Showing a Restoration Benefit: The Easy, the Not-So-Easy, and the Very Hard

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Outline

- Need to show a restoration benefit
- Restoration goals
- Monitoring challenges in time and space
- Matching goals to reality
- The Easy
- The Not-So-Easy
- The Very Hard
- Where do we go next?

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Need to Show a Restoration Benefit

- Proof is not yet provided
- Public is not convinced
- Governments need to justify expenditures
- Chesapeake Bay 2010 Trust Fund has a mandate to demonstrate benefits
- It's now or never

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Restoration Goals

- All assessment (and therefore monitoring) should be goal oriented
  - Assessment objectives (indicators)
  - Measurement (monitoring) objectives
- So what are our goals?
  - Restored ecosystem health (designated uses)
  - Reduction in stressors (loading of pollutants)
  - Protection of infrastructure or property
  - Results that are fast and over large scale

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Monitoring Challenges

- Restoration takes TIME
  - Heal the construction
  - Overcome the legacy
  - Emerge from natural variability
- Ecosystems are BIG
  - Need many small projects to restore
  - Many outside forces confound results

Matching Goals to Reality

- Choosing a restoration goal has implications for monitoring feasibility (and cost)

  - **The Easy**: measuring what you actually did (e.g., changed the stream channel shape)

  - **The No-So-Easy**: measuring the proximal effect of that change (e.g., reduction in sediment load from bank erosion)

  - **The Very Hard**: measuring the ultimate effect on a resource of interest (e.g., improvement in the biota expected from a decrease in sedimentation)

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The Easy

- Photodocumentation
- Cross sections
- Plan views
- RBP physical habitat and BEHI

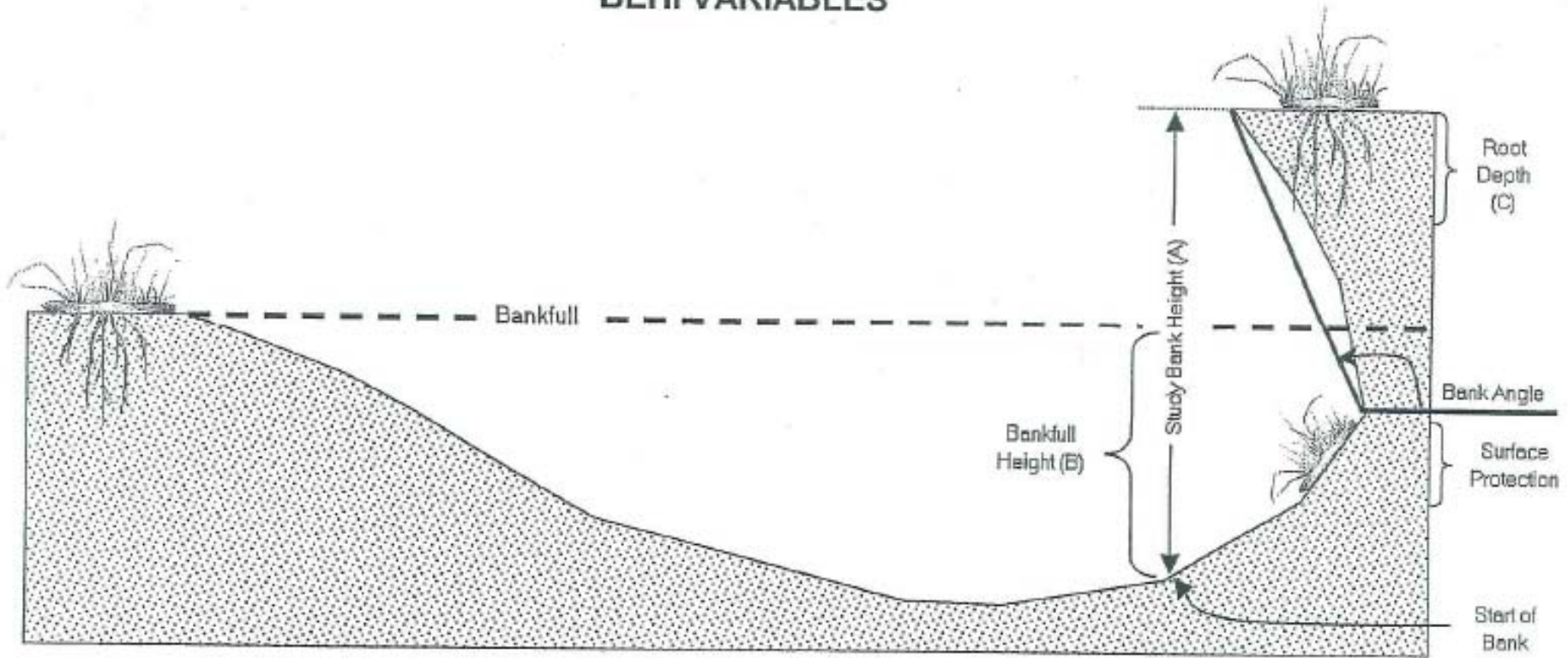# Cross Sections

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Plan View

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RPB Habitat and BEHI

BEHI VARIABLES

The Not-So-Easy

- Water chemistry
- Hydrology
- Pollutant loadings
- Cross sections over time
- Bank pins and scour chains
- Pebble counts
- Sediment transport studies
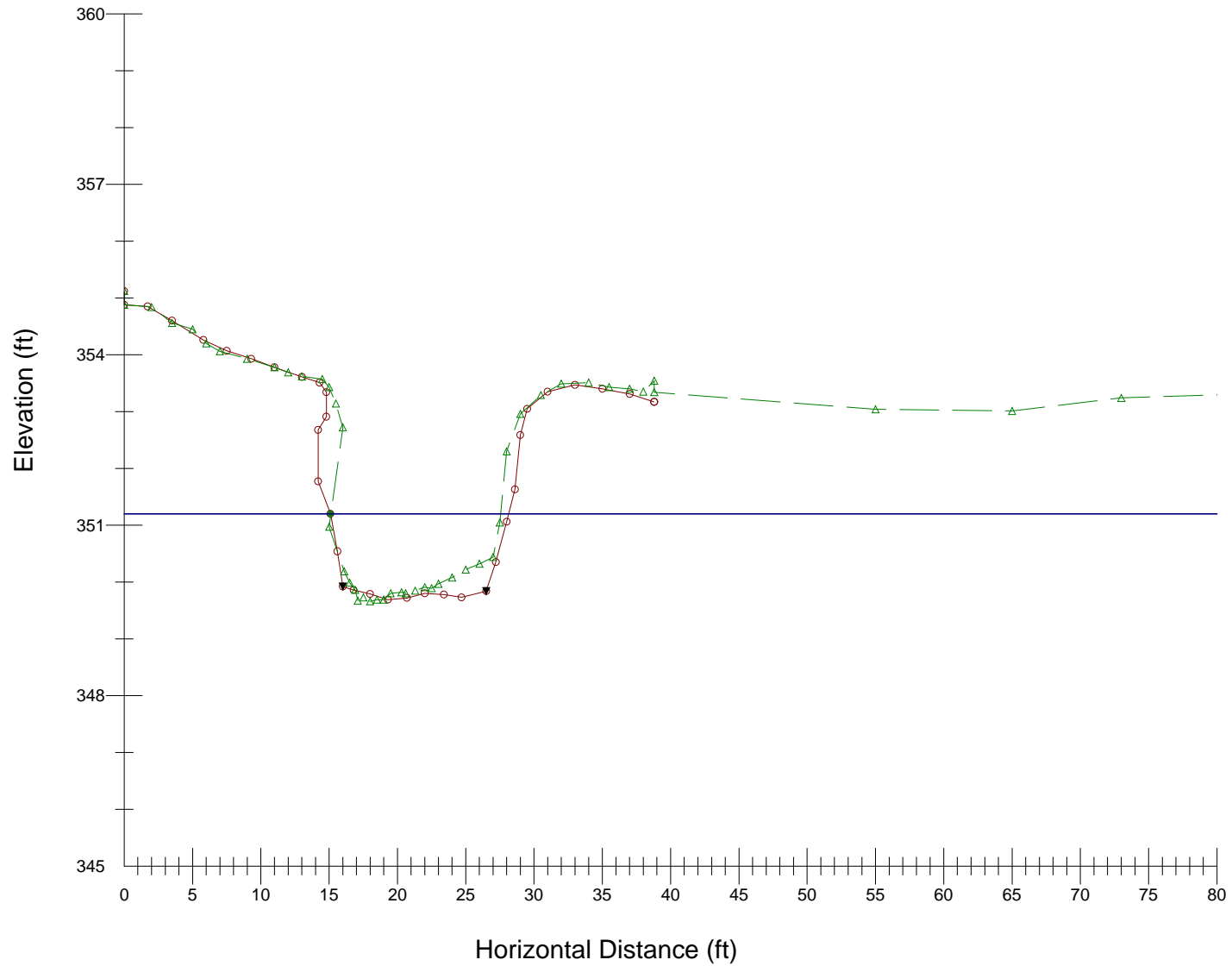
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Water Chemistry

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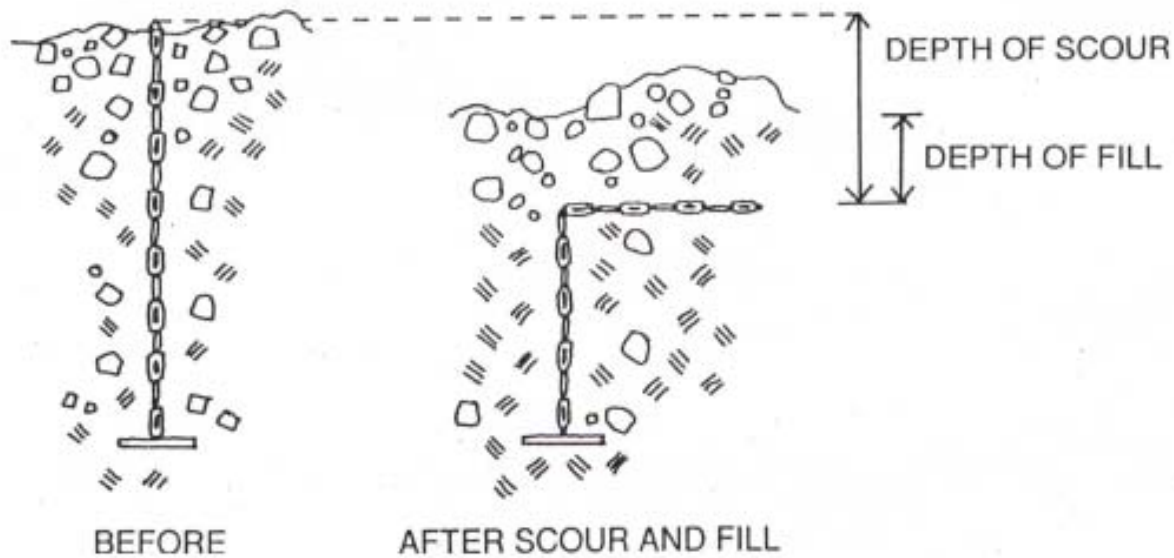# Hydrology and Loadings

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Cross Section XS-02: 2003 and 2007

○ 2007 XS-02   ◆ Bankfull Indicators   ▼ Water Surface Points   △ 2003 XS-02

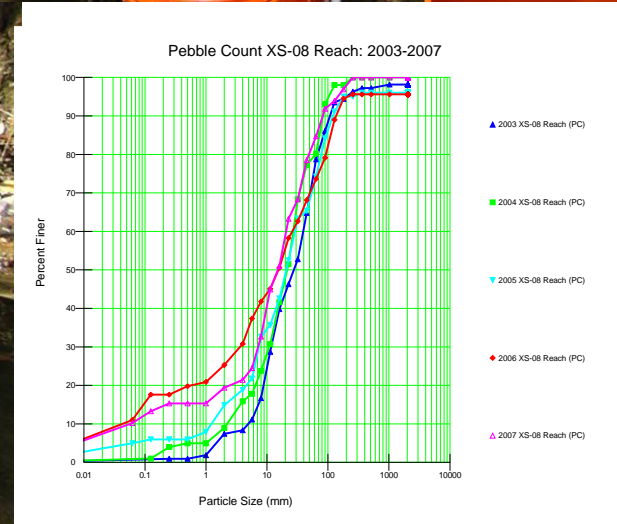Wbkf = 13   Dbkf = 1.28   Abkf = 16.7

Elevation (ft)

Horizontal Distance (ft)

Not-So-Easy

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Bank Pins and Scour Chains

BEFORE   AFTER SCOUR AND FILL

DEPTH OF SCOUR

DEPTH OF FILL

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Pebble Counts and Sieves

Pebble Count XS-08 Reach: 2003-2007

Not-So-Easy

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The Very Hard

- Benthic macroinvertebrate community
- Fish community
- Other biota
- Rare species
- Stream metabolism
- Other stream functions
- Connection to larger ecosystems
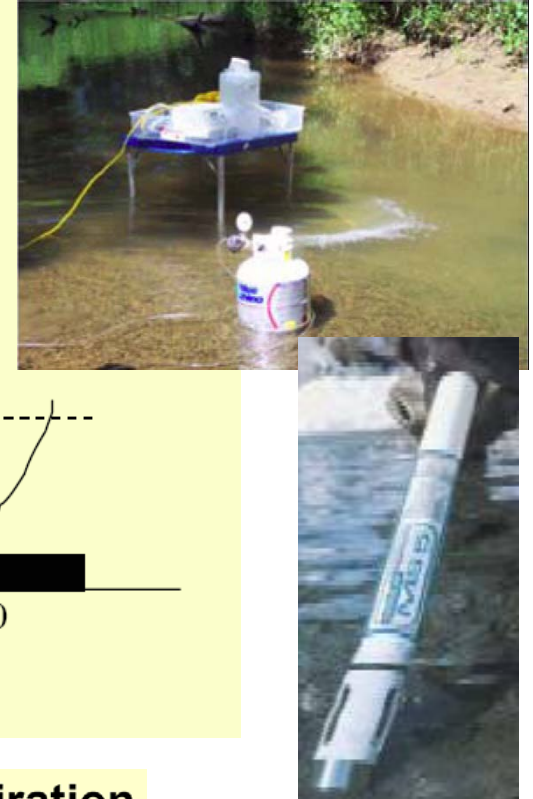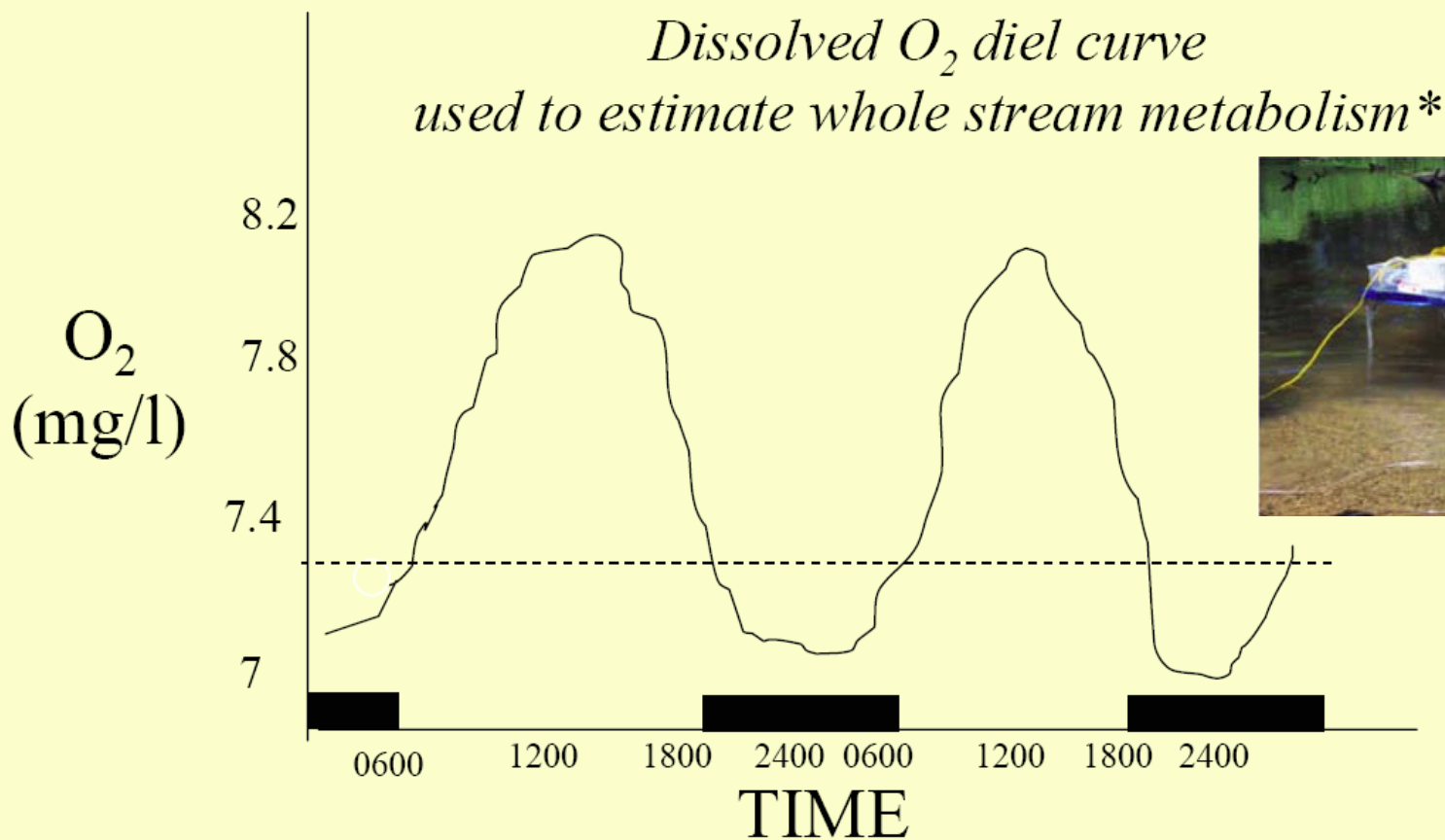
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Benthic Sampling

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Electrofishing

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Other Biota and Rare Species

Photo: Alvin Braswell

Periphyton are microorganisms that play a vital role as primary producers in stream food webs.

Very Hard

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Stream Metabolism

Dissolved O_2 diel curve
used to estimate whole stream metabolism*

Y-axis: O_2 (mg/l) — 7, 7.4, 7.8, 8.2

X-axis: TIME — 0600, 1200, 1800, 2400, 0600, 1200, 1800, 2400

NDM* = GPP – community respiration

Average daytime O_2 production (includes losses due to heterotrophic respiration) — Average night-time O_2 use

Very Hard

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The Very Hard

- **Good**: We have indicators
  - MBSS IBIs for benthos and fish
  - References for biotic integrity and biodiversity

- **Bad**: Indicators are subject to confounding
  - Variability in IBIs
  - Annual variability
  - Land use and other stressor changes
  - Legacy effects
  - Delays in response

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Where Do We Go Next?

- Example Goals and Methods
  - Frederick County stream restoration
  - Little Patuxent Restoration Partners proposal to 2010 Trust Fund
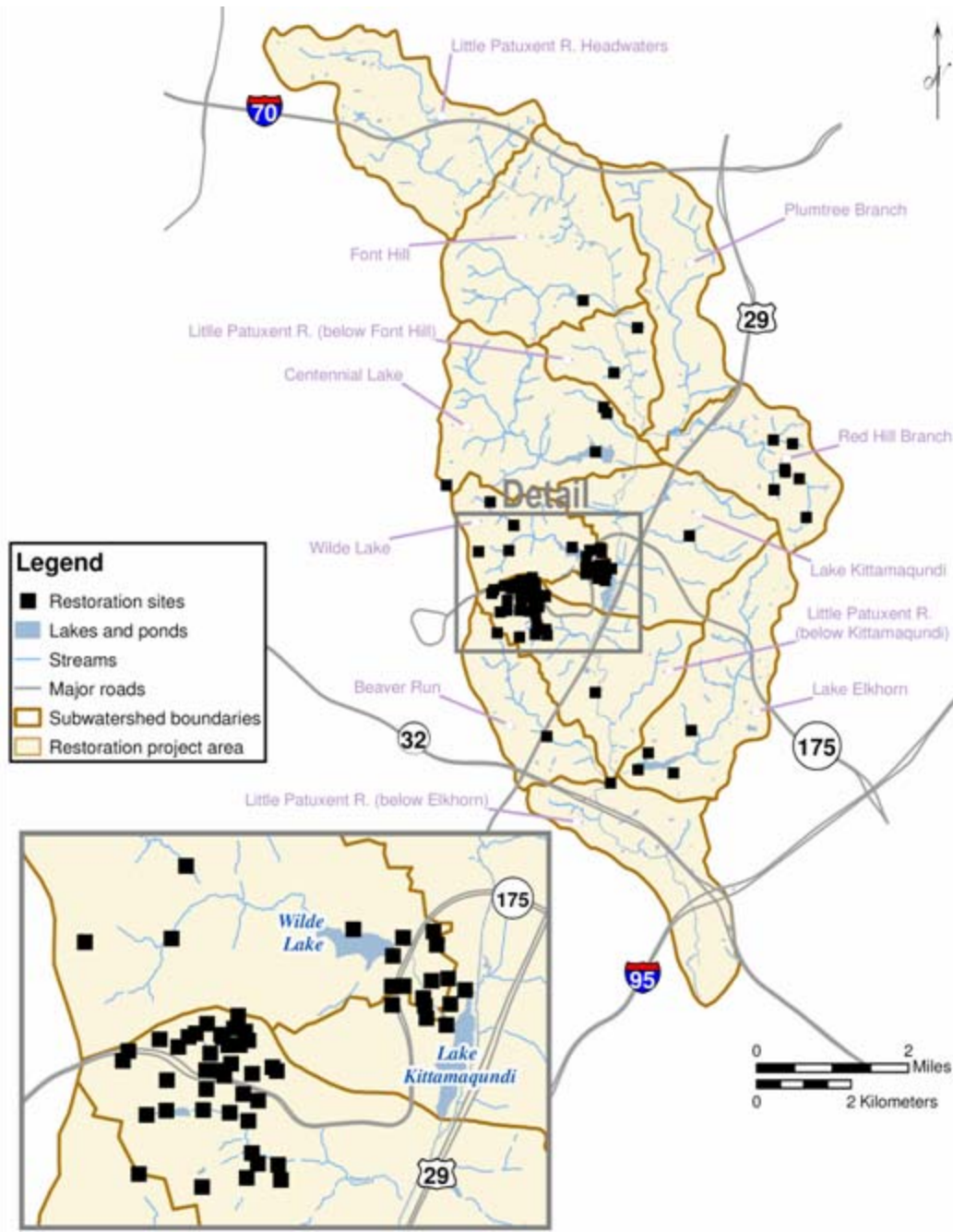
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Frederick County

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Frederick County

- Goal is to "*restore stream bank stability*"

- Methods are
  - Easy: photo, cross section, BEHI
  - Not-So-Easy: bank pins, pebble counts
  - Very Hard: benthos, fish

- Scale is SMALL

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Little Patuxent 2010

Little Patuxent 2010

- Goal is to "*reduce downstream loadings of nutrients and sediment*"
- Methods are
  - Easy: BEHI
  - Not-So-Easy: N, P, and sediment x flow
  - Very Hard: benthos and fish
- Scale is BIG
  - Also monitor subwatersheds and lakes

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Where Do We Go Next?

- Choose from tiered goals:
  - Be clean (safe for human contact and consumption)
  - Be good neighbor (no adverse loadings downstream)
  - Be good steward (ecological health and biodiversity)
- Choose methods to show a restoration benefit quickly to establish political will and to allow for adaptive management
- Always choose an Easy method (to go with your Not-So-Easy and Very Hard)

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