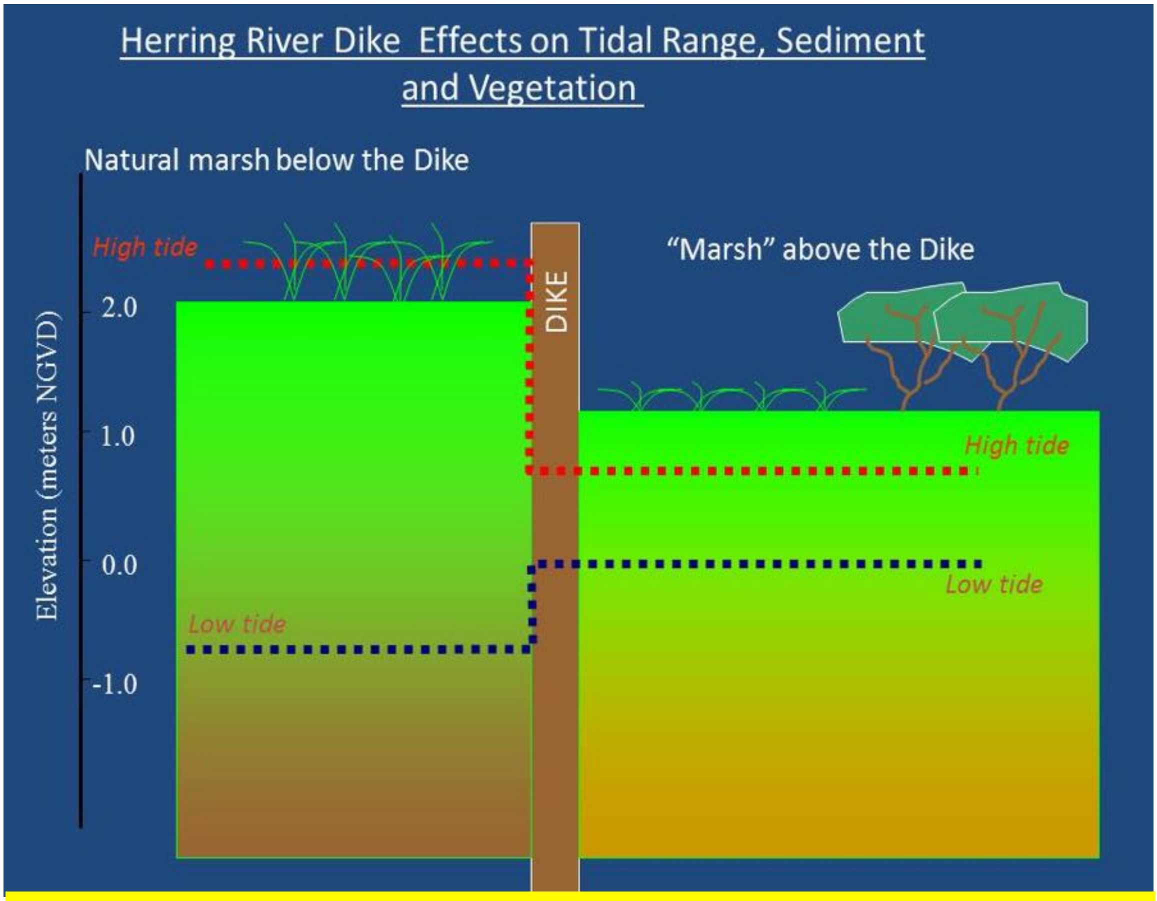
HERRING RIVER TODAY:
PROBLEMS CAUSED BY TIDAL RESTRICTION

Friends of Herring River
2016



Restriction Lowers Tidal Range and Contributes to Sinking of Marsh

- By restricting tidal flow, the dike artificially lowers tidal range above the dike. Tidal range is the difference between mean high and mean low tides. Below (seaward of) the dike the natural tidal range is 7-8 feet. Above the dike, tidal range is restricted to only 1.5 ft, resulting in lower high tides and higher low tides above the dike.
- The lowering of high tides, along with stream channelization and ditch drainage, has lowered wetland water levels above the dike causing the marsh to subside (sink) 2-3 feet.
- Elimination of tidal flooding and salinity has allowed non-native *Phragmites* to invade the salt marsh immediately above the dike, and upland shrubs and trees to invade above High Toss Road, where "high tides" never reach the original marsh surface.

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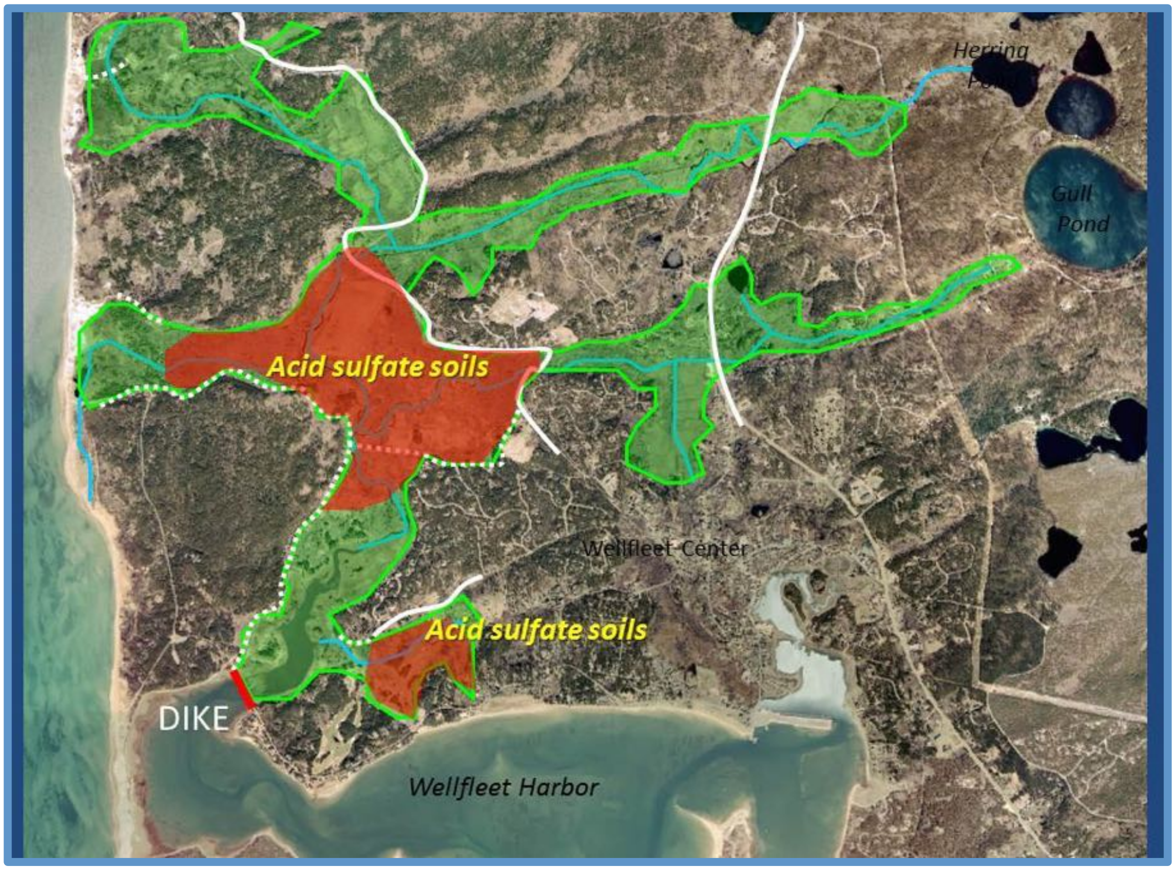
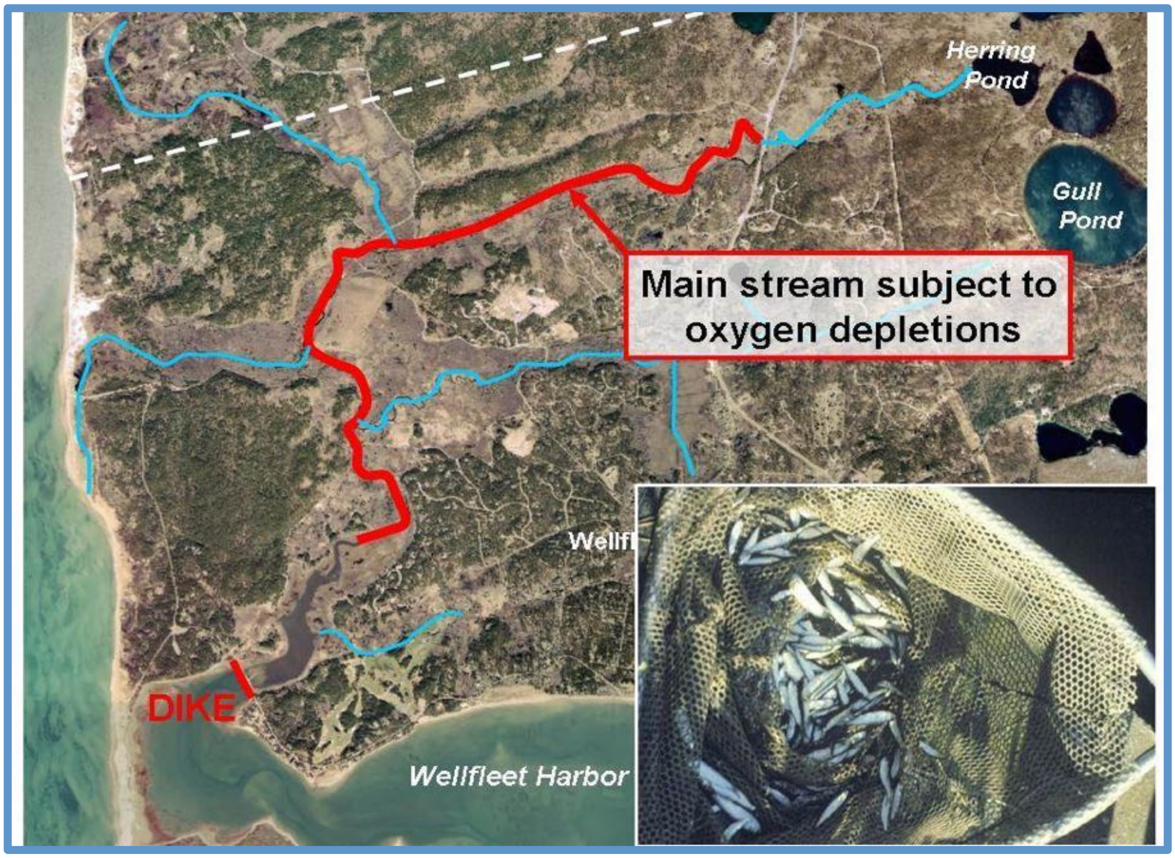


Acid Sulfate Soils Leach Toxins into Surface Water

- The tidal restriction caused by the dike has led to drainage of the salt marsh. Prolonged oxidation (exposure to air) causes salt marsh to decompose and release sulfuric acid into surrounding soils and receiving water.
- Acid sulfate soils are a major problem over hundreds of acres of original Herring River marshes.
- These soils leach toxic acidity and aluminum into remaining surface water, killing aquatic animals.

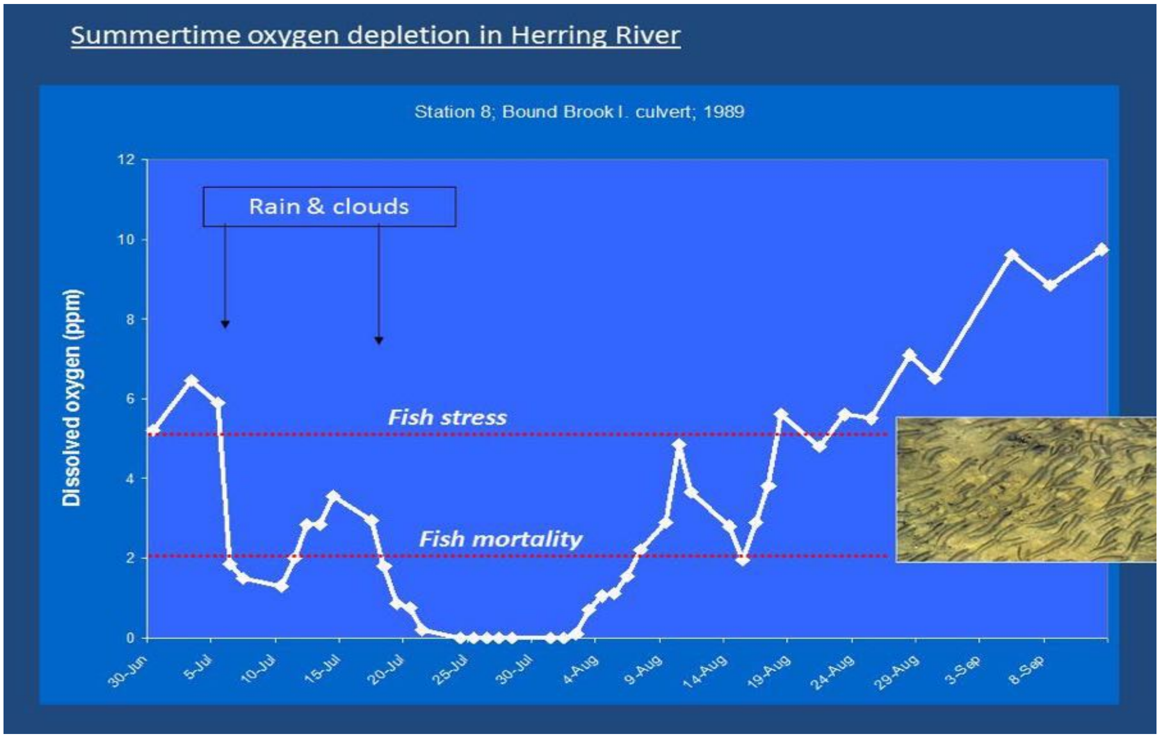


Lack of Tidal Flushing Depletes Dissolved Oxygen Needed for Healthy Aquatic Life

- The lack of tidal flushing **causes dissolved oxygen depletions and fish kills** in the summertime.
- This, together with the physical obstruction of the dike, likely contributed to the decline in the herring run, a major asset of the Town prior to 1900.
- The inset shows young-of-the-year alewives killed by oxygen depletion during their emigration from the kettle ponds and down Herring River in July 1985. The kill was apparently total as there was little detectable oxygen in the river main stem.

Highly Acidic River Water Unsafe for Aquatic Life

- This galvanized steel minnow trap dissolved in Herring River ditch water above High Toss Road after just 30 days.
- The water is as acidic as lemon juice or vinegar, a consequence of diking, drainage and the consequent leaching of sulfur as sulfuric acid.
- Acidity is so high that it dissolves aluminum from native marsh clays, in concentrations that kill fish and other aquatic animals.



Depletion of Dissolved Oxygen Leads to Fish Kills

- Dissolved oxygen depletion is caused by low tidal flushing and decaying vegetation from the extensive wetlands in the watershed.
- Most serious events occur in summer with high water temperatures, rainfall and wetland runoff, and cloudy weather.
- Note that fish are stressed by low dissolved oxygen throughout most of the summer, leading to fish kills
- Inset shows migrating river herring fry, 3-5 centimeters length.

Highly Acidic River Water Leads to Fish Mortality

- Low pH (high acidity) and high aluminum in Herring River stress and kill fish by damaging gill surfaces, affecting oxygen exchange, and by causing skin lesions.
- After the river was channelized in the early 1980s, exposing acid sulfate soils to oxidation, river pH plummeted (acidity increased) and thousands of American eels were found dead and dying on the river bottom from below High Toss Road to Route 6. Moribund eels that were moved above the acidic main stem, or into seawater below the dike, recovered over night.

High Bacterial Concentrations Lead to Shellfish Closures

- Extensive oyster beds above and below the Herring River dike have been closed due to fecal coliform contamination since 1985.
- These bacteria, likely from wildlife, accumulate around the dike because of the lack of flushing with relatively clean and high-salinity seawater.
- Tidal restoration will likely allow the re-opening of shellfish beds by 1) increasing tidal exchange many times, greatly diluting contaminated river water with cleaner water from Cape Cod Bay; and 2) Increasing the salinity of river water, which decreases the survival time of coliform bacteria.

Lost Salt Marsh Replaced with Invasive Vegetation

The original intertidal salt marsh above High Toss Rd is now covered with invasive non-native plants and dying shrubs and trees. Photo taken on 1 November 2016 from Pole Dike Road looking south.

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