MACKWORTH-ENVIRO
Aquatic Barrier & Screening Solutions

Lovett Generating Station
Hudson River, Tomkins Cove, NY

Project Background

Mackworth personnel, working as Gunderboom, Inc., designed, built, and installed a bottom-sealing filter barrier for the Lovett Generating Station in Tomkins Cove, NY.

The purpose of the project was to minimize entrainment of fish eggs and larvae at the Lovett cooling water intakes on the Hudson River. The AFB was utilized for four seasons under an SPDES permit.

The Hudson experiences a 3-ft tidal range and has salinities ranging from 0-10 ppt depending on tides and freshwater flows. The river experiences periods of high total suspended solids (TSS) and flows 160,000 cfs as a result of seasonal rain events and snowmelt.

Design

The AFB was designed to prevent aquatic biota from being drawn into water intake structures for a once-through cooling system, including organisms as small as planktonic fish eggs and larvae. A specialized non-woven laser perforated fabric curtain incorporated an apparent opening size (AOS) on the order of 150 microns, with an added fabric perforation of 0.4-0.6 mm, and an approach velocity of 0.012 fps. This design allowed the passage of water, prevented passage of fish, including eggs and larvae, inward to the plant intakes as well as avoided even larval impingement on the geotextile fabric. As a side benefit, it reduced the passage of suspended sediments into the plant's cooling system.

The polyester-fiber permeable fabric was constructed in two layers subdivided into vertical cells. An excess of filter fabric was designed into the boom to accommodate water level fluctuations. It was fitted with a flotation hood that runs the top length of the boom and keeps the system above water. This top hood, coupled with the systems that seal the bottom and ends of the filter barrier, ensured that only water, or aquatic biota, sediment or other materials, that passed through the barrier reached the facility's intake. The barrier was fixed in position by a custom-engineered anchoring and mooring system.

Figure 1. Aerial photo of the Lovett Generating Station

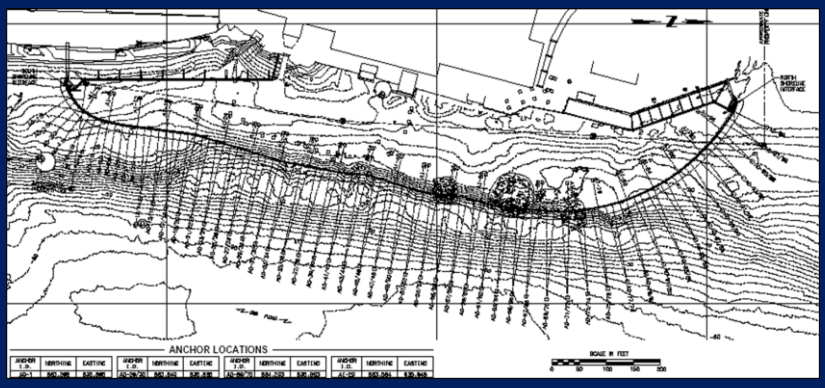

Figure 2. Anchor locations for the Lovett system

A heavy skirt constructed of durable, impermeable, rubberized material was attached to the bottom of the filter fabric to create a seal with the substrate and prevent aquatic organisms from passing underneath.

Considerations during the design process included physical and biological parameters such as: water level fluctuations, flow rates, bi-directional currents up to ~2 fps, waves up to ~3 feet, waterborne sediments, substrate quality and potential fouling species (e.g. zebra mussels). There was also variable suspended sediment loading, up to ~50 mg/L and river bottom was comprised of unconsolidated sediments.

Detailed analyses were made for the loading on the AFB mooring point connections, mooring lines and anchors (created by high hydraulic head differential) under conditions of high sediment loading, with maximum CWS flow, and at extreme low water and rising tide. Buoyancy requirements for the AFB included consideration of CWS flow, water level and currents on maximum loading, and the ability to overtop to relieve pressure should excessive loading occur.

The resulting barrier design incorporated sheet pile walls to extend the shoreline length of the AFB and extend the CWS discharges further north and south, and barrier alignment along the 30-foot MLLW (mean lower low water) depth contour.

Performance

Ichthyoplankton monitoring was conducted during the developmental program to measure the system's effectiveness at reducing entrainment. Paired samples were collected during 1995, 1998, and 2000. Results from an Ichthyoplankton Monitoring Program indicate that the system's exclusion rate was greater than 80% effective at reducing entrainment. As a result of this development program, the MLES™ was determined to be a BTA for mitigating environmental impacts associated with the use of surface waters at cooling water intake structures.

Lovett Managers contracted ASA Analysis and Communication, Inc. to evaluate the biological effectiveness of the barrier at Lovett from 2004 to 2007. Their results reported an "average exclusion effectiveness of 79% for all species and life stages of ichthyoplankton combined" (Normandeau, 2009). ASA reports further stated, "on average the system was estimated to exclude 89% of the bay anchovy (inter-annual range 68% to 100%), 89% of the striped bass (inter-annual range 85% to 94%), 85% of the white perch (inter-annual range 62% to 97%), and 52% of the river herring (inter-annual of 57% to 99%)" (Normandeau, 2009).

Figure 3. Installation of the Lovett BSFB MLES

Figure 4. Lovett AFB in operation

References Cited

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Normandeau Associates, Inc. 2009. Biological Performance of Intake Screen Alternatives to Reduce Annual Impingement Mortality and Entrainment of Merrimack Station. Prepared for Public Service of New Hampshire.

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