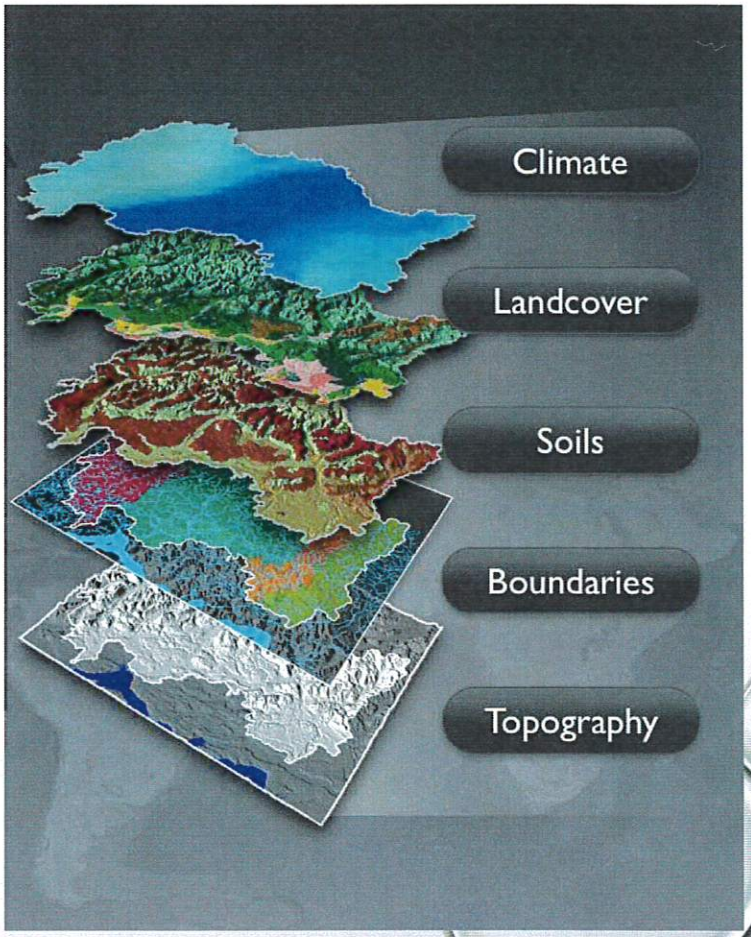
WATERSHED MANAGEMENT PLAN UPDATE

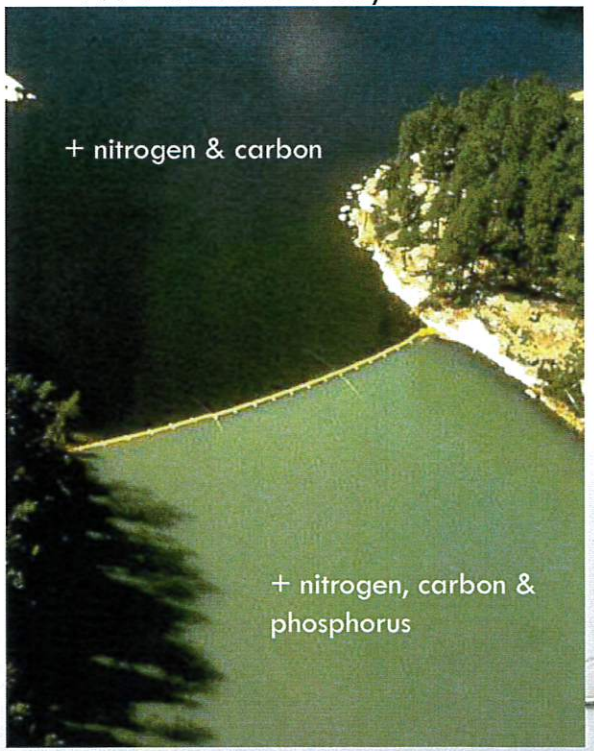
2018 – 2020



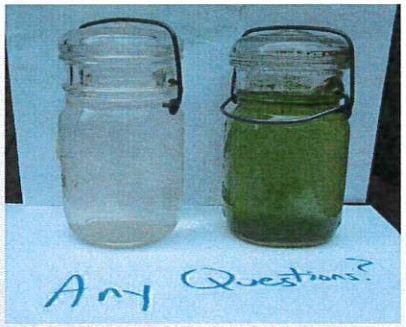
BACKGROUND

- EXISTING 2008 PLAN DOES NOT MEET CURRENT EPA REQUIREMENTS (9 ELEMENTS)
- FUTURE EPA 319 FUNDING POSSIBLE WITH NEW PLAN NOT OLD
- $50,000 319 FUNDS WERE GRANTED TO LSPA FOR PLAN UPDATE – MARCH 2020 DEADLINE
- PRIMARY PURPOSE: REDUCE CURRENT & FUTURE NUTRIENT LOADING (TP) INTO LAKE SUNAPEE TO AVOID A DECLINE IN WATER QUALITY

1973 Schindler Study - Ontario



Lake Wentworth Water



Wentworth Water With Phosphorus Lawn Fertilizer

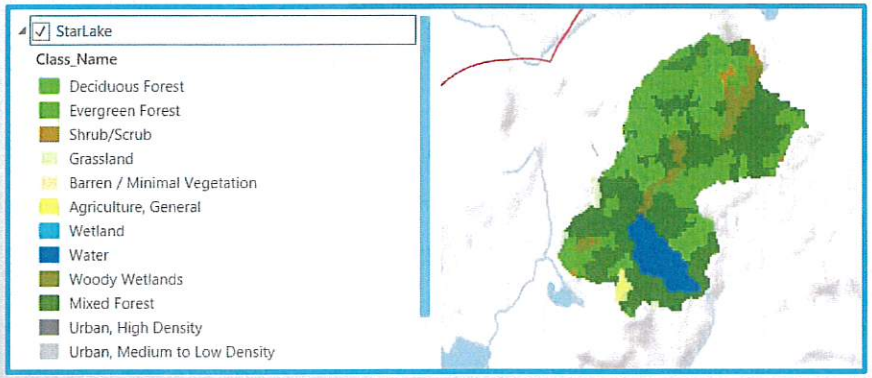
DK

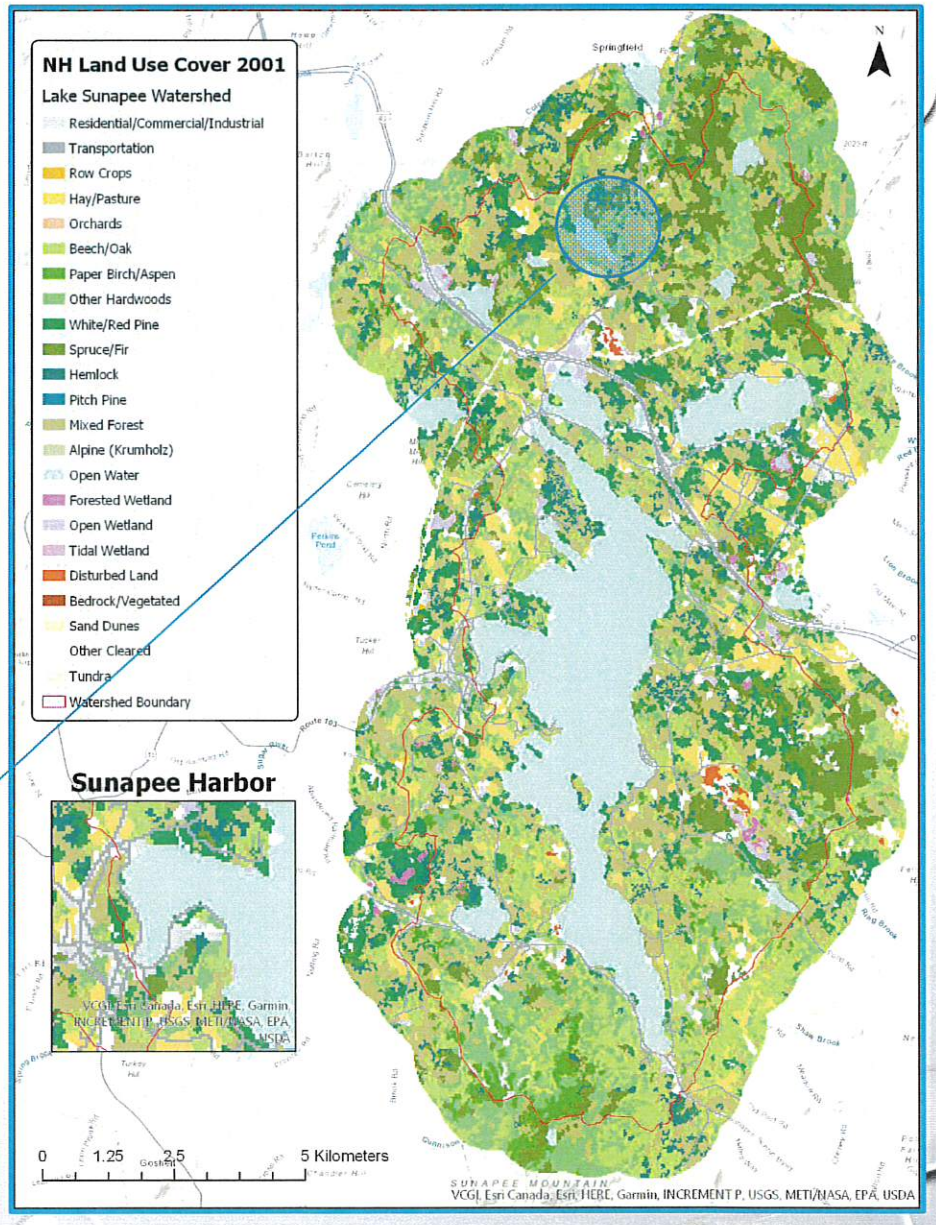
EARLIER PROGRESS

- ✓ CONSULTANT SELECTED – DK WATER RESOURCE CONSULTING LLC & STONE ENVIRONMENTAL
- ✓ 2008 WATERSHED PLAN REVIEWED – PARTS TO BE INCORPORATED INTO NEW PLAN
- ✓ PUBLIC INFORMATIONAL MEETING HELD – APRIL 2018
- ✓ WATERSHED COMMITTEE MEMBERS (20) & WATER QUALITY ADVISORY GROUP RECRUITED (6)
  - TASKED WITH REVIEWING RECOMMENDED ACTIONS, WQ GOAL & OVERALL PLAN
- ✓ INITIAL WATERSHED COMMITTEE MEETING HELD – AUGUST 2018
- ✓ SITE SPECIFIC PROJECT PLAN (SSPP) COMPLETED (DK) & APPROVED – AUGUST 2018

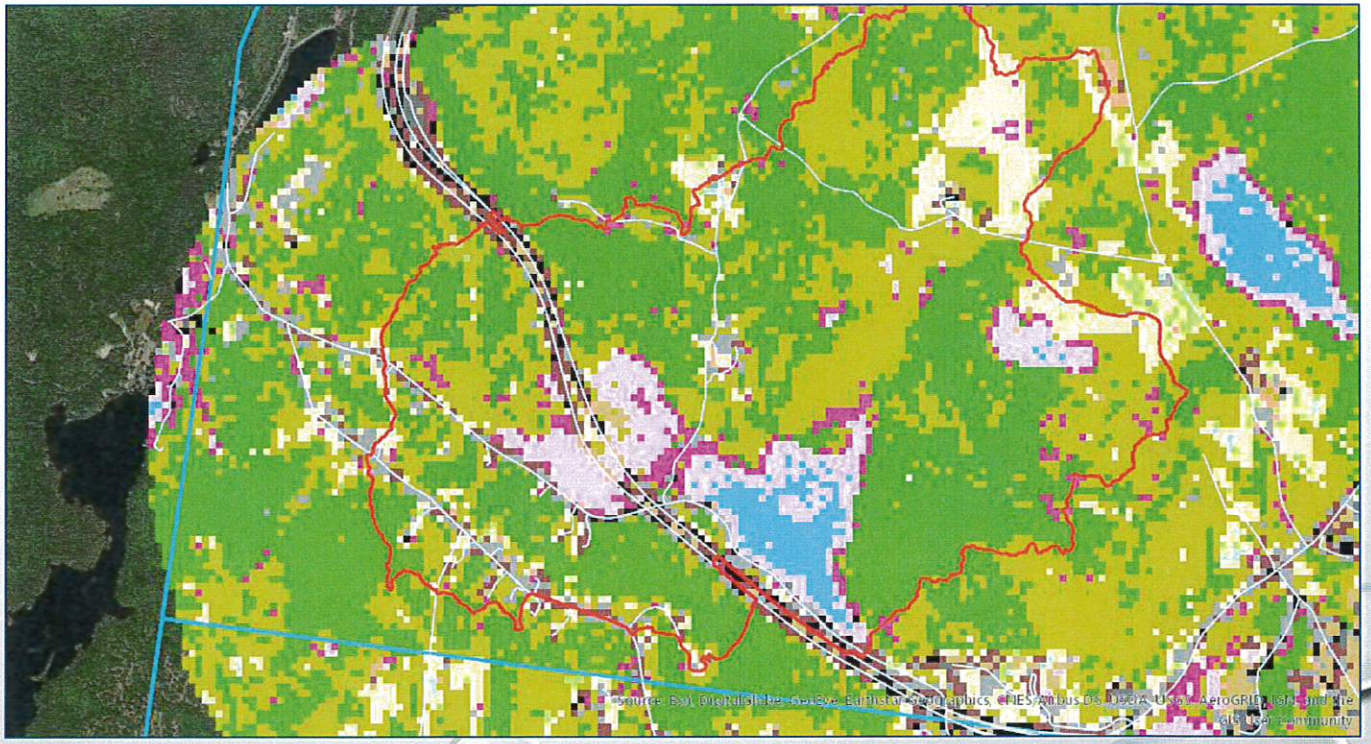
LAND COVER

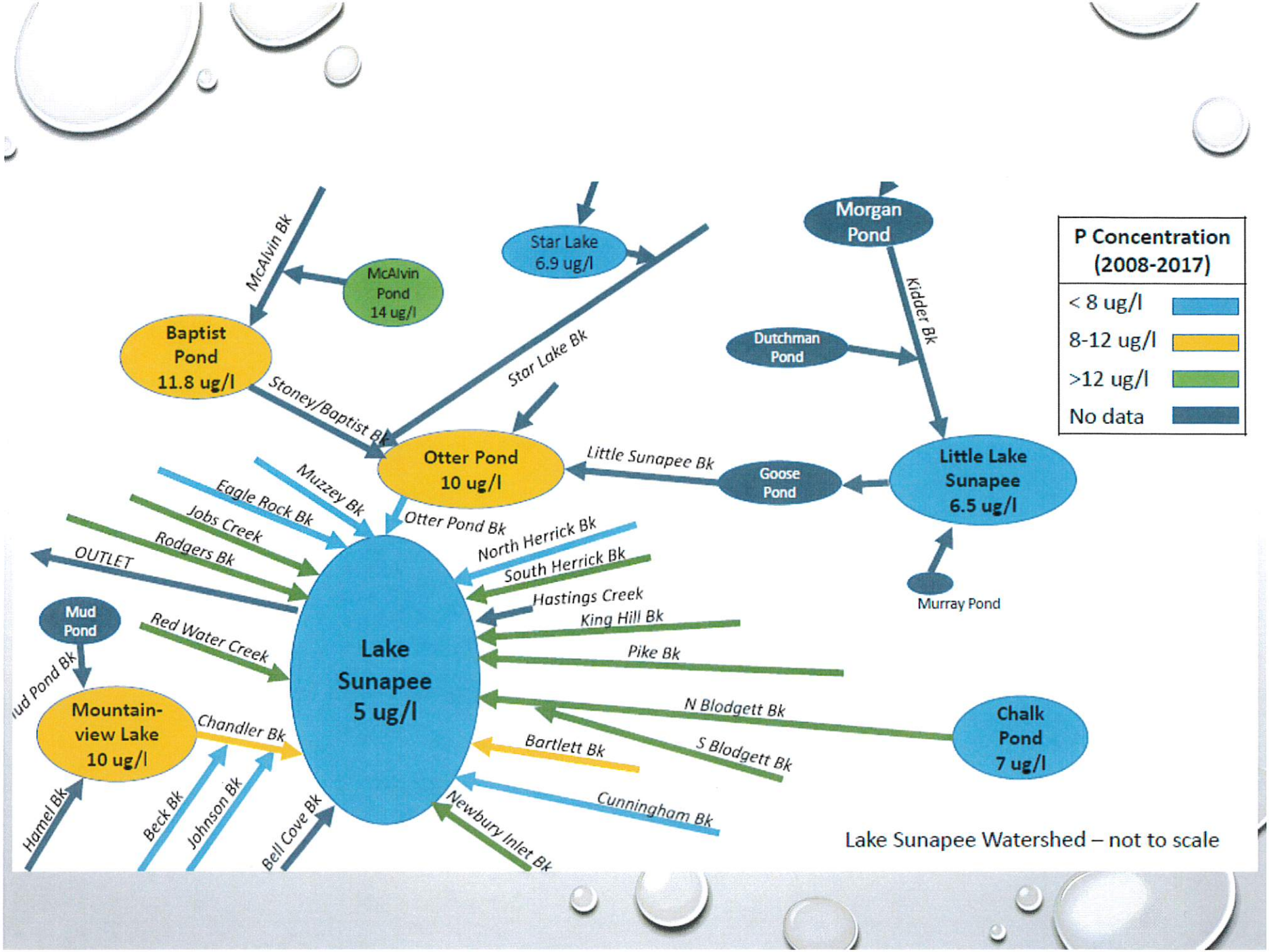
- VISUALIZE AND DETERMINE LAND COVER VIA SATELLITE IMAGERY
- DEVELOPED LAND VS NON-DEVELOPED





2018 LAND COVER




P Concentration (2008-2017)
< 8 ug/l
8-12 ug/l
>12 ug/l
No data
Lake Sunapee 5 ug/l
Otter Pond 10 ug/l
Baptist Pond 11.8 ug/l
McAlvin Pond 14 ug/l
McAlvin Bk
Star Lake 6.9 ug/l
Star Lake Bk
Stoney/Baptist Bk
Morgan Pond
Kidder Bk
Dutchman Pond
Little Lake Sunapee 6.5 ug/l
Goose Pond
Little Sunapee Bk
Murray Pond
Muzzey Bk
Eagle Rock Bk
Jobs Creek
Rodgers Bk
OUTLET
Otter Pond Bk
North Herrick Bk
South Herrick Bk
Hastings Creek
King Hill Bk
Pike Bk
Mud Pond
Red Water Creek
Mountain-view Lake 10 ug/l
Chandler Bk
Hamel Bk
Beck Bk
Johnson Bk
Bell Cove Bk
Newbury Inlet Bk
Cunningham Bk
Bartlett Bk
N Blodgett Bk
S Blodgett Bk
Chalk Pond 7 ug/l
Lake Sunapee Watershed – not to scale

LAKE SUNAPEE IN LAKE TP CONCENTRATION

The State of New Hampshire has set water quality criteria for nutrients based on the aquatic life designated use of the waterbody (Table 1).

Table 1. TP and Chl-*a* Criteria for Aquatic Life Designated Use

Trophic State	TP (µg L^{-1})	Chl-*a*(µg L^{-1})
Oligotrophic	< 8.0	< 3.3
Mesotrophic	<= 12.0	<= 5.0
Eutrophic	<= 28	<= 11

Table 2: Summary of pooled epilimnetic water quality data for 10 year period (2009-2018) for Lake Sunapee (Stations 200, 210, 220 and 230).

Parameter	Sunapee 2009-2018
Total Phosphorus (µg/l)	
Mean	5.0
Median	5.0
N	176
Chlorophyll *a* (µg/l)	
Mean	1.6
Median	1.6
N	175
Secchi disk transparency (m)	
Mean	8.4
Median	8.4
N	155

ASSIMILATIVE CAPACITY

Development of a Watershed Plan for Lake Sunapee

Assimilative Capacity Analysis

DK Water Resource Consulting LLC February 2019

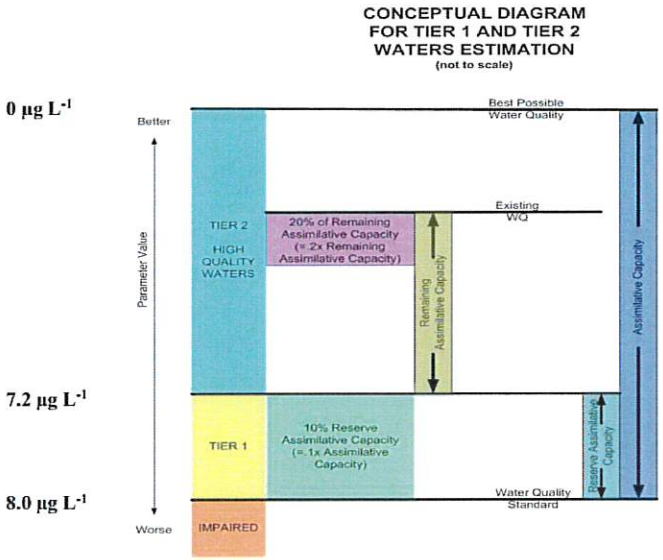


Figure 1. Conceptual diagram for the determination of Assimilative Capacity for an oligotrophic waterbody.

Development of a Watershed Plan for Lake Sunapee

Assimilative Capacity Analysis

DK Water Resource Consulting LLC February 2019

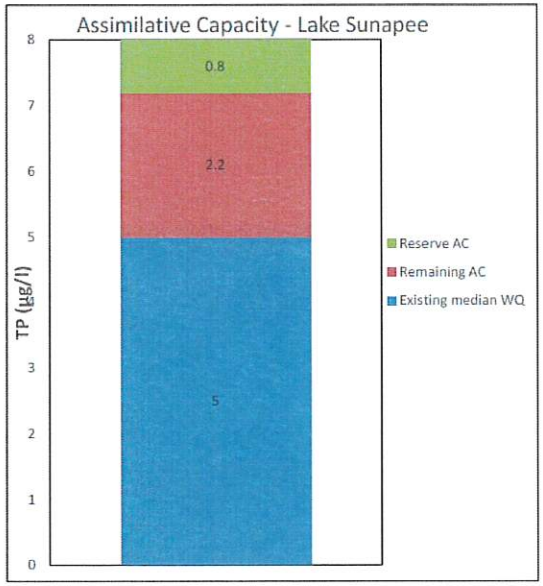
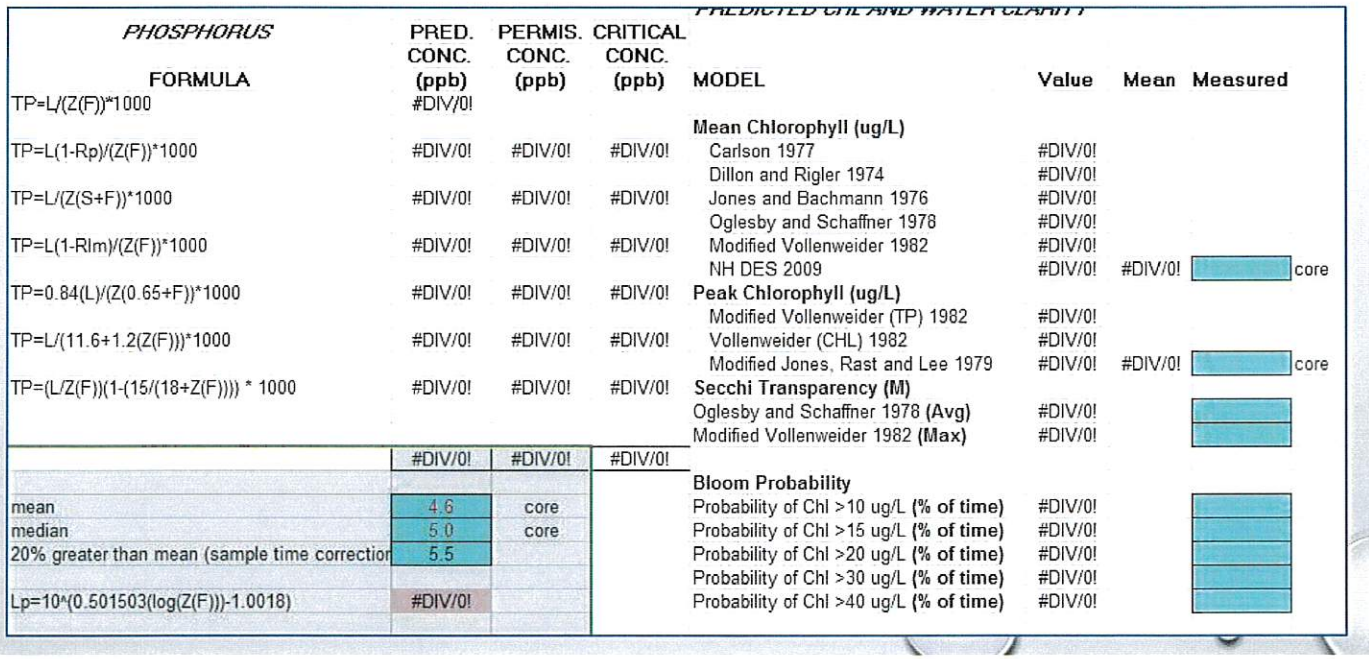


Figure 2. Graph depicting the results of the Assimilative Capacity analysis for total phosphorus for Lake Sunapee.

RECENTLY COMPLETED TASKS

- ✓ GIS MAPPING/ANALYST FOR MODELING NEEDS – COMPLETED SPRING 2019
- BUILD-OUT ANALYSIS (STONE) – COMPLETED SUMMER 2019
- WATERSHED MODELING & WATER QUALITY GOAL BY DK – COMPLETED SUMMER 2019
- ✓ **DETERMINE MEDIAN PHOSPHORUS LEVELS & ASSIMILATIVE CAPACITY**
- ✓ **WATERSHED SURVEY TO DOCUMENT STORMWATER ISSUES – COMPLETED SPRING 2019**
- ✓ **DETERMINE % REDUCTION PHOSPHORUS GOAL 7 1/2% 100 KG/YR (OUT OF 1400)**



PHOSPHORUS	PRED. CONC. (ppb)	PERMIS. CONC. (ppb)	CRITICAL CONC. (ppb)
FORMULA			
TP=L/(Z(F))*1000	#DIV/0!		
TP=L(1-Rp)/(Z(F))*1000	#DIV/0!	#DIV/0!	#DIV/0!
TP=L/(Z(S+F))*1000	#DIV/0!	#DIV/0!	#DIV/0!
TP=L(1-Rlm)/(Z(F))*1000	#DIV/0!	#DIV/0!	#DIV/0!
TP=0.84(L)/(Z(0.65+F))*1000	#DIV/0!	#DIV/0!	#DIV/0!
TP=L/(11.6+1.2(Z(F)))*1000	#DIV/0!	#DIV/0!	#DIV/0!
TP=(L/Z(F))(1-(15/(18+Z(F)))) * 1000	#DIV/0!	#DIV/0!	#DIV/0!
	#DIV/0!	#DIV/0!	#DIV/0!
mean	4.6	core	
median	5.0	core	
20% greater than mean (sample time correction	5.5		
Lp=10^(0.501503(log(Z(F)))-1.0018)	#DIV/0!		

PREDICTED CHL AND WATER CLARITY

MODEL	Value	Mean	Measured
Mean Chlorophyll (ug/L)			
Carlson 1977	#DIV/0!		
Dillon and Rigler 1974	#DIV/0!		
Jones and Bachmann 1976	#DIV/0!		
Oglesby and Schaffner 1978	#DIV/0!		
Modified Vollenweider 1982	#DIV/0!		
NH DES 2009	#DIV/0!	#DIV/0!	core
Peak Chlorophyll (ug/L)			
Modified Vollenweider (TP) 1982	#DIV/0!		
Vollenweider (CHL) 1982	#DIV/0!		
Modified Jones, Rast and Lee 1979	#DIV/0!	#DIV/0!	core
Secchi Transparency (M)			
Oglesby and Schaffner 1978 **(Avg)**	#DIV/0!		
Modified Vollenweider 1982 **(Max)**	#DIV/0!		
Bloom Probability			
Probability of Chl >10 ug/L **(% of time)**	#DIV/0!		
Probability of Chl >15 ug/L **(% of time)**	#DIV/0!		
Probability of Chl >20 ug/L **(% of time)**	#DIV/0!		
Probability of Chl >30 ug/L **(% of time)**	#DIV/0!		
Probability of Chl >40 ug/L **(% of time)**	#DIV/0!		

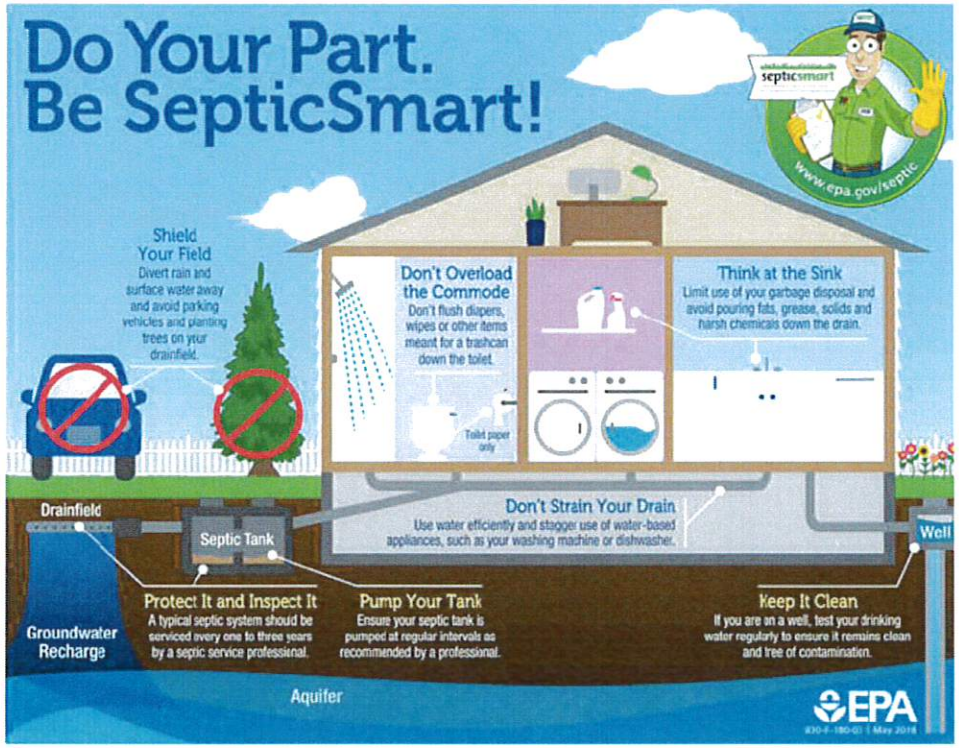
Public (Town) / Private	Project ID	Site Name	
New London	NL-01	Route 114 Lakefront Vegetation	Riparian buffer planting
New London	NL-02	Bucklin Beach Swale	
New London	NL-03	Lakeside Landing Shoulder Vegetation	Bioretention Riparian buffer planting
New London	NL-04	Columbus Ave Swale Improvements	
New London	NL-05	Poor Road and Lakeside Road Swale Improvements	Grass Swale Grass Swale
New London	NL-06	Hastings Landing	Grass Swale
Newbury	NW-01	Chandler Brook Culvert	Culvert Replacement
Newbury	NW-02	Newbury Police Department	Riparian buffer planting
Newbury	NW-03	Pine Cliff Step Pool Conveyance	
Newbury	NW-04	Highland Avenue	Regenerative Conveyance
Newbury	NW-06	Brats Cove Stormwater Improvements	MSTD - Swirler
Newbury	NW-07	Stream Canal at Lakewood Manor Road	Grass Swale Grass Swale
Newbury	NW-08	Eroded Ditch Along Park 10 Road	Grass Swale Infiltration Trench
Newbury / Private	NW-09	Mountain View Lake Drainage Channel	Riparian buffer planting
Springfield	SP-01	Stryker Road	
Springfield	SP-02	Little Sunapee Lake Road Shoulder Improvements	Bioretention
Sunapee	SP-01	Modified Sediment Baffle Tank	MSTD - Swirler
Sunapee	SP-02	Garnet Street Biofiltration	Deep Sump Catch Basin
Sunapee	SP-03	The Anchorage Deep Sump Catch Basin	Deep Sump Catch Basin
Sunapee	SP-04	Sunapee Harbor Park	Grass Swale

Watershed Mgmt Plan
BMP Table
Sites and Solutions

2019 Septic System Survey

As you've probably heard, Lake Sunapee Protective Association (LSPA) is currently in the process of updating our **Watershed Management Plan (WMP) so that it satisfies all nine elements required by the EPA for a watershed-based plan.** The main goal of the new plan is to identify strategies to reduce current and future phosphorus loading into Lake Sunapee to avoid a decline in water quality. Based on computer modeling, it is estimated that nearly **10% of the phosphorus loading into Lake Sunapee comes from septic systems.**

As part of the updated plan, LSPA has been tasked with conducting a septic system survey (enclosed) for all properties within 250 feet of waterbodies in the Lake Sunapee watershed that are not on town sewer. **By providing your contact information you will be entered into a drawing for a $100 gift certificate to XX restaurant.** Additionally, by participating in this survey, you will be eligible for group inspection and pumping discounts with local septic services companies.



Did you know the EPA hosts an annual "Septic Smart" week in September to remind homeowners that septic systems can be a major source of pollutants into a waterway if they are not properly maintained? If a septic system malfunctions, due to improper care or age, untreated wastewater can seep into the ground and make its way to a nearby lake or pond, posing a threat to humans and animals. Additional nutrients will lead to an increase in unwanted plant and algae growth in a lake or pond which negatively affects water quality. Declines in water quality impacts recreational uses, local businesses and property values.