

Land Use Affects Water Quality in Candlewood Lake?

Assessing Land Use

Human land use and vegetation features at each location were observed and recorded. Data were recorded in a comprehensive Epicollect smartphone web form, created for this study. Data were exported in the spreadsheet as shown below.

	1. Does the location have septic systems?	2. How close is the septic system?	3. Is the septic usage light, medium, or heavy?	4. Is there manicured lawns?	5. Is the lawn area small, medium, or large?	6. Is there a dock?	7. How many boat docks are there within sight?	8. How many swimming docks?	9. Is there a parking area?	10. If there is a parking area, is it dirt or asphalt?	11. Is there any free standing (dry) stone walls?	12. Is there any stone and mortar walls?
Lynn Deming Park	No	N/A	N/A	Yes	Large	No	0	0	No	N/A	Yes	No
North of Chimney Hill Point	No	N/A	N/A	Yes	Medium	Yes	9	1	No	N/A	No	Yes
Brookfield Town Beach	Yes	Close	Medium	Yes	Large	Yes	21	3	Yes	Dirt & Asphalt	Yes	No
Candlewood Orchards	Yes	Close	Medium	Yes	Large	Yes	30	1	No	N/A	No	Yes
South of Kellogg St	Yes	Close	Heavy	Yes	Large	Yes	3	0	Yes	Dirt & Asphalt	No	Yes

	13. Is there vegetation near the shoreline?	14. Is the vegetation area small, medium, or large?	15. Are there any trees?	16. Are there a small, medium, or large amount of trees?	17. Is the closest road near or far?	18. Are there any dirt paths or walkways?	19. Are there any man-made structures in the prior question.	20. Describe any man-made structures in the prior question.	21. Describe soil type of shoreline.	22. What is the primary use of the land?	23. Does the use bring in low or high traffic of people?
Lynn Deming Park	Yes	Large	Yes	Large	Far	Yes	No	N/A	Wet, Dark soil	Hiking Trails	Low
North of Chimney Hill Point	Yes	Large	Yes	Large	Near	No	Yes	Houses further away	Light, dry soil	No use	Low
Brookfield Town Beach	Yes	Medium	Yes	Large	Near	No	Yes	Community Building with Food	Sand	Beach (seasonal)	High
Candlewood Orchards	Yes	Small	Yes	Small	Near	Yes	Yes	Houses	Sand & Dry	Housing	Low
South of Kellogg St	Yes	Small	Yes	Medium	Near	Yes	Yes	Restaurant, houses	Dark soil	Restaurant	High



Results By Test Location

South of Kellogg Street (KS)

- High septic usage and proximity
- High amounts of manicured lawns
- High boat activity
- High amounts of asphalt and dirt parking and traffic
- Low vegetation, minimal to block run-off into lake
- Land usage (see map & table) corresponds to negative water results (see water quality section):
 - Dark Soil
 - Highest levels of phosphates, nitrates, nitrites, and ammonia
 - High weed growth indicating high phosphates (1)

Candlewood Orchards (COPO)

- Second worst in land use, second highest in water quality test results

Brookfield Beach (BB)

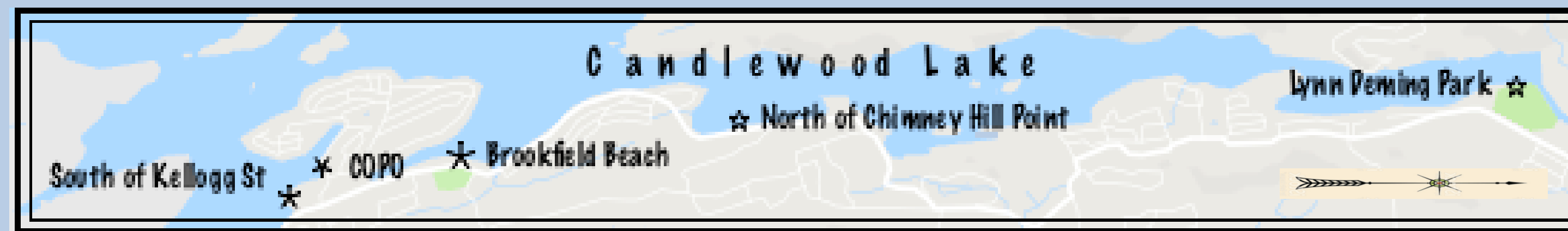
- Third worst inland use, unexpected low result in phosphates
- Possible explanations: low use of detergents or current patterns

North of Chimney Point (CP) and Lynn Deming (LD)

- Lowest amount of human land use, lowest test results
- Best water quality of the 5 locations

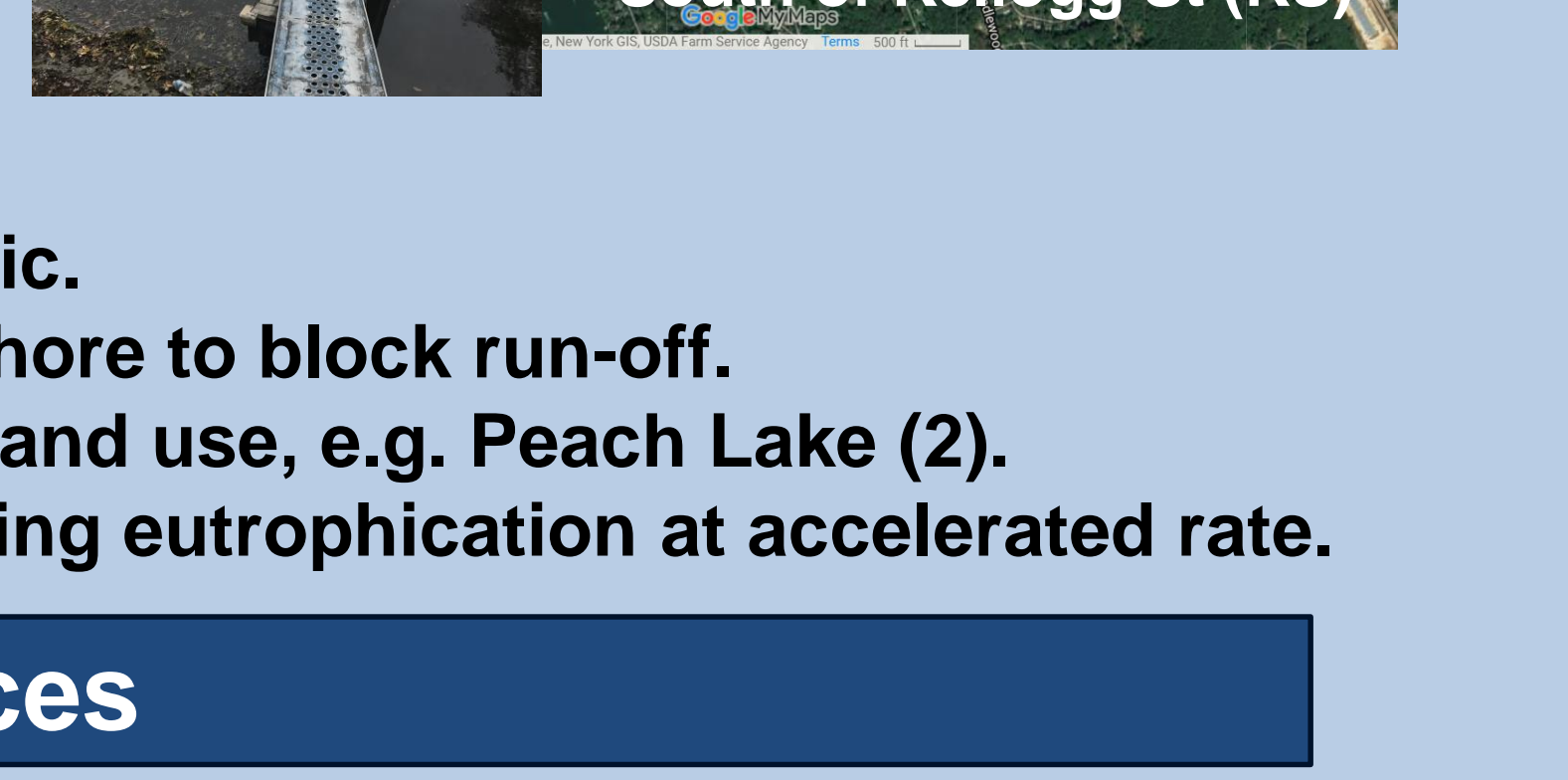
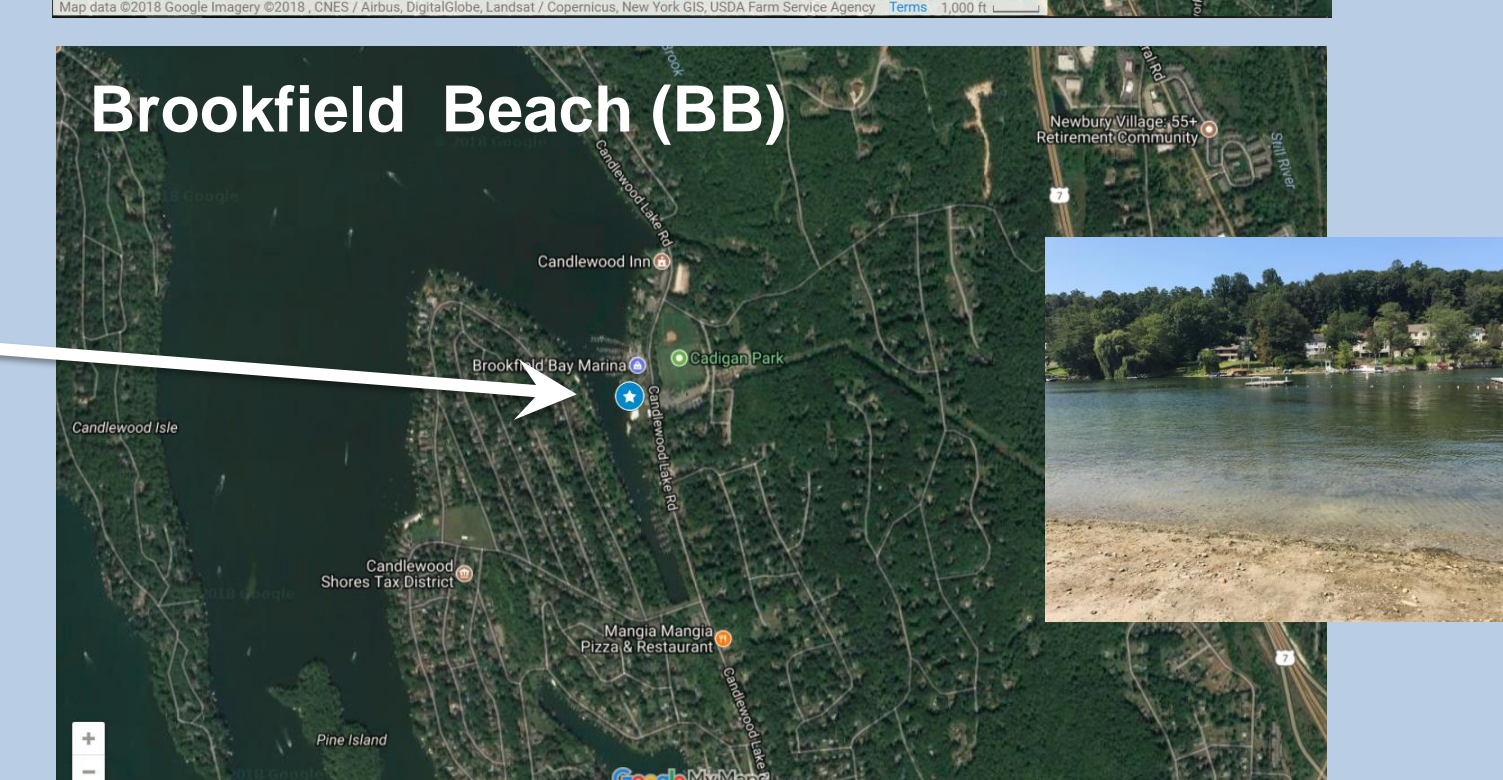
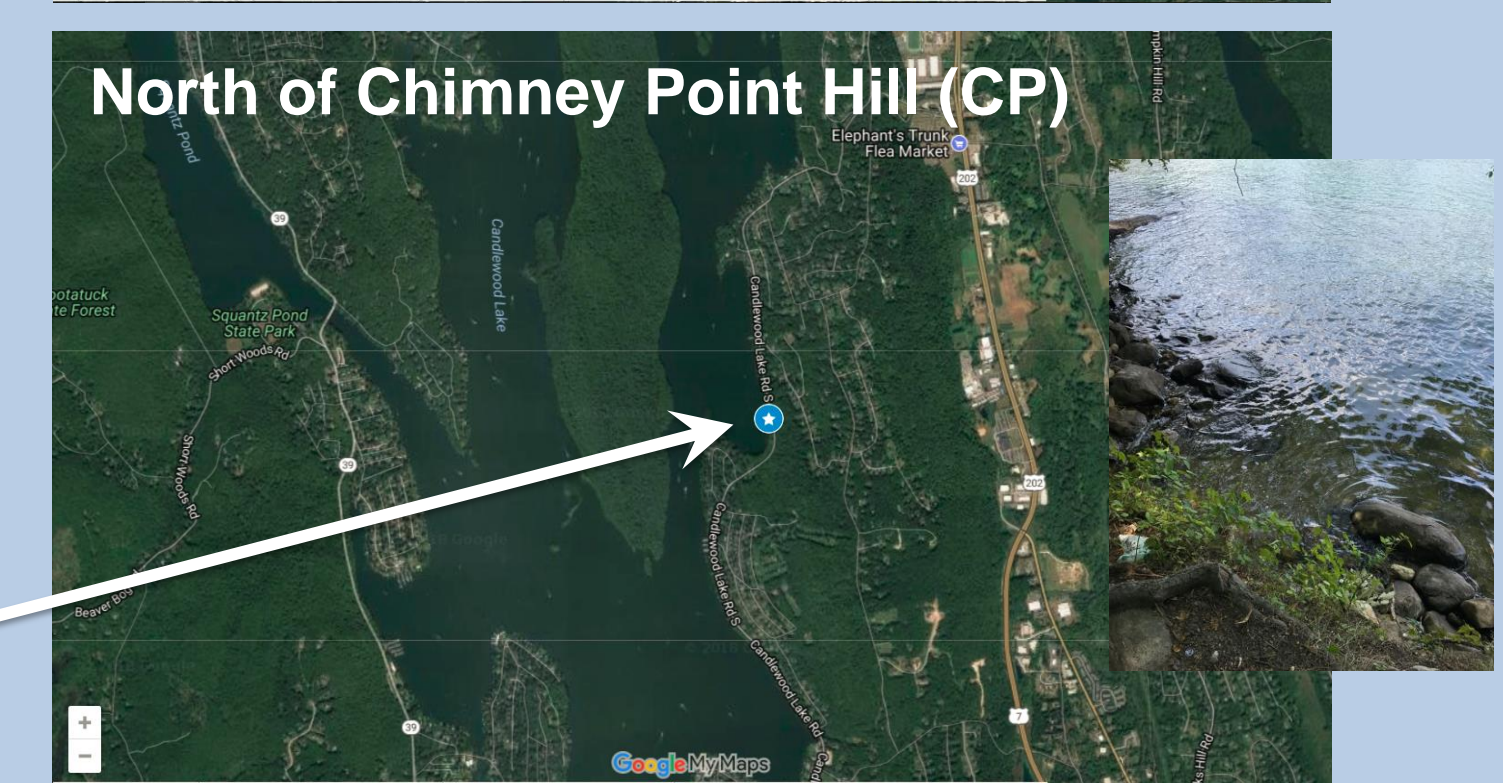
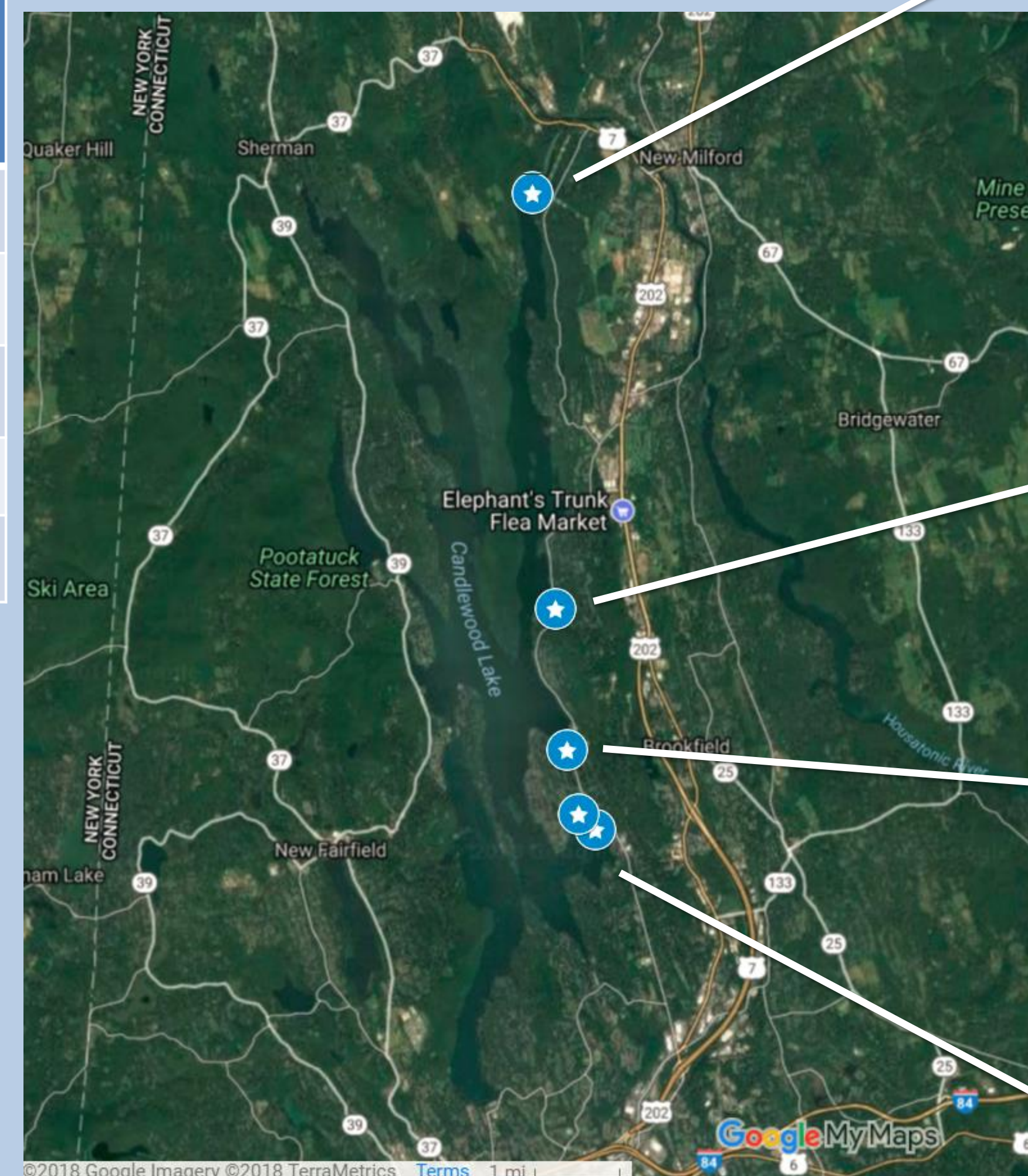
Focal Question

How does land use around Candlewood Lake affect water quality?



Scope of Study

Five (5) test locations that have different degree of land use were chosen to be tested for seven (7) water quality variables.



Recommendations

Our results suggest that water quality decreased with increasing human land usage. As such, we recommend:

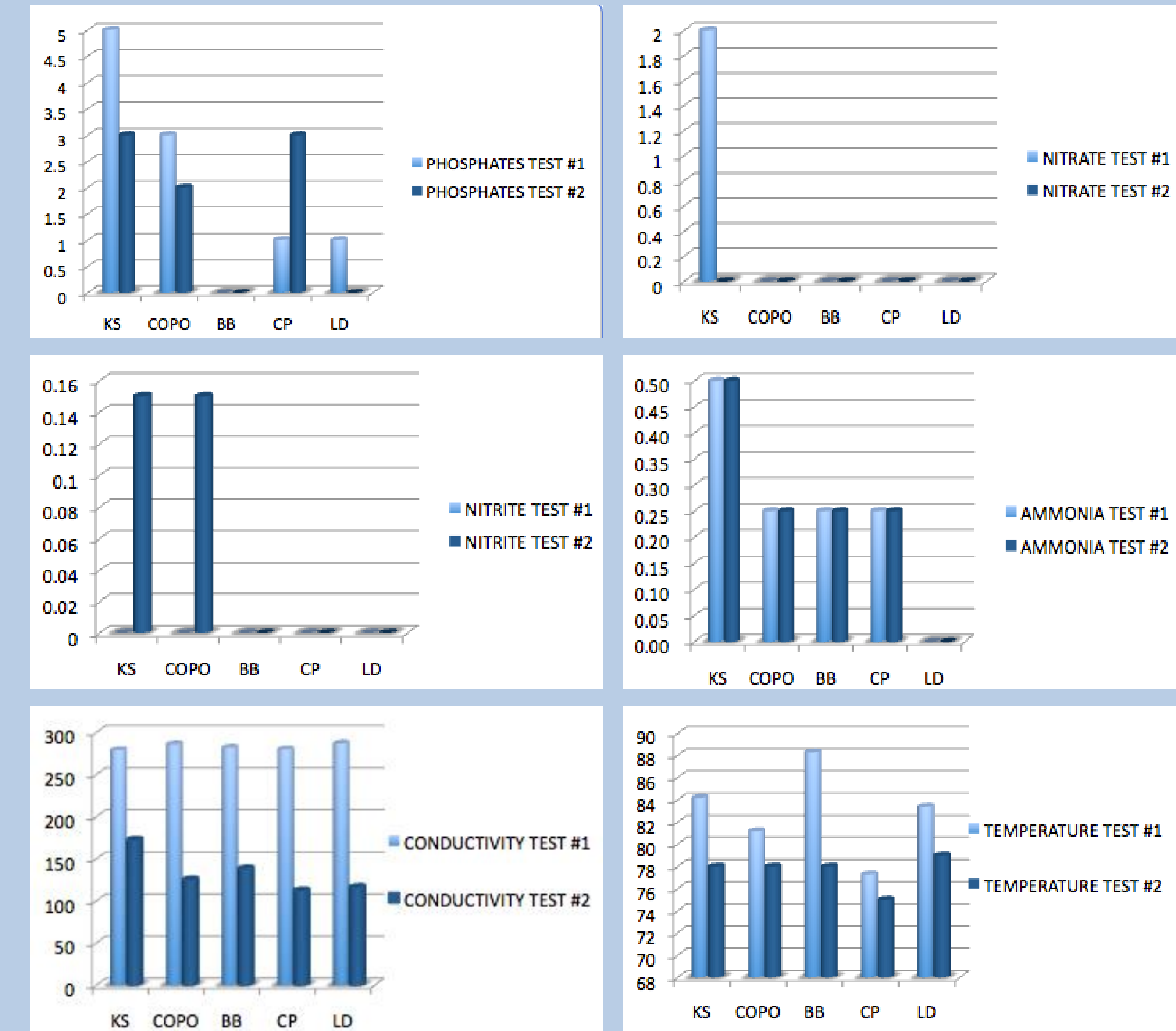
- Reducing septic, manicured lawns, boating, parking, development.
- Extending city sewer versus private septic.
- Offset with vegetation, tree lines along shore to block run-off.
- Investigate programs that reduce/offset land use, e.g. Peach Lake (2).
- Necessary as Candlewood Lake is reaching eutrophication at accelerated rate.

References

- (1) [Candlewood Lake . Watershed Awareness and Lake Preservation](#), Candlewood Lake Authority, August 1998.
- (2) [Modernpumpingtoday.com Water & Wastewater Solutions](#), Peach Lake Finds a Solution For a Dying Septic System, Part 1 of 2. Joseph Harmes, October 2015.
- (3) [Water, Water Everywhere](#). HACH Company, Second Edition, 1983
- (4) Alken Murray Company, [Interpreting Water Analysis Test Results](#), Revised 8/25/2006
- (5) Based on levels from [Water, Water Everywhere](#). HACH Company, Second Edition, 1983

Assessing Water Quality

- Water samples were taken and tested for phosphates, nitrates, nitrites, and ammonia (using Hach test kits) at each location.
- A conductivity meter was used to measure temperature and conductivity at each location as well.
- This method was performed in August 2017 (Test #1 – light blue) & October 2017 (Test #2 – dark blue).



Stress & Danger Limits:

Phosphates (mg/L) (3): Ideal 0.01 - 0.03 mg/L; Avoid accelerated eutrophication < 0.1 mg/L
Nitrates (PPM) (4): Ideal 0.1 - 0.2 in marine environments; Unhealthy for lakes > 50
Nitrites (PPM) (4): Ideal 0.01 - 0.04 for marine fish; can cause disease >0.55
Ammonia (PPM) (4): Safe level in marine environments 0.02 - 0.4; Toxic to fish > 0.03
Conductivity (PPM) (4) is effected by temperature, lower the temperature, lower the conductivity

AQUATIC WEED GROWTH: The 7th water quality test was aquatic weed growth, which was based on visual observation. Two locations (KS and COPO) had thick aquatic weed growth (see photos of KS & COPO).

Results By Test Category

- Phosphate levels are very high at all locations except Brookfield Beach, indicating accelerating Eutrophication (5). Further testing at a more sensitive scale might reveal unacceptable levels.
- Nitrate and nitrite levels are high at KS at 2 ppm and 0.15 ppm, above ideal levels of 0.1 to 0.2 ppm and 0.01 to 0.04 ppm, respectively. Nitrite levels are the same for COPO test location.
- Ammonia levels are above the toxic level to fish at 0.03 ppm at all test locations and above the 0.4 ppm maximum safe level in marine environments at KS with test readings at 0.5 ppm.
- Conductivity is inconsistent with temperature readings indicating other factors other than temperature is affecting the conductivity of the water.

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