LONG ISLAND SOUND HABITAT RESTORATION INITIATIVE

SECTION 6: RIVERINE MIGRATORY CORRIDORS

(Version 1.0, February 2014)

Technical Support For Coastal Habitat Restoration

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DESCRIPTION

Riverine migratory corridors refer to rivers and streams that flow between inland and coastal waters and are important corridors for the movement of diadromous fish. These systems connect breeding grounds with the travel lanes that are often required for the organism to reach maturity. The corridors also provide habitat for many of these fish species and support a myriad of other organisms such as birds and small mammals.

During the last 400 years, the landscape around Long Island Sound (LIS) has changed dramatically due to centuries of anthropogenic degradation of the environment. Rivers in particular have been significantly altered as a result of farming practices, building of infrastructure, and pollution caused by storm-water runoff. Many of these alterations have diminished historic river function and overall river water quality. This in turn impacted many of the organisms that rely on these systems for their survival including the use of these systems as migratory corridors by diadromous fish.

The History of Riverine Migratory Corridors in America

The characteristics of rivers are influenced by a number of factors including the size of watershed, slope of the landscape, amount of precipitation, soil types and the geology of the region. The size of the watershed will determine the overall amount of flow through a river and the slope of the land and its geology will impact river characteristics such as the rate of meandering, type and distribution of sediments and water chemistry. And all of these factors are ultimately influenced by the amount and type of precipitation that falls. Any changes to the landscape will force a concurrent change to the river.

The differences in geology and geomorphology of the Long Island Sound Basin impact the size and number of rivers dramatically. Because of this, Connecticut and New York’s Westchester and Bronx Counties (continental bedrock) contains many more rivers of various sizes when compared to Long Island (glacial moraine). Although this presents many more unique opportunities to restore fish to Connecticut, Westchester, and the Bronx when compared to Long Island, both regions are important to the overall health of fish populations in the Long Island Sound. Efforts must be coordinated to ensure proper management of such an important resource.

For centuries, humans have altered river function and flow through the creation of dikes, dams, and culverts, resulting in the disassociation of the river from the landscape and from established pathways of energy flow. The decoupling of the river environment has changed the hydrology of the watershed and energy flow between the upland and river habitats. During the European Colonial Period, large areas of floodplain forest were cleared and reclaimed as farmland and/or settlements. This helped release sediments to the river environment. To maintain access to the river many portions of the bank were replaced with docks and structures that began a process of “hardening” the river bank. Eventually, many rivers were dammed to produce power to run mills and, to protect from flooding, dikes and flood control structures were installed. Together these activities further disconnect the river from the remainder of the landscape.

Alterations to the river environment continued as populations expanded and the need for land increased. The installation of the railroads during the mid 1800s subjected rivers to crossings that often resulted in restrictions to flow. As the populations grew and demographics changed, open space and farms were converted to urban and suburban communities where the many roads required further restrictions on rivers and streams. The continual development also resulted in significant increases in impervious surfaces allowing water and sediments to leave the landscape more rapidly. As suburbs expanded and home landscaping took hold, the use of herbicides, pesticides and fertilizers increased. These chemicals have had a major negative impact on the health of our rivers, lakes and coastal zones.

Collectively, the changes that have occurred to the landscape during the last 400 years or so have diminished the function of the river to the landscape. Today, many rivers are polluted and flows are interrupted to the point that they no longer support many native organisms. So many rivers are restricted that migratory species such as diadromous fish have seen dramatic declines in their populations during the 20th Century. Such declines have implications to the food web and are adding (along with overfishing) to a decline in marine fish populations and impacting the structure and diversity of fish communities within coastal and ocean habitats.

Values and Functions

The value and function of the riverine migratory corridor is directly related to river characteristics. The composition of the streambed will have a major influence on the channel morphologies and success of any individual fish species. The rate of meander and the presence of riffles and pools can also impact a species. The appearance of vegetation within the river or along its banks will be important to the lifecycle of many organisms. The more habitats available to migratory fish, the more successful species will be in reproducing and surviving.

Riverine migratory corridors also include the palustrine and lacustrine components of the landscape and their associated values. The palustrine environment refers to slow moving water across saturated soils that include forests and grasslands. A forested palustrine riverbank can control water temperature and provide critical cover for young fish and other organisms. A floodplain or swamp can provide favorable spawning sites and many marshes are used as nurseries. The lacustrine environment refers to the slow moving standing water common to ponds and lakes. These bodies of water can provide fish and other organisms with valuable spawning sites and aquatic habitat the fish may require as well as supply the landscape with critical water storage. Along with the river itself, these environments help recharge and maintain much of the groundwater supply within a region. Indeed the groundwater system may even be supplying the river with constant discharge through seeps and springs. Therefore, the river corridor is a complex mosaic of environments that goes beyond the river itself.

Status and Trends

Prior to European settlement the rivers and streams of Long Island Sound had uninterrupted flow to the sea. For example, it has been estimated that by 1700 in Connecticut, over 90% of all tidal rivers had some dike or dam restricting the river flow (Steinke 1974). Although Long Island has fewer rivers than Connecticut, these too were altered early during the European settlement period. During the ensuing centuries the construction of roads, culverts and dams have added to the impacts on fish passage and changes to the river habitat have been significant. Each restriction to flow affects a variety of diadromous fish species.

With the exception of the lower Connecticut River as it passes through Connecticut, most rivers have been subjected to multiple chokepoints that have impacted fish passage. The construction of dams between 1700 and 1920 has decimated the native anadromous fish runs. Efforts to improve fish access in the region began as early as 1866 with the creation of the Commission of Fisheries in the State of Connecticut. However, it is not until the last few decades that the problem has been seriously addressed. For example, during the last 50 years hundreds of river miles in Connecticut have been reconnected to the Long Island Sound, including almost 300 river miles since 1998 (CTDEEP Records) when the Long Island Sound Study began tracking reconnected river miles as a metric for fish passage restoration.

New York State has over 500 miles of freshwater rivers and streams which empty into the Atlantic/Long Island Sound Watershed. Although the bulk of NY's LIS-connected streams empty into the western portion of the Sound (e.g., Bronx River, Mamaroneck River, and Mianus River), a few notable systems are located further east including the Nissequogue River, Sunken Meadow Creek and the Wading River. As in Connecticut the rivers and watersheds have been subjected to many changes associated with settlement during the last few centuries. Reconnection of riverine migratory corridors in NY's LIS-connected streams began in truth during the mid-2000s and momentum continues to gather with several projects in various states of design and construction and numerous locations selected for future fish passage projects.

River Habitat Restoration

There are many ways to define river restoration. For purposes of this report river restoration will mean an enhancement of ecological functioning of the system on a path to recovery toward an improved target condition. Although the preferred method of restoration is one where the river looks and operates as it did prior to European settlement, this is all but impossible to achieve due to centuries of anthropogenic actions and habitat degradation. Therefore other approaches will be required in order to restore habitat or function to a river system.

The best way to truly restore river habitat is to attempt to restore historic river flow conditions. This requires that all impediment to flow (i.e., dams, dikes) are removed or modified sufficiently to allow for proper river hydrology. However, due to development throughout the watershed, restoring historic river flow will not be feasible under present conditions. Volumes and rates of discharge have changed during the last few centuries thus rendering past river morphologies inadequate to deal with present day conditions. Therefore, when considering river restoration, alternative options need to be explored.

If historic flow conditions cannot be reestablished then attention can turn to improving river habitat through bank restoration and streambed design. River morphology not only provides habitat, it also helps to stabilize the system, store runoff and limit erosion.

A variety of factors will be important in the ability to restore river systems including availability of land, costs, flooding concerns and social considerations. Since these factors are often difficult to control other approaches will need to be considered in the design of a project. When a river cannot be restored to its "natural" condition, a goal oriented approach can be used. Establishing the needs of a particular project such as fish passage or habitat replacement will go a long way in the design of the plan. Priority should be given to removing obstacles such as dams and restoring degraded river habitat whenever possible. However, when it is not feasible to attain the optimal goals, other limited approaches can be considered. For example, if a dam cannot be removed then a fish passage system can be substituted and still achieve some functional enhancement of the system. Although there are many engineering solutions available, the design should pursue the use of natural solutions as much as possible. By-pass channels can provide both the function for fish passage as well as increasing habitat.

River enhancement/restoration plans should include both primary and secondary goals. To help define these terms consider primary goals to be those activities that perform a major service to the landscape. This may include water storage and conveyance, fish and wildlife habitats and corridors and providing control for sediments and pollutants within the watershed. Secondary goals would be those goals that are not included as the primary design, but, rather other functions that may be important to the landscape in general. For example, if fish passage is the primary goal of the project, incorporating secondary goals such as upstream habitat enhancements into the design can improve the overall success of a project.

In deciding on restoring river habitat, a number of factors should be considered:

- **Hydrology –** pre-and post-changes in water storage to a landscape may be required. Rivers confer water with some storage capabilities that primarily move water off the landscape. If the volume or rate of discharge has changed then the river will need to reflect the present flow conditions. Calculations will need to include the size of the watershed, slope of the land, projected velocities, bank full volumes and flood considerations will be required in the design of any channel. Particular attention should be paid to the conditions of discharge in order to protect resources downstream. Scour and fill analyses will be required as hydrographs change towards more open flow conditions. The channel design will also need to account for average daily flow volumes that pass through the area once flow is restored.
- **Materials –** testing will be required to characterize the sediments that will be exposed under post-construction river flows. The size and distribution of sediments will be important in protecting the river from erosion and infilling downstream. Since most rivers have experienced an industrial past it would be **advised** that the sediments be tested over depth to determine the potential for the movement of buried contaminated sediments once flows are restored. Although it would be preferred to leave river sediments in place, any contaminated soils will have to be treated in accordance with regulations. If sediments are to be removed, consideration must be given to the size structure of the fill material. Materials along a bank may need to be replaced or modified with additional engineering solutions. Many products and designs are available to limit erosion (e.g., erosion blankets, log revetments, etc.).
- **Riverbanks –** although riverbanks help provide shade, prevent erosion, and support many organisms, they also provide storage **capacity** for the river itself. Therefore, the

banks are part of the river function and must be considered in any river restoration project. River banks must be sloped properly in order to stabilize the river. Slopes can vary according to materials and volumes with steeper slopes requiring more engineering solutions. Generally side slopes of less than a 3 to 1 ratio can be stabilized with vegetation and reduce construction costs. A properly designed bank can also provide function and quality of habitat to the river itself.

- **Channel –** we do not yet know enough about fluvial geomorphology to properly mimic nature and accurately design and build meanders into a river system. However, there are some steps that can be taken to enhance a design. Historic photographic or survey information about river morphologies can be used as a template to help design a restoration plan. If archival information is **lacking** another potential source of design can be estimated through an analysis of a similar stream order within other portions of the watershed. Comparisons can be made to help in design of meandering characteristics. Of course in order to restore any river requires that river flows have not changed appreciably since the archival material was first collected. If that is not the case and river flows have changed then an analysis of a similar stream's order with similar types of development in other watersheds may provide some important clues to design criteria. One design that could help to overcome our limitations in creating meanders would be to install a low flow terrace that is at least two times the size of the proposed channel. This terrace would allow the river to establish its own meander rate based on present flow dynamics. Such a design would require sediment control basins downstream until the river stabilizes its bed morphology. Where meanders cannot be restored the proper engineering would be required to ensure that the channel being proposed can handle the volume without instigating erosion.
- **Infrastructure –** changing a river or removing pond water will change the characteristics of the landscape and flow conditions both locally and downstream. Downstream culverts and the road crossings will need to be considered under the new flow regimes. Any utilities that cut through the system will need to be explored particularly if they bisect the position of the new channel. Side slopes and **changes** in elevation should also be researched to maintain public safety and prevent erosion.
- **Upstream Habitat –** it may not always be feasible to restore the entire river habitat. In those instances it may be possible to restore some function or service that a river provides. For example, providing fish passage across a barrier restores the river corridor function but not necessarily breeding habitat. **The** area gained can then rely on breeding sites upstream to complete the life cycle of the fish. It is important, therefore, that upstream surveys are conducted to help determine the efficacy of restoring a river migration corridor.
- **Recreation and Access –** although not necessarily a technical issue, these issues impact the community. It is advised that recreation and access be considered at the beginning of any project and that education and outreach is utilized to its fullest in order to promote any project. Local land trusts, environmental justice groups, environmental non-profits, and historical societies are just a few of the **groups** that can be helpful.

Fish Migration Restoration

Riverine migratory corridors refer to those areas where migratory fish pass between salt and freshwater systems for the purpose of reproduction. It includes most ponds and rivers and lakes and many of their associated habitats such as stream banks, floodplain swamps and marshes. This chapter will concentrate its discussion on river watercourses and include anadromous (live in saltwater, spawn in freshwater), catadromous (live in freshwater, spawn in saltwater) and amphidromous (migrate between fresh and saltwater for purposes other than spawning) fish all collectively referred to as diadromous (use salt and freshwater in life cycles) fish species.

Although most people think that migratory fish such as salmon can jump over many natural impediments, it turns out that most migratory fish have trouble moving even past small structures. Therefore even structures that may not appear to be a problem can be significant barriers to the passage of fish.

In order to mitigate this problem work has been started to improve access for migratory fish. Fish ladders, parallel or by-pass channels and modified openings have been used to increase access both up and downstream. In all cases, it is important that the design of the passages not disrupt flood protection and storage capacity upstream. Therefore fish passage projects require the proper engineering analysis to ensure proper protection of our infrastructure.

To start a fish passage project one must first identify the target species of fish and understand its needs. The design will best be served by shaping the system to serve the weakest swimmer. Understanding of the species will also provide opportunities to time activities and possibly modify design. Some ladders may be closed after the spring season and others may be left open for migration of other species. The following target species are common visitors to streams emptying into Long Island Sound that will use fishways (Whitworth 1996).

- ***Clupeidae***
    - Alewife (*Alosa pseudoharengus*)

    - Blueback herring (*Alosa aestivalis*)

  - American shad (*Alosa sapidissima*)

  - Hickory shad (*Alosa mediocris*)

- ***Salmonidae***
  - Brown Trout (*Salmo trutta*)

  - Atlantic salmon (*Salmo salar*)

- ***Serranidae***
  - Black Sea Bass (*Centropristis striata*)

- ***Moronidae***
    - Striped Bass (*Morone saxatilis*)

    - White Perch (*Morone Americana*)

- ***Anguillidae***
    - American Eel (*Anguilla rostrata*)

- ***Petromyzontidae***
    - Sea Lamprey (*Petromyzon marinus*)

- ***Aciperensidae***
    - Shortnose sturgeon (*Acipenser brevirostrum*)

- ***Osmeridae***
    - Rainbow smelt (*Osmerus mordax*)

Figure 6-1. Photographs of some of the major diadromous fish species common in Long Island Sound. Photos courtesy of S. Gephard, R. Jacobs, and K. Gottschall, CTDEEP.

Before any design can be considered an analysis of the impediment would need to be conducted. If the structure is providing flood protection or creating a reservoir it must be inspected to ensure that the modification is possible. If the structure is a dam, then the dam must be able to accept the changes without compromising the safety and function of the dam. In all cases the dam must be inspected and the results analyzed by the dam safety unit of the Connecticut Department of Energy and Environmental Protection (CT DEEP) or New York State Department of Environmental Conservation (NYS DEC). The dam safety unit will make a determination whether or not a dam safety permit would be required. It is here that attention must be paid to both structural concerns and costs. If dam repairs are required the costs and timing of the project may be extended significantly. These are considerations that must be built into any project design.

Once the dam issues have been resolved, alternative designs for fish passage may be considered. Alternative designs may include number of different approaches including removal of a structure, modifications to a structure, and or the addition of fish ladders or bypass channels to the system. No matter what individual alternative is considered they all must include a hydraulic assessment for each contingency considered. Changes in flow intensity, flow duration and rate are just some of the criteria that will need to be addressed. Some important considerations are listed below:

- Will installation of the passage present new flooding considerations downstream?
- Will changes in the flow increase erosion or change channel configurations?
- Will changes in flow reduce or change water storage potential within the watershed?
- How will the new flow regimes respond to one, five, 10, 50, and 100 year storms?

Besides engineering issues there are a number of socio-economic issues that should be considered as well. It is important that the landowners, municipalities, and the public are informed and brought into the discussion. Such information should be considered as early as possible in planning your fish passage project. Some important considerations are listed below:

- Will the structure impact aesthetics?
- Does the structure carry a historic designation?
- Has the public been surveyed and are there any objections to the project?

- Have all of the landowners been contacted?
- Has a cost benefit analysis been conducted on the project and its alternatives?
- Is there a chance to combine projects?
- Who will maintain any structures, and who will pay for maintenance and operation?

Alternative designs will need to be specific to the individual project. However there are a number of general categories that can be considered in any alternatives analysis. Except for removal, the design of these systems will require a mechanism for steering fish towards the appropriate structure. This can be achieved by proper placement of rocks and even nets to direct the fish towards the passage system.

Basic Methods of Restoring Fish Passage

The basic fish passage restoration categories are noted below (Katopodis 1992, Connecticut River Watershed Council 2000, National Engineering Handbook 2007):

1) Removal of structure – although the best fix of any migratory problem would be to remove the impediment, this is not always possible. Removal of a structure may be more expensive than modifying the structure and careful cost analyses would be required. If a structure is to be removed adequate downstream engineering analyses will also have to be considered. This may include culverts that are miles downstream of the project site. At present dam removal is not a very common solution to fish migration, particularly when a dam is a historical structure. However, it is gaining acceptance.

2) Addition of a bypass channel – if the slope of the land is correct it may be possible to bypass the impediment with a new or existing channel. If land is available this option avoids the need to modify the structure. Depending on the repairs that may be required to the existing structure, such an option may also be cost effective.

3) Fish ladders – fish ladders collectively referred to structures that are built in place that allow fish to move across a barrier. There are multiple designs that may be employed depending on the height of the obstruction, slope of the landscape and the length of the river channel downstream. The basic types used around LIS are noted below:

- **Rock ramps –** rock ramps are a series of pools and channels built into the river bottom that raise the elevation of the fish across more shallow barriers. The structures use natural material to help it blend into the surrounding environment. The advantages to this fish ladder are that they can look very natural and require minimal upkeep once installed. The disadvantages to this fish ladder are they require a longer run and have the potential to disrupt more of the riverbed. This type of fish passage system is also limited to shallow barriers.

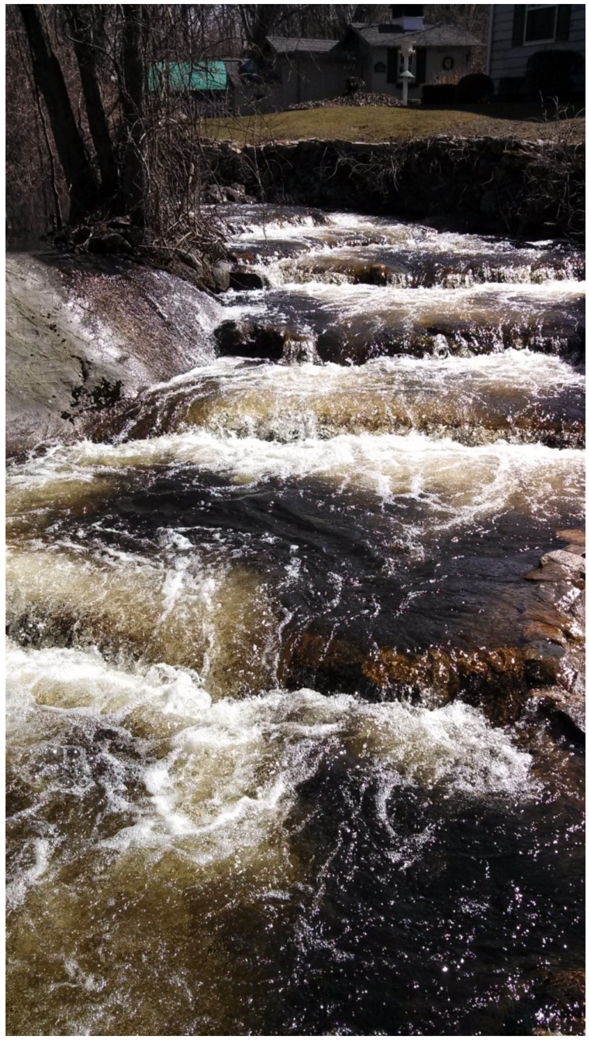

Figure 6-2. Photograph of a rock ramp. Photo credit: Steve Gephard, CTDEEP/Inland Fisheries Division.

- **Pool and weir fishway –** is useful for crossing smaller obstructions. Individual pools are typically constructed out of stone or concrete and separated by a series of walls or weirs. Each pool slightly increases the elevation of the run and, like the rock ramp, can be made to blend in with the surrounding environment.
- **Steep pass–** steep pass units are pre-engineered aluminum sections that are fitted with internal vanes to break the flow. The sectional units are attached together to form a continuous channel and raise the elevation of the fish across steeper barriers. These units come in various configurations depending on the length and height of the barrier. These fish ladders are very effective for steep inclines. These ladders are more controllable and may be shut down during all seasons. Steep pass units are typically less aesthetic than the rock ramps; however, this may be mitigated by fronting with a rock face. This option requires more maintenance and inspection on a regular basis.
- **Denil fishway –** is a type of fish ladder similar to a steep pass unit (typically pre-engineered aluminum) that is used to cross larger obstructions. Denil fish ladders use wooden or aluminum baffles within each section to break the flow along slopes of 10% to

25%. A denil ladder also contains a narrow entrance that creates high water velocities in order to attract fish and often employs multiple sections in order to maintain slope over longer distances. Resting pools can be included by inserting a level section intermittently along the length of the ladder. This option also requires regular maintenance and inspection.

- **Fish elevators –** fish elevators are employed when other options are not available. They can be used to surmount any elevation differential particularly those found on large dams that are part of a hydroelectric power system. These devices will fill with fish and mechanically raise them up and over the barrier. They are the most expensive of the systems and require constant maintenance and energy to function. Fish elevators will probably not be the choice of municipal and privately owned projects where there is no large-scale commercial gain.

The design of the fish passage must consider the energy requirements of the fish. Resting pools must be built into any design that exceeds the fish's ability to comfortably swim for some duration at a particular incline (or slope?). The pools built into the rock ramp are an example of this consideration. In designing steep pass units, sections must be employed that are relatively flat in slope providing the fish with a resting area. Indeed some steep pass units may even include pools for further rest. Since many fish can traverse waterfalls in the downstream direction most fish passage systems are designed for the upstream direction only. If a downstream component is desired it will need to be included in the design. Design criteria may also require structures that direct the fish to the fishway entrance. Although the fish utilize both chemical and physical cues to find their way upstream, water flowing over the dam often makes this signal confusing. Therefore additional steps may be required to direct the fish towards the entrance of the fish passage system. Additional rock ledges and other structures (e.g., booms fitted with nets) may be necessary to direct the fish to the passage unit.

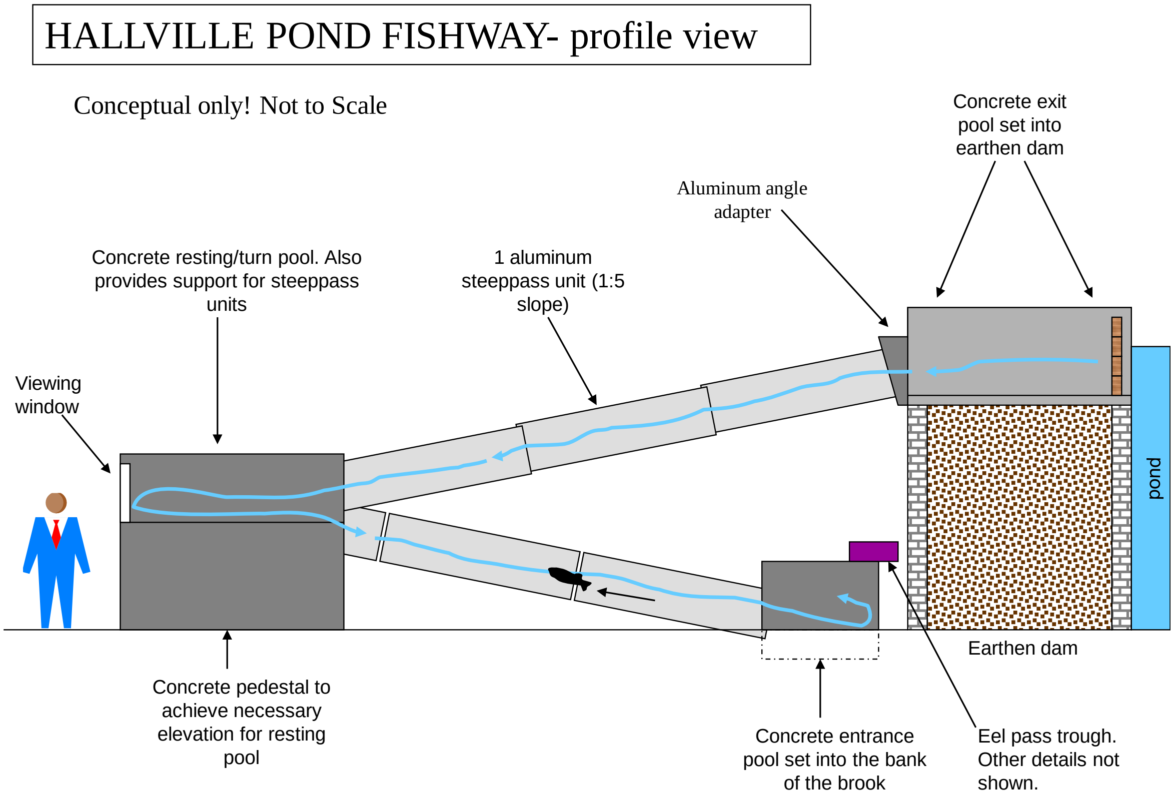

Figure 6-3. Conceptual profile of the Hallville Pond Fishway. Conceptual design sketches can be created to suggest how the fishway may appear to a property owner or a civic group. Although these sketches are relatively simple to create, the engineering required to build a fishway is complex and may take a year or more to complete. Always consult with experts to design the fishway. Credit: Steve Gephard, CTDEEP/Inland Fisheries Division.

New York State Permitting Requirements

In order to obtain the necessary permits for fish passage installation in New York State it is important to check with the NYSDEC and your local municipality as early as possible during the planning stages of your project.

For the NYSDEC, the first thing project stakeholders should do is contact their Regional Permit Administrators. The NYSDEC strongly recommends a pre-application conference for complex, multi-residential, commercial and industrial projects. During the pre-application conference the Permit Administrators can answer your questions regarding project plans, application procedures, the need for other permits, stream classification, and standard permit issuance. (http://www.dec.ny.gov/permits/6222.html).

The following Regional Permit offices serve the Long Island Sound watershed**:**

Region 1	Region 2	Region 3
SUNY Campus, Bldg. 40 Stony Brook, NY 11790	47-40 21st St Long Island City, NY 11101	21 South Putt Corners Rd. New Paltz, NY 12561
Phone: (631) 444-0365	Phone: (718) 482-4997	Phone: (845) 256-3054
Email: r1dep@gw.dec.state.ny.us	Email: r2dep@gw.dec.state.ny.us	Email: r3dep@gw.dec.state.ny.us

During the pre-application meeting, the Permit Administrators will determine which permits your project will require. If a dam is present a key step is assessing if your project will alter the dam, a decision that can only be determined by the Dam Safety Section. If dam alteration is planned, then a Dam Safety Permit under a Joint Application (sent to the NYSDEC and the U.S. Army Corps of Engineers (USACOE)) will be required. (http://www.dec.ny.gov/permits/6222.html#Joint)

Information on NY State's Dam Safety program can be found at http://www.dec.ny.gov/lands/4991.html

NYSDEC Dam Safety Section
625 Broadway, 4th Floor Albany, NY 12233-3507
Phone: (518) 402-8185

In order for the Dam Safety Section to properly determine if you need a Dam Safety permit you must supply a written description of the work proposed along with, at minimum, a conceptual sketch of the proposed design. A visit to the project site by a Dam Safety Environmental Engineer may also be required during this process.

If Dam Safety decides the project scope doesn't constitute alteration, then the project can proceed without a dam safety permit. You will likely have to complete additional permits such as the Stream Disturbance permit.

If your project does constitute alteration, then you will need the owner of the dam/project leader to submit the following studies completed by a licensed engineer:

- Application for **Permit** for the Construction, Reconstruction, or Repair of a Dam or Other Impoundment Structure –Joint Application Supplement D1 form (http://www.dec.ny.gov/permits/6222.html#Joint)
- Engineer **Report**-this report must be completed by a licensed engineer and will include the following:
    - Hydrology Report
    - Hydraulics Report
    - Structural Stability Report

- Construction **drawings** that **include** specifications for the construction materials to be used.
- **Stream** Disturbance Permit (http://www.dec.ny.gov/permits/6554.html)
    - Section 401 Water Quality Certification (http://www.dec.ny.gov/permits/81010.html)

There are other permits that may be required by the NYSDEC in order for you to install your fish passage. These permits will be discussed at your pre-application meeting with your Permit Administrator:

- Freshwater Wetlands Permit – if your fishway might have impacts on freshwater wetlands, including fresh-tidal. Information on NY State's Freshwater Wetlands Permitting program can be found at http://www.dec.ny.gov/permits/6058.html
- Tidal Wetlands Permit – if your fishway might have impacts on tidal wetlands. Information on NY State's Tidal Wetlands Permitting program can be found at http://www.dec.ny.gov/permits/6039.html
- Wild, Scenic, & Recreational Rivers Permit-NYS's Wild Scenic and Recreational Rivers Act protects those rivers of the state that possess outstanding scenic, ecological, recreational, historic, and scientific values. (http://www.dec.ny.gov/permits/6033.html)

In addition to the NYSDEC permits, you may be required to apply for permits within the municipality of your project location. There may be some local and County (Suffolk, Nassau, Queens, Bronx, Westchester) permits that are required for fish passage projects. It is advised that project stake holders check with their local town, village, county, and/or city permits office to see if additional permits are required for adjustments to infrastructure.

Project stakeholders in NY should keep in mind that the permitting process can be lengthy and will add on time to your project schedule. It is advised to leave additional time in your project schedule for the permitting review process. The earlier project leaders meet with regulatory agencies the better for the completion of your fish passage project.

It is possible that you may need additional permits through the USACOE. It is to your best interest to contact and inform the USACOE of your project. Unless the project is very small, a USACOE permit will likely be required. For more information on USACOE permitting in NY, please call 917-790-8511 or see webpage for US Army Corps of Engineers – New York Region Regulatory Branch, New York District http://www.nan.usace.army.mil/Missions/Regulatory.aspx

Connecticut State Permitting Requirements

** Although not a permitting body of the agency, CT DEEP's Inland Fisheries Division (IFD) should be consulted very early in the fishway planning process. In fact, they should be the first group to be contacted when considering a fishway. For more information: deep.inland.fisheries@ct.gov, or (860) 424-FISH (3474), or http://www.ct.gov/deep/cwp/view.asp?a=2696&q=322700&deepNav_GID=1630.

All projects will be required to go through similar review processes for state and federal (and, occasionally municipal) permits. It is important that during the design phase, the project staff determines what permits will be required to build the fishway or remove the dam. Then, applications must be made to the approval agencies in a timely manner that will result in all permits being obtained by the time construction is set to begin. It may also be necessary for projects to be reviewed by the Connecticut DOT or Amtrak. Some of the typical permits required for these projects are listed below, and it is very common for individual projects to need multiple permits from various divisions within DEEP and other organizations as well.

CTDEEP – Inland Water Resources Division (IWRD) Permits

A list of all IWRD permits (application forms, instructions, fact sheets, etc) can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324222#inlandwaterresources; the main contact number for IWRD is 860-424-3019. Activities that can trigger the need to obtain one or more of these permits can be very complicated so it is best to contact IWRD and ask directly. IWRD staff are available for pre-application meetings to help you determine which permit(s) you will need. Determining which permits will be needed early along in the process will help to ensure smooth progress with fewer surprises.

1) Dam Safety Permit / Dam Construction Permit - if the barrier to fish movement is identified as a hazardous dam by the IWRD's Dam Safety Unit, then a Dam Safety Permit will be required. The Dam Safety Unit will be able to assist project leaders with understanding permit requirements. If the dam is not able to handle the additions or the structure itself is failing, improvements to the dam may be required. This can add significant time and cost to a project and could result in terminating the project if the dam owner is not willing to spend money on the repairs. This needs to be considered early in the process. The Dam Safety Unit can be contacted directly at Deep.DamSafety@ct.gov, and Fact Sheet on this program can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324170&deepNav_GID=1643

2) Flood Management Certificate – if State funds are used to fund design/engineering, or construction of the project, a Flood Management Certificate will be needed. However, if your project requires a Dam Safety Permit, then the Flood Management Certificate is no longer required. A Fact Sheet on this program can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324172&deepNav_GID=1643

3) Inland Wetlands and Watercourses Permit – any state agency or instrumentality undertaking an activity or project in or affecting inland wetlands or watercourses must apply for this permit. All others must apply for a local Inland Wetlands and Watercourses permit (details below). A Fact Sheet on this program can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324174&deepNav_GID=1643

4) Water Diversion Permit – if a project proposes to divert water (ground water, surface water, essentially any inland waters of the state), then this permit may be needed. A Fact Sheet on this program can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324178&deepNav_GID=1643

5) 401 Water Quality Certificate – this may be needed for any project or activity that proposes to or could result in any discharge into the navigable waters, including all wetlands, watercourses, and natural and man-made ponds. A Fact Sheet on this program can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324168&deepNav_GID=1643

CTDEEP – Office of Long Island Sound Programs (OLISP) Permits

OLISP issues coastal permits for structures and activities in the tidal and navigable waters of the State. In terms of OLISP permit requirements for fish passage projects, authorization would be needed for fishways and dam removals at tidal dams, dams that are the head of tide, culverts in the tidal area, by-pass channels with at least one connection to tidal water, or any other fish passage project in tidal or navigable waters. OLISP issues three types of permits for this kind of work and it is best to contact the Office for guidance on which permits may be needed after at least conceptual design plans have been created. OLISP staff are also available for pre-application meetings to help you determine which permit(s) you will need. It's always best to determine which permits will be needed as early along in the process as possible. OLISP can be contacted directly by calling 860-424-3034, and a list of all OLISP permits (application forms, instructions, fact sheets, etc) can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324222#LongIslandSound

1) Certificate of Permission (COP) – COPs are certificates issued for certain minor activities involving dredging, erection of structures, or fill in any tidal, coastal or navigable waters of the state. The specific activities eligible under this program are listed in CGS section 22a-363b and include: substantial maintenance and minor alterations or amendments of authorized or pre-jurisdiction structures, fill, obstructions and encroachments; maintenance dredging of maintained permitted dredged areas; removal of derelict structures and vessels; most coastal habitat restoration projects; and other enumerated minor activities. If your project requires a Dam Safety Permit, then the Certificate of permission is no longer required. A Fact Sheet on this program can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324162&deepNav_GID=1643

2) Individual Permits - Structures, Dredging and Fill, and Tidal Wetlands – This permit program regulates a variety of activities in tidal wetlands and in tidal, coastal or navigable waters of the state through two different permit programs: Structures, Dredging and Fill; and Tidal Wetlands. If your project requires a Dam Safety Permit, then this permit is no longer required. A Fact Sheet on this program can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324180&deepNav_GID=1643

3) Water Quality Certificate – this may be needed for any project or activity that proposes to or could result in any discharge into the navigable waters, including all wetlands, watercourses, and natural and man-made ponds. A Fact Sheet on this program can be viewed at http://www.ct.gov/deep/cwp/view.asp?a=2709&q=324168&deepNav_GID=1643

Other Permits for Work in Connecticut

1) Natural Diversity Database (NDDB) – A review of the natural diversity database is a requirement of most DEEP permits, but may still be required even if other permits are not. The NDDB will review the project site for records of listed species (endangered, threatened, or special concern), and respond with a letter outlining seasonal and other restrictions with respect to project implementation. Information about listed species can be found here: http://www.ct.gov/deep/cwp/view.asp?a=2702&q=323486&deepNav_GID=1628. NDDB maps can be viewed online at http://www.ct.gov/deep/cwp/view.asp?a=2702&q=323464&deepNav_GID=1628&deepNavPage=%7C. And you can request a review of the NDDB here: http://www.ct.gov/deep/cwp/view.asp?a=2702&q=323466&deepNav_GID=1628

2) CT Dept of Transportation (DOT) – fish passage projects often cross roadways that are part of the DOT system. If a DOT structure is involved, the DOT will also need to be contacted. Their involvement will depend on the structure and its relationship to the project. At the very least the DOT would probably need to review any engineering plans, but it could require more interaction with the agency depending on the scope of the project and its potential impact on DOT structures. Since road culverts downstream of the site may be impacted, it may be best to let the DOT decide if they need to be involved. You may also need to apply for a DOT permit to conduct work on DOT property/structures. The primary contacts for DOT permits related to fishways are in DOT's Office of Environmental Planning: http://www.ct.gov/dot/cwp/view.asp?a=3529&q=431980

3) U.S. Army Corps of Engineers (USACOE) Permit – Unless the project is very small, a USACOE permit will likely be required. However, the USACOE's program in Connecticut is coordinated by the IWRD and/or OLISP, which can assist project leaders to understand if a USACOE permit is required and how to apply for it. For more information on their Programmatic General Permit for regulated activities in CT, please call 978-318-8335 or see webpage for US Army Corps of Engineers – Regulatory Branch, New England District at http://www.nae.usace.army.mil/Missions/Regulatory/StateGeneralPermits/ConnecticutGeneralPermit.aspx

4) Historical Resources – Although not technically a permit, some projects will require a letter from the State Historical Preservation Office to affirm that the project will not endanger important historical or archaeological resources. If federal funds are used for the project, such a letter (referred to as a Section 106 consultation) will be required. Sometimes, the letter may set certain conditions or recommendations for proceeding, such as photo-documenting any historical resources that are encountered. For more information on the SHPO, please see http://www.ct.gov/cct/cwp/view.asp?a=3948&q=293806&cctNavPage=%7C

5) Municipal Permits – Many projects will include numerous landowners and interested parties, particularly at the local level. Fish passage projects may require permits from local land-use agencies particularly the Inland Wetland Commission (IWC) for the town where the project is located. If the project requires any permit from the IRWD, the local IWC will not have any jurisdiction and no local permits will be needed.

Fish passage projects will be reviewed by the CTDEEP's Inland Fisheries Division (IFD). They will be consulted by the regulatory agencies before those agencies issue a permit. It is beneficial to have the IFD review the plans before you submit them to ensure it endorses the project. This will prevent unforeseen problems from creeping up later in the review process. However, any party considering a fish passage project in Connecticut should be consulting the IFD from the very start and including its staff in every step of the project. IFD staff can be instrumental in helping to design a project and, at times, securing the funding. It is strongly advised not to attempt a fish passage project in Connecticut without full and early involvement by the IFD.

6) Other - sometimes a project might occur on federal land in which case the federal government would need to be contacted. Fish passage projects may also include the railroads. This would require contacting the managing agency such as Amtrak. The agency can advise you best as to what information they will need and any permission that may be required.

Once the project has been completed, there will be future considerations that must be codified. Ownership of the structure, future maintenance and potential repair all need to be considered upfront. If a fish counter or some other recording device is utilized procedures will need to be incorporated into the project so that it may be continued after the installation is complete.

Literature Cited

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