**Summary – Workshop on hydrodynamic modeling for 'No-dams' alternatives**
**Centredale Manor Restoration Project**
**North Providence, Rhode Island**

**May 8, 2007**



**List of Attendees attached**

Agenda:

- Hydrodynamic Modeling Analysis by Kirk Ziegler, QEA (distributed to dialogue participants following the meeting)
- Q&As
- Discussion of impacts on river functions and uses

Kirk Ziegler provided a power point presentation outlining objectives of the study and key parameters in development of the model, including model boundaries and flow conditions for various channel designs.

Samples of questions raised and discussed during and following the presentation included:

- How will global warming and more frequent and intense flooding be addressed in this model?
- How change in water temperature and flow conditions will affect habitat and fish species, including potential for fish migration? Can analysis be conducted of what type of fish will survive in this area under a dam removal scenario?
- How the aesthetics and desirable recreational uses (swimming, boating and fishing, including "warm water fisheries" used by children) would be impacted?
- What is the impact on groundwater recharge?

In regard to questions on the potential future width of the channel and surface areas of the ponds, it was discussed that the model can show what configurations are possible to sustain what uses.

North Providence's representative expressed concerns from the perspective of abutters and the Town about alterations to the shore line and losing much of the water area and depth of the existing ponds.

Several participants noted that eventually they want to see the water used for boating, fishing, and other recreational uses. They also expressed an interest in creating an area where there is no sediment contamination under free flowing water and designing river banks which, while sustaining shade-creating vegetation, do not threaten future contaminant releases.

EPA noted that one advantage of dam removal as part of the cleanup alternatives is a potential for more flexibility in dealing with the excavated sediment should it not be shipped off-site. The PRPs' contractors noted that additional land mass can be created for public access and use as well as new ecological systems.

Ownership issues, should new upland be created, were also mentioned by the State and North Providence representatives. Concerns about long-term monitoring and maintenance of such areas were also raised.

It was suggested that the participating parties work together to "identify the values and functions" that the water can play - both with, and then without the dams in place. It was suggested that such evaluation can be done with a public-friendly list of "pros and cons" for the dam removal options.

At the end of the meeting EPA agreed to reconvene for another meeting when initial results of the modeling on the various pond/channel configurations are available, expected to be in late summer. EPA will contact all interested parties.

5/8/07

# Centerdale Manor Hydrodynamic Modeling Meeting

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|---|---|---|
| Louis Maccarone | RIDEM | 401-222-2797 x 7142 / louis.maccarone@dem.ri.gov |
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| Diedre Dahlen | Battelle | |
| Greg Peterson | LimnoTech | |
| Dave Scotti | LEA | |
| Beverly Lawerence | ACoE | |
| Mark Geib | ACoE | |
| Mark Otten | Battelle | |
| Jeff Karp | | |
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via phone

# Centredale Manor Dam Removal:
## Hydrodynamic Modeling Analysis

**C. Kirk Ziegler**
**Quantitative Environmental Analysis, LLC**

QEA

**May 8, 2007**

# Overview of Presentation

- Study objectives
- Development of hydrodynamic model
- Hydrodynamic modeling: Primary Study Area
  - Channel design
  - Effects of dam removal on high-flow events
- Hydrodynamic modeling: Manton Dam to Confluence

# Study Objectives

- **After dam removal:**
  - **Evaluate various channel designs in Allendale and Lyman Mill Pond areas after dam removal**
  - **Investigate hydrodynamics and extent of floodplain inundation in Allendale, Lyman Mill and Manton Pond areas**

- **Evaluate effects of dam removal on stage height and floodplain inundation during high-flow events in region from Manton Dam to confluence of Woonasquatucket and Moshassuck Rivers**

# Description of Hydrodynamic Model

- Using EFDC, which is a well-tested model that is supported by USEPA
  - Same model used during sediment stability study conducted by QEA for Battelle, USACE and USEPA

- This model has the ability to simulate over-bank flow and floodplain inundation during high-flow events

# Model Development: Numerical Grid

- Model domain extends from:
  - Upstream boundary at USGS Centredale gauging station
  - Downstream boundary at Manton Dam
  - Approximately 2.3 miles
- Includes floodplain areas
- High-resolution numerical grid needed for channel design process
  - Original approach: 1-meter square grid
  - Initial testing indicate 1-meter grid is not feasible
  - Developed 2-meter grid

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# Model Development: Parameters

- Primary hydrodynamic parameter is effective bed roughness ($Z_o$)
  - Calibration during bed stability study yielded $Z_o$ = 0.1 cm

- Uncertainty in $Z_o$ after dam removal will be addressed through use of bounding simulations
  - Establish realistic upper- and lower-bound values for $Z_o$
  - Level of uncertainty in predictions reflected in results of bounding simulations

# Model Development: Boundary Conditions

- **Upstream boundary: inflow**
  - Based on historical data collected at USGS gauging station
  - Flood frequency analysis conducted by Maureen Corcoran (USGS)

- **Downstream boundary: stage height at Manton Dam**
  - Using standard weir equation to determine stage height as function of flow rate

# Model Application in PSA:

## Channel Design

- **Model will be used to support AMEC/LEA during design of new channel after dam removal**
- **Bathymetry/topography of numerical grid will be adjusted to incorporate various channel designs**
  - **High-resolution grid provides flexibility necessary for channel design**
  - **Iterative process**

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# Model Application in PSA:

## Channel Design

- For a particular channel design, four flow conditions will be simulated:
  - Low flow (7Q10 flow)
  - Average flow
  - 2-year flood
  - 100-year flood

- For each flow condition, upper- and lower-bound simulations using different $Z_o$ values will be conducted
  - Bounding simulations provide estimate of uncertainty in model predictions

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# Model Application in PSA:

## Channel Design

- **Model results will be presented as graphical representations of:**
  - **Current velocity**
  - **Bed shear stress**
  - **Stage height**
  - **Extent of floodplain inundation**

# Model Application in Manton Pond Area:

## Effects of Dam Removal

- **Focus on high-flow events**
  - **2-year and 100-year floods**

- **Compare hydrodynamics with and without upstream dams in place**
  - **Current velocity**
  - **Bed shear stress**
  - **Stage height**
  - **Extent of floodplain inundation**
  - **Flow rate at Manton Dam**

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# Hydrodynamic Modeling Analysis for Manton Dam to Confluence

- Compare predicted hydrographs at Manton Dam during floods with and without upstream dams
- Determine extent of impact of dam removal on flood hydrograph
  - Decide if additional analysis is necessary
- If needed, a hydrodynamic modeling analysis for the region downstream of Manton Dam will be conducted

# Manton Dam to Confluence Analysis:

## Model Development and Application

- Apply 1-D hydrodynamic model to region from Manton Dam to the confluence
  - Widely used USACE model: HEC-RAS
- Will need to collect bathymetry data between Manton Dam and the confluence
- Use 1-D model to simulate 2-year and 100-year floods with and without upstream dams
  - Comparisons of stage height and floodplain inundation

QEA