

Applying an alternate approach to watershed management for two New Hampshire lakes with unique water quality stressors and responses

March 15, 2019

NH Water & Watershed Conference



LANDSCAPE ALTERATIONS



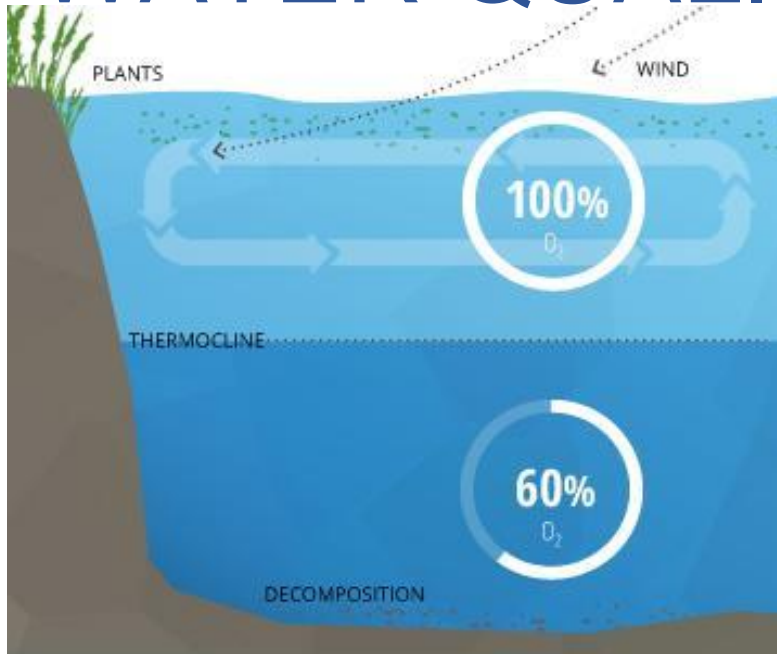
ECOLOGICAL PROCESSES

TRADITIONAL APPROACH

UNEXPECTED PHENOMENA

ADJUSTED ACTION PLAN

WATER QUALITY CONCERNS



© Fondriest



© Lake Hopatcong Commission



© Community Architect

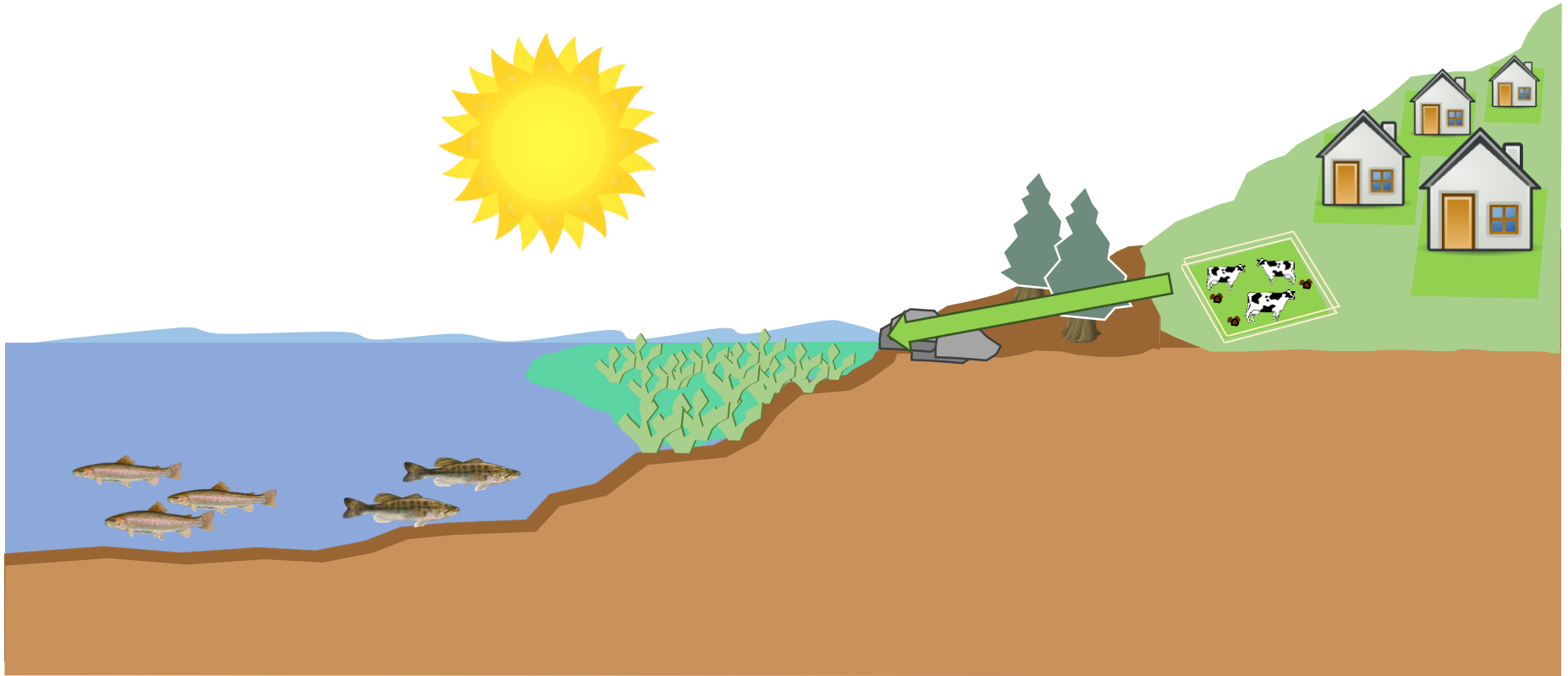
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NUTRIENT LOADING



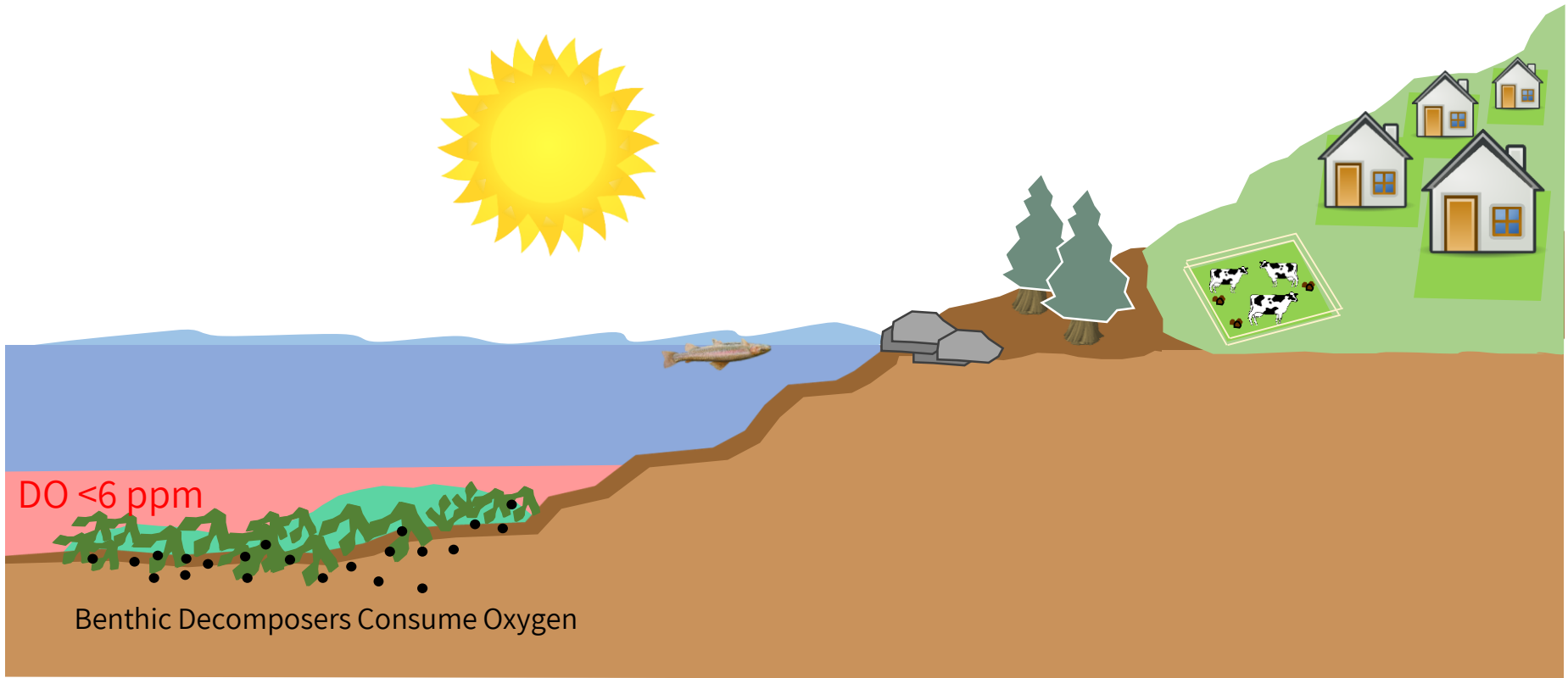
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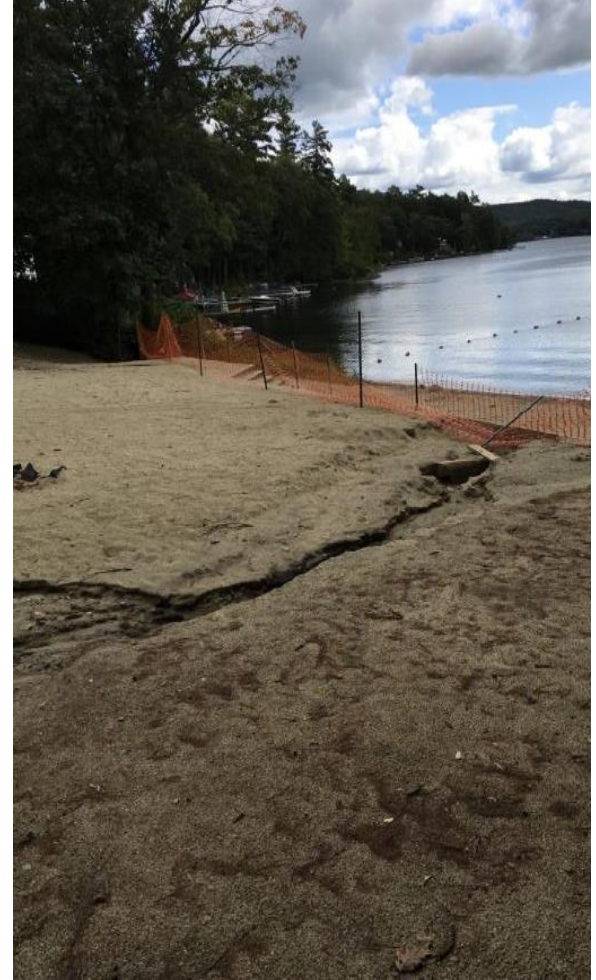
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SOURCES OF PHOSPHORUS



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BEST MANAGEMENT PRACTICES



Reduce, divert, and infiltrate surface runoff.



Stabilize shoreline access points through vegetation or riprap.



Minimize and define parking areas and pathways.



Maintain shoreline, streamside, and wetland buffers.

Minimize pollutants (e.g., fertilizers, detergents, and other phosphorus-based products).

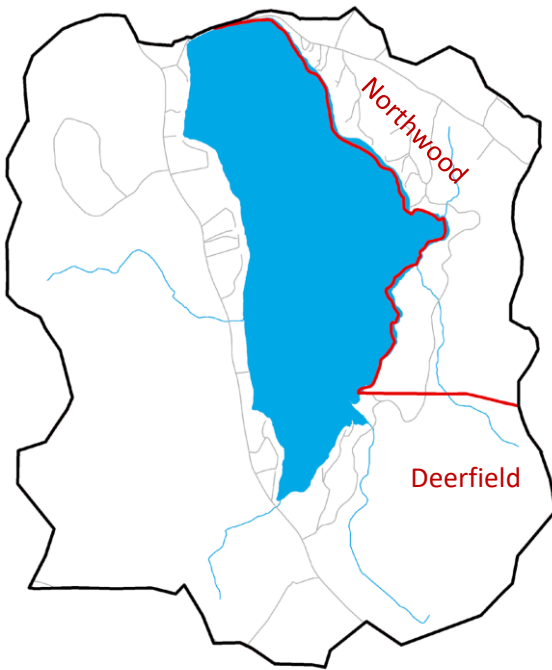
Photo credit: FBE, AWWA, SOAK UP the Rain, Open Clipart

LOW DO AND LOW PHOSPHORUS?



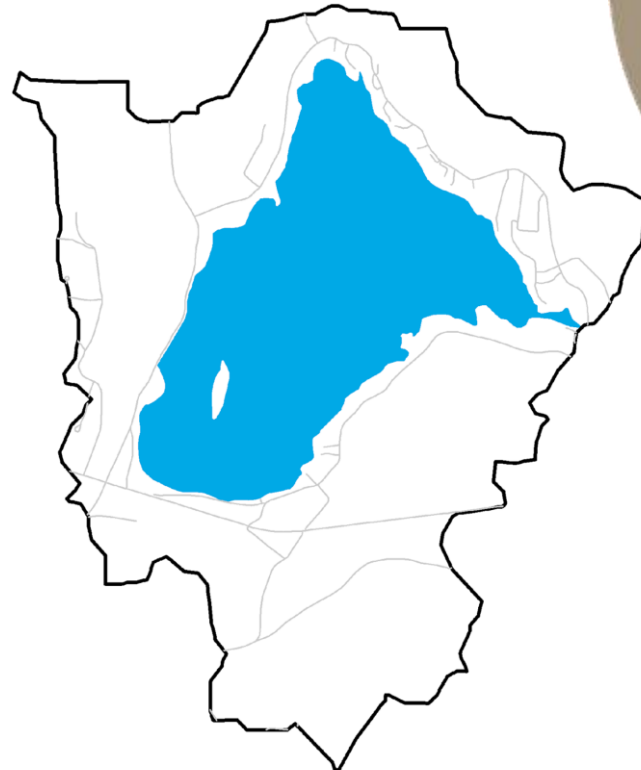
Pleasant Lake


(Deerfield/Northwood, NH)



Spofford Lake

(Chesterfield, NH)

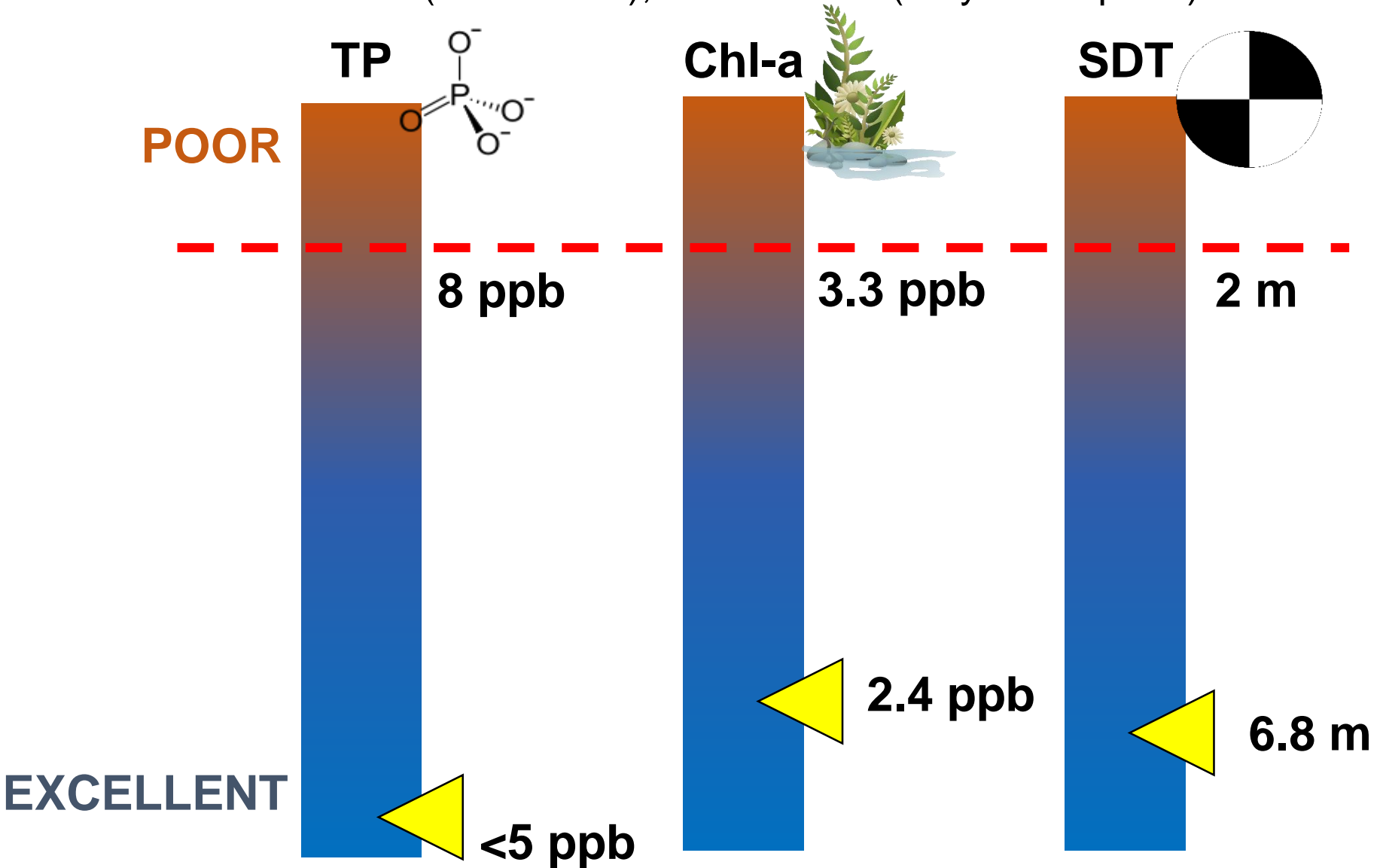


-  Lake/streams
-  Watershed Boundary
-  Town Boundary
-  Roads



PLEASANT LAKE WATER QUALITY SUMMARY

RECENT (2006-2015), SEASONAL (May 24-Sept 15)



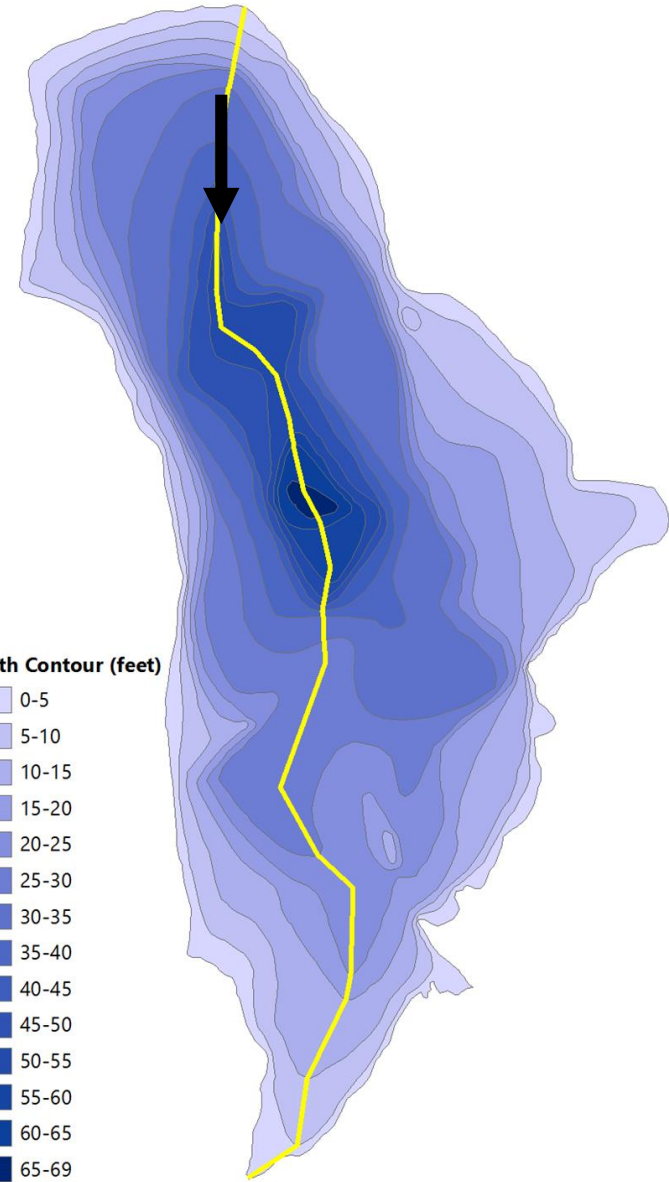
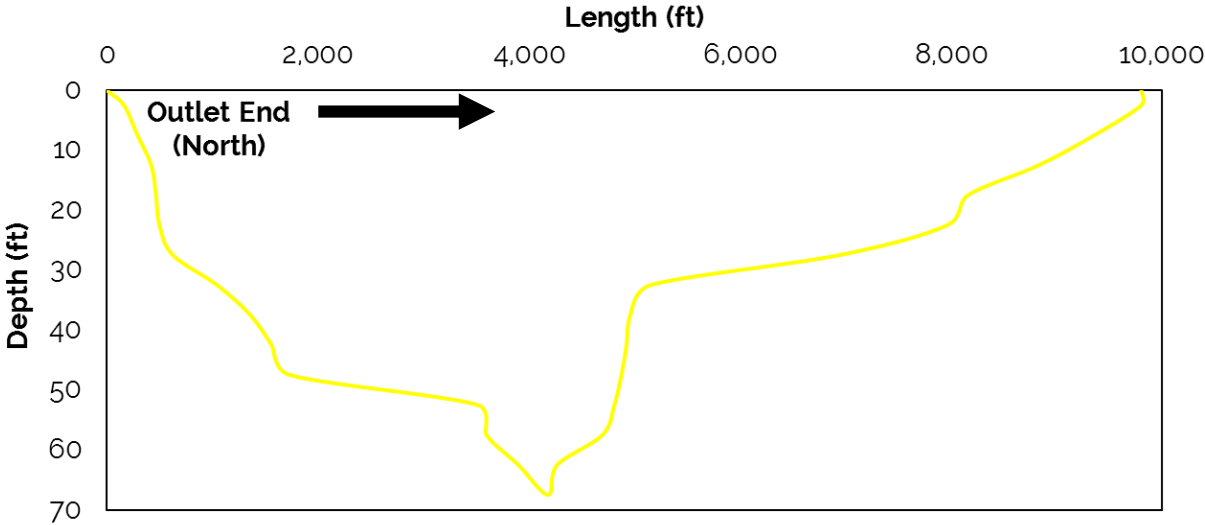
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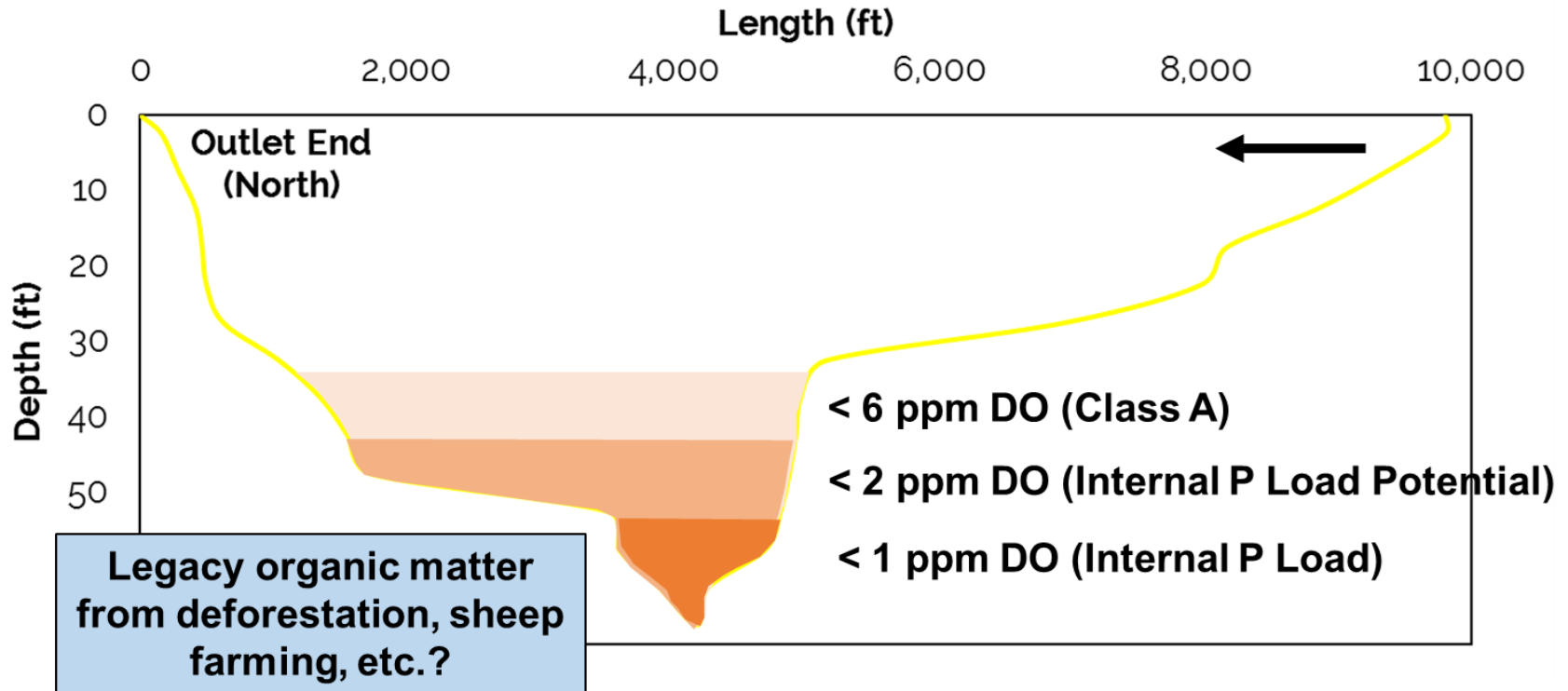
PLEASANT LAKE WATER QUALITY SUMMARY



PROBLEM: LOW OXYGEN

Pleasant Lake is impaired for aquatic life use based on low dissolved oxygen concentrations in bottom waters.

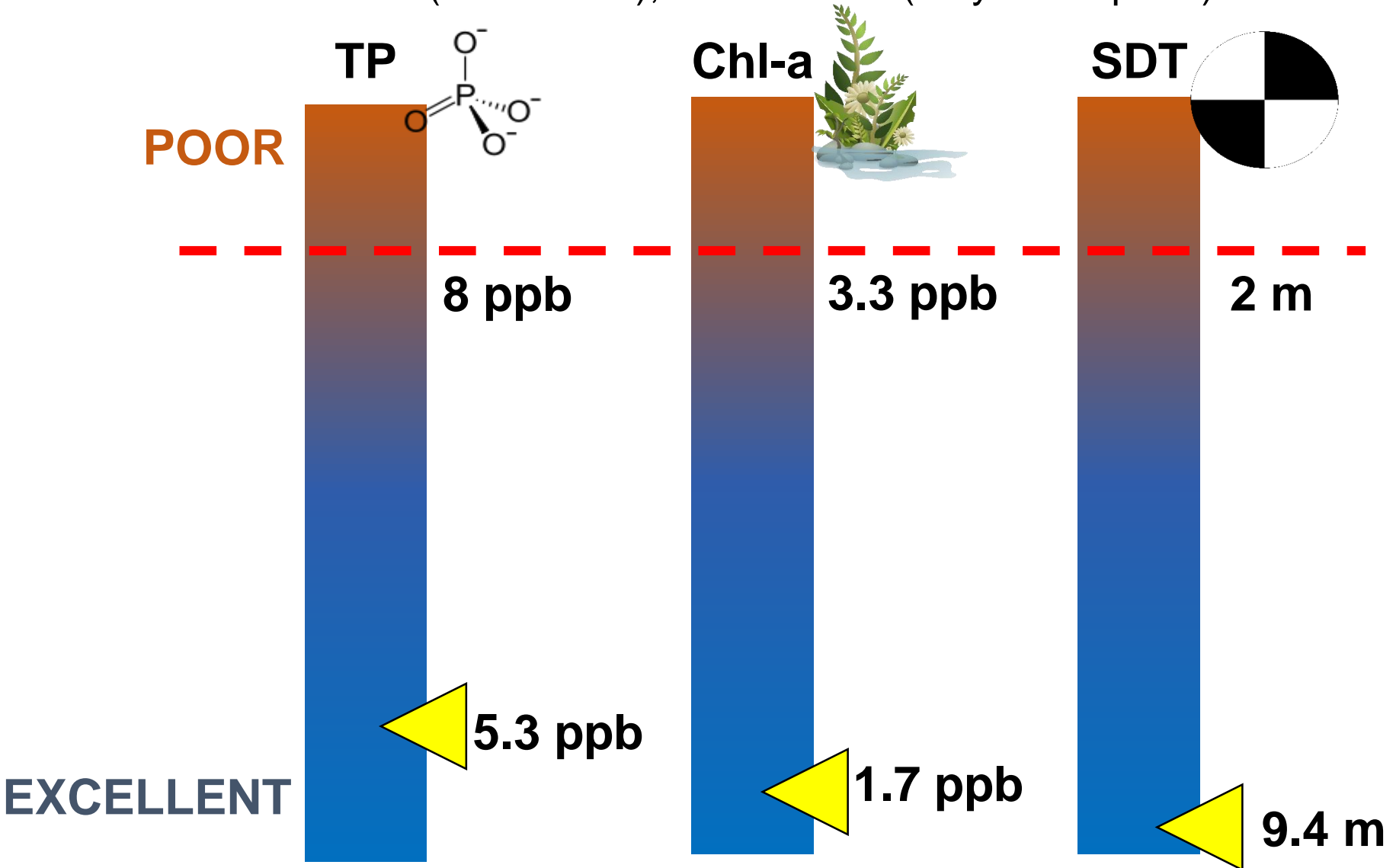
PLEASANT LAKE WATER QUALITY SUMMARY



- Low oxygen in bottom waters **CAN be a natural phenomenon** when thermal stratification in late summer separates oxygenated surface waters from bottom waters where decomposition of organic matter consumes oxygen.
- In this case, the extent and duration of low oxygen in Pleasant Lake **may be harmful to aquatic life** seeking desirable habitat.

SPOFFORD LAKE WATER QUALITY SUMMARY

RECENT (2008-2017), SEASONAL (May 24-Sept 15)



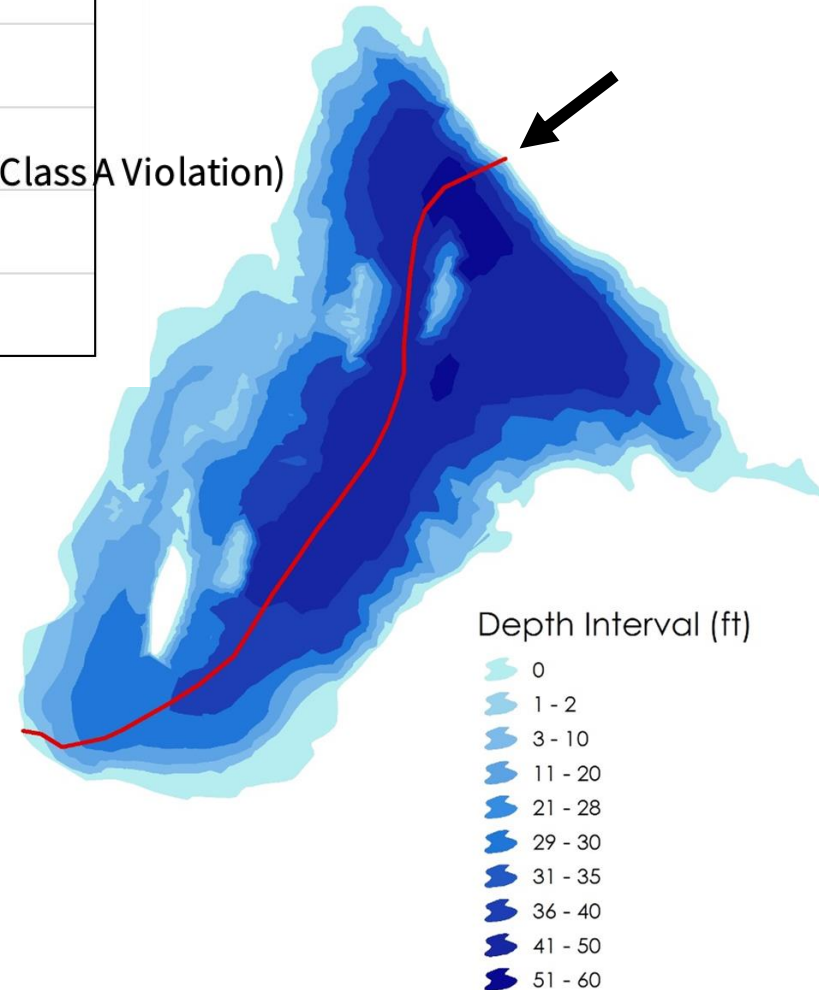
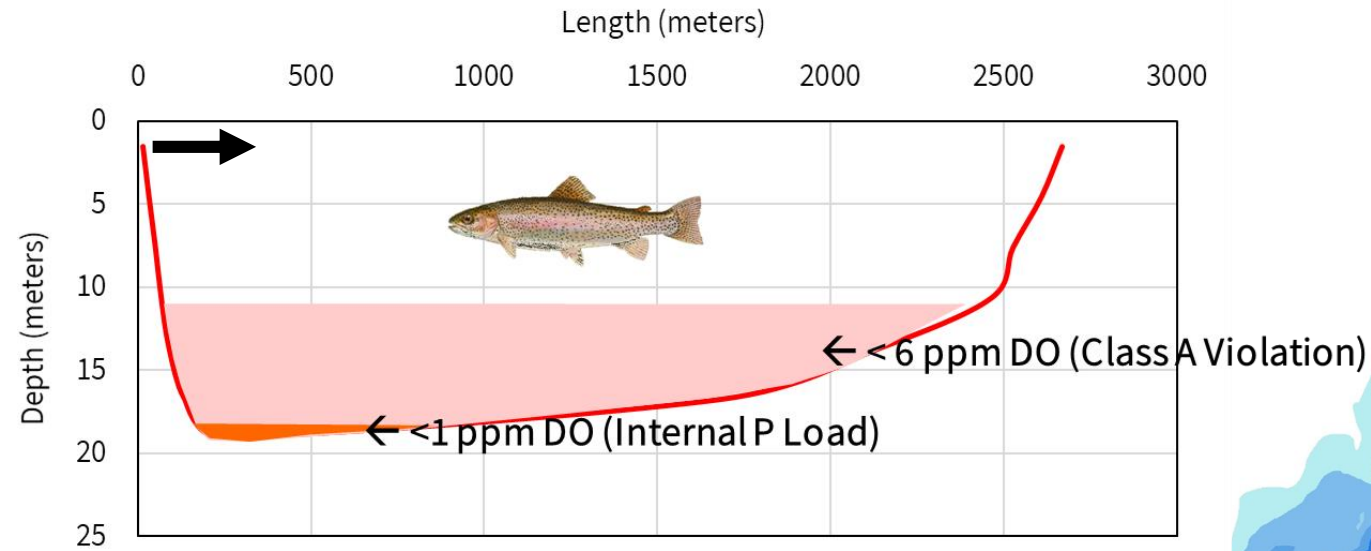
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SPOFFORD LAKE WATER QUALITY SUMMARY



PROBLEM: LOW OXYGEN

Nearly half the lake volume is impacted by oxygen levels undesirable for many aquatic life.

LEGACY ORGANIC MATTER LOADING

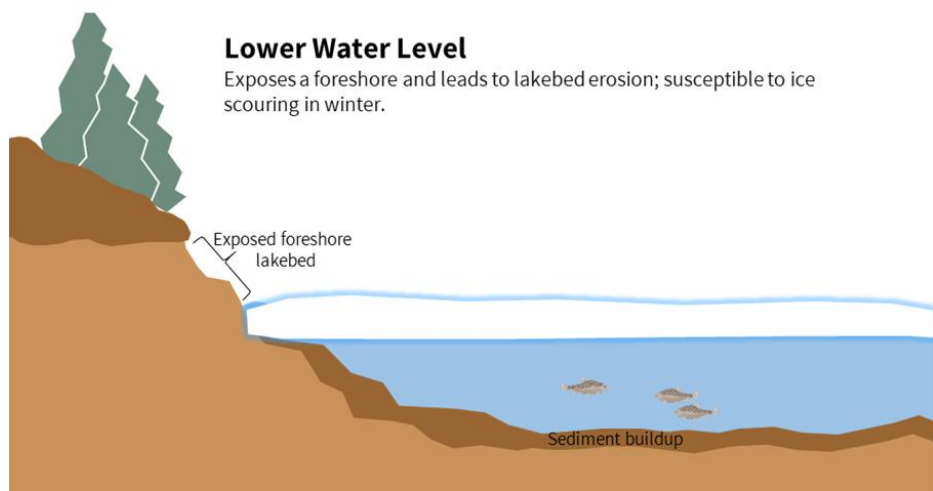
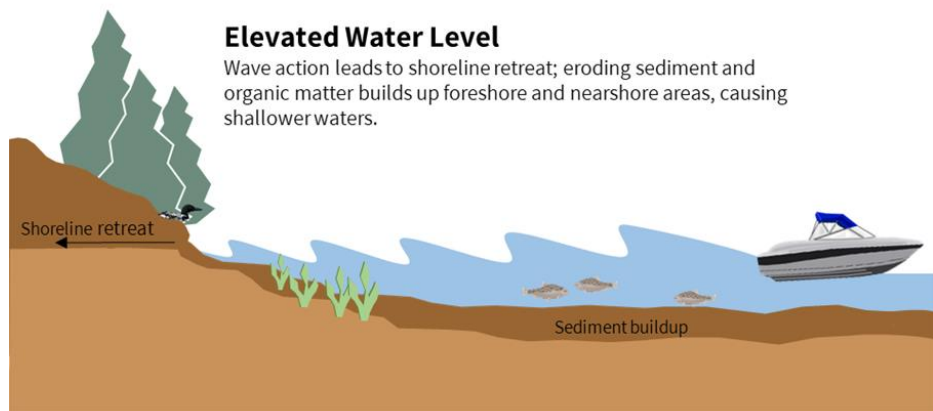
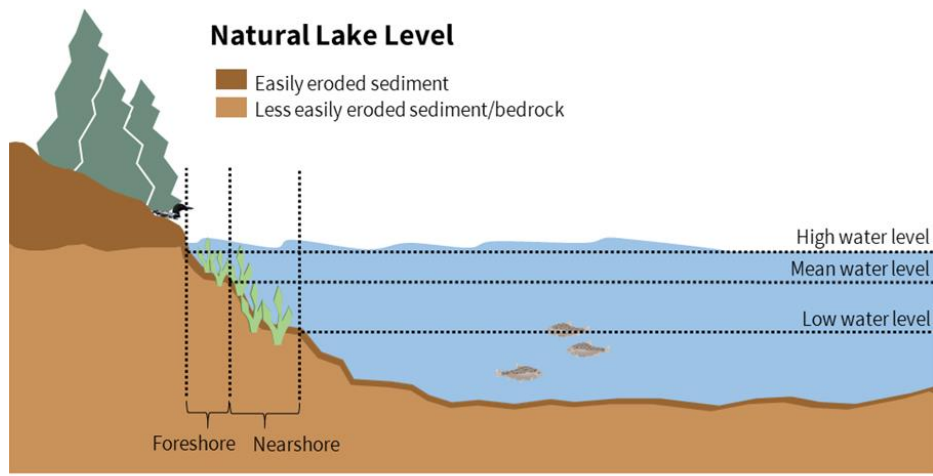


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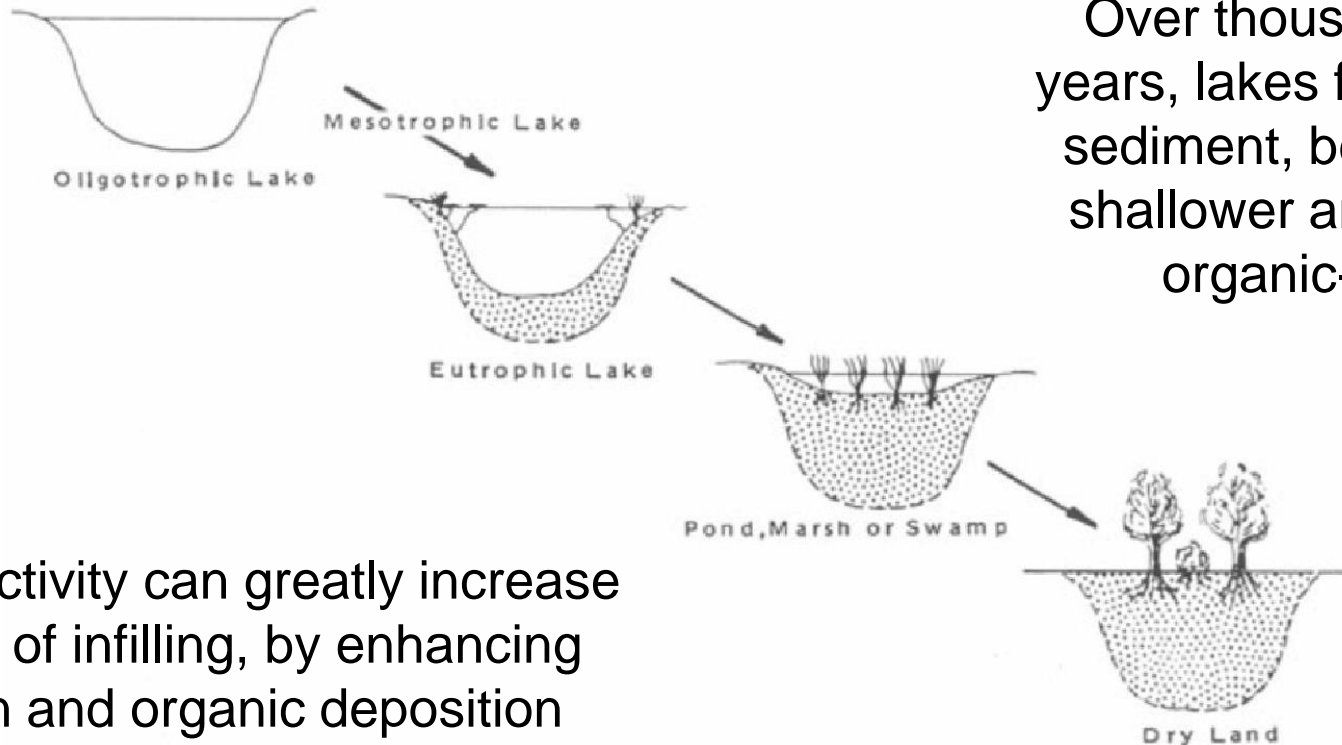
ADJUSTED ACTION PLAN





SEDIMENT CORING

All solid material in a watershed eventually ends up at the lowest spot. In lakes, this material is permanently trapped by the basin, so it accumulates. Coring collects these materials in their depositional sequence.



Over thousands of years, lakes fill up with sediment, becoming shallower and more organic-rich

Human activity can greatly increase the rate of infilling, by enhancing erosion and organic deposition

Sediment Core Collection by Plymouth State University



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Sediment Core Collection by Plymouth State University



Both cores have subtle but distinct changes in sediment color

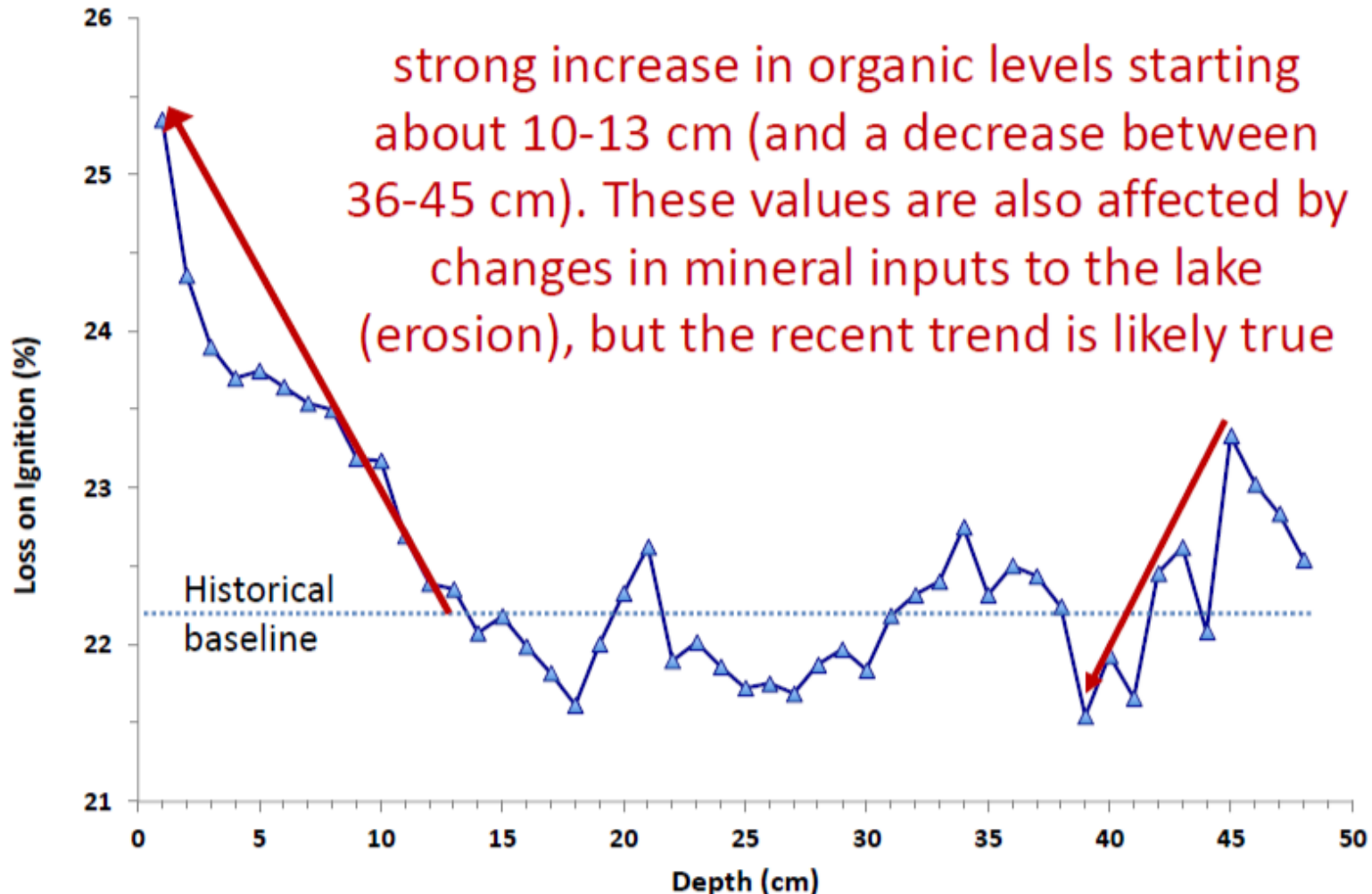
changes occur at about 10-13 cm and 36-40 cm below the core top

smearing of sediment on the core liner blurs color transition, but remember those depths!

© Dr. Lisa Doner; Graduate Student William Tiftt, Plymouth State University

Sediment Core Collection by Plymouth State University

Organic Carbon Content of Pleasant Lake's Sediments



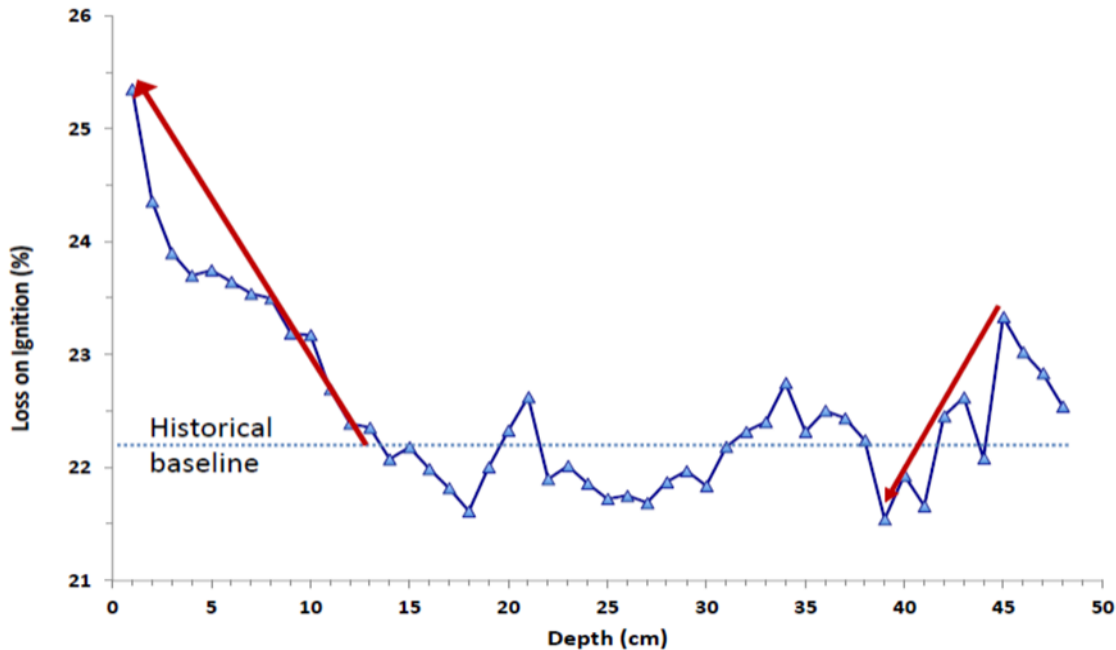
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NEXT STEPS

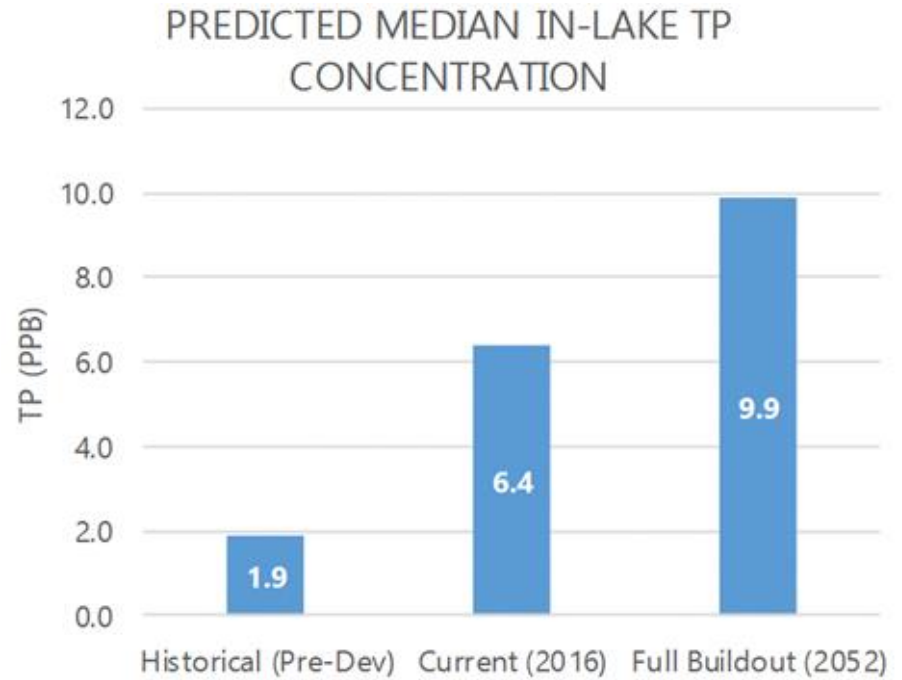
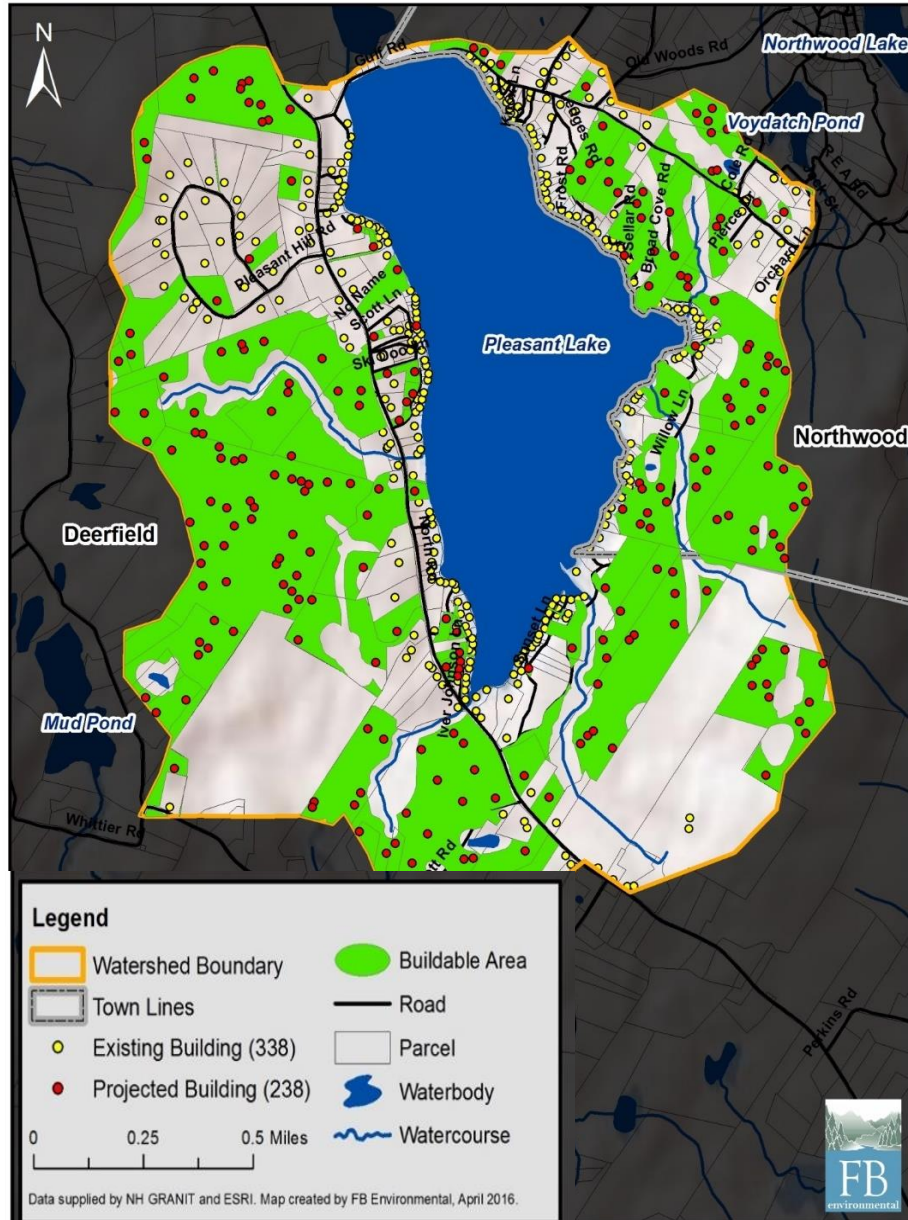
Low dissolved oxygen in these lakes may be driven by organic matter accumulation.

This is still preliminary research and data.

Future analysis of the sediment cores will help disentangle the drivers of organic carbon in lake sediments.



FUTURE PROJECTIONS



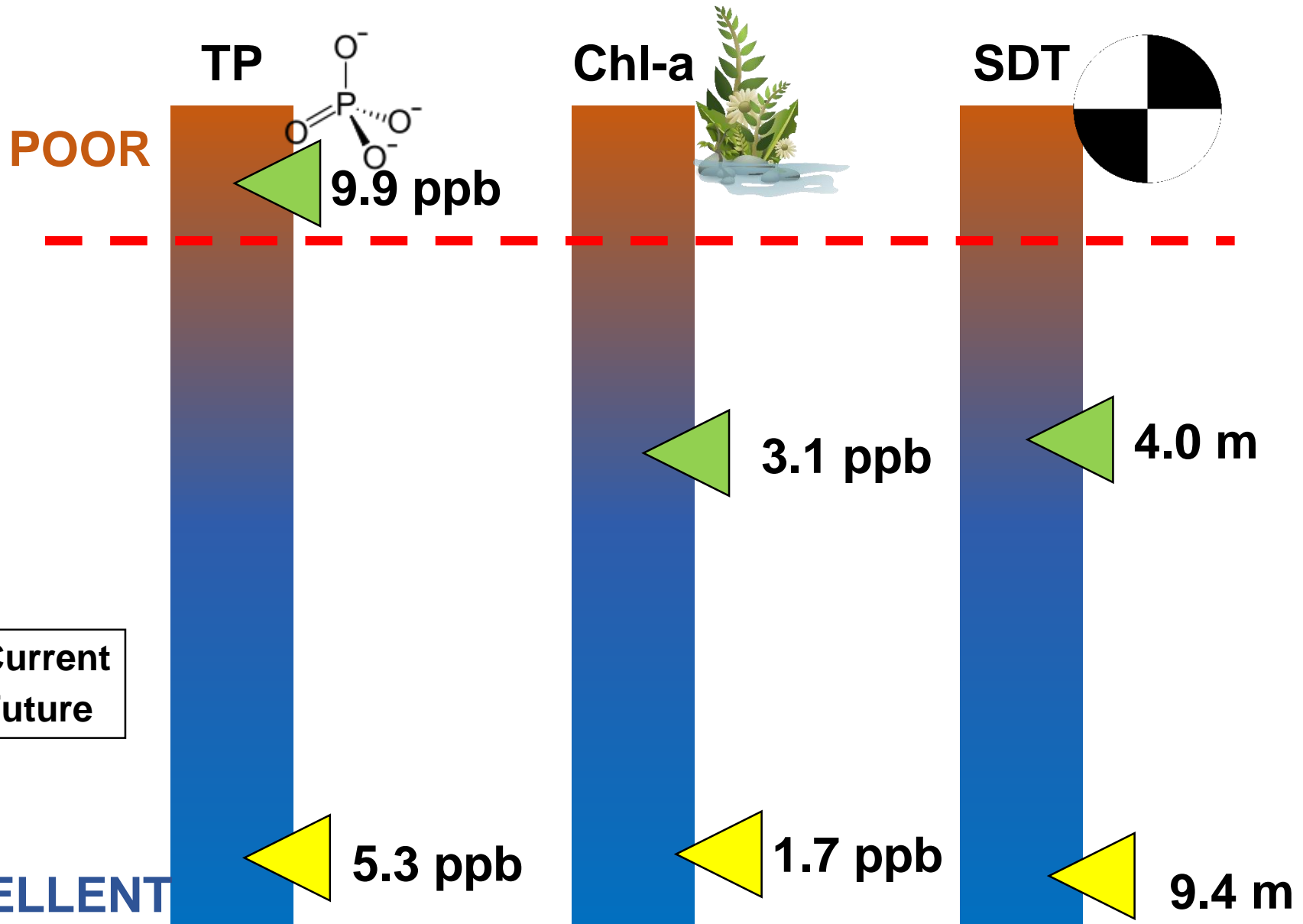
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FUTURE PROJECTIONS, Spofford Lake



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NEXT STEPS

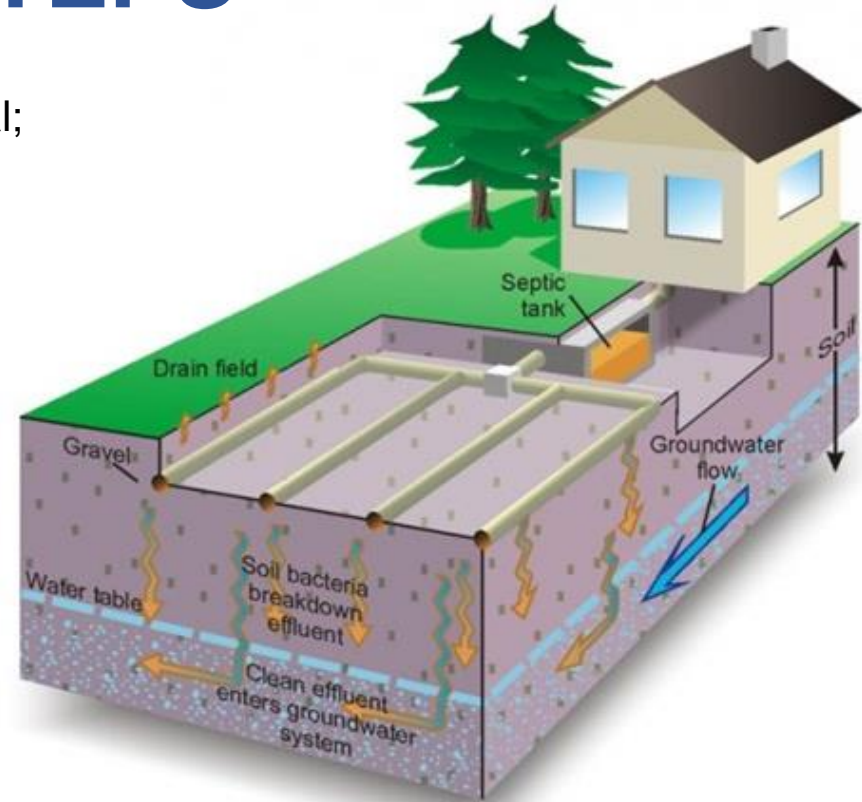


- Avoid over-fertilizing!
- Get soil tested before applying
- Apply in September, not before spring leaf-out
- Leave grass clippings
- Calibrate spreader to apply half recommended amount on bag label
- Younger lawns may need N, not P!

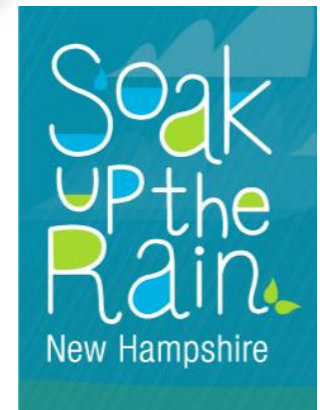


NEXT STEPS

- Pump out system every 2-3 years (less if seasonal; more if use garbage disposal)
- Be sure usage matches septic capacity
- Inspect systems more than 25 years old
- Divert drains, pumps, runoff from leachfield
- Keep trees and heavy machinery off leachfield
- Avoid flushing bulky items, greases, or chemicals (like bleach)



A failing septic system can go unnoticed, depending on site conditions!



Questions?

NH Water & Watershed Conference Presentation, 3/15/19
L. Diemer, FB Environmental Associates



Applying an alternate approach to watershed management for two New Hampshire lakes with unique water quality stressors and responses

Elevated in-lake total phosphorus (TP) concentrations typically drive eutrophication in lakes, leading to increases in the extent and duration of low dissolved oxygen (DO) in the hypolimnion during late summer thermal stratification. TP (bound to eroding sediment) then typically becomes the target parameter for achieving measurable reductions that meet water quality goals set in watershed management plans. Two New Hampshire lakes (Pleasant Lake in Deerfield/Northwood and Spofford Lake in Chesterfield) are listed by the NHDES as impaired for aquatic life use due to low levels of DO, but both have excellent (low) in-lake TP concentrations. We present on the alternative water quality goal setting process used for these two unique waterbodies and what insights we have gained from the water quality and sediment core analyses to help explain the apparent disconnect between TP and DO.

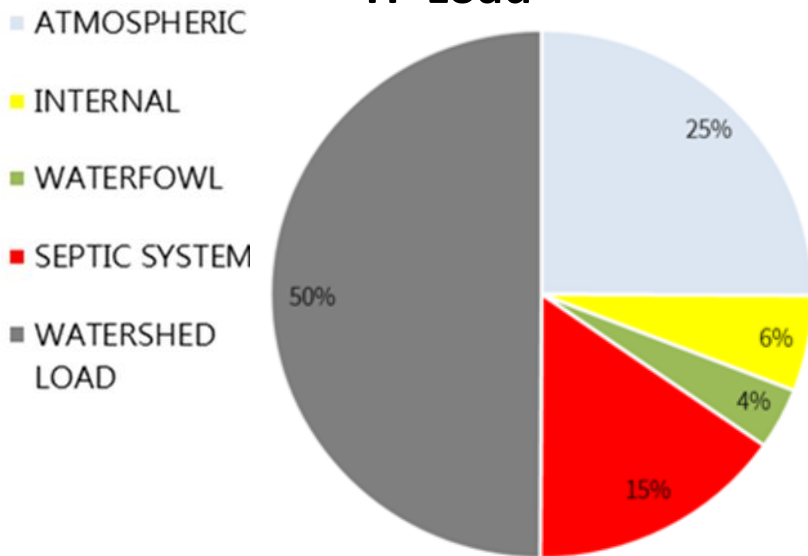
OUTLINE

- Understanding phosphorus and eutrophication
- Understanding low DO in the hypolimnion
- NORMAL WMP approach targets TP bound eroding sediment

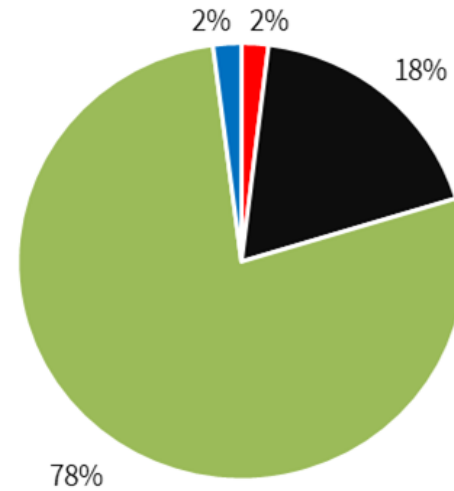
- Introduce Pleasant Lake and Spofford lake
 - Impairments, DO levels
- Alternative water quality goal setting process used for these two lakes
- Insights gained from WQ and sediment core analyses
- Results -> explanation of the apparent disconnect between TP and DO.
- Moving forward

CURRENT P LOADING

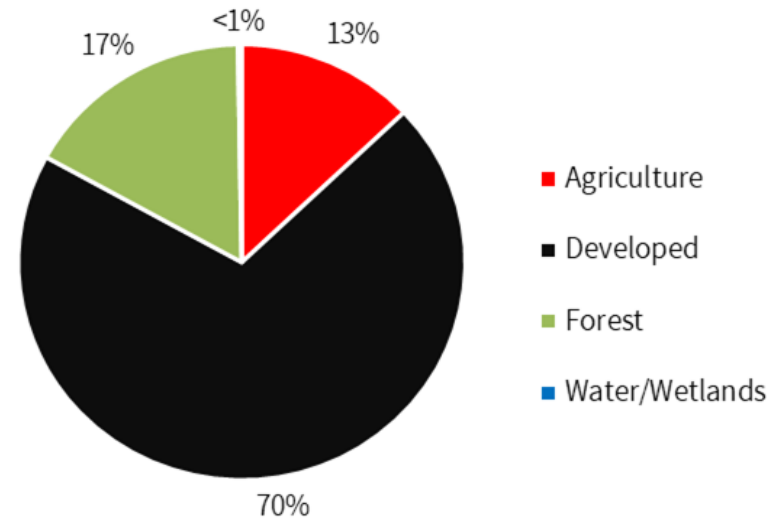
Spofford Lake Watershed TP Load



Watershed Land Cover Area

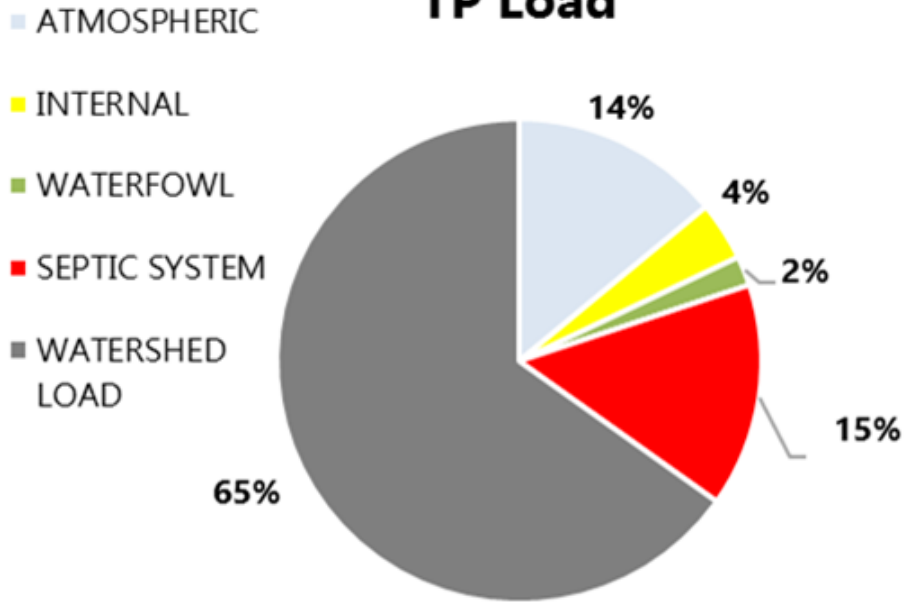


TP Load by Land Cover Type

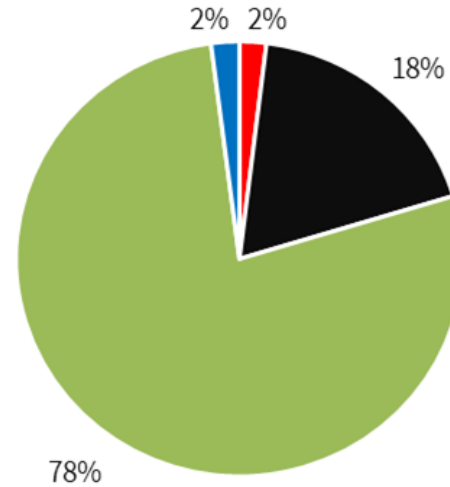


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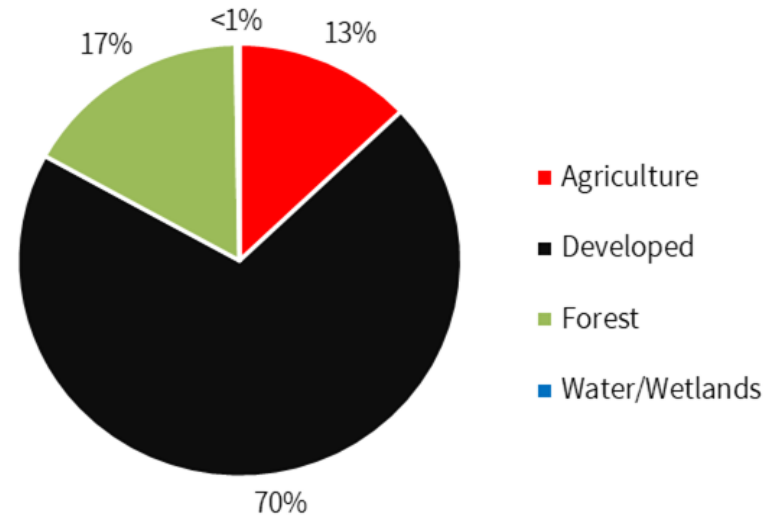
Pleasant Lake Watershed TP Load



Watershed Land Cover Area



TP Load by Land Cover Type



NEXT STEPS

