

Land Type Affects Water Quality in Candlewood Lake

UConn CTP Project

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SCOPE OF STUDY: Five Test Locations were chosen to be tested for 7 different criteria to evaluate how surrounding land types affect current quality of the water in Candlewood Lake.

EXISTING PHOTOS:



South of Kellogg St (KS)
Test Location



Candlewood Orchards
(COPO) Test Location



Brookfield Beach (BB)
Test Location



North of
Chimney Point Hill (CP)
Test Location



Lynn Deming Park (LD)
Test Location

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QUESTIONS & ANSWERS: The following tables document the different land types at each of the five locations tested.

| | 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? |
|-----------------------------|---|---|---|---|--|---|--|---|--------------------------------------|--|--|--|
| South of Kellogg St | Yes | Close | Heavy | Yes | Large | Yes | 3 | 0 | Yes | Dirt & Asphalt | No | Yes |
| Candlewood Orchards | Yes | Close | Medium | Yes | Large | Yes | 30 | 1 | No | N/A | No | Yes |
| Brookfield Town Beach | Yes | Close | Medium | Yes | Large | Yes | 21 | 3 | Yes | Dirt & Asphalt | Yes | No |
| North of Chimney Hill Point | No | N/A | N/A | Yes | Medium | Yes | 9 | 1 | No | N/A | No | Yes |
| Lynn Deming Park | No | N/A | N/A | Yes | Large | No | 0 | 0 | No | N/A | Yes | No |
| | 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? | 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? | |
| South of Kellogg St | Yes | Small | Yes | Medium | Near | Yes | Yes | Restaurant, houses | Dark soil | Restaurant | High | |
| Candlewood Orchards | Yes | Small | Yes | Small | Near | Yes | Yes | Houses | Sand & Dry | Housing | Low | |
| Brookfield Town Beach | Yes | Medium | Yes | Large | Near | No | Yes | Community Building with Food | Sand | Beach (seasonal) | High | |
| North of Chimney Hill Point | Yes | Large | Yes | Large | Near | No | Yes | Houses further away | Light, dry soil | No use | Low | |
| Lynn Deming Park | Yes | Large | Yes | Large | Far | Yes | No | N/A | Wet, Dark soil | Hiking Trails | Low | |

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TEST RESULTS: The following tables documents the results of the tests taken at two (2) different times (8/2017 & 10/2017). The lake water was tested for the following: Phosphates, Nitrates, Nitrites, Ammonia, Temperature and Conductivity

| | PHOSPHATES | | | NITRATE | | | NITRITE | | | AMMONIA | | | TEMPERATURE | | | CONDUCTIVITY | | |
|------|------------|---------|--|---------|---------|--|---------|---------|--|---------|---------|--|-------------|---------|--|--------------|---------|--|
| | TEST #1 | TEST #2 | | TEST #1 | TEST #2 | | TEST #1 | TEST #2 | | TEST #1 | TEST #2 | | TEST #1 | TEST #2 | | TEST #1 | TEST #2 | |
| KS | 5 | 3 | | 2 | 0 | | 0 | 0.15 | | 0.50 | .50 | | 84.2 | 78 | | 279 | 172 | |
| COPO | 3 | 2 | | 0 | 0 | | 0 | 0.15 | | 0.25 | 0.25 | | 81.2 | 78 | | 286 | 125 | |
| BB | 0 | 0 | | 0 | 0 | | 0 | 0 | | 0.25 | 0.25 | | 88.3 | 78 | | 282 | 138 | |
| CP | 1 | 3 | | 0 | 0 | | 0 | 0 | | 0.25 | 0.25 | | 77.3 | 75 | | 280 | 112 | |
| LD | 1 | 0 | | 0 | 0 | | 0 | 0 | | 0.25 | 0.25 | | 83.4 | 79 | | 287 | 116 | |

AQUATIC WEED GROWTH: The seventh test criteria was aquatic weed growth, which was tested based on visual observation. Two locations KS and COPO had thick aquatic weed growth (see photos).

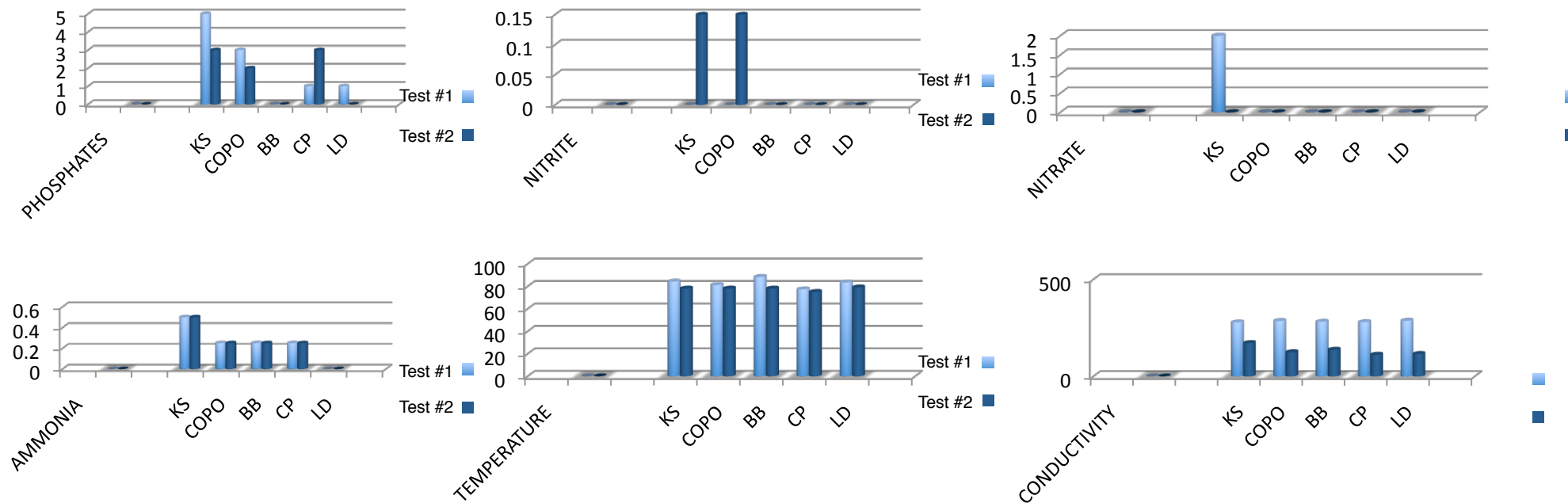
ANALYSIS OF TEST RESULTS:

- Phosphate levels are dangerously high at all locations except Brookfield Beach, (further testing at a more sensitive scale might reveal unacceptable levels) indicating accelerating Eutrophication. (1)
- Nitrate and Nitrite levels are high at KS location at 2 ppm on Test #1 and .15 ppm on Test #2, above ideal levels of .1 to .2 ppm and .01 to .04 ppm respectively. Nitrite levels are the same for COPO test location.
- Ammonia levels are above the toxic level to fish at .03 ppm at all test locations and above the .4 ppm maximum safe level in marine environments at KS at both test readings at .5 ppm.
- Conductivity is inconsistent with temperature readings indicating other factors other than temperature is affecting the conductivity of the water.

(1) Based on levels from Water. Water Everywhere. HACH Company, Second Edition, 1983

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Stress & Danger Limits –

Phosphates (mg/L) (2)
 Ideal .01 - .03 mg/L
 Max. acceptable to avoid accelerated Eutrophication .1 mg/L
 1 mg/L accelerated growth and consequent problems

Nitrates (PPM) (3)
 Ideal .1 - .2 in marine environments
 Unhealthy for lakes > 50

Nitrites (PPM) (3)
 Ideal .01 - .04 for marine fish
 can cause disease > .55

Ammonia (PPM) (3)
 Safe Level in Marine Environments .02 - .4
 Toxic to Fish > .03

Conductivity (PPM) (3)
 is effected by temperature, lower the temperature, lower the conductivity

(2) Water, Water Everywhere. HACH Company, Second Edition, 1983

(3) Alken Murray Company, Interpreting Water Analysis Test Results, Revised 8/25/2006

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www.ctvisit.com

ANALYSIS OF TEST LOCATIONS:

The Kellogg Street (KS) location ranks highest in septic system usage ranked both in proximity to the water and actual usage. The location also has bordering large manicured lawns. The location has above average boat activity due to boat docks and boat traffic to this location. There is a heavily used asphalt as well as dirt parking area that is heavily used. There is some minimal stone and mortar sea walls. There is a small amount of vegetation and trees, but both are not positioned as to directly block runoff from the roadway, parking lots, septic systems, or manicured lawns. The location has nearby roads, pathways, popular restaurants and bars, as well as residential homes. 2 heavily trafficked marinas are also down road from the test location. The soil at the test site was dark soil. The location's negative affect on the water quality are evident in its ranking in the test results and directly correlates. This location had the highest level of phosphates, nitrites, nitrates, and ammonia levels within the test locations. . This location also had visibly dense weed growth, also indicating high levels of the phosphates.(4) The conductivity had mixed results given the lowest level of conductivity in test #1 and then the highest level of conductivity in test #2. Temperature alone does not explain these results given it was one of the highest temperatures in test #1 relative to the other test sites. A possible explanation could be the seasonal traffic patterns abruptly decreasing as the summer traffic and usage is seasonal from test #1 to test #2.

The Candlewood Orchards (COPO) location follows with the same correlation as the KS location, being second in magnitude to KS. The location's conductivity rankings seem to be consistent with the temperature rankings, so it is difficult to make any conclusive findings from these tests.

The outlier or unexpected test findings was the Brookfield Beach (BB) location. Despite medium ranking in terms of septic use and location, large area and number of manicured lawn, heavy boat and swimming dock usage, heavy parking usage, low or small amounts of vegetation of trees (especially as a boundary or border to water), heavily trafficked road, walkways and man-made structures, this location had tested relatively low in the rankings of the test locations. The biggest outliers were the phosphate levels at zero. One explanation could be the lack of usage of detergents, etc. at the public beach (same side of lake) versus the other locations and the location of the residential usage (across the lake) at this test location. Water current at this location versus the other may also account for the test results. The conductivity levels were also relatively low, given the relative temperature readings.

Most of the North of Chimney Hill Point (CP) and Lynn Deming (LD) test findings returned to more expected results ranking among the lowest or least damaging to water quality. Phosphates levels were relatively low when compared to the other test locations except for a reading of 3 at CP in Test #2. Unexpected usage or a bad test result could explain the reading. Nitrates and nitrite levels were good at zero at both locations. The zero level of ammonia at LD could indicate the absence of septic systems, docks, parking areas, man-made structures and traffic in addition to the stone wall, vegetation and tree line mitigating the negative causes result in relatively better water quality than the other test locations. The exception is the conductivity levels, which seem to be relatively high in LD in Test #1 and at the same time low in LD in Test #2. Other factors affecting algae growth or other factors not in this study might be one explanation for these readings.

(4) Candlewood Lake . Watershed Awareness and Lake Preservation. Candlewood Lake Authority, August 1998.

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CONCLUSION:

Candlewood Lake is reaching Eutrophication at an accelerated rate. To reverse this trend watershed citizens should look at land usages and take action. City sewer versus septic would reduce waste levels running into the lake. Peach Lake in Putnam and Westchester Counties (5) reversed their deterioration of their lake. Manicured lawns should be kept to a minimum and natural fertilizers should replace industrial products. The affects of boating and swimming docks, parking lots, and roadways should be offset by areas of vegetation, tree lines, and stone walls between the lake water and the source of this runoff water, wherever possible.



(5) Modernpumpingtoday.com Water & Wastewater Solutions, Peach Lake Finds a Solution For a Dying Septic System, Part 1 of 2. Joseph Harmes, October 2015.