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Action for our region's environment.

Kinneytown Dam Removal

Project Summary and Preliminary Sediment Assessment Report

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Introduction

The Naugatuck Valley Council of Governments (NVCOG) in partnership with Save the Sound (STS) is pursuing the de-commissioning and removal of the Kinneytown Dam on the Naugatuck River in Ansonia, with funding from NOAA's Restoring Fish Passage Through Barrier Removal Grant received in April 2023 by NVCOG in partnership with STS. This project aims to fully remove the Dam, which is considered to be the highest priority barrier to fish passage in the region. The Kinneytown Dam is the first coastal barrier and only remaining barrier to fish migration from the Long Island Sound 16 river-miles (rm) south, to Thomaston, CT, nearly 30 miles upstream of Kinneytown.

The Kinneytown Dam Facility is regulated by the Federal Energy Regulatory Commission (FERC) and includes two dams (Kinneytown Dam and Canal Reservoir Dam) and associated structures (collectively known as the "Kinneytown Hydropower Project"). The Kinneytown Dam is located on the main stem of the Naugatuck River in Seymour, with an associated intake structure and power generating unit (Unit 1), and a Denil fish ladder. A gatehouse on the east bank leads to a canal that delivers water through an impoundment (Coe Pond, aka Canal Reservoir) to a second structure and generating unit (Unit 2) approximately one mile south in Ansonia, at a second off-line dam (aka "Canal Reservoir Dam").

This document is intended to serve as a brief summation of project history and preliminary sediment assessment completed to-date that is accompanied by a compilation of downloadable digital data and information (Appendix 1: Kinneytown Project Conceptual Design Slides (single PDF), Appendix 2: Transformational Habitat Zones, Appendix 3: Sediment Assessment Data (a zip file of four PDFs and three MS Excel spreadsheets) that is relevant to the next steps forward, which include: stakeholder engagement, property acquisition, data collection, engineering design, regulatory review, FERC decommissioning, construction, site restoration, and implementation monitoring. In addition, multiple files are available for download at the NVCOG website (nvcogct.gov/noaa) including:

- NOAA grant application
- Plan to Restore Diadromous Fishes to the Naugatuck River Watershed (CTDEEP 2022)
- Site Photos
- Videos of Migratory Fish at the Base of Kinneytown Dam
- Archaeological Assessment of Dams within the Naugatuck River Basin (1999)
- NVCOG Natural Hazard Mitigation Plan (2021)
- Pathway to Revitalization: Economic Impacts of Phased Completion of the Naugatuck River Greenway (NVCOG 2017)
- Hydrology and Hydraulic HEC-RAS Model (from Kinneytown Dam to Thomaston Dam)
- Dam Safety Data
- Sediment Data from Seven (7) Upstream Dams
- Review of Fish Passage Data
- Historic Engineering Plans
- eDNA Sampling Results
- Kinneytown Powerhouse and Gate House Details
- Kinneytown Dam Phase 1 Environmental Site Assessment
- Coe Pond Dam Inspection Report
- Additional files added, when available.

Project Background and Context

Migratory fish once had free access to the length of the entire Naugatuck River and its tributaries. The Naugatuck is itself a large tributary, the largest watershed contained entirely within Connecticut. Blueback herring, alewife, and American shad are Managed Species of Concern at both the state and federal level that are effectively blocked by the Kinneytown Dam. See "Review of Fish Passage Data" and "Exploring Fish Passage Efficacy Through eDNA Sampling" at nvcogct.gov/noaa. These fish serve an important ecological role by transporting nutrients upstream to increase ecosystem productivity and are important as prey for commercial fish species in Long Island Sound and the Atlantic Ocean. Dam removal has been identified by CT DEEP as the preferred method of fish passage at Kinneytown in the Plan to Restore Diadromous Fishes to the Naugatuck River Watershed (2022) (available for download at the NVCOG website: nvcogct.gov/noaa). Restoring fish passage at Kinneytown Dam will allow diadromous fish to enter through the mouth of the Housatonic River and move freely inland up to the mainstem of the Naugatuck River to adult spawning and juvenile rearing habitat. Full access above the dam is estimated includes 30.7 rm for American Shad, 37.6 rm for Alewife, 30.7 rm for Blueback Herring, 73.0 rm for Sea Lamprey, and 73.9 rm for American Eel. Analyses based on other river systems suggest that the habitat within this targeted area can support substantial populations of American Shad (21,479), river herring (141,245), and Sea Lamprey (6,836). This project will begin the process of rebuilding historic fish populations to protective and sustainable levels in the Naugatuck River, benefiting river ecology, bolstering the marine commercial fisheries, and attracting sport anglers to the region. A direct measurable impact of this project will be the attraction of anglers pursuing shad, increasing the local tourism economy.

In addition to restoring effective fish passage to the Naugatuck River, the removal will enhance approximately 1,402 acres of estuarine/coastal and other critical habitat downstream through sediment augmentation (see Appendix 2: Transformational Habitat Zones), and strengthen ecosystem resilience by converting 74.3 acres of a warm, shallow, minimally buffered impoundment into a swift, free flowing, self-sustaining river with a vegetated floodplain. Removal of the dam will also reduce flood risk to communities up and downstream and restore natural sediment flows that will help attenuate downstream coastal flooding and enhance riverine and coastal wetlands, estuaries, and beaches. Downstream habitats that will benefit from sediment augmentation include approximately 3.5 acres of in-channel wetland bars within the reach from the Kinneytown Dam to the Naugatuck River's confluence with the Housatonic River, 341 acres of riverine and coastal wetlands on the Housatonic River, 867 acres of coastal estuary, and 191 acres of beach and delta habitat at the mouth of the Housatonic River. Enhancement and transformation of these valuable wetland and coastal habitats will improve water quality and enhance coastal resilience.

The Naugatuck River is the largest tributary to the Housatonic River and the largest internal watershed in Connecticut, encompassing 311mi^2 (Regional Basin 6900 HUC12). Kinneytown Dam is just four miles upstream from the confluence with the Housatonic. There are no barriers to fish passage below Kinneytown Dam, and target species find themselves below the dam with no effective means to pass. A Denil fish ladder at the facility has a long record of ineffectiveness. Despite the Connecticut Department of Energy and Environmental Protection (CT DEEP) alewife stocking efforts, and hundreds of millions in public investment removing obstacles upstream and improving water quality and habitat, an average of

only a dozen target fish, including both American shad and river herring, have ascended the Kinneytown Dam ladder annually for two decades. Fish passage has virtually ceased since hydroelectric generation ended in 2020. The habitat quality upstream would be supportive of increased diadromous production if large numbers of fish could reach it. Tingue Falls is the next barrier upstream, 1.86 miles north of Kinneytown, and has a nature-like fishway bypass that was reengineered in the spring of 2022 to achieve modern fish passage standards. The small Plume & Atwood Dam in Thomaston is the next barrier to migration 29.2 miles upstream from Kinneytown Dam. The next and final large barrier to reopening the entire river is a USACE Flood Control Project, Thomaston Dam, located 30.7 miles upstream. The larger watershed strategy to build community and ecological resilience depends on the benefits that would be achieved by this project, including restoration of sea-run fish and safe public access, engagement of underserved communities in restoring a river devastated by its industrial past to a resilient and sustainable future, lifting property values, connecting the public to the Naugatuck River with a greenway, and providing high quality angling and subsistence fishing for residents and visitors.

The dam owner at the time of grant submission, Hydroland, Inc., provided written support of this removal, and established an agreement in principle to transfer ownership ("asset purchase agreement") of the Kinneytown Hydroelectric Project to the CT Brownfield Land Bank (CTBLB), a nonprofit brownfield redevelopment corporation affiliated with NVCOG. In the recent years, ownership of the Kinneytown Hydroelectric Project and the operator Kinneytown Hydro Company Inc., has transferred through multiple power generation companies: (i) Enel North America, Inc., (ii) Hydroland, Inc., (iii) Natel Energy, Inc., and is currently held by, (iv) Trimaran Energy LLC. The latest ownership transfer has not been fully recorded in FERC records.

Removing barriers on river systems improves both habitat quality and quantity and aligns with multiple fishery management and recovery planning efforts. "Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" are considered as NMFS Essential Fish Habitat (EFH) as defined in the Magnuson Stevenson Act. Furthermore, the Atlantic States Marine Fisheries Commission has initiated the first regional Ecosystem-Based Fishery Management Plan (EBFM) with Ecological Reference Points (ERPs). The New England Fisheries Management Council is also considering EBFM and some options include Atlantic herring ERPs. River herring are known to school with Atlantic herring, so river herring bycatch is a concern in the Atlantic herring fishery. In addition, the Long Island Sound Study Comprehensive Conservation and Management Plan lists opened river miles as a congressionally reported metric.

When fish pass into habitats where they have been extirpated, ecological and community resilience are enhanced. Mussels that rely on fish for dispersal will expand their range and provide ecosystem services such as filtration and food web diversity. Sea lampreys will modify gravel, improving salmonid spawning. Animals such as eagles and ospreys that have returned to the Naugatuck will increase their populations based on the new food sources. All these population expansions also will increase genetic diversity within each species, inherently increasing their resiliency to a changing environment. Fewer impoundments will make the Naugatuck a cooler system and likely provide increased access to springfed coldwater refuges for newly returning populations, thereby decreasing seasonal mortality rates. The ability of anadromous fish to transport marine-derived nutrients inland increases and diversifies primary productivity and insect populations that can benefit all species of fish in the system.

In saltwater, increased migration of juvenile and adult river herring diversifies prey species and seasonal availability. This provides a wider food opportunity for predator species such as cod, tuna, striped bass, eagles, seals, and seabirds. The target species spend considerable time in the estuarine environment from head of tide below the Kinneytown Dam to the mouth of the Housatonic. The river mouth is bordered by an Audubon oyster reef and dune restoration project on one side, and on the other, the Charles E. Wheeler State Management Area, a large salt marsh complex dominated by spartina and cordgrass, and Milford Point Unit of the Stewart B. McKinney National Wildlife Refuge containing intertidal mudflats, coastal barrier beach, sandflats, and marshes. See Appendix 2: Transformational Habitat Zones for annotated figures. It is an important foraging area for roseate terns, nesting habitat for piping plover and a nursery for diamondback terrapin.

Removing Kinneytown Dam with partial passive sediment transport will contribute sediment for natural wetland, estuary, delta, and beach nourishment, critical to maintaining coastal habitat and sustaining our coastal defenses. Building additional coastal land mass through the restoration of natural sediment transport processes will therefore strengthen resilience to climate change within the target habitat and surrounding ecosystem. This is supported by the recent findings of the NOAA-funded Dams and Sediment in the Hudson Project that looked at the Hudson, and to some degree the Connecticut River watershed, on both sides of the Housatonic watershed, and discussed the potential for dam removal-derived sediment to help offset sea level rise in tidal wetlands and increase coastal resilience.

Initial Project Developments

Early action to fully restore fish passage at Kinneytown came from the U.S. Fish and Wildlife Service that initiated an investigation by Federal Energy Regulatory Commission (FERC) into the dam's license compliance. The Naugatuck Valley Council of Governments (NVCOG), Save the Sound (STS), and Naugatuck River Revival Group have formed the Naugatuck River Restoration Coalition (NRRC) to lead the effort of pressuring the dam owner and FERC to fully comply with their obligations to safe, timely, and effective fish passage. Since then, municipalities, river users, environmental organizations, and other stakeholders have expressed their broad support for this effort.

The most comprehensive record of these recent efforts can be viewed at (NVCOG) website title "HydroLand Kinneytown Dam Fish Passage" (https://nvcogct.gov/project/current-projects/kinneytown-dam-fish-passage/) and the Interactive Story Map. The website includes NVCOG and Coalition Comment Letters filed as part of the FERC Docket, Legal Action documents, and opinion pieces. The Story Map includes a detailed Timeline of the FERC Docket from January 2021 to the present with approximately 60 official documents (e.g. letters, legal complaints, comments, responses, declarations, status reports, and memoranda) of correspondence primarily among USFWS, FERC, the dam owner, CTDEEP, NRRG, NVCOG, as well as Housatonic Valley Association and Department of Interior. The Story Map also includes a record of published press, stakeholder comments, and videos.

Site Description and Condition

The Kinneytown Dam Facility is accessed from the gated entrance adjacent to the Seymour Public Works yard at 721 Derby Avenue, Seymour, CT at the on-ramp to Route 8 (North). Floods have twice wiped out the Kinneytown Dam, once in 1910 and again in 1955, and the dam was twice rebuilt. The plans dated

1910 indicate a former timber crib structure immediately upstream of the existing concrete spillway and a former embankment on the east bank. As-built plans are dated 1957, and repair plans are dated 1980 and 1984. Download "Historic Engineering Plans" at nvcogct.gov/noaa. The existing facility includes the primary spillway that stands approximately 25 feet high and spans approximately 400 feet across the mainstem of the Naugatuck River. At low flows, cracking, spalling, and exposed rebar is visible on the spillway face. The Facility includes a gate structure and approximately 150 feet downstream a powerhouse for the hydro turbines (Unit 1). See "Kinneytown Powerhouse and Gate House Details" at nvcogct.gov/noaa. The buildings are also in poor condition and are no longer maintained. See "Kinneytown Dam Phase I Environmental Site Assessment" at nvcogct.gov/noaa; the Phase I assessment recommended further sediment investigation for potential contaminants and building inspections for hazardous materials prior to demolition. The Denil fishway extends approximately 410 feet from the powerhouse outflow to the gate house; several wooden baffles were either missing or damaged at a recent site visit in March 2023. The impoundment extends approximately 7,000 feet upstream (north) and is bound by Route 8 on the west and the Metro-North Railroad to the east. Two sewer lines cross the impoundment, flowing as gravity-fed siphons from east to west, approximately 600 ft and 2,500 ft upstream of the spillway (download "Historic Engineering Plans" at nvcogct.gov/noaa). Impounded flow is directed under a railroad bridge adjacent to the east end of the spillway and runs through a gatehouse and canal that extends 3,500 south to Coe Pond and then discharges to a second powerhouse (Unit 2) in Ansonia, which discharges over a spillway to the mainstem of the Naugatuck River 6,500 feet downstream of the primary spillway. Unit 2 in Ansonia allegedly ceased hydropower generation in 2013; Unit 1 ceased hydropower generation around 2020. A recent engineering assessment has confirmed that the earthen embankment that contains Coe Pond has not been maintained or inspected, is in poor condition, and could wash out the active Metro-North commuter railroad upon breaching. The report recommends lowering impounded water levels as soon as conditions allow. See Coe Pond Dam Inspection Report at nvcogct.gov/noaa for details.

Sediment Probing, Sampling, and Analysis

Save the Sound completed initial sediment probing and screening-level sediment sampling and laboratory analysis to identify sediment management concerns and to inform dam removal feasibility.

Sediment probing was conducted from wading or a 10-foot aluminum jon boat using a 16-foot graduated aluminum range rods in 52 locations (see File #1 in Appendix 3 for a location map). Sediment probes were distributed across the impoundment as either approximate centerline of the impoundment (14 probes), at 3 channel-spanning cross-sections, or at other selected features. Depths of water, sediment, and refusal were recorded with probe locations collected by a GPS, along with observations of sediment characteristics at the surface and encountered at manual refusal. However, manual probing was conducted with tools shorter than the height of the dam and did not encounter refusal in several locations. Some locations were not conducive to manual probing, due to mucky sediments or excessive water depth. Sediment depths ranged from 3 to greater than 16 feet but were typically 8 feet. Depth measurements were later transformed to elevations (NAVD88 feet) of top and bottom of sediment based on the elevation of water surface relative to the known elevation of the spillway. Sediment probing depths measured from the longitudinal profile and three representative cross-sections were extrapolated to estimate the total volume of impounded sediment between 750,000 and 1,000,000 cubic yards (CY) (see File #2 in Appendix 3 for spreadsheet of calculations and File #3 for an annotated

FEMA profile, cross-sections, additional calculations, and field notes). Estimations of sediment likely to be mobilized by full dam removal and passive sediment release range from 500,000 to 750,00 CY, as sediment on the periphery of the impoundment would be expected to remain on the recreated floodplain. Additional sediment investigation is necessary to refine these volume estimates of total and potentially mobilized sediment.

Past dam removal projects upstream revealed a densely-packed layer of coarse gravel, cobbles, and debris (e.g. wood, concrete, brick) from destroyed structures that was presumed to be deposited during the 1955 flood. At many probe locations in the Kinneytown impoundment, a coarse layer was encountered many feet above what was identified as firm "refusal." However, additional analysis will help to determine whether a deposited debris layer (from the 1955 flood, or others) obscured the actual refusal layer during this preliminary manual probing.

Sediment samples for laboratory analysis were sampled from two sediment cores that were extracted with a Vibracore device that was 6 feet in length. Two cores of approximately 4 feet in length were extracted approximately 4,400 feet upstream of the dam (See Appendix 3, File #4 for map of Vibracore locations). Cores were cut vertically and samples were extracted with sterilized utensils, placed in sterilized, laboratory-provided glassware, stored in cooler on ice, and transferred to the laboratory along with completed chain-of-custody forms. Three samples were extracted from the Location 1 core (top, mid, bottom) and two samples were extracted from the Location 2 core (top and bottom).

Samples were analyzed for the suite of CT RCP contaminants typically required by CTDEEP for sediment management planning, including:

- Metals (15): Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn
- Polynuclear Aromatic Hydrocarbons (PAHs)
- Organochlorine Pesticides
- Chlorinated Herbicides
- Polychlorinated Biphenyls (PCBs)
- Semivolatile Organics
- Volatile Organics

These results have been compared against:

- CT Residential Direct Exposure Criteria for Soil (R-DEC) (2021)
- Probable Effect Concentrations (PEC) for freshwater sediment (compiled by NOAA 2008 SQuiRTs)
- Threshold Effect Concentrations (TEC) for freshwater sediment (compiled by NOAA 2008 SQuiRTs)
- USEPA Region 3 BTAG Freshwater Sediment Screening Benchmarks (2006)

These freshwater sediment quality guidelines are compiled by the National Oceanic and Atmospheric Administration in the Screening Quick Reference Tables (SQuiRTs). Consensus-based sediment quality guidelines have been developed to synthesize previously published toxicity studies and have been shown to be both accurate predictors of sediment toxicity and negative predictors for toxicity to benthic

invertebrates by direct contact.[1] These guidelines have been established in two-tiers: Threshold Effect Concentration (TEC) and Probable Effect Concentration (PEC). TEC is the concentration below which harmful effects are unlikely to be observed; PEC is the concentration above which harmful effects are likely to be observed. These guidelines do not consider the potential for bioaccumulation and are not intended to serve as site-specific clean-up levels. Instead, they are applied to facilitate the decision-making process regarding sediment management; an absence of exceedances generally serves as a defensible basis for no further investigation. Based on over 40 small dam removals in the northeastern US, concentrations equivalent with TEC concentrations have been found commonly in in-stream sediments outside of impoundments and thus have come to represent background concentrations in many river systems. CTDEEP Residential Direct Exposure Criteria for Soil (ResDEC) is based on daily contact for 30 years, and thus serves as a conservative threshold for assessing human health risk at this site and in downstream reaches. The USEPA Region 3 Freshwater Sediment Screening Benchmarks, which expand upon the TEC list, were developed by the Biological Technical Assistance Group (BTAG) are used for screening level ecological risk assessments and include compounds for which benchmark values have been established or that are considered bioaccumulative.

Laboratory results from the five samples of sediment impounded by Kinneytown Dam (see Appendix 3; Files #6 and #7 for MS Excel spreadsheets of results, and File #8 for the laboratory report) indicate that reporting limits were sufficiently low to allow for comparison relative to the above-listed criteria. Many of the analytes were not detected: chlorinated herbicides, most organochlorine pesticides, most PCBs, most SVOCs, and most VOCs.

Most compounds did not exceed the Residential Direct Exposure Criteria (ResDEC) except for:

- Dieldrin
- Benz(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(ghi)perylene
- bis(2-Chloroethyl)ether
- Hexachlorobenzene
- Pentachlorophenol
- 1,2-Dibromoethane

Relative to ecological criteria, observations of these results include:

- Concentrations of most PAHs exceeded NOAA-FTEC and USEPA Region 3 SQGs across all samples.
- PAH concentrations were most elevated in the bottom section of Location 1 and the top of Location 2.
- Acenaphthylene and Indeno(1,2,3-cd)Pyrene concentrations were notably elevated across all

[1] MacDonald, DD, Ingersoll, CG, and Berger, TA. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology. 39:20-31.

samples, averaging over 30x the USEPA Region 3 SQGs.
- Pyrene concentrations exceeded the NOAA-FPEC in 3 out of 5 samples.
- Pesticides Chlordane and Toxaphene were not detected in any sample; however, reporting limit concentrations were elevated, with the latter being significantly higher than the ecological screening criteria (but both well below the ResDEC).
- Dieldrin was not detected in all samples; however, concentrations exceeded ResDEC & FPEC in the bottom section of Location 1.
- Several Aroclor concentrations as well as Total PCBs exceeded NOAA-FTEC and USEPA Region 3 SQGs, and were notably higher in the bottom section of sediment at Location 1.
- Metal concentrations were not particularly elevated relative to NOAA-FTEC and USEPA Region 3 SQGs except for Chromium and Copper in the bottom section of sediment at Location 1.

These results from this preliminary sampling effort are generally consistent with results from sediment sampling and analysis at other dam removals in Connecticut and across the northeastern US. (See also "Sediment Data from 7 Upstream Dams" at nvcogct.gov/noaa.) These results do not rule out the possibility of on-site sediment management or passive release. Additional sampling and analysis, and potential ecological risk assessment, is warranted (i) to achieve a number of samples that is more representative of the total impounded quantity, (ii) to address human health concerns with on-site sediment management options, and (iii) to address potential ecological concerns associated with downstream receptors, including for example, aquaculture at the mouth of the Housatonic River.

STS has discussed this project and these laboratory results with ecoSPEARS, a private firm that specializes in emerging sediment remediation technology. This firm is refining three pollutant remediation technologies that may be of use in this project:

- ecoSPEARS: in-situ contaminant extraction;
- ecoAINA: ex-situ contaminant extraction; and,
- ecoCUBE: ex-situ contaminant destruction.

Potential applications at the Kinneytown Dam include in-situ pollutant extraction prior to dam removal, or in-situ pollutant removal at an on-site sediment placement location. Additional analysis by ecoSPEARS is necessary to determine if the technology is effective for the types and concentrations of contaminants that may be of concern for this project.

A subsequent sampling and analysis effort by the USDOT Volpe Center has been initiated by the USEPA in partnership with the Connecticut Brownfield Land Bank. The Volpe Group has received the sediment sampling and analysis data described above and coordinated with CTDEEP to continue a sediment sampling and analysis regime that will address CTDEEP requirements.

Initial Design Concept

STS developed conceptual design plans (for the removal for both the Kinneytown Dam and the Canal Reservoir Dam) as part of the grant application for NOAA's Restoring Fish Passage Through Barrier Removal Grant (See Appendix 1: Kinneytown Project Conceptual Design Slides). The conceptual design was informed by general awareness of (i) sediment quantity, quality, and physical characteristic data from the dams that were previously removed upstream, (ii) engineering reports, hydrologic and

hydraulic models of the entire Naugatuck River, and (iii) archeological and historic analysis of the Naugatuck River dams. Additional data collection, site assessment, and analysis is necessary to develop an engineering design from this initial concept.

Additional existing data includes 1-foot contour mapping from 2016, video records of the fish reaching the base of the dam, eDNA data collected downstream of the dam to identify the species of fish present, and as-built engineering plans of the two sewer siphons that will need to be relocated during dam removal.

Construction may involve a first year of sediment management followed by a second year of major construction activities. Major elements of the proposed design include:

- Demolish and remove the Kinneytown Dam spillway;
- Demolish and remove remnant timber crib dam upstream;
- Remove or bury the underground penstocks;
- Demolish and remove the intake structure and Denil fishway;
- Demolish and remove Unit 1 Powerhouse;
- Reinforce the embankment along the Route 8 embankment where necessary;
- Reinforce the river left (east) abutment along MetroNorth Railroad (MNR);
- Reinforce the MNR bridge spanning the entrance to the east canal;
- Reinforce the embankment along the MNR where necessary;
- Demolish and remove the gate house at the east canal entrance;
- Dewater and potentially fill the canal to convert to a multi-use trail as an extension of Naugatuck River Greenway;
- Remove the existing sewer siphons crossing the impoundment and install new sewer crossing below river grade;
- Lower or dewater Coe Pond and potentially regrade with remediated impounded sediment and restored inflowing tributary;
- Maintain option for onsite solar power generation options to be developed by others post-project;
- Demolish and remove Canal Reservoir Dam;
- Demolish and remove Unit 2 Powerhouse;
- Remove existing chain-link fencing; and,
- Create naturalized cascade and river access.

With full dam removal, partial sediment excavation, and passive release of sediment, the 74-acre impoundment is anticipated to be restored to a free-flowing river with sand, gravel, and cobble substrate and adjacent narrow floodplain corridor. The conceptual design developed for the grant application assumes that sediment management will include some combination of hydraulic dredging and relocating on-site while allowing the remaining sediment to be passively released and transported downstream ultimately to coastal estuaries. One lower-cost option includes hydraulically dredging the top four feet of sediment from the wetted impoundment, which is where the majority of elevated concentrations of contaminants existed for the five upstream mainstem dams removed between 1999 and 2004. A second higher-cost option includes hydraulically dredging the potentially mobile portion of the impounded sediment. The hydraulically dredged spoils would be sluiced down the existing canal that

parallels the river's eastern bank into the Coe Pond and stabilized and capped. The Canal Reservoir Dam, which currently impounds Coe Pond, is proposed to be breached or removed and potentially transformed into a cascade or waterfall feature combined with pedestrian access extending under the existing railroad bridge in this area. In the conceptual design, the tributary flowing into Coe Pond is proposed to be restored on the newly graded surface of the former impoundment and the former Coe Pond site is proposed to be landscaped as part of the existing Naugatuck River Greenway plans. This will allow for the reconnection of the adjacent underserved community to the Naugatuck River, which is currently blocked from river access by large chain-link fencing that is proposed to be removed. The project will also investigate opportunities to replace the former hydroelectric energy generation with solar energy generation. The engineering design phase of this project will build upon these ideas to develop a revised and refined approach and design.

Estimate of Probable Construction Cost

An estimate of probable construction cost estimate was also developed by STS based on the initial conceptual design (See Appendix 1: Kinneytown Project Conceptual Design Slides). Over 40 construction elements have been identified; the estimated cost ranges from $31 to $43 million.