CDM

# Assabet River - Sediment and Dam Removal Study

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## USACE New England
## Assabet River - Sediment and Dam Removal Study

- **Objective:**
  Reduce phosphorus concentrations and improve aquatic habitat within the Assabet River from sediment and dam removal.

## Sediment and Dam Removal Study Objectives

- Evaluate alternatives that will help achieve water quality compliance and restore aquatic ecosystem
- Target: 90% reduction in phosphorus sediment flux
- Alternatives considered:
  - Sediment removal
  - Dam removal

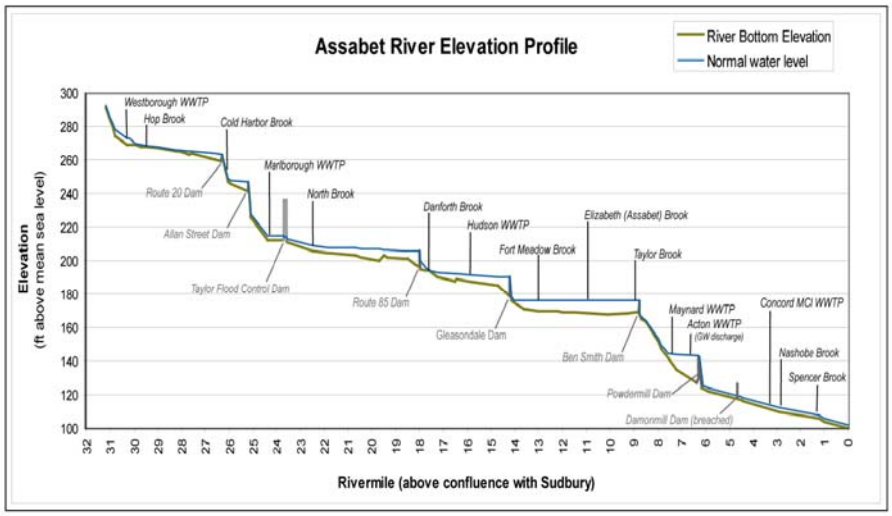
  } to reduce P loading from sediment
- Planned Improvement
  - Lower WWTF phosphorus effluent criteria

  } to reduce P loading from point sources

## Study Area Description

- Assabet River ~20 miles west of Boston, MA
- River
  - 31 miles long
  - DA = 177 sq. mi.
  - average monthly flows: 400 cfs (Mar) – 60 cfs (Aug)*
- River flows through 9 towns
- 8 dams located on mainstem (2 are flood control)
- 5 wastewater treatment facilities discharge into river (4 of these are public)

*flows measured at Maynard USGS gage

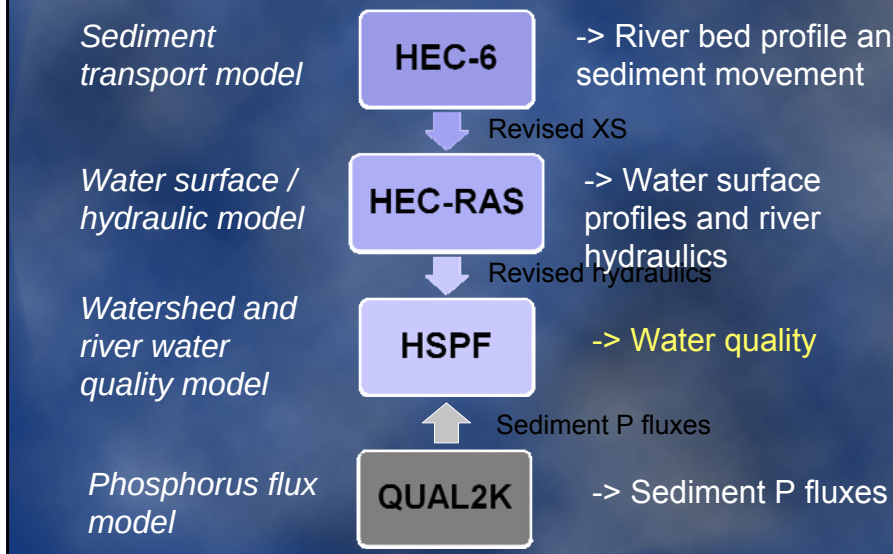



SOURCE: Profile prepared by Organization for the Assabet River (OAR)

## Study Objectives

- **Computer models were used to evaluate the impacts of dam removal, dredging, and lower WWTF effluent criteria**
- **The following were evaluated:**
  - **Water surface profiles** — During high and low flow conditions
  - **Sediment volumes and mobility**
  - **Water quality** — Specifically, its dependency on hydraulics and sediment nutrient flux

## Methodology




## Scenarios

| Scenario | Wastewater Treatment Plant Improvements | River Sediment Removal | Dam Removal |
|---|---|---|---|
| Existing conditions (2000) | | | |
| Planned WWTF improvements | √ | | |
| Dredging | √ | 3 ft from each impoundment | |
| Full dam removal | √ | | all 6 dams |
| Partial dam removal | √ | | Hudson, Gleansondale, Ben Smith |
| Partial dam removal | √ | | Ben Smith |

## Findings – WWTF Improvements

(2005 NPDES Permits of 1.0 TP winter and 0.1 TP growing season)

- Reducing phosphorus discharges from the WWTFs has several impacts on water quality:
  - Lower instream P concentrations in river
  - Lower algal counts
  - Improved DO
  - Less algal settling
  - Reduced P flux from sediment due to lower algal settling

  60% reduction in P flux

  Note: high summer P fluxes are due not only to algal settling and cycling through sediment, but also the high P in the sediment during winter time

## Findings - Sediment Removal/Dredging

- Based on USGS study, total P sediment concentration in the impoundments was highest in top 3 ft of sediment
- Removing the top 3 ft of sediment from each impoundment results in the following water quality impacts:
  - Reduced sediment phosphorus flux lasts only for a few years; as dredged areas fill back in, P flux will increase back to previous levels
  - Dredging increases residence time in impoundments
  - Reduces reaeration and dissolved oxygen
  - Increases algal growth from deeper impoundments

  Dredging does not improve water quality

# Findings – Dam Removal

| Dam | Dam Height (ft) | Sediment Volume (ac-ft)* | Impound-ment Area (acre)* | Maximum Water Depth (ft)* | Change in Water Surface if Dam Removed (ft)** |
|---|---|---|---|---|---|
| Aluminum City | 4.9 | 0.3 | 0.4 | 3.9 | - 4.8 |
| Allen Street | 9.7 | 34 | 7 | 8.2 | - 3.5 |
| Hudson | 7.4 | 45 | 22 | 9.8 | - 6.9 |
| Gleansondale | 6.4 | 54 | 14 | 10.8 | - 4.5 |
| Ben Smith | 7.9 | 470 | 146 | 10.8 | - 7.4 |
| Powdermill | 10.8 | 97 | 27 | 8.2 | - 7.6 |

Data sources:
* From *Sediment Studies in the Assabet River, Central Massachusetts* (USGS, 2003)
** From USACE New England Assabet River Sediment and Dam Removal Study modeling, full dam removal scenario for summer average flow conditions (CDM, 2007)

# Findings – Dam Removal

- Dam removal results in the following water quality impacts:
  - Reduced residence time
  - Reduced biomass production
  - Improved DO
  - Less algal settling
  - Reduced P flux from sediment due to lower algal settling

Additional 20% reduction in P flux from dam removal for a total 0f 80%.

Note: Removing the dams for the larger impoundments has the greatest benefit

## Summary of Water Quality Findings

| Dam | Base Condition (2000) | Planned Improvements | Dredging | Dam Removal |
|---|---|---|---|---|
| Aluminum City | 🟢 | 🟢 | – | + |
| Allen Street | 🟢 | 🟢 | – | + |
| Hudson | 🟡 | 🟢 | – | ++ |
| Gleasondale | 🟡 | 🟢 | – | ++ |
| Ben Smith | 🔴 | 🟡 | – | +++ |
| Powdermill | 🟡 | 🟢 | – | ++ |
| Downstream Load to Concord River | 🟡 | 🟢 | – | + |

**Legend**

**Existing Conditions:** 🟢 **= Good,** 🟡 **= Fair,** 🔴 **= Poor**

**Improvements: (–) = No improvement, (+) = some improvement, (++) = good improvement, (+++) = significant improvement**

## Study Findings

- Sediment removal from impoundments does not help reduce sediment phosphorus flux and has a negative long term effect on water quality
- Sediment P fluxes vary seasonally and are a function of both summer AND winter loadings
- A combination of measures may be necessary; including the following :
  - Planned WWTF improvements (expected reduction of 60% from P limits: 0.1 mg/l summer & 1.0 mg/l winter)
  - Lower winter P discharge from WWTF below 1.0 mg/l
  - Consider removing Ben Smith dam and if possible, Gleasondale and Hudson/Rt 85 dams

Questions?