Dam Removal
Project Overview

Brian Graber
American Rivers

Vermont Project Manager Training
October 22, 2009
American Rivers
*Thriving By Nature*
More than 740 dams have been removed around the country
More than 13,126 dams in CT, RI, MA, VT, NH (databases)
Removing a dam seems like an intimidating process.
You'd like to manage a project
Goals:

1) Understand the dam removal process

2) Be able to scope out the components of a project
Understand the overall dam removal process and components
Dam Components

- Impoundment
- Spillway
- Sediment
- Gates
- Infrastructure
Determine the challenges specific to your project

- Sediment quantity
- Sediment quality
- Dam size
- Dam condition
- Impoundment size
- Impoundment shape
- Surrounding infrastructure
- Surrounding environment

The depth of analysis should reflect the scale of the project: make easy projects easy and complex projects complex.
Step 1: The dam owner must be on board with the project

Overall Process: Initial Reconnaissance
Several factors separate easy projects from difficult projects:

- Land ownership
- Current dam uses
- Public interest

Overall Process: Initial Reconnaissance
Several factors separate easy projects from difficult projects:

- Contaminants
- T & E species
- Infrastructure

Overall Process: Initial Reconnaissance
Funding hooks

Diadromous Fish
Brook Trout
Listed Species

Overall Process: Initial Reconnaissance
The project manager’s role is to coordinate
Expect that projects will take 3 years to complete

Year 1: Recon. and Prelim. Design

Year 2: Design and Permitting

Year 3: Implementation

Overall Process: Project Manager Role
Dam removal projects have several steps

1. Initial Reconnaissance
2. Fundraising
3. Preliminary/Concept Design
4. Community/Stakeholder Involvement
5. Permitting (and pre-permitting)
6. Engineering and Restoration Design
7. Construction
8. Monitoring

Who does the work?

Overall Process: Project Manager Role
The basic steps cover 4 major topics:

1. **Fundraising**
2. **Permitting**
3. **Social Issues**
4. **Design/Construction**

*Overall Process: Project Manager Role*
Consider long-term benefits vs. short-term impacts

Flow Regime

Water Quality

Continuity

Complexity
Removing the structure alone will provide most of the restoration

Overall Process: Long-Term Benefits/Short-Term Impacts
Some *short-term* impacts occur during construction.

- Sediment movement
- Construction access
- Habitat change

Overall Process: Long-Term Benefits/Short-Term Impacts
There are 3 potential long-term impacts if not managed well:

- Contaminants
- T & E species
- Infrastructure

Overall Process: Long-Term Benefits/Short-Term Impacts
Understand the components of designing a dam removal

<table>
<thead>
<tr>
<th>Data Collection/Surveying</th>
<th>Hydrology/Hydraulics</th>
<th>Sediment Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protecting Infrastructure</td>
<td>Species Protection</td>
<td>Site-Specific Issues</td>
</tr>
</tbody>
</table>
Data Collection and Surveying
Find existing data on the dam and the river

- Past Dam Inspections (state dam safety)
- FEMA - FIS, profiles, plans, and computer model (state, town library or engineer), or
  http://www.msc.fema.gov
- Aerial or orthophotographs (web or order)
  http://maps.google.com
  http://earth.google.com
- USGS topographic mapping
- Local topographic mapping (town, state, web)
- Sanborn mapping (commercial properties to 1867):
  http://www.edrnet.com/sanborn.htm
- Historic topo maps: http://historical.maptech.com
  For northeast:
  http://docs.unh.edu/nhtopos/nhtopos.htm
- Tax Assessors Mapping (town)
- Geological mapping
- GIS Data (town, region, or state)
- State Rare & Endangered Species Mapping
- Wetland Mapping
- EPA Watershed Mapping & Info
  http://www.epa.gov/surf/
- USGS Gauge Data (flow & sediment)
  http://water.usgs.gov/
- Additional Flow Data (state, web, ACOE, local group, old reports)
- Fisheries Data (state)
- Past Plans. (of dam, site, or nearby construction) (DOT, town engineer, state)
- Permit applications (town, state, feds, or web)
- Old Reports (environmental, historic, engineering, planning, state studies, etc.)
- Photographs (current and historic) (town, neighbors)
- Historic Records (town, state)
- FERC Reports: http://elibrary.ferc.gov
- Utility Information (town or state)
- Web pages for local recreation

Design Components: Data Collection/Surveying
Survey dam structure, longitudinal profile, cross sections, and sediment depths
Survey long profile through impoundment; survey cross sections to capture change

Design Components: Data Collection/Surveying
Hydrology/Hydraulics
What’s the difference between hydrology and hydraulics?

Hydrology:
Magnitudes and probabilities of flows

Hydraulics:
Depths and velocities of flows
Does your dam provide flood control? Probably not

No Flood Storage Potential: has full impoundment and constant flow over spillway

Flood Storage Potential: has storage volume and flow through a controlled outlet

Design Components: Hydrology/Hydraulics
What’s a HEC-RAS and when do you need one?

- Infrastructure protection
- To prove fish passage
- Post-project water levels for stakeholders
- Advanced sediment transport modeling
- To prove no flood control?

Design Components: Hydrology/Hydraulics
Sediment Management
Some general sediment thoughts

- Consider background yield
- Sediment can be beneficial or harmful
- Not all dams have a lot of sediment
- Not all sediment moves

Design Components: Sediment Management
Assess the quantity, particle sizes, quality, and potential mobility of impounded sediment.
The longitudinal profile is a fundamental sediment analysis tool.

Ox Pasture Brook Longitudinal Profile - 8/22/06

Design Components: Sediment Management
Test sediment for contaminants and compare to ecological and human risk thresholds

- Complete ‘due diligence’
- Assess quantity of sediment
- Collect sediment cores (not grabs)
- Test for organics and heavy metals
- Compare test concentrations to human risk and ecological thresholds

Design Components: Sediment Management
There are several approaches to managing clean sediment (depending on quantity and particle sizes)

- Natural erosion
- Sediment removal (dredging)
- Stabilize in place
  - Open dam gates
  - Remove dam slowly
  - Remove dam in stages
- Combined approaches
There are fewer approaches to managing contaminated sediment

- Management options
  - Remove and dispose
  - Isolate and cap

- If contaminant management is necessary, can greatly add to cost of project

- Conundrum: dams are not good hazardous waste containment facilities
Protecting Infrastructure
Consider whether any infrastructure is at risk

Design Components: Protecting Infrastructure

- Bridges
- Retaining walls
- Utilities
Look in and along impoundment and in the dam for at-risk bridges, retaining walls, or utilities.

Design Components: Protecting Infrastructure
Management approaches: always consider if infrastructure can be moved first; next consider direct stabilization.
Species Protection and Additional Restoration (beyond structure removal)
Identify if species of concern could be affected by dam removal

- Contact the Nongame and Natural Heritage Program

- Maps are available at: (http://maps.vermont.gov/imf/sites/anr_natresviewer/jsp/launch.jsp)
Manage for Aquatic Species

- Time the removal
- Manage sediment
- Relocate species
- Monitor during construction

Design Components: Species Protection/Restoration
Revegetate and consider multiple species and multiple life stages in additional restoration plans.
Dam uses can often be replaced

Design Components: Site-Specific Issues
Other site-specific issues:

well impacts, ice jams, parks, walking trails, renderings, etc.
You now have the basis for writing a scope of work

<table>
<thead>
<tr>
<th>Data Collection/Surveying</th>
<th>Hydrology/Hydraulics</th>
<th>Sediment Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protecting Infrastructure</td>
<td>Species Protection</td>
<td>Site-Specific Issues</td>
</tr>
</tbody>
</table>
Understand the components of (de)construction
First, slowly drain the impoundment
There are several approaches to removing a structure:

- **Explosives**
- **Heavy Machinery**
- **By Hand**
We almost never use explosives in the northeast.
Most commonly a backhoe with a hydraulic hammer will breach one side and then move across.
We have also used more careful construction approaches.
Dam RemovalClearinghouse:
http://www.lib.berkeley.edu/WRCA/damremoval/index.html
Initial Reconnaissance: Is My Project Easy or Complex?
<table>
<thead>
<tr>
<th>Dam name</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marshfield-8 Dam</td>
<td>Winooski River, Marshfield, VT</td>
</tr>
</tbody>
</table>

| Dam owner         | Land ownership around impoundment |

| Ecological benefits | Community benefits |

Initial Recon: Marshfield-8 Dam
<table>
<thead>
<tr>
<th>Existing dam uses</th>
<th>Infrastructure issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rare species</td>
<td>Sediment quality</td>
</tr>
<tr>
<td>Community concerns</td>
<td>Funding possibilities</td>
</tr>
<tr>
<td>Dam name</td>
<td>Location</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Swanton Dam</td>
<td>Missisquoi River, Swanton Village, VT</td>
</tr>
</tbody>
</table>

| Dam owner        | Land ownership around impoundment |

<table>
<thead>
<tr>
<th>Ecological benefits</th>
<th>Community benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing dam uses</td>
<td>Infrastructure issues</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Rare species</td>
<td>Sediment quality</td>
</tr>
<tr>
<td>Community concerns</td>
<td>Funding possibilities</td>
</tr>
</tbody>
</table>
Developing a Scope of Work
Consultant Hiring Process

One approach:
• Simple bid request
  – Express goals of project, but not details
  – Consultants give details in their proposal

• Detailed scope of work
  – Negotiated between hiring entity and consultant
  – Covers both hiring entity and consultant for exact performance
Scope of Work Potential Topics

• Data Collection
• Survey and Mapping
• Sediment Assessment
• Hydrology/Hydraulics
• Structure Removal
• Channel/Riparian Restoration
• Species Assessment/Protection
• Site-specific Issues
• Monitoring
• Drawings
• Permitting
• Reports
• Meetings

Developing a Scope of Work: Marshfield-8 Dam
Developing a Scope of Work: Marshfield-8 Dam
Scope of Work Potential Topics

- Data Collection
- Survey and Mapping
- Sediment Assessment
- Hydrology/Hydraulics
- Structure Removal
- Channel/Riparian Restoration
- Species Assessment/Protection
- Site-specific Issues
- Monitoring
- Drawings
- Permitting
- Reports
- Meetings

Developing a Scope of Work: Swanton Dam
Developing a Scope of Work: Swanton Dam
Developing a Scope of Work: Swanton Dam
Developing a Scope of Work: Swanton Dam
Developing a Scope of Work: Swanton Dam
Developing a Scope of Work: Swanton Dam
Developing a Scope of Work: Swanton Dam
Developing a Scope of Work: Swanton Dam
Things that Go Wrong
(And How to Make Them Go Right)
What to Look for in a Consultant

• Integration of skills
  – Engineering, geomorphology, ecology (and experience with this integration)
  – Permitting
  – Presentation skills
  – Responsiveness and project management
  – No one firm is truly good at all of these

• Consider requiring subconsultants
A Traditional Engineering Approach
Blending Skills: Engineers, Geomorphologists, Biologists
Remove the full vertical extent of the dam (and as much of the lateral extent as possible)
Construction oversight is critical
Be cautious/skeptical with structural approaches