Stream Restoration Symposium 2019

Lessons Learned from Stream Restoration in Other Jurisdictions

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5 | SMOOTH STONES
RESTORATION INC

Toronto and Region Conservation Authority

Dam Removal and Stream Restoration

Stantec

Lessons Learned from Stream Restoration in Other Jurisdictions

November 13, 2019

Michael Chelminski, P.E., Principal
Stantec Consulting Services Inc.

Photograph by Stantec

Agenda

- ✓ ***Safety Moment***

1.0 Introduction

2.0 Reasons for Dam Removal

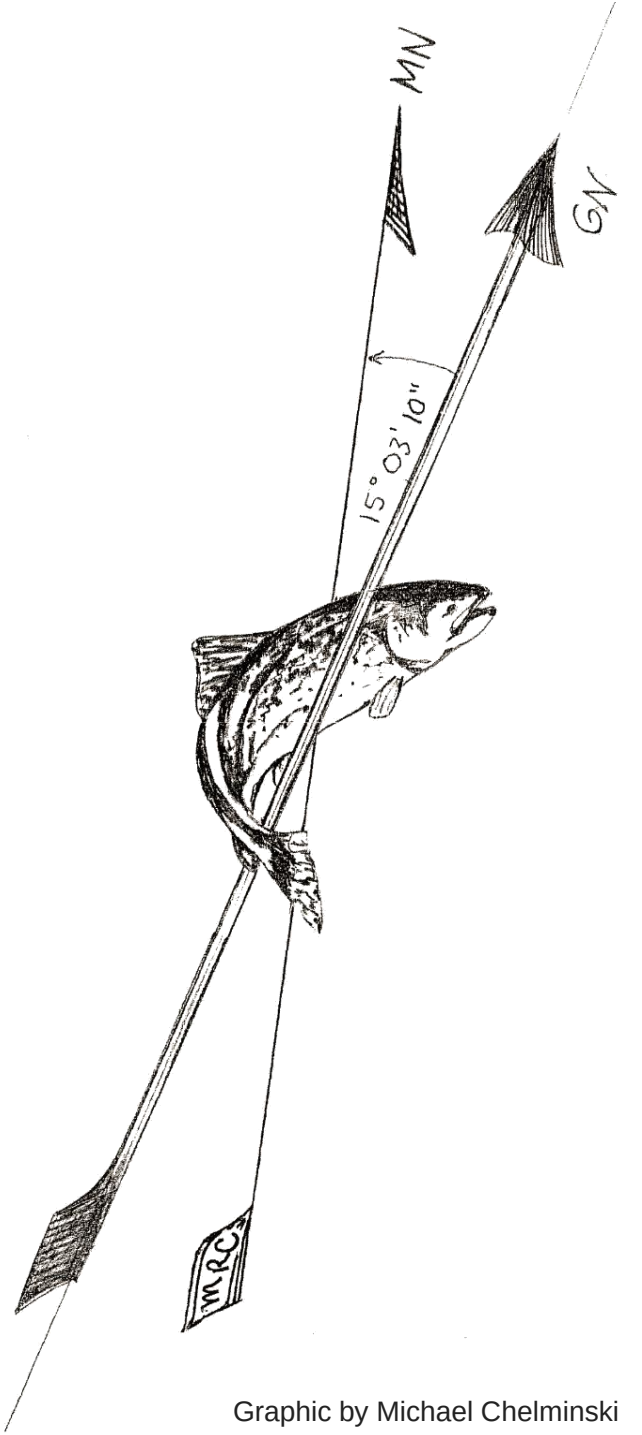
3.0 Dams in the Riverscape

4.0 Dam Removal Process

5.0 Alteration of Fluvial Processes

6.0 Dam Removal &
Stream Restoration

7.0 Questions & Responses



Graphic by Michael Chelminski

Safety Moment

Source: Global News
https://globalnews.ca/news/5398506/dam-failure-road-quinte-west/
June 2019 Dam Failure in Quinte West, Ontario

- Damage to Roads
- Exposure of Gas Main
- Vehicle Swept into River

-road-quinte-west/

ork Time... Washington Post: B... DuckDuckGo — Pri... ARC Service Login Atlantic Salmon Fis...

Global NEWS

World Canada Local Politics Money Health Entertainment Lifestyle Watch

CANADA

Dam failure causes road collapse in Quinte West

BY ALEXANDRA MAZUR - GLOBAL NEWS

Posted June 17, 2019 10:01 am

— A dam failure in Quinte West destroyed a large portion of Trenton-Frankford Road in Glen Miller, Ont. *City of Quinte West*

Share the River,
Share the Road,
Share the Load.

Section 1.0: Introduction

Photograph by Jimmy Powell, Jones River Watershed Association

Ontario Guidance on Small Dam Removal

Existing Guidance is Available for Small Dam Removal in Ontario:

https://www.ontario.ca/page/small-dam-removal

- *"Why Should You Consider Removing Your Dam*
  1) *Safety*
  2) *Economic*
  3) *Environmental*
  4) *To Improve Water Quality*
  5) *Societal"*

The next item in the list is:

"Approvals Required"

The Challenge:

- Regulatory processes for dam removal can be daunting…

A Good Resource for Small Dam Removal

Massachusetts Division of Ecological Restoration

- 10 years as a State Division
- Predecessor entities ("Riverways Program", "Wetlands Restoration Program") as state "programs"

➢ Success based on persistence and collaboration

- Relevant Materials
  - ✓ Annual Reports
    https://www.mass.gov/lists/ders-publications#annual-reports-
  - ✓ Ebb & Flow Newsletter
    https://www.mass.gov/lists/ders-publications#der's-newsletter---ebb&flow-
  - ✓ Restoration and Economy Reports
    https://www.mass.gov/lists/ders-publications#restoration-and-economy-reports-

What did the fish say when it went upriver?

Section 2.0
Reasons for Dam Removal

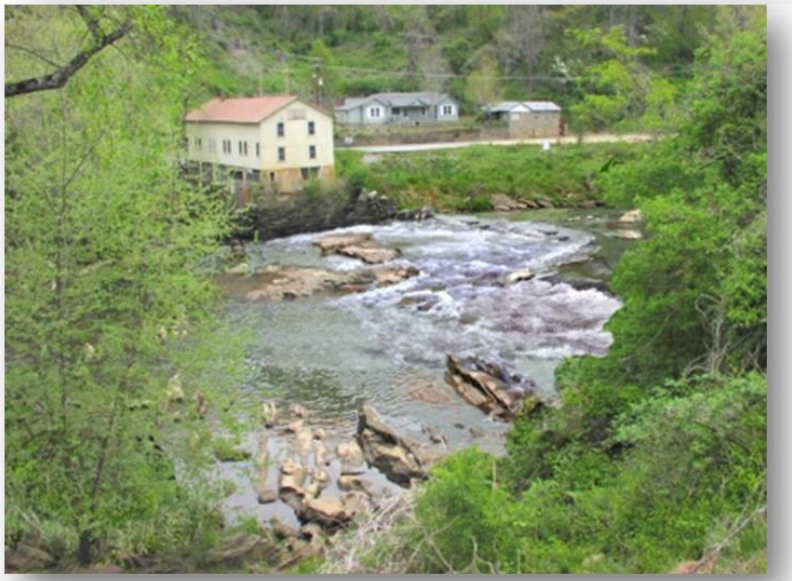
Photograph by Stantec.

General Drivers for Dam Removal

- Public Safety & Dam Safety
- Fish Passage
- Aquatic Habitat Restoration
- Restoration of Fluvial Processes

- Boating Access
- Water Quality

- *Opportunities:*
  - *Restoration*
  - *Mitigation*
  - *Compensation*



Tuckasegee River, Dillsboro Dam: Photograph & Photo-Simulation for Stantec.

Dam Removal Pros and Cons

Pros

- Eliminate Dam Safety Concerns
- Eliminate Dam Maintenance & Operations
- Eliminate Dam Costs
- Eliminate Safety Hazards
- Eliminate Dam Impacts to Natural Resources

Cons

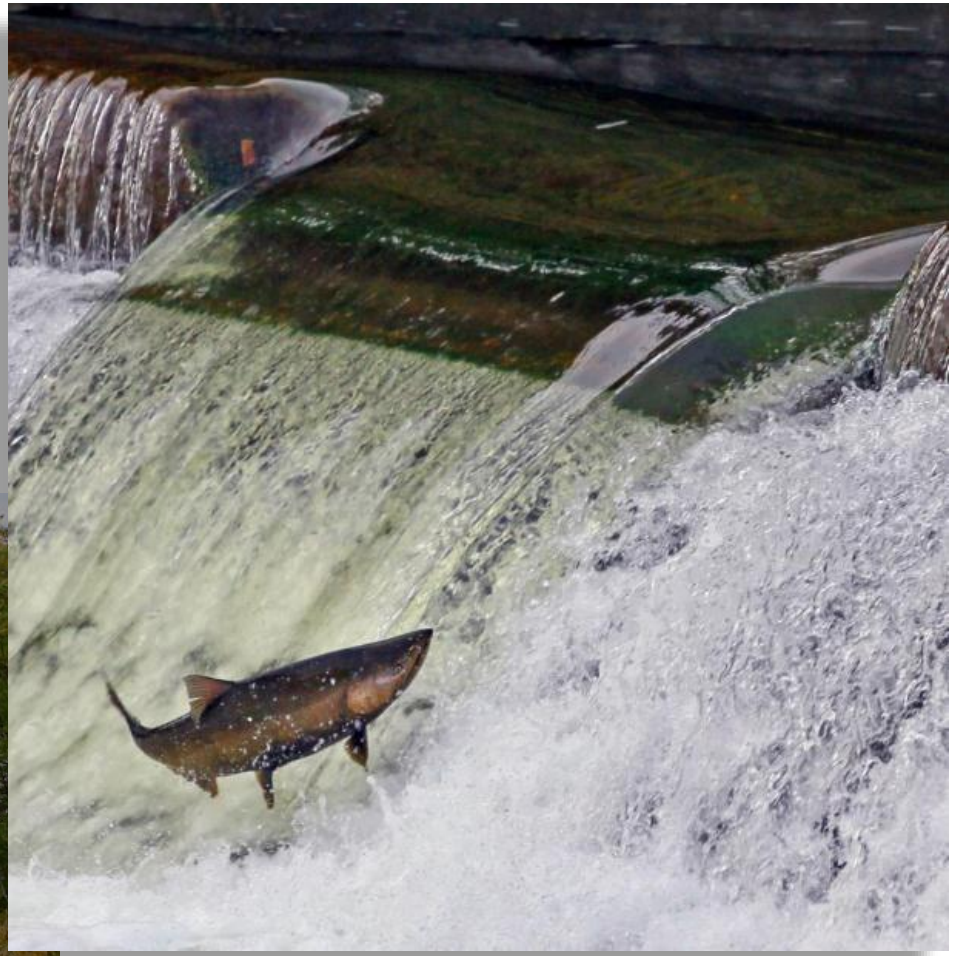
- Eliminate Benefit(s) of Dam
- Limited Dam Removal Experience
- Applicable Regulations are Evolving
- Dam Removal Impacts to Natural Resources

Photograph by Stantec

Example: Humber River Weirs, Ontario

Opportunities & Constraints

- Maintenance Costs
- Upstream Fish Passage (provide and prevent)
- Sediment
- Public Perceptions



Photographs by Stantec

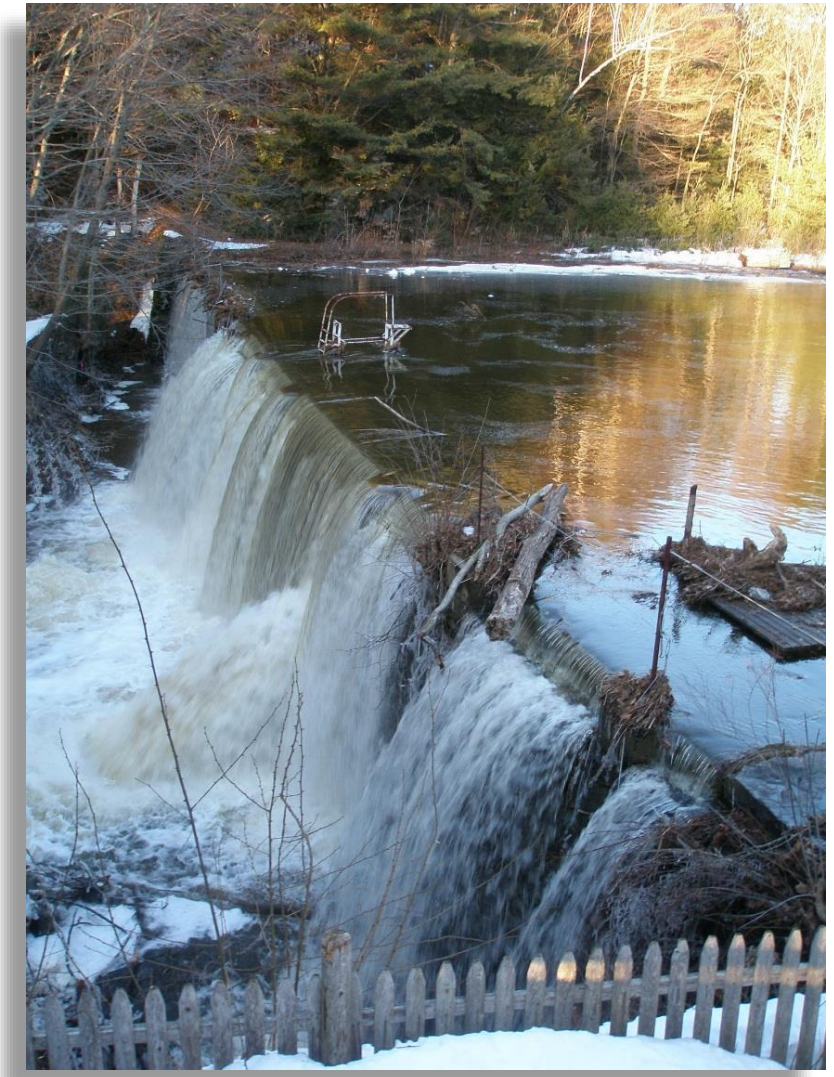
Count the Dams on Your Rivers

Section 3:
Dams in the Riverscape

Photograph by Stantec

Dams and Small Dams

- **What is the definition of a "Small Dam"?**
  - Reference applicable dam safety regulations!
  - Reasonable Definition:
  - "*Hydraulic Height Less than 25 ft*."
- **Alternative Definition:**
  - *"A dam that no longer serves its intended purpose and is not financially viable."*



Photograph by Stantec

Restoration of Sediment Transport

Amethyst Brook Restoration Project

- **Dam Removed in December 2012**

Photographs by Stantec.

October 26, 2012

November 9, 2012

December 6, 2012

April 14, 2013

May 10, 2013

June 6, 2013

Dams in the Riverscape

- **Ecological Impacts**
  - Cumulative Impacts on Connectivity
- **Infrastructure Impacts**
  - Cumulative Impacts to Adjacent Infrastructure
  - Emergency Response
- **Small Dam Removal Objective**
  - Eliminate or Reduce Risk
  - Improve Resiliency

Photograph by Stantec.

Image and Content Credit: ASCE

2017 American Society of Civil Engineers Infrastructure Report Card

- "D" is for "Dam"
- "D+" in 2012 ASCE Report Card.

✓ The trend is in the wrong direction.

Planning is good!

Section 4.0:
Small Dam Removal Project Process

Photograph by Stantec

Targeting Dams for Removal

1. Targets based on <u>expected beneficial and adverse impacts</u> to natural resources.

2. Targets based on relative cost of dam removal versus ongoing maintenance costs and/ or reconstruction.

Photograph by Stantec

The Top 2 List of Stakeholder Comments:

1. **"The River Will Go Away!"**
2. **"It Will Look Like Low Tide Forever!"**

Table 1: Small Dam Removal Hydrology

Scenario	Flow (m^3/s)					
	Summer	***Bankfull***	***10-Year***	***50-Year***	***100-Year***	***500-Year***
Dam (existing conditions)*	1.1	6.2	10.2	14.5	18.7	21.8
Dam Removal (perception)	0	"what?"	20	30	39	45
Dam Removal (reality)	~1	~6	~10	~15	~19	~22

***Note:** Existing values obtained from analysis of real-time hydrometric data station conveniently located near the dam.*

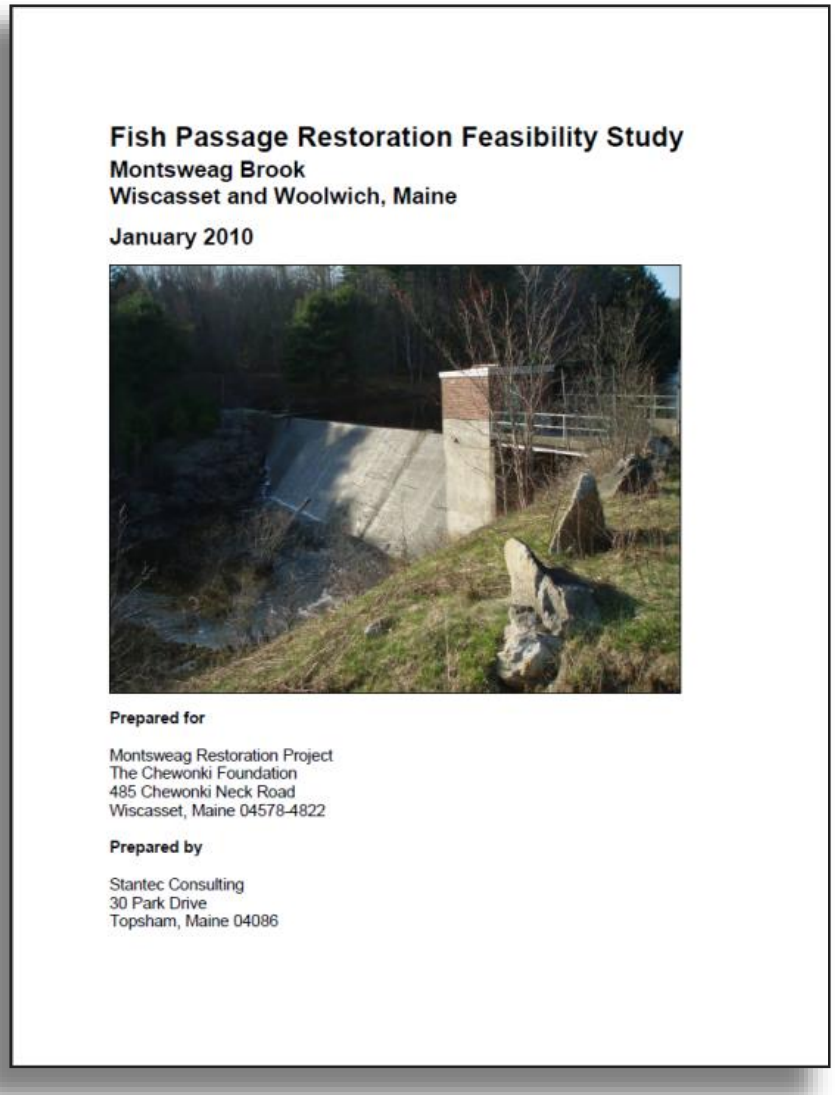
Typical Small Dam Removal Process

Typical Process

1. Planning
2. Reconnaissance
3. Feasibility Study*
4. Design & Permitting
   (NOT "Design and then Permitting")
5. Construction

**Feasibility studies must be properly scoped to acknowledge that primary issues are usually associated with costs and social factors.*

Technical issues usually are addressed as part of design.



Fish Passage Restoration Feasibility Study
Montsweag Brook
Wiscasset and Woolwich, Maine

January 2010

Prepared for

Montsweag Restoration Project
The Chewonki Foundation
485 Chewonki Neck Road
Wiscasset, Maine 04578-4822

Prepared by

Stantec Consulting
30 Park Drive
Topsham, Maine 04086

Permitting Process(es)

Background

- Natural Resource Permitting Requirements are Focused on Development-Based Activities.
- Regulatory Agencies are Stakeholders.
- Design/Engineering may encounter unfamiliar conditions.

Approach

➢ Top-down approach (e.g., permitting follows design) may not be efficient or effective.

✓ Integration of design and permitting.

✓ Early and frequent communication.

Photograph of client stuck in the mud by Stantec.

Scoping for Design and Permitting

- Scoping for dam removal can be difficult.
- Regulatory requirements and drivers are not well adapted for dam removal.
- Design may be broad-brushed and not focused and result in high associated cost.
- Dam removal projects require work in protected resources.
- Uncertainty and varying opinions regarding beneficial and adverse impacts.

✓ Scoping benefits from a multi-disciplinary process.

✓ Engage and Inform Stakeholders.

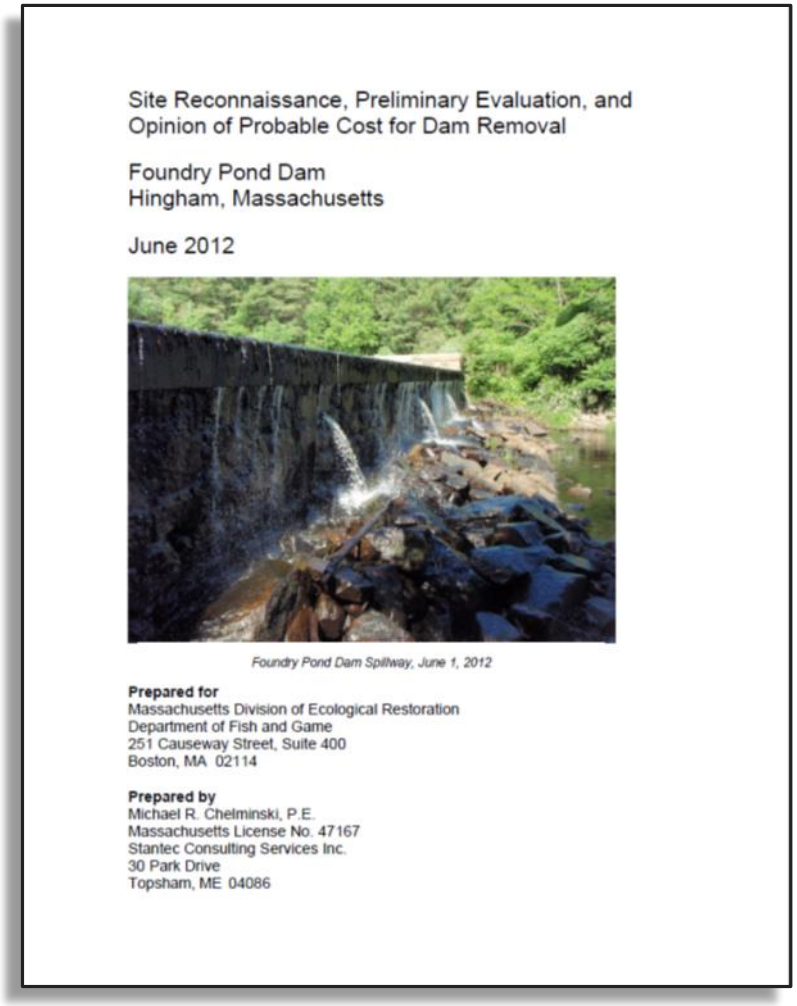
Planning and Reconnaissance

Planning for Dam Removal:

- Plan for Success
- Project Selection
- Stakeholder Engagement

Reconnaissance Study Elements

- ½-Day Site Visit
- Project Dam
- Stakeholder Concerns
- Resource Issues
- Sediment Management
- Conceptual Design
- Conceptual Permitting Approach
- Preliminary Costs
- ✓ Facilitate Stakeholder Engagement



Site Reconnaissance, Preliminary Evaluation, and Opinion of Probable Cost for Dam Removal

Foundry Pond Dam
Hingham, Massachusetts

June 2012

Foundry Pond Dam Spillway, June 1, 2012

Prepared for
Massachusetts Division of Ecological Restoration
Department of Fish and Game
251 Causeway Street, Suite 400
Boston, MA 02114

Prepared by
Michael R. Chelminski, P.E.
Massachusetts License No. 47167
Stantec Consulting Services Inc.
30 Park Drive
Topsham, ME 04086

Summary of Planning Process for Small Dam Removal

1) Planning:

- Develop & Implement a Plan

2) Reconnaissance:

- Site visit
- Fatal flaws (e.g., infrastructure)
- Brief report
- $5K - $10K

3) Feasibility

- Site Data Collection
- Sediment, Hydrology, Wetlands
- Preliminary Design
- $50K - $100K

4) Design & Permitting

- Engage Permitting Agencies
- Design, Permitting
- Reengage Permitting Agencies
- $200K - $500K

First Principals: Example Project

Study Approach

- Understanding Impacts
- Technical Studies
- Project Development
- Impacts to Resource

Lessons Learned

- Accommodate Constraints
- Focus on Primary Element(s)
- Impact Assessment
- Integration of Design and Permitting

Example:
Little River Dam Removal, Maine

Basis of Design

- "Blow and Go"

Dam Removal Construction

- September 21, 2009

Photograph by Stantec.

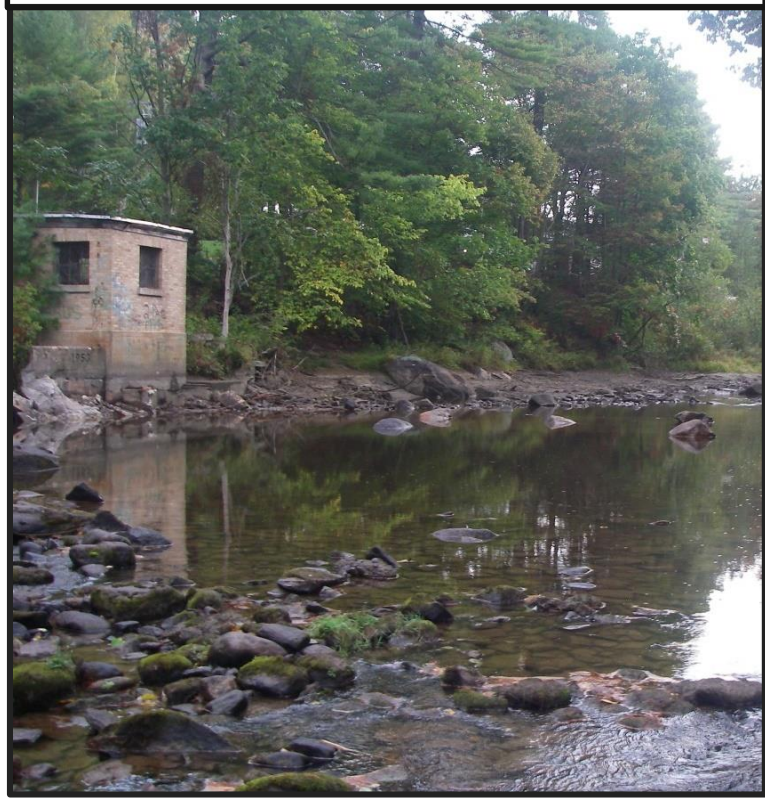
First Principals: Lessons Learned

Accommodate Constraints & Uncertainty

1) Dam removal design and permitting including beneficial reuse of demolition debris on site.
2) "Stream restoration" was limited to:
   a) Placement of boulder debris in channel; and
   b) Limited grading of streambanks.
3) "Difficult" elements of project were accommodated:
   a) Pump house retained; and
   b) In-water impacts minimized by not attempting to reconstruct the channel.

Example:
Little River Dam Removal, Maine

Result: Continuity Restored of Fluvial Processes



Photograph by Stantec.

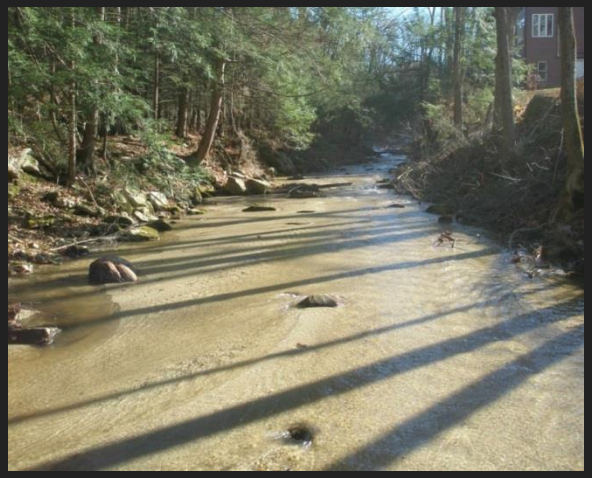
Water Management

Photographs by Stantec.

How to Manage Water?

- Work in the Dry ($$$)
- Work in the Wet
- ✓ Work in the Damp
- ➢ *Consider time-value of impacts*

October 26, 2012



November 9, 2012

December 6, 2012

April 14, 2013

May 10, 2013

June 6, 2013

Bartlett Rod Shop Company Dam

Section 5.0: Alteration of Fluvial Processes

Photograph by Stantec

Alteration of Fluvial Processes

1) 7 Meter Height Dam in Poor Condition
2) Alteration of Physical Habitat
3) Minimal Alternative Hydrology
4) Alteration of Fluvial Processes
   - Sediment Transport
   - Morphology
5) Equilibrium?

Photographs by Stantec

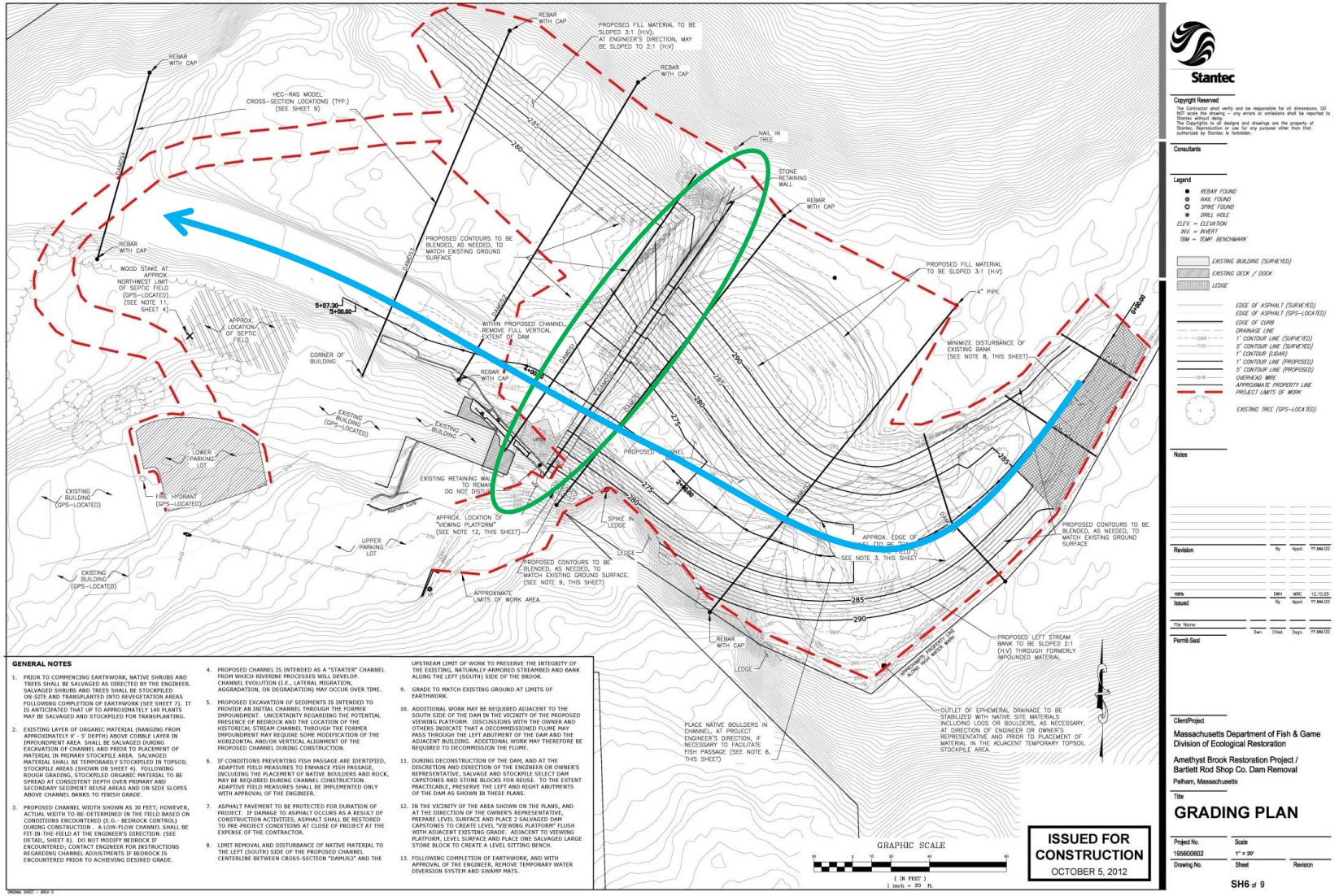
Alteration of Fluvial Processes

- Dam Safety Concerns are Warranted?

Photographs by Stantec

Section 5: Alteration of Fluvial Processes

Dam Removal Results in Alteration of Fluvial Processes



Design by Stantec

Construction Approach

1) ~4,000 M^3 of Sediment Repositioned Onsite
   - River Maintains Access to Sediment

Photograph by Stantec

Movie Time

Construction Is A Mix of Natural and Anthropogenic Processes….

Still Image Movie by Massachusetts Division of Ecological Restoration

Channel Evolution

Photographs by Stantec

May 28, 2013

July 7, 2013

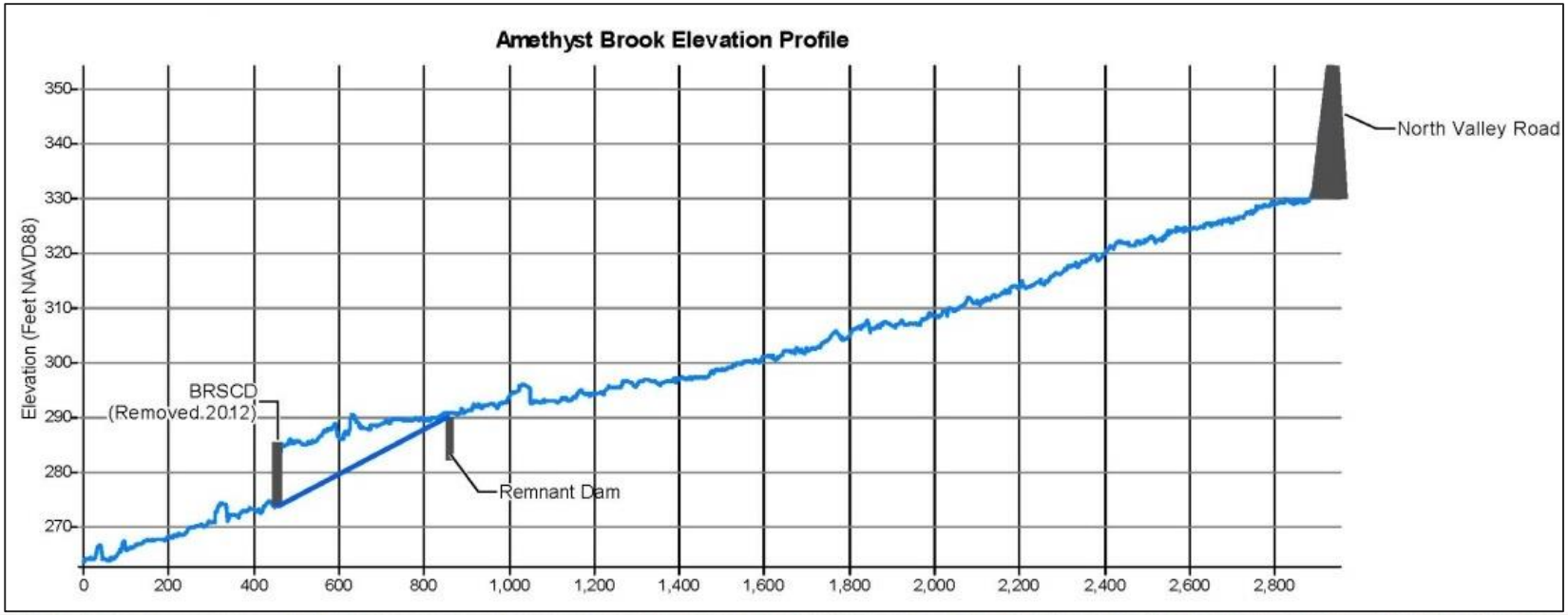
April 5, 2014

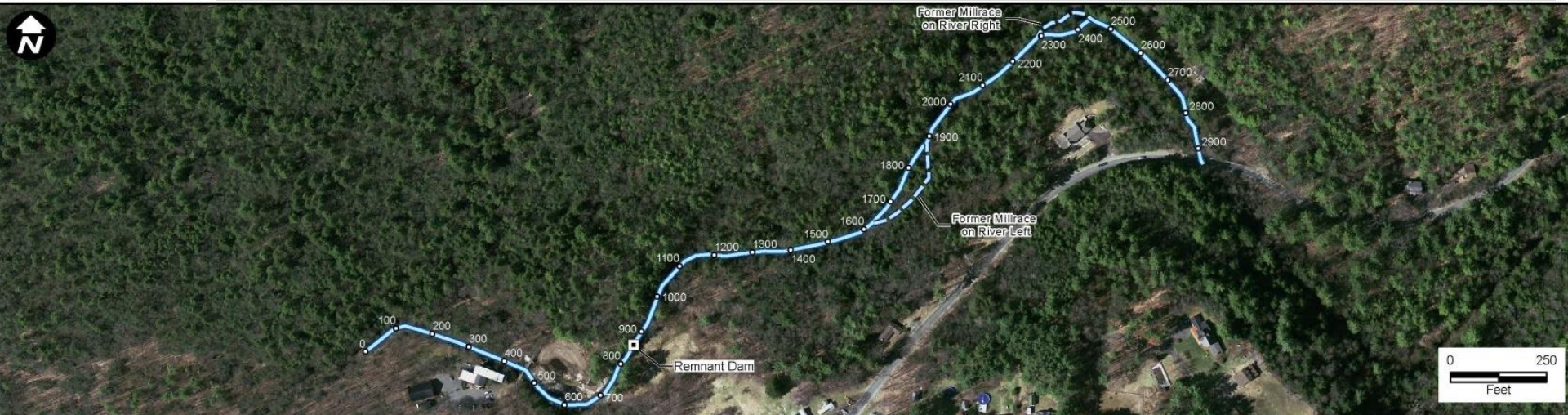
May 22, 2014

Section 5: Alteration of Fluvial Processes

Dam!

Images by Stantec





Success Builds a Foundation

- 2.5-M High Dam
- Construction Access
- Funding

- ✓ Streamlined Permitting Process
- ✓ Construction "In the Wet"

Photographs by Stantec

Timber Dam
May 28, 2013

Timber Dam Removal
January, 2016

Low Tide?

Section 6.0:
Dam Removal & Stream Restoration

Photograph by Stantec

When and Why

Factors that May Drive Active Restoration

- Project Goals & Objectives
- Sediment Management
- Infrastructure
- Aesthetics
- Available Funding

✓ Drivers are Project Specific

Photograph by Stantec

"Low Tide" Doesn't Last Forever

Montsweag Brook Dam Removal – No Active Restoration

June 1, 2010: Drawdown

July 13, 2011: Nine months post-removal

Photographs by Stantec

Example of Dam-Infrastructure Coupling

- **Small Dam Removed Approximately 500 ft Downstream in 2016**
  - Active and abandoned water mains (buried and exposed)
  - Abandoned 30-inch Water Main is a Barrier to Upstream Fish Passage

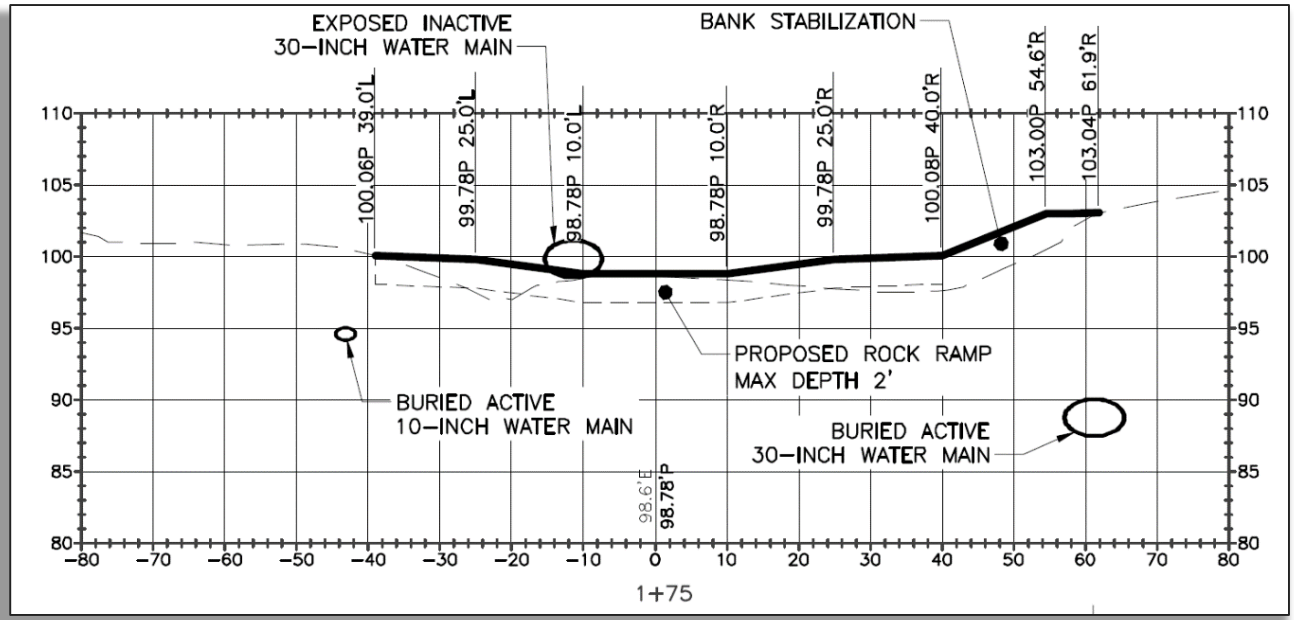
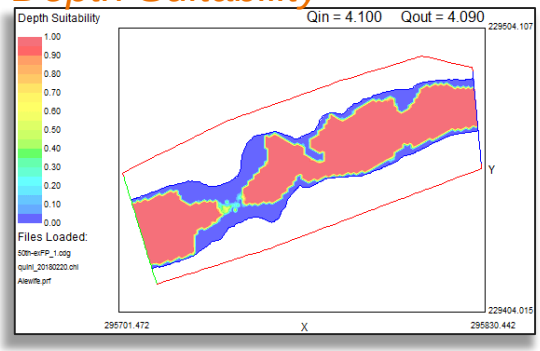


Image and photograph by Stantec

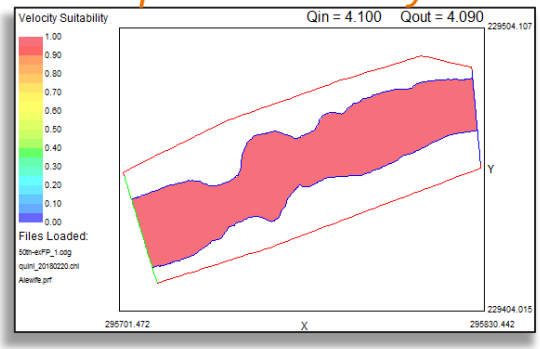
Water Main Protection Project Example

- **Design and Permitting**
  - Natural Resource Protection Rules & Regulations
  - Maintenance of Infrastructure Services
  - Engineering Design

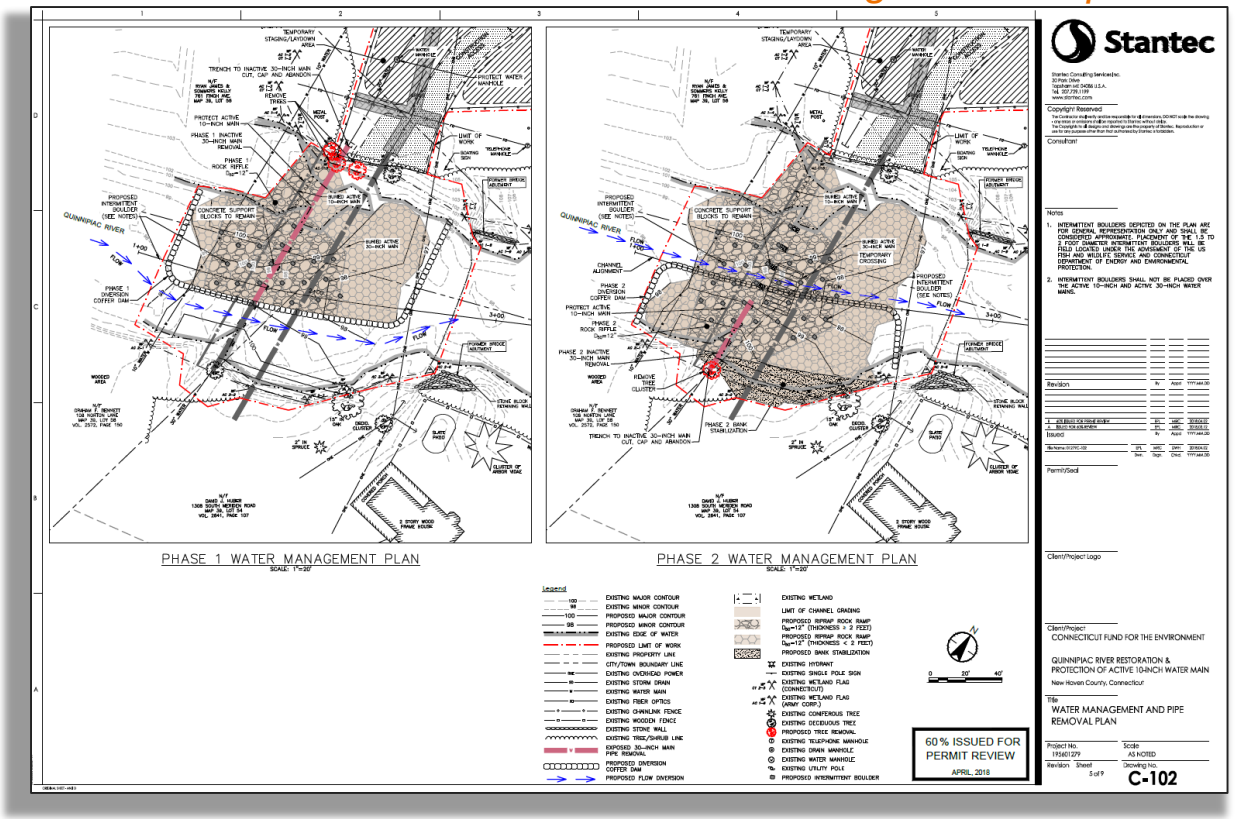
Depth Suitability



Flow Speed Suitability



Water Management Sequence



Images by Stantec

Water Main Protection Project Example

- **70 m channel reach**
- **Construction (March – April, 2019)**

Photograph by Stantec

Section 7.0: Questions & Responses

Questions & Responses

Stream Restoration Symposium 2019

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