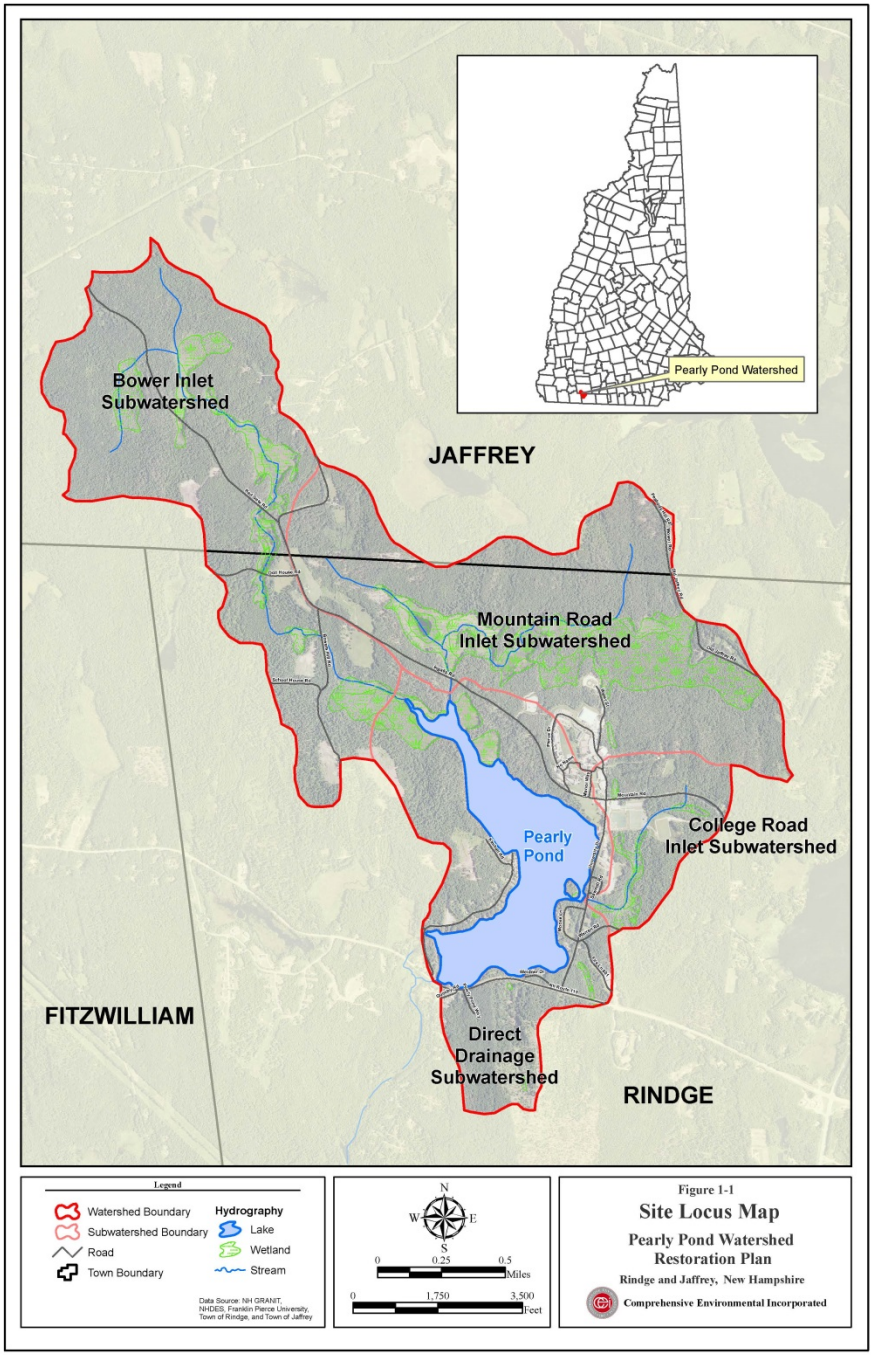
Managing Phosphorus Loads to Pearly Pond

January 25, 2016

NEWEA 2016 Annual Conference
Boston Marriott Copley Place

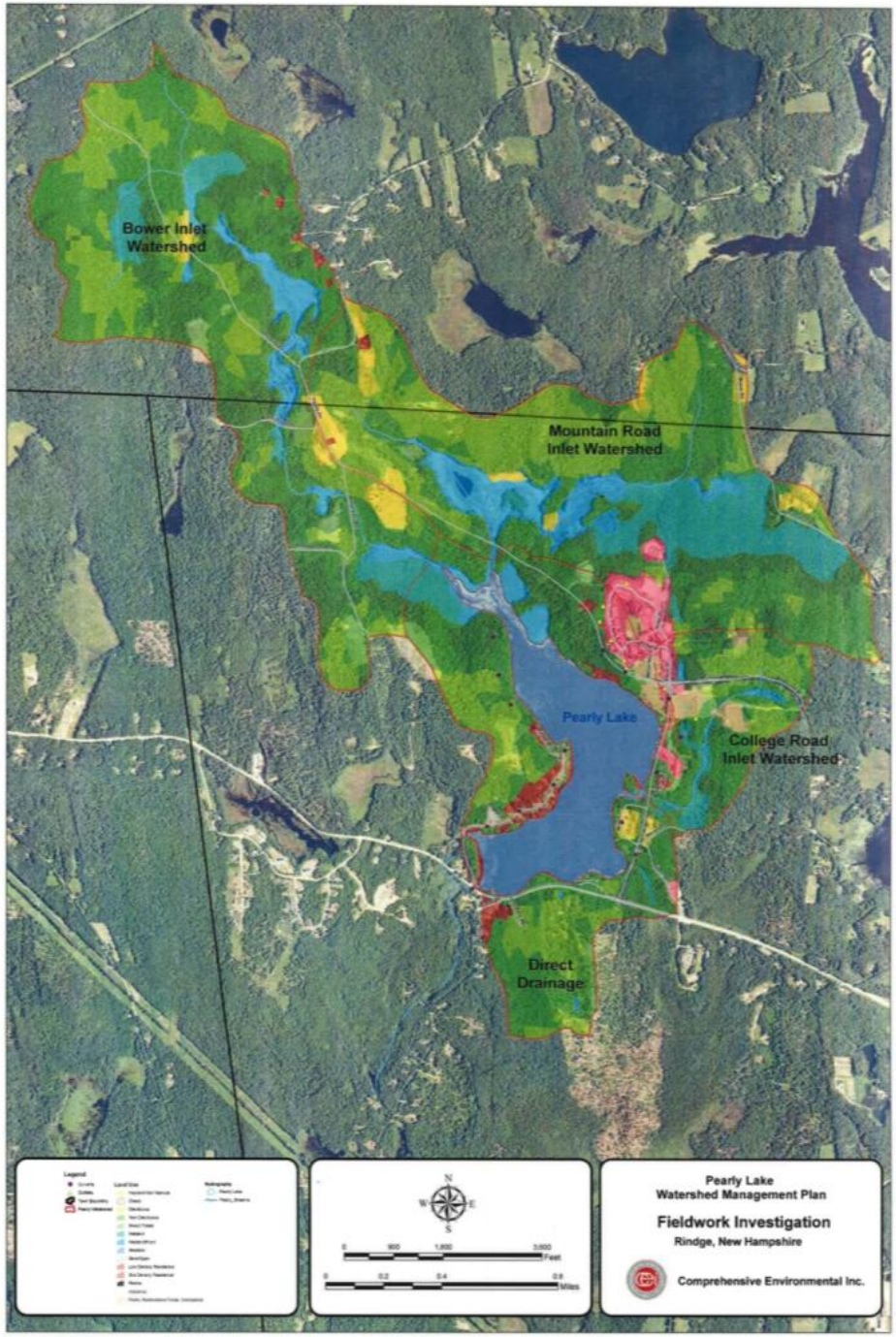
Session 3

Comprehensive Environmental Inc.



Pearly Pond

- Located in Rindge, NH
- 191 acres
- Depth
  - Average – 7 ft.
  - Maximum – 17 ft.
- Flushing Rate - ~4x/year



Watershed

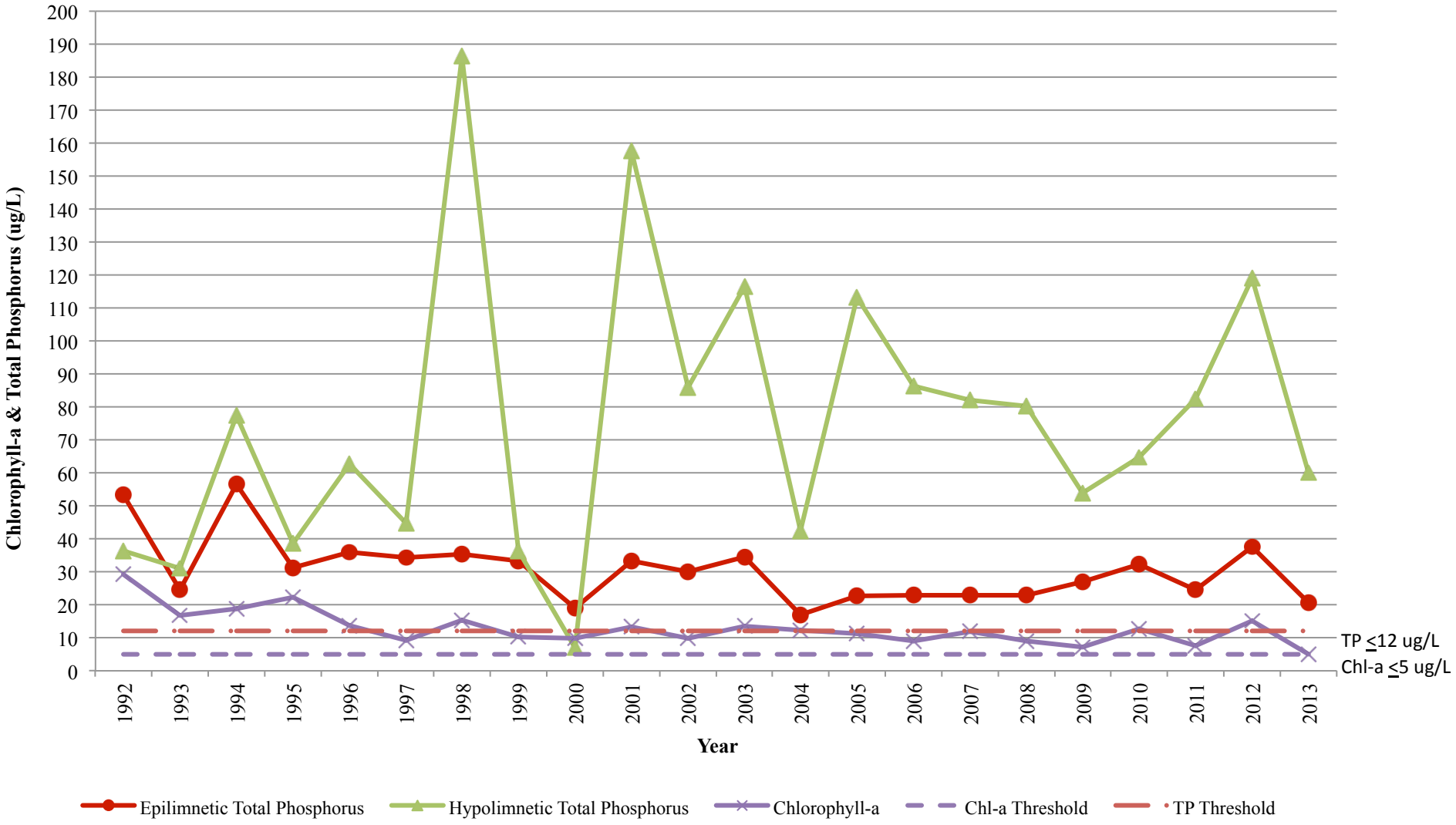
- 2,126 acres
- Largely Undeveloped
  - 75% forested
  - 15% wetlands
  - 7% developed
    - Franklin Pierce University
    - residential
  - 3% hayland/open

Impairments

- High Chlorophyll-a – pigment found in algae, indicator of algal biomass
- Low Dissolved Oxygen (DO) – Excess algae leads to low DO

Underlying cause: Too much phosphorus→too much algae!

Historical Deep Spot
Epilimnetic & Hypolimnetic Total Phosphorus, & Chlorophyll-a



Pearly Pond Restoration

- Collaborative Effort
  - NH Department of Environmental Services
  - Franklin Pierce University (FPU)
  - Pearly Pond Management Advisory Council
  - Town of Rindge, NH
  - Comprehensive Environmental Inc.

Watershed Restoration Plan

- Identify Phosphorus Sources & Loads
- Develop Water Quality Goals & Phosphorus Reductions to Achieve Goals
- Identify Corrective Measures


Pearly Pond Watershed Restoration Plan

Final Report
December 10, 2014

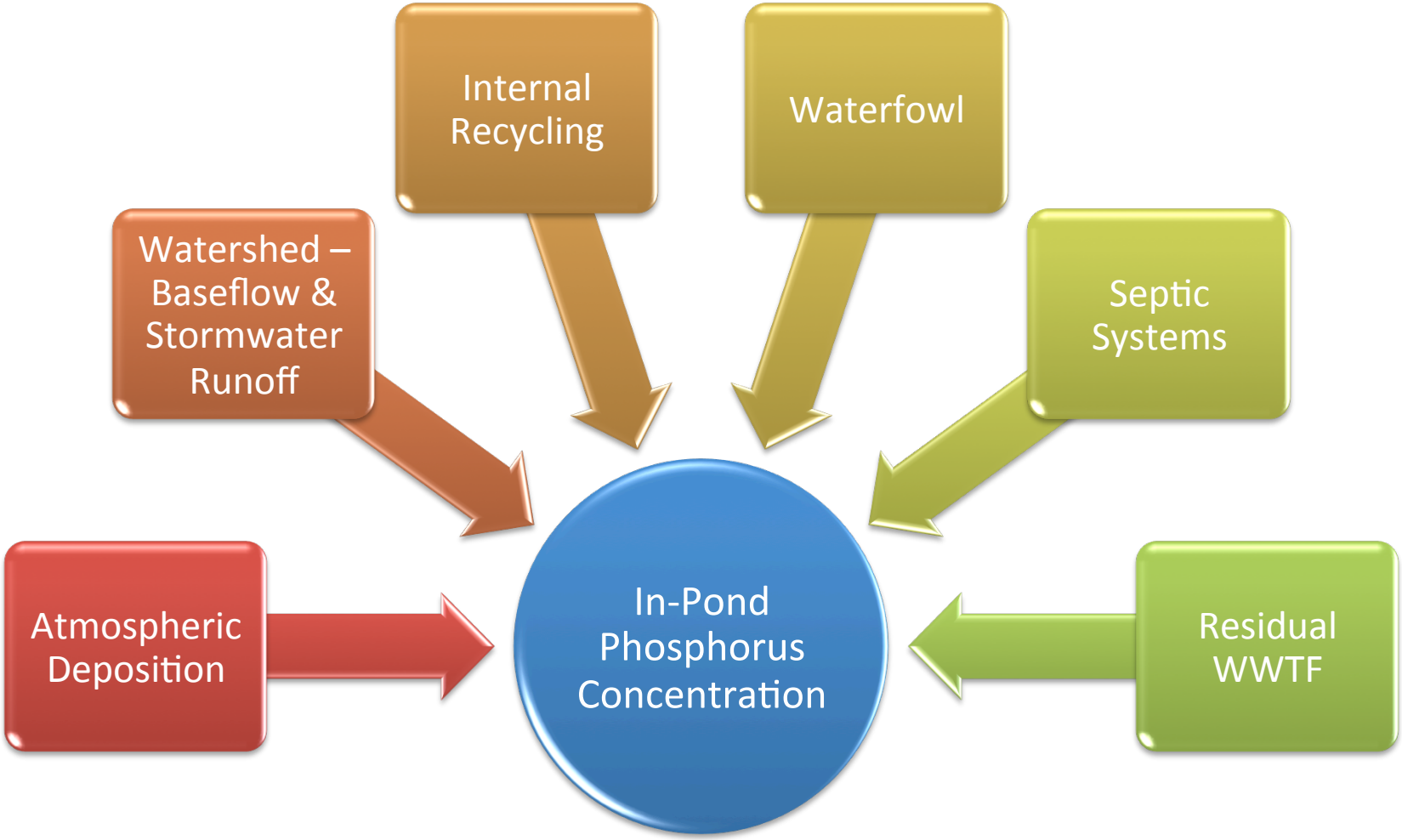
Prepared for:
Pearly Pond Management Advisory Council, Pearly Pond Association And Franklin Pierce University

Prepared by:
Comprehensive Environmental Inc.

With Funding by:
New Hampshire Department of Environmental Services,

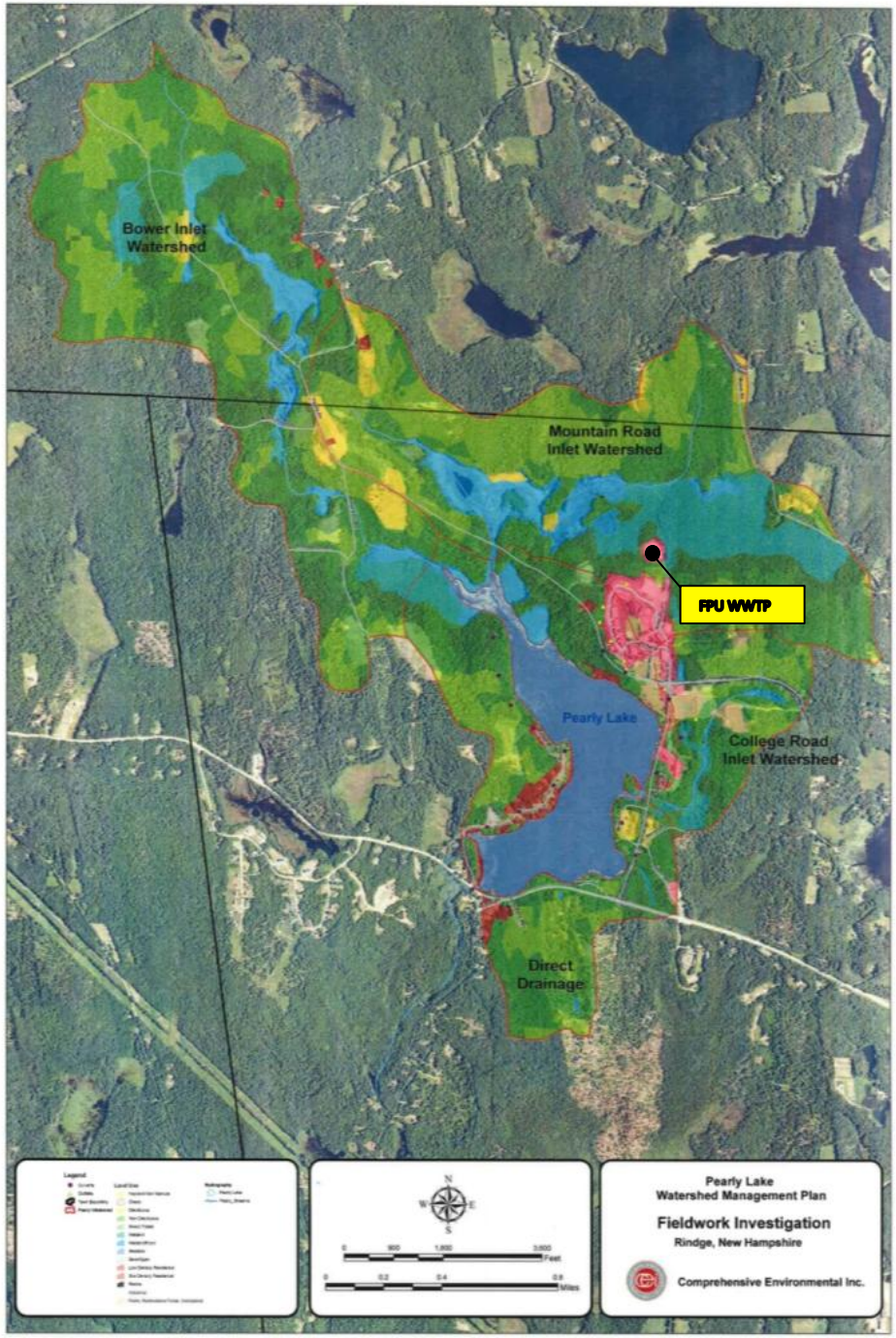
Funding for this project was provided in part by a Watershed Assistance Grant from the New Hampshire Department of Environmental Services with Clean Water Act Section 319 funds from the U.S. Environmental Protection Agency

Phosphorus Sources



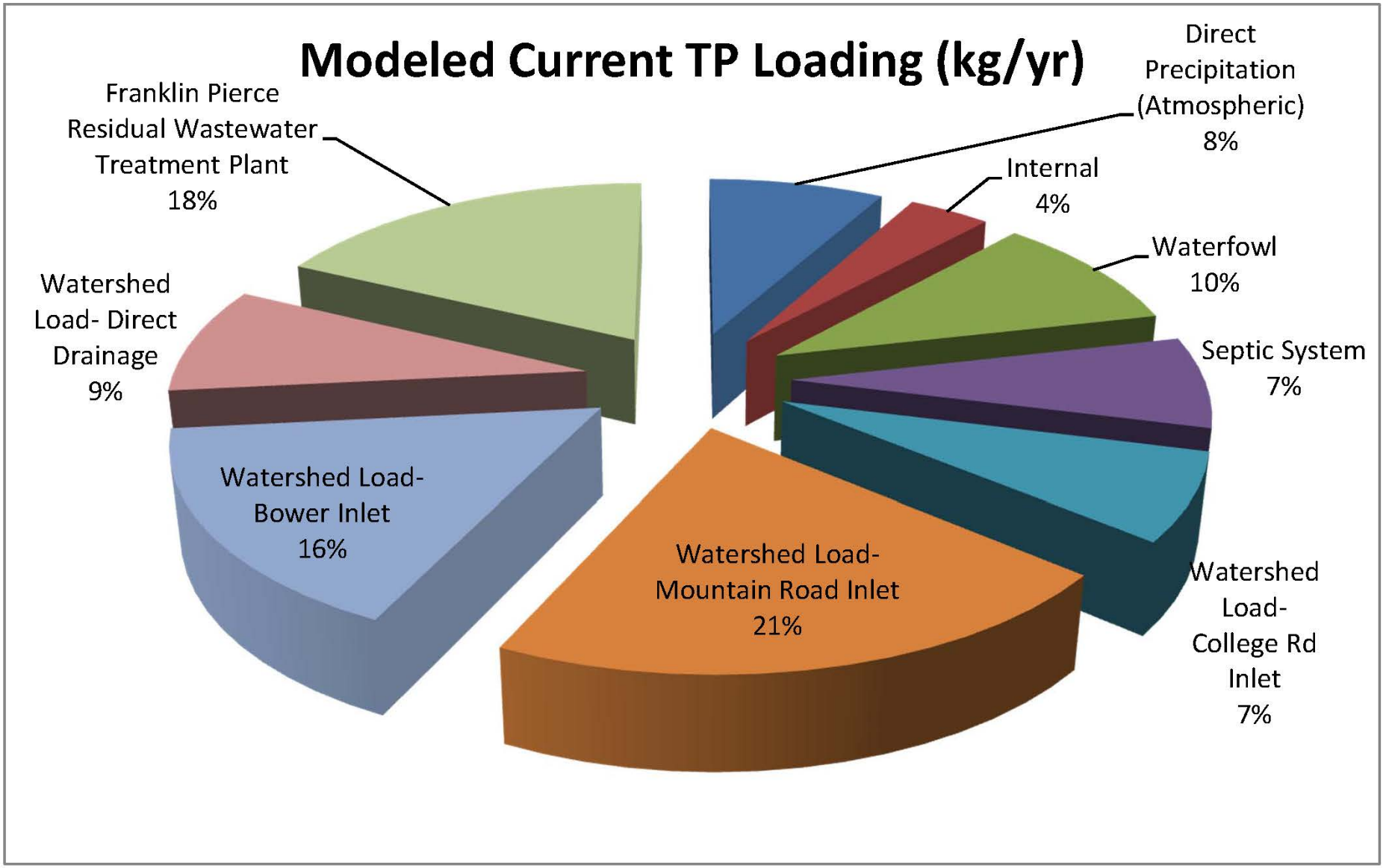
Phosphorus Load Estimations

- Lake Response Model – Land Use Export Coefficient Model
- Inputs Predict Phosphorus Load, Water Load, & Phosphorus Concentrations in Streams & Pond
- Calibrated to Observed Data



Interesting Findings

- High Background TP
  - Bowers Inlet >30 ug/L
  - Mountain Road Inlet >60 ug/L
- Residual TP Load from Historic WWTF
  - Discharged to wetland 1967-2008
  - Sent to RIBs in 2009
  - WQ Data Shows Residual Contributions



- Stormwater Surface Runoff & NPS Pollution Contributes 45% of the TP Load
- Estimated Load of 240 kg/yr of TP to Pond

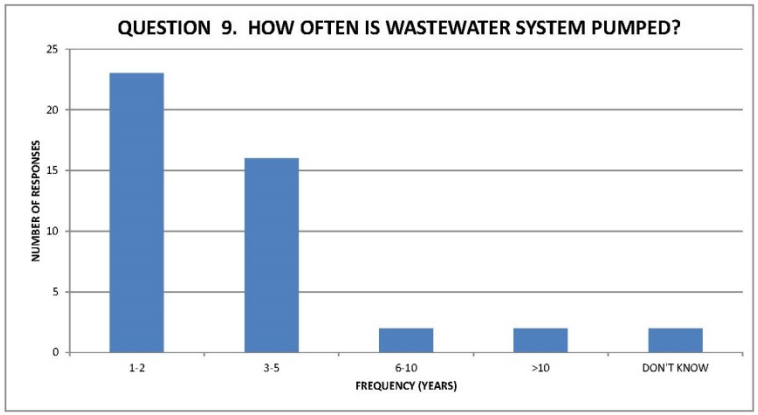
Water Quality Goal: 17 ug/L

- Based on high phosphorus levels in Bower Inlet (pristine subwatershed), background TP in-pond anticipated to be 17 ug/L.
- To reduce TP levels to 12 ug/L, would require reducing natural inputs of TP, and would cost more than $2.6 million to reduce.
- According to the NHDES 2009 report, there are unimpaired lakes that have TP levels as high as 27.5 ug/L, and 25% of the unimpaired lakes are higher than 11 ug/L.
- Pearly Pond appears to be naturally somewhat eutrophic, and may be one of those lakes which can achieve unimpaired status and avoid harmful algae blooms with a TP level as high as 17 ug/L.
- This will require reduction of 90 lbs/year of phosphorus (38%)

Corrective Measures

- Focus on Highest Contributors
  - Waterfowl (10%) – Population Controls & Education
  - Septic Systems (7%) – Education on Maintenance/ Repairs
  - Wastewater & Wetland (18%) – Improvements & BMPs
  - Stormwater (45%) – BMPs
- These Contribute 80% of Loading

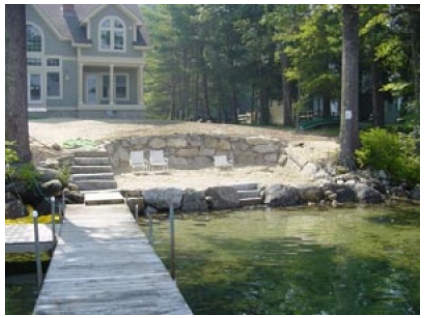
Public Education

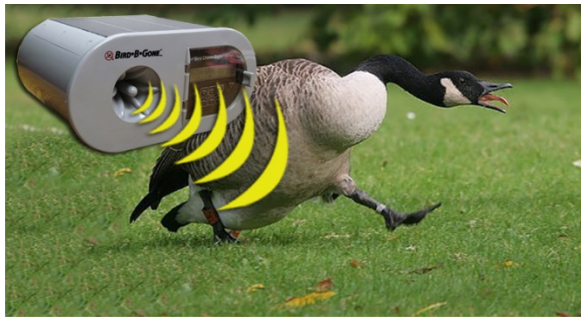


- Educate and Involve Homeowners Within the Watershed & Along Shoreline of the Lake
  - Lawn & yard care
  - Phosphorus products
  - Septic maintenance
  - Pet waste
  - Waterfowl

Waterfowl

- Resident outreach program
  - Demonstration project
  - Vegetated buffers
  - Perched beaches
- Campus Pilot to Identify Hazing/Scaring Techniques
  - Border collies
  - Coyote effigies
  - Drones
  - Distress calls



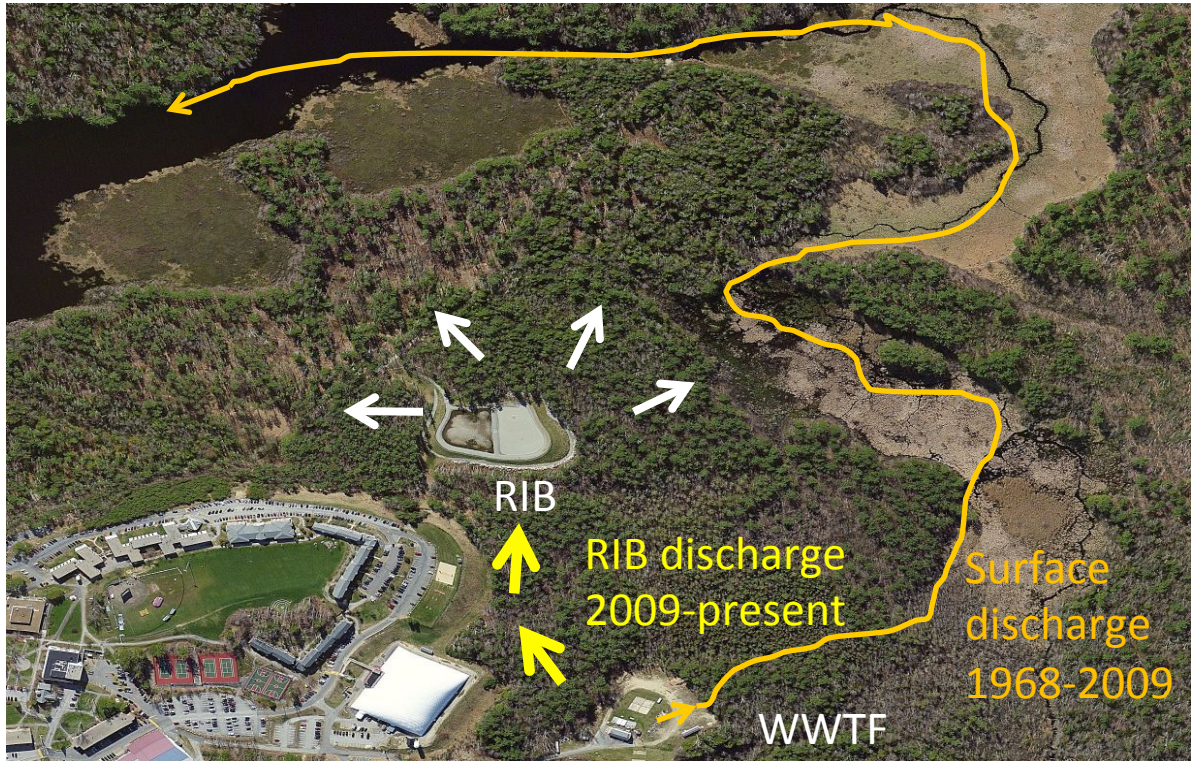


Septic Systems

- In 5 Years Time ~50% of the Systems Surveyed Will be ≥25 Years Old
- Implement Septic System Public Outreach Program
  - Encourage more frequent maintenance
  - Explore options to obtain lower bulk rate
  - Track & credit maintenance, repairs & replacement

Wastewater

- WWTF
- Residuals from Historic Surface Discharge to Wetlands



https://www.bing.com/maps/

Wastewater treatment facility (WWTF)

RIB=Rapid Infiltration Beds

WWTF Improvements

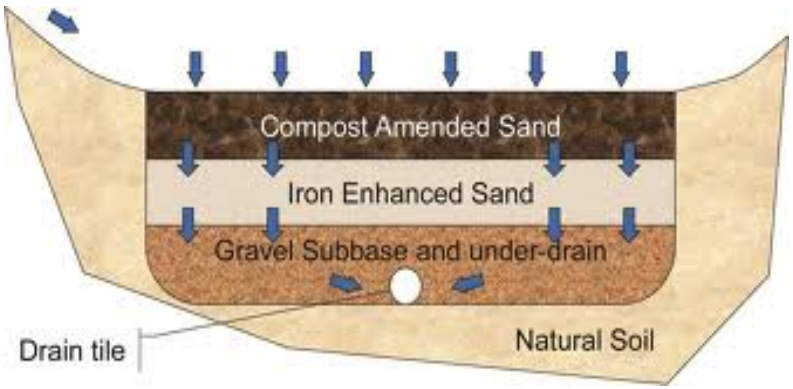
- Increase TP Removal
  - Chemical/biological additives for the Rotating Biological Contactor (RBC)
    - Increase Aluminum Sulfate (flocculent)
    - Increase Sodium Hydroxide (pH controls)
  - Iron Enhanced Sand in RIBs

http://portfolio.htp.bcit.ca/A00747714/novatec_13abcd/solutions_MWT.html

http://www.fresh-culture.com/equipment.htm

Wetland Treatment for Residual

- Iron Enhanced Sand Filter
  - Binds phosphorus (iron enhancement 6-8% by wt.)
  - Install at existing trail crossing
  - Requires shallow water depths & needs to fully drain to provide wet/dry cycles
  - Replace ~5 years



Iron Enhanced Sand Filter

http://stormwater.safl.umn.edu/

http://www.first4magnets.com/

Wetland Treatment for Residual

- Floating Treatment Wetlands
  - Inexpensive and simple to construct and install (volunteers)
  - Requires 2-3 feet water depth
  - Requires removal during winter months
  - Maintenance would include replacement of dead vegetation

Treatment Islands

http://www.wastewateralternatives.com/#/biohaven-floating-islands

Stormwater BMP Evaluation

- Stormwater BMPs Could Treat ~120 acres of the 185 Developed Acres (~6% of entire watershed)
- Top 10 BMPs Could Reduce TP by 15-20 kg per year - ~20% of Needed Reduction
- Target FPU Campus & Roadways
  - Gravel wetlands
  - Vegetated buffers
  - Bioretention/raingardens
  - Infiltration
  - Wet ponds
- Long-term Maintenance Required

Stormwater BMP Example

Option 3 - Kimball Rd – Beach Access

Install several rain gardens at Beach access. Use existing drainage system to connect rain garden overflows to outlet piping. Install rain gardens on both sides of Kimball Road and adjacent to the beach area / existing drainage outfall. Stabilize a small section of beach access with porous pavers and/or porous pavement systems (Geoblock®). Provide overflow system for porous pavement to prevent runoff from flowing over beach area. Connect overflow to existing drainage system.

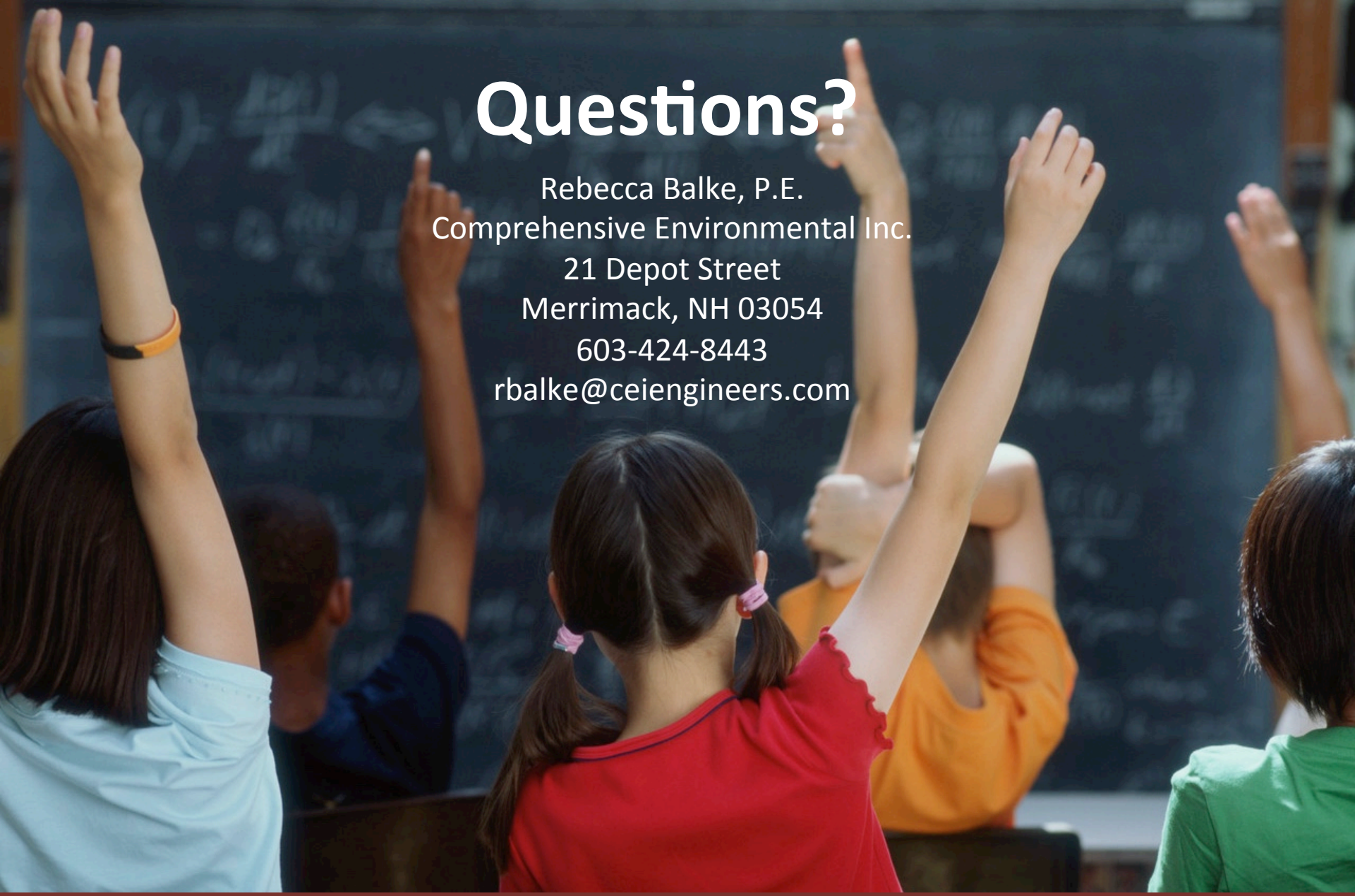
Pearly Pond Capital Improvement Plan & Schedule			
Recommendation	**Capital Cost Range**	**O&M / Planning Cost**	**Annual Phosphorus Removal (kg/yr)**
Public Education, Outreach and Regulatory Controls	**$9,800 - $16,100**	**$6,600**	**16**
Stormwater BMPs and Demonstration Projects	**$798,300 - $1,073,200**	**$8,100**	**19**
Wastewater Controls & Treatment System Upgrades	**$212,600 - $266,400**	**$1,500**	**11**
Wetland Effluent Treatment	**$35,550 - $51,300**	**$5,750**	**24**
Septic System Improvements	**$105,300 - $120,700**	**$1,500**	**9**
Waterfowl Controls	**$17,800 - $30,700**	**$2,100**	**8**
Additional Studies, Monitoring and Updates	**$38,500 - $79,500**	**$5,000**	**0**
Totals	**$1,217,850 - $1,637,900**	**$30,550**	**87**

Implementation 2016-2018

- $90,900 in Grant Funds
- $69,100 in Matching Funds
  - Develop education and outreach campaign
  - Outreach – waterfowl, septic system maintenance
  - Pearly Pond clean-up
  - Iron-enhanced sand filter at Hodge Pond trail crossing
  - Install vegetated buffers/rain gardens (voluntary private landowners)
  - Implement waterfowl scare practices
  - Kimball Road beach access stormwater BMP
  - Promote increased infrastructure maintenance
  - Long-term monitoring
- Estimated ~36 kg/yr TP Reduction

Conclusions

- Even in undeveloped areas, TP can be a problem.
- Requires “buy-in” by many involved parties and a very proactive support group.
- Phosphorus controls can be expensive ($15,000/kg).
- Maximize available funding sources.



Questions?

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