

The Pennichuck Brook Watershed

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Overview

- I. Watersheds and the Hydrologic Cycle
- II. The Pennichuck Watershed – Where We Have Been
- III. The Pennichuck Watershed – Where We Are Going

What is a Watershed?



**Conceptual Watershed
Cross Section**

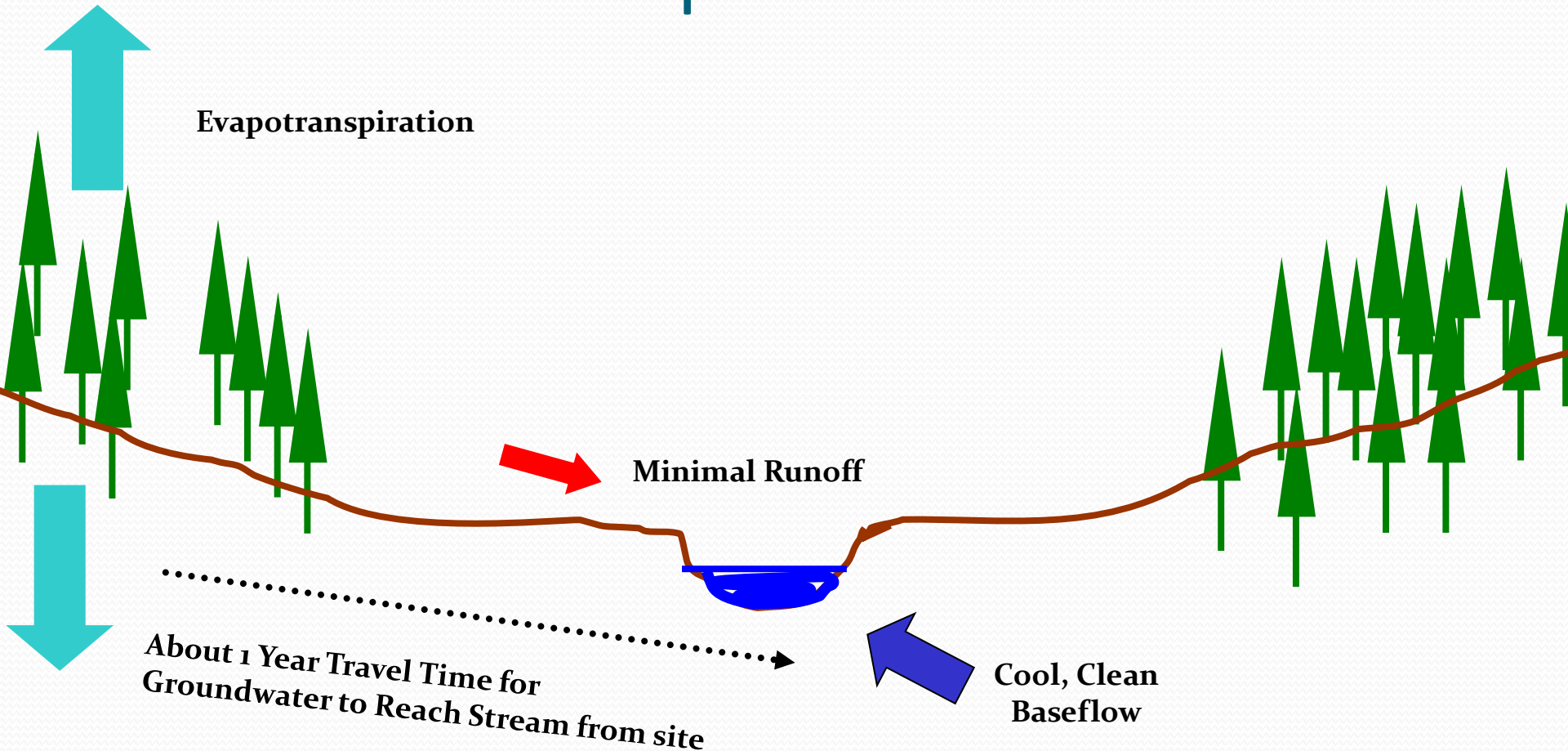
- Area of land that contributes run-off water to a drainage course or water body
- Defined by highpoints and ridgelines
- What we do on the land affects water quality and quantity

Source: http://www.cityofberkeley.info/Public_Works/Sewers_-_Storm/Watershed_Resources.aspx

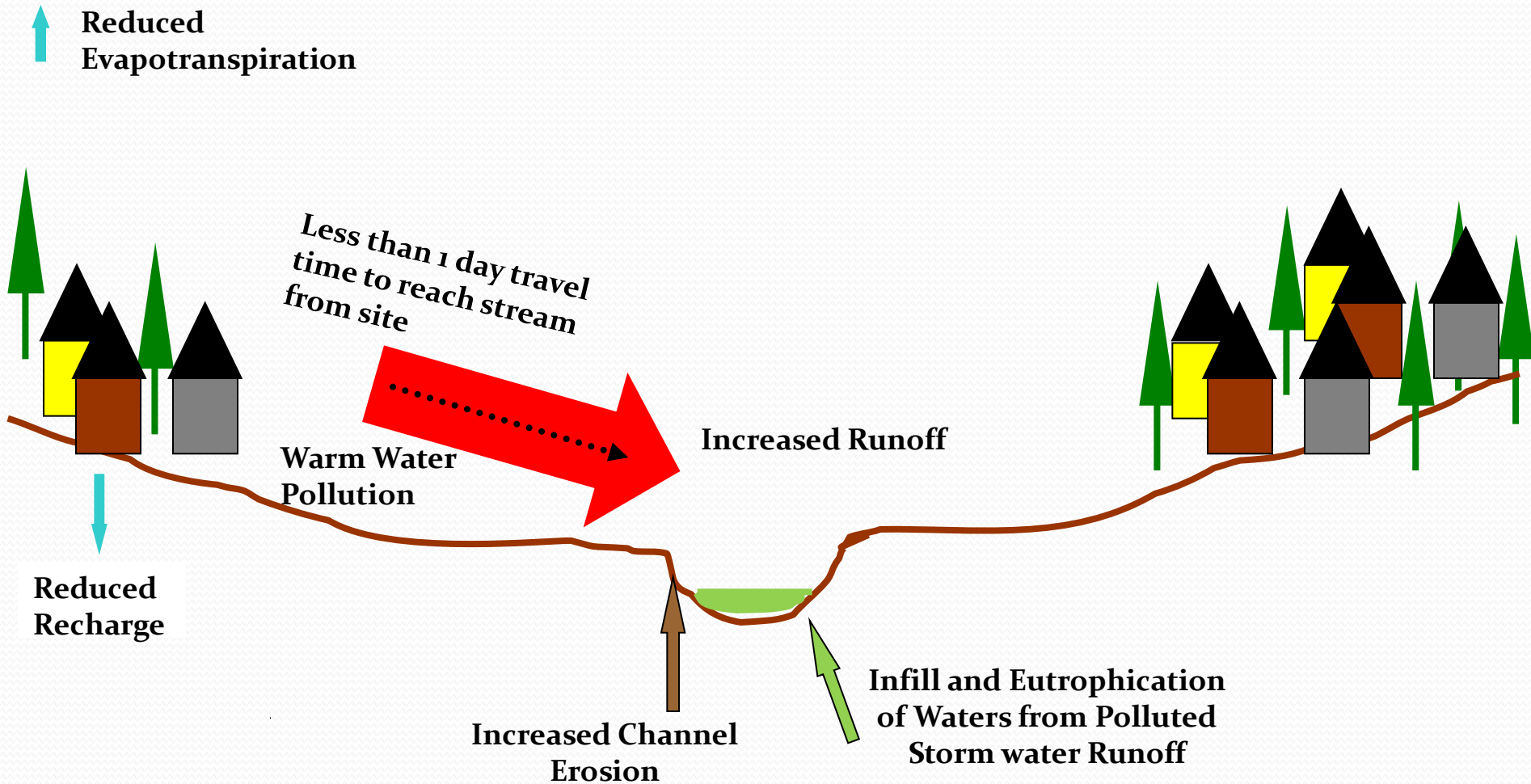
Changes to the Landscape can have dramatic impacts on:

- Water Quality due to:
 - Increased Sediment loads created by stream bed erosion
 - Increased Phosphorous levels from lawns, roofs, leach fields and pavement
 - Increased Nitrogen levels from farming, lawn care, leach fields
 - Increased levels of Volatile Organic Chemicals from parking lots
 - Increased water temperature from parking lots and roofs
- Water Quantity
 - Increased levels of storm water
 - Decreased levels of base groundwater flows

Pre-development - "Before"

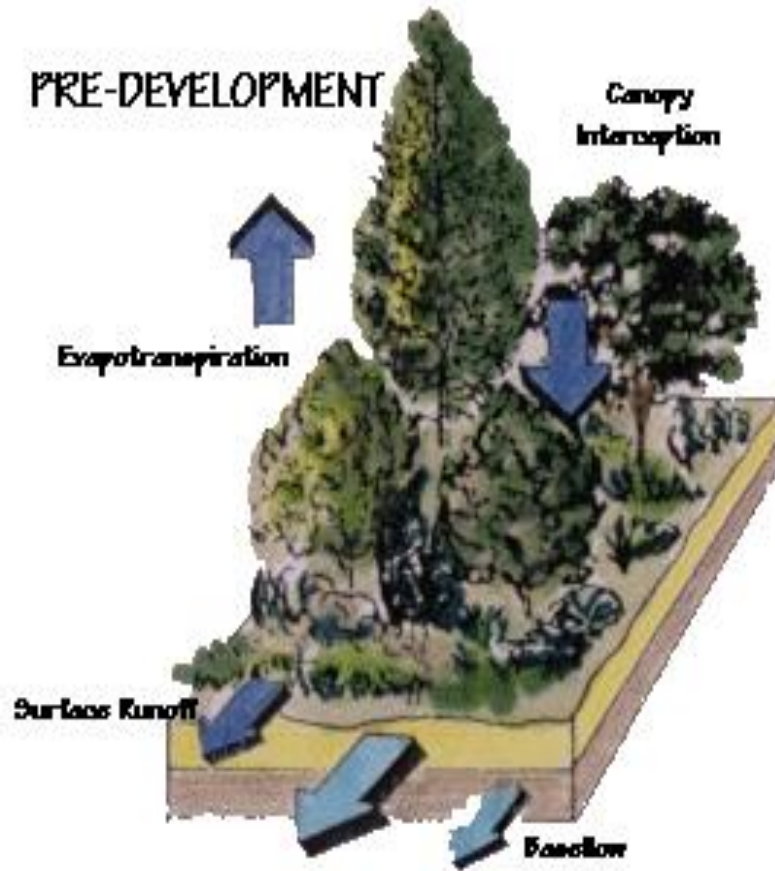


Post-development - “After”



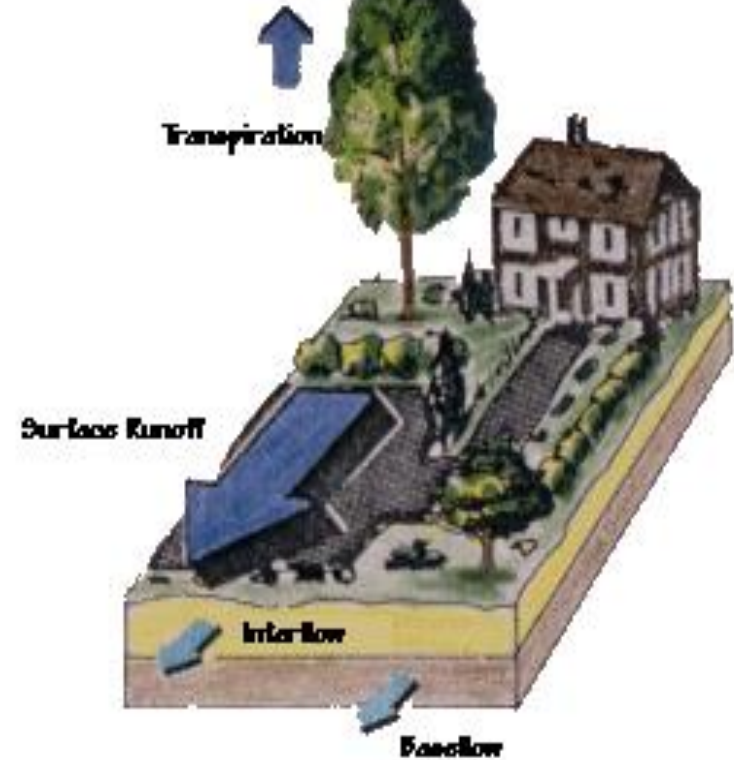
WATER BALANCE

PRE-DEVELOPMENT



- Clean cool base flow
- Minimal storm water (surface) runoff

POST-DEVELOPMENT



- Impervious area increases storm water runoff & reduces base flow
- Runoff picks up pollution – nutrients, sediments, oil & grease

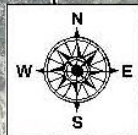
Maintaining a Sustainable Water Supply

- Maintain health of ponds
 - Reduce pollutant loads
 - Treat storm water before it enters Pennichuck Brook
 - Reduce infill from sediments
 - Reduce peak storm water flows via on site detention
 - Promote groundwater recharge and base flows
 - Induce onsite infiltration
 - Slow down rate of eutrophication within the ponds
 - Remove Phosphorous from storm water
 - Promote Ordinances that result in Low Impact Development

II. The Pennichuck Watershed – Where We Have Been

Background

- 17,000 acre urbanizing/urbanized watershed to outlet of Harris Pond
- Occupies land in five towns – Nashua, Merrimack, Amherst, Milford, Hollis
- 10 subwatersheds of roughly 1,200 - 3,200 acres each



Legend

Subwatershed Boundaries

Town Boundaries

0 3,500 7,000
Feet

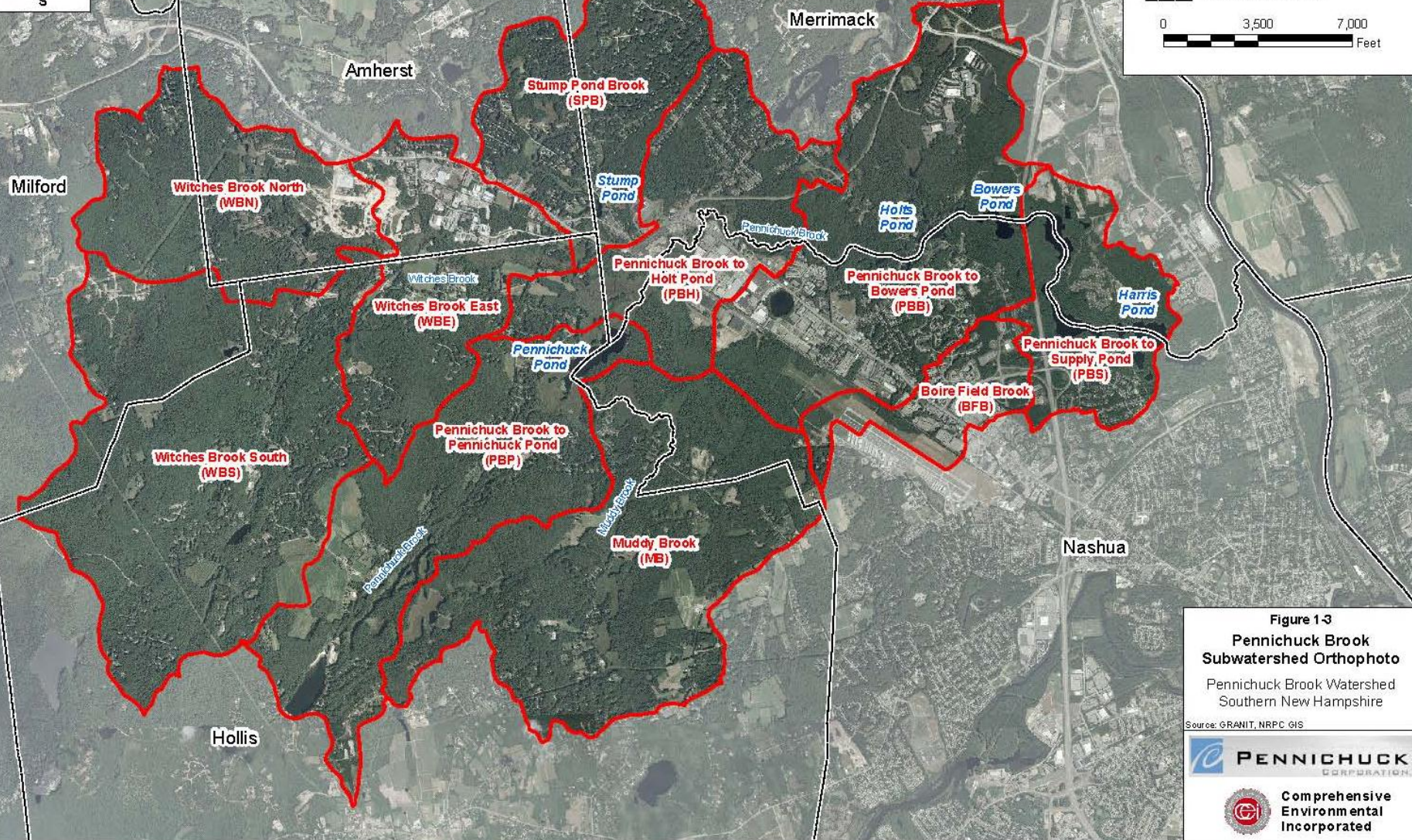


Figure 1-3

Pennichuck Brook Subwatershed Orthophoto

Pennichuck Brook Watershed
Southern New Hampshire

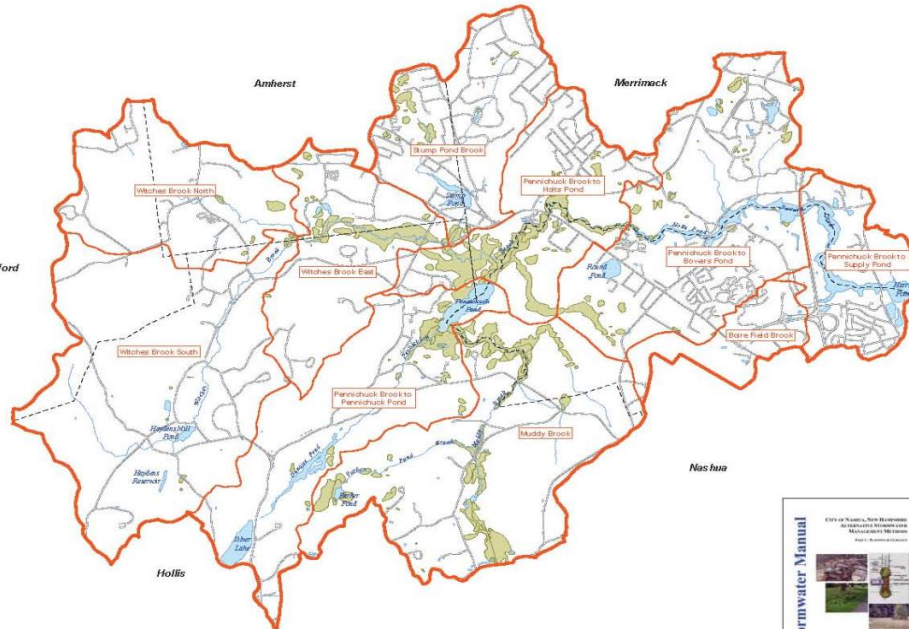
Source: GRANIT, NRPC GIS



Comprehensive
Environmental
Incorporated

Past Efforts (1998-Present)

Pennichuck Water Works Watershed Management Program



Studies of Urban Non-Point Source Pollution Source Water Protection Grants

- Bore Field Brook \$14,600
- Pennichuck Brook to Bowers Pond: DES Grant \$13,700
Pennichuck Water Works \$9,200
- Stump Pond Brook: DES Grant \$15,000
Pennichuck Water Works \$9,200

319 Watershed Assistance Grant

- Remaining Five Subwatersheds:
- Muddy Brook, Pennichuck Brook to Hots Pond, Pennichuck Brook to Pennichuck Pond, Pennichuck Brook to Supply Pond, Witches Brook South
- DES Grant \$19,100
Pennichuck Water Works \$28,600



Provided Guidance to Communities for
Developing Stormwater Zoning Criteria



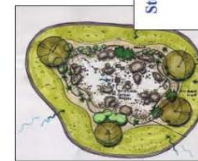
Storm Drain Mapping & Marking Program
Source Water Protection Grant
DES Grant: \$15,000
Pennichuck Water Works: \$19,000



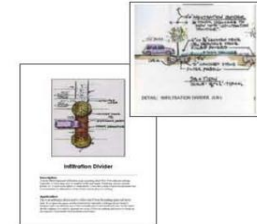
Hot Spots Program
319 Watershed Assistance Grant
DES Grant: \$15,000
Pennichuck Water Works: \$9,300



Cornerstone Site Structural BMP/
Post Office Treatment Swale & Biolog
319 Watershed Assistance Grant
DES Grant: \$21,000
Pennichuck Water Works: \$14,000



Alternative Stormwater Management Manual
319 Watershed Assistance Grant
DES Grant: \$40,000
Matching Contribution: \$58,500 by:
Pennichuck Water Works: \$75,000
City of Nashua: \$25,000
Comprehensive Environmental Inc.: \$8,500



Pennichuck Square
and
Celina Avenue BMPs
Source Water Protection Grant
DES Grant: \$26,500
Pennichuck Water Works: \$27,500



Nashua Community Technical College
Wet Detention
Pennichuck Water Works: \$175,000



Stormwater Management
Workshop Series
Source Water Protection Grant
DES Grant: \$12,000
Pennichuck Water Works: \$8,000

Figure 1-2
Pennichuck Water Works
Watershed Management Projects
Pennichuck Brook Watershed
Southern New Hampshire

Source: GRANT, MPEC GIS



Efforts to Date

- **Studies**

- 1998 Watershed Study
- Subwatershed Studies
- Pond Sediment Study
- 2008 Watershed Restoration Plan

- **Public Education/Zoning**

- City Watershed Protection Ordinance
- Catch Basin Marking Program
- Community Based Social Marketing (CBSM)
- Public Works/Planning Staff Seminars
- Watershed Website

Efforts to Date

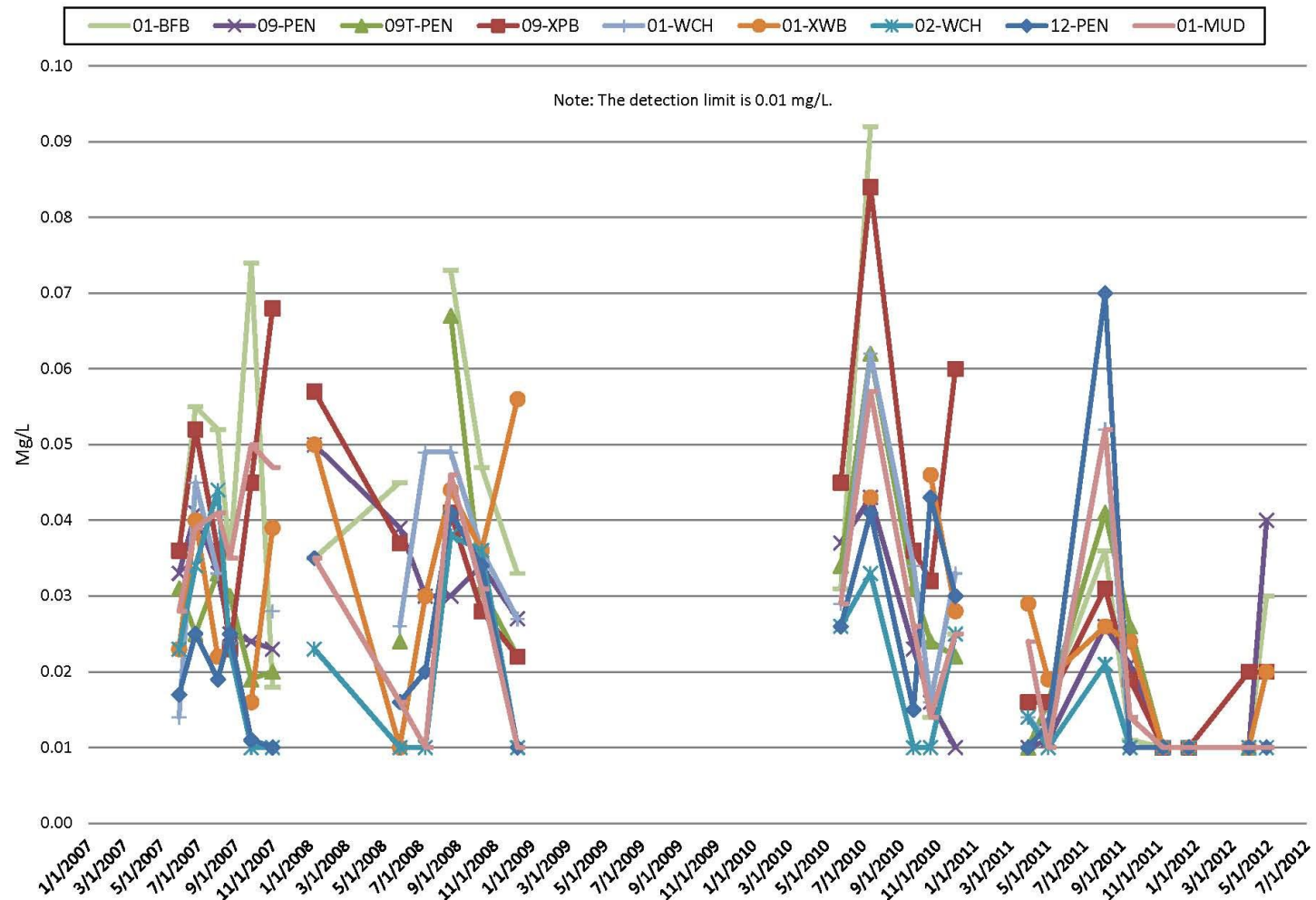
(Cont.)

- **Projects**

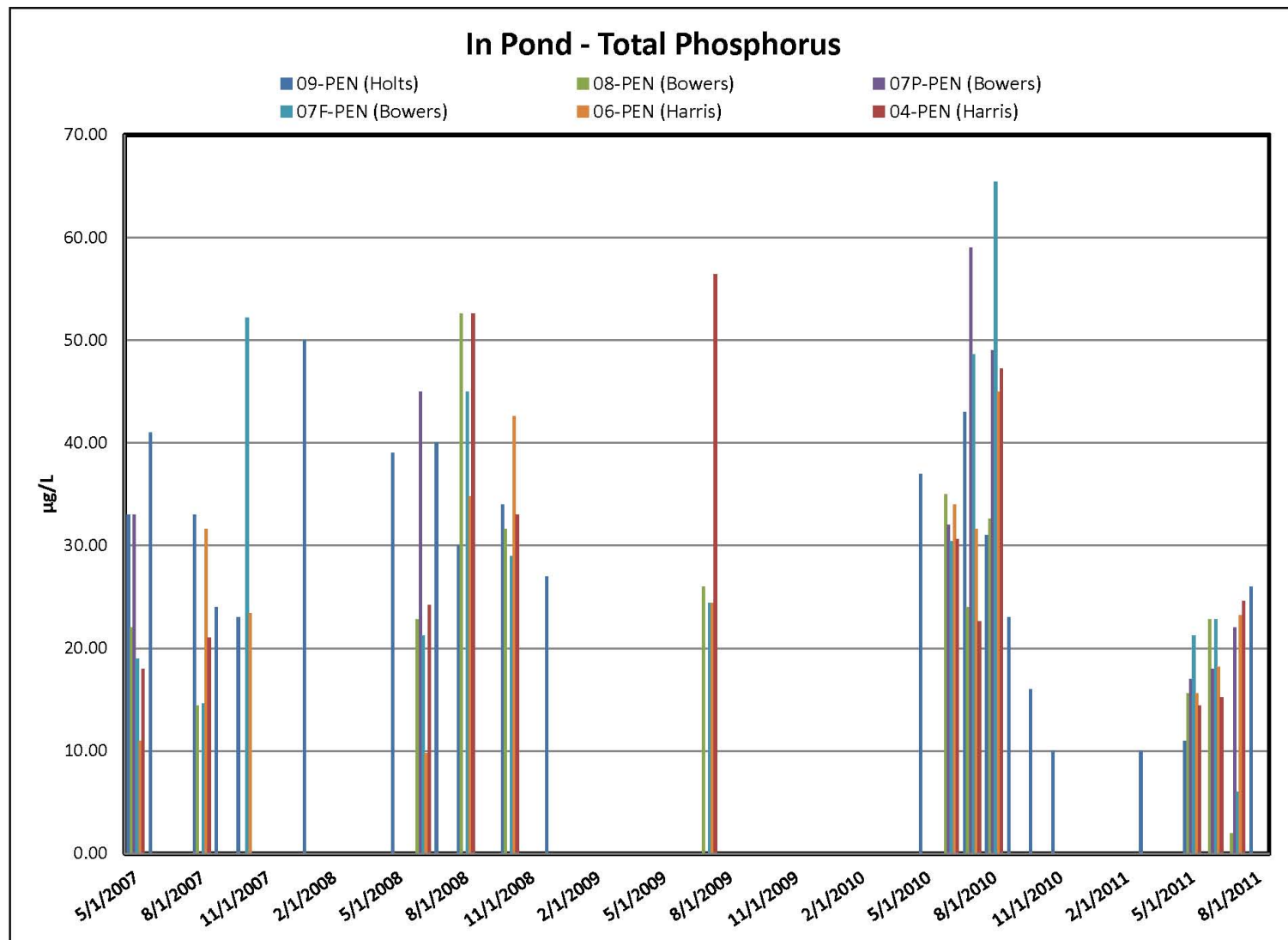
- Nashua Community College Stormwater treatment system
- Pennichuck Square Demo Retro site
- Celina Ave and Cornerstone Storm Water Best Management Practices (BMP's)
- Tinker Road Detention Basin Retrofit
- Harris Pond Aeration
- Long-Term Monitoring Program

Water Quality – What We Know

Dry Weather Sampling - Phosphorus Levels 2007-2012



Water Quality – What We Know



Water Quality – What We Know

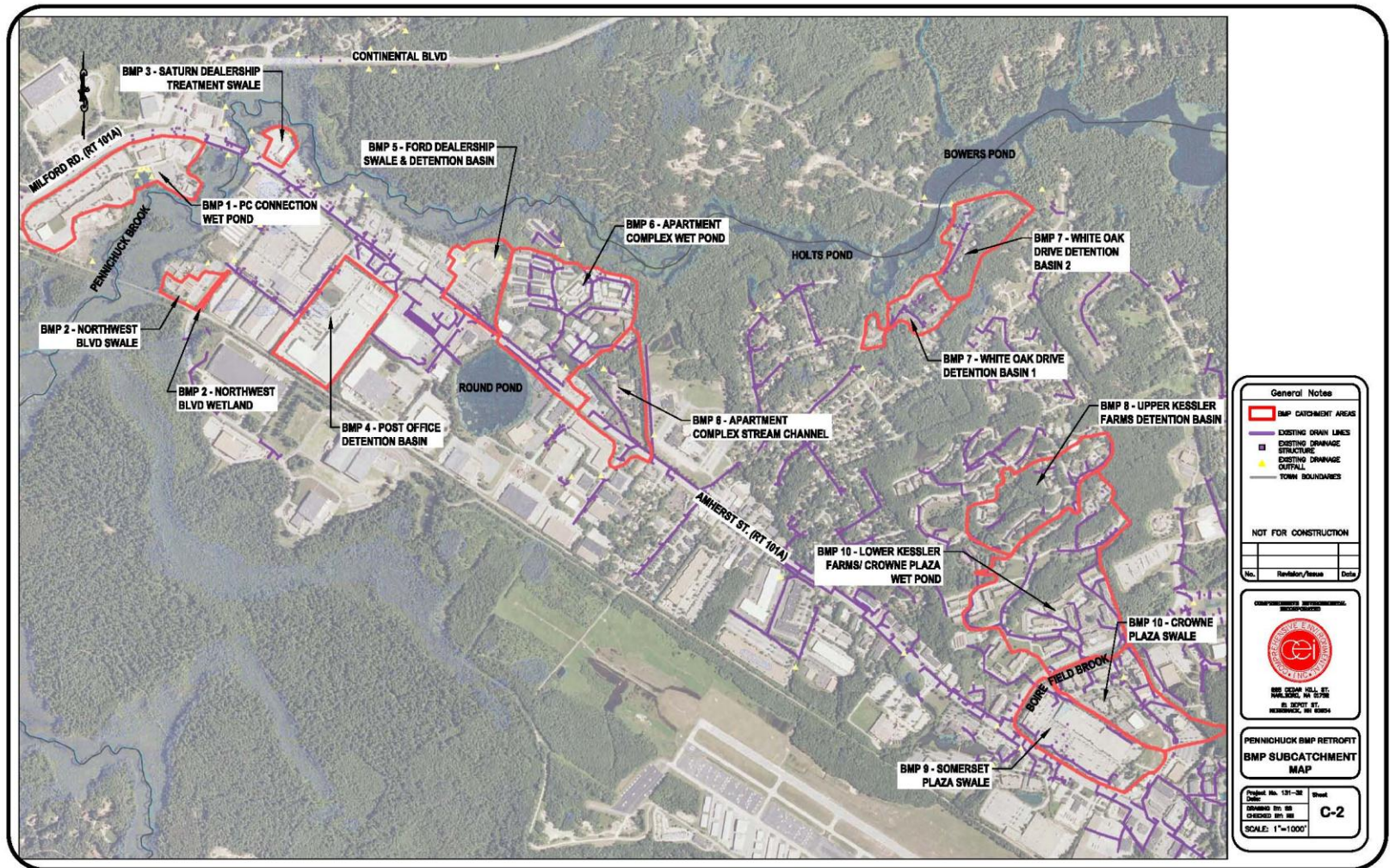
- Water quality appears to be improving but data is limited
- More data is needed to better define the health of the ponds and watershed and direct future watershed clean up efforts
- Goals are:
 - Reduction in phosphorous and nitrate levels
 - Reduction in sediment inputs into the pond
 - Rebuild base groundwater flows

III. The Pennichuck Watershed – Where We Are Going

Watershed Restoration Plan

- 2008 Plan updated this year
 - Goal – Remove over 2000# of Phosphorous (PO^4) input into the ponds per year
- Identifies biggest “bang for buck”
 - Public education – 285# of PO^4 per year
 - Develop Storm water program for schools
 - Lawn Maintenance practices
 - Website
 - Regulations - Encourage Local Adoption of State Alteration of Terrain regulations – 936# of PO^4 per year
 - Private property maintenance (very expensive, hard to implement)
 - Parking Lot Sweeping – 96# of PO^4 per year
 - Catch Basin Cleaning– 135# of PO^4 per year
 - Installation of Storm Water BMP’s at top 10 sites - 231# of PO^4 per year

Top 10 Storm Water BMP's



Recommended Approach to Water Supply Protection

- Continue monitoring over next 3-4 years to obtain enough information to assess health of ponds.
- Initiate Groundwater monitoring.
- Focus on public education and local adoption of State regulations during this time.
- Update restoration plan model at end of 3-4 year period and re-evaluate restoration approach.

Questions ??