## Connecticut River Conservancy Comment Exhibit List*

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| Exhibit A | Affidavit of Michael Lew-Smith (Feb 24, 2025) |
| Exhibit B | Affidavit of Boyd Kynard (Feb 24, 2025) |
| Exhibit C | Connecticut River Conservancy Photo Log: The Current State of Erosion as of Sept 25, 2024 |
| Exhibit D | Princeton Hydro, LLC, Comment on Water Quality Certification with Conditions Firstlight Hydroelectric Project FERC License Nos. 1889 (Turners Falls) and 2485 (Northfield Mountain) ( Feb. 24, 2025). |
| Exhibit E | FRCOG Comment on Water Quality Certification with Conditions Firstlight Hydroelectric Project FERC License Nos. 1889 (Turners Falls) and 2485 (Northfield Mountain) ( Feb. 24, 2025). |

* These exhibits are attached to this comment document for reference. The complete set of photos from Exhibit C was too large to attach in an email and will be submitted to DEP via the Sharepoint folder that Elizabeth Stefanik sent to Nina Gordon-Kirsch on 2/20/25.

# EXHIBIT A

## AFFADAVIT OF MICHAEL LEW-SMITH
## ON BEHALF OF THE CONNECTICUT RIVER CONSERVENANCY

1. My name is Michael Lew-Smith. I am an ecologist and principal botanist for Arrowwood Environmental, an ecological services and consulting firm located at 950 Bert White Road, Huntington, Vermont. I have a Bachelor of Science from the University of Michigan School of Natural Resources and a Master of Science from the University of Minnesota, Department of Plant Biology. I have worked throughout New England on natural resource identification, assessment, and management projects. This work includes considerable experience inventorying aquatic invasive species and rare aquatic plant species. For instance, I have worked closely with lake associations on vegetation management plans and throughout Lake Champlain mapping and controlling aquatic invasive species. I am also currently working on an aquatic natural community classification system.
2. The purpose of my affidavit is to explain the classification of two plants — Tradescant's aster and tufted hairgrass — as wetland plants and to explain the Connecticut River Conservancy's ("CRC") comments regarding those plants.
3. To provide this affidavit testament, I reviewed the Draft Water Quality Certification ("DraftWQS") and am familiar with its contents. I also reviewed scientific literature regarding the classification of these plants. A complete list of this literature is cited at the end of this affidavit.
4. Based upon my review, I conclude that Tradescant's aster and tufted hairgrass could be considered wetland plants, as distinct from aquatic plants.
5. While there is no national system which categorizes aquatic plants, there is a large body of scientific literature which distinguishes aquatic plants from non-aquatic plants. In his classic treatise on aquatic plants, Sculthorpe states that aquatic plants "live and reproduce in partly or wholly submerged state" (Sculthorpe 1967). More recent researchers have defined aquatic plants as "… photosynthetic organisms … that actively grow permanently or periodically submerged below, floating on, or growing up through the water surface." (Chambers et al. 2007) or plants "whose life cycle takes place completely or periodically in the aquatic environment." (Lesiv, Polishchuk, and Antonyak 2020).
6. In order to survive in aquatic environments, there are a wide range of adaptive mechanisms that aquatic plants have evolved, including specialized tissues for internal gas exchange to survive in anoxic environments, reduced or absent cuticles to facilitate gas and nutrient exchange, and adaptive morphology such as highly dissected leaves (Sculthorpe 1967).
7. It is also important to make a distinction between wetland plants and aquatic plants. According to the National Wetlands Inventory ("NWI") classification, both Tradescant's aster and tufted hairgrass are considered facultative wetland plants ("FACW"). FACW plants usually occur in wetlands, but may occur in non-wetlands. Due to the wide ecological amplitude of both of these species, they are also very commonly found in non-wetland habitats.

8. For the purposes of determining how often a species occurs in wetlands, wetlands are defined "as … those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." 33 C.F.R. § 328.3
9. Using the above definitions and NWI classification as a guidance, both Tradescant's aster and tufted hairgrass could be considered wetland plants. However, neither Tradescants' aster nor tufted hairgrass are known to survive in truly aquatic environments. A review of the herbarium records of each of these species in Massachusetts fails to find any occurrences documented in aquatic habitats. In addition, neither of these species is known to possess any specific adaptive features that indicate they have evolved to survive in an aquatic environment.
10. The habitats that the aster and hairgrass occupy in the bypass area have been defined by MassWildlife as "river-scoured bedrock, cobble and gravel shores" and state that the plants are "rooting in very limited soil (i.e. rock crevices/cracks)." The habitat that the plants currently occupy in the bypass area can therefore not be considered an aquatic habitat. While it may experience flooding for brief periods outside of the growing season, environmental conditions during most of the growing season are clearly not aquatic.
11. In their assessment of the available habitat at the site for both the aster and hairgrass, MassWildlife has stated that the "vertical lower extent of habitat is limited by persistent inundation" (Draft WQS, p21). However, as noted above, being able to survive persistent inundation is what defines an "aquatic" plant. While elsewhere MassWildlife has stated that these species are "unquestionably classified as aquatic/wetland species" they are here admitting that neither plant can actually survive in aquatic habitats.
12. Finally, Hickler, *et al.*, conducted a botanical inventory of aquatic plant species of this stretch of the Connecticut River (Hickler et al. 2018). This survey documented all of the "truly aquatic taxa, which rarely stray beyond the permanently flooded reaches of the river." Neither Tradescant's aster nor tufted hairgrass are included in that list. While their presence is well known to local botanists, they were not included in the list because they were not considered aquatic flora.
13. I declare under penalty of perjury that the foregoing is true and correct.

Executed this 24th day of February 2025, in Hardwick, Vermont.

Michael Lew-Smith

Works Cited

Chambers, P. A., P. Lacoul, K. J. Murphy, and S. M. Thomaz. 2007. "Global Diversity of Aquatic Macrophytes in Freshwater." *Freshwater Animal Diversity Assessment*, April, 9–26. https://doi.org/10.1007/978-1-4020-8259-7_2.

Hickler, Matthew G., Robert I. Bertin, Glenn Motzkin, and Karen B. Searcy. 2018. "Notable Aquatic Plants from the Connecticut River in Franklin County, Massachusetts." *Rhodora* 120 (981): 76–86. https://doi.org/10.3119/17-14.

Lesiv, M S, A I Polishchuk, and H L Antonyak. 2020. "Aquatic macrophytes: ecological features and functions." https://doi.org/10.30970/sbi.1402.619.

Sculthorpe, C.D. 1967. *The Biology of Aquatic Vascular Plants*. 2nd ed. London: Edward Arnold Publishers Ltd.

U.S. Army Corps of Engineers. 2020. National Wetland Plant List, version 3.5. http://wetland-plants.usace.army.mil. U.S. Army Corps of Engineers. Engineer Research and Development Center. Cold Regions Research and Engineering Laboratory, Hanover, NH

# MICHAEL LEW-SMITH

PARTNER – ECOLOGIST – BOTANIST

ARROWWOOD ENVIRONMENTAL

## Areas of Expertise

- Rare, Threatened and Endangered Plant Inventories
- Aquatic Plant Inventories
- Wetland Delineation
- Natural Community Mapping and Assessment
- Freshwater Mussel Inventories
- Vernal Pool Mapping and Assessment
- Invasive Species Mapping and Management
- Herpetological Studies
- Rare Plant Transplantation and Monitoring

## Education & Professional Training

- M.S., University of Minnesota Department of Plant Biology, 1997
- B.S., University of Michigan School of Natural Resources. Natural Resource Management, 1991
- Freshwater Mussel Identification and Ecology, USFWS Training Center, Shepardstown, WV, 2016
- Reptiles and Amphibians of Vermont, Hogback Community College Vt. Family Forests. Bristol VT, 2011
- Boreal Flora, University of Michigan Biological Station, 1995
- Bryophytes, University of Michigan Biological Station, 1995

Mr. Lew-Smith is an ecologist and principal botanist for Arrowwood Environmental. He has worked closely with conservation organizations, agencies, municipalities, companies, and private individuals on natural resource identification, assessment and management. Mr. Lew-Smith conducts botanical inventories, wetland delineations, wildlife habitat assessments, and ecological restorations. He also has considerable experience mapping and assessing natural communities for private organizations and public land managers and is currently working on an aquatic natural community classification system. Mr. Lew-Smith regularly conducts inventories of aquatic invasive species and rare aquatic plants and works closely with lake associations on aquatic vegetation management plans. Mr. Lew-Smith has also worked throughout Lake Champlain mapping and controlling aquatic invasive species. He is one of the founders of the Vermont Vernal Pool Mapping project, which mapped and assessed vernal pools statewide.

## Significant Projects & Experience

- Aquatic Species Mapping and Assessment: Map native and non-native aquatic plants in lakes throughout Vermont and develop plans for the management of aquatic nuisance species.
- Freshwater mussel inventories: Conduct inventories for freshwater mussels throughout Vermont.
- Northern Pass: Project Manager and ecologist working for the NH Attorney General's office on providing an independent review of the environmental assessment of the proposed Northern Pass transmission line.
- Wetland Reclassification: Provide technical support and detailed analysis to support Class I reclassification petition for the LaPlatte River Marsh Wetlands.
- Renewable Energy: Project manager and principal ecologist working with project sponsors and engineers of small and large scale solar projects to design layouts that avoid and protect significant natural resources.
- Member of the Floral Advisory Group: Advising the Vermont Endangered Species Committee on matters related to Vermont's Rare, Threatened and Endangered Plants.
- Vernal Pool Mapping: Co-founder of the Vermont Vernal Pool Mapping Project. Developed a vernal pool mapping methodology and a statewide Vernal Pool map and database.

# Exhibit B

## AFFADAVIT OF BOYD KYNARD
## ON BEHALF OF THE CONNECTICUT RIVER CONSERVENANCY

1. My name is Boyd Kynard. I am a migratory fish behaviorist who consults on conservation, research and fish passage for migratory fish. I have dedicated most of my life to studying sturgeon and have published nearly 200 scientific articles on sturgeons and other fishes. In 2012, I published a book on Shortnose sturgeon (*Acipensor brevirostrum*) entitled *Life history and behaviour of Connecticut River shortnose and other sturgeons.* I earned a PhD from the University of Washington, College of Fisheries in 1971. Between 1989 and 2007, I worked for the United States Geological Survey as a research fish biologist. I was a section lead of fish behavior and conducted research on life history of migratory fish and fish passage in the United States, Brazil, China, and Romania. I have also taught courses at the University of Arizona and at the University of Massachusetts–Amherst, including Biology and management of anadromous fish and ecological genetics of fish. In 2008, I formed a private company, BK-Riverfish, LLC, with my son. The business specializes in developing fish ladders for sturgeon and non-salmonid riverine fish. My curriculum vitae is attached as Exhibit 1 to this Affidavit.
2. The purpose of my affidavit is to explain the Connecticut River Conservancy's ("CRC") comments regarding the potential impacts of Massachusetts Department of Environmental Protection's ("MassDEP") draft water quality certification ("401 certification") on Shortnose sturgeon in the project area.
3. To provide this affidavit testimony, I reviewed the draft 401 certification. I am also familiar with the Turners Falls Dam and Turners Falls Impoundment. I have researched Connecticut River Shortnose sturgeon extensively and have published widely on the topic, including my 2012 book, *Life history and behaviour of Connecticut River shortnose sturgeon and other sturgeons*.
4. Based upon my review, I conclude that proposed flows below the dam could result in strandings that can injure or, potentially, kill Shortnose sturgeon. Additionally, fish passage should account for upstream and downstream migration of Shortnose sturgeon, including those Shortnose sturgeon now known to live above the Turners Falls Dam.
5. Along with my co-researchers, I studied Connecticut River Shortnose sturgeon for a 15-year period between 1990 and 2005 to evaluate the effects of Holyoke Dam on migrations and population structure. The results of those studies are published in *Life history and behaviour of Connecticut River shortnose sturgeon and other sturgeons.* My co-researchers and I concluded that the Holyoke Dam impacts Shortnose sturgeon population structure by limiting the number of spawning adults to only a few upstream adults (i.e., those adults living above the Holyoke Dam), decreasing the production of young sturgeons, and reducing abundance by killing downstream migrants. Based on that research and my understanding of the the Turners Falls Dam and the associated power station, Cabot Station, I believe that these same impacts apply to the Turners Falls Dam and, thus, would likewise impede the restoration of the segment of Shortnose sturgeon upstream of Turners Falls Dam.

LOW SUMMERTIME FLOW PUNCTUATED BY PERIODS OF HIGH FLOW COULD CAUSE SHORTNOSE STURGEON TO BE STRANDED BELOW THE TURNERS FALLS DAM; STRANDINGS COULD HARM STURGEON.

6. It is my understanding, based on my review of CRC's comments, that two adult Shortnose sturgeon were stranded below the Turners Falls Dam in separate instances this past summer (summer of 2024).
7. High flows during the summer, when my co-researchers and I have tracked rare adult Shortnose sturgeon in the bypass reach, would attract and facilitate upstream movements of exploring adults.
8. Based on my understanding of Shortnose sturgeon, I would conclude that Shortnose sturgeon venturing upstream to Turners Falls Dam, as the two stranded this summer did, would be helped by more water being released in the July–November timeframe because it would create more escape routes for Shortnose sturgeon to swim back downstream. Adults are in small wintering areas in September – March.
9. Given the rocky nature of the substrate below Turners Falls Dam, there is potential for Shortnose sturgeon stranded in that area to injure themselves scraping against the rocks, especially during periods of lower flow.
10. Based on observations of hundreds of adults contacting rocks during migration at Holyoke, it can be certain that the two rows of ventral scutes of adults stranded in the bypass reach would be similarly damaged by scraping against rocks. Bloody wounds can result from this scraping and can lead to infection and possibility death, though I cannot verify a Shortnose sturgeon mortality from this cause. To protect adult Shortnose sturgeon attracted into the bypass reach during periods of high flows or unnatural spillage through the bascule gate from stranding and injury, flows through the bascule gate should be reduced slowly overnight for a one-night period. This will enable adult Shortnose sturgeon to escape from potential stranding prompted by high flow in the dark when Shortnose sturgeon will most prefer to use shallow water. There must be escape channels to the main channel available to them.

FISH PASSAGE MUST ACCOUNT FOR THE UP- AND DOWNSTREAM MIGRATION OF SHORTNOSE STURGEON AT THE TURNERS FALL DAM

11. Now that there is eDNA evidence of Shortnose sturgeon above Turners Falls Dam, conditions must be put in place to protect Shortnose sturgeon from the operations at Northfield Mountain Pump Station and during downstream passage, including protection at Turners Falls Dam. Telemetry research in the 2012 sturgeon book demonstrates that some adult Shortnose sturgeon will migrate downstream annually and some juveniles will do similarly. These sturgeons would be migrating downstream past Holyoke Dam, but the population segment upstream of Turners Falls Dam will behave similarly and need protection. Shortnose sturgeon migrations are genetically coded and have been going on for millions of years and any examination of Shortnose sturgeon population segments in one river have found they are identical genetically. Therefore, age-0 juveniles upstream of Turners Fall Dam will undertake downstream migrations similar to age-0 juveniles spawned at Rock Dam when those upstream age-0 juveniles reach their migration time. My research also shows that many adults migrated downstream from the Rock Dam after

spawning; thus, the same migration by some adults upstream of Turners Falls Dam should occur. Additionally, although we did not study migrations of older juveniles at Holyoke, we know from telemetry data that older juveniles (age 2-4 years old) also migrate up- and downstream all summer. Thus, juveniles and adult sturgeons are migrating downstream May – August. Our research in the 2012 sturgeon book also shows that adult (and likely juvenile) migrations take months. Mortality of adults at Holyoke Dam was 44.9% or higher. Juvenile mortality is unknown, but would be less.

12. Likewise, the design of the fish lift at Turners Fall Dam must take Shortnose sturgeon passage into account. If the fishway entrance is accessible to adult sturgeons, Shortnose sturgeon may still pass upstream via the new lift. Experience at the Holyoke lift shows that, even when fish lifts are not designed for Shortnose sturgeon, some, but very few, Shortnose sturgeon still pass upstream. Once modifications to the fish lift were made at Holyoke around 2016, the numbers of sturgeons documented in the fish lift increased dramatically; specifically, the National Marine Fisheries Service December 4, 2019 Holyoke Biological Opinion shows the number of sturgeons documented in the fish lift increased from 3.8 sturgeons per year from 1975 to 2015, to 85 per year from 2016-2018. Based on the few adults we tracked in the bypass reach downstream of the Turners Falls Dam, the data predict that few adults will use the lift at Turners Falls at this time. Nonetheless, adult Shortnose sturgeon will use the bypass reach into the summer, so if the fish lift operates into July for passing American shad, the lift might attract non-spawning Shortnose sturgeon in June and July. Presently, 27 years of telemetry have shown that adult Shortnose sturgeon do not swim far up the bypass reach in April or May when spawning occurs because females are at the Rock Dam at this time and males are attracted to the females' pheromones. Spawning typically ends around mid-May. In the future, that could change if there is successful downstream migration from the sturgeon population segment upstream of Turners Falls Dam, because there will be prespawning adults returning to the bypass reach that were imprinted to the spawning site upstream of Turners Falls Dam. It is important that the fish lift at Turners Falls Dam is designed to pass sturgeon.
13. We do not yet understand the biological significance of the small population of Shortnose sturgeon upstream of the Turners Falls Dam. We will never know if this upstream group is a natural upstream segment of the larger downstream population or if it is a group of dislocated individuals that began to spawn together. However, genetically they are the same as the downstream segment. Thus, if lower river adults are passed upstream and juveniles and adults migrating downstream are protected, the two groups / population segments can be joined. Such a joining would not genetically or otherwise disadvantage the lower river population segment, but it should increase the Darwinian fitness of the entire population for long-term survival.
14. Based on my understanding of the Northfield Mountain operations and of Shortnose sturgeon behavior, there may be detrimental impacts on Shortnose sturgeon from Northfield operations. Shortnose sturgeon on downstream migrations remain in the dominant river flow (usually in the channel in natural systems) to protect themselves from stranding and conserve energy. The flow of water into Northfield's intake could attract age 0 and older sturgeons (to adults) migrating downstream because evolution has evolved this behavior in response to survival success. Those sturgeon could die if they remain in the generation water, or are otherwise impinged or entrained due to

Northfield's operations. Additionally, when operations at Northfield result in a reversal of river flow, Shortnose sturgeon in the channel migrating downstream will be impacted. Shortnose sturgeon have no evolutionary history with changes in river flow direction, so downstream migrating Shortnose sturgeon would remain in the dominant flow, whether that flow is natural or unnatural. In this case, the dominant flow (which is upstream when Northfield is releasing water to generate electricity) may direct sturgeons in the opposite direction of their normal migratory route. Removal of small juveniles from their normal migration route could expose them to increased predation and reduced forage plus physical damage if they reach the facility.

15. Take of Shortnose sturgeon, as the term take is defined in the Endangered Species Act, could occur for downstream migrants from impacts from Northfield's water intake structures or the river flow being reversed and, at Turners Falls Dam or at Cabot Station, from impacts from operations and turbines. For upstream migrants, take could occur due to strandings below the dam. While there are no data available, my understanding of Shortnose sturgeon and their behavior, as informed by 27 years of research, and my experience with similar structures and barriers at Holyoke Dam indicate there would likely be takes, particularly of older juveniles and adults at Turners Falls Dam and Cabot Station. Though without data, because the presence of Shortnose sturgeon above Turners Falls Dam has only been recently established, it seems likely that a guidance barrier could be installed at the intake to Northfield that would protect age-0 juveniles, larger juveniles, and adults, but such a net must be designed and installed taking sturgeon behavoir and morphology into account. A barrier to protect downstream migrant sturgeon from entering the Hadley Falls Station at Holyoke Dam can provide guidance on a similar facility at Cabot Station.

OTHER BENEFITS OF RESTORING A DEWATERED SECTION OF THE RIVER

16. Increasing river flow in the bypass reach would restore a major dewatered part of the river with life, providing rearing areas for diverse fish species and invertebrates. In addition to sturgeons, juvenile eels, a major emphasis for restoration, live in the area. Additionally, snorkeling surveys I have conducted revealed many yearling smallmouth bass in the reach. The bypass reach is likely the major spawning reach for adults and rearing there provides most of the smallmouth bass to the river. Providing flow for a normal river width would greatly increase benthic invertebrates and rearing habitat for many fish species.

I declare under penalty of perjury that the foregoing is true and correct. Executed this 23rd day of February, 2025, in Amherst, Massachusetts.

Boyd Kynard

Boyd Kynard

# Vitae – November 2025


## Boyd E. Kynard

Owner, BK-Riverfish, LLC
Office: 28 Echo Hill Road, Amherst, MA 01002-1633
Fish Behavior-Fish Passage Laboratory @ Renovators Supply, 1 River Road, Erving, MA 01344
&
Adjunct Professor of Fisheries, Environmental Conservation Department, University of Massachusetts, Amherst, MA 01003

Office: 413-253-9421; mobile 413-695-6571; e-mail: drboyd@umass.edu; web site: bk-riverfish.com


## Personal Information

*Born*: January 2, 1939 in Jackson, MS; Married with two children (son 50, daughter 55); *Health*: normal activities in treatment of multiple myeloma; *Hobbies*: reading, travel, gardening.

## Military Service

U.S. Marine Corps (Active): 1957-60.
U.S. Navy Active Reserve: 1963-67.

## Research and Experience Summary

Boyd Kynard is a fish behaviorist who studies behavior of migratory fish during life history to conserve fish populations and to design up- and downstream fish passage facilities for migrant fish at dams. His expertise is in (1) migratory fish life history behavior (timing and ecology of up- and downstream migrations and evolution of migration styles), (2) R & D on the design of up- and downstream passage for migrant fish at dams in North America, China, and Brazil, 3) designing research facilities and techniques to study migratory fish and fish passage in large rivers and artificial streams, and 4) conservation of migratory fish in large north temperate and neo-tropical rivers with hydroelectric dams. Prior to moving to Massachusetts, he was a tenured Associate Professor of Fisheries at the University of Arizona, Tucson, where he started the undergraduate fisheries major and studied endangered desert fishes in Arizona and Mexico. In Massachusetts, he has 41 years of experience studying the behavior, ecology, and fish passage of Atlantic coast diadromous fishes, with a focus on sturgeons, American shad, and sea lamprey. In the USA, research has involved many species of Atlantic coast fish: American shad, river herring, Atlantic salmon, striped bass, sea lamprey, shortnose and Atlantic sturgeons; and also, sturgeons in the central USA and the Pacific coast: pallid, shovelnose, green and white sturgeons and American paddlefish. He has led or co-led field and laboratory research projects on migrations, habitats, and fish passage for migratory fishes in the United States (Connecticut, Merrimack, Kootenai, and Potomac rivers); Brazil (San Francisco and Grande rivers and the Madeira R., a headwater tributary of the Amazon River); Romania (Danube River); and China (Yangtze River). As a federal employee of the FWS or USGS, he developed four state-of-the-art research programs: (1) field and lab research on migrations and habitats of shortnose and white sturgeons, (2) a lab research program on the ontogenetic behavior, habitat selection, and dispersal of sturgeons from North America, Asia, and Europe, and (3) flume research on

American shad, sturgeons, and riverine fishes to develop up- and downstream passage systems, and (4) evaluation of river regulation on migratory fish life history behavior. After retiring from the US Dept. of Interior (USGS) in 2007, he established a private migratory fish consulting business (BK-Riverfish,llc) and for 10 years has conducted research on fish behavior in the lab, conducted R&D to develop a new type of fish ladder (Patent granted in USA & Canada) for diverse riverine fishes, including sturgeons, and consulted on migratory fish conservation and protection. Details on this work with his son, Brian, is under the heading BK-Riverfish,llc Consulting.

## Education

**B.S. Biology**, Millsaps College, Jackson, MS, 1965.
**M.S. Zoology**, Mississippi State University, State College, MS, 1967.
**Ph.D. Fisheries Biology,** College of Fisheries, University of Washington, Seattle, 1972.

## Professional Employment

**Assistant Marine Biologist**, Gulf Coast Research Lab, Ocean Springs, MS, 1965-66.
**Research Assistant**, Zoology Department, Mississippi State University, State College, MS, 1966-67.
**Assistant Curator & Research Assistant**, College of Fisheries Museum, University of Washington, Seattle, WN, 1968-72.
**Assistant & Associate Professor of Fisheries Science**, Department of Watershed Management, University of Arizona, Tucson, AZ, 1972-78.
**Research Scientist**, U.S. Forest Service, Forest Science Lab, Juneau, AK (participant, Forestry Faculty Program), Summer 1973.
**Assistant Unit Leader**, Massachusetts Cooperative Fishery Research Unit, Department of Forestry and Wildlife, University of Massachusetts, Amherst, MA, 1978-79 and 1980-89.
**Acting Unit Leader**, Massachusetts Cooperative Fishery Research Unit, Department of Forestry and Wildlife, University of Massachusetts, Amherst, MA, 1979-80 and 1989.
**Fish Research Biologist & Fish Behavior Section Leader**, Conte Anadromous Fish Research Center (USFWS and USGS/BRD), Turners Falls, MA, 1989-2007.
**Owner, BK-Riverfish, LLC**, (a consulting company on migratory fish behavior and fish passage), 28 Echo Hill Rd., Amherst, MA 01002-1633, 2008-present.

## Professional Affiliations

American Fisheries Society (Life Member)
Danube River Society (member )
World Sturgeon Conservation Society (member)
North American Soc. For Conservation of Sturgeons & Paddlefish (Life Member)

## Professional Service

**Desert Fish Council**
Lower Sonoran Desert Fish Committee, Chair, 1976-78.
**Arizona Chapter American Fisheries Society**, Founder and Faculty Sponsor, 1978.
**National American Fisheries Society**
Monetary Values of Fish Committee, Member, 1978-80.

Career Opportunities Committee, Chair, 1985.
Career Opportunities Committee, Member, 1986.
Best Paper Committee, Member, 1988.

**Northeast Division American Fisheries Society**

Best Student Presentation Committee, Chair, 1984-91.
Nominations Committee, Member, 1987.
Cooperative extension Education Committee, Member, 1991- 2002.

**Southern New England Chapter American Fisheries Society**

Vice President, 1980, President, 1981, Membership Committee, 1983.

**Nat. Marine Fish. Serv. Shortnose Sturgeon Recovery Team**

Member, 1980-1998

**North Amer. Chapter, World Sturgeon Cons. Soc.**

Executive Board, 2008-2012

**North American Society for Conserv of Sturgeons & Paddlefish**

Exec. Board 2012-2015

**The Nature Conservancy, Massachusetts Chapter**

Trustee – 2010-2015

**Journal of Fishery Science of China**

Member, Editorial Board 2014-present

**IUCN- Sturgeon Specialists Group**

Member, 1995-present

## Awards

Northeast Division American Fisheries Society -- D. W. Webster Award of Merit, 2008.

PhD paper in the journal Behaviour selected for the book Tinbergen's Legacy: 60 years of landmark stickleback papers, 2010.

International Conf. on Engineering and Fish Passage – Life-Time Achievement Award, 2012.

## University Experience and Classes Taught

**University of Arizona, Tucson, AZ**

Assistant and Associate Professor (tenured) of Fisheries, Dept. of Watershed Mgmt.

Introduction to Fisheries, lecture, 3 hr, 1973-77.
Advanced Fisheries Science, lecture, 4 hr, 1974-78.
Natural Resource Measurements, lecture, 1 hr, 1974-78.
Fish Behavior, Fish Speciation, Fish Ecological Genetics, Desert Fisheries-seminars, 1 hr/yr, 1974-78.

**University of Massachusetts, Amherst, MA**

Associate Professor (Adjunct), Dept. of Forestry and Wildlife and Dept. of Zoology.

Fisheries and Wildlife Program Seminar, 1 hr/yr, 1978-79.
Migratory Fish Biology and Management, lecture, 3 hr/wk, 1981-1997).
Anadromous Fish Biology & Restoration, 1 hr lect./yr, 1978-1999.

## Extension and Public Service

## University of Arizona

* **Fisheries Sub-Group Planning Committee**, Member, Intermountain Region, U.S. Forest Service, 1976.

## University of Massachusetts, USFWS, NBS, and USGS

* **Technical Committee for Restoration of Anadromous Fish to the Connecticut River**, Scientific Advisor, 1978-88.
* **American Shad Committee (Conn. River Technical Committee)**, Member, 1981-2007.
* **Represented USFWS on restoring anadromous fish to the Susquehanna River,** Federal Energy Regulatory Commission hearings, Washington, DC, Expert Witness, 1981-83.
* **Downstream Passage Sub-committee of Conn. River Technical Committee),** member, 1982-89..
* **Shortnose Sturgeon Recovery Team,** NMFS, Member, 1986-1998.
* **Shortnose Sturgeon Protocol Development Team,** NMFS, Member, 1998-1990.
* **Expert Advisor**, USFWS RO-5, James River, VA, Instream Flow Study for passing anadromous fish, 1992.
* **Hudson River Foundation**, Expert Advisor on sturgeon research program, 1992.
* **USFWS Representative & Advisor to China for Sturgeon Telemetry Research**, 1993.
* **IUCN Sturgeon Committee, Member**, (1994-2002; 2012 to present).
* **Expert Advisor on sea lampreys,** Great Lakes Commission, 1995.
* **Expert Advisor on fish passage**, CEMIG (state hydropower co.), MG, Brazil, 1996-2004.
* **Expert Advisor on sturgeon passage**, Danube Delta Institute, Romania, 1996-2012.
* **Instructor**, USFWS Fish Passage and Diversions Course, Fisheries Academy, 1989-2004.
* **Connecticut River Shortnose Sturgeon Workgroup**, Member, 2000-2004.
* **USFWS Diplomatic Team to Amur River, Russia Workshop on Biodiversity,** Member, 2002.
* **Expert Advisor on sturgeon passage on Danube River,** World Wildlife Society, 2003.
* **Expert Advisor on upstream and downstream fish passage to Australia,** 2003 & 2006.
* **Expert Advisor on sturgeon passage to World Sturgeon Society,** Po River, Italy. 2006.

# Grants and Contracts (Academic and Private Business)

## University of Arizona

* Use of electricity to immobilize fish. University of Arizona Foundation, $2,000 for 1974.
* Apache Trout: Biology and effects of logging on habitat. McIntyre - Stennis Forestry Research Program, $42,000 for 1974-78.
* Potential effects of anti-transpirants on aerial insects, rodents, nesting birds, and fish. U.S. Department of Interior, Office of Water Resources Research, $78,000 for 1975-78.
* Effect of riparian vegetation in reducing siltation in endangered trout habitat. U.S. Forest Service, $4,500 for 1977.
* Biology and protection of desert pupfish on Organ Pipe Cactus National Monument. U.S. Park Service, $11,500 for 1976-78.

## University of Massachusetts, USFWS, NBS, USGS

*Population estimate for shortnose sturgeon in the Connecticut River; Atlantic salmon smolt movements at Holyoke Dam; Adult and juvenile American shad and blueback herring movement past Holyoke Dam; Evaluation of fish lifts at Holyoke Dam; Development of a prototype by-pass

for downstream migrant American shad -- Northeast Utilities Service Company, $355,000 for 1979-85.
* Potential effects of low-head hydro turbines on anadromous fish and effects of flow regulation by hydro dams on fish. U.S. Department of Energy, $375,000 for 1980-82.
* Behavioral interactions between juvenile rainbow trout and Atlantic salmon. U.S. Fish and Wildlife Service, $30,000 for 1980-82.
* Behavior of adult sea lampreys; Movements of sub-adult striped bass; Behavior of adult shortnose sturgeon; Artificial rearing and behavior of larval and juvenile shortnose sturgeon; * Development of a riverine migrant trap for Atlantic salmon smolts; Movements of salmon smolts in relation to hydro-dam operations; Vertical distribution of adult American shad and blueback herring during riverine migration; Vertical distribution of juvenile shad and blueback herring during migration; Evaluation of Atlantic salmon fry stocking habitat on fry survival and production. Anadromous Fish & Wallop-Breau Federal Aid-Massachusetts Division of Fisheries and Wildlife, $325,000 for 1980-1992.
* Occurrence and movements of shortnose and Atlantic sturgeons in the Merrimack and Taunton Rivers, National Marine Fisheries Service Federal Aid and contributed state funds, $120,000 for 1987-93.
* Effect of road building on reproductive success of shortnose sturgeon. Massachusetts Highway Department, $60,000 for 1992-95.
* Research & development of fish passage facilities for lake sturgeon in two Wisconsin rivers. Menominee Indian Tribe, USFWS, Wisconsin DNR, $8,000 for 1996.
* Spawning of Chinese sturgeon in the Yangtze River, Three Gorges Corp. and Yangtze River Fisheries Institute, $100,000 for 1994-1999.
* Impact of Holyoke Dam on shortnose sturgeon migration, Northeast Utilities Service Co. and Holyoke Gas & Elect. Co., $230,000 for 1997- 1999..
* Migration and habitat of Danube River sturgeons, World Bank & Danube Delta Institute, $220,000 for 1997-2000.
* Development of a prototype fishway for lake sturgeon and Great Lakes fishes. Great Lakes Foundation, $135,000 for 1999-2000.
* Migration and fish passage of Brazilian migratory fishes, CEMIG (hydropower co.), Minas Gerais, Brazil. $190,000 for 1999-2002; $240,000 for 2003-2007.
*Behavior of juvenile pallid sturgeon in a fish ladder environment. US Corp. of Eng., $37,000 for 2001-2002.
* Downstream migration and behavior of pallid sturgeon early life stages. US Corps of Engineers, $90,000 for 2002.
* Seasonal movements and habitats of Potomac River shortnose sturgeon, U. S. Nat. Park Serv. $320,000 for 2003-2005.
* Seaward migration of Chinese sturgeon using pop-up tags, S. China Sea Fisheries Inst., Shanghai, $70,000 for 2005-2006.
* Ontogenetic behavior, dispersal, and habitat preference of Kootenai R. white sturgeon, Idaho Fish & Game, $37,000 for 2005.
*Life history of early life stages of Kootenai R. white sturgeon & field studies on forage and habitat in river, Kootenai Tribe of Idaho, $700k for 2006-2014.

## BK-Riverfish, LLC: Consulting

*** Design of fish behavior-passage research facility for Iron Gates Dam, Danube River, Romania**, 2006-2010.
* Biological Assessment of impacts of power plants and construction projects on sturgeons & diadromous fishes (Sierra Club, 2007 and 2016).

* Kootenai Tribe of Idaho: Lab and field research on behavior of Kootenai white sturgeon early life stages and their river environment, particularly during wintering -- 2008-2014.

* Two bridge construction companies: sturgeon protection at two Merrimack Bridge renovation & replacements – 2010 and 2014-2016

* CEMIG Power Company, Brazil: Development of fish passage for new dam in Brazil & design of a river research laboratory – 2010-2016.

* SAE Power Company, San Paulo, Brazil: Development of fish passage for new dam in Brazil and design of a river research lab – 2009-2016

*The Sierra Club: Impact of an electric generating facility on shortnose sturgeon in Potomac R. ─ 2013

* The Sierra Club: Evaluation of NOAA ruling on critical habitat of Atlantic sturgeon – 2016

* Yangtze River Fisheries Research Institute: Design of fish passage facility for new dam – 2015

* South China Sea Research Institute: Telemetry of mitten crab in Yangtze Estuary – 2015

* Design of the first fish lift in China (Huangdeng) on upper Yangtze River, Ecofish Research LTD – 2015

* Hudson and Delaware Riverkeepers: Impact of electric generating facilities on sturgeon – 2016-2017

* Tetra Tech LLC: Sub-contract on USACE project on EIS and design of pallid sturgeon fish passage on Lower Yellowstone Intake Diversion, Yellowstone R., MT – 2015-2016

* Eversource Power Co.: Evaluation of Owens Pond fishway, Amherst ─ 2015-2016

* Southern Environ. Law Center: Evaluation of James R. Chesterfield power plant effects on Atlantic sturgeon – 2017-2020.

* R & D to develop a new modular fishway design for Stockdale Mill Dam, Eel River, IN (USFWS & Manchester University partners) – 2014-2018.

* USPS & Duke Law Center: Evaluation of a power line across the James River on Atlantic sturgeon (– 2018.

* Battelle Memorial Institute: Sturgeon passage expert, member of team to evaluate fish passage planned by USACE at Savannah Bluff Lock & Dam, Savannah River – 2019.

* European Bank: Sturgeon life history expert to evaluate the status of sturgeons in the Rioni River and effects of two new dams proposed in the Rioni River, Georgia, on sturgeons – 2019-2020.

* Biocitizen, Inc. (NGO): Research instructor for youth environmental education—taught students methods to study Connecticut River fish ecology, conservation & fish passage -- 2018-2019; 2021.

* Southern Environ. Law Center: sturgeon expert to evaluate impact of James River, VA, Chesapeake Power Station on Atlantic sturgeon –2019-2020.

* Southern Environmental Law Center: fish passage expert on team to develop fish passage for Savannah R. New Savanah Bluff Lock and Dam, GA. 2020-present.

*R&D in the BK-Riverfish hydraulic/fish behavior lab in Erving, MA, to develop a new type of modular fish ladder for diverse diadromous and potamodromous (freshwater) fishes (US Patent #11,168, 453 granted November 2021; Canadian Patent CA 29892333 granted 8/7/2023. Prototype fishway installed at Stockdale Mill Dam, Eel River, IN in 2017 with cooperation from dam owner (Stockdale Mill Foundation), Manchester Univ., and the US Fish and Wildlife Serv. Presently designing three additional fishways one each in Illinois, Massachusetts, and Puerto Rico. See website: bkriverfish.com for more information.

## Presentations (2000 to present)

Kynard, B. M. Kieffer, M. Burlingame, and P. Vinogradov. 2000. Effect of Holyoke Dam on the up- and downstream migration of Connecticut River shortnose sturgeon, Annual meeting of American Fisheries Society, St. Louis, MO.

Kynard, B., and A. Haro. 2001. Up- and downstream passage of American shad at dams: A review. International Shad Symposium, Baltimore, MD.

Kynard, B., M. Kieffer, M. Burlingame, and P. Vinogradov. 2001. Effect of Holyoke Dam on the population structure of Connecticut River shortnose sturgeon. Annual meeting of American Fisheries Society, Phoenix, AZ.

Kynard, B., D. Pugh, E. Henyey, and T. Parker. 2002. Behavior of lake and pallid sturgeon in fishway environments: a new paradigm for developing fish passage. Annual meeting of American Fisheries Society, Baltimore, MD.

(Invited) Kynard, B. 2002. Fish behavior important to development of fish passage facilities. International Workshop on Natural Bypasses and Dam Removal. October 2002, White Mountains, NH.

(Invited) Kynard, B. 2003. Fish passage and habitat protection for riverine migratory fish in the Northeast United States. Symposium on Fish and the Environment, Shanghai, China.
(Invited) Kynard, B. 2003. Downstream protection of migratory fishes in the United States. First Workshop on Downstream Fish Passage, Canberra, Australia.

(Invited) Kynard, B. 2005. Life history migrations and upstream fish passage development in North and South America. Workshop on the Ord River, Western Australia, Kunnunara, Australia.

(Invited) Kynard, B. 2005. Restoration of sturgeon populations using fish passage. Workshop on Danube R. sturgeons, Petrocelli, Austria.

(Invited) Kynard, B. 2006. Passage of sturgeons and other large fishes in fish lifts: basic considerations. World Sturgeon Society, Piacenze, Italy.

(Invited) Kynard, B. 2006. Diadromous fish migrations that connect river and estuary: importance and need for study. Int. Symp.on Aquatic Biodiversity and Environ. Restoration of Estuarine and Coastal areas. Shanghai.

(Invited) Kynard, B. 2008. Behavior of fish and fish passage in China and Brazil. SE Chapt. AFS

(Invited) Kynard, B. 2008.Fish behavior and fish habitat protection. Forum on fisheries, Shanghai.

(Invited) Kynard, B., D. Pugh, and T. Parker. 2009. Lake sturgeon use of a spiral fishway. SE Chapt. AFS.

Kynard, B., D. Pugh, and T. Parker. 2010. Lake sturgeon use of a spiral fishway. NA Chapt. World Stur. Cons. Soc., Chico, MT.

Kynard, B. and M. Horgan. 2011. Life history and fish passage of sea lamprey in the Connecticut River, Massachusetts. Nat. AFS meeting, Seattle, WN.

Kynard, B., R. Junco, A. Godinho. 2011. A conceptual model for designing bypass fishways for neotropical rivers. Nat. Conf. on Engineering and Ecohydraulics for fish passage, Univ. of MA, Amherst.

Parker, E., B. Kynard**,** B. E. Kynard, and M. Horgan. 2012. Substrate and water velocity selection by early life stages of Kootenai R. White Sturgeon. Internat. Meeting, World Sturgeon Cons. Soc., Nanaimo, BC, Canada.

Kynard, B., D. Pugh, and T. Parker. 2012. Impingement and entrainment of shortnose sturgeon at a vertical bar rack with and without a bypass orifice. National Fish Passage Conf., Univ. Mass, Amherst.

Kynard, B., B. E. Kynard, and M. Horgan. 2013. Velocity selection by young Kootenai R. white

sturgeon. Internat. Symp., World Sturg. Cons. Soc., Nanaimo, BC, Canada.

(Invited) Kynard, B. and M. Horgan. 2014. Fish passage and life history of Connecticut R. sea lamprey. Internat. Conf. on Lampreys, York, England.

(Invited) Kynard, B. 2014. Early life of sturgeons: the key to successful restoration programs. Keynote Address, Southern Div. Amer. Fish. Soc., Charleston, SC.

(Invited) Kynard, B. 2014. Importance of fish behavior to fish conservation and management. Keynote Address, Annual meeting of Chinese aquatic research biologists, Yichang, China.

Kynard, B., E. Parker, B. E. Kynard, and M. Horgan, 2014. Activity of young-of-the-year Kootenai River white sturgeon and Connecticut River shortnose sturgeon in response to winter temperature cycles. Annual AFS meeting, Quebec City, Canada.

(Invited) Kynard, B. 2015. Upstream passage of sturgeons at dams. Intern. Conf. on Fish Passage – 2015, Groningen, The Netherlands. + Moderated a Session on passage for Danube sturgeons at Iron Gates Dams.

Kynard, B., B. E. Kynard, C. Morgan. 2016. Evaluation of the Owens Pond fishway, Amherst, Ma. Intern. Conf. on Fish Passage, UMass Amherst, USA.

Kynard, B., B.E. Kynard, G. Hoffman. 2017. Activity during the winter temperature cycle by YOY of two North American sturgeon species: implications for river warming to affect YOY. World Sturgeon Conserv. Soc. ISS8 meeting, Vienna, AU.

Kynard, B., B,E. Kynard, E, Parker, M. Horgan. 2017. Activity of year-0 Connecticut River juvenile shortnose sturgeon during winter. Meeting of Connecticut River Anadromous Fish Restoration Program, Hadley, MA.

Kynard, B., B. E. Kynard, J. Sweeten, D. Henry, and C. Root. 2018. Development and performance of a new type of fish ladder for riverine fishes. Ohio River Conference, Wilder, KY.

Kynard, B. and B.E. Kynard. 2018 Development and performance of the Kynard Ladder at Stockdale Mill Dam, Eel River, IN. Amer. Fish. Soc, North-Central Div., Rivers & Streams Tech. Comm. Meeting, Milan, IL.

Pfister, A, B.M. Wood, N. Thompson, and B. Kynard. 2021. Implementation of electronarosis in laboratory experimentation with bluegill sunfish. Poster at Amer. Fish. Soc. National meeting, Baltimore, MD. Oct. 2021.

Kynard, B. and 6 coauthors. 2023. The Kynard Alternating Side-Baffle Fishway: A Technical Upstream Fishway that Passes Diverse Diadromous and Potamodromous Fishes with Small and Large Bodies. Presentation at NED AFS Diadromous Fish Symposium, Boston, Ma.

Kynard, B. and 6 coauthors. 2024. The Kynard Alternating Side-Baffle Fishway: A Technical

Upstream Fishway that Passes Diverse Diadromous and Potamodromous Fishes with Small and Large Bodies. Presentation at International Symposium of Fish Passage, Quebec City, Canada.

## Publications (asterisk by number indicates a refereed paper)

1. Kynard, B. 1967. Avoidance behavior of insecticide resistant and susceptible populations of mosquitofish to four insecticides. Masters Thesis, 38 pp.

2. Kynard, B. 1972. Breeding behavioral ecology of male lateral plate phenotypes of threespine sticklebacks, *Gasterosteus aculeatus*. Ph.D. Dissertation, 98 pp.

*3. Kynard, B. 1974. Avoidance behavior of insecticide resistant and susceptible populations of mosquitofish to four insecticides. Trans. Amer. Fish. Soc. 4:557-561.

*4. Kynard, B. 1974. Measuring Fisheries Resources, Chapter 12, pp. 241-354. Natural Resource Measurements, ed. T. E. Avery, McGraw-Hill.

*5. Kynard, B., and J. Tash. 1974. Freshwater jellyfish (*Craspedacusta sowerbyi*) in Lake Patagonia, southern Arizona. J. Ariz. Acad. Sc. 9(2):76-77.

*6. Kynard, B., and E. Lonsdale. 1975. Experimental study of galvanonarcosis for rainbow trout immobilization. J. Fish. Res. Bd. Canada 32:300-302.

*7. Kynard, B., and K. Curry. 1976. Meristic variation in a population of threespine sticklebacks from Auke Lake, Alaska. Copeia 1976:811-813.

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*9 Kynard, B. 1976. Desert pupfish and their habitat in Quitobaquito Spring, Organ Pipe Cactus Nat. Mon., Ariz. Tech. Rept. No. 1, Coop. Nat. Pk. Res. Unit, 44 pp.

10. Kynard, B. 1976. Study of the pollution sources and aquatic habitat of Eagle Creek watershed, Apache Sitgraves Nat. Forest, Arizona. U.S. Forest Ser. S.W. Rocky Mt. Expt. Sta. Rept. on Proj. No. 16-514CA, 76 pp.

*11. Kynard, B., and R. Garrett. 1977. Reproductive ecology and life history of desert pupfish in Quitobaquito Spring, Organ Pipe Cactus Nat. Mon., First Conf. on Sci. Res. in Nat. Parks, New Orleans, 17 pp.

*12. Garrett, R., and B. Kynard. 1977. Chemical oxygen demand of the antitranspirant Folicote. Hydrology and Water Research in Arizona and the Southwest 7:115-117.

*13. Kynard, B.. 1978. Breeding behavior of a lacustrine population of three-spine sticklebacks, *Gasterosteus aculeatus*. Behavior 67:178-207. **(Selected in 2009 by Behaviour as one of the**

**best papers in the past 50 years on sticklebacks).**

*14. Kynard, B. 1978. Nest desertion of male *Gasterosteus aculeatus*. Copeia 1978:702-703.

15. Kynard, B., T. McMahon, and R. Garrett. 1978. Antitranspirant effects on fish and wildlife. pp. 20-31. In Factors influencing usefulness of antitranspirants applied on phreatophytes to increase water supplies. Completion Report for Proj. C-6030, OWRT, U.S.D.I.

*16. McMahon, T., and B. Kynard. 1978. Avoidance of antitranspirant by western mosquitofish. S.W. Nat. 43:101-106.

*17. Curry, K., and B. Kynard. 1978. Experimental study of galvanonarcosis effects on behavior of rainbow trout and channel catfish. J. Fish. Res. Bd. Canada 35:1297-1302.

*18. Kynard, B. 1979. Nest habitat preference of low plate number morphs in threespine sticklebacks *Gasterosteus aculeatus*. Copeia. 1979:525-528.

*19. Kynard, B. 1979. Population decline and change in frequencies of lateral plates in *Gasterosteus aculeatus*. Copeia 1979:635-638.

*20. Davenport, D. C., J. E. Anderson, L. W. Gay, B. E. Kynard, E. K. Bonde, and R. M. Hagen. 1979. Phreatophyte evapotranspiration and its reduction without eradication. Water Res. Bull. 15:1293-1300.

21. O'Leary, J., and B. Kynard. 1980. Seaward migration of Atlantic salmon smolts at the Holyoke Dam complex, Connecticut River. Final Rept. to Northeast Utilities Service Co., Berlin, CT. 14 pp.

22. Barry, T., and B. Kynard. 1980. Movements of American shad in the Holyoke Dam tailrace during spawning migration. Final Rept. to Northeast Utilities Service Co., Berlin, CT. 26 pp.

23. O'Leary, J. and B. Kynard. 1980. Downstream passage of American shad at Holyoke Dam complex using a prototype electrical array system. Final Rept. to Northeast Utilities Service Co., Berlin, CT. 42 pp.

24. Moffitt, C. M., and B. Kynard. 1980. Passage of anadromous fish at Holyoke and Turners Falls Dams in 1980. Fed. Aid Dept. Proj. 4-F-R. 39 pp.

*25. Buckley, J., and B. Kynard. 1981. Artificial spawning and rearing of shortnose sturgeon (*Acipenser brevirostrum*) from the Connecticut River. Prog. Fish-Cult. 43(2):74-76.

*26. Conover, D., and B. Kynard. 1981. Environmental sex determination: Interaction of temperature and genotype in a fish. Science 213:577-579.

27. O'Leary, J., and B. Kynard. 1981. Evaluation of the downstream passage facility for adult American shad during 1980. Final Rept. to Northeast Utilities Service Co., Berlin, Ct. 30 pp.

28. O'Leary, J.and B. Kynard. 1982. Evaluation of the downstream passage facility for adult American shad using biotelemetry. Final Rept. to Northeast Utilities Service Co., Berlin, Ct. 24 pp.

29. Knapp, W., B. Kynard, and S. Gloss. 1982. Potential effects of Kaplan, Ossberger, and Bulb turbines on anadromous fishes of the northeast United States. Final Tech. Rept. to USFWS, DOE/DO1-FWS-20733-3. 132 pp.

*30.Moffitt, C. M., B. Kynard, and S. G. Rideout. 1982. Fish passage facilities and anadromous fish restoration in the Connecticut River basin. Fisheries 7:1-11.

31. Barry, T., and B. Kynard. 1982. Movements of adult American shad (*Alosa sapidissima*) in the Holyoke Dam tailrace during their spawning migration. Final Rept. to Northeast Utilities Service Co., Berlin, Ct. 31 pp.

32. Krska, R., and B. Kynard. 1982. Passage of anadromous fish at Holyoke and Turners Falls Dams in 1981. Fed. Aid Rept. Proj. 4-F-R. 41 pp.

33. Buckley, J., and B. Kynard. 1983. Spawning habitat characteristics, population estimate and age structure of shortnose sturgeon (*Acipenser brevirostrum*) in the Connecticut River below Holyoke Dam, Holyoke, Massachusetts. Final Rept. to Northeast Utilities Service Co., Berlin, Ct. 40 pp.

34. Taylor, R., and B. Kynard. 1984. Studies of downrunning adult alosids in the Holyoke Dam system - 1983. Final Rept. to Northeast Utilities Service Co., Berlin, Ct. 29pp.

*35. Conover, D. O., and B. Kynard. 1984. Field and laboratory observations of spawning periodicity and behavior of a northern population of the Atlantic silverside, *Menidia menidia* (Pisces: Atherinidae). Env. Biol. of Fish. 11: 161-171.

36. Buckley, J., and B. Kynard. 1985. Vertical distribution of juvenile American shad and blueback herring during the seaward migration in the Connecticut River. Final Rept. to Northeast Utilities Service Co., Berlin, Ct. 13 pp.

37. Minkkinen, S., and B. Kynard. 1985. Sex ratio, length, and species composition of downstream migrant juvenile alosids at Holyoke Dam, 1985. Final Rept. to Northeast Utilities Service Co., Berlin, Ct. 7 pp.

*38. Taylor, R., and B. Kynard. 1985. Mortality of juvenile American shad and blueback herring passed through a low-head Kaplan turbine hydroelectric turbine. Trans. Amer. Fish. Soc. 114: 430-435.

*39. Bell, C. E., and B. Kynard. 1985. Mortality of adult American shad passing through a 17-megawatt Kaplan turbine at a low-head hydroelectric dam. North American Jour. Fish. Mgmt. 5:33-38.

*40. Buckley, J., and B. Kynard. 1985. Yearly movements of shortnose sturgeons in the Connecticut River. Trans. Amer. Fish. Soc. 114: 813-820.

41. Perham, R., and B. Kynard. 1986. Studies of downstream migrant juvenile alosids at Holyoke and Turners Falls Dams, 1985. Final Rept. to Northeast Utilities Service Co., Berlin, CT. 10 pp.

*42. O'Leary, J., and B. Kynard. 1986. Behavior, length, and sex ratio of seaward-migrating juvenile American shad and blueback herring in the Connecticut River. Trans. Amer. Fish. Soc. 115:529-536.

*43. Barry, T., and B. Kynard. 1986. Attraction of adult American shad to fish lifts at Holyoke Dam, Connecticut River. North American Jour. Fish Mgmt. 6:233-241.

*44. Stier, K., and B. Kynard. 1986. Movements of sea-run sea lampreys, *Petromyzon marinus,* during the spawning migration in the Connecticut River. Fishery Bulletin 84:749-753.

*45. Warner, J., and B. Kynard. 1986. Scavenger feeding by subadult striped bass below a low-head hydroelectric dam. Fishery Bulletin 84:220-222.

*46. Stier, K., and B. Kynard. 1986. Abundance, size, and size ratio of adult sea-run sea lamprey, *Petromyzon marinus,* in the Connecticut River. Fishery Bulletin 84:476-480.

*47. Buckley, J., and B. Kynard. 1986. Habitat use and behavior of pre-spawning and spawning shortnose sturgeon in the Connecticut River. pp. 111-117. North American Sturgeons (ed.) F. Binkowski and S. Doroshov. Junk Publ., Dordrecht, The Netherlands.

*48. Hearn, W. E., and B. Kynard. 1986. Competition between juvenile Atlantic salmon (*Salmo salar)* and rainbow trout (*Salmo gairdneri*) in the White River of Vermont. Canadian Jour. Fish. Aq. Sci. 3:1988-1998.

*49. Kynard, B., and J. Warner. 1986. Spring and summer movements of subadult striped bass, *Morone saxatilis,* in the Connecticut River. Fishery Bull. 85:143-147.

*50. McMenemy, J., and B. Kynard. 1988. Use of inclined plane traps to study downstream movement and survival of Atlantic salmon smolts in the Connecticut River. N. Amer. Jour. Fish. Mgmt. 8:481-488.

*51. Witherell, D., and B. Kynard. 1990. Vertical distribution of adult American shad in the Connecticut River during up- and downstream migration. Trans. Amer. Fish. Soc. 119: 151-155.

*52. Kynard, B. and J. O'Leary. 1990. Behavioral guidance of adult American shad using underwater AC electrical and acoustic fields. Pp. 131-313. *In*: Proceedings of International Symposium on Fishways, Gifu, Japan.

53.Kynard, B. 1991. Vertical distribution of juvenile alosids during outmigration in the

Connecticut River. Final Rept. to Conte AFRC, 7 pp.

*54. Kieffer, M., and B. Kynard. 1993. Annual movements of shortnose and Atlantic sturgeons in the Merrimack River. Trans. Amer. Fish. Soc. 122: 378-386.

55. Buerkett, C., and B. Kynard. 1993. Shortnose and Atlantic sturgeons in the Taunton River, Massachusetts. Final Rept. to Mass. Div. Marine Fish, Boston, MA. 32 pp.

56. Vinogradov, P., and B. Kynard. 1993. Movements and reproductive success of shortnose sturgeon at Holyoke Dam in 1993. Annual Rept. to Massachusetts Highway Department, 12 pp.

*57. Kynard, B. 1993. Behavior of anadromous fish important for fish passage. pp. 95-104. Canadian Tech. Rept. 1905.

*58. Kynard, B., and J. O'Leary. 1993. Development and evaluation of a bypass system for spent American shad at Holyoke Dam. N. Amer. Jour. Fish Mgmt. 13: 388-407.

*59. Richmond, A., and B. Kynard. 1995. Ontogenetic behavior of shortnose sturgeon. Copeia 1995(1):172-182.

*60. Kynard, B., Q. Wei, and F. Ke. 1995. Use of ultrasonic telemetry to locate the spawning site of Chinese sturgeon. Chinese Acad. Sci.40:668-671.

61. Kynard, B., Q. Wei, and F. Ke. 1996. Movements, spawning habitat, and vertical distribution of Chinese sturgeon at Gezhouba Dam, Yangtze River. Final Rept. to Chinese Acad. Sci. 36 pp.

*62. Kieffer, M., and B. Kynard. 1996. Spawning behavior of shortnose sturgeon in the Merrimack River. Trans. Amer. Fish. Soc. 125:179-186.

*63. Kynard, B. 1997. Life history, latitudinal patterns, and status of shortnose sturgeon, *Acipenser brevirostrum.* Environ. Biology Fishes 48: 319-334.

*64. Bemis, W., and B. Kynard. 1997. Sturgeon rivers: An introduction to acipenseriform biogeography and life history. Environ. Biology Fishes 48: 167-183.

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Dam - effect of the dam on up- and downstream migration, behavior, and population structure. Final Rept. to Northeast Utilities Serv. Co., Berlin, CT. 48 pp.

*69. Kynard, B., M. Horgan, M. Kieffer, and D. Seibel. 2000. Habitats used by shortnose sturgeon in two Massachusetts Rivers, with notes on estuarine Atlantic sturgeon: a hierarchial analysis. Trans. Amer. Fish, Soc. 129: 487-503.

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*74. Kynard, B., P. Zhuang, Lonzhen Zhang, Tao Zhang & Zhen Zhang. 2002. Ontogenetic behavior and migration of Volga River Russian sturgeon, *Acipenser gueldenstaedtii*, with a note on adaptive significance of body color. Environ. Biol. Fish 63: 411-421.

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**Louisiana State University**

1. Bradley Wood. PhD student studying swimming/anatomy relationships of Connecticut River Sea lamprey. Member of committee (2014-2020).

# EXHIBIT C

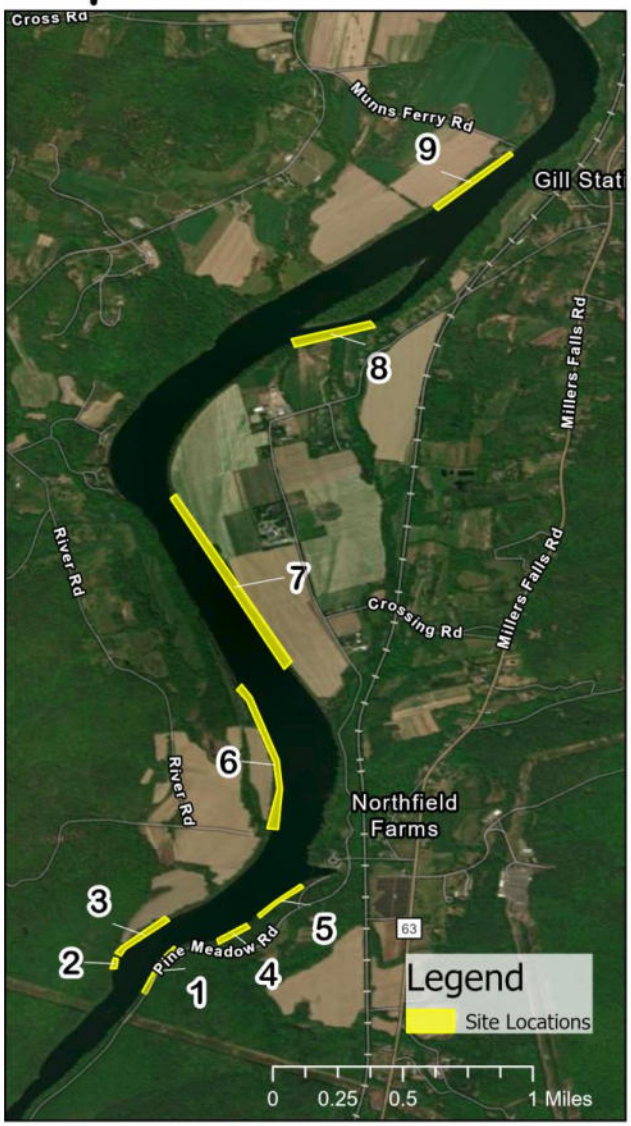
## CRC Erosion Photo Log

On September 25, 2024, CRC staff toured the Connecticut River from Turners Falls Dam to just upstream of the MA/NH/VT state line. The photos below were grouped by "sites" of varying lengths with locations shown below on the map. Photo numbers increase from downstream to upstream.

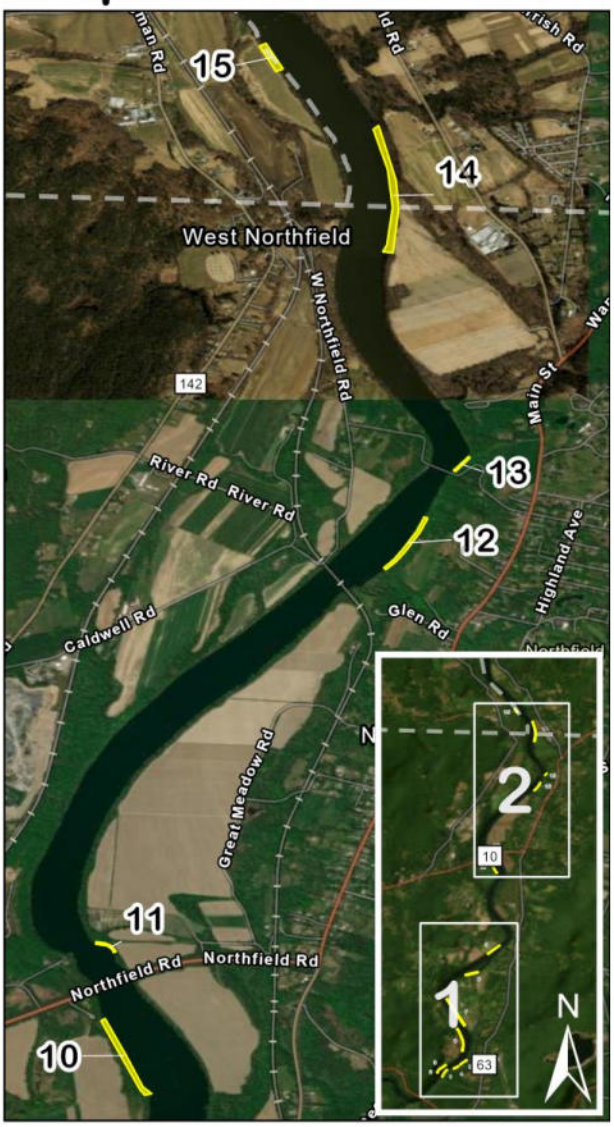
More than ten photos were taken at each of the fifteen sites. The photos indicate extensive erosion along much of the Connecticut River, with frequent notching at the typical level of water fluctuations. The hypothesis that erosion is largely caused by high flow events does not seem logical based on observation of the banks.

This report highlights a few photos from each site as examples and the rest of the photos are available to DEP to assess.

## Map 1




## Map 2




F. Ryan O'Donnell, Connecticut River Conservancy
February 24, 2025

# Site 1

2024 CRC Site 1 (16)
Notching, creating a shelf of vegetation above rocks

2024 CRC Site 1 (18)
Exposed roots above water fluctuation zone

2024 CRC Site 1 (29)
Undercutting, leading to erosion in the bank above

# Site 2

2024 CRC Site 2 (9) : Landslide

2024 CRC Site 2 (12): Landslide

# Site 3

2024 CRC Site 3 (10) :
Notching, creating a shelf of vegetation above rocks

2024 CRC Site 3 (2): Old restoration project that is no longer intact

# Site 4

2024 CRC Site 4 (2) : Immense Landside of riverbank into the river

2024 CRC Site 4 (5) : Unstable Bank eroding with exposed dirt

2024 CRC Site 4 (7) : Exposed roots in water fluctuation zone

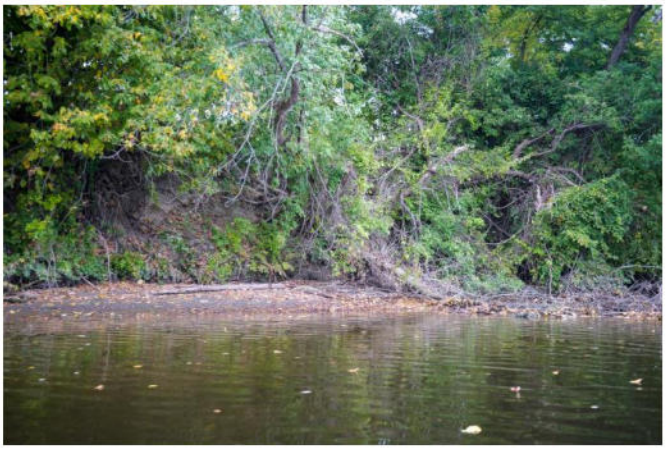
# Site 6

2024 CRC Site 6 (24) :
Previous restoration site with fully exposed logs,
meaning the restoration mitigation failed

2024 CRC Site 6 (28):
A little further north at the same site, the
logs are less exposed, but still exposed

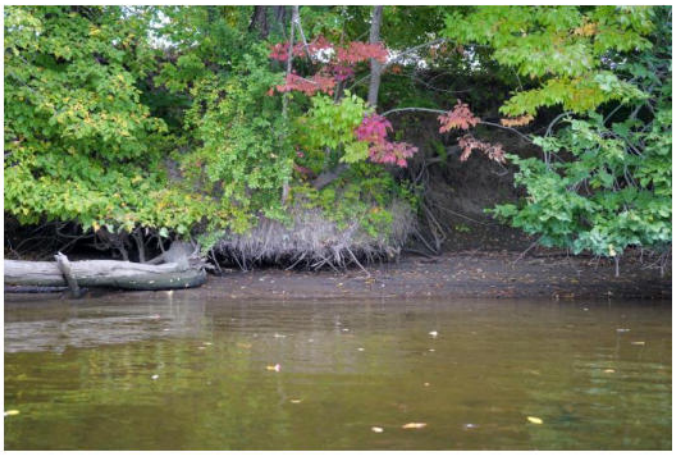
# Site 7 – River left, upstream of Shearer property

2014 FRR LB1831

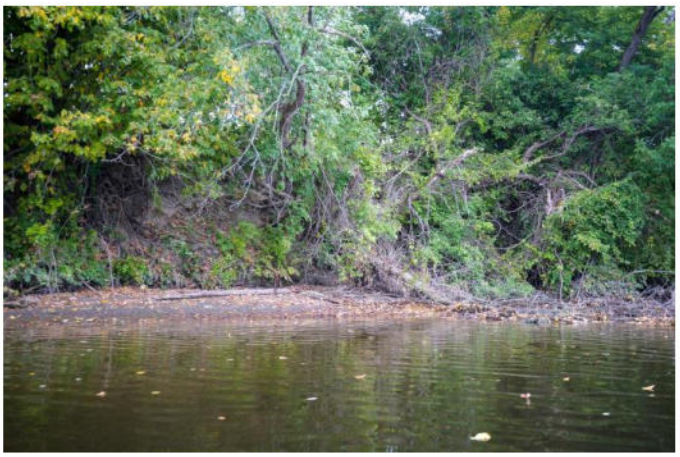


2024 CRC Site 7 (27)

In 2014, the banks were eroded but obscured by hanging trees.
In 2024, erosion more evident. Bittersweet vines are prominent.



2024 CRC Site 7 (18)
Undercutting

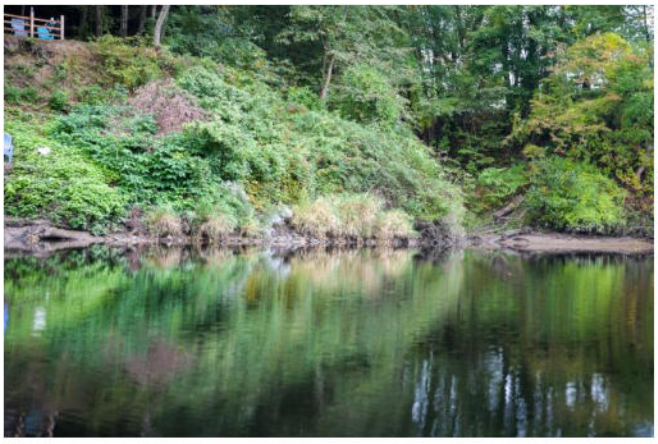


2024 CRC Site 7 (27)
Bank erosion, growth of bittersweet

2024 CRC Site 7 (30)
Undercutting

# Site 8 – River left across from Kidd's Island

2014 FRR LB1688



2024 CRC Site 8 (13)

Small tributary helps match site photos above, from 2014 FRR to 2024 CRC survey.
In 2014, restoration site upstream of stream confluence had re-vegetated, but fabric was loose. In 2024, site had changed with addition of fencing and chairs. Bank was becoming vegetated with Japanese knotweed (below). Site photo numbers increase from downstream to upstream.

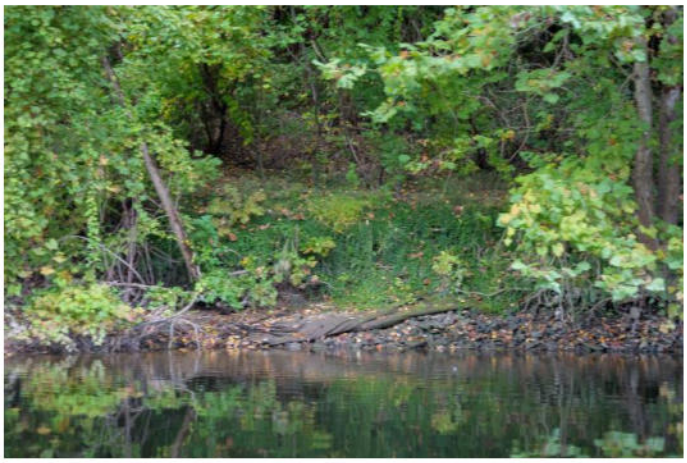
2014 FRR LB1686

2024 CRC Site 8 (15)

2024 CRC Site 8 (19)
Notching continues near repaired toe

2024 CRC Site 8 (20)
Loose fabric and erosion uphill

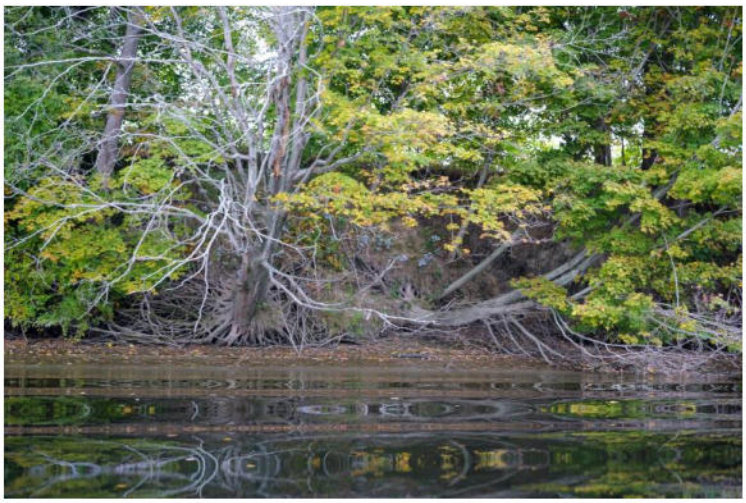
# Site 8 – River left across from Kidd's Island



2024 CRC Site 8 (24)
Various levels of erosion happening on the bank

2024 CRC Site 8 (25)
Notching forming above protected toe – this demonstrates the concern about holding the impoundment at higher average elevations than in the past.

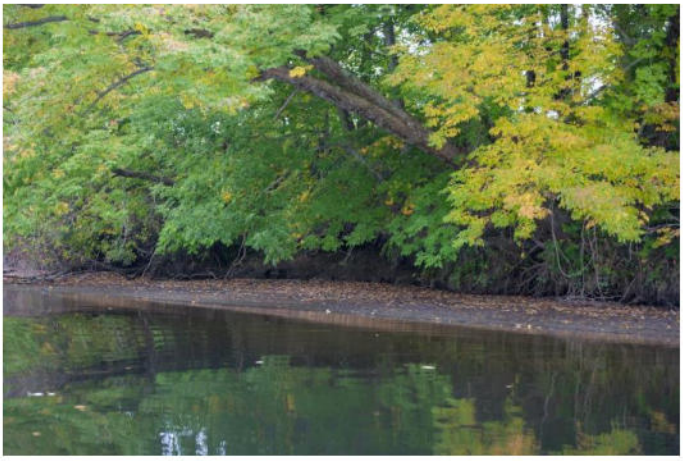
2024 CRC Site 8 (31) – knotweed overtaking repaired section



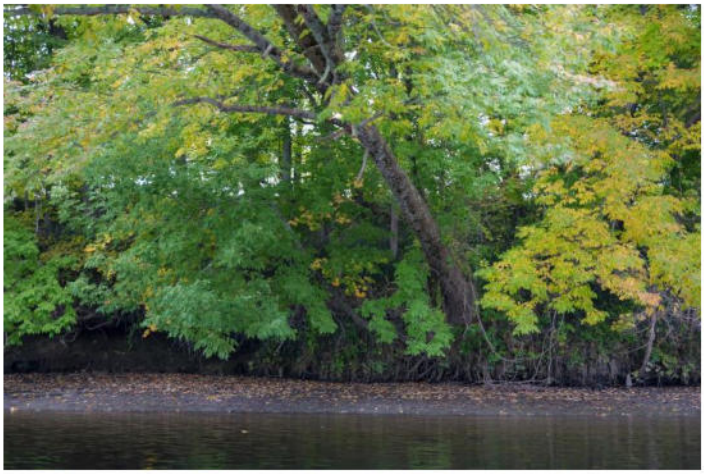
2024 CRC Site 8 (33)

# Site 9 – River right

2024 CRC Site 9 (5)
Erosion at bank toe is causing trees to fall in



2024 CRC Site 9 (17)
Exposed roots at bank toe



2024 CRC Site 9 (18)
Exposed roots at typical fluctuation zone.

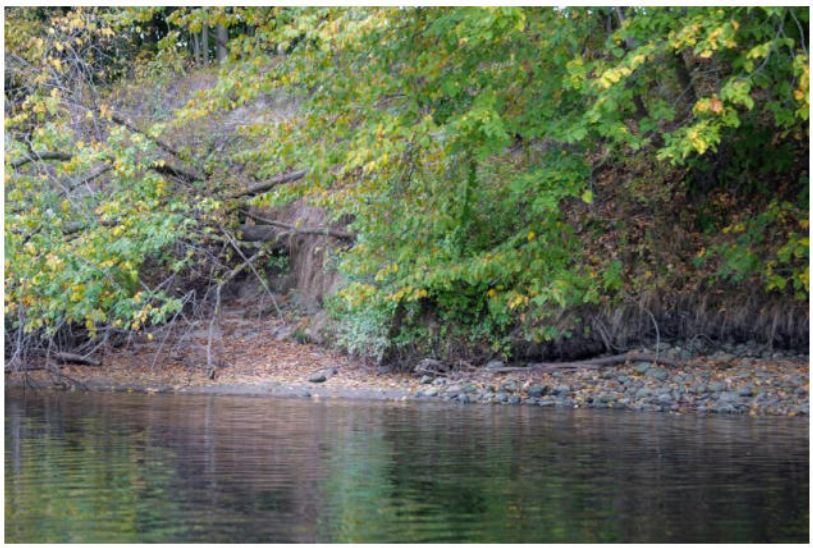
2024 CRC Site 9 (21)
Close-up of eroded area

# Site 10 – River Right along Bennett Meadow

2014 FRR RB0987

2024 CRC Site 10 (14)

In 2014, the banks were eroded but obscured by hanging trees.
In 2024, erosion more evident.



2024 CRC Site 10 (18)
Exposed roots at the fluctuation zone, leading to tree failures on the left

2024 CRC Site 10 (22)
Exposed roots at the fluctuation zone, leading to slump in upper left

# Site 11

2024 CRC Site 11 (10) : Exposed roots and collapsing riverbank in water fluctuation zone

2024 CRC Site 11 (19) : Undercutting of soil in water fluctuation zone

2024 CRC Site 11 (21) : Immense Landside of riverbank into the river

# Site 12

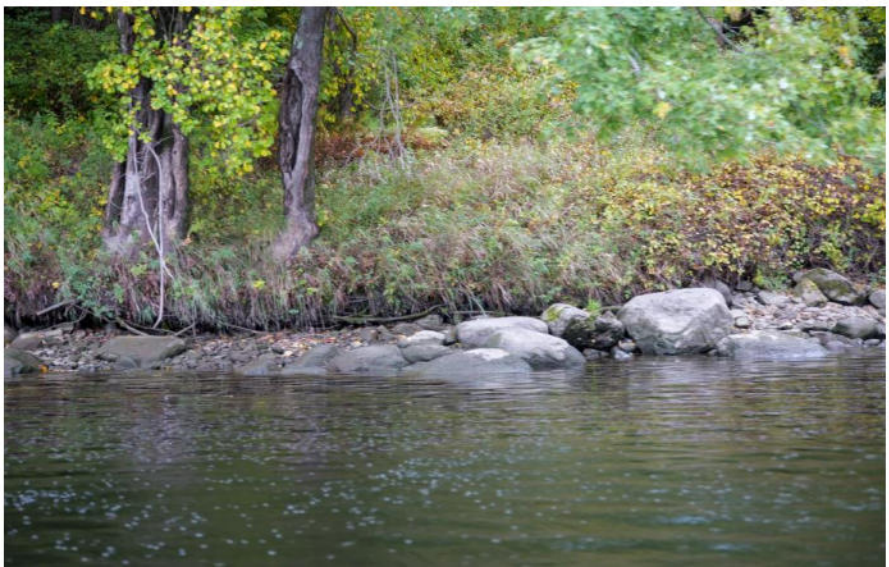
2024 CRC Site 12 (5) :
Previous restoration site where vegetation is unable to grow in the water fluctuation zone

2024 CRC Site 12 (7):
Previous restoration site with unsightly material trying to hold the riverbank together

# Site 13

2024 CRC Site 13 (1) : Exposed roots and collapsing riverbank in water fluctuation zone

2024 CRC Site 13 (10) : Notching, creating a shelf of vegetation above rocks

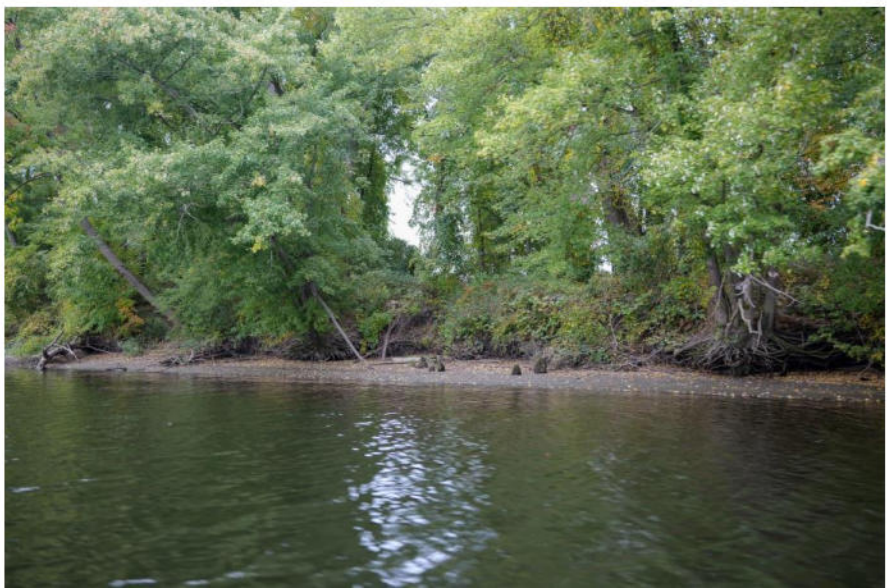


2024 CRC Site 13 (12) : Notching, creating a shelf of vegetation above rock

# Site 14

2024 CRC Site 14 (19) : Severe notching and undercutting, of trees in a vegetative line that are on a trajectory to collapse into the river

2024 CRC Site 14 (15) : Eroded riverbank caused by landslide and creates steep edge



2024 CRC Site 14 (17) : Wider pan view exhibiting notching and landslides next to one another

# Site 15

2024 CRC Site 15 (6) :
Vegetation unable to grow in the water fluctuation zone from pumping

Nina Gordon-Kirsch
MA River Steward
Connecticut River Conservancy
15 Bank Row | Greenfield, MA 01301

**EXHIBIT D**

**RE: Comment on Water Quality Certification with Conditions**
**FirstLight Hydroelectric Project**
**FERC License Nos. 1889 (Turners Falls) and 2485 (Northfield Mountain)**

February 24, 2025

Dear Ms. Gordon-Kirsch,

Princeton Hydro LLC (Princeton Hydro) was retained by the Connecticut River Conservancy (CRC), a stakeholder and participant in the re-licensing process of the Federal Energy Regulatory Commission (FERC) for two hydropower facilities owned by FirstLight Power Resources Inc. (FirstLight) on the Connecticut River, to provide a technical review of the components of the Draft 401 Water Quality Certification (WQC)[1] related to bank stability and monitoring for the reach of the Connecticut River known as the Turners Falls Impoundment (TFI). FirstLight MA Hydro LLC and Northfield Mountain LLC (collectively FirstLight or the Applicant), respectively, filed applications for new major licenses to operate the 62.0-megawatt Turners Falls Hydroelectric Project (Turners Falls Project; FERC No. 1889) and the 1,166.8-MW Northfield Mountain Pumped Storage Project (Northfield Mountain Project; FERC No. 2485).

**Introduction and Background**

As part of the relicensing process, FERC regulations required FirstLight to file with the Massachusetts Department of Environmental Protection (MassDEP) its 401 Water Quality Certificate Application. FirstLight filed a single 401 Application with MassDEP for

[1] Mass DEP, (Draft) Water Quality Certification with Conditions, 2025. FirstLight Hydroelectric Project, FERC License Nos. 1889 (Turners Falls), 2485 (Northfield Mountain), dated January 24, 2025.

both Projects on April 22, 2024. The submission of the 401Water Quality Application is an essential part of the relicensing process as it must receive the approval of Massachusetts. Under Section 401 of the Clean Water Act (CWA), a federal agency may not issue a permit or license to conduct any activity including Federal Energy Regulatory Commission (FERC) licensed hydropower facilities unless a Section 401 WQC is issued by a state, or certification is waived. It is also important to acknowledge that the WQC review process seeks to ensure that the project, in this case FirstLight's relicensing of the Turners Falls Project and the Northfield Mountain Project, will not continue to negatively impact the water quality of the Connecticut River as set forth in Massachusetts's surface water quality standards. A "WQC" under the Clean Water Act enables states to participate in a federal approval process such as the FERC relicensing of FirstLight's hydropower facilities to protect water quality in a water body such as the Connecticut River by allowing states to regulate and potentially deny permits for projects that could worsen the condition of any water body including already impaired waters. In this context the WQC process must be shown by FirstLight to be consistent with the designated water quality standards for relevant segments of the Connecticut River. The stretch of the Connecticut River associated with the Turners Falls Dam and the Northfield Mountain Pumped Storage Project is listed as Class B waters, which are designated in accordance with 314 CMR 4.05(3)(b) "as habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation." Importantly, and of relevance to the pending 401 application, the entire Massachusetts part of the Connecticut River upstream of the Turners Falls Dam is listed as impaired in the 2022 Massachusetts Integrated List of Waters. The stated impairments in the upper 3.5-mile section of the

Turner Falls Impoundment (TFI) are indicated to be due, at least in part, to "alteration in streamside or littoral vegetative covers" and "flow regime modification".[2] Similarly, the segment of the Connecticut River from the Route 10 bridge to the Turners Falls dam is also considered to be impaired, in part, for the same reasons "alteration in streamside or littoral vegetative covers" and "flow regime modification".

**The combination of the two causes of impairment identified above are not commonly designated in Massachusetts and would appear to be specific to the Turners Dam impoundment and pumped storage project operations**. The role of First Light's operations on erosion has been consistently identified in comments by various experts indicating that project operations contribute or exacerbate erosion in the TFI. However, FirstLight's application for this WQC states that "[a] consistent finding throughout all the erosion evaluations conducted during relicensing is that the dominant causes of erosion in the TFI are high flows/floods and, in the Barton Cove area, boat waves. Project operations is not a *dominant* cause of erosion at any locations in the TFI but is a contributing cause of erosion in the following locations of the TFI in Massachusetts: in: (1) an approximately 21,600-foot-long reach from the exit of Barton Cove to the French King Gorge (both sides of the river), and (2) an approximately 4,700-foot-long reach on river right upstream of the Northfield Mountain tailrace."[3] Based on work done on an earlier report by Princeton Hydro[4] and review of other reports regarding the TFI including reports

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[2] Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle. November 2018-2021. Watershed Planning Program. http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html

[3] FirstLight. April 22, 2024. Prepared for: FirstLight. Northfield, MA: Author. April 22, 2024. Turners Falls Hydroelectric Project (FERC No. 1889) Northfield Mountain Pumped Storage Project (FERC No. 2485) 401 Water Quality Certificate Application.

[4] Wildman, L., Woodworth, P., & Daniels, M. (October 2016). Peer-Review of Relicensing Study 3.1.2 Northfield Mountain / Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability Study Report.

by the US Army Corps of Engineers (1979)[5], Field Geology Services[6] (2007) and, most recently, Dr. Evan Dethier (2024)[7] we remain unconvinced that FirstLight's position indicating that operations do not have a significant or dominant role in the impoundment's erosion issues is accurate. Dethier (2024) states that "There is substantial evidence of erosion in the Turners Falls Impoundment (TFI), much of it consistent with fluctuations in water level due to dam operations. Several reports and memos, including by the US Army Corps of Engineers, Field Geology Services, and Princeton Hydro, have already established that water level fluctuations in the TFI can, and do, enhance erosion in the reservoir."

Impacts on bank stability and water quality associated with the operations of pumped storage facilities such as TFI have been documented for many years. For example, in a 1982 document by the US Army Corps of Engineers states "[o]perating a reservoir in a peaking mode, that is, controlling releases to match peak energy demands, creates another level of impacts within the reservoir and downstream of the dam. Reservoir fluctuations cause many biological impacts in addition to the aesthetic and recreational nuisance of the exposed drawdown zone."[8] This publication goes on to state "**[l]arge seasonal or diurnal fluctuations in water level primarily affect the stability of the shoreline substrate and water quality** (emphasis added)."[9] A 1981 report by Dames

[5] U.S. Army Corps of Engineers, 1979, Report on Connecticut River Streambank Erosion Study: Massachusetts, New Hampshire and Vermont: Department of the Army New England Division Corps of Engineers: Waltham, MA, 185 p.
[6] Field (Field Geology Services), 2007, Fluvial geomorphology study of the Turners Falls Pool on the Connecticut River between Turners Falls, MA and Vernon, VT: Unpublished report prepared for Northfield Mountain Pumped Storage Project, 131 p
[7] Dethier, Evan May 19, 2024, Review of Erosion in the Turners Falls Impoundment Prepared for the Connecticut River Conservancy and Franklin Regional Council of Governments. 53 pages
[8] United States Army Corps of Engineers. March 1982. National Hydroelectric Power Resources Study, Environmental Assessment. Institute for Water Resources, Kingman Building, Fort Belvoir, Virginia 22060. Page 3-7.
[9] id

and Moore describes the adverse effects of reservoir water-level fluctuations during hydropower operations and indicates impacts such as "**degradation of wetland habitats above the dam; with bank erosion".**[10] In a more recent 2020 publication by Saulsbury, he states "[b]oth open-loop and closed-loop PSH (pumped storage hydropower) pumping and generating operations may affect geology and soils primarily due to large and frequent reservoir water-level fluctuations and resulting shoreline erosion. These impacts may be higher at open-loop projects such as Northfield Mountain, including add-on projects where the lower reservoir was already constructed for other purposes, because of the potential effects of their shoreline erosion and resulting sedimentation on the naturally flowing water bodies to which they are connected. [11] Evan Dethier stated that "[t]he current project operational range for reservoir levels exacerbates erosion relative to a narrower range by exposing a large swath of the reservoir banks to erosive properties and raising the "base-level" for natural flooding, adding to flood heights and thus erosive power."[12]

It is, however, interesting that the operations of other pumped storage facilities are often linked to erosion, but FirstLight asserts that the TFI is somehow not. FirstLight's claim that the predominant impacts on riverbank stability stems from "natural" high flows and boat traffic wake is questionable. There is nothing natural about the TFI. The simple existence of the TFI and pumped storage operation already creates a baseline of

[10] Dames and Moore. 1981. *An Assessment of Hydroelectric Pumped Storage*. In *National Hydroelectric Power Resources Study*. Volume X. Prepared for the U.S. Army Engineer Institute for Water Resources, Fort Belvoir, Virginia. https://www.iwr.usace.army.mil/portals/70/docs/iwrreports/iwr019-000001-000517.pdf
[11] Saulsbury, J.W. A Comparison of the Environmental Effects of Open-Loop and Closed-Loop Pumped Storage Hydropower; Pacific Northwest National Lab. (PNNL): Richland, WA, USA, 2020.
[12] Dethier, Evan May 19, 2024, Review of Erosion in the Turners Falls Impoundment Prepared for the Connecticut River Conservancy and Franklin Regional Council of Governments. Page 52.

complex anthropogenic impacts to the hydrology of the Connecticut River that has little in common with a natural river system. The artificial elevation of the river correspondingly elevates the adjacent groundwater all along the TFI, while the Northfield Mountain pumped storage system adds the variability of the water surface elevations in the TFI daily. At a minimum, these artificial elevations of the TFI section of the Connecticut River influence every instance of bank failure.

We commend MassDEP on its understanding and recognition of the issues associated with operations and erosion in the TFI as indicated in the following statement:[13]

> "…it is clear that project operations will continue to contribute to erosion in the TFI. It is difficult, however, to quantify the extent of that contribution. It is therefore necessary to establish erosion-related measures in the WQC to address the existing impairments and to ensure compliance with the SWQS. The measures are intended to balance the limitations and difficulties of precisely determining erosion causation in the TFI with the need to address existing erosion and impairments and monitor for and address any future erosion. The SWQS require that the existing and designated uses and the necessary water quality be maintained and protected and that they be free from solids, color, and turbidity that would be aesthetically objectionable, impair any use, or impair the benthic biota or degrade the chemical composition of the bottom."

[13] Mass DEP, (Draft) Water Quality Certification with Conditions, 2025. Page 41 of 117.

It is in this light that our comments focus on the issues associated with reliance on a dated erosion and sediment control plan, the 2013 Full River Reconnaissance (FRR) Quality Assurance Plan[14]. It is also important to acknowledge that the 2013 FRR avoids the identification of issues related to operations such as the absence of vegetation and bank instability as contributing to water quality impairment.

We have significant issues concerning the Draft WQC and the proposed use of the 2013 Full River Reconnaissance Report (2013 FRR) and the associated Quality Assurance Project Plan (QAPP) to guide Special Condition 25, which is detailed in Appendix F, of the Draft 401 WQC. Failure to use objective, quantitative metrics to determine the causes of bank instability and loss of shoreline vegetation will not contribute to the development of consistent water quality improvements. Specifically, our concerns are summarized below and then described in more detail in the following pages.

1. **The methods in the 2013 FRR and its QAPP warrant an update, especially considering MassDEP's understanding that operations play a key role in the erosion as well as bank instability and the absence of shoreline vegetation within the impoundment.** Since 2013, technology has advanced and reduced survey and monitoring costs. For example, unmanned aerial vehicles (UAV) or helicopter LiDAR surveys can accurately survey and provide repeatable, defensible documentation. This technology would provide a complete survey of the entire impoundment; including the measurement of elevations with as

[14] Simons & Associates and New England Environmental (2012), Quality Assurance Project Plan, 2013 Full River Reconnaissance Turners Falls Impoundement of the Connecticut River, October 29, 2012.

small an interval as several inches and can document and calculate vegetative cover.

2. **The 2013 FRR is too focused on visual indicators of erosion and fails to place much, if there is any, emphasis on bank instability that is more related to operations.** Appendix D of the 2013 QAPP proposes to use reference photographs to estimate bank heights, slopes, soils/sediment types, vegetative cover, and erosion. However, as will be discussed, the proposed use of photographs, and subjective and inconsistent metrics which will only provide inaccurate/inconsistent judgements of the condition of the slopes. While the conditions for "erosion" are noted, they do not include global stability and deep-seated failures, such as slides, that are clearly shown in the photographs but downplayed in the descriptions.
3. Because the FERC license has a 30 to 50-year life span, **the Final WQC must have provisions to update survey methods as technology is developed to further improve the accuracy, repeatability, and defensibility of data collected.**
4. **The formation of a panel of experts, with equal voting rights, must be included as a requirement of the Final WQC to evaluate developing trends in surveying, monitoring, and mitigation techniques and technology**. At a minimum, the panel would consist of representatives from MassDEP, FirstLight, Franklin Regional Council of Governments, CRC, Connecticut River Streambank Erosion Committee, and their respective experts to evaluate the progress of monitoring, conditions of the river and its banks, and make recommendations to ensure protection of the water quality of the Connecticut River.

5. In Appendix F of the Draft 401 WQC, the determination of how much bank stabilization needs to be completed is vague, at best, and from what we can interpret of **the requirement to repair 5% of a failed riverbank will be meaningless regarding protecting water quality.**
6. In Appendix F of the Draft 401 WQC, MassDEP is proposing that FirstLight repair newly eroding sites. **The provision to allow five (5) years to implement bank stabilization measures provides permission for FirstLight to violate the MA Water Quality Standards for that period, when sediment and nutrients contained in the sediment will continue to discharge to the Connecticut River.**

**Comments on <u>Monitoring</u> within the Draft WQC Appendix F, Erosion, Stabilization, and Monitoring Plan**

After a thorough and thoughtful review of all the documents and comments submitted regarding FirstLight's application for 401 Water Quality Certification, MassDEP

> "finds it necessary to impose the erosion-related measures in Special Condition 25 for the Projects to comply with the Federal Clean Water Act, the Massachusetts Surface Water Quality Standards, and other water quality-related requirements of state law. Accordingly, MassDEP imposes Special Condition No. 25."

Special Condition 25 relates to the Erosion Mitigation, Stabilization, and Monitoring Plan located at Appendix F of the Draft 410 Water Quality Certification. A comprehensive and current plan to address shoreline issues within the impoundment is essential to MassDEP's goal of improving impoundment water quality. It is vitally important that monitoring and

the resulting mitigation and stabilization measures be based on highly repeatable, defensible, and precise measures for determining the causation of shoreline and riverbank erosion and instability. Appendix F of the Draft 401WQC is relying upon the 2013 FRR in Study No, 3.1.1.[15] Appendix F of the Draft WQC and the 2013 FRR rely on metrics and methodologies that are dated in terms of the available remote survey technologies. In fact, the 2013 QAPP to Study 3.1.1 (included as Appendix D in the study report to 3.1.1) relies upon references photographic/video georeferencing and global positioning systems (GPS) equipment that has been surpassed in technological development.

**Frequency of Observations**

One area for which we mostly agree with the proposed monitoring plan is the frequency of field observations. According to the 2013 QAPP, FERC requires FirstLight to conduct FRRs every 3- 5 years[16], however, the Draft WQC states that Erosion Monitoring Surveys will be conducted in years 2, 10, 20, and 30[17], while Boat-Based Inspections are to be conducted in years 4, 6, 8, 12, 15, 25, 35, and 45[18]; leaving a 10 year gap between years 35 and 45, and no inspections at year 50. MassDEP would be better served by requiring inspections at consistent intervals, with three (3) years for the life of the FERC License as the standard for scheduled surveys. Such consistency will allow for the identification of riverbank change over time. As will be described below for improvements to monitoring, in addition to the years specified above (whichever is determined to be correct), a baseline survey must be completed in the first year of the issuance of the FERC license, and it would be beneficial to provide additional FRR surveys

[15] Simons & Associates and New England Environmental (2012).
[16] Simons & Associates and New England Environmental (2012). Page 5 of 38.
[17] Mass DEP, (Draft) Water Quality Certification with Conditions, 2025. Page 107 of 117.
[18] Mass DEP, (Draft) Water Quality Certification with Conditions, 2025. Page 108 of 117.

following major storm induced flooding, such as those caused by hurricanes, tropical depressions, and other major flooding events. In addition to consistent frequency of surveys, It is imperative that these surveys are conducted at a level as to be accurate, replicable, and defensible in the eyes of MassDEP, using modern methods (further described below). Without this, the proposed FRR monitoring plan is unenforceable due to the vagueness and lack of detail to be obtained.

**Equipment included in the 2013 QAPP**

None of the equipment and observation methodology described in the 2013 QAPP is adequate for accurately determining the progression of bank failure when it occurs. The proposed equipment to be used in the assessment of the TFI's riverbank conditions only provide support for the location where qualitative and subjective (see below for comments on the bank condition classification system) observations are made and are not repeatable in terms of understanding monitoring of the changes in topography are made, especially to those movements that would otherwise reveal that a slope is mobilized.

**Trimble Geoxt Sub-Meter GPS Specifications** – Appendix A of the QAPP specifies a Trimble submeter accurate GPS product, and the version of this model from 12 years prior. Due to reductions in cost of equipment and increased access to reference GPS stations, submeter accuracy systems have been supplanted by sub-centimeter/survey grade Real Time Kinematic (RTK) GPS equipment to allow for detailed surveys rather than simple locating of points of observations. Current technology allows for the collection of sub-centimeter accuracy elevations to be collected directed on the slopes with relative ease. This would provide MassDEP with a clearer

understanding of how the riverbanks are responding to hydropower operations.

**Laser Range Finder Equipment Specifications** – Appendix B of the QAPP includes a product brochure for a LTI TruPulse 360B range finder. These range finders are handheld and subjective in terms of where on a slope, for example, a distance is measured. The manufacturer's specifications included in this appendix state that the accuracy of the device is +/- 1 ft (this means that a distance could be 2 feet off), with an inclination and azimuth accuracy of +/-0.25 degrees and +/-1 degree, respectively. The accuracy combined with the inconsistent measurement points chosen on a slope at each event, will not provide useful information on changes in elevations and slopes, especially where a slope is already failing, but in slow progression between survey events.

**Red Hen Systems -** A quick search on the internet for the "Red Hen Systems Geo-Referenced Video Mapping" equipment included as Appendix C of the QAPP, reveals the latest website reference to this equipment is dated 2016. It is not clear that this equipment can be purchased or serviced/calibrated by Red Hen Systems, if they are no longer in business. This equipment may have been made obsolete with the advent of georeferenced smart phone photographic technology, but even then, all these systems provide is a location for where the photographs were taken.

**Riverbank Classification Reference Photographs**

Appendix D of the 2013 QAPP includes a proposed classification system to assess the Upper Riverbank Slope, Lower Riverbank Sediment, Upper Riverbank Height, Upper Riverbank Vegetation, Lower Riverbank Vegetation, and Extent of Current Erosion. On the last page of Appendix D (and of the entire document) it states:

> *NOTE: All quantitative classification criteria (e.g., slope, height, vegetation, extent, etc.) will be based on approximate qualitative estimates made during field observations of riverbanks. The FRR is a reconnaissance level survey that will not include quantitative field measurements of characteristics. Photographs contained in this appendix will be used for reference checking in the field to ensure consistent and accurate data classification.*

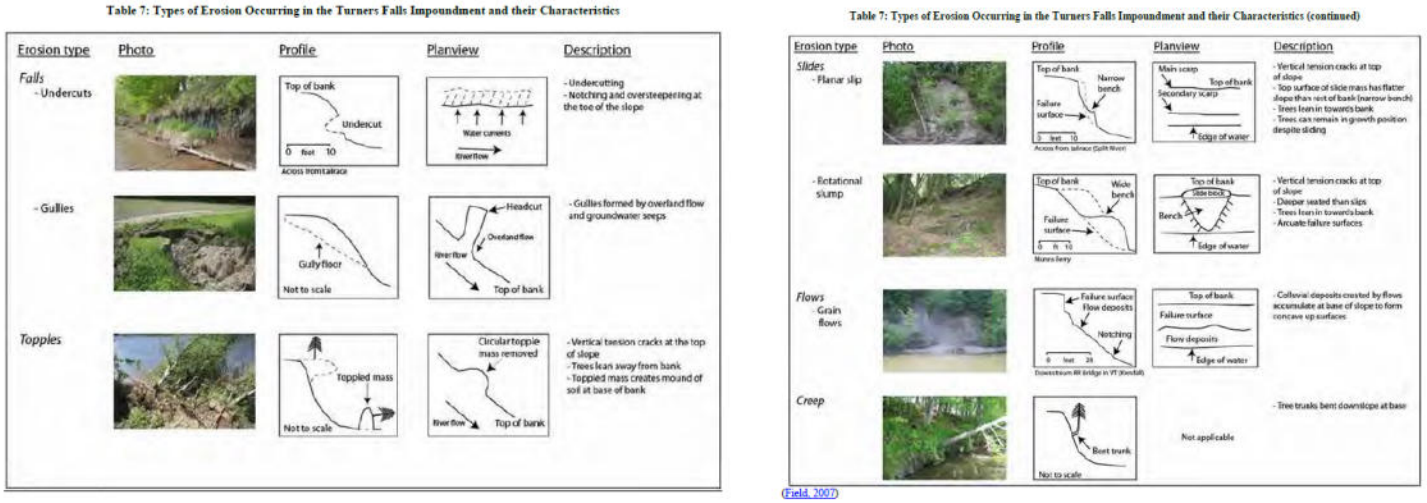



*Figure 1 Table (sic) 7 from the 2013 QAPP. While labeled as erosion, it is actually depicting bank stability and failure mechanisms, both caused by erosion, as well as other factors such as loss of vegetation and rapid drawdown of the impoundment.*

This statement is contradictory in that it claims to be "quantitative," but subsequently qualifies that word using the phrase "approximate qualitative estimates" (each of these three words used are subjective). This note goes further to admit that the "…FRR is a

reconnaissance level survey that will not include quantitative field measurements of characteristics." **There will be absolutely no way to determine if there has been any degradation of riverbanks, unless there are massive changes or catastrophic failures that would by then negatively impact water quality by introducing significant quantities of sediment to the river.** There is the potential for significant variation in observations, both from the same individual over time, and from different individuals conducting the surveys. **Human errors must be eliminated in the documentation as much as possible. Based on current technology, these surveys should be done more rigorously and with repeatability/replicability.**

Additionally, while mass failures of the slopes were depicted within Table 7 of the 2013 QAPP (Figure 1), none of these failure mechanisms were included as one of the parameters in the classification photographs in Appendix D of the QAPP.

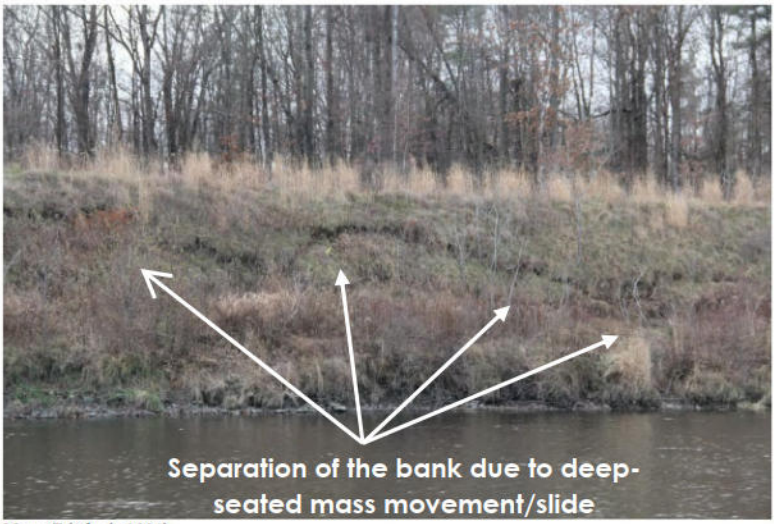



*Figure 2 "Extent of Current Erosion" identified as "none/little (<10%)" in Appendix D of the QAPP. Arrows pointing to surface evidence of separation, and circle illustrates the portion sliding into the river. "rotational slump" per Table 7 (See Figure 1, above).*

The example photographs and their corresponding "classification" focus on erosion and not mass failures of the riverbanks. A prime example of the inconsistency in the example photographs included in Appendix D, is illustrated in Figure , where the "Extent of Current Erosion" is identified as "none/little (<10%)". This figure

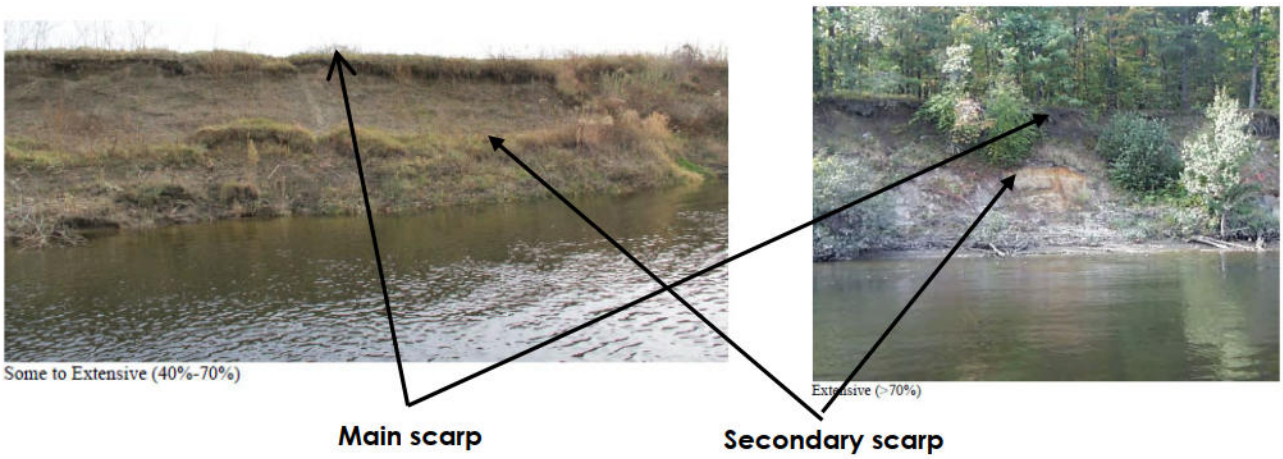



*Figure 3 Two photographs depicting "planar slip" as per Figure 1 above. These two have the same failure mechanism and would both be considered "extensive" by this author. It is unclear as to how the preparer of the QAPP determined which one was more extensive, unless they based it on vegetative cover, which would be a different category.*

clearly shows the initiation of a deep-seated bank failure as shown in the arch shaped separation, highlighted. This bank should have been identified as "extensive."

Another example is illustrated in Figure 3, wherein the failure mechanisms are identical, yet having various levels of severity for the same condition illustrate the additional confusion that will result when the surveys are completed, and MassDEP will be tasked with enforcement of the WQC.

**Updated Requirements of Technology for Use in Monitoring, combined with Modeling**

The subjectivity and outdated survey methods proposed in the 12-year-old FRR and its QAPP must be updated and improved to accurately define the existing conditions of the Connecticut River's banks. Otherwise, MassDEP will not have the data and information to adequately enforce the requirements of the WQC and improve the state's water quality.

Due to the advancement and cost efficiency of LiDAR technologies for use in the monitoring of rivers and bank stability, obtaining riverbank topographic data and vegetative cover, even over an impoundment as long as one behind the Turners Falls Dam, is strongly recommended. Such data to be collected will be an initial baseline flyover via drone or helicopter survey to collect the above and below water surface slope

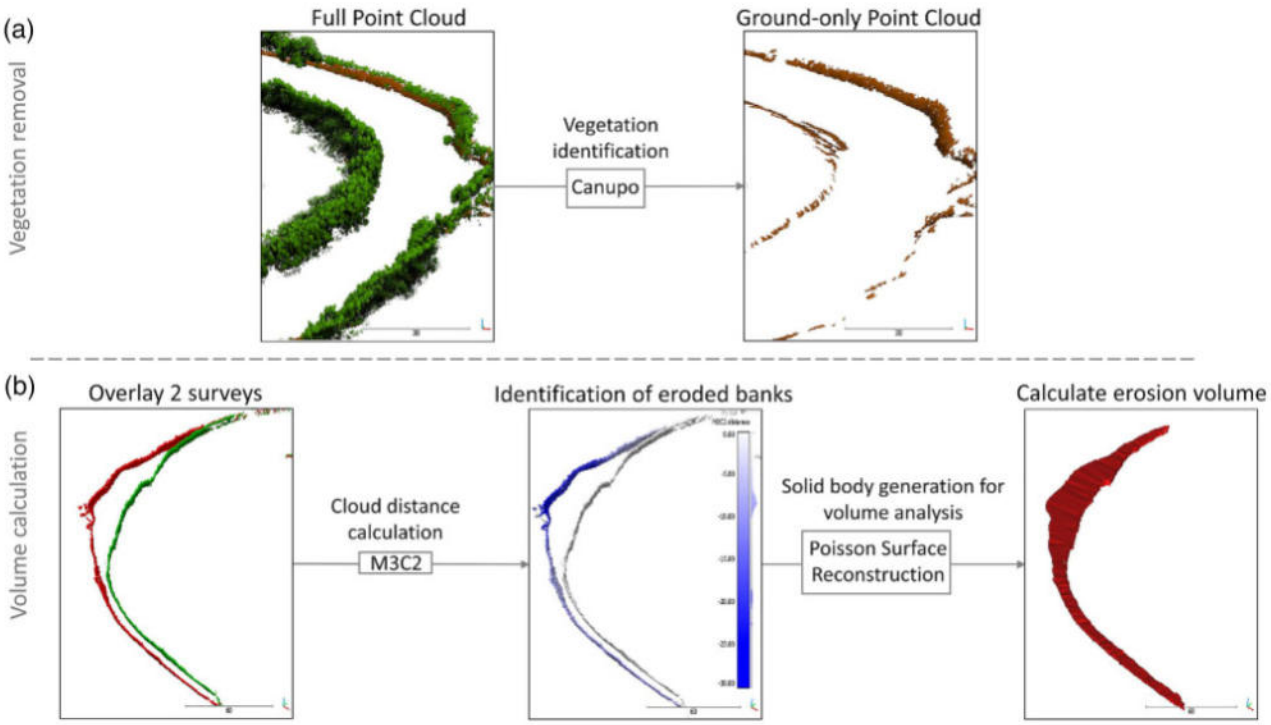



**FIGURE 2** Schematic overview of the data processing workflow. Note that the bank segment shown in figure (a) (vegetation removal) differs from the bank segment shown in figure (b) (volume calculation) because areas with considerable bank erosion are generally near-vertical banks without vegetation cover—thus, different segments are best used to illustrate the two steps. [Color figure can be viewed at wileyonlinelibrary.com]

Figure 4 Illustration of the ability of the use of LiDAR to accurately assess vegetation cover and slope/volume changes of riverbanks.

Haddadchi, A., Bind, J., Hoyle, J., & Hicks, M. (2023). Quantifying the contribution of bank erosion to a suspended sediment budget using boat-mounted lidar and high-frequency suspended sediment monitoring. *Earth Surface Processes and Landforms*, 48(14), 2920–2938. https://doi.org/10.1002/esp.5667

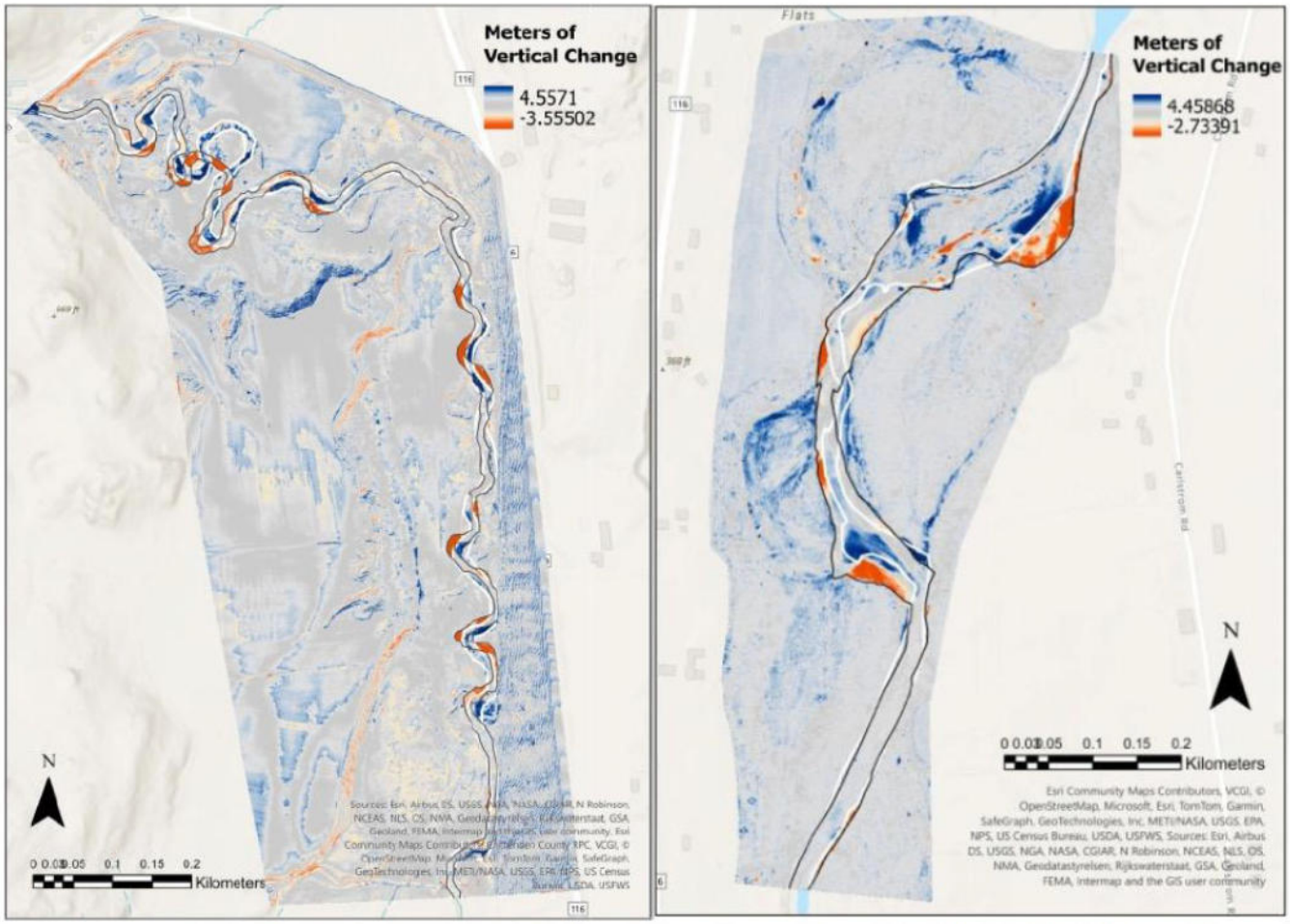



**Fig 3.** The Lewis Creek DoD (left) and New Haven River DoD (right). The black outline represents the 2023 stream channel boundary, and the white outline shows the older channel boundary. Polygons representing the extent of bank erosion were drawn in between the channel boundaries where the new channel was outside the older channel.

Figure 5 Another illustration of the ability of the use of LiDAR to accurately assess vegetation cover and slope/volume changes of riverbanks.
Flanzer, Zoe C., "Examining Variability in Streambank Erosion Rates in the Lake Champlain Basin, Vermont" (2024). *UVM College of Arts and Sciences College Honors Theses*. 129. https://scholarworks.uvm.edu/castheses/129

conditions. Such data can be used to identify existing slope movements and vegetative covers. Such a survey would be completed at the same frequency as the "Boat-Based Inspections" and the "Erosion Monitoring Surveys." It is also strongly recommended that the LiDAR survey be conducted on or about the effective date of the renewed FERC

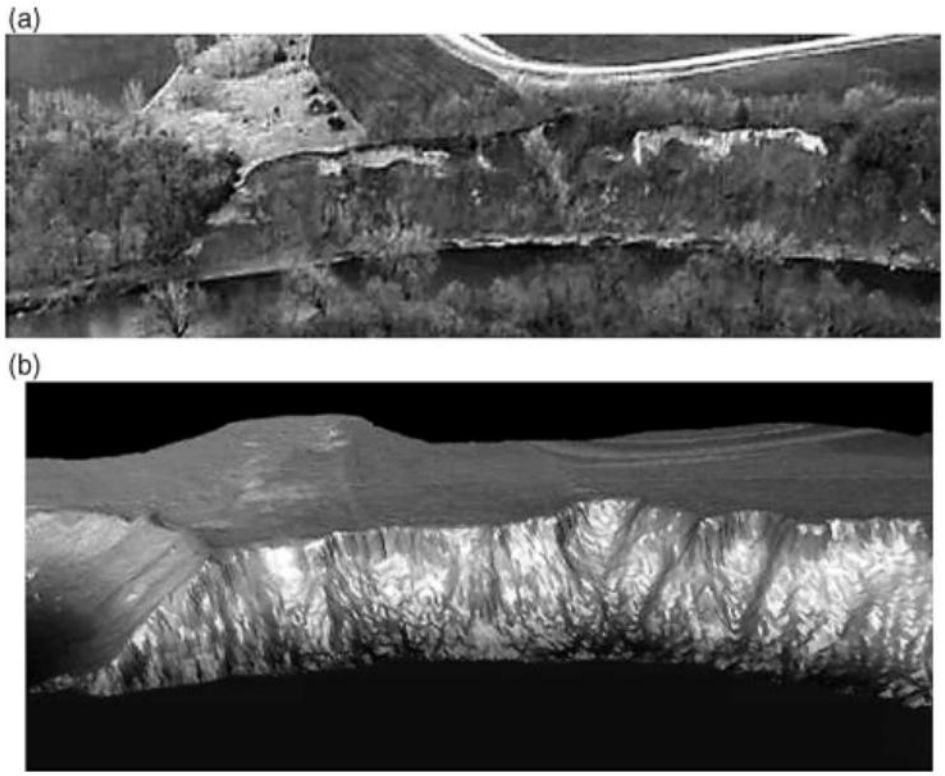



Fig. 2. (a) A severely eroded site along the Blue Earth River photographed at an oblique viewing angle from the air, and (b) rendered as a bare-earth elevation model from the LIDAR data. Vegetation was filtered and points gridded to a 1 m interval in the LIDAR image to create the model. Note gravel road passing through fallow field for scale in both figures.

Figure 6 The use of LiDAR from oblique angles to evaluate the overall stability and areas of failures on riverbanks.

Thoma, D. P., Gupta, S. C., Bauer, M. E., & Kirchoff, C. E. (2005). Airborne laser scanning for riverbank erosion assessment. *Remote Sensing of Environment, 95*(4), 493–501. https://doi.org/10.1016/j.rse.2005.01.012

license to obtain baseline conditions, and after significant flooding events such as flooding caused by tropical storms, nor'easters, or summer catastrophic storms such as have occurred over New England in the last two years. Subsequent years can be precisely overlain over prior years to calculate changes in slope elevations to evaluate if there is displacement or erosion of the riverbanks, as well as understanding the volume of sediment that is discharging into the TFI. Especially following significant flooding, the impacts between regional storm events versus bank instability caused by operations can be distinguished. The accuracy of LiDAR surveys is impressive, and can collect elevation

data, accurate to within 0.06 meters[19], and would be much more reliable than simple, subjective observations (Figure 4, Figure 5, and Figure 6). In fact, the LiDAR technology can obtain topographic data to depths of up to 15 meters, depending on water clarity, which would provide a more complete understanding of erosion and stability occurrences.[20] The ability to obtain topographic data below the water surface would allow for the comparison of surveys over time, regardless of the water depth.

In consulting with remote sensing/survey firms who conduct such services, each survey, including analysis and reporting can be completed for less than $50,000 in 2025 dollars, providing MassDEP and the public with a more comprehensive, quantitative assessment of the stability of the riverbanks and the vegetative cover that adds to river stability. Such a cost would be comparable, if not less costly than ground surveying the limited number of river sections previously completed to determine the overall stability of slopes within the subject impoundment.

In addition to monitoring using remote sensing technology, the causation of loss of vegetation, bank instability, and erosion can be corroborated by using a 2-dimension model such as the US Army Corps of Engineers, Hydraulic Engineering Center, River Analysis System (HEC-RAS).[21] This model, which is free to the public, and a universal modeling software of river hydraulic modelers, would be used to evaluate river flow patterns because of baseflow, natural flooding, and hydropower operational changes

[19] Tamimi, Rami & Toth, Charles. (2024). Accuracy Assessment of UAV LiDAR Compared to Traditional Total Station for Geospatial Data Collection in Land Surveying Contexts. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. XLVIII-2-2024. 421-426. 10.5194/isprs-archives-XLVIII-2-2024-421-2024.
[20] LiDAR survey below the water surface is also referred to as "blue LiDAR", referring to the blue-green wavelengths used to obtain below water surface data.
[21] U.S. Army Corps of Engineers. HEC-RAS River Analysis System, Version 6.6: User's Manual. Davis, CA: Hydrologic Engineering Center (HEC), 2024.

in flow patterns to compare to areas where there is found to be riverbank instability. The comparison of the model to the surveys would allow for a significantly higher level of accuracy and precision in determining whether a riverbank failure is caused by operation of FirstLight's projects or natural processes.

**Comments on Stabilization and Mitigation within the Draft WQC Appendix F, Erosion, Stabilization, and Monitoring Plan**

**Repair & Stabilize Certain 2013 FRR Sites**

The proposed plan indicates that "within 6 years of license issuance, the Licensee shall repair and stabilize all previously stabilized sites in the TFI where the 2013 Full River Reconnaissance (2013 FRR) identified erosion, and the sites have not already been repaired since 2014. These sites include bank segments 14, 371, 65, and 478 that were delineated during the 2013 FRR, equaling approximately 429 linear feet." Although we concur that the repair of existing stabilization sites is important to improving water quality in the impoundment, stabilization projects should be reviewed by an expert panel that includes key stakeholder groups as well as FERC and MassDEP, to minimize the chance of future failures. As indicated by MassDEP "hydropower operations contribute to erosion by raising and lowering the water surface elevation more frequently and significantly than natural fluctuations." It is related to the additional stress associated with operations that may make certain types of streambank stabilization unsuitable for TFI. For example, daily water surface fluctuations can create a stressful environment for vegetation and thus preclude the colonization and successful establishment of stabilizing vegetation. The lack of vegetation at the toe of the bank or the lower bank within the impoundment may be directly associated with stresses associated with daily water surface fluctuations.

The lower bank is typically a flat, beach-like feature that in many ways is like that of a tidal marsh where the absence of vegetation is related to the duration of inundation. As such, reliance on plant material to stabilize or assist in the stabilization of the banks of the impoundment may not, at least in some areas of the impoundment, be a viable option. **A thorough and objective understanding of the causes of erosion at a particular location is essential for the development of future designs that will provide long term stability and improve water quality.**

**Additional New Sites to be Stabilized**

The proposed draft certification indicates that "[i]n addition to the completed stabilization projects noted above, within 6 years of license issuance, the Licensee shall implement stabilization or preventative maintenance projects at three additional sites within the TFI, which equate to an additional 667 linear feet. These sites were identified during the 2013 FRR as having the most erosion of the banks within Massachusetts that had not already been stabilized. These sites include bank segments 90, 87, and 119 that were delineated during the 2013 FRR, equaling approximately 667 linear feet."

We concur that the stabilization contemplated for previously unrestored highly eroded banks is important to the water quality of the impoundment banks. We continue to be concerned that the design will be appropriate for the long-term stability of the banks in the face of the highly modified hydrology of the TFI. As indicated in the previous comment, it is our recommendation that MassDEP and First Light establish a stakeholder group to provide feedback on any stabilization design contemplated for the highly eroded section of the impoundment.

**Future New Stabilization Sites**

The proposed draft certification indicates that [s]ites that are newly identified after issuance of the license as exhibiting 'Some to Extensive' or 'Extensive' erosion based on the definitions contained within the 2013 FRR and which were not previously repaired or stabilized by anyone nor identified above in Table 1, shall be repaired and stabilized by the Licensee within 5 years of their discovery during the Erosion Monitoring Surveys or the Boat-based Site Inspection, subject to the following "limitations."

The limitations of this condition will be discussed later. The identification of newly identified erosion areas exhibiting "some to extensive" or "extensive erosion" based on definitions created in the 2013 Full River Reconnaissance Study and Quality Assurance Project Plan (2013 FRR)[22] limits the types of newly eroded banks to those that have substantially more than a minimal amount of erosion and more realistically define bank failure. Based on the definitions referred to in the 2013 FRR, "Some to Extensive" erosion is assigned to those riverbanks "where the total surface area of the bank segment has approximately 40-70% active erosion present" (see Figure 3) while riverbanks with extensive erosion is assigned to those banks "where the total surface area of the bank segment has approximately more than 70% active erosion present" (See Figure 3) . This would seem to indicate that the newly identified areas erosion subject to this component of the plan would, at a minimum, fall into the 40-70% active erosion class to qualify as new and require stabilization within 5 years of their discovery. Both the "some to

[22] 2013 FirstLight Full River Reconnaissance Study and Quality Assurance Project Plan. August 14, 2013. Prepared by: Simons & Associates and New England Environmental. Prepared for: FirstLight Power Resources Services, LLC c/o FirstLight Hydro Generating Company 99 Millers Falls Road Northfield, MA 01360. https://www.northfield-relicensing.com/content/Documents/RSP%20Volume%202%20-%20Appendix%20D.pdf

extensive" and "extensive" erosion categories shown as examples in the FRR represent areas of substantial bank instability. lin order to improve the water quality of the impoundment areas of significant bank failure and erosion should not have to wait up to five years to be stabilized and warrant prioritization for stabilization.

The Draft WQC indicates one of the limitations related to the stabilization of new erosion areas is related to the amount of stabilization required and the time in which it is to be done. The draft certification states that "[t]he Licensee shall be responsible for repairing 5% of the total new bank segments identified in the intervals between each of the Erosion Monitoring Surveys (Years 2, 10, 20, and 30), regardless of whether they were identified during the above Boat-based Inspections or the Erosion Monitoring Surveys. New bank segments revealing 'Some to Extensive' or 'Extensive' erosion includes any segment not previously stabilized or in Table 1. Following each Erosion Monitoring Survey, the Licensee shall quantify the total linear feet of new bank segments that were identified either during the Erosion Monitoring Survey or during preceding Boat-based Site Inspections as exhibiting 'Some to Extensive' or 'Extensive' erosion. First, the requirements for stabilizing new erosion sites are limited to requiring the stabilization of only 5% of newly eroded riverbank. So, does this mean if a 100-foot section of extensive erosion is identified FirstLight is only responsible for stabilizing 5 feet of riverbank? If the section of riverbank identified as having extensive erosion is 1,000 feet long is the stabilization limited to 50 feet? If these examples, based on how this percentage of eroded riverbank to be stabilized is to be interpreted, then it must be understood that the remaining 95% of these eroded segments of riverbank would lack stabilization and continue to be a source of pollutants to the impoundment. With this approach it seems doubtful that improved water quality in the impoundment is attainable.

Although the Draft WQC includes a caveat the allows MassDEP to determine whether the linear foot equivalent of 5% will not provide a significantly improved stream bank condition, they may reserve the equivalent linear feet for use in the future. This approach would thus be more significant in those cases where longer sections of severe bank erosion are to remain unstabilized and serve as a continued source of sediment into the impoundment. This does not seem like an appropriate solution to improving the water quality of the impoundment.

**Need for Connecticut River Stakeholder Panel**

It is important that, especially as this next FERC license will be in effect for the next 50 years, periodic reviews of the latest technological advances for monitoring riverbank stability, and reviews of the effectiveness of the stabilization and mitigation measures be conducted. It is strongly recommended that a panel of stakeholders be established that would include MassDEP, FirstLight, Franklin Regional Council of Governments, CRC, Connecticut River Streambank Erosion Committee, the affected towns, their respective experts, and other parties that may be warranted. The panel would meet to coincide with monitoring events to review the current conditions of the impoundment water quality, bank stability, and erosion, and have discussions on the implementation of "state of the art" technology to ensure that the monitoring program is following.

**Conclusion**

As previously stated, we commend MassDEP for its understanding of the issues associated with operations and erosion in the TFI. MassDEP's inclusion of project operations as a contributing element to erosion in the TFI is important. However, compliance with the SWQS should not be based on an outdated erosion and sediment

control plan, the 2013 Full River Reconnaissance (FRR) and its Quality Assurance Project Plan. This plan is qualitative in nature and avoids the identification of issues related to operations such as the absence of vegetation and bank instability that contribute to water quality impairment. The need to implement a viable plan to address erosion and bank instability in the TFI is related to MassDEP's stewardship of the water quality within the impoundment. MassDEP's position that "project operations will continue to contribute to erosion in the TFI" is important to any plan designed to improve the water quality of this currently impaired waterbody in the future. Although MassDEP acknowledges that it is difficult to definitively quantify the causes of erosion in the TFI the Draft WQC also concludes that it is nonetheless "necessary to establish erosion-related measures in the WQC to address the existing impairments and to ensure compliance with the SWQS." The draft certificate states "SWQS require that the existing and designated uses and the necessary water quality be maintained and protected and that they be free from solids, color, and turbidity that would be aesthetically objectionable, impair any use, or impair the benthic biota or degrade the chemical composition of the bottom." However, the key to improving water quality in the impoundment in the future is related to the design and implementation of a new plan that addresses all the riverbank issues related to bank instability, lack of riparian vegetation and erosion.

The following changes and improvements must be made to ensure that the causes of riverbank instability and impacts to the water quality of the Connecticut River are understood, or the application for the MA Water Quality Certificate must be denied.

1. Develop an updated Erosion Control Monitoring Plan and QAPP that has, at a minimum, the following components:
    a. the use of modern equipment, high accuracy survey techniques, such as LiDAR (upland survey and bathymetry[23]) to replace the subjective river observation techniques in the 2013 QAPP.
    b. a process for MassDEP to require updated survey equipment and methods as technology and riverine processes are advanced over the next 50 years.
    c. methods and clearer references to document observed erosion features and bank stability features.
    d. require full impoundment surveys using LiDAR obtained via UAV or helicopter surveys, with follow up localized land-based observations and surveys to further analyze areas suspected of becoming destabilized. This survey would be used to provide accurate, or at least, precise physical measurements to supplement the boat-based photo surveys, which as we described above, are subjective and inconsistent in their categorization in the existing form of the 2013 FRR QAPP. While not discussed above, in the alternative, there is boat-based LiDAR technology that could be used to

[23] Bathymetry is defined as the measurement of underwater topographic surfaces.

survey the riverbanks, which would provide additional detail of areas where the toe of the slope has been undercut/undermined.

e. in addition to the already established history of the cross sections monitoring, there must be an ability to add cross sections when new areas of bank failure appear imminent or in process..

f. require consistent survey frequency of 3 years for the life of the FERC License, and add surveys following major flooding events, such as after hurricanes, tropical storms, nor'easters, and local storms that cause severe flooding in the TFI.

g. to corroborate the causes of erosion, use a HEC-RAS 2-D model that is calibrated to natural and operational flow impacts to areas identified as becoming destabilized during the surveys.

2. Ensure that the definition of "new erosion" in the Erosion Control Monitoring Plan is clear and expand the insignificant requirement of only requiring the stabilization of 5% of "newly eroded areas". Additionally, the surveys would be more appropriately conducted by a third-party survey/consulting firm, with expertise in fluvial geomorphology, hydraulics, and geotechnical engineering, be selected by a stakeholder panel (see recommendation 3, below) to ensure that a balanced collection of data is obtained to evaluate the causes of erosion and riverbank failure.
3. Create a stakeholder panel of experts, including MassDEP, FirstLight, Franklin Regional Council of Governments, CRC, Connecticut River Streambank Erosion Committee, the affected towns, their respective experts, and other parties, to review the results of surveys, recommend improvements to survey and modeling

methods, evaluate mitigation measures, and review how operations are affecting the goals of the MassDEP Water Quality Standards.

Thank you for the opportunity to comment on behalf of the Connecticut River Conservancy.

Sincerely,

Geoffrey M. Goll, P.E.
President
Princeton Hydro, LLC

Mark Gallagher
Vice President
Princeton Hydro, LLC

cc : FRCOG

**EXHIBIT E**

Franklin Regional Council of Governments

February 24, 2025

Elizabeth Stefanik,
MassDEP Bureau of Water Resources
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: Northfield Mountain Pumped Storage Project No. 2485-071
Turners Falls Project No. 1889-085
**Comments on FirstLight's 401 Draft Water Quality Certificate**

*Sent electronically via email to dep.hydro@mass.gov*

Dear Ms. Stefanik and the MassDEP team,

The Franklin Regional Council of Governments (FRCOG) hereby submits comments on the January 24, 2025, draft 401 Water Quality Certification (WQC) for the Turners Falls Hydroelectric Project ("Turners Falls Project") owned by FirstLight MA Hydro LLC and Northfield Mountain Pumped Storage Project ("Northfield Mountain Project") owned by Northfield Mountain LLC. Collectively, we refer to the two facilities as "Projects" and the owner and operator as "FirstLight" or "Licensee." The issuance of a 401 WQC for the Projects is a critical step in this process that began over a decade ago when the FERC relicensing process started with the filing of the Pre-Application Document (PAD) on October 31, 2012. There is no existing 401 WQC for the projects and this 401 WQC will be in place for 50 years, a very long time.[1] Massachusetts Department of Environmental Protection (MassDEP) has broad authority under section 401 of the Clean Water Act to maintain or restore water quality to protect the existing and designated uses of the Connecticut River. It is critical that MassDEP issue a strong 401 WQC that will be relevant for operational patterns over many decades, and protective of habitat and water quality for the duration of the license.

FRCOG is a statutorily created regional service organization comprised of and serving the 26 municipalities of Franklin County, Massachusetts. The Connecticut River bisects Franklin County and is a major economic, recreational, and environmental resource for the residents of our member towns. For almost three decades, FRCOG (and its predecessor organization, the Franklin County Commission) and its Connecticut River Streambank Erosion Committee (CRSEC) have been actively involved with landowners and organizations concerned about the ongoing and extensive erosion in the Turners Falls Power Pool. The Federal Energy Regulatory Commission (FERC) recognized FRCOG's CRSEC in 1999 as an Ad Hoc Committee that would work with the power company to develop and

[1] We are aware that FERC can issue a license for a length of 30-50 years, and for the sake of brevity we are referring to the *proposed* license duration.

implement bioengineering bank stabilization projects pursuant to an Erosion Control Plan ordered and approved by the FERC.

FRCOG and municipalities in Franklin County have a significant stake in protecting the water quality of the Connecticut River and in ensuring that FirstLight's operation of the Projects meet water quality standards. Collectively, our communities have invested untold amounts of time and resources to protect and improve water quality through treating and managing stormwater and municipal wastewater, regulating the use of land, restoring habitat, and both regulating and educating our citizens to prevent pollution of the River. The Connecticut River is the lifeblood of our region and is vital to our economy and quality of life. We ask that MassDEP acknowledge and respect the role of local governments in protecting and improving the quality of the River in our corner of Massachusetts (particularly related to municipal wastewater treatment requirements), and to demonstrate the Commonwealth's shared commitment to the health of the Connecticut River by holding FirstLight accountable to operating the Projects in compliance with water quality standards.

## Regulatory Framework

Massachusetts General Law (MGL) c. 21, §§ 26 through 53 charges MassDEP with the duty and responsibility to protect the public health and enhance the quality and value of the water resources of the Commonwealth. It directs MassDEP to take all action necessary or appropriate to secure to the Commonwealth the benefits of the federal Clean Water Act (CWA), 33 U.S.C. § 1251 et seq. The objective of 33 U.S.C. § 1251 et seq. is the restoration and maintenance of "the chemical, physical and biological integrity of the Nation's waters" 33 U.S.C. § 1251(a). To achieve the requirements, MassDEP has adopted the Massachusetts Surface Water Quality Standards that designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected.

Under the Massachusetts Surface Water Quality Standards, 314 CMR 4.06, the Connecticut River from the Vermont, New Hampshire, and Massachusetts state line to the Turners Falls Dam is designated as a Class B warm water river. 314 CMR 4.05 (b) states that Class B "…waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation… These waters shall have consistently good aesthetic value."

Section 305(b) of the CWA requires states to assess waters with respect to their attainment of designated uses such as habitat for fish, other aquatic life and wildlife, fish and shellfish consumption, and primary (e.g., swimming) and secondary (e.g., boating) contact-recreation. Section 303(d) of the CWA requires states to identify those waterbodies that are not expected to meet surface water quality standards. MassDEP fulfills those obligations by preparing an "integrated" list of waters. In the Massachusetts Year 2022 Integrated List of Waters, there are three different segments that make up the Turners Falls impoundment (TFI). All three are listed as impaired, as follows:

- **Segment 34-01** is the 3.5-mile segment between the Vermont/New Hampshire/Massachusetts state line and the Route 10 bridge. This segment is listed as impaired for alteration in streamside or littoral vegetative covers, flow regime modification, and PCBs in fish tissue.

- **Segment 34-02** is the 11.4-mile segment between the Route 10 bridge and the Turners Falls Dam, excluding Barton Cove. This segment is listed as impaired for alteration in stream-side or littoral vegetative covers, flow regime modification, water chestnut, and PCBs in fish tissue.

- **Barton Cove is MA34-122**, a 160-acre cove of the Connecticut River upstream of the Turners Falls Dam, is listed as impaired for curly-leaf pondweed, Eurasian water milfoil (*Myriophyllum spicatum*), fanwort, water chestnut, Escherichia coli (*E. coli*), and PCBs in fish tissue.

Appendix 15 to the 2018-2020 Massachusetts Integrated List, which is the most recent detailed analysis of the attainment status for waters in the Connecticut River basin, states that these segments are "not supporting" the "Fish, other Aquatic Life and Wildlife Use" because of the impairments described above, listed in that document as "stream bank alteration," and "flow modification."

**314 CMR 4.03(3)(b) states, "When the Department issues a 401 Water Quality Certification of an activity subject to licensing by the Federal Energy Regulatory Commission, flows shall be maintained or restored to protect existing and designated uses."** The designated uses that must be legally protected are "habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation." Primary and secondary contact recreation includes swimming, fishing, and boating.

## What is at Stake

The Connecticut River is the largest river system within New England and has offered sustenance to animals and humans for thousands of years. In 1947, the U.S. Geological Survey produced a paper in cooperation with the Commonwealth of Massachusetts Department of Public Works, looking at the geologic features of the Connecticut River valley in Massachusetts, relative to the floods of 1936 and 1938.[2] Though these devastating floods broke all flow records in Massachusetts, this report on page 2 stated that, "In the Connecticut Valley heavy, destructive river scour on fertile flood plains and terraces occurred at points of extraordinary floodwater concentration. *Strong bank erosion was confined to the outer margins of two bends; the stabilizing influence of vegetation was effective at all other places*." (italics ours)

Northfield Mountain has been operating for the last 53 years, and the impacts on the Connecticut River and its banks in the TFI have been catastrophic. Gone are the terraces that were described in

[2] U.S. Geologic Survey, 1947. Geologic Features of the Connecticut Valley, Massachusetts as Related to Recent Floods. By Richard H. Jahns. Prepared in Cooperation with the Commonwealth of Massachusetts Department of Public Works. Online at https://pubs.usgs.gov/wsp/0996/report.pdf

1947. Trees have fallen and are actively falling into the river along the entire impoundment. Bank erosion is universally present, no matter whether at the inside or the outside of river bends. Banks have retreated in excess of 25 feet in places. Aquatic habitat has degraded and Barton Cove has filled with sediment.

Photos such as the two provided below, taken by the Connecticut River Conservancy in September of 2024, are illustrative of what is happening wherever there is no bedrock to prevent erosion: **erosion begins at the toe of the bank, where the water fluctuates every day or more than once day, and this leads to failure of the riverbank**.[3]

*Figure 1. Photo taken by Connecticut River Conservancy in September 2024 on eastern bank at a location roughly 4,000 feet downstream of the Northfield Mountain tailrace. Note the exposed roots due to loss of bank material in the area that experiences daily river fluctuations.*

[3] Please refer to the Connecticut River Conservancy's comment letter on the draft 401 WQC for more photos of eroding river banks in 2024.

*Figure 2. Photo taken by Connecticut River Conservancy in September 2024 on western bank at a location along Bennett Meadow downstream of the Route 10 Bridge. Note undercutting of toe of bank slope and progression of erosion cycle. Notching at the toe leads to bank slumping, loss of bank material and loss of mature riparian trees, and lateral retreat of the banks. Exposed soil and roots are visible at the top of the bank. All this is occurring despite the presence of a forested riparian area in this location.*

Our concerns about this erosion were outlined in FRCOG's Motion to Intervene filed with FERC on April 11, 2024, and they include the following:

- Sedimentation
- Loss of aquatic and riparian habitat
- Loss of prime farmland
- Loss of traditional cultural properties and archaeological sites
- Destruction of natural resource areas
- Damage to repaired areas
- Impacts on recreation, municipal infrastructure, and our local economy

## Summary of FRCOG's Concerns with the draft 401 WQC

Given the significant length of time that the license will be in place, the inability of the Commonwealth of Massachusetts to make changes for the duration of the license, and the impaired condition of the affected waters, FRCOG has substantial concerns with the draft 401 WQC. As noted by MassDEP, FirstLight has not provided the Department with sufficient information to determine whether its proposed operations will improve and then protect the quality of the Connecticut River. FRCOG appreciates that the draft 401 WQC, and related license conditions as proposed in the 2023 Flow and Fish Passage Settlement Agreement (FFP), will provide important improvements to water quality *below* Turners Falls dam. The 401 WQC as drafted will, however, allow FirstLight to continue to operate the Northfield Mountain Project in a manner that degrades the already impaired water quality above the dam in the Turners Falls impoundment (TFI) both downstream and upstream of FirstLight's pumped storage facility. Remarkably, the draft 401 WQC would allow FirstLight, largely at its own discretion, to fluctuate the levels of the impoundment well outside of the current typical operating levels – fluctuations that have already resulted in significant water quality impairment. Even more concerning, during certain instances, MassDEP proposes to *eliminate all limits*, which even FirstLight has not proposed. FRCOG asks that MassDEP impose operating conditions that significantly *reduce* fluctuations sufficient to ensure that water quality standards will be met in this 20-mile-long segment of the CT River.

We encourage MassDEP to exercise its basic mandate and revise the draft 401 WQC to ensure that operations of the Projects do not continue to cause erosion, and the sections of the river impacted by the two projects are restored, as necessary to ensure that MA WQS are attained and to meet the requirements of state and federal clean water laws.[4] Most relevant to FRCOG's comments, and as noted on page 7 of the draft 401 WQC, is that FirstLight's current operations are causing or contributing to impairment of Massachusetts Surface Water Quality Standards ("SWQS") due to "Alteration in streamside or littoral vegetative covers" and "flow regime modification" in the segments of the Connecticut River most directly impacted by the operation of the Northfield Mountain Project. **MassDEP can and must do more than the conditions in this proposed water quality certification to address the causes of this impairment as necessary to ensure that the Massachusetts Surface Water Quality Standards are met.**

FRCOG has been involved in the relicensing of the two projects since 2013 and we submitted extensive comments on the 401 Water Quality Certification process on June 3, 2024. In those comments, FRCOG provided technical information from Dr. Evan Dethier clearly demonstrating project impacts on riverbank erosion, providing justification for limiting impoundment fluctuations. In this letter, we provide MassDEP with new information that, among other things, provides concrete suggestions for requiring modern monitoring technologies to avoid the bias and subjectivity that has plagued analysis of riverbanks and water quality for the past 30 years.

[4] Massachusetts Clean Waters Act, M.G.L. c21, §§ 26-53; Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq.; and Massachusetts Surface Water Quality Standards, 314 CMR 4.00 et seq.

We are pleased that the draft 401 WQC included conditions related to our four primary recommendations, which are listed again below.

- MassDEP's goal should be to bring Project operations into compliance with WQS and other appropriate requirements of state law and assure compliance over the license term.
- License conditions must be set to bring the Projects into compliance. Reducing the range of river level fluctuations will reduce project impacts.
- FirstLight should provide good stewardship of a vegetative riparian buffer the Connecticut River.
- FirstLight should conduct and make public more and better monitoring of project operations and river conditions.

The draft 401WQC provides for good stewardship of riparian areas but falls short in addressing the other three recommendations. **Not only do the draft conditions not adequately address existing impairments, fail to reach attainment, and prevent further degradation, these draft conditions allow the impairments to persist over the next 50 years.** Further, the Special Conditions rely on many plans that have yet to be written and so require a leap of faith that these plans will be strong enough to bring about improvements. That is why we urge MassDEP to strengthen monitoring requirements to avoid the introduction of bias, and adopt modern technologies that can accurately track habitat and water quality trends.

Given these concerns, FRCOG is submitting detailed comments on several of the Special Conditions in the draft 401 WQC, and they center around three key points, as summarized below.

1. **MassDEP can and must do more to ensure water quality standards are met.**
   Section 401 of the Clean Water Act gives the Commonwealth of Massachusetts both the authority and responsibility to protect a public trust, the Connecticut River. MassDEP should only certify these projects as meeting water quality standards if the projects can, if operated under the conditions of the certification, actually meet water quality standards. It is not sufficient to limit the conditions such that the new license maintains the status quo or allows TFI fluctuations with greater frequency and/or intensity. MassDEP has not demonstrated that water quality conditions can be met and appears to contemplate the likelihood that water fluctuations will increase. This is unacceptable and must be changed in the final 401 WQC. Our comments on the following Special Conditions fall under this key point:
   - Special Condition 10 – TFI water level management
   - Special Condition 26 – Water quality monitoring
   - Special Condition 27 – Invasive Species Management Plan

2. **Quality Assurance Project Plans must ensure scientific rigor and encourage modern monitoring technologies.**
   We applaud MassDEP's monitoring requirements to look at trends in erosion, water quality and sediment management over the license term. FRCOG offers specific recommendations related to the erosion monitoring QAPP in order to ensure that project impacts, or

improvements, are adequately documented. We recommend the development of new QAPPs that are regularly updated and include 1) the use of modern technology and scientifically sound and replicable methodologies, 2) precise definitions, and 3) clear decision matrices. Flawed erosion survey methods from the 2013 QAPP for the Full River Reconnaissance, for example, should not be used. Our comments on the following Special Conditions fall under this key point:

- Special Condition 25 – Erosion Monitoring Plan
- Special Condition 26 – Water quality monitoring
- Special Condition 30 – Sediment Management Plan

3. **MassDEP must allow public access to required plans and reports, and recognize the input of members of the public and the Connecticut River Streambank Erosion Committee.** Most of the progress on bank stabilization and protection has happened because of the people who live and work along the river on a regular basis and have long been involved in observing the operations of Northfield Mountain Pumped Storage Project. MassDEP will benefit by allowing public comment periods for the plans it requires and reviews. Final plans and required reports must be publicly posted so that individuals and organizations do not have to repeatedly file Freedom of Information Act (FOIA) requests. Additionally, the Connecticut River Streambank Erosion Committee (CRSEC) is an ad hoc group that has been involved for more than 25 years, and its members are interested in continuing its collaborative role. MassDEP and FERC should continue to recognize this group. Our comments on the following Special Conditions fall under this key point:
    - Special Condition 8 – Flood Flow Operations
    - Special Condition 12 – TFI impoundment reports
    - Special Condition 25 – Erosion Mitigation, Stabilization, and Monitoring
    - Special Condition 26 – Water Quality monitoring
    - Special Condition 27 – Invasive Species Plan
    - Special Condition 28 – Riparian Management Plan
    - Special Condition 30 – Sediment Management Plan

## Detailed Comments on Draft 401 Conditions

FRCOG's comments filed in this letter and its attachments focus on the issue of streambank erosion and the connection to Massachusetts Surface Water Quality Standards. We include a memorandum as Attachment A, prepared by Princeton Hydro and addressed to the Connecticut River Conservancy. CRC contracted with Princeton Hydro to review technical elements of the draft 401 Water Quality Certificate related to erosion. Funding for this contract was provided by the CRC, FRCOG, and the towns of Gill, Northfield, and Montague.

Below, we list our comments and recommendations by Special Condition of the draft 401 WQC.

## Special Condition 8: Flood Flow Operations

Special Condition 8 requires the Licensee to operate the Project "in accordance with its existing agreement with the U.S. Army Corps of Engineers (USACE)." This agreement with the Army Corps has repeatedly been mentioned in relicensing documents, but the agreement itself has never been appended and available to the public. This leaves MassDEP in a precarious position with a special condition that is unknown and unenforceable. [5]

This comment also relates to Key Point #3, the need for full public engagement and transparency.

### Recommendation for Special Condition 8

FRCOG recommends either attaching the USACE agreement to the final 401 WQC or writing in the actual conditions to clearly denote what part of the flood operations are actual 401 conditions.

## Special Condition 10: Turners Falls Impoundment Water Level Management

Special Condition 10 proposes to amend FirstLight's Proposed Article A190. Whereas FirstLight proposed to continue to be able to fluctuate the impoundment between 176 and 185 feet as measured at the Turners Falls Dam, MassDEP proposes a requirement to maintain water levels between 178.5 and 185 feet, except under discretionary and nondiscretionary circumstances. Combined, these exceptions swallow the rule and allow FirstLight to increase the level of impoundment fluctuations beyond their current operations, which are already known to be causing water quality impairments. The nondiscretionary circumstances remove an absolute operating range limit and are particularly worrisome.

MassDEP has sidestepped erosion-related impairments in this Special Condition, despite listed impairments, more than four decades of advocacy around Northfield Mountain's erosion impacts, and numerous peer reviews of the work of consultants hired by the licensee.

**MassDEP's proposed condition would allow FirstLight to violate the surface water quality standards including the anti-degradation provisions and to further degrade the Connecticut River.**

FRCOG supports limits placed on impoundment water level management, but MassDEP has not demonstrated that operations under the proposed Special Condition will meet water quality

[5] Page 66615 of the 401 Rule Preamble states, "However, for certifications with conditions, it is important to clearly indicate what information is merely background or supplementary information as opposed to the actual conditions that must be incorporated into the Federal license or permit. For example, when EPA acts as the certifying authority it clearly denotes which aspects of the certification with conditions are general information versus the actual certification conditions. Clearly parsing out this information in the decision document ensures project proponents are best positioned to understand and comply with certification conditions . . . "

standards. In fact, FRCOG believes the conditions will do little to safeguard water quality and may further degrade water quality.

MassDEP determined that "the entire Massachusetts part of the river upstream of the Turners Falls Dam is listed as impaired" as described in the draft 401 WQC.[6] The causes of the impairment include the alteration in streamside or littoral vegetative cover and flow regime modification.[7] FirstLight's operation of the Northfield Mountain Project is the primary cause of these impairments.[8]

Given this context, FirstLight has the burden of showing that its operation will not violate water quality standards. Yet, FirstLight has not met its burden, but instead has provided inadequate information in support of its application for a 401 WQC, as described in FRCOG's initial comments. MassDEP correctly concluded that,

> "FirstLight failed to provide sufficient information for MassDEP to determine that operating in the range of 176-179 without sufficient limitations would comply with the SWQS",
> …
> "FirstLight failed to provide sufficient information to determine that allowing unlimited impoundment levels in the full range of 176-179 feet would comply with the anti-degradation rule",
> …
> "Using the full range of 176-179 without limitations would decrease flows in the [Turners Falls Impoundment], leaving expanses of land under water exposed, and would not protect existing and designated uses such as aquatic life and its habitat and water-related recreation. FirstLight failed to present any evidence to the contrary,"

and

> "The alterations caused by unlimited fluctuations between 176-179 would likely adversely affect the physical or chemical nature of the bottom, interfere with the propagation of fish or shellfish, and adversely affect populations of nonmobile or sessile benthic organisms. FirstLight failed to present any evidence to the contrary,…"

Draft 401 WQC at pages 25-27.

Similarly, FirstLight did not provide any information in its application, and no finding is provided in the draft 401 WQC, supporting a determination that this amount of impoundment variability is necessary and unavoidable.

[6] Water Quality Certification with Conditions First Light Hydroelectric Project FERC License Nos. 1889 (Turners Falls) 2485 (Northfield Mountain) (DRAFT-1-24-25) at pages 7-8.
[7] Id.
[8] See Section 2 of "Review of Erosion in the Turners Falls Impoundment" prepared by Dr. Evan Dethier, submitted together with FRCOG's June 3, 2024, comments.

Despite these conclusions, MassDEP decided to only limit excursions below 178.5 ft, and did not explain how this limit will comply with the SWQS. In the absence of sufficient information from FirstLight, MassDEP has only two options:

1. deny the 401 WQC and require FirstLight to submit the information that the department needs to ensure compliance with SWQS; or
2. include stringent operational requirements with a sufficient margin of safety to ensure that the fluctuations will not continue to contribute to erosion and impairment of the Connecticut River as necessary to address the causes of the current impairments, reach attainment (as evidenced by comprehensive and scientifically defensible monitoring), and protect uses for the next 50 years.

To obtain the benefits of an updated FERC license with new conditions, FRCOG encourages MassDEP to take the second option. **As currently written, Special Condition 10 does not, however, provide the level of operational limits necessary for the Turners Falls impoundment to meet surface water quality standards.** For instance, if MassDEP has determined that elevations below 178.5 ft are detrimental to existing uses of the Connecticut River, there should be no reason to have discretionary events at all. **Meeting water quality standards should not be optional**. Moreover, the discretionary events, if used to the maximum extent, add up to 420 hours (4.7% hours in a year), which would allow incursions into this low range *more than double* the amount of time they have been under current conditions.[9]

FRCOG agrees that there may be nondiscretionary events requiring deviations – we incorporated such a concept in our June 3, 2024, comments. MassDEP's proposed conditions, however, are particularly dangerous -- they **do not include a lower or upper limit at all.** During these nondiscretionary events, MassDEP proposes conditions in which the licensee "could deviate from the operating range of 178.5-185." This language includes no mention of a floor or ceiling for water surface elevations during these nondiscretionary events. FRCOG recommended in our June 3, 2024, comments an allowed range of 179-184 feet as measured at the dam, and FL has requested a range of 176-185 feet.

FRCOG also notes that typical fluctuation patterns associated with current project operations are important drivers of erosion, causing the river segments above the dam to not meet aquatic life uses.[10] Daily operations include fluctuations that can range over 4.8 feet, but more typically range 1.2 to 1.6 feet, measured at Turners Falls Dam. MassDEP included two figures in Appendix B of the draft 401 WQC, showing current and proposed future conditions (FFP Settlement

[9] Page 25 of the draft WQS cites a FirstLight study that states that "For existing operations, FirstLight operates at or above 178.8 feet approximately 98% of the time."

[10] See Appendix 15 to the 2018-2020 Massachusetts Integrated List of Waters, page 22, which said "Aquatic Life Use of this Connecticut River AU (MA34-01) will continue to be assessed as Not Supporting. Although the water quality data collected were indicative of good conditions the historical impairments 'flow modification' and 'stream bank alteration' due to issues with bank erosion and the operation of multiple hydroelectric generating facilities along the Connecticut River are being carried forward."

Agreement). These graphs, which did not include a date range or information about whether existing conditions were modeled or actual values, do not show typical daily fluctuation ranges, only the mean and extreme high and low frequencies by month. Our comments dated June 3, 2024, on pages 8 and 22 recommended **a stepped approach based on what we know of actual operational patterns**. FRCOG's recommendations were based on actual, measured impoundment patterns as reported by FirstLight, not modeled results for a range of years that is not representative of the current climate patterns or the presence of Northfield Mountain.[11]

Typical operations are having an effect on erosion – the notching and undercutting of the bank toe at the water line instigates the sequence of erosion illustrated in Figure 30 of Field Geology's 2007 report on the TFI, included as Attachment B to this letter.[12] Notching or undercutting destabilizes the entire bank, resulting in lateral and vertical bank retreat and significant sediment loading to the river. See also Recommendation 20 in Princeton Hydro's peer review of Study 3.1.2 dated December 16, 2016.[13]

MassDEP appears to have also concluded that FirstLight's proposed operating conditions will allow an increase in the fluctuations of the Turners Falls Impoundment levels. On page 22 of the Narrative, MassDEP explains that there is a small occurrence of the state-listed plant, the tufted hairgrass, in the TFI, but "MassWildlife does not anticipate long-term persistence of this subpopulation **under the anticipated increase in impoundment variability** needed to help FirstLight naturalize flows downstream of Cabot Station." (emphasis ours) While in the course of negotiating the FFP Settlement Agreement, MassWildlife may have been comfortable trading off the survival of this plant for improvements downstream of the dam, but MassDEP may not allow FirstLight to increase the impoundment variability and continue to degrade water quality, in violation of the SWQS.

By focusing only on a recreational use impairment under low impoundment conditions in their Appendices C, D, and E and justification for this Special Condition, MassDEP left the impairment of the aquatic life use unaddressed.

The SWQS, and particularly the anti-degradation provisions of 314 CMR 4.04, require protection of all existing and designated uses of water bodies, and maintenance of the level of water quality needed to protect those uses. MassDEP's proposed Special Condition 10 fails to protect existing and designated uses because it does not protect against extreme Turners Falls Impoundment (TFI) variability or regular sub daily fluctuations, both of which lead to bank instability and erosion-related impairments.

[11] According to personal communication to FRCOG from FirstLight's consultants dated 2/19/2025, Appendix B to the draft 401 WQC includes modeled results for the period 1962-2003.
[12] Field Geology Services, 2007. Fluvial Geomorphology Study of the Turners Falls Pool on the Connecticut River Between Turners Falls, MA and Vernon, VT. Prepared for Northfield Mountain Pumped Storage Project by Field Geology Services, Farmington ME, November 2007.
[13] This letter was part of **Attachment 3** to FRCOG's comments submitted to MassDEP on June 3, 2024.

Impoundment fluctuation restrictions are necessary

Operation of the Northfield Mountain pumped storage project during the current FERC license has caused or contributed to the current listed impairments of "alteration in streamside or littoral vegetative covers" and "flow regime modification" in the Connecticut River segments 34-01 and 34-02. During this time, while water surface elevations lower than 178.5 ft at the dam have been rare (less than 2% of the time), fluctuations in the range of 1 to 3 feet as measured at the dam have been happening on a sub daily and daily basis. This operation pattern has contributed to a lack of vegetation in this fluctuation zone, leading to notching at the toe (bottom) of the bank and increased rates of erosion. The 1979 Army Corps report recognized that limiting pool fluctuations and encouraging growth of vegetation on the banks could reduce the bank erosion problems.[14] The 401 WQC and new FERC license represent the first opportunity to address this problem since 1968. The conditions MassDEP has drafted will not limit a wider typical daily range of fluctuations, and the impairments could get worse.

In Appendix B of the draft 401 WQC, modeled FFP conditions appear to show that the median impoundment levels will be 1 foot higher in the months of April, May, July, and August, and 1 foot lower in September than under modeled "current conditions." A fluctuation zone centered around a different elevation than the patterns established during the first 50 years of project operations could lead to an increase instability. As noted by our consultant Dr. Evan Dethier, on page 8 of his report appended to our June 3, 2024, comment letter, increased water saturation due to reservoir inundation can enhance erosion processes. Changes in average water levels will change the area of riverbank currently subject to cycles of wetting (saturation) and drying (water draining out of the soil column) increasing bank instability and bank erosion. When the dam was raised and the pumped storage facility brought online in 1972, the river had a catastrophic response, with thousands of feet of bank eroded. A similar response should be expected if a new "shock" to the system is allowed.

FRCOG's comments filed on June 3, 2024, expressed concern about future conditions that may affect operations and operational patterns at Northfield Mountain. In November of 2024, Governor Maura Healey signed a sweeping new climate law that includes a provision for long term contracts for storage, allowing existing storage facilities to be included.[15] This may incentivize the operation of Northfield Mountain even when energy prices are not competitive, thereby causing Northfield Mountain to operate more than it has been during the period modeled for the relicensing studies.

As we have been participating in relicensing, we have attempted to understand current operational patterns and proposed (likely) patterns. The licensing documents have been based on different data sets that are not comparable to one another and make it difficult to understand

[14] Page v of Connecticut River Streambank Erosion Study: Massachusetts, New Hampshire, and Vermont. Prepared by D. B. Simons et al. for the U.S. Army Corps of Engineers, 1979. Contract No. DACW 33-78-C-0297.
[15] *An Act promoting a clean energy grid, advancing equity, and protecting ratepayers.* See Section 98 for storage procurement.

current vs. proposed conditions. Moreover, as described in the previous paragraph, we believe any attempts to predict future patterns are likely inaccurate because of climate change and a changing electric market. Through communication with FirstLight's consultants, we have learned that the graphs in Appendix B in the draft 401 WQC are based on modeled hourly data for a period 1962-2003 under baseline (existing modeled) conditions and under the Flows and Fish Passage Settlement Agreement conditions.[16] The BSTEM modeling results, on the other hand, represent modeled baseline (existing) conditions and FFP conditions from 2000-2014. Data provided in the Pre-Application Document (PAD) and other relicensing study reports presented actual conditions. All of this uncertainly reinforces our opinion that strict operational controls based on what we know about actual (not modeled) conditions are essential in the 401 WQC.

Setting license terms for impoundment levels at a single location is not adequate

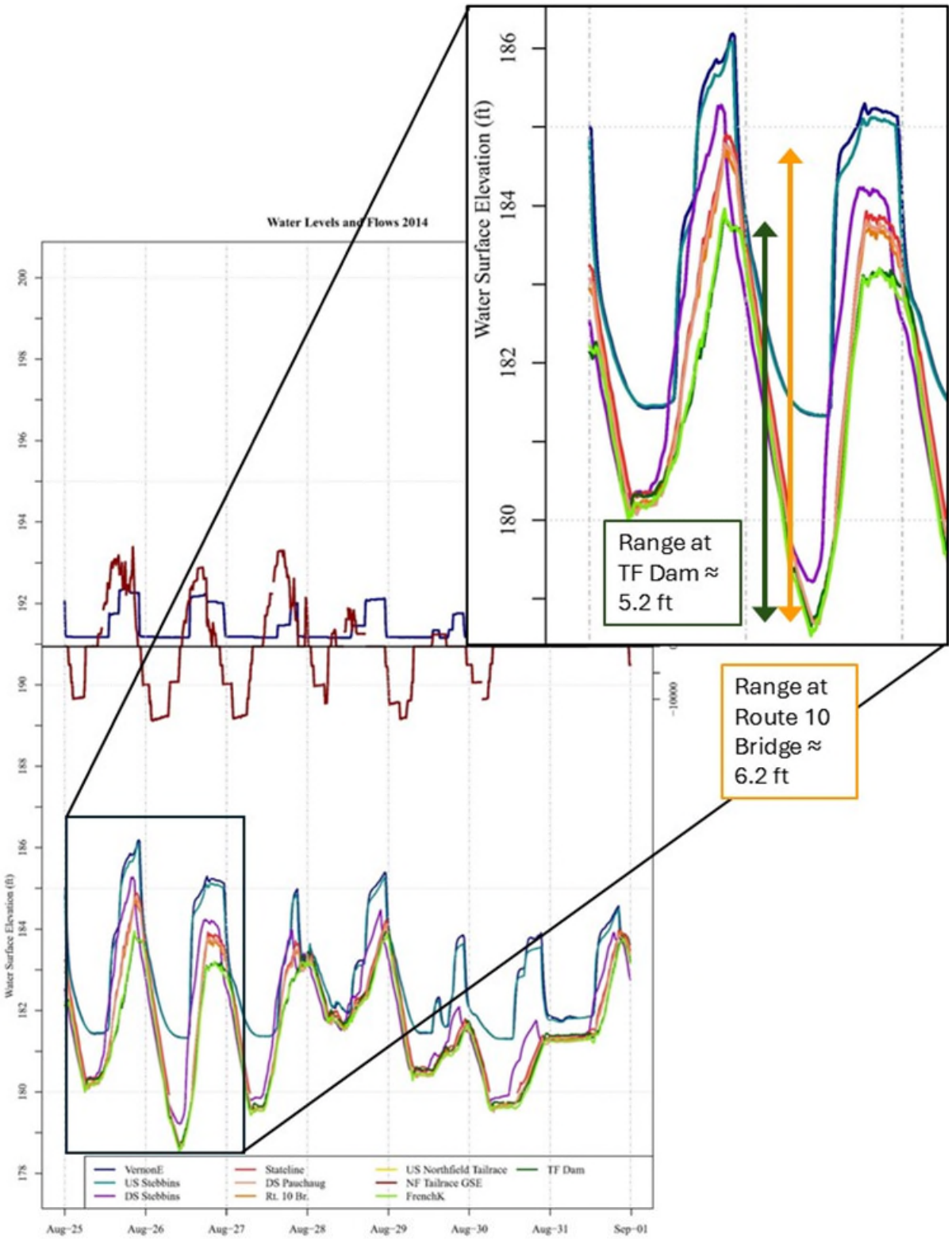
Measuring water surface elevations (WSEs) at a single location, at the dam, has been a major problem in the existing license. There is no need to continue using this flawed approach for the next 50 years. Equally important is how other locations in the TFI upstream of the French King Gorge react to fluctuations, sometimes more severely.

FRCOG adds here an important point of clarification regarding MassDEP's statement on page 26 of the draft Narrative: *the Turners Falls Dam location does not represent the location where fluctuations are the most extreme*. On page 26 of the draft Narrative, MassDEP says that Saco Lane in Gill, six miles upstream of the Dam is "where the impacts of drawdowns should be less than impacts at points close to the dam, such as Barton Cove." Relicensing Study Report 3.2.2, the Hydraulic Study, demonstrated this assumption to be false. **Locations upstream of the Northfield Mountain tailrace, downstream of the MA-VT-NH state line, can experience wider daily fluctuation ranges in a 24-hour period than at the dam.**

The Turners Falls Dam, after all, has several ways to control river levels: a gatehouse that sends water into the power canal, bascule gates, and Tainter gates. There are no such controls upstream, where Northfield Mountain withdraws and then discharge enormous amounts of water, often in excess of the flow of the mainstem river. A figure taken from page 171 of Study Report 3.2.2 shows, for example and shown below as Figure 3, river levels at various loggers in August of 2014. **The logger at the dam showed a 5.2-foot drop in water surface elevation overnight on August 25-26, 2014, whereas the logger at the Route 10 bridge in Northfield showed a 6.2-foot drop during the same period**. Both loggers recorded a low elevation of approximately 178.5 ft, despite the Route 10 bridge being located almost 11 miles upstream and therefore starting at a higher elevation.

[16] Northfield Mountain came online in 1972, so the model represents a fictional scenario that assumed the facility was operating during the flow conditions of that time.

*Figure 3. Page 171 from relicensing Study 3.2.2, with August 25-27, 2014, time period zoomed in and fluctuation range emphasized.*



### Recommendations for Special Condition 10

1. Unless MassDEP chooses to deny a 401 Water Quality Certificate to the Northfield Mountain Pumped Storage Project, FRCOG believes **the only way to bring Northfield Mountain's operations into compliance with water quality standards would be to limit water surface elevation fluctuation patterns**. Our June 3, 2024, comments explained our concept of a **target elevation and target bandwidth (based on actual conditions), as measured both at the Turners Falls Dam and the USGS gage at the Route 10 bridge in Northfield**. We refer to our original recommendations.
2. FRCOG's June 3, 2024, recommendations included two locations to measure compliance with impoundment fluctuation limits. FRCOG continues to stress the importance of establishing two points, and for this reason we emphasize that funding for the USGS gage location at the Route 10 bridge is critical for understanding fluctuation patterns in the next license period.

## Special Condition 12: Flow Notification and Website

FRCOG supports MassDEP's additional requirement of part (d), which requires quarterly reports regarding operational data, and part (e), which requires an annual report detailing impoundment fluctuation extremes. MassDEP did not specify to whom FirstLight will provide these quarterly reports. FRCOG recommends that these reports be posted so that the public will not have to repeatedly request access via the Freedom of Information Act (FOIA).

### Recommendations for Special Condition 12

FRCOG offers the following recommended edits to tighten up the requirement. Suggested new text is underlined; no change is proposed to the rest of this Special Condition after the second bullet.

(d) For the life of the license, quarterly reports will be submitted to MassDEP, FERC, and the CRSEC, by the end of the second month following each quarter that include data concerning the following:

- Continuous hydrographs showing hourly impoundment levels for three locations: the Turners Falls Dam, the Northfield Mountain tailrace, and the USGS gage at the Route 10 bridge. The hydrographs will show the three locations superimposed on the same graph with the elevation shown in feet on the x-axis and the hour and date on the y-axis.
- Weekly and monthly statistics on the impoundment levels in feet mean sea level as measured at the Turners Falls Dam and at the USGS gage located at the Route 10 bridge, as follows: average impoundment elevation with standard deviations; median impoundment level; maximum elevation; minimum elevation; average daily elevation change with standard deviations; number of elevation changes that exceed 2 feet/day; average and maximum rates of change in elevation, both increases and decreases; and average number of hours impoundment level rises vs. falls.

## Special Condition 25: Erosion, Mitigation, Stabilization and Monitoring

MassDEP proposes to include a requirement of an Erosion Mitigation, Stabilization, and Monitoring Plan as outlined in Appendix F of the draft 401 WQC. FRCOG supports the inclusion of a requirement that the Licensee prepare and carry out efforts to monitor, mitigate, and stabilize riverbank erosion. Though the basic ideas of many of FRCOG's recommendations in our comment letter dated June 3, 2024, were adopted, we caution that without clear requirements in the 401, bringing the project into compliance will be hindered by the same lack of data that has plagued this work for the last 50 years.

We stress to MassDEP that the effectiveness of this requirement will be in the details. Monitoring efforts should be scientifically rigorous, defensible, and replicable. Monitoring should be strong enough to be able to understand trends through the life of the next license and to inform decisions on bank repair and stabilization and to improve water quality. Our comments and recommendations in this section are geared to making this Special Condition more scientifically sound and effective.

Repair of Eroded Banks

MassDEP includes a requirement for FirstLight to repair sites described in Table D-1 within 6 years of license issuance.[17] By the time the license is issued, the project will have operated for 60 years with no 401 WQC. Requiring approximately 1,000 feet of bank repair (667 ft of new sites and 429 ft of previously stabilized sites) in 6 years, after what has been effectively a 10-year license extension, is inadequate. The licensee should be able to complete this work in 2 years given they will have ample time to prepare designs after the final 401 WQC is issued. MassDEP could refer to years of project compliance reports for the current FERC license to see the length of and schedule for bank stabilization projects that the licensee had been able to achieve in the past.

Table D-1 does not indicate whether the bank described is on the east (river left) or west (river right) bank, but it appears that DEP has chosen the segments that were identified as having "extensive" erosion in the 2013 Full River Reconnaissance (FRR) report.

FRCOG cautions against relying on these FRR designations as an indicator of what banks were eroding in 2013, and this caution also relates to using these same methods for future assessments and decisions about bank repair. We refer to the letter prepared by the Connecticut River Streambank Erosion Committee dated November 14, 2014, that was included as FRCOG's attachment 11 to our June 3, 2024, comments to MassDEP. Please note comments 3, 4, and 5 of that letter especially. A relevant portion of that letter is copied again here below in italics. The key reason for copying this excerpt is to stress that **the amount of eroding banks in 2013 far exceeded the 667 feet of new sites that MassDEP is proposing the licensee stabilize in the first**

[17] We note that possibly this Table should be named F-1, since it is within Appendix F.

**six years of the license.** As you will see in the photos below, segments of bank classified as having "little/none" erosion were in fact exhibiting severe erosion in photos .

*…"many areas of erosion were missed, and some were incorrectly categorized. Some examples of areas that were missed are shown below.*

*Cropped version of FirstLight photo DSC_1164. Shot November 2013. Located along segment 513, classified as* ***none/little*** *extent of erosion.*

*Cropped version of FirstLight photo DSC_1192. Shot November 2013. Located along segment 515, classified as **none/little** extent of erosion.*

*Cropped version of FirstLight photo DSC_1203. Shot November 2013. Located along segment 515, classified as **none/little** extent of erosion.*

*…*

*It is clear to us that splitting the riverbank into segments based on features other than erosion observations and then assessing the overall erosion in each segment is not a way to truly identify the extent of erosion along the banks. Therefore, the percentage numbers in 2013 and 2008 are meaningless, and in reality, using their methodology, no determination can be made about the extent of erosion and whether or not the riverbanks are getting more or less eroded over time. "*

Erosion Monitoring

MassDEP proposes to require an **Erosion Control Monitoring Plan** to be developed within one year of license issuance, and after consulting with MassDEP. There are two main components of the Erosion Control Monitoring Plan. MassDEP proposes to require **Erosion Monitoring Surveys** in years 2, 10, and 30. The surveys are required, at a minimum, to comply with the 2013 QAPP and must include a boat-based survey and delineation of bank features, with a report due to MassDEP in the first quarter of the year following the survey. MassDEP also proposes to require **boat-based inspections** in the TFI in years 4, 6, 8, 12, 15, 25, 35, and 45. This survey will include visual observation with geo-referenced video recordings and a summary memorandum, along with a repair and maintenance plan for sites requiring repair and preventative maintenance.

*Public review and input should be incorporated*

Throughout Appendix F, an important component is lacking: input from the public, from the Connecticut River Streambank Erosion Committee and its members, and Conservation Commissions of Gill, Northfield, and Montague. The 1999 Erosion Control Plan came about only after years of local advocacy and many meetings coordinated by FRCOG's predecessor organization, the Franklin County Commission. All projects completed under the 1999 Erosion Control Plan until 2013 when relicensing began were done with consultation and input from the Connecticut River Streambank Erosion Committee (CRSEC) and several were supported by funding secured by the FRCOG from MassDEP's s.319 Nonpoint Source Pollution grant program. This group, as well as residents who live along the river, are the eyes and ears of the Connecticut River, and MassDEP's work with the licensee into the next license will be enhanced by ideas and input from the public who care so deeply about the River. We recommend that a review committee that includes CRSEC be established and incorporated into the 401 WQC to oversee all parts of this Special Condition.

*A new QAPP must be prepared and should be regularly updated*

FRCOG is supportive of the requirement of a QAPP to be approved by MassDEP; in fact, we long requested that a QAPP be prepared to eliminate bias and require replicable methods for conducting the previous FRRs. **We recommend MassDEP require a new QAPP and updates of this QAPP be completed at least every 10 years**. We are <u>not</u> supportive of using the 2013 QAPP for the initial survey in year 2. We need to break the cycle of inadequate data collection for this impaired waterbody. The 2013 QAPP included in the relicensing study did not include signature lines for MassDEP staff so it is unclear if MassDEP reviewed and approved the QAPP. CRSEC comments on the 2013 draft QAPP dated January 25, 2013, were submitted as Attachment 19 to our comments dated June 3, 2024. We refer to this Attachment again as a reminder of our concerns about the adequacy of this document.

In Appendix F to the draft WQC, MassDEP has included reference to the recommendations and protocol developed by Dr. John Field dated July 2011 in a report commissioned by several landowners along the Connecticut River titled, "Detailed analysis of the 2008 Full River Reconnaissance of the Turners Falls Pool on the Connecticut River, Prepared for Landowners and Concerned Citizens for License Compliance Turners Falls Pool." FRCOG supports these recommendations, specifically those related to the types and stages of erosion, and we recommend survey methods that reduce reliance on subjective measures, which introduce bias and reduce the ability to compare the results against subsequent river surveys. This is especially critical over the term of a 50-year license. We note that the 2013 QAPP did not follow Dr. Field's recommendations and allows for the bias these recommendations attempted to avoid.

*Survey methods should be modernized and made less subjective and qualitative*

The FRCOG and the CRSEC have long been concerned that the FRR methods are subjective, non-reproducible, and lack scientific rigor. The technology now exists to do regular surveys using

LiDAR that would be more quantitative and would remove subjectivity and bias from the process. Please see comments prepared by our consultant, Princeton Hydro, for more details on recommended survey methods included in Attachment A. Special consideration should be given to observing and recording erosion occurring at the toe of the bank where water levels fluctuate due to project operations.

Additionally, we have long recommended that regulators create a mechanism for hiring 3rd party consultants to carry out monitoring and reporting. If MassDEP includes this requirement, it will provide a level of assurance to regulators and stakeholders that sound data is driving the decision-making for and stewardship of this public trust resource.

*Long term cross-section surveys should be continued*

FRCOG recommends that the long-term cross-section monitoring be continued. These surveys have been happening on an annual basis for more than 20 years and represent an important data set that should not be cast aside. Please see FRCOG Condition 3(c)(a) from our comments dated June 2, 2024, for suggested ways to improve the reporting of the cross-section surveys.

*Surveys need to supplement clear decision matrix on sites to be stabilized*

The Erosion Control Monitoring program must clearly inform decisions on sites to be stabilized. There is no discussion in Appendix F about project designs and standards. FRCOG recommends such details be included in the QAPP and/or Plan, and that the CRSEC, Conservation Commissions and landowners be consulted during the design phase of any stabilization projects.

<u>Repair of Previously Stabilized Sites</u>

FRCOG supports the requirement that the licensee repair previously stabilized sites. We are not clear whether this requirement impacts new sites that are fixed in say, year 10, and would need repair later in the license. We assume this requirement would include those sites and recommend that this is clearly laid out in the permit.

We also note that the impact of some ice events is exacerbated by project operations. Bank scouring from blocks of ice floating downstream would not be a project effect, but large chunks of ice that froze along the banks and then broke off the bank when the river level dropped, taking rocks and soil with it, would be a project effect.

<u>Stabilization of New Sites</u>

MassDEP proposes that 5% of the sites that are newly identified after issuance of the license as exhibiting "some to extensive" or "extensive" erosion based on the definitions contained within the 2013 FRR and which were not previously repaired or identified in Table 1 of Appendix F shall be repaired.

MassDEP has not explained its choice of 5% or how this will ensure that the Connecticut River will meet water quality standards, although there is a provision that if MassDEP determines the 5% will not provide a significantly improved stream bank condition, MassDEP "may reserve the equivalent linear feet for use in the future." It is not clear what "for use" means. If MassDEP is reserving the right to require more than 5% of repairing in the future, it should choose wording that clarifies.

We re-iterate our concerns from CRSEC's comment letter dated November 14, 2014, on the FRR. Comments #3 and 4 showed that the definitions and the chosen length of river segments lead to many eroding banks being identified as having "none/little" erosion. MassDEP must ensure a data collection process (new QAPP) that eliminates bias in identifying the type and stages of erosion and potential bank stabilization and aquatic habitat projects that will improve and protect water quality.

MassDEP exempts the licensee from needing to repair sites that exhibit unique conditions and list several criteria. It is not clear if these types of conditions are exempt from being part of the 5% that are repaired, or if the linear feet of erosion of this type will be subtracted from any calculation of "new" sites. We support allowing eroded areas to remain eroded that offer habitat for sensitive wildlife receptors like bank swallows and belted kingfishers. As for the other areas that are proposed to be exempt, MassDEP should be aware that FirstLight has their own permitting program for irrigation withdrawals and docks within the Turners Falls impoundment, separate from the MA Water Management Act and Chapter 91 licensing. MassDEP should review FirstLight's permitting program in light of this Special Condition to see if it is truly appropriate to exempt the Licensee. Additionally, we have long stated that boat wakes are a secondary project effect.

2-mile long no-wake-zone near the Dam

MassDEP has proposed that FirstLight work with the appropriate state and federal agencies to implement a no-wake zone from the Turners Falls Dam upstream to approximately the property of the Scheutzen Verein Club in Gill, a distance of 11,000 feet or **2 miles**. This is a recreation requirement, so we will refrain from detailed comments because we signed the Recreation Settlement Agreement. MassDEP should note that such a provision is not in the Recreation Settlement Agreement, and we recommend MassDEP discuss the logistics of enforcement with the Environmental Police before finalizing this requirement, if they have not done so already.

## Recommendations for Special Condition 25

1. Repair of Eroded Banks:
    a. An initial round of bank repair of new and previously stabilized sites, as identified by MassDEP, should be constructed within the first two years after license issuance.

b. The length of and schedule for bank stabilization projects should not be arbitrarily decided or based on the results of the flawed 2013 FRR and QAPP. Instead, the length of and schedule for bank stabilization projects should be specifically tied to the findings of the surveys conducted as part of a new Erosion Control Plan.

2. Erosion Monitoring:
    a. A review committee should be established that includes the Connecticut River Streambank Erosion Committee (CRSEC) to oversee all components of Special Condition 25 and ensure that public review and input is incorporated.
    b. A new Quality Assurance Project Plan (QAPP) must be developed and be regularly updated on a schedule at least every 10 years.
    c. Survey methods in the QAPP must be state-of-the-science and reduce reliance on subjective measurements, which introduce bias and reduce the ability of MassDEP and stakeholders to compare the results against subsequent river surveys. See specific survey recommendations in Attachment A.
    d. Require the hiring of a 3rd party contractor to carry out monitoring and reporting. This will provide a level of assurance to MassDEP and stakeholders that sound data is driving the decision-making process and stewardship of this public trust resource for the next 50 years.
    e. Monitoring of the long-term cross-sections should be continued. See FRCOG Condition 3(c)(a) from our June 2, 2024, comment letter for suggested ways to improve the reporting of the cross-section surveys.
    f. Monitoring and surveys need to inform clear decision matrices for bank stabilization projects. FRCOG recommends that project designs and standards be included in the QAPP and/or Erosion Control Plan and the CRSEC, town Conservation Commissions and landowners be consulted during the design and construction phases of any bank stabilization or habitat restoration projects.
3. Repair of Previously Stabilized Sites: FRCOG recommends that MassDEP specify that this requirement applies to sites repaired under the current FERC license and those repaired under the new FERC license.
4. Stabilization of New Sites: FRCOG disagrees with the entirety of this section of Special Condition 25, aside from the concept of a continued obligation to repair eroding banks. The length of and pace of bank stabilization work should be based on the data collection, monitoring and decision matrices in the new Plan and QAPP. See also 2f above.

## Special Condition 26: Water Quality Monitoring

Though we did not request it in our comments dated June 3, 2024, FRCOG generally supports the requirement of long-term water quality monitoring program for the life of the license to better understand license compliance, and to determine operational impacts on water quality over several decades. We support the requirement of a QAPP to be updated for approval every five years.

## Recommendations for Special Condition 26

1. A clear purpose for each monitoring requirement must be articulated.

2. The monitoring design and QAPP should have a public comment period in which the public could provide input on monitoring methods and locations.

3. Because the impairments listed in the Connecticut River segments above Barton Cove are not specifically due to chemical contaminants (see Regulatory Framework section earlier in this letter), it is critical that this Special Condition be rewritten to adequately track water quality status with regard to project operations and existing impairments.

4. The water quality, erosion, and riparian plans (and their associated QAPPs) should be interconnected to track progress towards meeting water quality standards.

5. Biological monitoring. Because the Connecticut River in the TFI is not supporting the Aquatic Life Use, we recommend that MassDEP require biological sampling. In MassDEP's 2022 Comprehensive Assessment and Listing Methodology (CALM), DEP includes an Index of Biotic Integrity (IBI) for wadable streams in Massachusetts. Presumably, the Connecticut River does not fall into the "wadable" category in most areas, but the TFI section of the Connecticut River is habitat for state-listed odonate species, and understanding trends of odonates in this stretch would be an important thing to keep track of. It is not clear if MassDEP ever moved forward with the work of Yoder et al. (2009) in developing an IBI for the Connecticut River.[18] We recommend that MassDEP include a biological monitoring requirement looking at species that use the littoral zone of large river systems (with input from the USFWS Connecticut River Coordinator's office and MassWildlife) to track improvement toward meeting water quality standards, or track declines. Juvenile shad surveys conducted by agency staff should also be summarized and migratory fish numbers tracked as part of this requirement, so that project operations and erosion can be assessed together with biological surveys.

6. Monitoring to understand attainment of littoral zone impairment. Submerged aquatic Vegetation (SAV) is the term used for a rooted aquatic plant that grows completely under water. These plants occur in both freshwater and saltwater systems and are important habitat for fish because it provides them with a place to hide from predators and it hosts food sources such as small invertebrates and other prey. SAV essentially forms a canopy, much like that of a forest but underwater.

   In February 2016, FirstLight published Study 3.5.1, Baseline Inventory of Wetland and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operational Impacts on Special Status Species. As part of this study, FirsLight surveyed and mapped

[18] Fish Assemblage and Habitat Assessment of the Upper Connecticut River: A Preliminary Report and Presentation of Data, 2009. https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-650.pdf

submerged aquatic vegetation (SAV) in the study area, which included the TFI. One map in the vicinity of the Northfield Mountain tailrace is copied below as Figure 4.

Study report 3.5.1 provides an important baseline survey of SAV. The New York State Department of Environmental Conservation has a webpage explaining SAV surveys of the Hudson River between 1997 to 2018, and they have a GIS map showing the SAV beds.[19] A monitoring and mapping program like this could be an important way of monitoring progress toward water quality goals.

FRCOG recommends that MassDEP include a requirement that FirstLight conduct an SAV survey of the TFI every 5-10 years for the duration of the license. MassDEP should develop goals for what amount of SAV would meet water quality standards prior to the completion of the monitoring plan, and the sampling would track the path toward attainment.

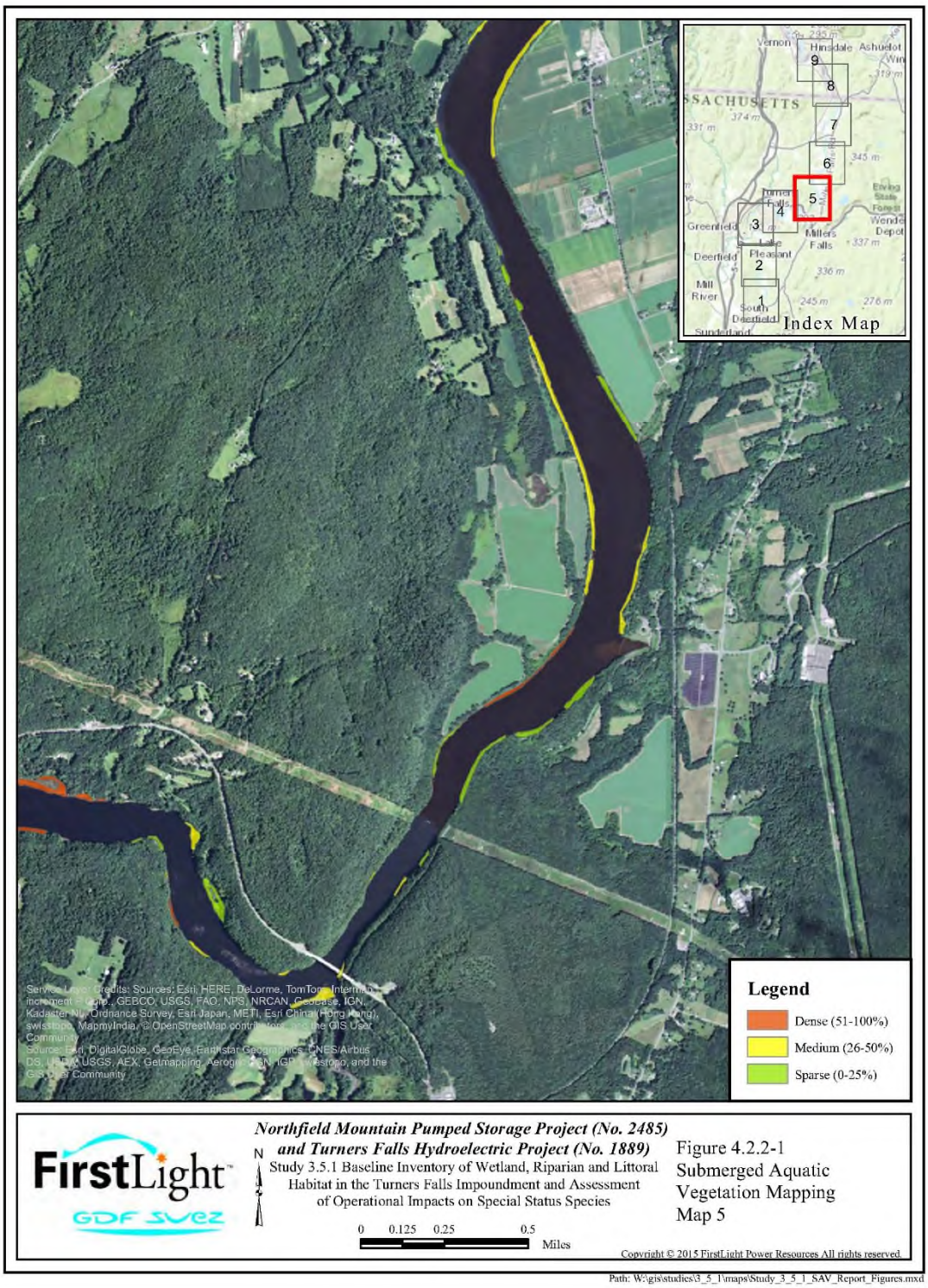
7. Surface water temperature. We urge MassDEP to adopt modern monitoring technologies that remove sample design problems and bias. For example, Gerald Szal submitted comments to FERC dated December 17, 2024 (accession number 20241217-5091). Mr. Szal has no affiliation with FRCOG, and our understanding is that his comments were submitted on his own behalf. In Mr. Szal's letter, he used satellite infrared imagery to demonstrate his concerns about the impact of Northfield Mountain on water temperature in the Connecticut River. MassDEP is proposing to require water temperature monitoring. Though any QAPP would need to set quality assurance parameters of satellite imagery, the imagery provided in Mr. Szal's comments offer a much more comprehensive view of water temperatures than the few locations suggested by MassDEP.

8. Nutrients. It is not clear from the draft 401 WQC if MassDEP has been collaborating with the partners working on the Nitrogen Reduction Strategy for Long Island Sound.[20] We recommend careful collaboration with USGS and other partners to make any nutrient monitoring as useful as possible.

[19] NYSDEC Hudson River SAV monitoring program described online here: https://dec.ny.gov/nature/waterbodies/oceans-estuaries/hudson-river-estuary-program/aquatic-habitats/submerged-aquatic-vegetation and map is online here: https://data.gis.ny.gov/datasets/nysdec::hudson-estuary-submerged-aquatic-vegetation/explore?location=42.136608%2C-73.856602%2C12.00

[20] More information at https://longislandsoundstudy.net/our-vision-and-plan/clean-waters-and-healthy-watersheds/nitrogen-strategy/

*Figure 4. One of several maps showing the SAV survey from Study 3.5.1. This map shows the river segment that includes the location of the Northfield Mountain tailrace.*



9. Total Suspended Solids (TSS). Rivers with impoundments are often thought of as "sediment starved" because dams reduce the movement of sediments downstream.[21] Movement of TSS can be important for river health, but it can also be a pollutant. MassDEP should establish a management goal for desirable sediment transport in the Connecticut River system, and figure out how this 401 Water Quality Certificate fits into the goal.

   Vernon Dam lies just upstream of the TFI, and there are hundreds of miles of river, with many more dams upstream, that can contribute TSS in the Connecticut River. The Connecticut River can often contain TSS washed downstream from storms far upstream. The sampling regime should be designed to help us understand whether MA 34-01 and 34-02 are meeting the standards for "flow regime alteration" or "stream-side or littoral vegetative covers. The proposed frequency (twice monthly) of sampling of TSS, limited to the months only of June-September, at the river segment between the Route 10 bridge and the dam (but not in segment MA34-01 upstream of the project), the Northfield Mountain tailrace, and the river below Cabot Station, is insufficient to inform our understanding of the effects of erosion from the Northfield Mountain Project. Section 4.2 of Study Report 3.1.3 demonstrated that TSS levels spiked when there were high flow events in the Connecticut River and looked at operational effects on TSS at lower flows. We are unsure what to recommend to improve this requirement without understanding better MassDEP's purpose. At a minimum, the Sediment Management Plan should be tied in to this requirement.

We encourage MassDEP to reach out to their federal and state partners and to work with FirstLight to develop a water quality monitoring plan that is related to best understanding long-term trends with regard to project effects and water quality impairments.

## Special Condition 27: Invasive Species Management Plan

FRCOG supports the requirement of an Invasive Species Management Plan to address a listed impairment.

### Recommendations for Special Condition 27

1. FRCOG requests that MassDEP add mention of a required public comment period on the draft Invasive Aquatic Plant Monitoring, Treatment, and Control Implementation Plan, and that all relevant agencies and organizations involved in aquatic invasive species be allowed to comment.

   There are a large number of watershed state agencies and nonprofits that have worked collaboratively on invasive species management in the Connecticut River through the

[21] See, for example, this post by American Rivers: https://www.americanrivers.org/2023/08/sedimentation-and-dam-removal-bringing-a-river-back-to-life/

Northeast Aquatic Nuisance Species Panel.[22] [23] Massachusetts Department of Conservation and Recreation's Lakes and Ponds program has focused on aquatic invasive plants and is inexplicably not mentioned as a consulting agency. MassDEP will benefit from other agency input, especially since this plan will be in force for 50 years.

The survey reports should be similarly distributed to these agencies and organizations, as well as the public, for their comment before the February 1 deadlines and agency meetings.

2. FRCOG continues to believe that rapid identification and response may someday be needed for non-plant aquatic invasives that may spread or become established due in part to project operations. The Plan should be adaptable to include other invasive aquatic species in the future.

3. Throughout Attachment G, the Turners Falls power canal should be mentioned as a location of rapid response, monitoring, and control of aquatic invasive species.

4. Attachment G, Section 2, paragraph 2 states that the licensee will not be responsible for treatment measures outside Barton Cove. The Turners Falls power canal should certainly be included in the areas that the licensee is responsible for. Additionally, there has been a small patch of water chestnut in the river channel just upstream of Barton Cove that FirstLight has long managed and monitored, and responsibility could continue. Given that the impoundment is 20 miles long, the justification for limiting FirstLight's responsibilities is not clear and appears unwarranted.

5. Section 2 requires the Licensee to allocate internal funds for the "treatment" of aquatic plants. The word "treatment" is not defined, and FRCOG recommends the definition not be limited to chemical treatment. Some aquatic invasives can be reduced or eliminated through hand or mechanical removal, which is preferred over the use of chemicals, if effective.

## Special Condition 28. Riparian Management Plan

FRCOG supports the requirement of a Riparian Management Plan to address listed impairments.

MassDEP proposes to require FirstLight to maintain a 75-foot vegetated riparian zone on properties owned by the Licensee. MassDEP did not provide a rationale for 75 feet in their Findings. The 1996 Massachusetts Rivers Protection Act provides protection to rivers by regulating activities within the Riverfront Area, which is a 200-foot-wide corridor on each side of a perennial river or stream, measured from the mean annual high-water line of the river. The requirements of the Rivers Protection Act have been incorporated into the Wetlands Protection

[22] https://www.northeastans.org/index.php/home-page/
[23] See the 2019 report titled "Mapping of Invasive Aquatic Species in the Connecticut River with a focus on Hydrilla verticillata & Trapa natans Agawam to Turners Falls, MA," conducted for the MA Department of Conservation and Recreation which had survey locations within the project areas up to the French King Bridge. https://www.northeastans.org/docs/meetings/201906/files/Hydrilla%20workshop%20Straub.pdf

Act regulations, 310 CMR 10.00. The Wetlands Protection Act establishes a buffer zone of 100 feet around other types of wetlands.

Parts (a), (b), and (d) of Special Condition 28 introduce unnecessary confusion over what lands fall under the Riparian Management Plan's requirements. In part (a), the riparian zone is described as property "owned by Licensee along the Connecticut River, where feasible (as determined by MassDEP)." Then in part (b), it states that the plan shall include "all lands owned in fee by the Licensee abutting the Connecticut River other than those used for the Specific Project Purposes identified above." It then lists specific project purposes identified below. These first two definitions are similar but not exactly the same, and the lands covered in the plan may or may not be ultimately decided by MassDEP. If FirstLight acquires any new land in fee during the license period, that land should fall under this requirement. Finally, in (d), it states that if the Licensee sells any land, all purchasers shall be given a copy of the Plan prior to sale.

Finally, Special Condition 28 unreasonably limits the scope of the plan to "lands that the Licensee owns in fee along the Connecticut River shoreline other than those used for the Specific Project Purposes of power production and Project recreation facilities." FirstLight may not, however, currently own all of the land in fee that is within the FERC Project Boundary and subject to erosion as a result of the operation of the Northfield Mountain Project. According to the maps in Study Report 3.6.5, revised dated May 31, 2016, there are significant parcels of land within the FERC Project Boundary that are not owned in fee by FirstLight but instead are subject to "flowage rights, leases, easements, etc." Many of these parcels are likely to be in active agricultural use, be designated as Prime Farmland, and/or are permanently protected by agricultural or other conservation easements. These lands should not be summarily excluded from the Riparian Management Plan.

## Recommendations for Special Condition 28

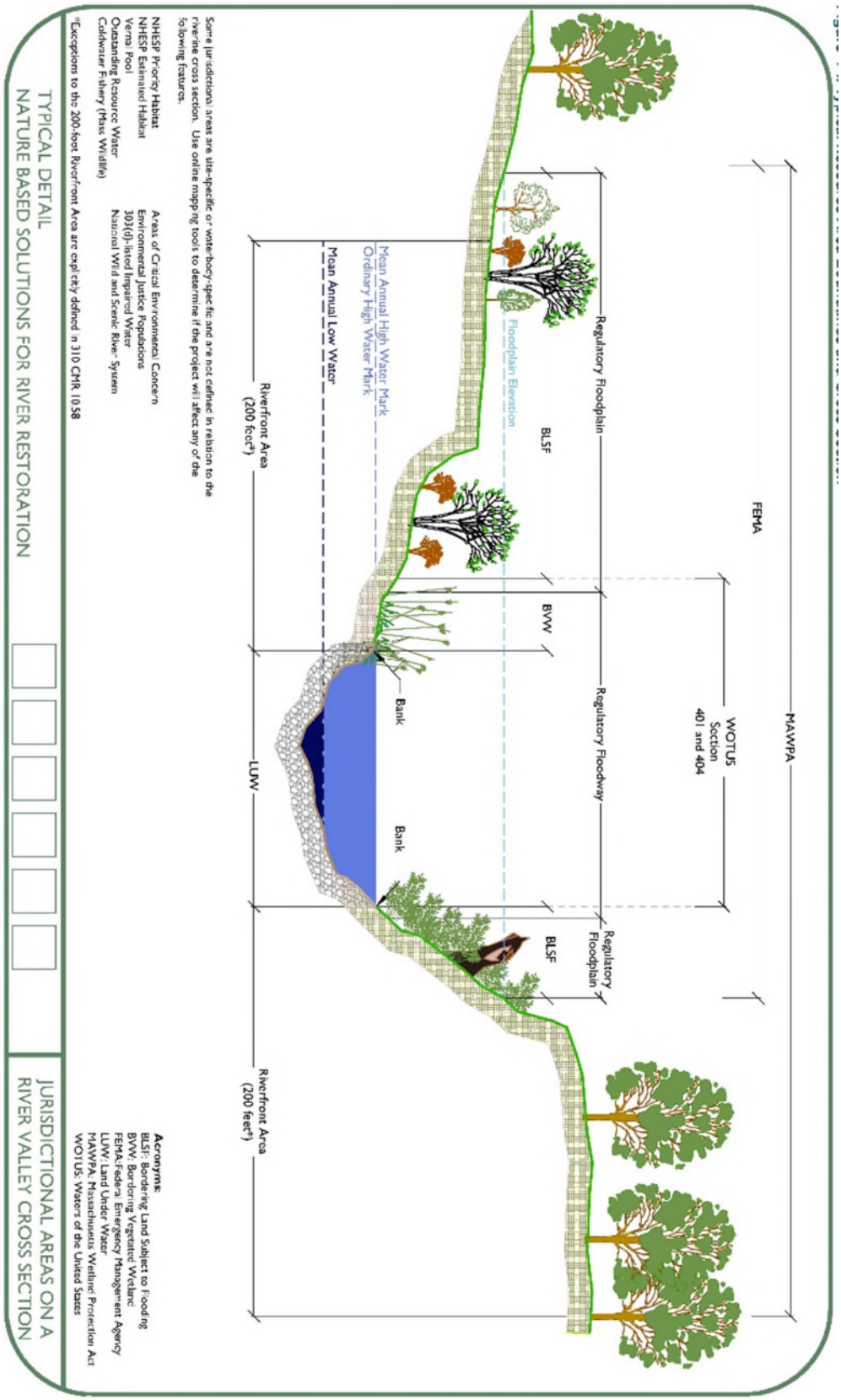
1. MassDEP should require a managed riparian area that is relevant to Massachusetts laws and regulations relating to rivers. FRCOG recommends that regulated resource areas (shown below) be referenced in the 401 WQC as illustrated below in Figure 5.
2. FRCOG strongly recommends targeted elimination, management, and treatment of priority riparian invasive plants within the riparian management plan. A healthy and diverse riparian habitat will be significantly impaired if taken over by oriental bittersweet. For more information, please see our comment letter dated June 3, 2024.
3. FirstLight should not be able to sell land along the Connecticut River, if that land will continue to be covered by the requirements of the FERC license and the 401 WQC including the Riparian Management Plan.
4. FRCOG recommends that part (c) be amended to incorporate review and approval of the draft plan by the New Hampshire Department of Environmental Services (NHDES) and Vermont Department of Environmental Conservation (VT DEC), as this provision appears to and should involve FirstLight's riparian lands in New Hampshire and Vermont. FRCOG

also recommends amending this section to incorporate public review of a draft Plan, and public posting of the Final Plan, with a set of maps clearly defining the parcels involved.

5. For this reason and in order for the Riparian Management Plan to be effective, the Plan should extend to all lands subject to erosion within the FERC Project Boundary. As currently written, Special Condition 28 is incomplete. Unless revised to encompass all land subject to erosion, as opposed to just land owned in fee, neither MA DEP nor the public will have sufficient assurance that this Plan, once approved and implemented, will address the impacts of the Project on water quality.

6. For properties not owned by FirstLight in fee but subject to easements, MassDEP should require FirstLight to consult with the landowners and develop riparian management strategies that will prevent erosion and are complementary to the current use of the land, whether it be active agricultural use of permanently protected farmland, stewardship of conservation land, or some other use.

*Figure 5. Typical regulated resource areas (taken from January 2025 draft version of FRCOG's "River Restoration Design and Permitting in Massachusetts: A Guide for Inland Rivers," in process)*



## Special Condition 29: Recreation Management Plan

FRCOG signed on the Recreation Settlement Agreement and fully supports MassDEP's adoption of the Recreation Management Plan into the 401 Water Quality Certificate.

## Special Condition 30: Sediment Management Plan

FRCOG supports the requirement for the licensee to file a revised Sediment Management Plan and to file a report summarizing monitoring and disposal details after each dredging event.

### Recommendations for Special Condition 30

1. We encourage MassDEP to expand this requirement for any dredging activities in the project areas.
2. Both the Plan and the reports should be publicly posted; the easiest way to require that would be to require the licensee submit the same documents to FERC, which maintains a publicly available project docket.
3. A regularly updated QAPP should be required for the Sediment Management Plan.

# Conclusion

FRCOG urges MassDEP to address the water quality impairments in the Connecticut River upstream of the Turners Falls Dam. This section of river has undergone a large experiment for the last 50 years. The impacts have been significant, and this is the only opportunity to course correct and set appropriate conditions for the next 50 years.

Thank you for this opportunity to review and provide comments on this draft Certificate. If you have any questions, please do not hesitate to contact myself (lindad@frcog.org) or Kimberly Noake MacPhee (kmacphee@frcog.org).

Sincerely,

Linda Dunlavy
FRCOG Executive Director

**ATTACHMENTS**

A: Princeton Hydro memo dated February 24, 2025

B: Figure 30 in Field Geology Services (2007), Fluvial Geomorphology Study of the Turners Falls Pool on the Connecticut River Between Turners Falls, MA and Vernon, VT. Prepared for Northfield Mountain Pumped Storage Project by Field Geology Services, Farmington ME, November 2007.

cc:
FERC Secretary Debbie-Anne A. Reese
Senator Edward Markey
Senator Elizabeth Warren
Massachusetts Governor Maura Healey
State Senator Jo Comerford
State Representative Natalie Blais
State Representative Susannah Whipps
Bryan Smith, Town Administrator, Town of Erving, MA
Ray Purington, Town Administrator, Town of Gill, MA
Walter Ramsey, Town Administrator, Town of Montague, MA
Andrea Llamas, Town Administrator, Town of Northfield, MA
Nina Gordon-Kirsch, River Steward, Connecticut River Conservancy

Nina Gordon-Kirsch
MA River Steward
Connecticut River Conservancy
15 Bank Row | Greenfield, MA 01301

**RE: Comment on Water Quality Certification with Conditions**
**FirstLight Hydroelectric Project**
**FERC License Nos. 1889 (Turners Falls) and 2485 (Northfield Mountain)**

February 24, 2025

Dear Ms. Gordon-Kirsch,

Princeton Hydro LLC (Princeton Hydro) was retained by the Connecticut River Conservancy (CRC), a stakeholder and participant in the re-licensing process of the Federal Energy Regulatory Commission (FERC) for two hydropower facilities owned by FirstLight Power Resources Inc. (FirstLight) on the Connecticut River, to provide a technical review of the components of the Draft 401 Water Quality Certification (WQC)[1] related to bank stability and monitoring for the reach of the Connecticut River known as the Turners Falls Impoundment (TFI). FirstLight MA Hydro LLC and Northfield Mountain LLC (collectively FirstLight or the Applicant), respectively, filed applications for new major licenses to operate the 62.0-megawatt Turners Falls Hydroelectric Project (Turners Falls Project; FERC No. 1889) and the 1,166.8-MW Northfield Mountain Pumped Storage Project (Northfield Mountain Project; FERC No. 2485).

**Introduction and Background**

As part of the relicensing process, FERC regulations required FirstLight to file with the Massachusetts Department of Environmental Protection (MassDEP) its 401 Water Quality Certificate Application. FirstLight filed a single 401 Application with MassDEP for

[1] Mass DEP, (Draft) Water Quality Certification with Conditions, 2025. FirstLight Hydroelectric Project, FERC License Nos. 1889 (Turners Falls), 2485 (Northfield Mountain), dated January 24, 2025.

both Projects on April 22, 2024. The submission of the 401Water Quality Application is an essential part of the relicensing process as it must receive the approval of Massachusetts. Under Section 401 of the Clean Water Act (CWA), a federal agency may not issue a permit or license to conduct any activity including Federal Energy Regulatory Commission (FERC) licensed hydropower facilities unless a Section 401 WQC is issued by a state, or certification is waived. It is also important to acknowledge that the WQC review process seeks to ensure that the project, in this case FirstLight's relicensing of the Turners Falls Project and the Northfield Mountain Project, will not continue to negatively impact the water quality of the Connecticut River as set forth in Massachusetts's surface water quality standards. A "WQC" under the Clean Water Act enables states to participate in a federal approval process such as the FERC relicensing of FirstLight's hydropower facilities to protect water quality in a water body such as the Connecticut River by allowing states to regulate and potentially deny permits for projects that could worsen the condition of any water body including already impaired waters. In this context the WQC process must be shown by FirstLight to be consistent with the designated water quality standards for relevant segments of the Connecticut River. The stretch of the Connecticut River associated with the Turners Falls Dam and the Northfield Mountain Pumped Storage Project is listed as Class B waters, which are designated in accordance with 314 CMR 4.05(3)(b) "as habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation." Importantly, and of relevance to the pending 401 application, the entire Massachusetts part of the Connecticut River upstream of the Turners Falls Dam is listed as impaired in the 2022 Massachusetts Integrated List of Waters. The stated impairments in the upper 3.5-mile section of the

Turner Falls Impoundment (TFI) are indicated to be due, at least in part, to "alteration in streamside or littoral vegetative covers" and "flow regime modification".[2] Similarly, the segment of the Connecticut River from the Route 10 bridge to the Turners Falls dam is also considered to be impaired, in part, for the same reasons "alteration in streamside or littoral vegetative covers" and "flow regime modification".

**The combination of the two causes of impairment identified above are not commonly designated in Massachusetts and would appear to be specific to the Turners Dam impoundment and pumped storage project operations**. The role of First Light's operations on erosion has been consistently identified in comments by various experts indicating that project operations contribute or exacerbate erosion in the TFI. However, FirstLight's application for this WQC states that "[a] consistent finding throughout all the erosion evaluations conducted during relicensing is that the dominant causes of erosion in the TFI are high flows/floods and, in the Barton Cove area, boat waves. Project operations is not a *dominant* cause of erosion at any locations in the TFI but is a contributing cause of erosion in the following locations of the TFI in Massachusetts: in: (1) an approximately 21,600-foot-long reach from the exit of Barton Cove to the French King Gorge (both sides of the river), and (2) an approximately 4,700-foot-long reach on river right upstream of the Northfield Mountain tailrace."[3] Based on work done on an earlier report by Princeton Hydro[4] and review of other reports regarding the TFI including reports

[2] Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle. November 2018-2021. Watershed Planning Program. http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html
[3] FirstLight. April 22, 2024. Prepared for: FirstLight. Northfield, MA: Author. April 22, 2024. Turners Falls Hydroelectric Project (FERC No. 1889) Northfield Mountain Pumped Storage Project (FERC No. 2485) 401 Water Quality Certificate Application.
[4] Wildman, L., Woodworth, P., & Daniels, M. (October 2016). Peer-Review of Relicensing Study 3.1.2 Northfield Mountain / Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability Study Report.

by the US Army Corps of Engineers (1979)[5], Field Geology Services[6] (2007) and, most recently, Dr. Evan Dethier (2024)[7] we remain unconvinced that FirstLight's position indicating that operations do not have a significant or dominant role in the impoundment's erosion issues is accurate. Dethier (2024) states that "There is substantial evidence of erosion in the Turners Falls Impoundment (TFI), much of it consistent with fluctuations in water level due to dam operations. Several reports and memos, including by the US Army Corps of Engineers, Field Geology Services, and Princeton Hydro, have already established that water level fluctuations in the TFI can, and do, enhance erosion in the reservoir."

Impacts on bank stability and water quality associated with the operations of pumped storage facilities such as TFI have been documented for many years. For example, in a 1982 document by the US Army Corps of Engineers states "[o]perating a reservoir in a peaking mode, that is, controlling releases to match peak energy demands, creates another level of impacts within the reservoir and downstream of the dam. Reservoir fluctuations cause many biological impacts in addition to the aesthetic and recreational nuisance of the exposed drawdown zone."[8] This publication goes on to state "**[l]arge seasonal or diurnal fluctuations in water level primarily affect the stability of the shoreline substrate and water quality** (emphasis added)."[9] A 1981 report by Dames

[5] U.S. Army Corps of Engineers, 1979, Report on Connecticut River Streambank Erosion Study: Massachusetts, New Hampshire and Vermont: Department of the Army New England Division Corps of Engineers: Waltham, MA, 185 p.
[6] Field (Field Geology Services), 2007, Fluvial geomorphology study of the Turners Falls Pool on the Connecticut River between Turners Falls, MA and Vernon, VT: Unpublished report prepared for Northfield Mountain Pumped Storage Project, 131 p
[7] Dethier, Evan May 19, 2024, Review of Erosion in the Turners Falls Impoundment Prepared for the Connecticut River Conservancy and Franklin Regional Council of Governments. 53 pages
[8] United States Army Corps of Engineers. March 1982. National Hydroelectric Power Resources Study, Environmental Assessment. Institute for Water Resources, Kingman Building, Fort Belvoir, Virginia 22060. Page 3-7.
[9] id

and Moore describes the adverse effects of reservoir water-level fluctuations during hydropower operations and indicates impacts such as "**degradation of wetland habitats above the dam; with bank erosion".**[10] In a more recent 2020 publication by Saulsbury, he states "[b]oth open-loop and closed-loop PSH (pumped storage hydropower) pumping and generating operations may affect geology and soils primarily due to large and frequent reservoir water-level fluctuations and resulting shoreline erosion. These impacts may be higher at open-loop projects such as Northfield Mountain, including add-on projects where the lower reservoir was already constructed for other purposes, because of the potential effects of their shoreline erosion and resulting sedimentation on the naturally flowing water bodies to which they are connected. [11] Evan Dethier stated that "[t]he current project operational range for reservoir levels exacerbates erosion relative to a narrower range by exposing a large swath of the reservoir banks to erosive properties and raising the "base-level" for natural flooding, adding to flood heights and thus erosive power."[12]

It is, however, interesting that the operations of other pumped storage facilities are often linked to erosion, but FirstLight asserts that the TFI is somehow not. FirstLight's claim that the predominant impacts on riverbank stability stems from "natural" high flows and boat traffic wake is questionable. There is nothing natural about the TFI. The simple existence of the TFI and pumped storage operation already creates a baseline of

[10] Dames and Moore. 1981. *An Assessment of Hydroelectric Pumped Storage*. In *National Hydroelectric Power Resources Study*. Volume X. Prepared for the U.S. Army Engineer Institute for Water Resources, Fort Belvoir, Virginia. https://www.iwr.usace.army.mil/portals/70/docs/iwrreports/iwr019-000001-000517.pdf
[11] Saulsbury, J.W. A Comparison of the Environmental Effects of Open-Loop and Closed-Loop Pumped Storage Hydropower; Pacific Northwest National Lab. (PNNL): Richland, WA, USA, 2020.
[12] Dethier, Evan May 19, 2024, Review of Erosion in the Turners Falls Impoundment Prepared for the Connecticut River Conservancy and Franklin Regional Council of Governments. Page 52.

complex anthropogenic impacts to the hydrology of the Connecticut River that has little in common with a natural river system. The artificial elevation of the river correspondingly elevates the adjacent groundwater all along the TFI, while the Northfield Mountain pumped storage system adds the variability of the water surface elevations in the TFI daily. At a minimum, these artificial elevations of the TFI section of the Connecticut River influence every instance of bank failure.

We commend MassDEP on its understanding and recognition of the issues associated with operations and erosion in the TFI as indicated in the following statement:[13]

> "…it is clear that project operations will continue to contribute to erosion in the TFI. It is difficult, however, to quantify the extent of that contribution. It is therefore necessary to establish erosion-related measures in the WQC to address the existing impairments and to ensure compliance with the SWQS. The measures are intended to balance the limitations and difficulties of precisely determining erosion causation in the TFI with the need to address existing erosion and impairments and monitor for and address any future erosion. The SWQS require that the existing and designated uses and the necessary water quality be maintained and protected and that they be free from solids, color, and turbidity that would be aesthetically objectionable, impair any use, or impair the benthic biota or degrade the chemical composition of the bottom."

[13] Mass DEP, (Draft) Water Quality Certification with Conditions, 2025. Page 41 of 117.

It is in this light that our comments focus on the issues associated with reliance on a dated erosion and sediment control plan, the 2013 Full River Reconnaissance (FRR) Quality Assurance Plan[14]. It is also important to acknowledge that the 2013 FRR avoids the identification of issues related to operations such as the absence of vegetation and bank instability as contributing to water quality impairment.

We have significant issues concerning the Draft WQC and the proposed use of the 2013 Full River Reconnaissance Report (2013 FRR) and the associated Quality Assurance Project Plan (QAPP) to guide Special Condition 25, which is detailed in Appendix F, of the Draft 401 WQC. Failure to use objective, quantitative metrics to determine the causes of bank instability and loss of shoreline vegetation will not contribute to the development of consistent water quality improvements. Specifically, our concerns are summarized below and then described in more detail in the following pages.

1. **The methods in the 2013 FRR and its QAPP warrant an update, especially considering MassDEP's understanding that operations play a key role in the erosion as well as bank instability and the absence of shoreline vegetation within the impoundment.** Since 2013, technology has advanced and reduced survey and monitoring costs. For example, unmanned aerial vehicles (UAV) or helicopter LiDAR surveys can accurately survey and provide repeatable, defensible documentation. This technology would provide a complete survey of the entire impoundment; including the measurement of elevations with as

[14] Simons & Associates and New England Environmental (2012), Quality Assurance Project Plan, 2013 Full River Reconnaissance Turners Falls Impoundement of the Connecticut River, October 29, 2012.

small an interval as several inches and can document and calculate vegetative cover.

2. **The 2013 FRR is too focused on visual indicators of erosion and fails to place much, if there is any, emphasis on bank instability that is more related to operations.** Appendix D of the 2013 QAPP proposes to use reference photographs to estimate bank heights, slopes, soils/sediment types, vegetative cover, and erosion. However, as will be discussed, the proposed use of photographs, and subjective and inconsistent metrics which will only provide inaccurate/inconsistent judgements of the condition of the slopes. While the conditions for "erosion" are noted, they do not include global stability and deep-seated failures, such as slides, that are clearly shown in the photographs but downplayed in the descriptions.
3. Because the FERC license has a 30 to 50-year life span, **the Final WQC must have provisions to update survey methods as technology is developed to further improve the accuracy, repeatability, and defensibility of data collected.**
4. **The formation of a panel of experts, with equal voting rights, must be included as a requirement of the Final WQC to evaluate developing trends in surveying, monitoring, and mitigation techniques and technology**. At a minimum, the panel would consist of representatives from MassDEP, FirstLight, Franklin Regional Council of Governments, CRC, Connecticut River Streambank Erosion Committee, and their respective experts to evaluate the progress of monitoring, conditions of the river and its banks, and make recommendations to ensure protection of the water quality of the Connecticut River.

5. In Appendix F of the Draft 401 WQC, the determination of how much bank stabilization needs to be completed is vague, at best, and from what we can interpret of **the requirement to repair 5% of a failed riverbank will be meaningless regarding protecting water quality.**
6. In Appendix F of the Draft 401 WQC, MassDEP is proposing that FirstLight repair newly eroding sites. **The provision to allow five (5) years to implement bank stabilization measures provides permission for FirstLight to violate the MA Water Quality Standards for that period, when sediment and nutrients contained in the sediment will continue to discharge to the Connecticut River.**

**Comments on <u>Monitoring</u> within the Draft WQC Appendix F, Erosion, Stabilization, and Monitoring Plan**

After a thorough and thoughtful review of all the documents and comments submitted regarding FirstLight's application for 401 Water Quality Certification, MassDEP

> "finds it necessary to impose the erosion-related measures in Special Condition 25 for the Projects to comply with the Federal Clean Water Act, the Massachusetts Surface Water Quality Standards, and other water quality-related requirements of state law. Accordingly, MassDEP imposes Special Condition No. 25."

Special Condition 25 relates to the Erosion Mitigation, Stabilization, and Monitoring Plan located at Appendix F of the Draft 410 Water Quality Certification. A comprehensive and current plan to address shoreline issues within the impoundment is essential to MassDEP's goal of improving impoundment water quality. It is vitally important that monitoring and

the resulting mitigation and stabilization measures be based on highly repeatable, defensible, and precise measures for determining the causation of shoreline and riverbank erosion and instability. Appendix F of the Draft 401WQC is relying upon the 2013 FRR in Study No, 3.1.1.[15] Appendix F of the Draft WQC and the 2013 FRR rely on metrics and methodologies that are dated in terms of the available remote survey technologies. In fact, the 2013 QAPP to Study 3.1.1 (included as Appendix D in the study report to 3.1.1) relies upon references photographic/video georeferencing and global positioning systems (GPS) equipment that has been surpassed in technological development.

**Frequency of Observations**

One area for which we mostly agree with the proposed monitoring plan is the frequency of field observations. According to the 2013 QAPP, FERC requires FirstLight to conduct FRRs every 3- 5 years[16], however, the Draft WQC states that Erosion Monitoring Surveys will be conducted in years 2, 10, 20, and 30[17], while Boat-Based Inspections are to be conducted in years 4, 6, 8, 12, 15, 25, 35, and 45[18]; leaving a 10 year gap between years 35 and 45, and no inspections at year 50. MassDEP would be better served by requiring inspections at consistent intervals, with three (3) years for the life of the FERC License as the standard for scheduled surveys. Such consistency will allow for the identification of riverbank change over time. As will be described below for improvements to monitoring, in addition to the years specified above (whichever is determined to be correct), a baseline survey must be completed in the first year of the issuance of the FERC license, and it would be beneficial to provide additional FRR surveys

[15] Simons & Associates and New England Environmental (2012).
[16] Simons & Associates and New England Environmental (2012). Page 5 of 38.
[17] Mass DEP, (Draft) Water Quality Certification with Conditions, 2025. Page 107 of 117.
[18] Mass DEP, (Draft) Water Quality Certification with Conditions, 2025. Page 108 of 117.

following major storm induced flooding, such as those caused by hurricanes, tropical depressions, and other major flooding events. In addition to consistent frequency of surveys, It is imperative that these surveys are conducted at a level as to be accurate, replicable, and defensible in the eyes of MassDEP, using modern methods (further described below). Without this, the proposed FRR monitoring plan is unenforceable due to the vagueness and lack of detail to be obtained.

**Equipment included in the 2013 QAPP**

None of the equipment and observation methodology described in the 2013 QAPP is adequate for accurately determining the progression of bank failure when it occurs. The proposed equipment to be used in the assessment of the TFI's riverbank conditions only provide support for the location where qualitative and subjective (see below for comments on the bank condition classification system) observations are made and are not repeatable in terms of understanding monitoring of the changes in topography are made, especially to those movements that would otherwise reveal that a slope is mobilized.

**Trimble Geoxt Sub-Meter GPS Specifications** – Appendix A of the QAPP specifies a Trimble submeter accurate GPS product, and the version of this model from 12 years prior. Due to reductions in cost of equipment and increased access to reference GPS stations, submeter accuracy systems have been supplanted by sub-centimeter/survey grade Real Time Kinematic (RTK) GPS equipment to allow for detailed surveys rather than simple locating of points of observations. Current technology allows for the collection of sub-centimeter accuracy elevations to be collected directed on the slopes with relative ease. This would provide MassDEP with a clearer

understanding of how the riverbanks are responding to hydropower operations.

**Laser Range Finder Equipment Specifications** – Appendix B of the QAPP includes a product brochure for a LTI TruPulse 360B range finder. These range finders are handheld and subjective in terms of where on a slope, for example, a distance is measured. The manufacturer's specifications included in this appendix state that the accuracy of the device is +/- 1 ft (this means that a distance could be 2 feet off), with an inclination and azimuth accuracy of +/-0.25 degrees and +/-1 degree, respectively. The accuracy combined with the inconsistent measurement points chosen on a slope at each event, will not provide useful information on changes in elevations and slopes, especially where a slope is already failing, but in slow progression between survey events.

**Red Hen Systems -** A quick search on the internet for the "Red Hen Systems Geo-Referenced Video Mapping" equipment included as Appendix C of the QAPP, reveals the latest website reference to this equipment is dated 2016. It is not clear that this equipment can be purchased or serviced/calibrated by Red Hen Systems, if they are no longer in business. This equipment may have been made obsolete with the advent of georeferenced smart phone photographic technology, but even then, all these systems provide is a location for where the photographs were taken.

**Riverbank Classification Reference Photographs**

Appendix D of the 2013 QAPP includes a proposed classification system to assess the Upper Riverbank Slope, Lower Riverbank Sediment, Upper Riverbank Height, Upper Riverbank Vegetation, Lower Riverbank Vegetation, and Extent of Current Erosion. On the last page of Appendix D (and of the entire document) it states:

> *NOTE: All quantitative classification criteria (e.g., slope, height, vegetation, extent, etc.) will be based on approximate qualitative estimates made during field observations of riverbanks. The FRR is a reconnaissance level survey that will not include quantitative field measurements of characteristics. Photographs contained in this appendix will be used for reference checking in the field to ensure consistent and accurate data classification.*

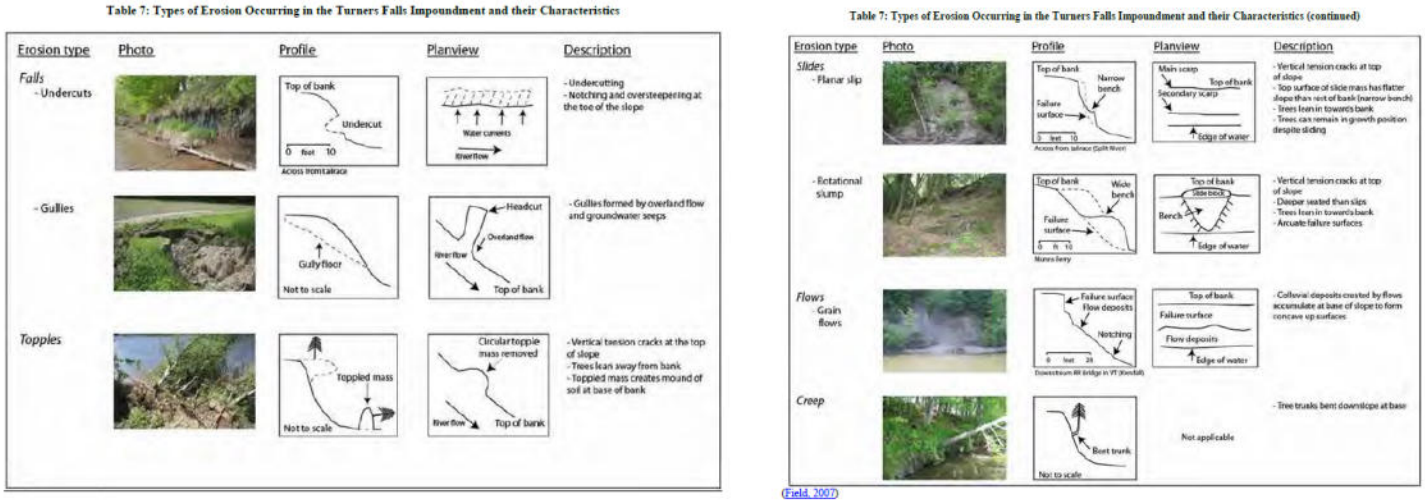



*Figure 1 Table (sic) 7 from the 2013 QAPP. While labeled as erosion, it is actually depicting bank stability and failure mechanisms, both caused by erosion, as well as other factors such as loss of vegetation and rapid drawdown of the impoundment.*

This statement is contradictory in that it claims to be "quantitative," but subsequently qualifies that word using the phrase "approximate qualitative estimates" (each of these three words used are subjective). This note goes further to admit that the "…FRR is a

reconnaissance level survey that will not include quantitative field measurements of characteristics." **There will be absolutely no way to determine if there has been any degradation of riverbanks, unless there are massive changes or catastrophic failures that would by then negatively impact water quality by introducing significant quantities of sediment to the river.** There is the potential for significant variation in observations, both from the same individual over time, and from different individuals conducting the surveys. **Human errors must be eliminated in the documentation as much as possible. Based on current technology, these surveys should be done more rigorously and with repeatability/replicability.**

Additionally, while mass failures of the slopes were depicted within Table 7 of the 2013 QAPP (Figure 1), none of these failure mechanisms were included as one of the parameters in the classification photographs in Appendix D of the QAPP.

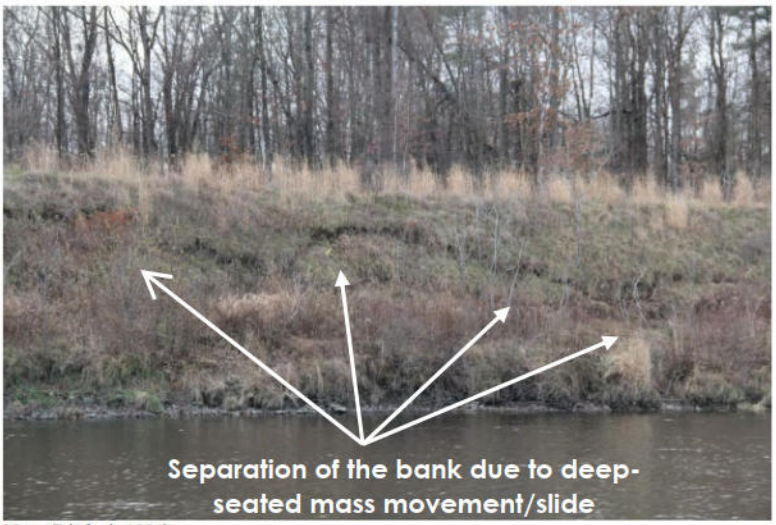



*Figure 2 "Extent of Current Erosion" identified as "none/little (<10%)" in Appendix D of the QAPP. Arrows pointing to surface evidence of separation, and circle illustrates the portion sliding into the river. "rotational slump" per Table 7 (See Figure 1, above).*

The example photographs and their corresponding "classification" focus on erosion and not mass failures of the riverbanks. A prime example of the inconsistency in the example photographs included in Appendix D, is illustrated in Figure , where the "Extent of Current Erosion" is identified as "none/little (<10%)". This figure

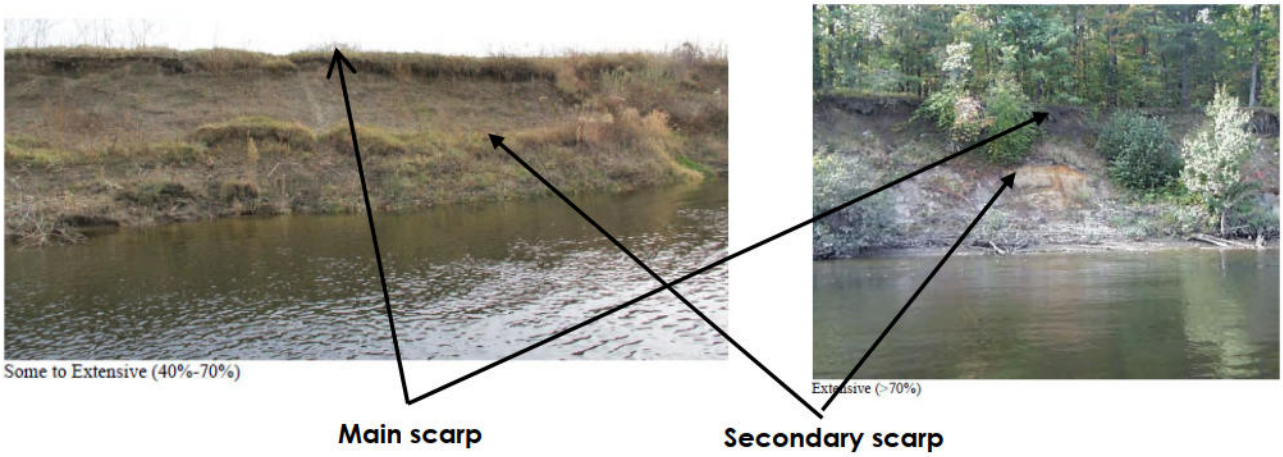



*Figure 3 Two photographs depicting "planar slip" as per Figure 1 above. These two have the same failure mechanism and would both be considered "extensive" by this author. It is unclear as to how the preparer of the QAPP determined which one was more extensive, unless they based it on vegetative cover, which would be a different category.*

clearly shows the initiation of a deep-seated bank failure as shown in the arch shaped separation, highlighted. This bank should have been identified as "extensive."

Another example is illustrated in Figure 3, wherein the failure mechanisms are identical, yet having various levels of severity for the same condition illustrate the additional confusion that will result when the surveys are completed, and MassDEP will be tasked with enforcement of the WQC.

**Updated Requirements of Technology for Use in Monitoring, combined with Modeling**

The subjectivity and outdated survey methods proposed in the 12-year-old FRR and its QAPP must be updated and improved to accurately define the existing conditions of the Connecticut River's banks. Otherwise, MassDEP will not have the data and information to adequately enforce the requirements of the WQC and improve the state's water quality.

Due to the advancement and cost efficiency of LiDAR technologies for use in the monitoring of rivers and bank stability, obtaining riverbank topographic data and vegetative cover, even over an impoundment as long as one behind the Turners Falls Dam, is strongly recommended. Such data to be collected will be an initial baseline flyover via drone or helicopter survey to collect the above and below water surface slope

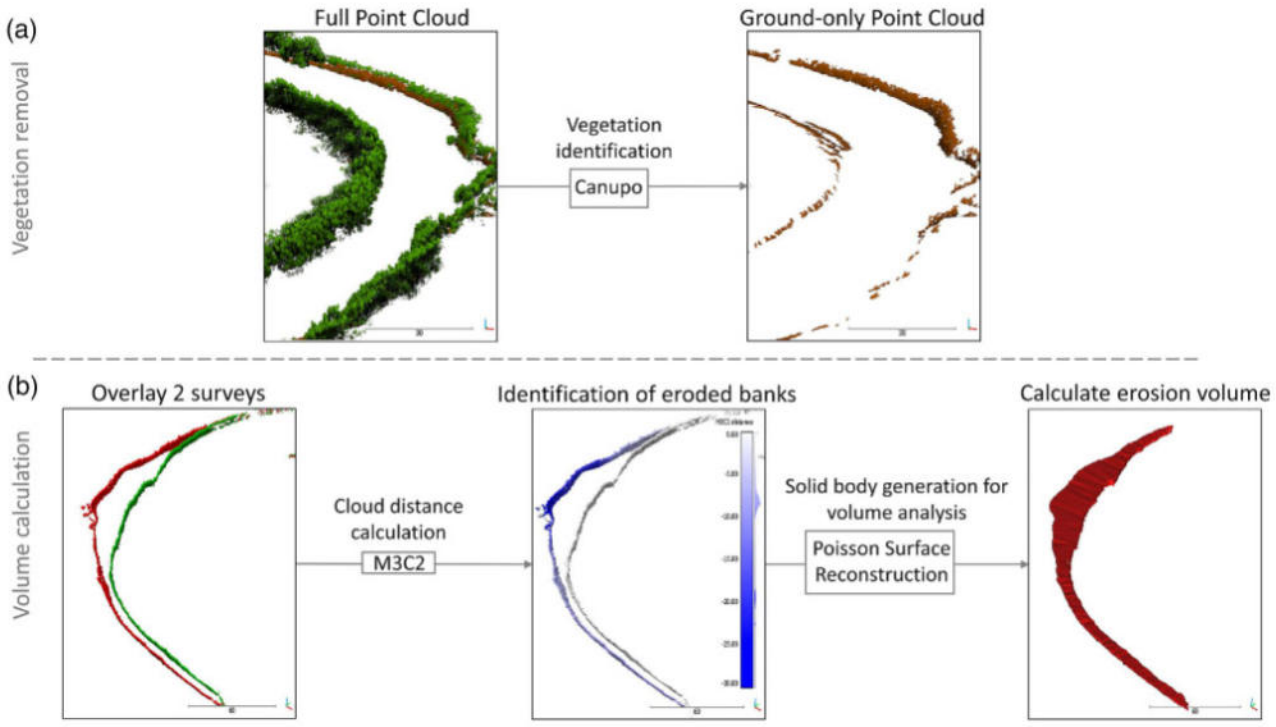



**FIGURE 2** Schematic overview of the data processing workflow. Note that the bank segment shown in figure (a) (vegetation removal) differs from the bank segment shown in figure (b) (volume calculation) because areas with considerable bank erosion are generally near-vertical banks without vegetation cover—thus, different segments are best used to illustrate the two steps. [Color figure can be viewed at wileyonlinelibrary.com]

Figure 4 Illustration of the ability of the use of LiDAR to accurately assess vegetation cover and slope/volume changes of riverbanks.

Haddadchi, A., Bind, J., Hoyle, J., & Hicks, M. (2023). Quantifying the contribution of bank erosion to a suspended sediment budget using boat-mounted lidar and high-frequency suspended sediment monitoring. *Earth Surface Processes and Landforms*, 48(14), 2920–2938. https://doi.org/10.1002/esp.5667

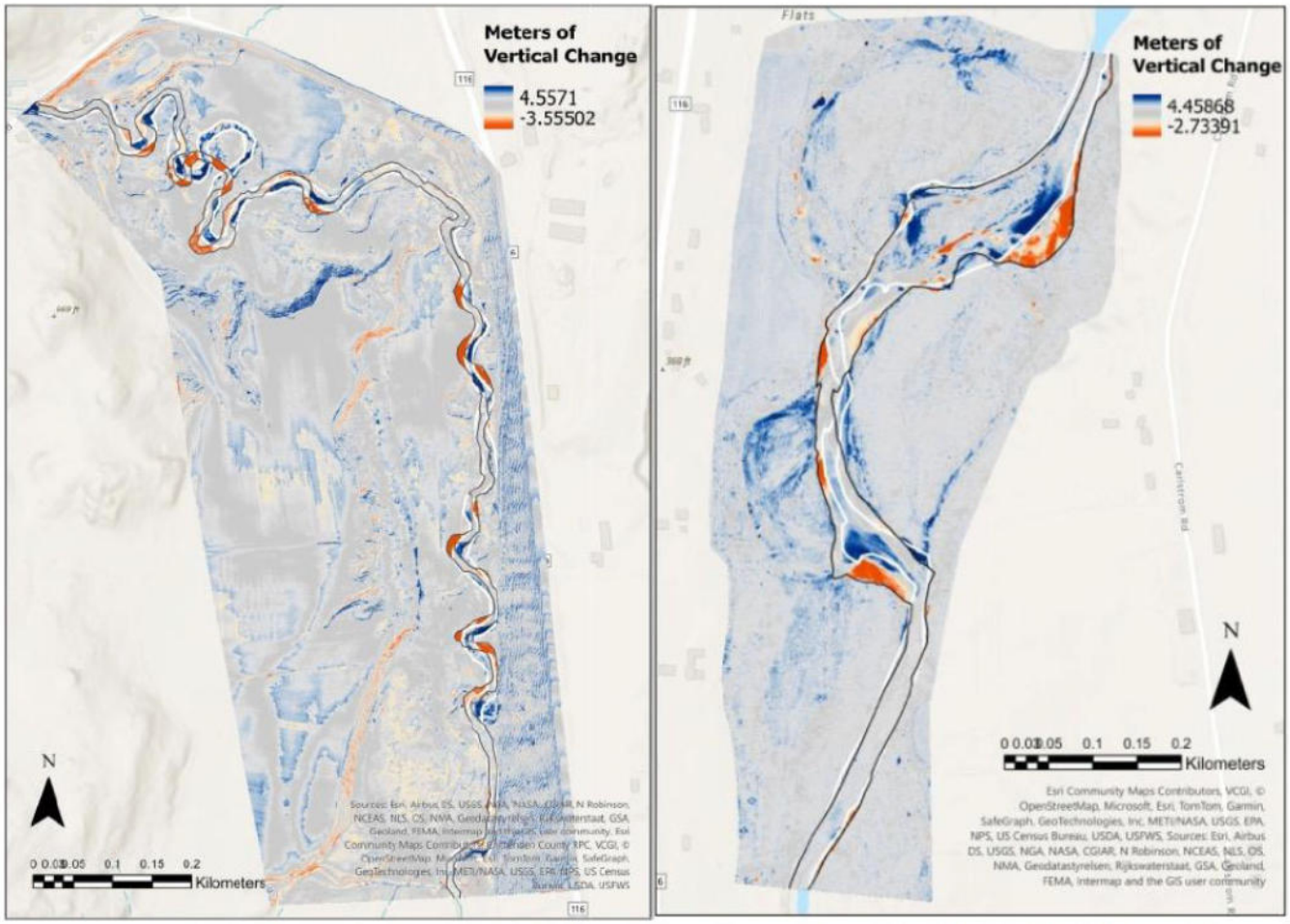



**Fig 3.** The Lewis Creek DoD (left) and New Haven River DoD (right). The black outline represents the 2023 stream channel boundary, and the white outline shows the older channel boundary. Polygons representing the extent of bank erosion were drawn in between the channel boundaries where the new channel was outside the older channel.

Figure 5 Another illustration of the ability of the use of LiDAR to accurately assess vegetation cover and slope/volume changes of riverbanks.
Flanzer, Zoe C., "Examining Variability in Streambank Erosion Rates in the Lake Champlain Basin, Vermont" (2024). *UVM College of Arts and Sciences College Honors Theses*. 129. https://scholarworks.uvm.edu/castheses/129

conditions. Such data can be used to identify existing slope movements and vegetative covers. Such a survey would be completed at the same frequency as the "Boat-Based Inspections" and the "Erosion Monitoring Surveys." It is also strongly recommended that the LiDAR survey be conducted on or about the effective date of the renewed FERC

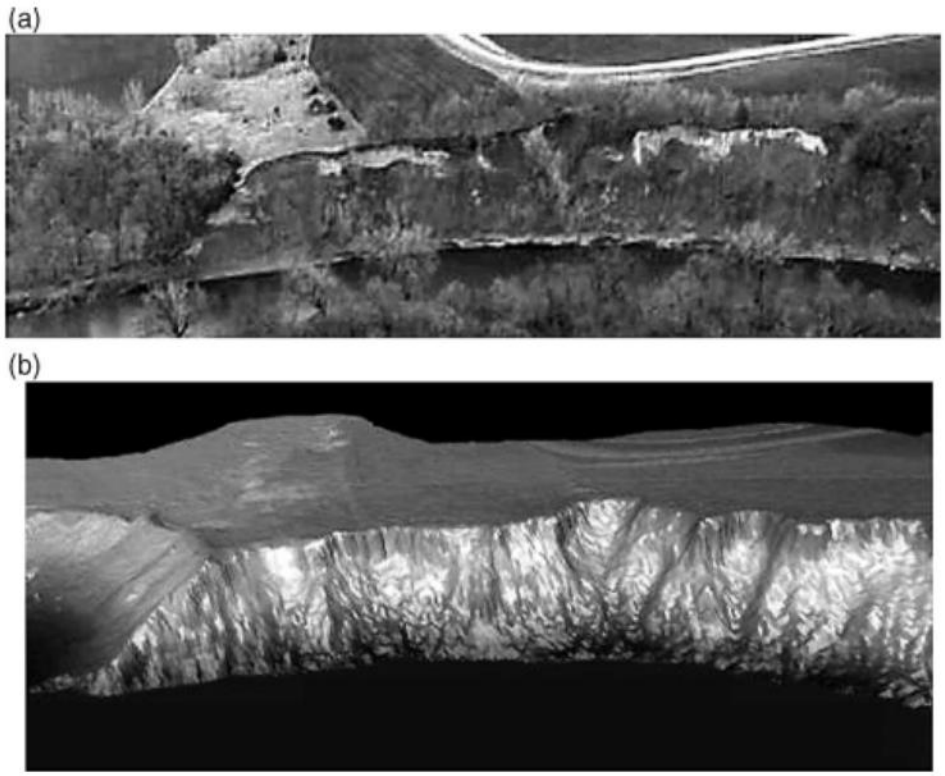



Fig. 2. (a) A severely eroded site along the Blue Earth River photographed at an oblique viewing angle from the air, and (b) rendered as a bare-earth elevation model from the LIDAR data. Vegetation was filtered and points gridded to a 1 m interval in the LIDAR image to create the model. Note gravel road passing through fallow field for scale in both figures.

Figure 6 The use of LiDAR from oblique angles to evaluate the overall stability and areas of failures on riverbanks.

Thoma, D. P., Gupta, S. C., Bauer, M. E., & Kirchoff, C. E. (2005). Airborne laser scanning for riverbank erosion assessment. *Remote Sensing of Environment, 95*(4), 493–501. https://doi.org/10.1016/j.rse.2005.01.012

license to obtain baseline conditions, and after significant flooding events such as flooding caused by tropical storms, nor'easters, or summer catastrophic storms such as have occurred over New England in the last two years. Subsequent years can be precisely overlain over prior years to calculate changes in slope elevations to evaluate if there is displacement or erosion of the riverbanks, as well as understanding the volume of sediment that is discharging into the TFI. Especially following significant flooding, the impacts between regional storm events versus bank instability caused by operations can be distinguished. The accuracy of LiDAR surveys is impressive, and can collect elevation

data, accurate to within 0.06 meters[19], and would be much more reliable than simple, subjective observations (Figure 4, Figure 5, and Figure 6). In fact, the LiDAR technology can obtain topographic data to depths of up to 15 meters, depending on water clarity, which would provide a more complete understanding of erosion and stability occurrences.[20] The ability to obtain topographic data below the water surface would allow for the comparison of surveys over time, regardless of the water depth.

In consulting with remote sensing/survey firms who conduct such services, each survey, including analysis and reporting can be completed for less than $50,000 in 2025 dollars, providing MassDEP and the public with a more comprehensive, quantitative assessment of the stability of the riverbanks and the vegetative cover that adds to river stability. Such a cost would be comparable, if not less costly than ground surveying the limited number of river sections previously completed to determine the overall stability of slopes within the subject impoundment.

In addition to monitoring using remote sensing technology, the causation of loss of vegetation, bank instability, and erosion can be corroborated by using a 2-dimension model such as the US Army Corps of Engineers, Hydraulic Engineering Center, River Analysis System (HEC-RAS).[21] This model, which is free to the public, and a universal modeling software of river hydraulic modelers, would be used to evaluate river flow patterns because of baseflow, natural flooding, and hydropower operational changes

[19] Tamimi, Rami & Toth, Charles. (2024). Accuracy Assessment of UAV LiDAR Compared to Traditional Total Station for Geospatial Data Collection in Land Surveying Contexts. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. XLVIII-2-2024. 421-426. 10.5194/isprs-archives-XLVIII-2-2024-421-2024.
[20] LiDAR survey below the water surface is also referred to as "blue LiDAR", referring to the blue-green wavelengths used to obtain below water surface data.
[21] U.S. Army Corps of Engineers. HEC-RAS River Analysis System, Version 6.6: User's Manual. Davis, CA: Hydrologic Engineering Center (HEC), 2024.

in flow patterns to compare to areas where there is found to be riverbank instability. The comparison of the model to the surveys would allow for a significantly higher level of accuracy and precision in determining whether a riverbank failure is caused by operation of FirstLight's projects or natural processes.

**Comments on Stabilization and Mitigation within the Draft WQC Appendix F, Erosion, Stabilization, and Monitoring Plan**

**Repair & Stabilize Certain 2013 FRR Sites**

The proposed plan indicates that "within 6 years of license issuance, the Licensee shall repair and stabilize all previously stabilized sites in the TFI where the 2013 Full River Reconnaissance (2013 FRR) identified erosion, and the sites have not already been repaired since 2014. These sites include bank segments 14, 371, 65, and 478 that were delineated during the 2013 FRR, equaling approximately 429 linear feet." Although we concur that the repair of existing stabilization sites is important to improving water quality in the impoundment, stabilization projects should be reviewed by an expert panel that includes key stakeholder groups as well as FERC and MassDEP, to minimize the chance of future failures. As indicated by MassDEP "hydropower operations contribute to erosion by raising and lowering the water surface elevation more frequently and significantly than natural fluctuations." It is related to the additional stress associated with operations that may make certain types of streambank stabilization unsuitable for TFI. For example, daily water surface fluctuations can create a stressful environment for vegetation and thus preclude the colonization and successful establishment of stabilizing vegetation. The lack of vegetation at the toe of the bank or the lower bank within the impoundment may be directly associated with stresses associated with daily water surface fluctuations.

The lower bank is typically a flat, beach-like feature that in many ways is like that of a tidal marsh where the absence of vegetation is related to the duration of inundation. As such, reliance on plant material to stabilize or assist in the stabilization of the banks of the impoundment may not, at least in some areas of the impoundment, be a viable option. **A thorough and objective understanding of the causes of erosion at a particular location is essential for the development of future designs that will provide long term stability and improve water quality.**

**Additional New Sites to be Stabilized**

The proposed draft certification indicates that "[i]n addition to the completed stabilization projects noted above, within 6 years of license issuance, the Licensee shall implement stabilization or preventative maintenance projects at three additional sites within the TFI, which equate to an additional 667 linear feet. These sites were identified during the 2013 FRR as having the most erosion of the banks within Massachusetts that had not already been stabilized. These sites include bank segments 90, 87, and 119 that were delineated during the 2013 FRR, equaling approximately 667 linear feet."

We concur that the stabilization contemplated for previously unrestored highly eroded banks is important to the water quality of the impoundment banks. We continue to be concerned that the design will be appropriate for the long-term stability of the banks in the face of the highly modified hydrology of the TFI. As indicated in the previous comment, it is our recommendation that MassDEP and First Light establish a stakeholder group to provide feedback on any stabilization design contemplated for the highly eroded section of the impoundment.

**Future New Stabilization Sites**

The proposed draft certification indicates that [s]ites that are newly identified after issuance of the license as exhibiting 'Some to Extensive' or 'Extensive' erosion based on the definitions contained within the 2013 FRR and which were not previously repaired or stabilized by anyone nor identified above in Table 1, shall be repaired and stabilized by the Licensee within 5 years of their discovery during the Erosion Monitoring Surveys or the Boat-based Site Inspection, subject to the following "limitations."

The limitations of this condition will be discussed later. The identification of newly identified erosion areas exhibiting "some to extensive" or "extensive erosion" based on definitions created in the 2013 Full River Reconnaissance Study and Quality Assurance Project Plan (2013 FRR)[22] limits the types of newly eroded banks to those that have substantially more than a minimal amount of erosion and more realistically define bank failure. Based on the definitions referred to in the 2013 FRR, "Some to Extensive" erosion is assigned to those riverbanks "where the total surface area of the bank segment has approximately 40-70% active erosion present" (see Figure 3) while riverbanks with extensive erosion is assigned to those banks "where the total surface area of the bank segment has approximately more than 70% active erosion present" (See Figure 3) . This would seem to indicate that the newly identified areas erosion subject to this component of the plan would, at a minimum, fall into the 40-70% active erosion class to qualify as new and require stabilization within 5 years of their discovery. Both the "some to

[22] 2013 FirstLight Full River Reconnaissance Study and Quality Assurance Project Plan. August 14, 2013. Prepared by: Simons & Associates and New England Environmental. Prepared for: FirstLight Power Resources Services, LLC c/o FirstLight Hydro Generating Company 99 Millers Falls Road Northfield, MA 01360. https://www.northfield-relicensing.com/content/Documents/RSP%20Volume%202%20-%20Appendix%20D.pdf

extensive" and "extensive" erosion categories shown as examples in the FRR represent areas of substantial bank instability. lin order to improve the water quality of the impoundment areas of significant bank failure and erosion should not have to wait up to five years to be stabilized and warrant prioritization for stabilization.

The Draft WQC indicates one of the limitations related to the stabilization of new erosion areas is related to the amount of stabilization required and the time in which it is to be done. The draft certification states that "[t]he Licensee shall be responsible for repairing 5% of the total new bank segments identified in the intervals between each of the Erosion Monitoring Surveys (Years 2, 10, 20, and 30), regardless of whether they were identified during the above Boat-based Inspections or the Erosion Monitoring Surveys. New bank segments revealing 'Some to Extensive' or 'Extensive' erosion includes any segment not previously stabilized or in Table 1. Following each Erosion Monitoring Survey, the Licensee shall quantify the total linear feet of new bank segments that were identified either during the Erosion Monitoring Survey or during preceding Boat-based Site Inspections as exhibiting 'Some to Extensive' or 'Extensive' erosion. First, the requirements for stabilizing new erosion sites are limited to requiring the stabilization of only 5% of newly eroded riverbank. So, does this mean if a 100-foot section of extensive erosion is identified FirstLight is only responsible for stabilizing 5 feet of riverbank? If the section of riverbank identified as having extensive erosion is 1,000 feet long is the stabilization limited to 50 feet? If these examples, based on how this percentage of eroded riverbank to be stabilized is to be interpreted, then it must be understood that the remaining 95% of these eroded segments of riverbank would lack stabilization and continue to be a source of pollutants to the impoundment. With this approach it seems doubtful that improved water quality in the impoundment is attainable.

Although the Draft WQC includes a caveat the allows MassDEP to determine whether the linear foot equivalent of 5% will not provide a significantly improved stream bank condition, they may reserve the equivalent linear feet for use in the future. This approach would thus be more significant in those cases where longer sections of severe bank erosion are to remain unstabilized and serve as a continued source of sediment into the impoundment. This does not seem like an appropriate solution to improving the water quality of the impoundment.

**Need for Connecticut River Stakeholder Panel**

It is important that, especially as this next FERC license will be in effect for the next 50 years, periodic reviews of the latest technological advances for monitoring riverbank stability, and reviews of the effectiveness of the stabilization and mitigation measures be conducted. It is strongly recommended that a panel of stakeholders be established that would include MassDEP, FirstLight, Franklin Regional Council of Governments, CRC, Connecticut River Streambank Erosion Committee, the affected towns, their respective experts, and other parties that may be warranted. The panel would meet to coincide with monitoring events to review the current conditions of the impoundment water quality, bank stability, and erosion, and have discussions on the implementation of "state of the art" technology to ensure that the monitoring program is following.

**Conclusion**

As previously stated, we commend MassDEP for its understanding of the issues associated with operations and erosion in the TFI. MassDEP's inclusion of project operations as a contributing element to erosion in the TFI is important. However, compliance with the SWQS should not be based on an outdated erosion and sediment

control plan, the 2013 Full River Reconnaissance (FRR) and its Quality Assurance Project Plan. This plan is qualitative in nature and avoids the identification of issues related to operations such as the absence of vegetation and bank instability that contribute to water quality impairment. The need to implement a viable plan to address erosion and bank instability in the TFI is related to MassDEP's stewardship of the water quality within the impoundment. MassDEP's position that "project operations will continue to contribute to erosion in the TFI" is important to any plan designed to improve the water quality of this currently impaired waterbody in the future. Although MassDEP acknowledges that it is difficult to definitively quantify the causes of erosion in the TFI the Draft WQC also concludes that it is nonetheless "necessary to establish erosion-related measures in the WQC to address the existing impairments and to ensure compliance with the SWQS." The draft certificate states "SWQS require that the existing and designated uses and the necessary water quality be maintained and protected and that they be free from solids, color, and turbidity that would be aesthetically objectionable, impair any use, or impair the benthic biota or degrade the chemical composition of the bottom." However, the key to improving water quality in the impoundment in the future is related to the design and implementation of a new plan that addresses all the riverbank issues related to bank instability, lack of riparian vegetation and erosion.

The following changes and improvements must be made to ensure that the causes of riverbank instability and impacts to the water quality of the Connecticut River are understood, or the application for the MA Water Quality Certificate must be denied.

1. Develop an updated Erosion Control Monitoring Plan and QAPP that has, at a minimum, the following components:
    a. the use of modern equipment, high accuracy survey techniques, such as LiDAR (upland survey and bathymetry[23]) to replace the subjective river observation techniques in the 2013 QAPP.
    b. a process for MassDEP to require updated survey equipment and methods as technology and riverine processes are advanced over the next 50 years.
    c. methods and clearer references to document observed erosion features and bank stability features.
    d. require full impoundment surveys using LiDAR obtained via UAV or helicopter surveys, with follow up localized land-based observations and surveys to further analyze areas suspected of becoming destabilized. This survey would be used to provide accurate, or at least, precise physical measurements to supplement the boat-based photo surveys, which as we described above, are subjective and inconsistent in their categorization in the existing form of the 2013 FRR QAPP. While not discussed above, in the alternative, there is boat-based LiDAR technology that could be used to

[23] Bathymetry is defined as the measurement of underwater topographic surfaces.

survey the riverbanks, which would provide additional detail of areas where the toe of the slope has been undercut/undermined.

e. in addition to the already established history of the cross sections monitoring, there must be an ability to add cross sections when new areas of bank failure appear imminent or in process..

f. require consistent survey frequency of 3 years for the life of the FERC License, and add surveys following major flooding events, such as after hurricanes, tropical storms, nor'easters, and local storms that cause severe flooding in the TFI.

g. to corroborate the causes of erosion, use a HEC-RAS 2-D model that is calibrated to natural and operational flow impacts to areas identified as becoming destabilized during the surveys.

2. Ensure that the definition of "new erosion" in the Erosion Control Monitoring Plan is clear and expand the insignificant requirement of only requiring the stabilization of 5% of "newly eroded areas". Additionally, the surveys would be more appropriately conducted by a third-party survey/consulting firm, with expertise in fluvial geomorphology, hydraulics, and geotechnical engineering, be selected by a stakeholder panel (see recommendation 3, below) to ensure that a balanced collection of data is obtained to evaluate the causes of erosion and riverbank failure.

3. Create a stakeholder panel of experts, including MassDEP, FirstLight, Franklin Regional Council of Governments, CRC, Connecticut River Streambank Erosion Committee, the affected towns, their respective experts, and other parties, to review the results of surveys, recommend improvements to survey and modeling

methods, evaluate mitigation measures, and review how operations are affecting the goals of the MassDEP Water Quality Standards.

Thank you for the opportunity to comment on behalf of the Connecticut River Conservancy.

Sincerely,

Geoffrey M. Goll, P.E.
President
Princeton Hydro, LLC

Mark Gallagher
Vice President
Princeton Hydro, LLC

cc : FRCOG

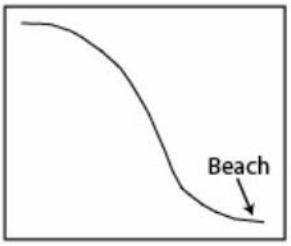
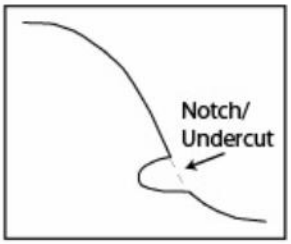
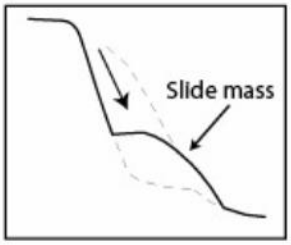
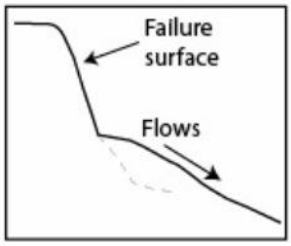
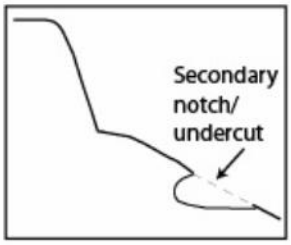
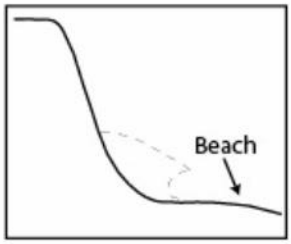
| Stage | Profile | Photo | Description |
|---|---|---|---|
| a) Stable bank |  |  | - Rounded slope, concave up at base<br>- Beach face protects slope from attack by currents |
| b) Notching or undercutting |  |  | - Bank toe oversteepened by notching or undercutting<br>- Upper slope remains stable |
| c) Slide or topple |  |  | - Upper slope eventually destabilized by oversteppening at toe<br>- Slide or topple mass remains intact with narrow bench at top |
| d) Flows |  |  | - Slide or topple mass becomes disaggregated at base and material flows to toe of slope |
| e) Secondary notching or undercutting |  |  | - Currents notch or undercut flow material to cause further collapse and flow of material |
| e) Bare bank |  |  | - Steep bare bank develops if flow material completely removed from base of bank<br>- Beach development can protect the toe of slope from further current attack<br>- If beach does not develop or persist, then erosion sequence can begin afresh |

Figure 30: Model illustrating idealized sequence of erosion. Different stages of erosion can be occurring adjacent to each other along a long continuously eroding bank.