Bartlett Pond Watershed Assessment: Project Update

Plymouth, Massachusetts

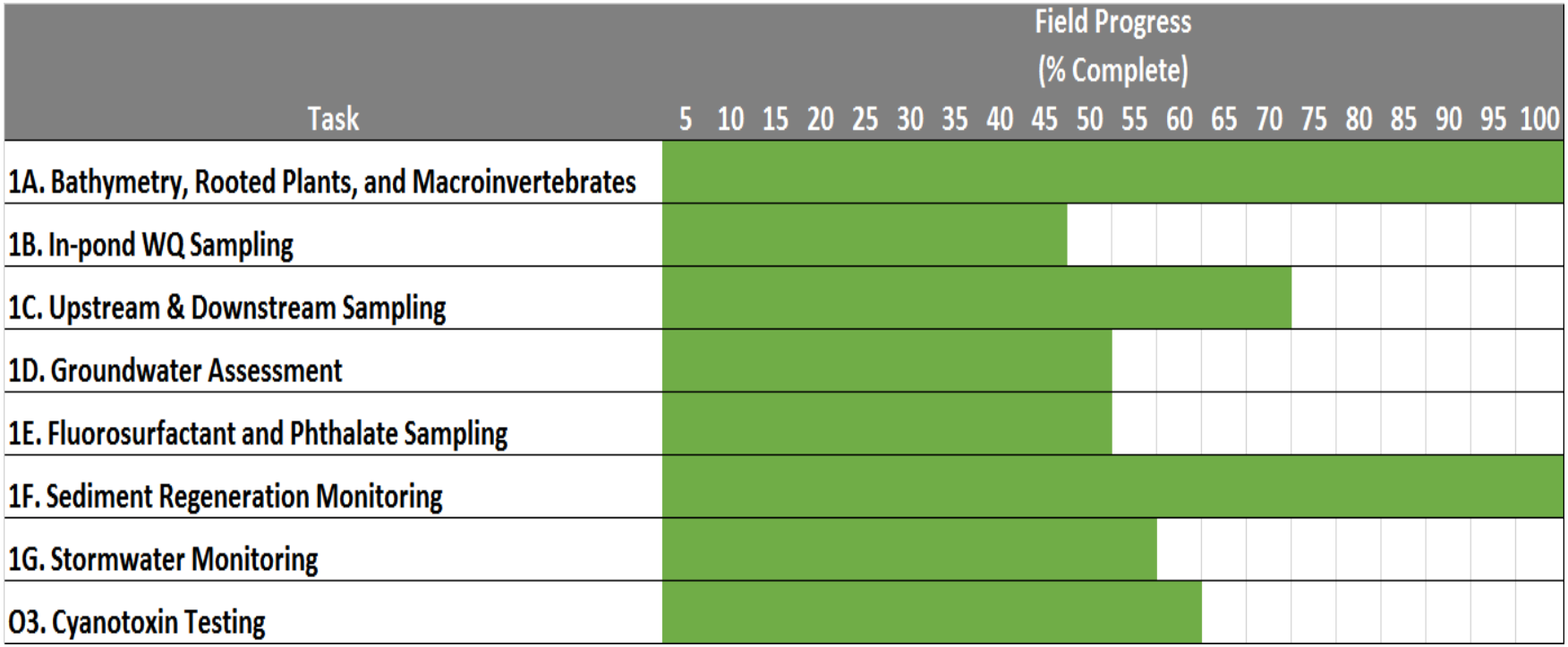
August 6, 2019

Before We Get Too Far Along...

- A quick overview:
- Water quality/public health issues have been suspected or documented for a long time
- Sources of these issues need to be better studied to bridge data gaps
- This project will consider:
  - Near-watershed sources
  - Far-watershed sources
  - Seasonal anoxia and sediment release of nutrients
  - Possible intrusion of higher salinity waters into the pond
- This project will recommend:
  - Management actions to address key issues and support restoration of the recreational, ecological, and economic viability of the area

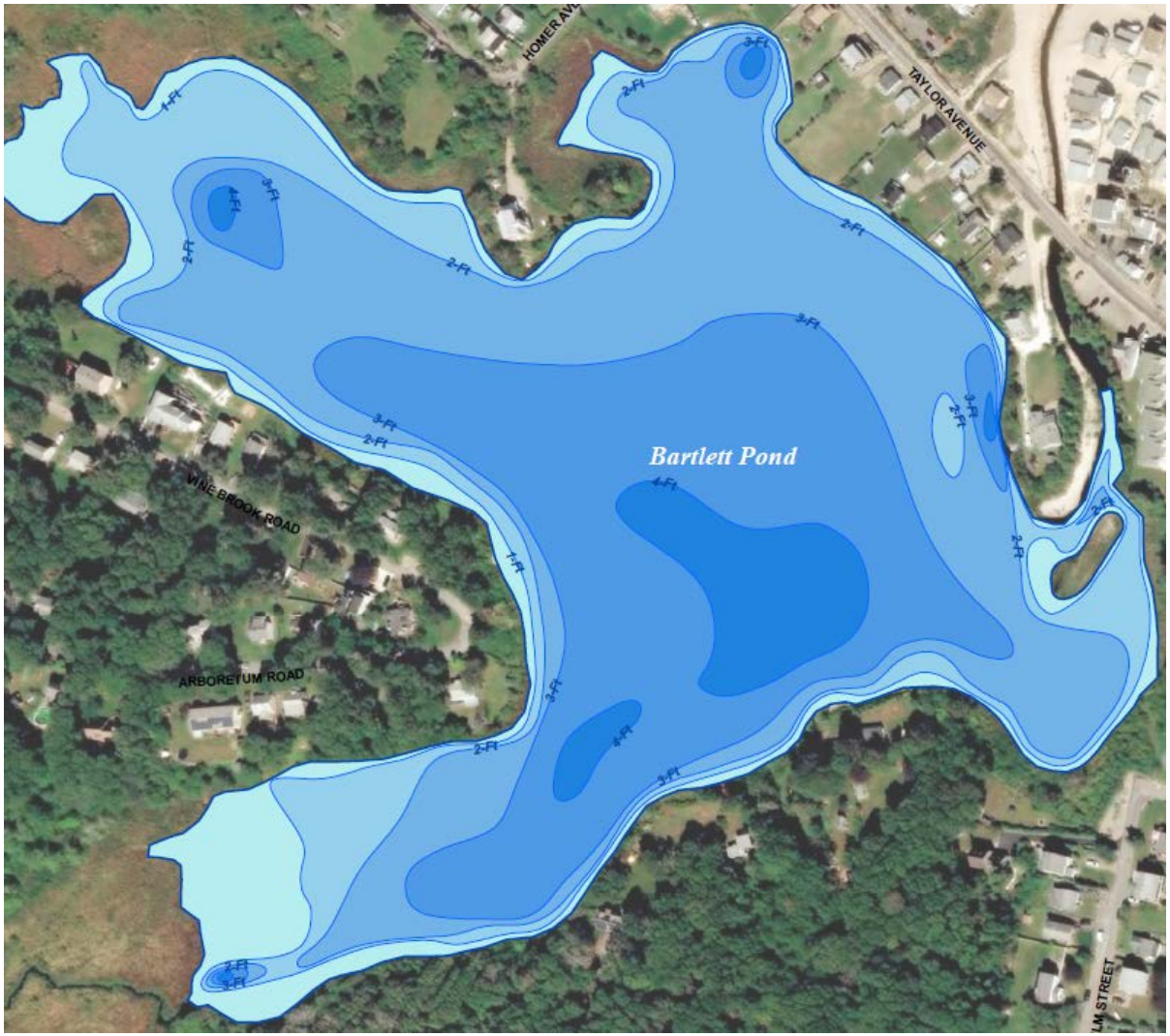
Where We're At

- Field program at or greater than 50% complete for most tasks
- We have at least some data for all factors of interest to date, which we'll discuss tonight



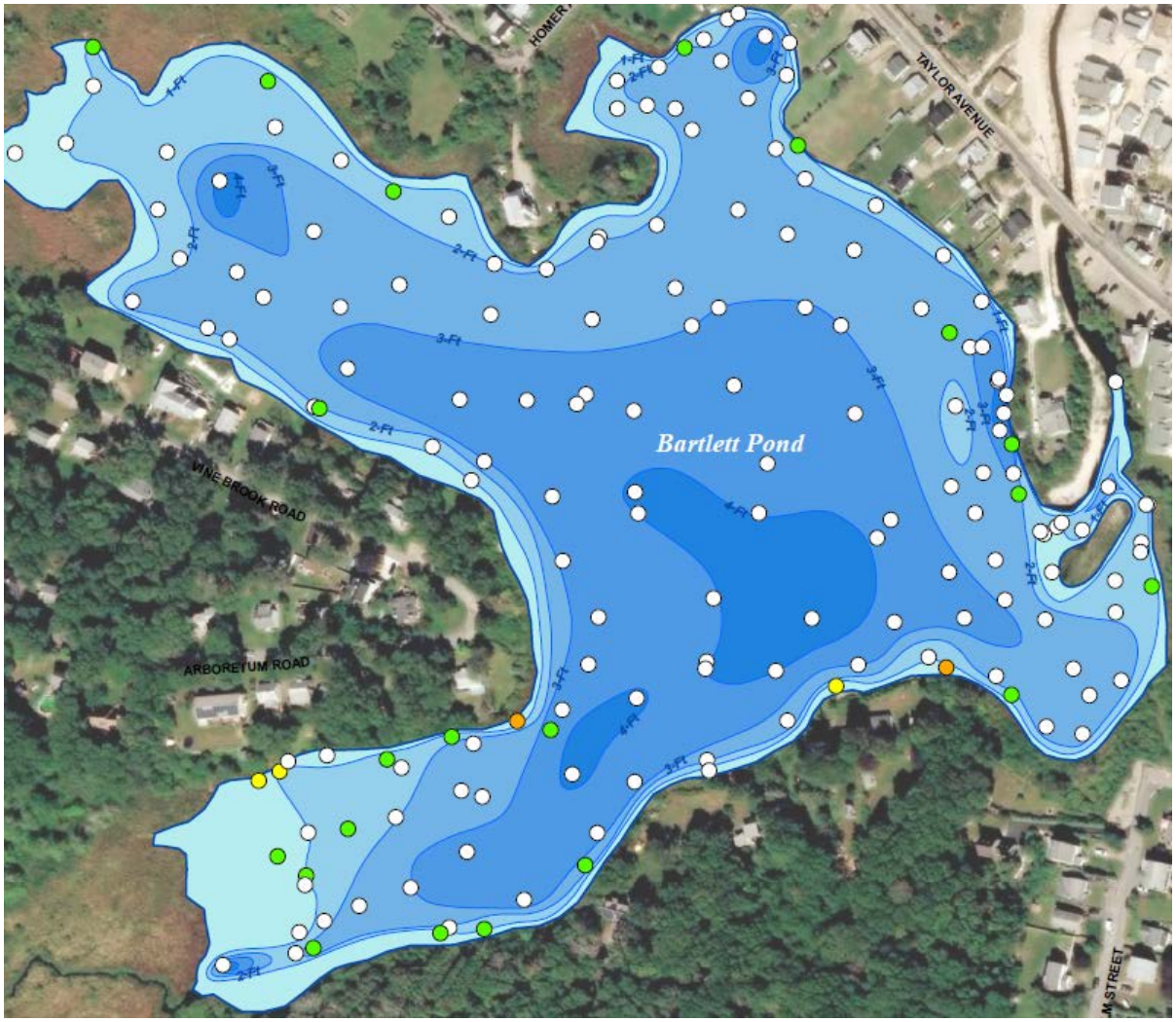
Task 1A - Bathymetry

- Max depth = 4.1 ft
- Avg depth = 2.4 ft
- Decrease of 1 to 2 feet from 1970
- Volume = 3.2 M cu ft
- Detention time of a few days – frequent pond flushing



Task 1A – Aquatic Plant Surveys

- Plants emerged late but sparse to patchy beds eventually developed
- Primarily in 1-2 feet of water
- Does not include water willow, which forms extensive emergent beds



Task 1A – Aquatic Plant Surveys

- No aquatic invasives noted
- Native aquatic plants present at low levels
- Large areas devoid of rooted aquatic plant life
- Lower species richness than prior surveys

Clasping-leaf Pondweed

Slender Milfoil

Typical Pond Bottom

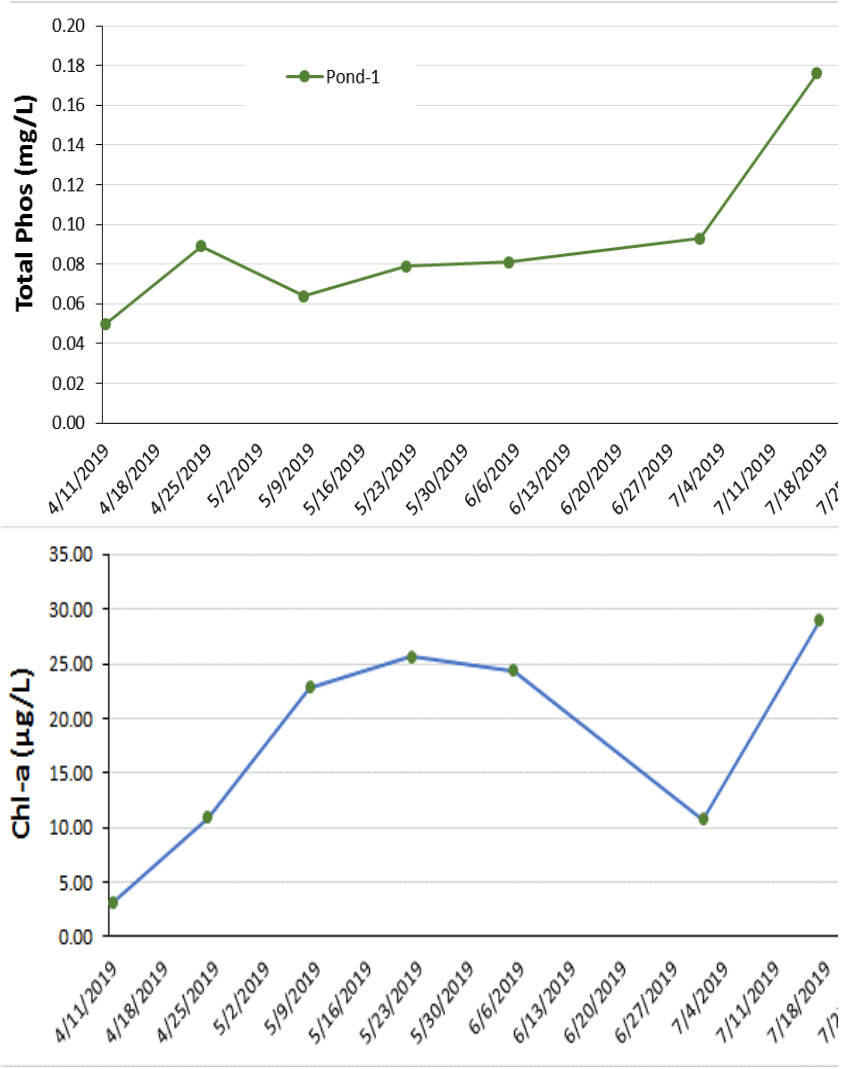
White Water Lily and Duckweed

Task 1A - Macroinvertebrates

- Sampled water willow beds, submerged plant beds, inlet, deep hole, sandbar, and outlet
- High diversity in plant beds
- High abundance in deep sediments
- Tolerant species
- Lack of brackish indicator species

Task 1B/C – Water Quality

- Phosphorus (P) levels elevated
  - All measurements >0.04 mg/L (total) and >0.02 mg/L (dissolved)
  - Increase from inlet to outlet
  - Increase from April to July
- Chlorophyll a levels elevated
  - May peak corresponds with diatom bloom (*Stephanodiscus hantzschii* – an indicator of eutrophic conditions)
  - July resurgence of uncertain origin
  - No sign of cyanobacteria blooms yet



Task 1B/C – Water Quality

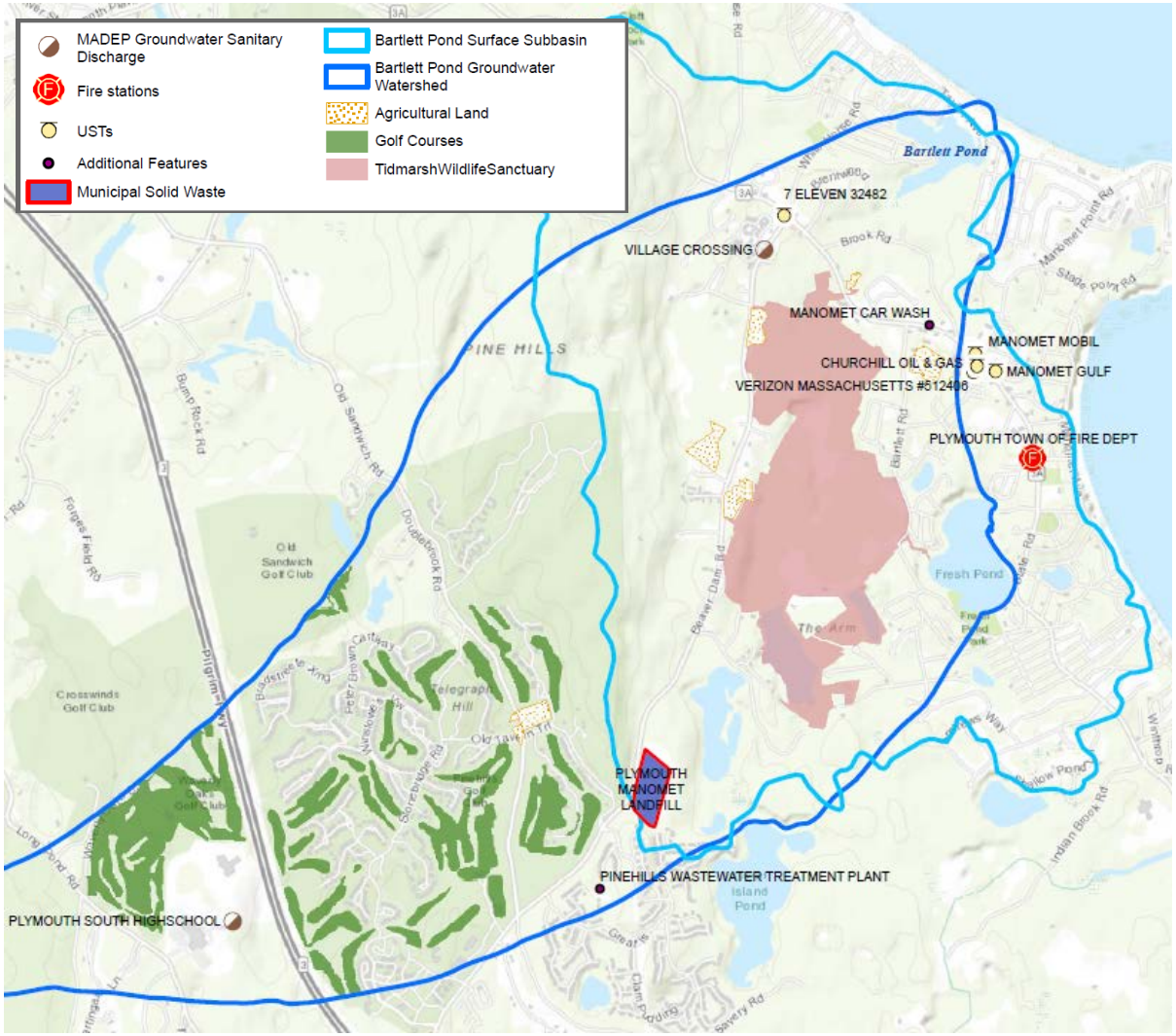
- Total nitrogen (N) levels elevated but not unusual for developed watersheds
  - All measurements <1 mg/L
- Bacteria variable but mostly below recreational thresholds
  - Highest Fecal Coliform and *E. coli* in late April
  - Highest Enterococci on July 17
- Dissolved oxygen okay but in decline
  - No anoxia observed yet
- Salinity remains very low
  - Freshwater conditions throughout pond from April to July

Task 1D - Groundwater

- Field-based Groundwater Seepage Assessment
- 4 shoreline segments evaluated
  - 1 background and 3 developed
- P and N *concentrations* vary substantially between shorelines
  - General increase in P from south to north
  - General increase in N from east to west
- P and N *loads* do not necessarily follow same pattern
- Seasonality may also come into play – sample again later in the year

Task 1D - Groundwater

- GIS-based and Desktop Assessment
- GW watershed larger/different from surface watershed
- Consider potential sources/sinks in both



Task 1E – PFAS and Phthalates

- Fluorosurfactants (aka PFAS)
  - Emerging contaminants
  - Very mobile and persistent
- Phthalates
  - Used in many industrial and consumer products
  - Low to moderate mobility
- No detections of either group during spring sampling round
  - Pared back to 2 rounds of samples at 3 locations
  - Will resample in late summer/early autumn

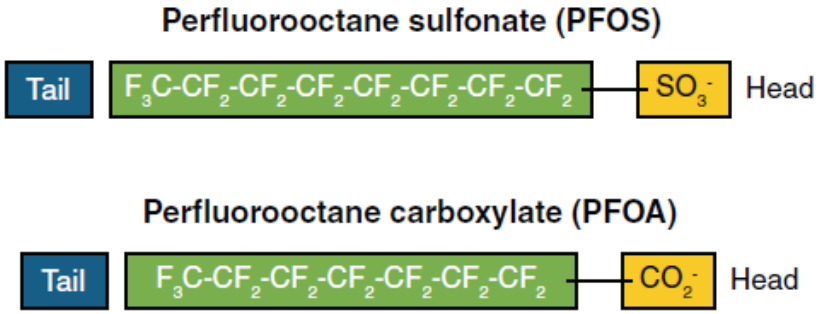


Figure 4. The tail and head structure of PFOS and PFOA molecules.

Source: ITRC PFAS Factsheet, 2018

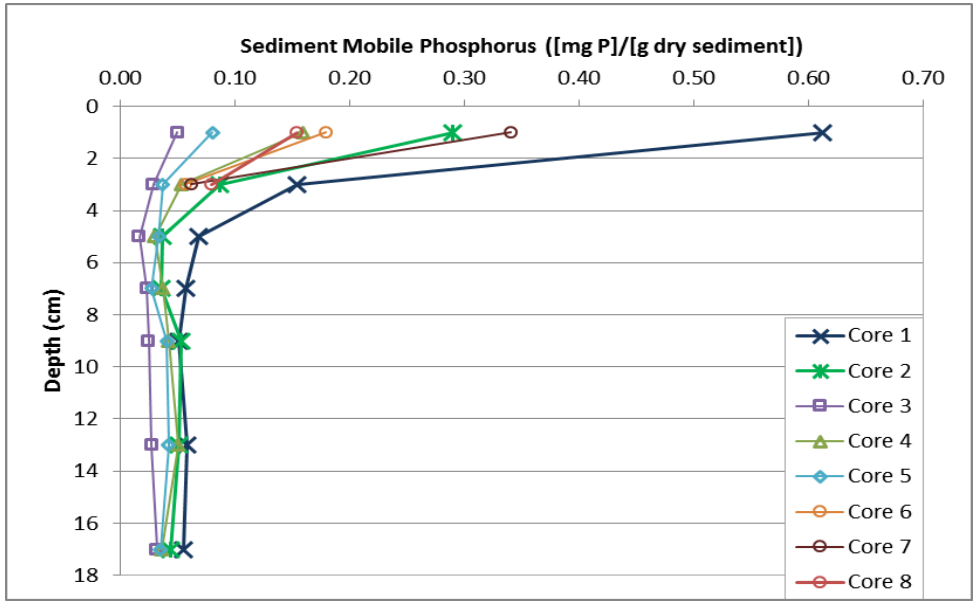
Source: FACT website

Task 1F – Sediment Regeneration

- Collected 8 sediment cores in early May
- Each core sectioned to provide vertical profile
- Analyzed for P fractions
- Focus on mobile P - easily released into water column

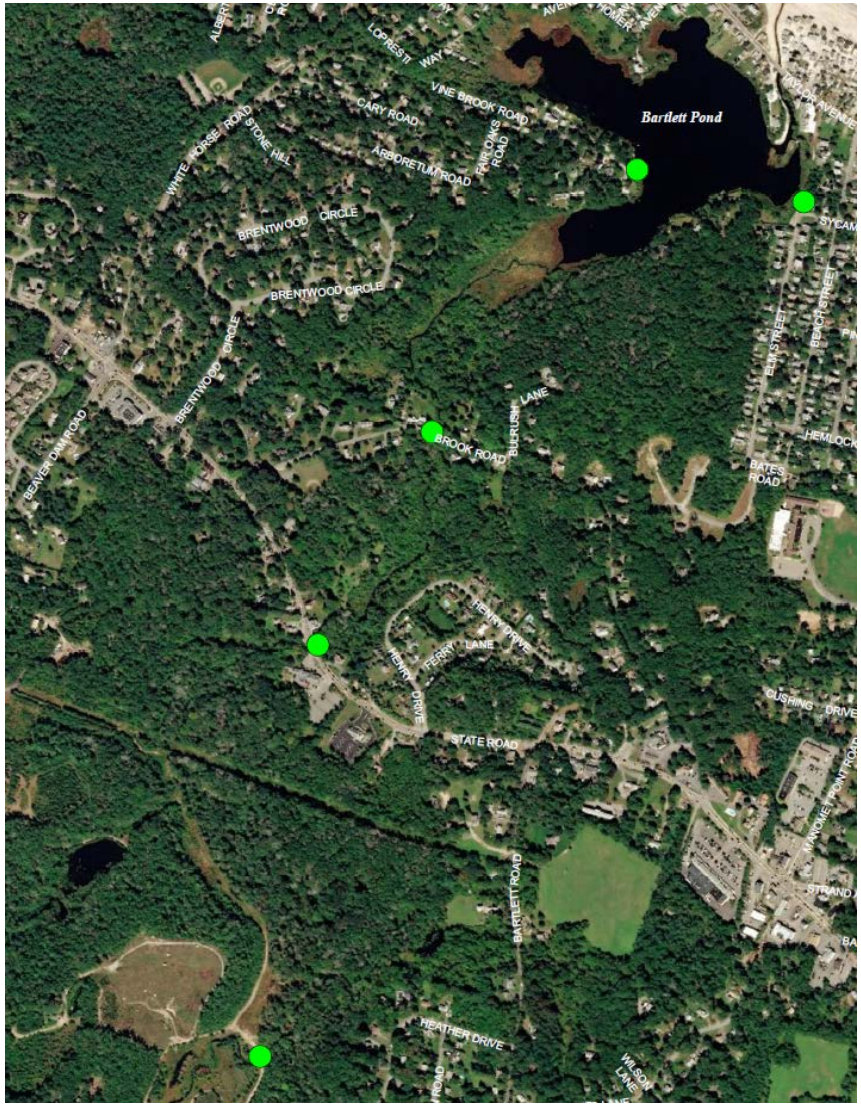
Task 1F – Sediment Regeneration

- Results show potential for P release under low DO
- Highest in central and southwestern sediments
- Modeling to show what this actually means for Bartlett Pond



Task 1G - Stormwater

- First event on July 23
- Rainfall total approached 2 inches
- Sampled 5 locations
  - Vinebrook Road outfall
  - Sycamore Terrace headwall
  - Beaver Dam Brook at
    - Brook Road
    - State Road
    - Tidmarsh Sanctuary



Task 1G - Stormwater

- Higher concentrations of most major analytes compared to dry weather conditions
- Very high levels of P (>0.1 mg/L) almost everywhere, N not as extreme (generally <1 mg/L)
- Precipitation concentrations of P (0.03 mg/L) & N (0.2 mg/L)

Scope Changes to Date

- Shifted budget from fluorosurfactant & phthalate sampling
  - Due to non-detect results in first round
  - Still another round in late summer/ fall
  - Also sampling as part of stormwater scope
- To Optional Task 03: Cyanotoxin Testing for 5 rounds
  - Analyzed 3 samples in July
  - All results non-detect to date
  - 2 more events planned through end of August
- Will also add another round of groundwater seepage sampling in late summer/fall

Source: EPA, Managing Cyanotoxins in Public Drinking Water Systems webpage

Thank You!