Route 116 Culvert Assessment & Aquatic Organism Passage

Starksboro/Hinesburg, Vermont

Assisted the Vermont Agency of Transportation, Towns, and Watershed Groups to identify culverts for replacement during a routine repaving project. Assessed condition of culverts, sized culverts for both hydraulic and fish passage needs, and recommended design changes for improved aquatic organism passage and geomorphic compatibility.

**Winooski River Flood Study
Berlin/Montpelier, Vermont**

Conducted field assessment, oversaw surveying, and created a hydraulic model for evaluation of potential floodplain restoration alternatives. The Winooski River has a highly developed river corridor and this project identified potential flood mitigation through floodplain reconnection.

**Culvert Geomorphic Compatibility Screening
Waterbury, Vermont**

Created a screening tool to be used by the State of Vermont for prioritization of culverts for modifications and/or replacement according to variables relevant to fluvial geomorphology. Researched literature for relationships between culverts and geomorphology and data analysis of existing culvert data collected by the State of Vermont.

**Lewis Creek Habitat & Geomorphic Assessment
Addison County, Vermont**

Assessed habitat conditions for selected mainstream and tributary reaches using the Vermont Agency of Natural Resources' newly updated Reach Habitat Assessment protocols. Performed Phase 2 Stream Geomorphic Assessment, including new stream habitat protocols for High Knob tributary. Recommendations for restoration and protection of habitat were provided for each reach segment.

**Lydall Reservoir #1 Spillway Repairs
Manchester, Connecticut**

Assisted with hydrologic modeling of two existing water supply reservoirs to determine if current spillway design needed alteration during upcoming repairs in order to safely pass target flood events.

**Phase 2 of Developing Vermont Physical Stream Habitat Protocols
State of Vermont**

Expanded existing methods for process-based physical stream habitat assessment as part of the Vermont Agency of Natural Resource's Stream Geomorphic Assessment strengthening the measurement links between physical river processes and habitat features. Conducted a pilot field study to fine-tune the rapid habitat assessment prior to incorporation into the Vermont Stream Geomorphic Protocols.

**Culvert Aquatic Organism Passage (AOP) Screening Tool
State of Vermont**

Created a three tiered screening tool to be used by the State of Vermont for prioritization of culverts for modification and/or replacement according to variables relevant to fish passage. Researched literature for relationships between culverts and fish passage and data analysis of existing culvert data collected by the State of Vermont. The screening tool includes a course screen, retrofit potential, and potential habitat reconnected.

**Five Mile River Flood Evaluation
New Canaan, Connecticut**

Updated effective FEMA hydraulic model to reflect current conditions and evaluated alternatives to reduce risk of flooding along highly developed corridor.

**Stony Clove Creek Bank Stabilization
Phoenicia, New York**

Collected field data including geomorphic condition, channel dimensions, and sediment sizing in channel with multiple mass failures. Developed river assessment report and created hydraulic model to evaluate potential river restoration alternatives in an effort to reduce suspended sediment loads associated with bank and bed erosion at multiple sites. Assisted with final design and construction oversight.

**Rondout Creek at Clair Road
Sundown, New York**

Served as principal construction inspector for this stream restoration project involving creation of a terrace and bankfull stage branch, use of bioengineering techniques, creation of a riparian buffer, and relocation of the adjacent roadway to its former location.

Roderick H. Craib, Jr.
President

Professional Experience:

Maine Coast Surveying, Damariscotta, ME President and founder	1979 - present
Wright-Pierce, Topsham, ME Party Chief	1977 - 1979
Wayne P. Libby, Surveyor, Pittston, ME Party Chief	1975 - 1977
Bridgewater Twp., N.J. Engineering Dept. Party Chief	1974 -1975

Professional Registration:

Maine Professional Land Surveyor #1191 - 1978
Massachusetts Professional Land Surveyor #39043 - 1995

Professional Associations:

Maine Society of Land Surveyors (MSLS) - Member
(served on Board of Directors 14 years including two as President)
Midcoast Chapter MSLS - Member
National Society of Professional Surveyors - Board of Directors (representing New England and the
Maritime Provinces of Canada)
American Congress on Surveying & Mapping (ACSM) - Fellow
Maine Land Title Association - founding member

Education:

B.S.- Natural Resource Management, University of Maine 1974
Safety Training for Hazardous Waste Operations (OSHA 29 CFR 1910.120) 1993-1996

Representative Projects:

Boundary Expert Witness in many boundary surveys and disputes throughout Lincoln and Knox Counties. More than 1000 Boundary and Topographic surveys in Lincoln and Knox Counties, most drawn in AutoCad.

Crabapple Creek Subdivision: A 14-unit low-income cluster housing development designed in Bremen, Maine.

Dutch Neck, Waldoboro, Maine: 115-acre boundary and topographic survey including wetland mapping, road and building stakeout.

Alna, Maine: 100-acre Boundary Survey and timber trespass court case. Our client won and was awarded triple damages plus costs.

Central Maine Power Company: 4-mile transmission line inventory and design survey in Nobleboro, Maine. This survey was tied into the Maine State Plane Coordinate System. Drawings were delivered in AutoCAD Format and plotted on four overlapping map sheets.

Central Maine Power Company: Boundary Survey for 23-mile transmission line corridor from Windsor to Wiscasset involving 600 parcels. Drawings were delivered in AutoCAD format and plotted in 23 overlapping map sheets. Also construction layout for over 200 structures.

Great Salt Bay Sanitary District, Damariscotta, Maine: Boundary survey of 200 parcels for acquisition of 75 adjacent easements plotted on 9 overlapping map sheets.

Tax Mapping revisions and updating on an annual basis from 1981 to the present for Damariscotta, Newcastle, Bristol, South Bristol, Bremen, and Nobleboro.

Balsam Environmental Consultants and Groundwater Technology, Inc: Six acre topographic mapping project on Union Chemical Company (a superfund hazardous waste site) in Hope, Maine using aerial photography, ground surveying, and GPS. Over 100 monitoring wells and many other structures were staked out. Data was delivered on mylar and in AutoCAD format with attached database for monitoring well data.

Stephanie Wyman, E.I.T.

Civil Engineer

Years of Experience:

With This Firm: <1
With Other Firms: 2

Education:

B.S., Environmental Engineering
University of Vermont
Burlington, Vermont

License/Certification:

Engineer In Training
- Vermont
Maine DOT – Local Project
Administration Certification
Maine Certification in
Maintenance and Inspection of
Stormwater BMPs

Professional Affiliations:

ASCE – Maine Chapter Informant
Co-Chair
WTS – Maine Chapter
Sponsorship/Fundraising
Committee



Ms. Wyman is a Civil Engineer in our Portland, Maine office. She has experience using AutoCAD/Civil 3D to draft plans, profiles, and alignments for linear projects. Ms. Wyman is well-versed in preparing erosion and sediment control plans, and grading and utility plans. She also has experience in preparing road permit applications and drawings for utility crossings and temporary and permanent access road.

Highlights of Ms. Wyman's experience follows:

Tow Path Road River Access and Parking Lot Gorham, Maine

Prepared project drawings for permitting and construction related to road extension, parking lot and river access for hand-carry boats. Prepared permit applications to State, Federal and Local Agencies related to activities in and adjacent to protected natural resources.

Eel Weir Hydrodam Culvert Replacement Standish, Maine

Assisted Sappi with preparation of construction plans in coordination with geotechnical engineers and structural engineers retained by Sappi. Assisted in compliance submissions to Federal Regulatory Commission. Participated in construction monitoring.

College Administration Building 216 Maine Street Brunswick, Maine

Drafted permit plans and construction plans related to the demolition of an existing building and construction of a new 3-story administration building for Bowdoin College. Completed grading and utilities drawings for the new building. Assisted with project coordination with sub consultants.

Bill Dodge Auto Group Automobile Dealerships Saco and Westbrook, Maine

Prepared construction plan and permit documents for auto dealerships in Saco and Westbrook Maine. Worked on stormwater management design, as well as grading and utilities of two auto dealerships.

Depot Street Improvements Bridgton, Maine

Design Engineer responsible for preparation of road plan and profile drawings associated with the reconstruction of 800 linear feet of Depot Street. Project also included streetscape elements, new sidewalks on both sides of Depot Street, and drainage improvements. The project was funded under the Community Development Block Grant program.

Spring Street Portland, Maine

Design Engineer responsible for preparation of road plan and profile drawings, utilizing AutoCAD Civil 3D, associated with the reconstruction of approximately 2,000 linear feet of Spring Street. Assisted in preparation of bid documents and design specifications.

**Cameron Drive Storm Drainage Improvements
Spartanburg, South Carolina**

Designed and prepared construction documents for replacement of drainage system on Cameron Drive.

**Ridgewood at Middlebury
Middlebury, Connecticut**

Prepared sediment and erosion control plans for wetlands submission for a proposed subdivision in Middlebury, CT.

Prior to joining Milone & MacBroom, Inc., Ms. Wyman worked on the following projects:

**Mehalick Unit Well Line
Cherry Township, Sullivan County, Pennsylvania**

Completed layout and design of ABACT BMPs for a project located in an exceptional value watershed. Conducted rate and volume analysis for pre-construction and post-construction in areas where permanent SUAs and access roads were being utilized. Drafted ESCGP-2 plans and construction documents with profile drawings. Prepared ESCGP-2 permit application documents for submission to PADEP.

**Dominetta Phase II Gathering Line
Wilmot Township, Bradford County, Pennsylvania**

Completed layout and design of standard and ABACT BMPs. Provided ABACT BMPs for areas with receiving waters classified as Wild Trout Streams. Drafted ESCGP-1 plans and construction documents with profile drawings. Prepared ESCGP-1 permit application documents for submission to PADEP.

**Wootten Gathering Line
Forkston, Mehoopany, Windham Townships, Wyoming County, Pennsylvania**

Completed layout and design of standard BMPs, including silt fence, filter sock, waterbars, culverts, flume pipes, erosion control blankets and rock construction entrances. Mapped drainage areas and used TR-55 to size permanent culverts for access roads. Drafted ESCGP-1 plans and construction documents with profile drawings. Prepared ESCGP-1 permit application documents for submission to PADEP.

**Vista Gathering Line
Elkand Township, Fox Township, Sullivan County, Pennsylvania**

Drafted utility sketches, site location maps, sight distance drawings, and profiles for utility crossings and temporary/permanent access roads. Calculated and compared existing sight distance to required sight distance for driveways located on state and local roadways. Prepared local and state driveway and utility road permit applications.

Becky Meyer, E.I.T.

Water Resources Engineer

Years of Experience:

With This Firm: 6
With Other Firms: 3

Education:

B.S., Civil Engineering
(Magna Cum Laude, Centennial
Scholar)
University of Rhode Island
Kingston, RI

Studied Abroad, National
University of Ireland, Galway

License/Certification:

Engineer-in-Training
- Connecticut



Ms. Meyer is a Water Resource Engineer specializing in the preparation of permit applications, site plan peer review, wastewater systems, and site plan engineering. She conducts peer reviews of submitted site plan applications, as well as reviews of land use regulations for several municipalities in order to encourage the use of Low Impact Development and Best Management Practices for water quality mechanisms.

Ms. Meyer is particularly proficient in hydraulic modeling and storm drainage analysis, performing open channel hydraulic modeling of watercourses utilizing HEC-RAS and storm drainage analyses including hydraulic computations and design of conveyance systems utilizing StormCAD.

Ms. Meyer's experience includes wastewater systems. She has executed large scale septic system design computations for flows greater than 5,000/gpd per Connecticut Department of Energy and Environmental Protection (CTDEEP) design standards and regulations. She is knowledgeable in the preparation of permit applications for approval by the CTDEEP and has completed required continued monitoring for large scale subsurface sewage disposal; discharge of stormwater and dewatering wastewaters associated with construction activities; discharge of stormwater associated with industrial activities; discharge of stormwater from small municipal separate storm sewer systems (MS4); and contaminated soil and/or staging management.

Highlights of Ms. Meyer's experience include:

Bronx Zoo Dam New York, New York

Engineer assisting with the preparation of (drafting) 50% submission design plans.

Peconic River Riverhead, New York

Engineer assisting with plan revisions (drafting) and response letter to reviewing authorities.

Rowayton Avenue Culvert Replacement Norwalk, Connecticut

Engineer performing HEC-RAS analysis of flood mitigation alternatives. Work also included preparing a report, conceptual design plans, and state/federal permitting.

Harbor Brook Flood Control Improvements Meriden, Connecticut

Engineer assisting in the development of master plan drawings for the analysis of Harbor Brook and the recommendations of alternatives for flood control. Work also included state and federal permitting, including USACE and FEMA.

Stony Brook and Goodwives River Watershed Evaluation Darien, Connecticut

Engineer assisting with the evaluation of Stony Brook and Goodwives River watersheds and drainage system analysis throughout the town as part of the town-wide drainage plan.

**Bruce Brook Watershed Evaluation
Stratford, Connecticut**

Engineer assisting with the analysis of Bruce Brook to evaluate flood mitigation alternatives at Barnum Avenue.

**Coppermine Brook Drainage Study
Bristol, Connecticut**

Project Engineer for a drainage and flooding study of Coppermine Brook, an 18-square mile tributary of the Pequabuck River.

**Richards Court and Stevens Street Flood Control
Bristol, Connecticut**

Project Engineer for a flood control project of Richards Court and Stevens Street area in the City of Bristol. The project involved permitting and design services to remove sediment from the channel at Stevens Street, improve the berm on the left bank at Richards Court, and lower the berm on the right bank downstream of Stevens Street. A HEC-RAS hydraulic model developed during the Coppermine Brook Study was updated.

**Coppermine Brook Watershed Storage Analysis
Bristol, Connecticut**

Project Engineer responsible for permitting and design services for additional storage area for Coppermine Brook.

**Rondout Creek at Clair Road
Sundown, New York**

Served as hydraulic modeler and project engineer for this stream restoration project involving creation of a terrace and bankfull stage branch, use of bioengineering techniques, creation of a riparian buffer, and reconstruction of the adjacent roadway to its former location.

**West Kill Creek at County Route 6
Lexington, New York**

Performed hydraulic modeling for this stream restoration and bank project involving a large-scale mass bank failure on the slope and significant channel incision of the stream bed, causing a partial failure of an upstream access drive bridge, movement of a residence on the slope, and repetitive failure of the county roadway. Developed design plans, stormwater pollution prevention plan, and technical specifications for the construction of the project.

**Ulster County Highway Garage at East Branch Rondout Creek
Denning, New York**

Engineering design and hydraulic modeling for this streambank stabilization project that included bank stabilization, design of stormwater best management practices, and riparian habitat restoration. Developed design plans, stormwater pollution prevention plan, and technical specifications for the construction of the project.

**Stony Clove Creek Sites 2 & 3 Restoration Project
Chichester, New York**

Hydraulic modeling and regulatory permitting assistance for this mass bank failure restoration project. Stabilization measures involve toe protection, channel relocation, and bank grading. Developed design plans, stormwater pollution prevention plan, and technical specifications for the construction of the project.

**West Branch Neversink Stream Restoration
Claryville, New York**

Undertook hydraulic modeling and engineering design for this distressed stream reach to improve the alignment; protect the adjacent roadway embankment; and improve sediment transport continuity, water quality, and riparian buffer habitat quality.

W. Andrew Greene, P.E., Associate

Senior Project Manager, Water Resources Engineering

Years of Experience:

With This Firm: 18

With Other Firms: 5

Education:

B.S., Civil Engineering
Lafayette College
Easton, PA

License/Certification:

Professional Engineer

- Connecticut
- Pennsylvania
- Delaware
- New Hampshire
- New York
- Massachusetts
- Vermont
- West Virginia

Professional Affiliations:

American Society of Civil
Engineers (ASCE)



Mr. Greene has over 20 years of experience in project management, design and construction review with an emphasis on dam repair, removal and fish passage projects. He also has experience in the design of sanitary sewage systems and community subsurface sewage disposal systems including pump stations, force mains, gravity sewers, site development projects and recreational facilities.

Mr. Greene's project experience follows:

182nd Street Dam Bronx, New York

Project Manager responsible for the preparation of construction drawings and specifications for the dam repairs and fish ladder construction on the Bronx River. Design repairs included structural concrete to encase the right non-overflow section of the dam to minimize leakage thru the existing stone masonry structure. The fish ladder design included a concrete encasement to the aluminum fish ladder with fish counting equipment and vandal resistant features.

Bunnell's Pond Bridgeport, Connecticut

Researched and analyzed 13 different options for the protection of Bunnell's Pond Dam during overtopping of the PMF design storm and submitted a report to the CT DEEP. Based upon the recommended protection scheme, designed a 10,000 CY roller compacted concrete armoring system to protect the dam during the design storm. The design also included a structural concrete wall, as well as improvements to the gate structure, low level outlets and an aluminum fish ladder.

Penobscot River Old Town, Maine

Project Manager responsible for the preparation of construction drawings and specifications for the removal of 1,000 foot long portion a run-of-the-river dam comprised of five distinct spillways constructed of concrete, stone masonry and timber cribbing. Construction access and water control were important design issues with average spring flows in excess of 20,000 cfs.

Mill House Pond Woodbury, Connecticut

The recommended repairs for the existing run-of-the-river dam on the Nonnewaug River included; resetting stone armoring to the existing abutments, injecting grout and replacing the existing stone masonry and concrete dam.

Mirror Lake Meriden, Connecticut

Performed an engineering study which included a visual dam inspection, pond sediment sampling, dredging recommendations, sediment source control methods, repairs to the stone masonry wall surrounding the lake, and improvements to the dam embankment and spillway channel.

Vly Creek and Bush Kill Creek Restoration Fleischmanns, New York

Served as Project Manager for this stream restoration and bank stabilization project that encompassed eight sites along Vly Creek and Bush Kill Creek in the Village of

Fleischmanns. Improvements include floodplain reclamation, slope regrading, and natural and structural stabilization methods.

**Hasen Pond Fish By-Pass Channel
Weston, Connecticut**

Project Manager responsible for the preparation of construction drawings and specifications for the construction of a combination naturalized fish by-pass channel and fish ladder thru the landscaped lawn of a private homeowner.

**Stillwater Pond
Torrington, Connecticut**

Designed reinforced concrete repairs to cap the existing spillway and training walls as well as improvements to the gate house and gate valves and gate controls. The downstream earth embankment was reduced in slope and toe drains were installed.

**Benedict Pond
Norfolk, Connecticut**

Resident Project Representative during the construction of a new concrete spillway capable of passing the required spillway design storm to replace an existing stone masonry spillway.

**Rondout Creek at Clair Road
Sundown, New York**

Served as Project Manager for this stream restoration project involving creation of a terrace and bankfull stage bench, use of bioengineering techniques, creation of a riparian buffer, and relocation of the adjacent roadway to its former location.

**Naugatuck River Dams
State of Connecticut**

Performed visual dam inspections and prepared inspection reports on eight dams in Thomaston, Waterbury, Naugatuck, and Seymour. The reports included conditions assessment and construction access was also evaluated for all the dams as part of an overall fish passage and dam removal project.

**Choate Rosemary Hall Lower Pond
Wallingford, Connecticut**

Project Manager responsible for the preparation of construction drawings and construction administration for the dredging of 2 ponds and repairs to a 100 year brownstone masonry dam in the center of the school campus.

**Woodtick Reservoir
Wolcott, Connecticut**

Designed repairs to a 100 year old, concrete gravity dam; including new structural concrete sections, concrete patch repairs, gate house and gate valve improvements as well as a new pre-fab structural steel pedestrian bridge spanning a secondary spillway on top of the dam providing access to the gate house. Served as Resident Project Representative for the dam repairs during construction.

**Lee's Pond
Westport, Connecticut**

Designed repairs to the 200 foot long 17 foot high stepped stone masonry spillway and outlet works originally constructed in 1903 on the Saugatuck River. Prepared permits for submission to the CT DEEP Dam Safety Division, as well as construction administration services.

**Ulster County Highway Garage at East Branch Rondout Creek
Denning, New York**

Served as Project Manager for this streambank stabilization project that included bank stabilization, design of stormwater best management practices, and riparian habitat restoration.

Edward A. Hart, P.E., Vice President

Director of Civil Engineering

Years of Experience:

With This Firm: 26
With Other Firms: 6

Education:

B.S., Civil Engineering
University of Vermont
Burlington, Vermont

Computer Science Courses
(Graduate Level)
University of New Haven
West Haven, Connecticut

Continuing Education:

Shore Protection
TR-55 and TR-20
Hydrology
On-Site Wastewater Trmt.
In-Stream Flow
Incremental Methodology

License/Certification:

Professional Engineer
- Connecticut
- Vermont
- Maine
- New Hampshire
- New Jersey



Mr. Hart is a Principal of Milone & MacBroom, Inc. and is Director of the Civil Engineering Group. He has over 30 years of experience with an emphasis in the areas of civil engineering, hydrology, hydraulics, stormwater management, dam construction and repairs, regulatory permit programs, and public and private site development. As Manager of the firm's Civil Engineering Group, Mr. Hart has the responsibility of overseeing and managing the firm's site development projects. He also assists in the stormwater management and the permitting aspects of site planning projects.

Highlights of Mr. Hart's project experience follows:

Danbury Dike, Candlewood Lake (FirstLight Power Resources) Danbury, Connecticut

Project Manager responsible for the design and inspection of repairs to a FERC regulated structure approximately 45 feet high and 650 feet long. FERC requires that the seepage leaking through the dike be controlled with a filter system.

Hydroelectric Canal Repairs (FirstLight Power Resources) Falls Village, Connecticut

Provided engineering services for the repair of approximately 1000' of the concrete canal. The repairs included pressure grouting of voids, shotcrete repair of deteriorated concrete and expansion joint replacement.

Chestnut Hill Reservoir Dam Wolcott, Connecticut

Provided engineering services for the design of the repairs to the Chestnut Hill Reservoir Dam. Work included determining the structure's hydraulic capacity and the preparation of detailed plans, specifications, and contract documents. Improvements included construction of a concrete side channel spillway, installation of a toe drain, and construction a riprap spillway channel.

Harbor Brook Flood Control Improvements Meriden, Connecticut

Engineering services to address the historic flooding problems along Harbor Brook. The project objective was to evaluate alternative methods of reducing flood damages within the Harbor Brook corridor, and to develop specific recommendations for river restoration improvements, including bank stabilization, water quality, fish habitat, and creation of a greenway.

Lydall Spillway #1 Structural Assessment Manchester, Connecticut

Project Manager involved in the structural assessment of the Lydall Spillway #1 located in the Lydall Reservoir. The structural assessment was conducted to verify the structural integrity of the spillway and analyzed the adequacy of the wingwalls and revealed that both had extensive cracking and spalling.

Lake Percival Dam Cheshire, Connecticut

Provided engineering services for the construction of a 14 foot high by 275 foot long dam impounding Lake Percival. Work included the preparation of detailed plans,

Professional Affiliations:

American Society of Civil Engineers
 Association of State Dam Safety Officials
 Association of State Floodplain Managers
 Connecticut Home Builders Association

specifications, and contract documents for bidding purposes and inspection services during the construction of the project. Improvements included concrete repairs to the existing spillway, a new grass-lined emergency spillway, riprap armoring, and providing a uniform crest elevation.

**Hydrology Improvements to Harvey's Lake Dam
 Barnet, Vermont**

Assisted with hydrology and hydraulics analysis to reduce local flooding.

**Levee Accreditation Analysis
 Derby / Ansonia, Connecticut**

Provided engineering services as part of the accreditation process of the flood control levee with FEMA National Flood Insurance Program. Work included hydraulic analysis of existing drainage outlets through the levee, field investigation to determine location and conditions of the drainage outlets, scour evaluation of the levee embankment, and preparation of supporting documentation to FEMA.

**Woodtick Reservoir Dam Rehabilitation
 Wolcott, Connecticut**

Designed improvements to the earth embankment and obtained the necessary regulatory permits for a 20 foot high by 1,600 foot long structure which impounds a 138 acre pond.

**Hopeville Pond Dam
 Griswold, Connecticut**

Project Manager for the design and construction of repairs where the existing spillway was supplemented with an additional 100 foot spillway.

**Bunnells Pond Dam
 Bridgeport, Connecticut**

Prepared a detailed hydraulic analysis of flood conditions including a dam breach analysis for a 31 foot high by 1,000 foot long dam. Designed the dam to be protected from overtopping using roller compacted concrete. Also designed a fish ladder.

**Cockaponset & Hackney Pond Dams
 Haddam, Connecticut**

Prepared inspections of both dams and designed and inspected the repairs.

**Anadromous Fish Restoration
 Naugatuck & Mad Rivers, Connecticut**

Analyzed alternatives for anadromous fish passage around seven dams on the Naugatuck and Mad Rivers, prepared engineering designs for the recommended alternatives, and supervised construction.

**Rockland Pond Dam
 Montville, Connecticut**

Project Manager responsible for the preparation of design plans and permit applications for construction, assisting in the selection of a contractor, inspecting the progress of the construction of the improvements to the dam, and preparing an Operations and Maintenance Manual and an Emergency Operations Plan for the dam.

Dustin M. Roma, P.E.

Lead Project Engineer, Civil

Years of Experience:

With This Firm: 2
With Other Firms: 8

Education:

B.S., Civil Engineering
University of New Hampshire
Durham, New Hampshire

License/Certification:

Professional Engineer
- Maine
Maine Certification in
Maintenance and Inspection
of Stormwater BMPs
Maine DOT Local Project
Administrator

Professional Affiliations:

Windham Economic
Development Corporation -
President
American Public Works Association
- Maine Chapter



Mr. Roma is a Project Manager in our Portland, Maine office. He has extensive experience in site design for large, complex projects for public and private clients and can handle a broad range of technical tasks including grading and drainage design, roadway layout design, and site/subdivision planning. He is well versed in Maine's local, state, and federal permitting requirements and has successfully permitted various projects including municipal barge landings, docks and dam restoration work in the coastal environment, commercial site plans, and residential subdivisions. Mr. Roma also brings experience in construction bid administration and construction oversight.

Mr. Roma's project experience includes:

Shoreline Management Drainage Improvements SAPPI Hydropower Facilities Presumpscot, Maine

Plans were prepared by Milone & MacBroom, Inc. for roadside ditch stabilization with riprap and subsurface drainage improvements at the Dundee Dam to mitigate flooding of the site that occurred during Spring snow melt and during intense storm events. The improvements were implemented to contain stormwater runoff that was flowing over the embankment at the tailrace in a closed drainage system that could be discharged at a controlled outlet.

Sunset Landing Property Evaluation Chebeague Island, Maine

Project Manager responsible for alternatives analysis for development of a nine acre ocean front town owned property. Work performed includes coordination of survey, wetland delineation, vernal pool assessment, and Maine Historic Preservation Commission review. Alternatives evaluated include residential, commercial, open space, ferry service, marinas and/or parking.

College Street Reconstruction Brunswick, Maine

The project was a collaborative effort between the Town of Brunswick, Bowdoin College, the Water District and the Sewer District to design upgrades to the infrastructure and a full depth reconstruction of the 1,800 foot roadway. The project incorporated various streetscape elements including granite crosswalks, speed tables with granite block ramps, bollards and sidewalks. The project was designed, bid, and constructed under a very strict timetable as to not disrupt the ongoing activities at Bowdoin College.

Spring Street Reconstruction and Streetscape Portland, Maine

Performed road realignment design to eliminate large raised median and incorporate new sidewalks, landscaped esplanades, dedicated bike lanes and streetscape amenities on approximately 2,000 linear feet of Spring Street between High Street and Union Street. The resulting design includes shorter pedestrian crosswalk distances, additional on-street parking accommodations, improved pedestrian plazas, green stormwater infrastructure and an enhanced urban corridor utilizing the "complete streets" methodology.

**Depot Street Reconstruction and Streetscape
Bridgton, Maine**

Project Manager and design engineer for Community Development Block Grant funded project to enhance Depot Street with new sidewalks, curbing, landscaping, furniture and lighting. The roadway was fully reconstructed to maximize drainage efficiency by incorporating additional drainage infrastructure and establishing a new vertical profile. Mr. Roma also assisted the Town by managing the community outreach process, bid administration and construction oversight of the project in conformance with the strict requirements associated with federally funded projects.

**Bill Dodge Auto Group Dealerships
Saco and Westbrook, Maine**

Projects at both locations included a multi-phase development approach with first analyzing existing site needs and constraints to determine if expansion of existing facilities or new site development provided the best value to the client. In addition to providing pre-purchase due-diligence consulting, Mr. Roma provided design and permitting services for a new Nissan dealership facility in Saco that included a large expansion to an existing stormwater pond and a new 19,000 square foot building with inventory display parking. The Westbrook project consisted of design and permitting of a replacement stormwater management system to handle over 11 acres of impervious surface.

**Design and Permitting of Municipal Barge Landings - Casco Bay
Portland, Maine**

Responsible for preparing design plans and permit applications for municipal barge landings on Cushing Island and Cliff Island in Casco Bay. The projects involved the analysis of several potential landing areas, public outreach, and preparation of final design plans and bid specifications for use in permitting and construction. Permit approvals were successfully obtained from the Portland Board of Harbor Commissioners, Portland Planning Board, Maine DEP, USACOE, Maine Bureau of Parks and Lands – Submerged Lands Lease Program, and other various agencies. Mr. Roma was also involved in construction coordination and bid administration.

**FERC Exhibit F Public Use and Safety Plans
SAPPI Hydropower Facilities
Presumpscot River, Maine**

Prepared updated boundary plans for three separate hydropower facilities at Mallison Falls, Dundee Dam, and Gambo Dam in Gorham, Maine. The Exhibit G drawings were classified Critical Energy Infrastructure Information (CEII) and included boundary plans, GIS Shape File data and aperture card micro film submission for archiving. The project required records research and compiling data from various sources including plans of record and public GIS data to create a composite map.

**FERC Exhibit F Public Use and Safety Plans
SAPPI Hydropower Facilities
Presumpscot, Maine**

The project at Dundee, Mallison Falls, and Gambo included critical components that allow for the safety and frequent use of the impoundments and river segments for recreation. Milone & MacBroom, Inc. was responsible for detailing the requirements for signage and defining areas for vehicle parking, portage routes, boat launch facilities, and angler access. At two projects, the angler access included site design and permitting for pedestrian bridges over an intake canal and an outlet channel to provide access to the natural river segments for recreational fishing. The Gambo project also included the procurement of easements outside of the existing project boundary to provide suitable angler access to the river.

**Grist Mill Reconstruction Project
Kennebunkport, Maine**

The project consisted of the reconstruction of a tidal-powered grist mill on the Kennebunk River in Kennebunkport and a new dock and float for public access to the river. Mr. Roma's responsibilities included overall project management, preparation of hydraulic analysis to determine impact of tidal dam gate on water levels, and preparation of local, state and federal permits in collaboration with other environmental consulting firms.

Matthew J. Sanford, M.S., Associate Lead Environmental Scientist

Years of Experience:

With This Firm: 12
With Other Firms: <1

Education:

B.S., Natural Resource
Management (Magna Cum Laude)
University of Connecticut
Storrs, CT
M.S., Wetland Biology
Southern Connecticut State
University
New Haven, CT

License/Certification:

Certified ACOE Wetland
Delineator
Certified Professional Soil
Scientist
Professional Wetland Scientist

Professional Affiliations:

Board of Directors of the
Connecticut Association of
Wetland Scientists (CAWS)
Former President
Former Vice President
Society of Wetland Scientists
Association of Massachusetts
Wetland Scientists
Connecticut Entomological
Society



Mr. Sanford is an Associate/Senior Environmental Scientist. His experience is in the area of natural resources, with specific expertise in GIS modeling, biological inventories; water quality monitoring; watershed planning; vernal pool surveys; wetland delineation, assessment, and functions; inland wetland and tidal wetland mitigation; and peer review services. Mr. Sanford's project experience includes computer modeling and design in ArcGIS and TR-20. He is a Professional Wetland Scientist (PWS) and is a certified soil scientist. He has expertise in United States Army Corps of Engineer (USACE) wetland delineations and has conducted USACE delineations in New York, Connecticut, Vermont, and Massachusetts. Mr. Sanford served as Vice President and President of the Connecticut Association of Wetland Scientists (CAWS).

Mr. Sanford has been retained by several Connecticut municipalities to provide third party review services to pending inland wetland and watercourse applications. Peer review services include reviewing potential impacts on wetland and watercourses associated with proposed residential and commercial developments. Mr. Sanford has provided such services to the Towns of New Milford, Ridgefield, Washington, Newington, Rocky Hill, Litchfield, Guilford, Redding, Wolcott; the Borough of Naugatuck; and the City of New London.

Highlights of Mr. Sanford's project experience follow:

First Light Power, Connecticut Shoreline Stabilization and Vegetated Buffer Zone Manual Litchfield County, Connecticut

Developed comprehensive shoreline stabilization and vegetated buffer zone manual for First Light Power owned impoundments. The manual provided homeowners guidance for selecting appropriate shoreline stabilization methods such as structural, bioengineering, and biotechnical design. In addition, the manual provides guidance on permitting procedures, design requirements, planting plans, erosion control, and other critical design parameters.

Pequabuck River Bank Stabilization Bristol, Connecticut

Prepared final design, regulatory permits, technical specifications, and provided bid assistance for the stabilization and creation of compound channel and flood shelf along a reach of the Pequabuck River in Rockwell Park. Provided construction inspection services for bank stabilization project including oversight on in water habitat features such as rock vortex weirs and boulder heaps. Monitor placement of topsoil and associated amendments and planting of native riparian zone vegetation.

Lower Hop Brook Restoration Manchester, Connecticut

Prepared final design, regulatory permits, technical specifications, and provided bid assistance for the stabilization along two segments of the brook in Manchester. Provided construction inspection services for the installation of wooden lunger structures, root wads, flood shelf creation, and replanting of riparian zone vegetation.

Choate Pond Restoration Wallingford, Connecticut

Evaluated alternatives for pond dredging and dam safety surrounding and within the viewsheds of the ponds such that the water features are more of a dramatic focal point

on the campus. Assisted with the permitting efforts for a CT DEEP 401 Water Quality Certification; a Water Diversion Permit and Dam Safety Permit; a U.S. Army Corps of Engineers 404 permit, and local permits from the Town of Wallingford.

**Lions Club Pond Restoration
Wolcott, Connecticut**

Provided ecological restoration alternatives to enhance an existing shallow three acre pond located on Lions Club Agricultural Society property. Prepared pond dredging conceptual plans, computed sediment removal volumes, collected sediment samples for chemical parameter analysis, and evaluated costs associated with preparing regulatory permits and final design plans. Prepared final design plans that included final grading, water handling and dewatering of sediments. Prepared and obtained regulatory permits from CTDEEP for Flood Management Certification and Temporary Discharge Authorization, as well as local inland wetlands and watercourse commission and zoning commission. Prepared final design, bid documents, and technical specifications for pond restoration.

**West River Duck Pond & Tidal Marsh Restoration
New Haven, Connecticut**

Provided regulatory permit support services for OLISP and USACE permits. Prepared final design and technical specifications for duck pond improvements including grading plans, planting plans, and invasive species management. Provided construction inspection services for implementation of grading, sunning boulders and plantings.

**UConn Mirror Lake & Swan Lake Restoration
Mansfield, Connecticut**

Completed sediment sampling, vegetation analysis, wetland delineation and conceptual dredging plans for Mirror Lake and Swan Lake. Prepared feasibility report that identified various dredging methods, probable construction costs and regulatory permit needs associated with each dredge method. Reviewed contributing watershed areas to each impoundment to identify potential stormwater management renovation measures to improve water quality within each impoundment. Identified potential Canadian goose deterrents to help maintain water quality within each impoundment.

**Old Field Creek Restoration Study
West Haven, Connecticut**

Developed a sediment sampling plan for proposed dredging of Old Field Creek. Performed GIS and field work, including sediment sampling. Assessed tidal vegetation communities upstream and downstream of old tide gate. Determined likely vegetation community changes if self regulating tide gates were installed. Assisted in the preparation of OLISP permits and provided limited construction oversight.

**Killingworth Reservoir Wetland Mitigation
Killingworth, Connecticut**

Inspected construction of approximately 6.2 acres of deep marsh, shallow marsh, and scrub/shrub wetlands along the littoral zone of Killingworth Reservoir. Responsibilities included monitoring of proposed grading activities within the creation areas, and observation of the placement of wetland soils and wetland plants within creation area. Provided five years of post construction annual monitoring and report preparation for wetland mitigation area in accordance with the USACE and CTDEEP special permit conditions.

**Rockwell Park Wetland Mitigation
Bristol, Connecticut**

Inspected the creation of a 1.3 acre open water pond and a 2.2 acre emergent marsh/scrub shrub wetland community within former Phragmites dominated lagoon. Responsibilities included monitoring of proposed grading activities within the creation areas, and observation of the placement of wetland soils and wetland plants within creation area. Provided post construction annual monitoring and report preparation for wetland mitigation in accordance with CTDEEP special permit conditions.

Jason C. Williams, L.A., Associate

Lead Landscape Architect

Years of Experience:

With This Firm: 8
With Other Firms: 4

Education:

M.S., Ecological Design
Conway School of Landscape
Design - Program in Sustainable
Landscape Planning + Design
Conway, MA
B.A., Cultural Anthropology
University of Montana
Missoula, MT

License/Certification:

Landscape Architect
- Connecticut

Professional Affiliations:

Groundwork Bridgeport
Board Member
American Society of Landscape
Architects
Connecticut Chapter
American Society of Landscape
Architects



Mr. Williams is an Associate/ Lead Landscape Architect involved in conceptual site design and master planning. He is also a professional illustrator. Mr. Williams's project experience includes educational, corporate; streetscape improvements; park and recreation facilities and residential site developments. He is an ecological designer whose work focuses on sustainable design, wetland creation and restoration. Mr. Williams is involved in all levels of construction documentation including layout, grading, planting, and construction detailing and specifications.

Highlights of Mr. Williams's project experience follow:

Hoosic River Revitalization North Adams, Massachusetts

Responsible for conceptual and alternative designs for improvements to transform the Hoosic River corridor and revitalize the City along the waterfront including presenting plans to the stakeholders.

Millbrook Meadow & Mill Pond Restoration Rockport, Massachusetts

Project Manager and Lead Landscape Architect responsible for conceptual design alternatives and Master Plan for meadow and park improvements including flood control, water quality, wetland and wildlife habitat, stream corridor, drainage and infrastructure, and dredging of two ponds.

Guilford Coastal Resilience Plan Guilford, Connecticut

Prepared illustrative planning graphics identifying potential flood storage areas and future development options.

Penobscot River Old Town, Maine

Prepared illustrative renderings for the removal of two dams and one bypass channel illustrating pre and post conditions.

Choate Pond Restoration Wallingford, Connecticut

Assisted with the preparation of landscaping plans for pond dredging, dam safety, and landscape and access improvements in the area surrounding and within the viewsheds of the ponds such that the water features are more of a dramatic focal point on the campus.

Pond Lily on the West River New Haven, Connecticut

Prepared conceptual designs for pedestrian walkways and overlook viewing areas. Prepared conceptual restoration planting scenarios.

Winooski River Montpelier, Vermont

Prepared 3D Illustration for agricultural uses along the floodplain.

Harvey's Lake Dam Removal

Barnet, Vermont

Milone & MacBroom was contracted by the Town of Barnet to design improvements to Harvey's Lake Dam. The project included hydrologic and hydraulics analysis of South Peacham Brook and Harvey's Lake. The project site has a long history of flooding that is affected by an existing dam located downstream of the confluence of the lake's outlet channel and the South Peacham Brook.

The firm performed a site inspection of the dam and immediate impoundment area around the channel up to Harvey's Lake. The dam was causing the water surface to rise rapidly behind the spillway during rainfall to the point where the water surface elevation behind the dam was higher than the level in the lake. The project team prepared a HEC-HMS hydrology model of the South Peacham Brook drainage basin to Harvey's Lake Dam and a hydrology model of the lake's drainage basin to the dam. In addition, cross sections of the floodplain area beyond the stream channel and wet sections were surveyed, identifying the elevations of the stream. Several alternatives were presented to town officials, including:

- Operating the gate valve at Harvey Lake Dam to provide more discharge capacity
- Removing the stop logs at Harvey Lake Dam to increase the dam's discharge capacity
- Modifying the fish ladder opening in the dam to increase the dam's capacity
- Dam removal

As part of the work, the firm contacted the State Dam Safety Engineers to review current data and hydrologic modeling procedures and requirements.

SERVICES PROVIDED:

- Survey
- Engineering
- Hydrology & Hydraulics Analysis

CLIENT:

Town of Barnet
Barnet, Vermont



Lydall Reservoir #1 Spillway Repairs

Manchester, Connecticut

Milone & MacBroom provided a structural assessment and design services for the Lydall Spillway #1 located on the Lydall Reservoir in Manchester, Connecticut. The reservoir is located in the northeast corner of Manchester, along Lydall Brook and immediately downstream of Lydall Reservoir #2. This reservoir was reportedly constructed in 1900; its capacity was subsequently increased in 1944.

Lydall Reservoir #1 covers a surface area of 2.64 acres and has a contributing drainage basin that is 0.19 square miles (12.07 acres) in size, not including the watershed of Lydall Reservoir #2. The spillway elevation of the reservoir is at 348.6 feet with an effective storage volume of 4.3 million gallons. The Lydall Reservoir #1 dam is a low earthen dam with two concrete spillways located on the western edge of the reservoir. The first spillway is an Ogee-crested weir that is 22 feet in length, and the second is a broad-crested weir with two 7 foot openings.

Milone & MacBroom provided a structural assessment of the Lydall Spillway #1 to verify the structural integrity of the spillway and analyzed the adequacy of the wingwalls. The assessment revealed that both the spillway and the wingwalls had extensive cracking and spalling. A hydrologic and hydraulic evaluation was completed of the existing water supply reservoir. Alternative modifications to the spillway were developed in order to obtain adequate hydraulic capacity and freeboard within the reservoir and new outlet control valves were designed.

SERVICES PROVIDED:

- Structural Assessment
- Hydrologic & Hydraulic Analysis

CLIENT:

Town of Manchester
Manchester, Connecticut



Bunnell's Pond Dam

Bridgeport, Connecticut

Bunnell's Pond Dam is a 31-foot high by 1,000 foot long dam. The existing spillway is a 150-foot long concrete/ogee spillway with an insufficient capacity to pass the probable maximum flood as required by State regulations. The Connecticut Department of Energy and Environmental Protection proposed that the spillway capacity be increased or the dam be protected from overtopping flows.

Milone & MacBroom prepared a detailed hydraulic analysis of flood conditions including a dam breach analysis. Considering the frequent flooding immediately downstream in the City of Bridgeport during relatively small rainfall events, the spillway capacity could not be increased sufficiently to pass the larger floods without causing increased flooding during smaller events. Therefore, it was decided to design an overtopping protection system for the dam. A detailed report comparing different overtopping systems, including their advantages, disadvantages, and cost was prepared for the Department of Energy and Environmental Protection. Roller compacted concrete armoring of the earthen portion of the dam was selected as the most durable and economical overtopping protection system. An Alaskan steeppass fish ladder was selected by the DEEP to be included in the design.

Milone & MacBroom prepared design plans and specifications for the roller compacted concrete overtopping protection system and for repairs to the broken low level outlet gate valve. Design of the Alaskan steeppass fishladder required a structural stainless steel support system of the aluminum fish ladder, as well as concrete piers.

SERVICES PROVIDED:

- Dam Breach Analysis
- Hydraulic Analysis
- Structural Engineering

CLIENT:

State of Connecticut Department of Energy and Environmental Protection



Dam Emergency Operations Plans

Norwich, Colchester, Montville, Connecticut

Milone & MacBroom was retained by Norwich Public Utilities to perform dam inspections and prepare Emergency Operations Plans for the dams impounding Deep River Reservoir, Fairview Reservoir, Bog Meadow Reservoir, Taftville Reservoir #1, and Taftville Reservoir #3. In addition, Milone & MacBroom updated the Emergency Operations Plan for the Stony Brook Reservoir dam.

The work built upon previous dam failure inundation mapping performed in the late 1970's for five of the six dams. We utilized the USACE "Rule of Thumb" Method for delineating the potential downstream inundation area for Taftville Reservoir #3. An Emergency Operations Plan was provided for each dam that identified specific routine and emergency monitoring protocols and how to interpret field observations. Included in each report was the identification of critical elements of the dam that should be monitored in the future, a map showing the downstream areas that are potentially subject to inundation in the event of a dam failure, and a list of town and state personnel who should be notified in the event of a dam-related emergency.

SERVICES PROVIDED:

- Dam Inspections
- Emergency Operations Plans

CLIENT:

Norwich Public Utilities
Norwich, Connecticut



Bronx River Dam Safety Assessment

Bronx, New York

Milone & MacBroom was retained to conduct a dam safety assessment of the 182nd Street, Bronx Zoo, and Snuff Mill Dams on the Bronx River. The dams are located in public parks, including the Bronx Zoo and New York Botanical Gardens. The goal of the project was to establish the current flood hazards associated with each of the three structures and how such conditions could change after implementation of proposed fish passage as required by the New York State Department of Environmental Conservation (NYSDEC) Dam Safety Unit.

The project included dam failure analysis, hazard classification, spillway capacity determination, and stability analysis. Field investigations were performed at each structure to confirm dimensions and update current conditions. A dam breach analysis was conducted using the unsteady HEC-RAS hydraulic model for a sunny day piping breach and for an overtopping breach during the one-half probable maximum flood. Breach formation parameters were calculated using equations based on currently accepted methods. Flood inundation maps were created in GIS for each structure.

The firm also performed a structural stability analysis following the criteria specified in the NYSDEC “Guidelines for Design of Dams” revised January 1987 and the U.S. Bureau of Reclamation manual “Design of Gravity Dams”, 1976. The key tasks were to evaluate the stability of the dam and its ability to resist sliding or overturning.

SERVICES PROVIDED:

- Survey & Mapping
- Dam Safety Assessment
- Hydraulic Modeling
- Structural Engineering

CLIENT:

Bronx River Alliance & Natural
Resources Group
Bronx, New York



Dam Breach Analyses

Various Counties, South Carolina

Milone & MacBroom was retained to conduct a dam breach analysis with assessment of potential resultant downstream flooding at the Gresham Park dam site in Greenville County, South Carolina. The dam was an existing earthen structure approximately 20 feet in height with a length of approximately 300 feet. Our efforts involved appropriate data collection, site inspection, and hydrologic and hydraulic analyses.

Milone & MacBroom was also retained to conduct a dam breach analysis with assessment of potential resultant downstream flooding at the Keowee Mountain dam site in Pickens County, South Carolina. The dam was an existing earthen structure approximately 30 feet in height with a length of approximately 350 feet. Our efforts involved appropriate data collection, site inspection, and hydrologic and hydraulic analyses.

In addition to these projects, the firm was retained to conduct a dam breach analysis with assessment of potential resultant downstream flooding at the Boulder Creek dam site in Greenville County, South Carolina. The dam was an existing earthen structure approximately 12 feet in height with a length of approximately 200 feet. Our efforts involved appropriate data collection, site inspection, and hydrologic and hydraulic analyses.

SERVICES PROVIDED:

- Engineering
- Hydrologic & Hydraulic Analysis
- Permitting

CLIENT:

Fant, Reichert & Fogleman
Greenville, South Carolina



Dundee Dam Hydropower on Presumpscot River Windham & Gorham, Maine

Milone & MacBroom provided consultation, design services, permitting, and FERC relicensing at the Dundee Dam Hydropower on the Presumpscot River in the towns of Windham & Gorham, Maine. Specific tasks included preparation of drainage improvement plans, design and permitting of a bridge to provide improved angler access, preparation of FERC Exhibit G Boundary Plans, and Exhibit F Public Use & Safety Plans.

The firm also completed similar work at other hydropower projects owned and operated by Sappi Fine Paper at the Mallison Falls, Gambo, and Saccarappa dams.

SERVICES PROVIDED:

- Dam Stability Analysis
- Permitting

CLIENT:

Sappi Fine Paper
Westbrook, Maine



Scour Analysis Training for Maine Department of Transportation Augusta, Maine

Milone & MacBroom was contracted by the Maine Department of Transportation to conduct scour analysis training for 20 engineers in the Department's Bridge Design Group. The firm developed training materials and conducted a one day course on river dynamics and scour as it relates to bridge design. Specific topics included:

- River dynamics
- Evaluating channel adjustments
- Sediment stability and transport
- Channel scour
- Scour evaluation methods
- Scour countermeasure methods

The Federal Highway Administration's HEC-18, HEC-20, and HEC-23 manuals were used to provide the framework for current scour analysis and countermeasure design. The training also went beyond the manuals to cover the history of development of scour equations and the limitations of analysis methods. The intention was to develop an understanding not only of analysis methods, but also of the potential shortcomings of the various analytical methods.

SERVICES PROVIDED:

- Scour Analysis Training

CLIENT:

Maine Department of Transportation
State of Maine



Harbor Brook Flood Control

Meriden, Connecticut

Milone & MacBroom was retained to assist the City in developing a flood mitigation and channel restoration plan for the Harbor Brook corridor. Implementation of the plan will remove structures from the floodplain and roadways located within the city's downtown, facilitating redevelopment opportunities. The project included evaluating channel characteristics over a three mile reach, including an inventory of bridges and structures that affect river hydraulics. Design plans were developed to reflect channel and structure modifications, construction of compound channels through floodprone areas, and construction of a linear river trail system that will run much of the length of the channel.

Project permits were obtained, including Diversion and 401 Water Quality Certificate from CT DEEP and Section 404 from ACOE. The permits authorize:

- Replacement or modification of 15 bridges
- Nearly three miles of channel improvements
- Daylighting 1,700 linear feet of channel to create an urban park
- 8.83 acres of waterway impact below ordinary high water of the channel
- 0.03 acres of permanent impact to federal wetlands and 0.28 acres of impact to state wetlands

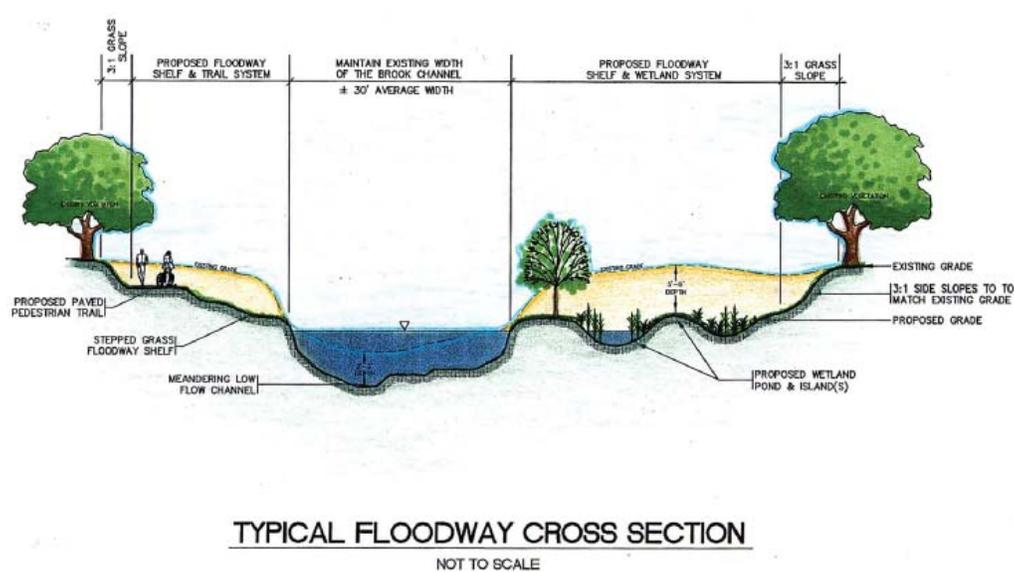
Once implemented the plan will provide flood reduction benefits within an urban greenway along with water quality enhancements, fisheries habitat structures, and improved stormwater management systems.

SERVICES PROVIDED:

- Flood Control
- Landscape Architecture
- Hydrologic & Hydraulic Modeling
- Regulatory Permitting
- FEMA LOMR
- Ecosystem-Based Habitat Restoration
- Construction Administration
- Public Outreach

CLIENT:

City of Meriden
Flood Control Implementation Agency
Meriden, Connecticut



Goodwives River Watershed Evaluation

Darien, Connecticut

Milone & MacBroom conducted hydraulic flood mitigation analysis for Goodwives River watershed, a seven square mile watershed area. Residences and businesses in the watershed have experienced increased flooding in recent years, with at least three events occurring since 2007. In some locations, complaints appear related to street flooding caused by insufficient drainage systems, while other are related to channel flooding.

Geomorphological evaluations of the channel were completed by staff, including mapping of impacted stream banks areas and channel encroachments. During this field work, the location of up to 50 surveyed cross-sections was identified to facilitate building a hydraulic model to evaluate flood water elevations. A HEC-RAS model was developed using the base information obtained from the FEMA FIS for the channel. The model was supplemented based on field observations and cross-sections were surveyed. The model reflected existing conditions, as well as evaluation of mitigation measures to reduce flooding frequency along the channel.

In addition, staff evaluated selected street drainage systems within the watershed and provided recommendations for mitigation where possible. The first two locations are in the same sub-watershed area and share a drainage system. We conducted an analysis of the three areas to determine the cause of the street flooding problems and to identify potential solutions. The systems were analyzed for the 25-year event.

SERVICES PROVIDED:

- Survey
- Watershed Planning
- Geomorphic Assessment
- Hydraulic Analysis
- Hydraulic Modeling
- Flood Mitigation Assessment
- Public Outreach

CLIENT:

Town of Darien
Darien, Connecticut



Coppermine Brook Drainage Study

Bristol, Connecticut

Milone & MacBroom was selected by the City of Bristol to perform a drainage and flooding study of Coppermine Brook. This 18 square mile tributary of the Pequabuck River is the source of recurring flood problems in the City. The goal of this project was to evaluate the river system, identify the causes of flooding, and recommend solutions.

The following specific work tasks were completed:

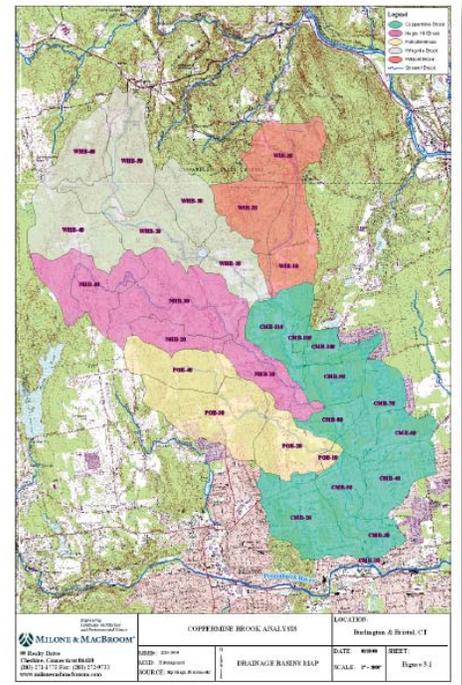
- **Hydrologic Modeling:** A watershed model was developed using HEC-HMS. Peak flows were determined for existing conditions and for full build out of the watershed within the context of existing land use regulations. Potential future flood storage areas were identified and modeled.
- **Hydraulic Modeling:** A HEC-RAS model was developed to predict peak flood elevations under existing conditions. Alternatives to reduce flooding were also evaluated.
- **Floodplain Mapping:** Using the HEC-RAS model output and base mapping from the City, Milone & MacBroom, Inc. mapped existing floodplains along the channel and compared the results to the City's Flood Insurance Study.
- **Development of a Comprehensive Plan:** The final product is a report that documented the work completed and recommended mitigation strategies to reduce flooding.
- **Public Outreach:** Throughout the project, Milone & MacBroom, Inc. was responsible in assisting the City in coordination with affected land owners. This included both formal information sessions and informal one-on-one meetings.

SERVICES PROVIDED:

- Survey
- Hydrologic & Hydraulic Modeling
- Watershed Planning
- Public Outreach

CLIENT:

City of Bristol
Bristol, Connecticut



Dutton Avenue Bridge at Rockwell Park Bristol, Connecticut

Milone & MacBroom was selected by the City of Bristol for Phase II of the Reconstruction of the historic Rockwell Park. As part of the project, the existing Dutton Avenue Bridge over the Pequabuck River was to be inspected for structural condition and bid documents were required.

The original bridge consisted of a single 42-foot span utilizing through steel plate girders with concrete encased floor beams and deck that carried two lanes of vehicular traffic. An inspection of the existing bridge showed that the steel structure was in poor condition and it was determined that it would not be cost effective to rehabilitate. The existing prestressed beams were in good condition. As part of the proposed project plans, the Dutton Avenue Bridge would be used mainly for pedestrian access from the south side of the park to the north side of the park. Due to the decreased width required of the bridge, the firm proposed to reuse the existing prestressed concrete beams while adding two additional prestressed beams. Decorative steel railings with stone posts were constructed along each fascia of the bridge with a concrete paver walking surface to create a welcoming connection across the river.

Scour analysis was carried out in accordance with the Federal Highway Administration's HEC-18, and HEC-23 publications and included sediment samples. Geomorphic assessment was completed to evaluate channel conditions near each bridge. Permits for the proposed work were obtained from the local wetlands commission, as well as the Connecticut DEEP and U.S. Army Corps of Engineers.

SERVICES PROVIDED:

- Bridge Inspection
- Scour Analysis
- Permitting
- Construction Administration

CLIENT:

City of Bristol
Bristol, Connecticut



First Light Power Shoreline Management Manual

Litchfield, Fairfield, New Haven, Connecticut

Milone & MacBroom was contracted by First Light Power (FLP) to develop a manual to help educate residents of lake and pond communities across Connecticut, as well as municipal land use officials in those municipalities. The manual is intended to provide FLP and the homeowners who live along their lakes a guide for the establishment and maintenance of vegetated buffer zones. The guides address the requirements of the Federal Energy Regulatory Commission, as well as the goals of FLP to develop a more ecologically sensitive and pro-active approach to preserving impoundments.

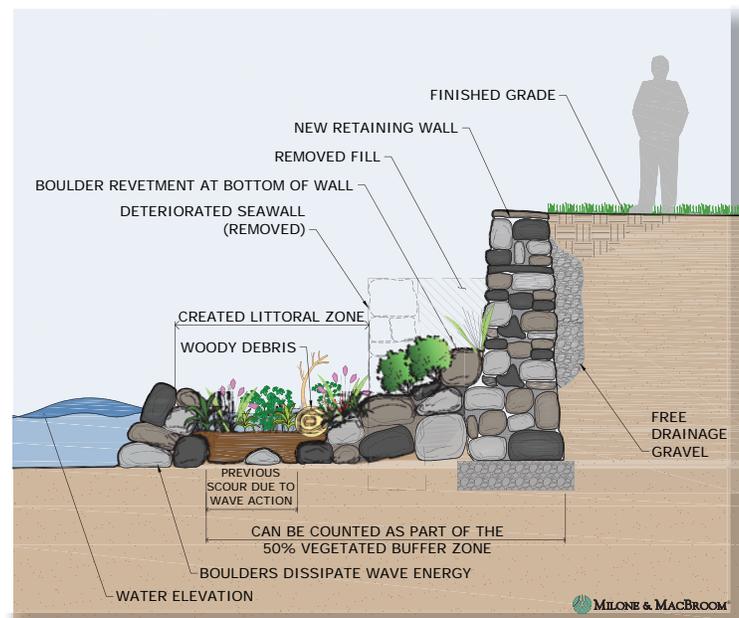
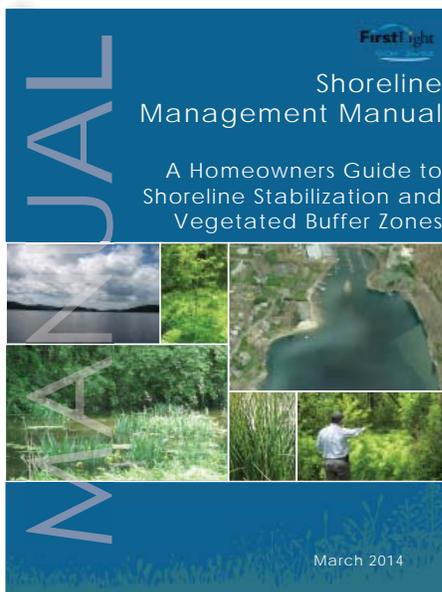
The manual provides options for more environmentally sustainable stabilization techniques such as bioengineering, as well as the planting of vegetative buffers. It also provides background on the function and importance of vegetated buffer zones; describes how to plan for and establish buffers; explores alternative shoreline protection measures; examines how to maintain new and/or established buffers over the long term; identifies appropriate plant species and densities; and provides guidance on where plants can be purchased. The completed manual is to be used for local land use regulations, and future construction activities associated with lakes/ impoundments within the region.

SERVICES PROVIDED:

- Research
- Landscape Architecture
- Bank Stabilization
- Public Outreach

CLIENT:

First Light Power
Litchfield, Connecticut



Noroton River Streambank Stabilization

New Canaan, Connecticut

The Noroton River near Old Stamford Road and Raymond's Pond had suffered extensive bank erosion, particularly as a result of past flood events. The site qualified for Emergency Watershed Protection (EWP) funds from the Natural Resource Conservation Service. Milone & MacBroom was contracted by Marchetti Consulting Engineers to develop a bank stabilization design to address the erosion issues and to prepare and submit permit applications to CT DEEP and the U.S. Army Corps of Engineers. Working with both agencies, the property owners, and town staff, the project team was able to secure these permits on a fast track schedule of approximately two months.

Locally, the Noroton River has a moderate to steep slope with sand, gravel, and cobble channel bed. The banks are generally lined with rock and woody vegetation, much of which had collapsed in the river due to the extensive erosion. After site investigations, the firm developed a design that incorporated natural elements such as log and stone wall to provide lower bank stability, with vegetation soil lifts, bank grading, and plantings to provide upper bank stability. Design plans included for the new channel depicting the proposed alignment, bed profile, and overbank grading and planting.

In addition, the firm assisted with bid assistance and performed construction inspection.

SERVICES PROVIDED:

- Bank Stabilization Design
- Permitting
- Construction Inspection

CLIENT:

Marchetti Consulting Engineers
Stamford, Connecticut



Streambank Stabilization & Natural Stream Channel Design Guidelines

Milone & MacBroom, Inc. researched and drafted a white paper and guidelines document on *Streambank Stabilization and Natural Stream Channel Design Guidelines* for the New Hampshire Department of Environmental Services and Department of Transportation (Schiff et al., 2007). The white paper covers the basic theory of fluvial geomorphology and river restoration that is often drawn upon for applied projects.

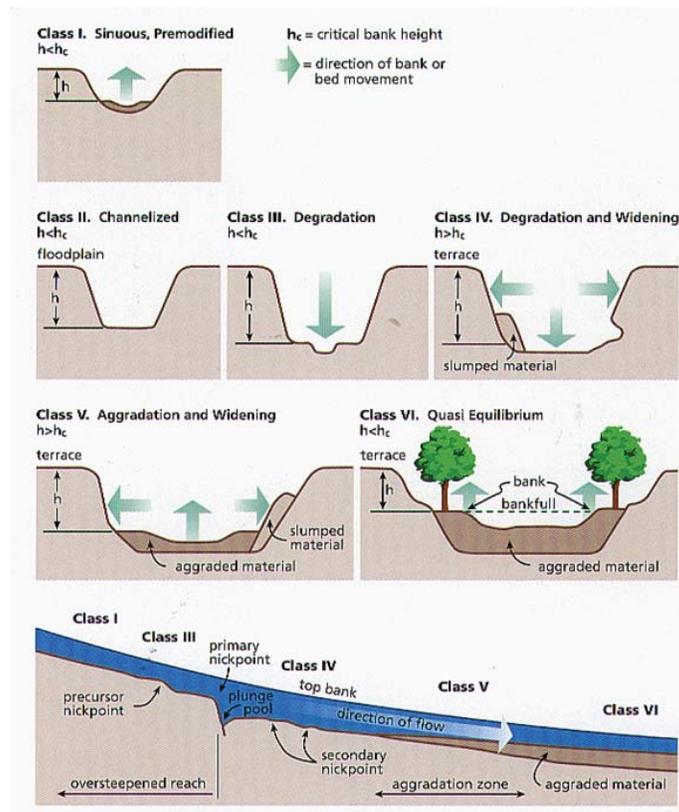
The guidelines document not only introduces all of the necessary tools for design of naturalized channel and bank stabilization projects, but also presents a project classification system to help select the appropriate design tools. With the many methods available to the practitioner, the project classification system helps structure project design. The document includes an extensive glossary and numerous links to tools available on the Internet. The guidelines document is intended for practitioners, regulators, municipal officials, members of non-profits, and others with some experience in naturalized channel design and bank stabilization projects.

SERVICES PROVIDED:

- Preparation & Research

CLIENT:

State of New Hampshire
Department of Environmental
Services



Vermont Stream Geomorphic Assessment Protocols

State of Vermont

The Vermont Department of Environmental Conservation retained Milone & MacBroom's services to assist with the development of a physical habitat assessment protocol, which is part of the Vermont Stream Geomorphic Assessment Protocols. The project included research and development of a process-based reach habitat assessment to establish indicators and measurement systems of key processes, ecological attributes, and resultant habitat features. Elements of the project included:

- A literature review to select and validate habitat indicators
- Review of existing habitat assessment protocols to identify the best methods of measuring selected indicators
- Development of habitat analyses to score ecological processes and requirements
- Creation of an annotated bibliography of resources utilized during the development of the habitat assessment
- Field testing and refinement of habitat assessment procedure
- Conduct a pilot study to compare previous and new habitat assessment methods
- Compare biomonitoring data and reach habitat assessment results to explore relationships between processes, habitat features and biological assemblages

SERVICES PROVIDED:

- Stream Habitat Assessment
- Research
- Environmental Testing
- Pilot Study

CLIENT:

Vermont Department of
Environmental Conservation
Waterbury, Vermont

