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To: North Long Lake Association
P.O. Box 54
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Subject: 2015 TSI Annual Report

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INTRODUCTION

The North Long Lake Association contracted A.W. Research Laboratories (AWRL) to complete monthly Trophic Status Index (TSI) monitoring during the summer of 2015. Sarah Fogderud of AWRL with the assistance of the staff at Train Bell Resort sampled three sites on North Long monthly from May through September of 2015. Figure 1 displays the locations of the three sampling sites.

Water samples were collected using standard methods and were analyzed by AWRL's certified laboratory. A Hydrolab Quanta meter was used to collect a profile of temperature, dissolved oxygen, pH, conductivity, and oxidation reduction potential at 10 foot intervals from the surface of the water to the lake bed at each site.

The following report presents the data collected for the Trophic Status Index Study and recommendations based on those results. The 2015 data collected by AWRL was supplemented with data from the Minnesota Pollution Control Agency's surface water database for each site¹.

Figure 1: Sampling Locations



¹ MPCA Surface Water Database: <http://cf.pca.state.mn.us/water/watershedweb/wdip/waterunit.cfm?wid=18-0372-00&tab=Assesments>

EXECUTIVE SUMMARY

The monitoring data collected in 2015 indicate that North Long Lake has good water quality overall. Compared to typical water quality conditions of other lakes within the Northern Lakes and Forest Ecoregion of Minnesota, North Long Lake ranks highly among other lakes in the ecoregion for the parameters measured. Table 1 below displays the typical summer ranges for lakes within the NLF Ecoregion alongside the average value measured at each site during the 2015 monitoring season. North Long Lake is below or at the low end of the NLF range for phosphorus, and within the expected range for chlorophyll a and Secchi depth at all sites.

Table 1: Ecoregion Comparison

| Parameter | NLF Range | Site 101 | Site 210 | Site 204 |
|----------------------|------------------|-----------------|-----------------|-----------------|
| Phosphorus (µg/L) | 14-27 | 15.0 | 10.3 | 16.0 |
| Chlorophyll a (µg/L) | < 10 | 5.0 | 4.3 | 5.0 |
| Secchi Depth (feet) | 7.8-15.1 | 14.3 | 13.1 | 10.3 |

RECOMMENDATIONS

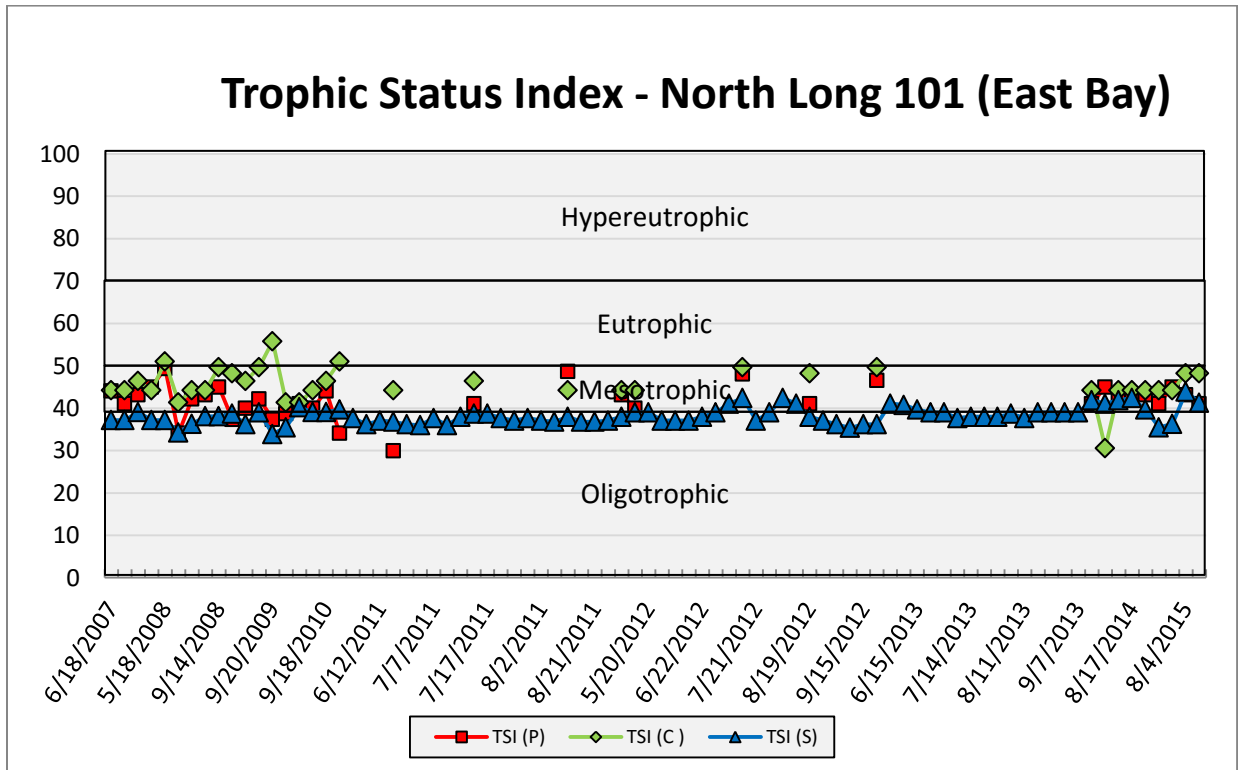
A.W. Research Laboratories recommends the following:

1. Continue annual TSI Monitoring with DO/Temp Profiles at each of the three monitoring sites on North Long Lake in 2016.
2. Complete Winter Profile Sampling at each of the three monitoring sites in February of 2016. (This sampling was last completed by the Thirty Lakes Watershed District at the East Bay Site only in 2006.)
3. Encourage North Long residents to adopt shoreline best management practices (BMP's) to reduce phosphorus loading from lawns and septic systems. Information about specific BMP's can be obtained from the University of Minnesota Extension at the following link: <http://www.extension.umn.edu/environment/shoreland/shoreland-best-management-practices/> or by contacting the Crow Wing Soil and Water Conservation District.

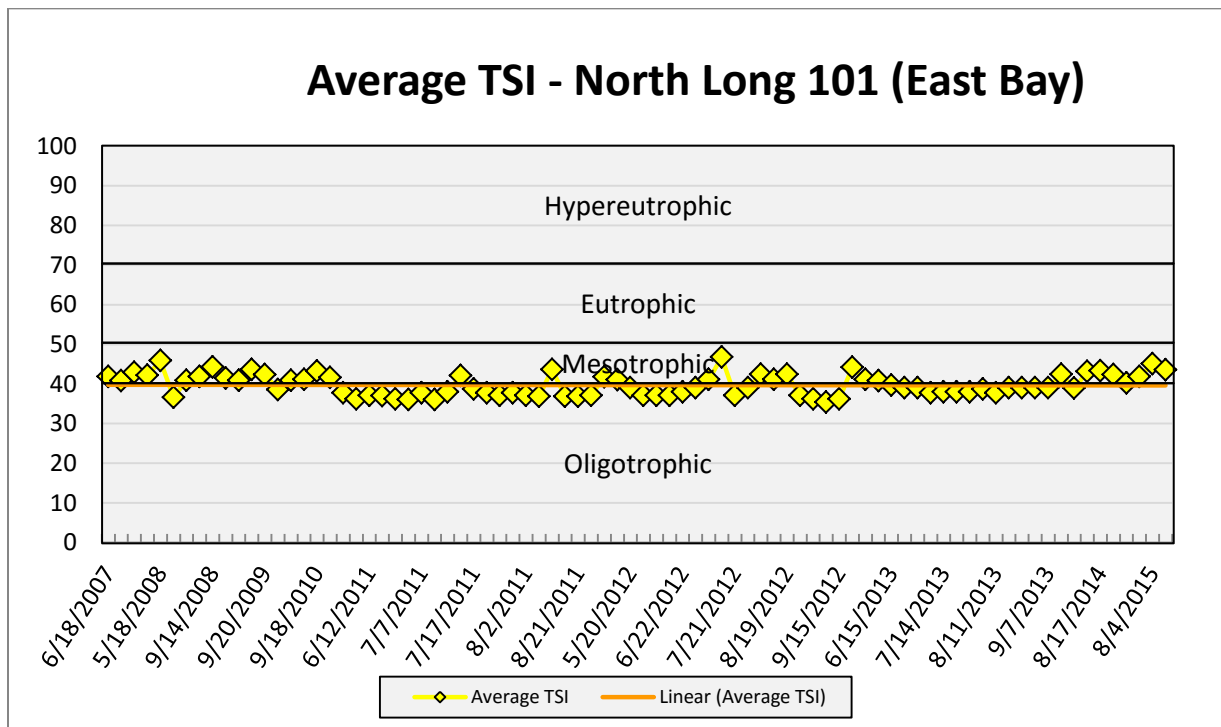
DATA

Site 101 – East Bay

Graph 1: Site 101 (East Bay) TSI, 2007-2015

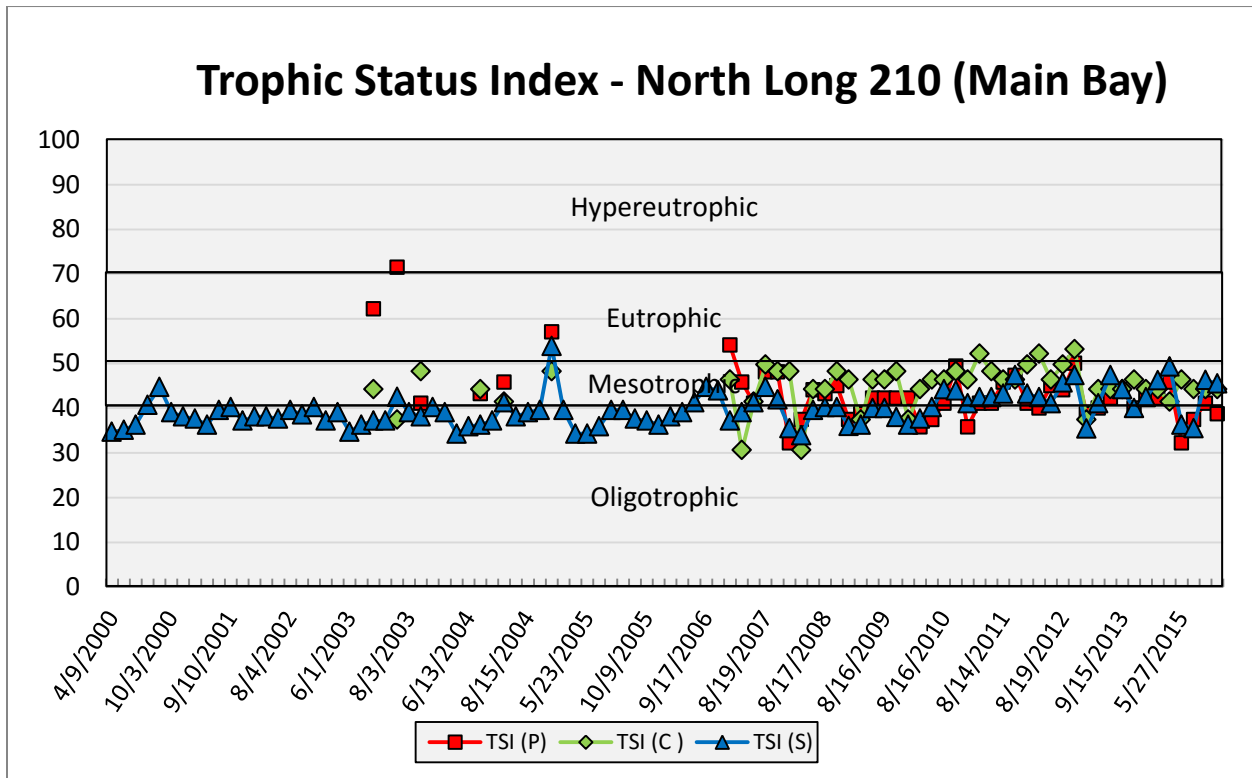


Graph 2: Site 101 (East Bay) Average TSI, 2007-2015

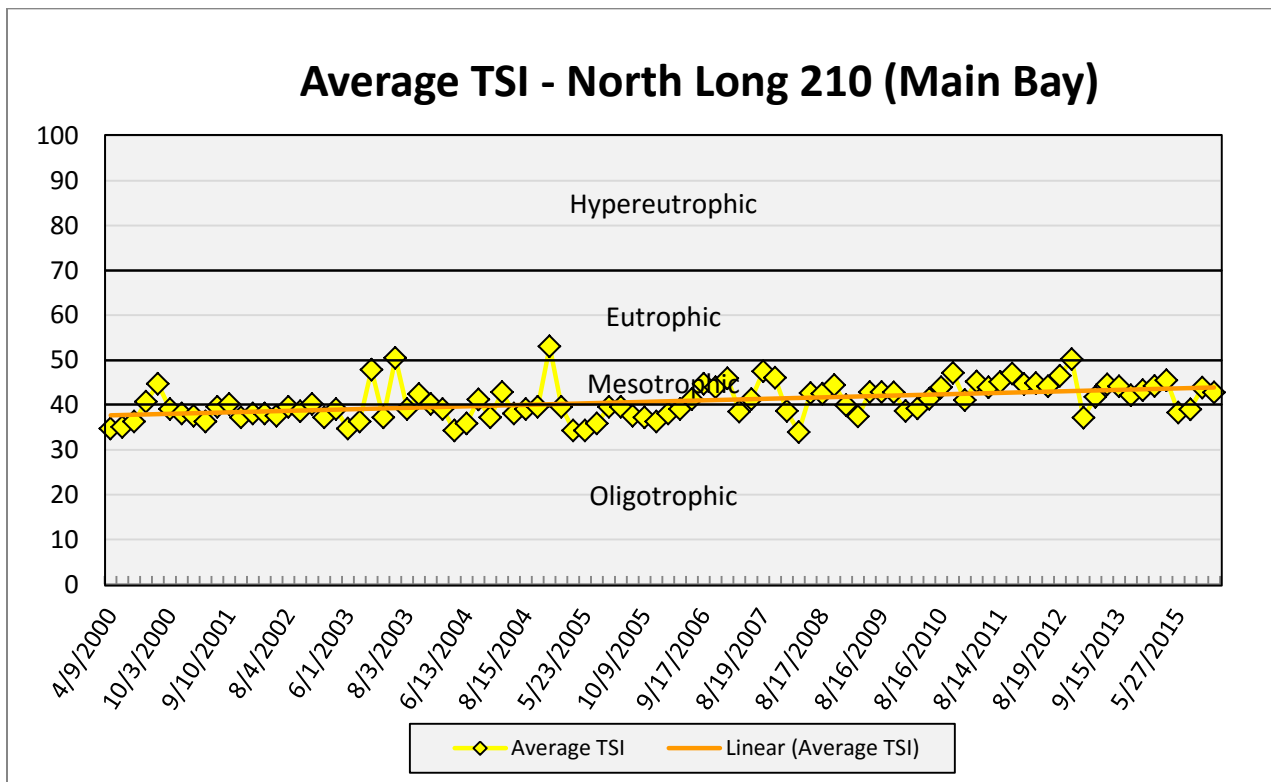


Site 210 – Main Bay

Graph 3: Site 210 (Main Bay) TSI, 2000-2015

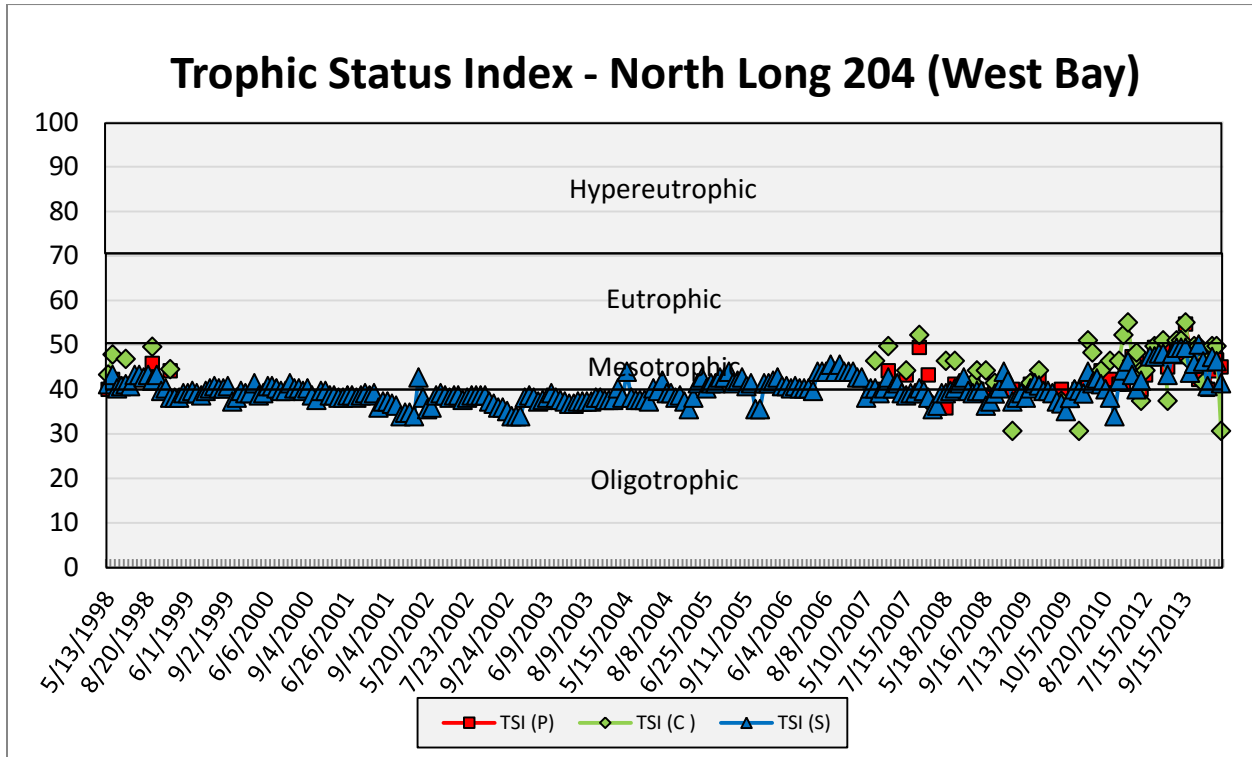


Graph 4: Site 210 (Main Bay) Average TSI, 2000-2015

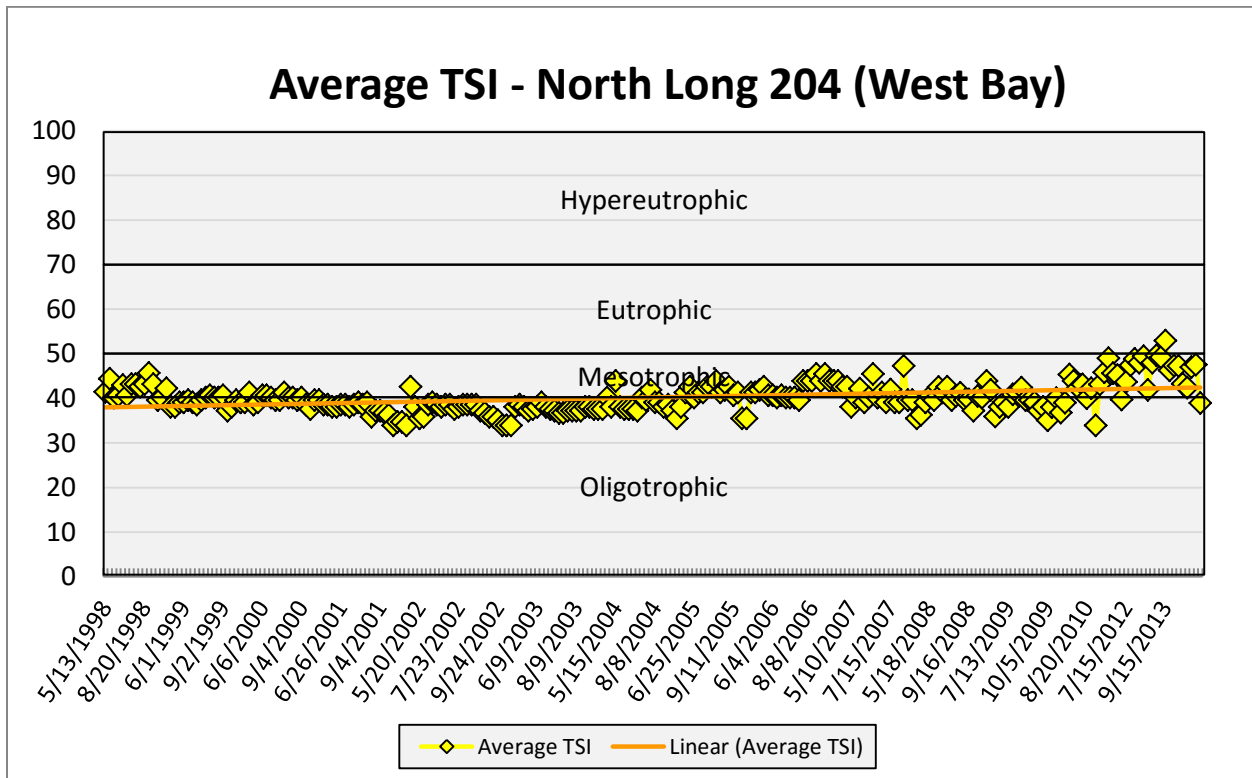


Site 204 – West Bay

Graph 5: Site 204 (West Bay) TSI, 2009-2015



Graph 6: Site 204 (West Bay) Average TSI, 2009-2015



AVERAGE TSI BY MONTH

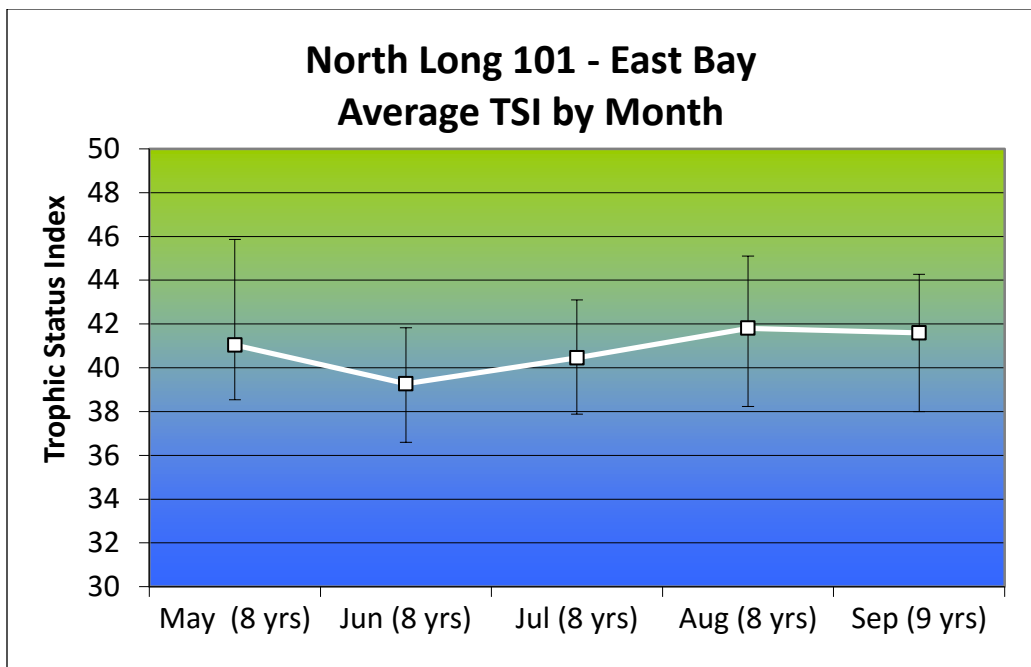
By combining the Average TSI for each month over a number of years, we are able to observe the seasonal TSI trend for each sampling site. Graphs 7-9 display the Average TSI by Month for each site.

Sites 101 and 210 (Graphs 7 and 8) show a similar seasonal TSI trend with a spike in TSI in May, a dip in June, followed by an increase throughout the remaining summer months. The increase in May is likely due to spring runoff and possibly some internal loading caused by the lake turning over in the spring. The increasing trend from July through September is more severe at Site 210 and indicates the effects of increased nutrient inputs during the summer from lawn runoff, increased septic system usage, and other seasonal use of the lake.

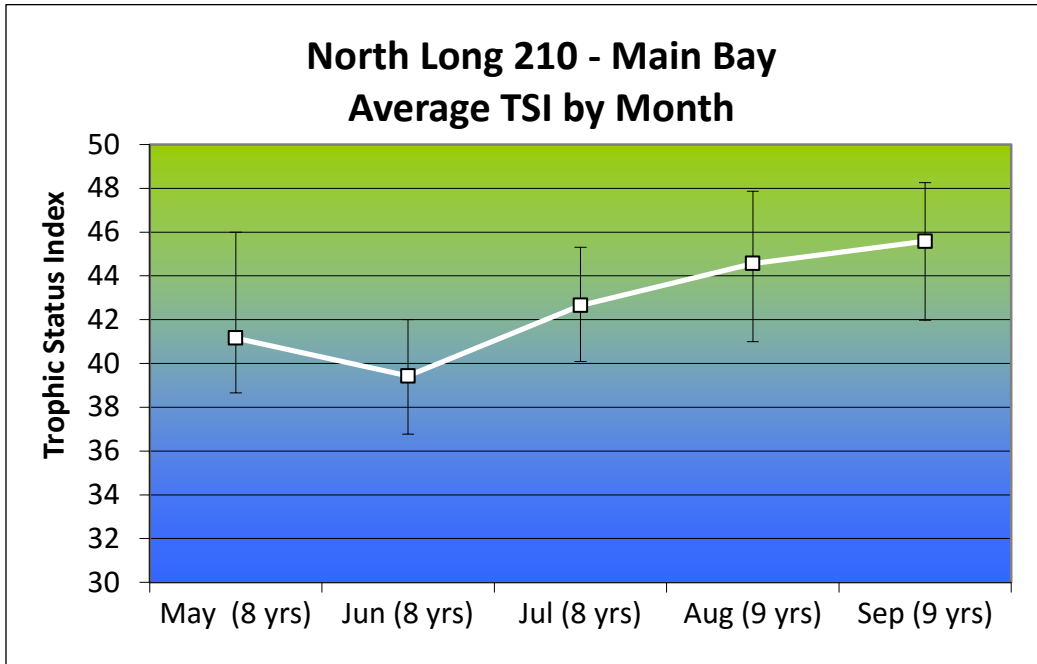
The trend at Site 204 shows a steady increase in Average TSI from May through August again showing us the effects of increased runoff and other seasonal use of the lake. In addition, the warming of this shallow bay can also cause increased algae production resulting in reduced water clarity and an increase in TSI. The Average TSI then drops in September which may be due to cooling waters or a decrease in lake recreational and shoreline activity after Labor Day.

The error bars on each graph indicate the highest and lowest Average TSI readings for each month. These bars give us the range of recorded values for each month over past years of monitoring.

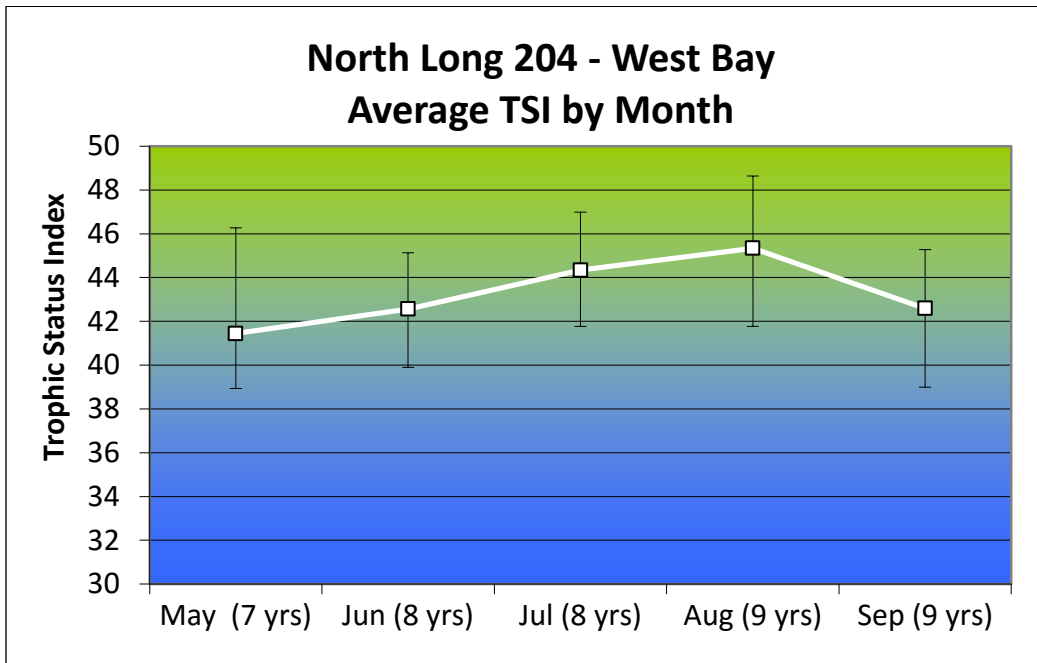
Graph 7: Site 101 Average TSI by Month



Graph 8: Site 210 Average TSI by Month



Graph 9: Site 204 Average TSI by Month



ALKALINITY & CALCIUM RESULTS

In addition to the Trophic State Index parameters, samples were collected for alkalinity and calcium at all three sites on August 4, 2015. The results were as follows:

Table 2: Zebra Mussel Suitability Results

| Parameter | Site 101 | Site 210 | Site 204 |
|--------------------------------------|----------|----------|----------|
| Calcium (mg/L) | 25.20 | 25.30 | 21.50 |
| Alkalinity (mg CaCO ₃ /L) | 113 | 113 | 104 |
| Secchi Depth (m) | 3.0 | 2.6 | 2.6 |
| Chlorophyll a (µg/L) | 6 | 4 | 7 |
| Total Phosphorus (µg/L) | 15 | 13 | 19 |
| pH | 8.2 | 7.7 | 7.9 |

The above parameters among others can be used to assess the suitability of a lake for zebra mussel growth and level of infestation. Table 3 below displays the ranges for each of these parameters that are correlated to varying levels of zebra mussel infestation. The risk levels indicate to what extent zebra mussels would be able to reproduce and colonize a lake once the lake is infested. Table 4 displays the correlated infestation level based on the 8/4/2015 measurements. Overall North Long Lake appears to have potential for a moderate to high level of infestation.

Table 3: Criteria used in determining levels of infestation by zebra mussels in the temperate zone of North America²

| Parameter | No infestation | Little Infestation | Moderate Infestation | High Infestation |
|--------------------------------------|----------------|--------------------|----------------------|------------------|
| Calcium (mg/L) | <10 | <16 | 16-24 | ≥24 |
| Alkalinity (mg CaCO ₃ /L) | <35 | 35-45 | 45-89 | >90 |
| Secchi Depth (m) | <0.1 | 0.1-0.2 or >2.5 | 0.2-0.4 | 0.4-2.5 |
| Chlorophyll a (µg/L) | <2.5 or >25 | 2.0-2.5 or 20-25 | 8-20 | 2.5-8 |
| Total Phosphorus (µg/L) | <5 or >35 | 5-10 or 30-35 | 15-30 | 10-15 |
| pH | < 7.2 | 7.2-7.5 | 7.5-8.0 or 8.7-9.0 | 8.0-8.6 |

² Taken from: *Risk Assessment of Water Quality in Okanagan Lake British Columbia to Zebra/Quagga Mussel Infestations*, Gerald L. Mackie, 2010

http://a100.gov.bc.ca/appsdata/acat/documents/r19917/zmriskassessmentOkanaganLake_1285775545871_6f199d9db208c3e62fdc905db20eaaf10c2bf168c16b282115a84b14f889a669.pdf

Table 4: North Long Lake Potential Zebra Mussel Infestation Levels

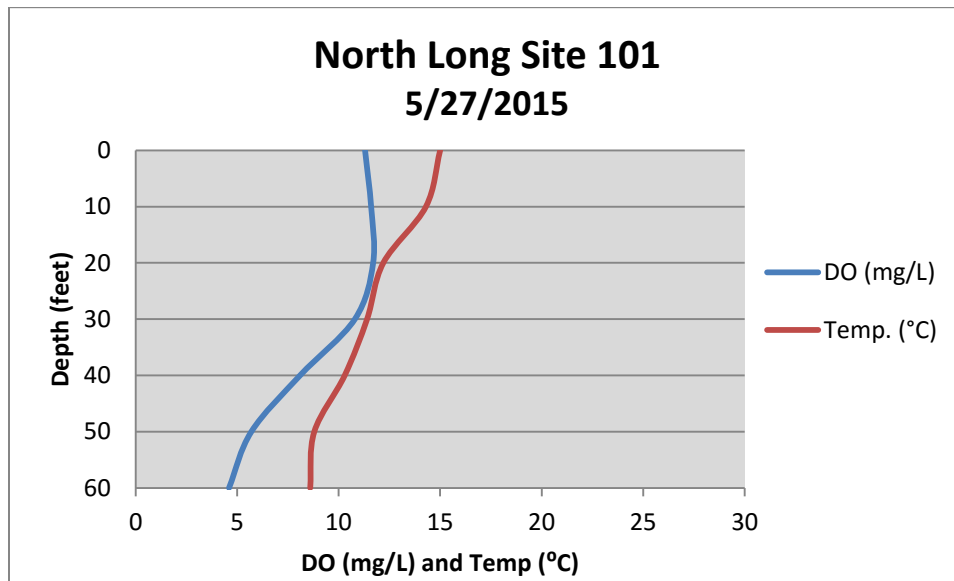
| Parameter | Site 101 | Site 210 | Site 204 |
|--------------------------------------|----------|----------|----------|
| Calcium (mg/L) | High | High | Moderate |
| Alkalinity (mg CaCO ₃ /L) | High | High | High |
| Secchi Depth (m) | Little | Little | Little |
| Chlorophyll a (µg/L) | High | High | High |
| Total Phosphorus (µg/L) | Moderate | Moderate | Moderate |
| pH | High | Moderate | Moderate |

DISSOLVED OXYGEN AND TEMPERATURE PROFILES

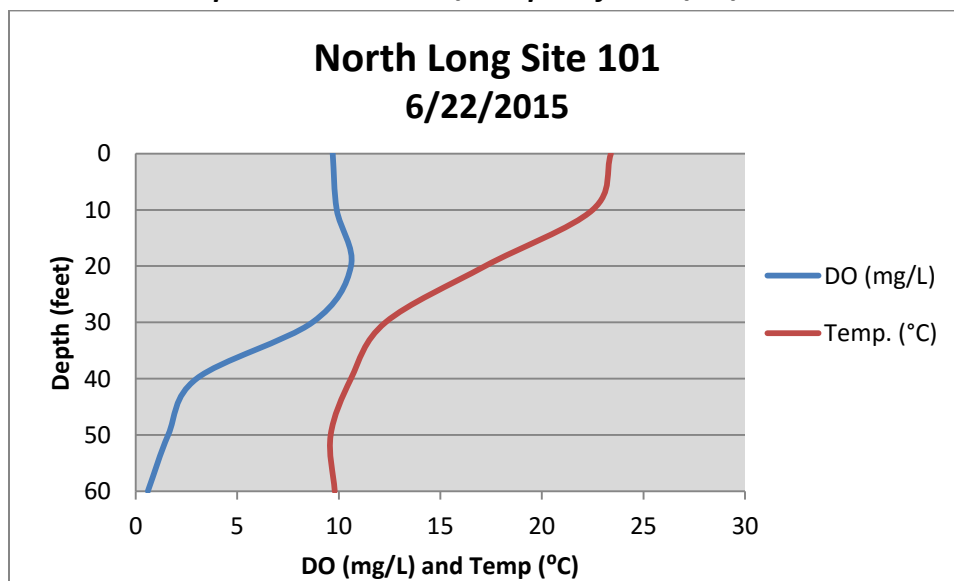
The dissolved oxygen and water temperature were measured with a Hydrolab Quanta field meter. At each TSI site, measurements were taken at the surface and every 10 feet to the bottom (every 5 feet at site 204 due to the shallow depth). Graphs 10-27 present the dissolved oxygen and temperature profiles for the 2015 sampling season for the three TSI sites on North Long.

Site 101

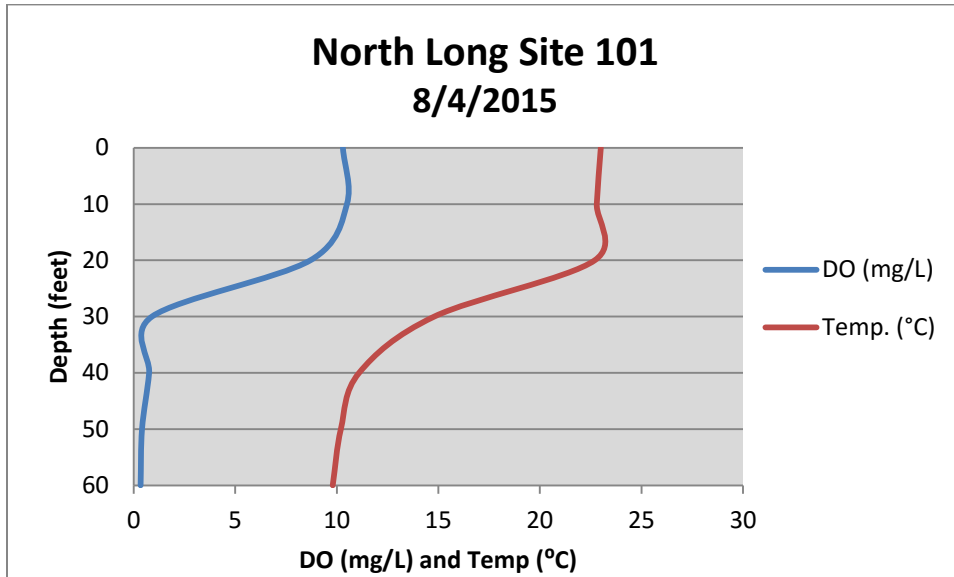
Graph 10: Site 101 DO/Temp Profile – 5/27/2015



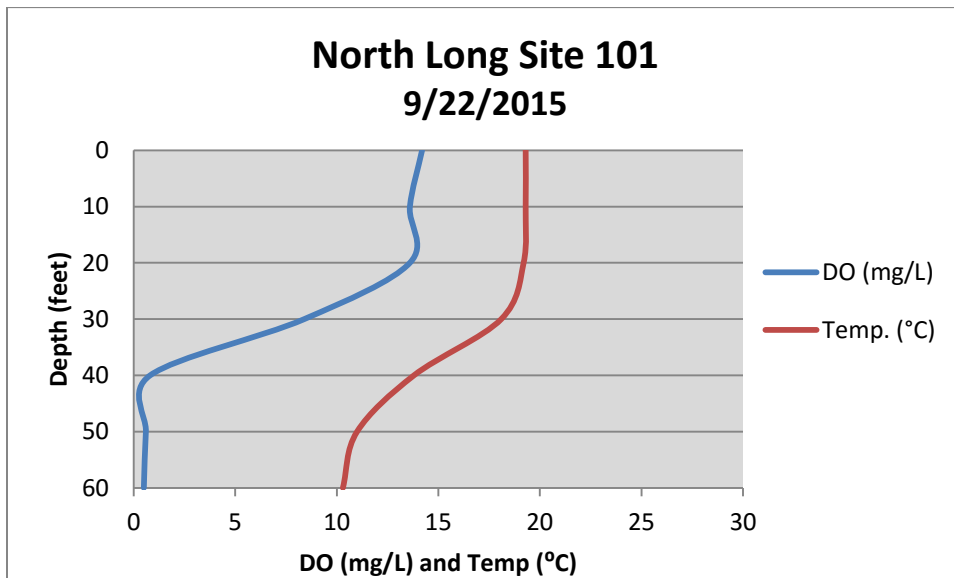
Graph 11: Site 101 DO/Temp Profile – 6/22/2015



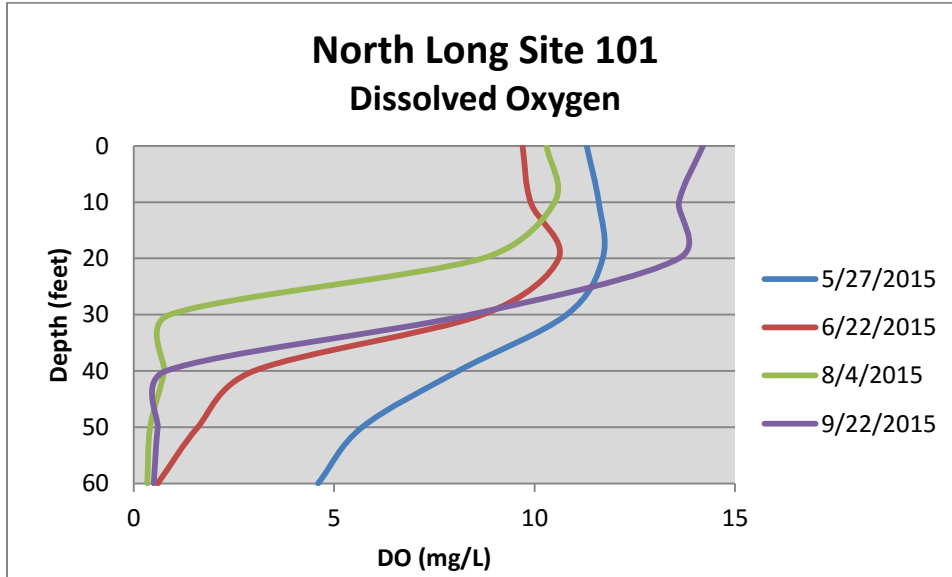
Graph 12: Site 101 DO/Temp Profile – 8/4/2015



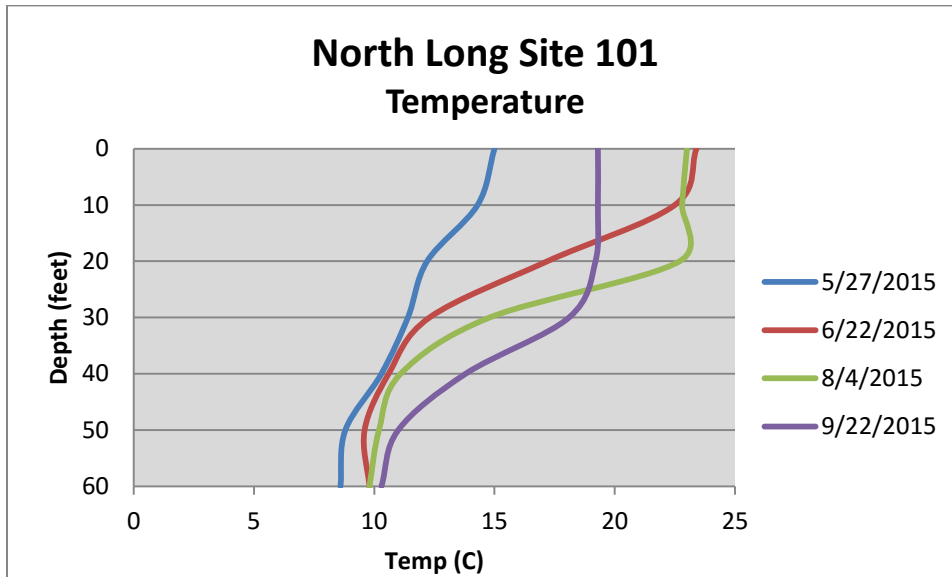
Graph 13: Site 101 DO/Temp Profile – 9/22/2015



Graph 14: Site 101 Dissolved Oxygen Profile – 2015



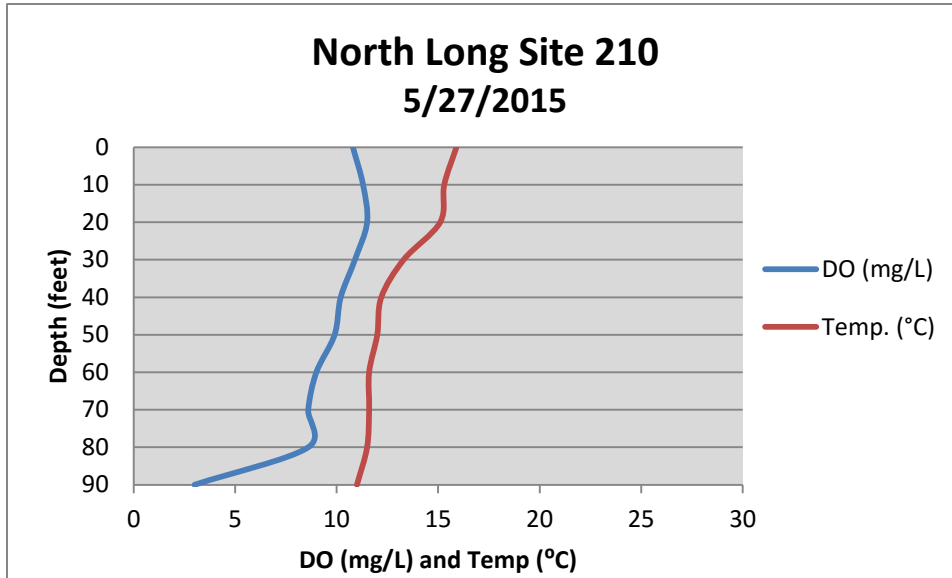
Graph 15: Site 101 Temperature Profile – 2015



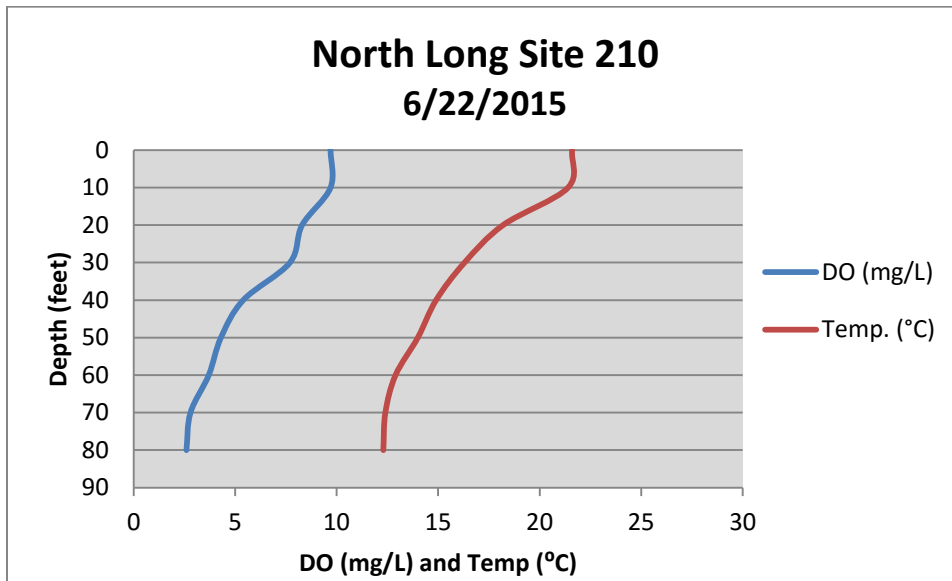
At Site 101 in the East Bay of North Long Lake we see a drop off in dissolved oxygen levels at or below 30 feet for each sampling date. This drop-off is most extreme in August where DO levels drop to less than 5 mg/L around 25 feet. Most fish species require greater than 3-4 mg/L of DO to live. Also in August, the temperatures from the surface to a depth of 20 feet exceed 22°C which can be stressful to many fish species. This squeeze in the late summer limits the portion of the water column that is suitable for fish.

Site 210 – Main Bay

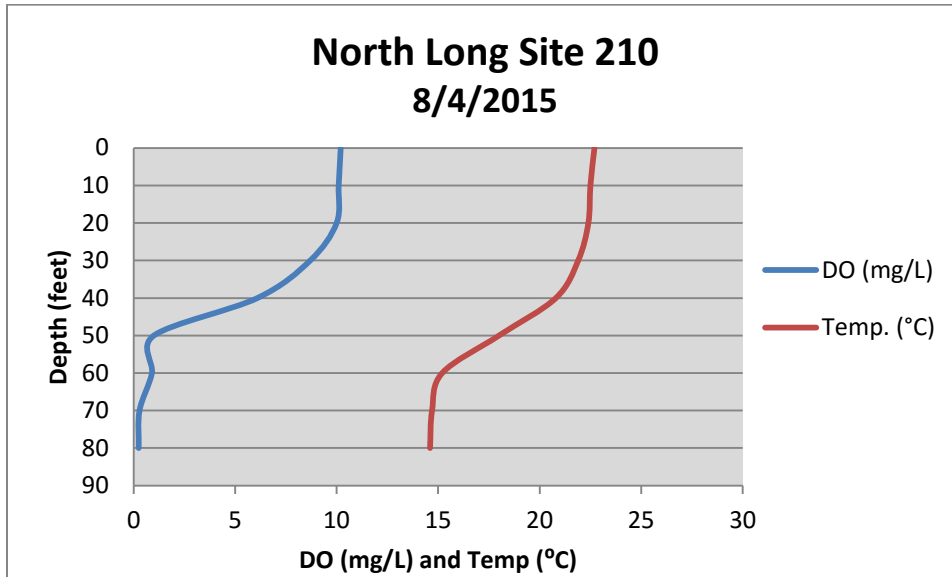
Graph 16: Site 210 DO/Temp Profile – 5/27/2015



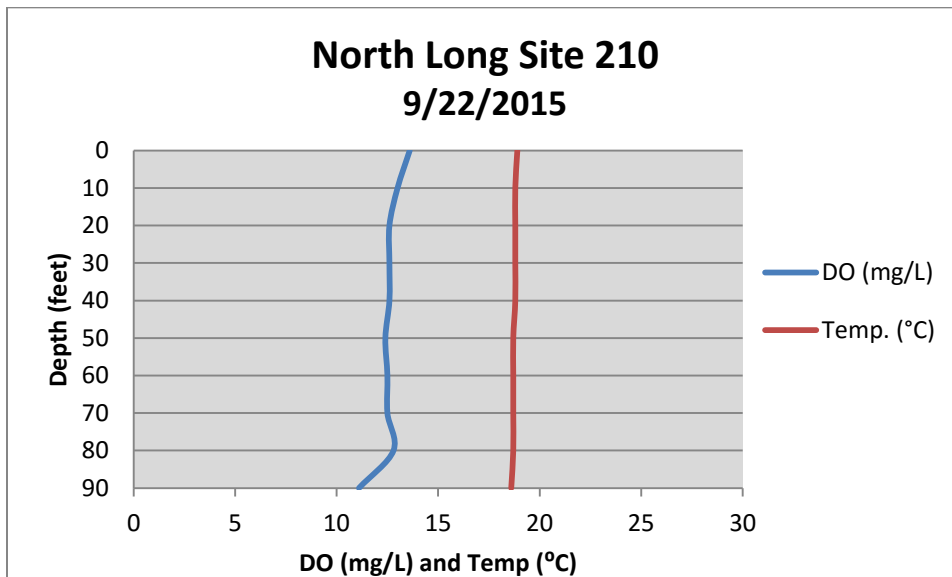
Graph 17: Site 210 DO/Temp Profile – 6/22/2015



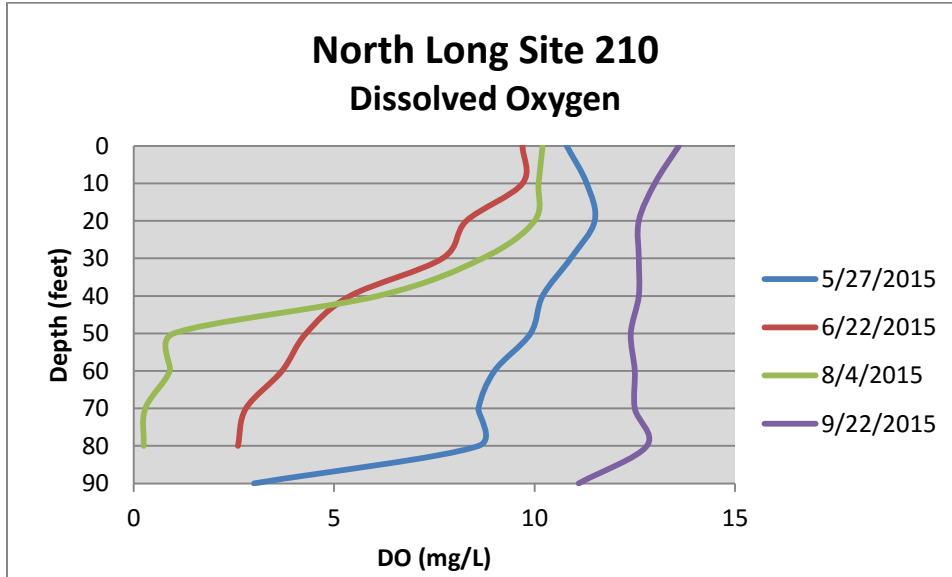
Graph 18: Site 210 DO/Temp Profile – 8/4/2015



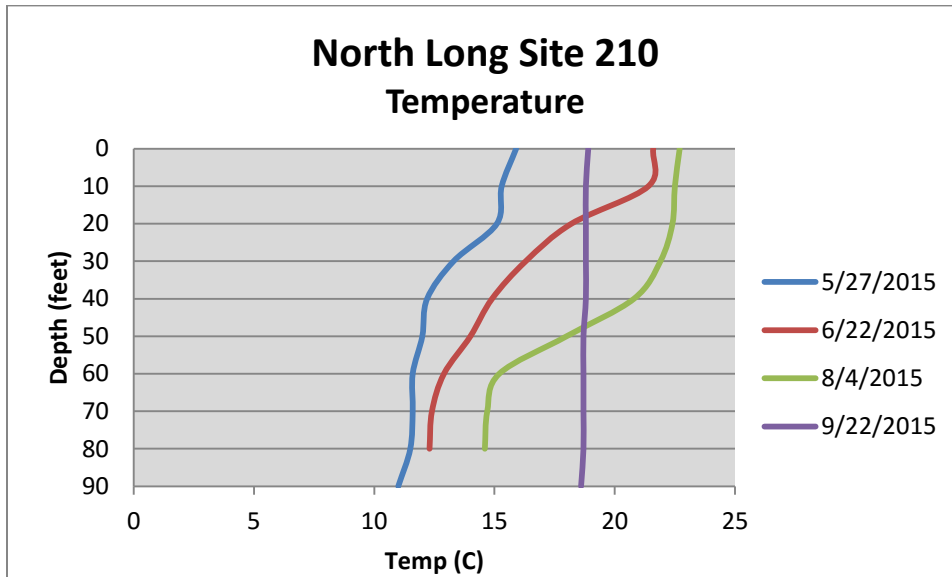
Graph 19: Site 210 DO/Temp Profile – 9/22/2015



Graph 20: Site 210 Dissolved Oxygen Profile – 2015



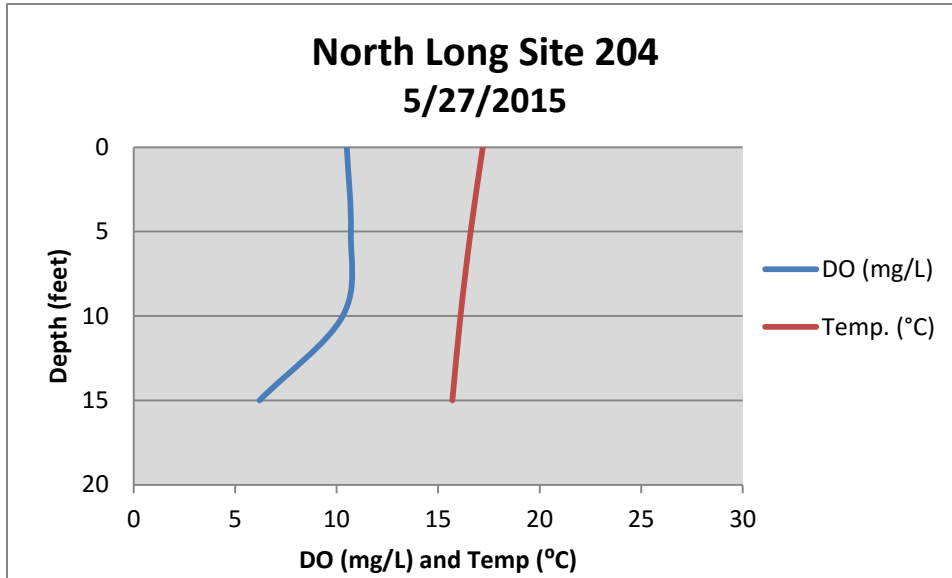
Graph 21: Site 210 Temperature Profile – 2015



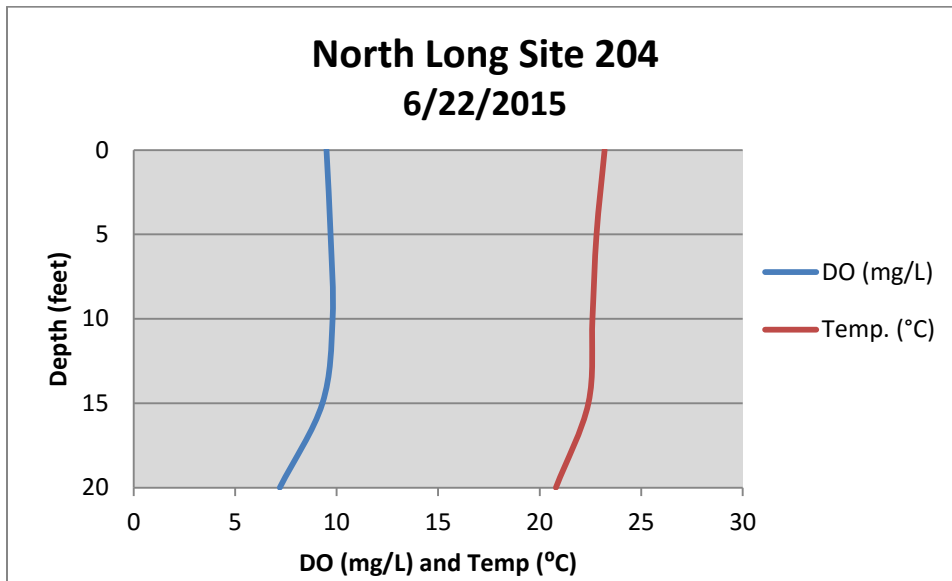
Site 210 is the deepest location on North Long Lake and therefore we expect to see a great difference between the dissolved oxygen and temperature readings at the surface compared to the bottom. Most fish species require dissolved oxygen levels to be greater than 3-4 mg/L. In August we saw dissolved oxygen dip below this required level at depths below 45 feet; we also saw temperatures at the surface greater than 20°C which can also put a strain on some fish species. This summer squeeze is common in many lakes and is not very severe at Site 210. In September the water column was fairly uniform from surface to bottom. This is rare for such a deep site, but is likely due to the wave action and mixing caused by the storm that preceded the September sampling date.

Site 204

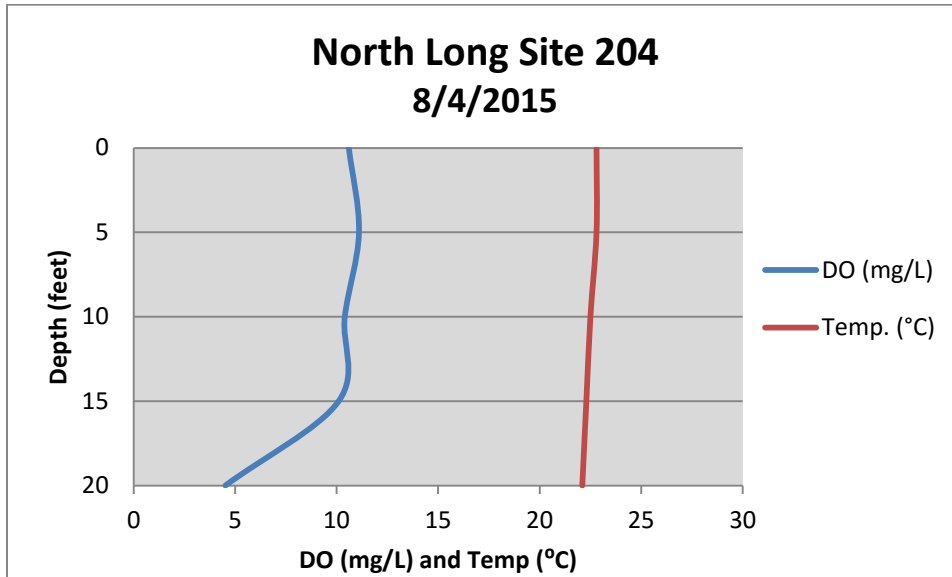
Graph 22: Site 204 DO/Temp Profile – 5/27/2015



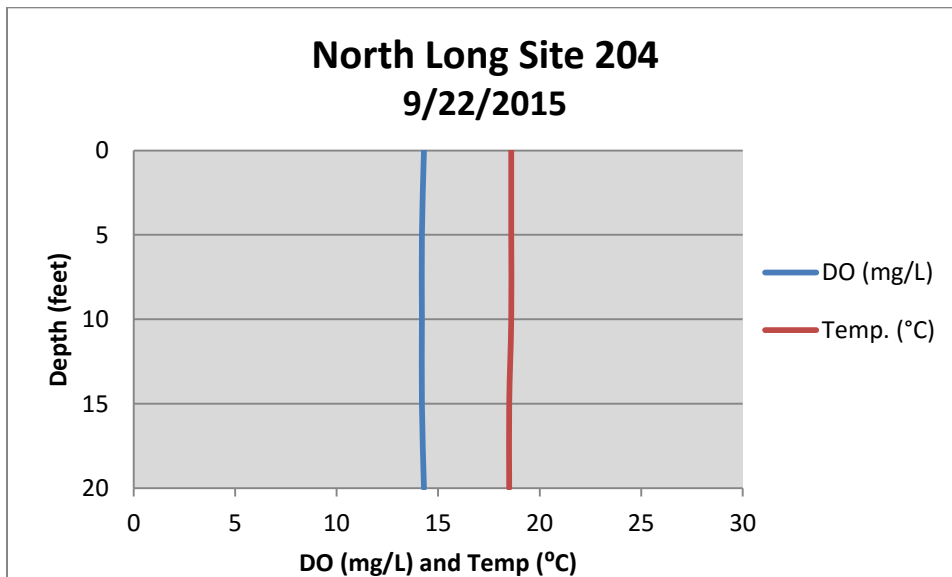
Graph 23: Site 204 DO/Temp Profile – 6/22/2015



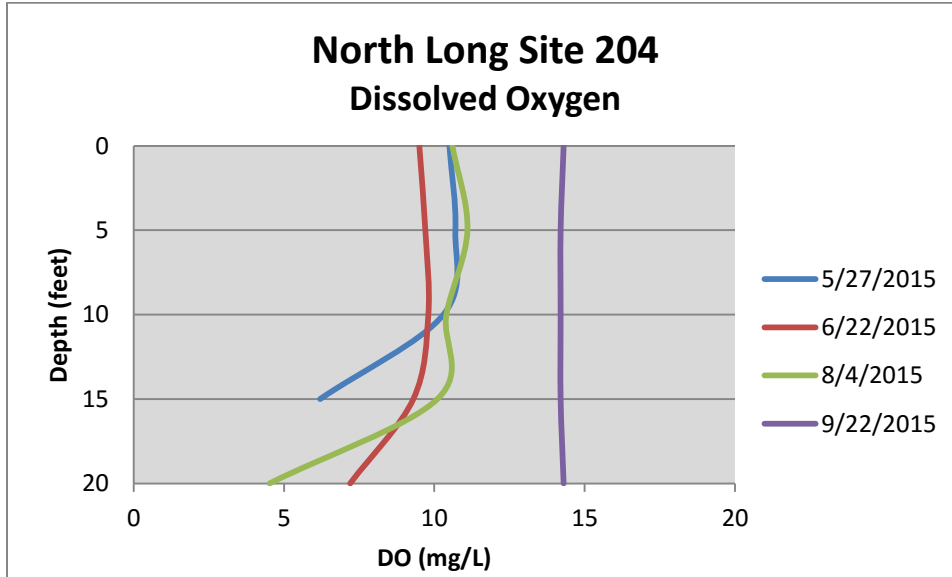
Graph 24: Site 204 DO/Temp Profile – 8/4/2015



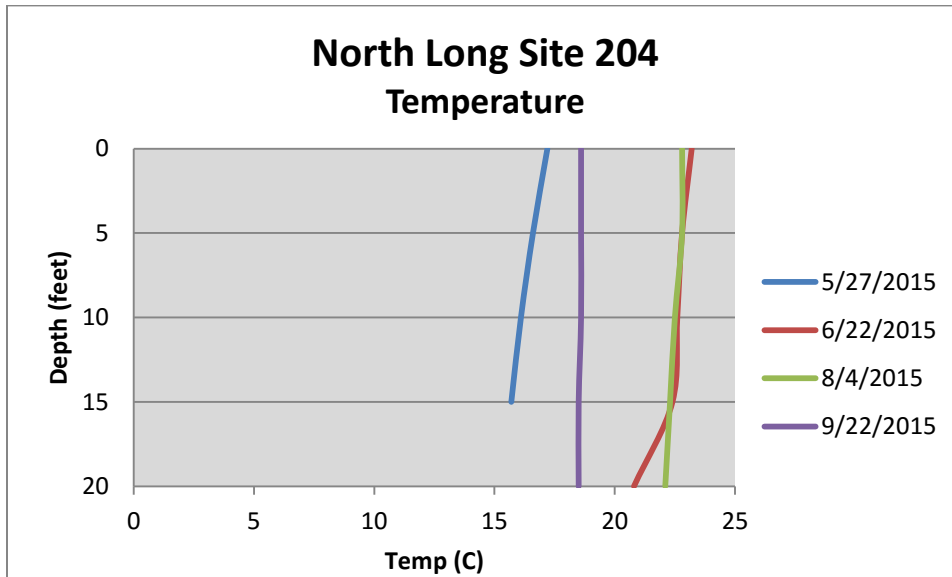
Graph 25: Site 204 DO/Temp Profile – 9/22/2015



Graph 26: Site 204 Dissolved Oxygen Profile – 2015



Graph 27: Site 204 Temperature Profile – 2015



Site 204 is the shallowest of the three sites and therefore tends to have a more even distribution of dissolved oxygen throughout the water column. Wind and wave action can better mix the water resulting in good oxygenation even at lower depths. The sample on September 22, 2015 was taken following a very windy storm and we can see an extremely uniform water column due to this mixing.

APPENDIX: RAW SAMPLING DATA*Table 5: Raw Data for Site 101*

| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|------------|-----------|--------------|----------------|----------------|---------|---------|---------|----------------|
| MPCA CLMP | 6/18/2007 | 16 | 4 | 16.01 | 44.1 | 44.2 | 37.2 | 41.83 |
| MPCA CLMP | 7/14/2007 | 13 | 4 | 16.01 | 41.1 | 44.2 | 37.2 | 40.83 |
| MPCA CLMP | 8/19/2007 | 15 | 5 | 14.01 | 43.2 | 46.4 | 39.1 | 42.90 |
| MPCA CLMP | 9/16/2007 | 17 | 4 | 16.01 | 45 | 44.2 | 37.2 | 42.13 |
| MPCA CLMP | 5/18/2008 | 23 | 8 | 16.01 | 49.4 | 51 | 37.2 | 45.87 |
| MPCA CLMP | 6/16/2008 | 8 | 3 | 19.49 | 34.1 | 41.4 | 34.3 | 36.60 |
| MPCA CLMP | 7/20/2008 | 14 | 4 | 16.99 | 42.2 | 44.2 | 36.3 | 40.90 |
| MPCA CLMP | 8/17/2008 | 15 | 4 | 14.99 | 43.2 | 44.2 | 38.1 | 41.83 |
| MPCA CLMP | 9/14/2008 | 17 | 7 | 14.99 | 45 | 49.7 | 38.1 | 44.27 |
| MPCA CLMP | 5/17/2009 | 10 | 6 | 14.44 | 37.4 | 48.2 | 38.7 | 41.43 |
| MPCA CLMP | 7/19/2009 | 12 | 5 | 17.06 | 40 | 46.4 | 36.2 | 40.87 |
| MPCA CLMP | 8/16/2009 | 14 | 7 | 14.11 | 42.2 | 49.7 | 39 | 43.63 |
| MPCA CLMP | 9/20/2009 | 10 | 13 | 20.01 | 37.4 | 55.8 | 33.9 | 42.37 |
| MPCA CLMP | 5/23/2010 | 11 | 3 | 18.01 | 38.7 | 41.4 | 35.5 | 38.53 |
| MPCA CLMP | 6/20/2010 | 13 | 3 | 12.99 | 41.1 | 41.4 | 40.2 | 40.90 |
| MPCA CLMP | 7/18/2010 | 12 | 4 | 14.01 | 40 | 44.2 | 39.1 | 41.10 |
| MPCA CLMP | 9/18/2010 | 16 | 5 | 14.01 | 44.1 | 46.4 | 39.1 | 43.20 |
| MPCA CLMP | 5/23/2011 | 8 | 8 | 13.45 | 34.1 | 51 | 39.7 | 41.60 |
| MPCA CLMP | 5/28/2011 | ** | ** | 15.42 | ** | ** | 37.7 | 37.70 |
| MPCA CLMP | 6/4/2011 | ** | ** | 17.06 | ** | ** | 36.2 | 36.20 |
| MPCA CLMP | 6/12/2011 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 6/19/2011 | 6 | 4 | 16.40 | 30 | 44.2 | 36.8 | 37.00 |
| MPCA CLMP | 6/26/2011 | ** | ** | 17.06 | ** | ** | 36.2 | 36.20 |
| MPCA CLMP | 7/2/2011 | ** | ** | 17.39 | ** | ** | 36 | 36.00 |
| MPCA CLMP | 7/7/2011 | ** | ** | 15.42 | ** | ** | 37.7 | 37.70 |
| MPCA CLMP | 7/9/2011 | ** | ** | 17.39 | ** | ** | 36 | 36.00 |
| MPCA CLMP | 7/14/2011 | ** | ** | 15.09 | ** | ** | 38 | 38.00 |
| MPCA CLMP | 7/17/2011 | 13 | 5 | 14.44 | 41.1 | 46.4 | 38.7 | 42.07 |
| MPCA CLMP | 7/17/2011 | ** | ** | 14.44 | ** | ** | 38.7 | 38.70 |
| MPCA CLMP | 7/24/2011 | ** | ** | 15.42 | ** | ** | 37.7 | 37.70 |
| MPCA CLMP | 7/24/2011 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 7/30/2011 | ** | ** | 15.42 | ** | ** | 37.7 | 37.70 |
| MPCA CLMP | 8/2/2011 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 8/8/2011 | ** | ** | 16.40 | ** | ** | 36.8 | 36.80 |
| MPCA CLMP | 8/14/2011 | 22 | 4 | 15.09 | 48.7 | 44.2 | 38 | 43.63 |
| MPCA CLMP | 8/14/2011 | ** | ** | 16.40 | ** | ** | 36.8 | 36.80 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 8/21/2011 | ** | ** | 16.40 | ** | ** | 36.8 | 36.80 |
| MPCA CLMP | 9/11/2011 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 9/17/2011 | 15 | 4 | 15.09 | 43.2 | 44.2 | 38 | 41.80 |
| MPCA CLMP | 5/20/2012 | 12 | 4 | 14.11 | 40 | 44.2 | 39 | 41.07 |
| MPCA CLMP | 5/20/2012 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 5/26/2012 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 6/2/2012 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 6/9/2012 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 6/22/2012 | ** | ** | 15.09 | ** | ** | 38 | 38.00 |
| MPCA CLMP | 6/29/2012 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 7/5/2012 | ** | ** | 12.14 | ** | ** | 41.1 | 41.10 |
| MPCA CLMP | 7/15/2012 | 21 | 7 | 11.15 | 48.1 | 49.7 | 42.4 | 46.73 |
| MPCA CLMP | 7/21/2012 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 7/28/2012 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 8/4/2012 | ** | ** | 11.15 | ** | ** | 42.4 | 42.40 |
| MPCA CLMP | 8/14/2012 | ** | ** | 12.14 | ** | ** | 41.1 | 41.10 |
| MPCA CLMP | 8/19/2012 | 13 | 6 | 15.09 | 41.1 | 48.2 | 38 | 42.43 |
| MPCA CLMP | 8/26/2012 | ** | ** | 16.08 | ** | ** | 37.1 | 37.10 |
| MPCA CLMP | 9/2/2012 | ** | ** | 17.06 | ** | ** | 36.2 | 36.20 |
| MPCA CLMP | 9/8/2012 | ** | ** | 18.04 | ** | ** | 35.4 | 35.40 |
| MPCA CLMP | 9/15/2012 | ** | ** | 17.06 | ** | ** | 36.2 | 36.20 |
| MPCA CLMP | 9/16/2012 | 19 | 7 | 17.06 | 46.6 | 49.7 | 36.2 | 44.17 |
| MPCA CLMP | 5/25/2013 | ** | ** | 12.14 | ** | ** | 41.1 | 41.10 |
| MPCA CLMP | 6/8/2013 | ** | ** | 12.47 | ** | ** | 40.8 | 40.80 |
| MPCA CLMP | 6/15/2013 | ** | ** | 13.45 | ** | ** | 39.7 | 39.70 |
| MPCA CLMP | 6/22/2013 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 6/27/2013 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 7/7/2013 | ** | ** | 15.42 | ** | ** | 37.7 | 37.70 |
| MPCA CLMP | 7/14/2013 | ** | ** | 15.09 | ** | ** | 38 | 38.00 |
| MPCA CLMP | 7/21/2013 | ** | ** | 15.09 | ** | ** | 38 | 38.00 |
| MPCA CLMP | 7/28/2013 | ** | ** | 15.09 | ** | ** | 38 | 38.00 |
| MPCA CLMP | 8/4/2013 | ** | ** | 14.44 | ** | ** | 38.7 | 38.70 |
| MPCA CLMP | 8/11/2013 | ** | ** | 15.42 | ** | ** | 37.7 | 37.70 |
| MPCA CLMP | 8/18/2013 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 8/25/2013 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 8/31/2013 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 9/7/2013 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 5/18/2014 | 13 | 4 | 11.48 | 41.1 | 44.2 | 41.9 | 42.40 |
| MPCA CLMP | 6/15/2014 | 17 | 1 | 12.14 | 45 | 30.6 | 41.1 | 38.90 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 7/20/2014 | 15 | 4 | 11.48 | 43.2 | 44.2 | 41.9 | 43.10 |
| MPCA CLMP | 8/17/2014 | 15 | 4 | 11.15 | 43.2 | 44.2 | 42.4 | 43.27 |
| MPCA CLMP | 9/21/2014 | 15 | 4 | 13.45 | 43.2 | 44.2 | 39.7 | 42.37 |
| Sarah - AWRP | 5/27/2015 | 13 | 4 | 18 | 41.1 | 44.2 | 35.5 | 40.27 |
| Sarah - AWRP | 6/22/2015 | 17 | 4 | 17 | 45 | 44.2 | 36.3 | 41.83 |
| Sarah - AWRP | 8/4/2015 | 15 | 6 | 10 | 43.2 | 48.2 | 43.9 | 45.10 |
| Sarah - AWRP | 9/22/2015 | 13 | 6 | 12 | 41.1 | 48.2 | 41.3 | 43.53 |

**No Data

Table 6: Raw Data for Site 210

| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 4/9/2000 | ** | ** | 19.00 | ** | ** | 34.7 | 34.70 |
| MPCA CLMP | 5/14/2000 | ** | ** | 18.50 | ** | ** | 35.1 | 35.10 |
| MPCA CLMP | 6/29/2000 | ** | ** | 16.99 | ** | ** | 36.3 | 36.30 |
| MPCA CLMP | 8/3/2000 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 9/2/2000 | ** | ** | 9.51 | ** | ** | 44.7 | 44.70 |
| MPCA CLMP | 10/3/2000 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 5/13/2001 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 6/10/2001 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 7/8/2001 | ** | ** | 16.99 | ** | ** | 36.3 | 36.30 |
| MPCA CLMP | 8/13/2001 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 9/10/2001 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 10/15/2001 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 6/2/2002 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 6/30/2002 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 7/13/2002 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 8/4/2002 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 8/5/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 9/2/2002 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 9/30/2002 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 5/7/2003 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 6/1/2003 | ** | ** | 19.00 | ** | ** | 34.7 | 34.70 |
| MPCA CLMP | 6/17/2003 | ** | ** | 16.99 | ** | ** | 36.3 | 36.30 |
| MPCA CLMP | 6/19/2003 | 56 | 4 | 16.01 | 62.2 | 44.2 | 37.2 | 47.87 |
| MPCA CLMP | 7/6/2003 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 7/28/2003 | 107 | 2 | 11.02 | 71.5 | 37.4 | 42.5 | 50.47 |
| MPCA CLMP | 8/3/2003 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 8/22/2003 | 13 | 6 | 15.03 | 41.1 | 48.2 | 38.1 | 42.47 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 9/7/2003 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 10/5/2003 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 5/9/2004 | ** | ** | 19.49 | ** | ** | 34.3 | 34.30 |
| MPCA CLMP | 6/13/2004 | ** | ** | 17.49 | ** | ** | 35.9 | 35.90 |
| MPCA CLMP | 6/29/2004 | 15 | 4 | 17.03 | 43.2 | 44.2 | 36.3 | 41.23 |
| MPCA CLMP | 7/11/2004 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 7/19/2004 | 18 | 3 | 12.01 | 45.8 | 41.4 | 41.3 | 42.83 |
| MPCA CLMP | 8/1/2004 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 8/15/2004 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 9/12/2004 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 9/16/2004 | 39 | 6 | 5.02 | 57 | 48.2 | 53.9 | 53.03 |
| MPCA CLMP | 10/4/2004 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 5/15/2005 | ** | ** | 19.49 | ** | ** | 34.3 | 34.30 |
| MPCA CLMP | 5/23/2005 | ** | ** | 19.49 | ** | ** | 34.3 | 34.30 |
| MPCA CLMP | 6/26/2005 | ** | ** | 17.49 | ** | ** | 35.9 | 35.90 |
| MPCA CLMP | 7/24/2005 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 8/28/2005 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 9/25/2005 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 10/9/2005 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 5/26/2006 | ** | ** | 16.99 | ** | ** | 36.3 | 36.30 |
| MPCA CLMP | 6/22/2006 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 7/16/2006 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 8/20/2006 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 9/17/2006 | ** | ** | 9.51 | ** | ** | 44.7 | 44.70 |
| MPCA CLMP | 10/7/2006 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 5/21/2007 | 32 | 5 | 16.01 | 54.1 | 46.4 | 37.2 | 45.90 |
| MPCA CLMP | 6/18/2007 | 18 | 1 | 14.01 | 45.8 | 30.6 | 39.1 | 38.50 |
| MPCA CLMP | 7/15/2007 | 13 | 3 | 12.01 | 41.1 | 41.4 | 41.3 | 41.27 |
| MPCA CLMP | 8/19/2007 | 21 | 7 | 9.51 | 48.1 | 49.7 | 44.7 | 47.50 |
| MPCA CLMP | 9/16/2007 | 21 | 6 | 11.52 | 48.1 | 48.2 | 41.9 | 46.07 |
| MPCA CLMP | 5/18/2008 | 7 | 6 | 18.01 | 32.2 | 48.2 | 35.5 | 38.63 |
| MPCA CLMP | 6/15/2008 | 10 | 1 | 20.01 | 37.4 | 30.6 | 33.9 | 33.97 |
| MPCA CLMP | 7/19/2008 | 16 | 4 | 13.48 | 44.1 | 44.2 | 39.6 | 42.63 |
| MPCA CLMP | 8/17/2008 | 15 | 4 | 12.99 | 43.2 | 44.2 | 40.2 | 42.53 |
| MPCA CLMP | 9/16/2008 | 17 | 6 | 12.99 | 45 | 48.2 | 40.2 | 44.47 |
| MPCA CLMP | 5/17/2009 | 10 | 5 | 17.39 | 37.4 | 46.4 | 36 | 39.93 |
| MPCA CLMP | 6/14/2009 | 11 | 2 | 16.99 | 38.7 | 37.4 | 36.3 | 37.47 |
| MPCA CLMP | 7/19/2009 | 14 | 5 | 13.12 | 42.2 | 46.4 | 40 | 42.87 |
| MPCA CLMP | 8/16/2009 | 14 | 5 | 13.12 | 42.2 | 46.4 | 40 | 42.87 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 9/20/2009 | 14 | 6 | 15.09 | 42.2 | 48.2 | 38 | 42.80 |
| MPCA CLMP | 5/23/2010 | 14 | 2 | 16.99 | 42.2 | 37.4 | 36.3 | 38.63 |
| MPCA CLMP | 6/20/2010 | 9 | 4 | 15.49 | 35.8 | 44.2 | 37.6 | 39.20 |
| MPCA CLMP | 7/18/2010 | 10 | 5 | 12.99 | 37.4 | 46.4 | 40.2 | 41.33 |
| MPCA CLMP | 8/16/2010 | 13 | 5 | 9.84 | 41.1 | 46.4 | 44.2 | 43.90 |
| MPCA CLMP | 9/19/2010 | 23 | 6 | 10.01 | 49.4 | 48.2 | 43.9 | 47.17 |
| MPCA CLMP | 5/22/2011 | 9 | 5 | 12.14 | 35.8 | 46.4 | 41.1 | 41.10 |
| MPCA CLMP | 6/19/2011 | 13 | 9 | 11.15 | 41.1 | 52.2 | 42.4 | 45.23 |
| MPCA CLMP | 7/17/2011 | 13 | 6 | 11.15 | 41.1 | 48.2 | 42.4 | 43.90 |
| MPCA CLMP | 8/14/2011 | 18 | 5 | 10.50 | 45.8 | 46.4 | 43.2 | 45.13 |
| MPCA CLMP | 9/19/2011 | 20 | 5 | 7.87 | 47.3 | 46.4 | 47.4 | 47.03 |
| MPCA CLMP | 5/20/2012 | 13 | 7 | 10.50 | 41.1 | 49.7 | 43.2 | 44.67 |
| MPCA CLMP | 6/17/2012 | 12 | 9 | 11.15 | 40 | 52.2 | 42.4 | 44.87 |
| MPCA CLMP | 7/15/2012 | 17 | 5 | 12.14 | 45 | 46.4 | 41.1 | 44.17 |
| MPCA CLMP | 8/19/2012 | 16 | 7 | 8.86 | 44.1 | 49.7 | 45.7 | 46.50 |
| MPCA CLMP | 9/16/2012 | 24 | 10 | 7.87 | 50 | 53.2 | 47.4 | 50.20 |
| MPCA CLMP | 6/16/2013 | 11 | 2 | 18.04 | 38.7 | 37.4 | 35.4 | 37.17 |
| MPCA CLMP | 7/23/2013 | 12 | 4 | 12.14 | 40 | 44.2 | 41.1 | 41.77 |
| MPCA CLMP | 8/18/2013 | 14 | 4 | 7.87 | 42.2 | 44.2 | 47.4 | 44.60 |
| MPCA CLMP | 9/15/2013 | 16 | 4 | 9.84 | 44.1 | 44.2 | 44.2 | 44.17 |
| MPCA CLMP | 5/18/2014 | 12 | 5 | 13.12 | 40 | 46.4 | 40 | 42.13 |
| MPCA CLMP | 7/19/2014 | 15 | 4 | 11.15 | 43.2 | 44.2 | 42.4 | 43.27 |
| MPCA CLMP | 8/17/2014 | 14 | 4 | 8.53 | 42.2 | 44.2 | 46.2 | 44.20 |
| MPCA CLMP | 9/14/2014 | 18 | 3 | 6.89 | 45.8 | 41.4 | 49.3 | 45.50 |
| Sarah - AWRL | 5/27/2015 | 7 | 5 | 17 | 32.2 | 46.4 | 36.3 | 38.30 |
| Sarah - AWRL | 6/22/2015 | 10 | 4 | 18 | 37.4 | 44.2 | 35.5 | 39.03 |
| Sarah - AWRL | 8/4/2015 | 13 | 4 | 8.5 | 41.1 | 44.2 | 46.3 | 43.87 |
| Sarah - AWRL | 9/22/2015 | 11.00 | 4 | 9 | 38.7 | 44.2 | 45.5 | 42.80 |

**No Data

Table 7: Raw Data for Site 204

| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 5/13/1998 | 12 | 3.65 | 12.14 | 40 | 43.3 | 41.1 | 41.47 |
| MPCA CLMP | 6/22/1998 | 14 | 5.77 | 10.50 | 42.2 | 47.8 | 43.2 | 44.40 |
| MPCA CLMP | 6/30/1998 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 7/9/1998 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 7/14/1998 | 13 | 5.19 | 12.14 | 41.1 | 46.8 | 41.1 | 43.00 |
| MPCA CLMP | 7/20/1998 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 7/27/1998 | ** | ** | 10.50 | ** | ** | 43.2 | 43.20 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 8/8/1998 | ** | ** | 10.50 | ** | ** | 43.2 | 43.20 |
| MPCA CLMP | 8/13/1998 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 8/20/1998 | ** | ** | 10.50 | ** | ** | 43.2 | 43.20 |
| MPCA CLMP | 8/21/1998 | 18 | 6.9 | 11.52 | 45.8 | 49.5 | 41.9 | 45.73 |
| MPCA CLMP | 8/30/1998 | ** | ** | 10.50 | ** | ** | 43.2 | 43.20 |
| MPCA CLMP | 9/17/1998 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 9/25/1998 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 9/28/1998 | 16 | 4.13 | 14.99 | 44.1 | 44.5 | 38.1 | 42.23 |
| MPCA CLMP | 10/9/1998 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 4/27/1999 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 5/29/1999 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 6/1/1999 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 6/9/1999 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 6/17/1999 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 6/24/1999 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 6/29/1999 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 7/10/1999 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 7/23/1999 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 8/3/1999 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 8/20/1999 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 9/2/1999 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 9/22/1999 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 9/28/1999 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 10/4/1999 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 4/27/2000 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 5/4/2000 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 5/7/2000 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 5/21/2000 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 5/31/2000 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 6/6/2000 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 6/12/2000 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 6/19/2000 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 6/30/2000 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 7/15/2000 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 7/22/2000 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 8/2/2000 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 8/6/2000 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 8/18/2000 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 9/4/2000 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 9/16/2000 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 9/28/2000 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 5/13/2001 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 5/19/2001 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 5/28/2001 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 6/2/2001 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 6/9/2001 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 6/19/2001 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 6/26/2001 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 7/2/2001 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 7/8/2001 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 7/16/2001 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 7/22/2001 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 8/1/2001 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 8/13/2001 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 8/19/2001 | ** | ** | 17.49 | ** | ** | 35.9 | 35.90 |
| MPCA CLMP | 8/25/2001 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 9/4/2001 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 9/9/2001 | ** | ** | 16.50 | ** | ** | 36.7 | 36.70 |
| MPCA CLMP | 9/17/2001 | ** | ** | 16.99 | ** | ** | 36.3 | 36.30 |
| MPCA CLMP | 9/25/2001 | ** | ** | 20.01 | ** | ** | 33.9 | 33.90 |
| MPCA CLMP | 10/1/2001 | ** | ** | 19.00 | ** | ** | 34.7 | 34.70 |
| MPCA CLMP | 10/9/2001 | ** | ** | 19.00 | ** | ** | 34.7 | 34.70 |
| MPCA CLMP | 10/15/2001 | ** | ** | 20.01 | ** | ** | 33.9 | 33.90 |
| MPCA CLMP | 5/5/2002 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 5/12/2002 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 5/20/2002 | ** | ** | 18.01 | ** | ** | 35.5 | 35.50 |
| MPCA CLMP | 5/27/2002 | ** | ** | 17.49 | ** | ** | 35.9 | 35.90 |
| MPCA CLMP | 6/3/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 6/11/2002 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 6/18/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 6/24/2002 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 7/1/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 7/8/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 7/15/2002 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 7/23/2002 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 7/30/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 8/5/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 8/13/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 8/20/2002 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 8/26/2002 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 9/3/2002 | ** | ** | 16.50 | ** | ** | 36.7 | 36.70 |
| MPCA CLMP | 9/10/2002 | ** | ** | 17.49 | ** | ** | 35.9 | 35.90 |
| MPCA CLMP | 9/15/2002 | ** | ** | 17.49 | ** | ** | 35.9 | 35.90 |
| MPCA CLMP | 9/24/2002 | ** | ** | 18.50 | ** | ** | 35.1 | 35.10 |
| MPCA CLMP | 9/30/2002 | ** | ** | 20.01 | ** | ** | 33.9 | 33.90 |
| MPCA CLMP | 10/6/2002 | ** | ** | 20.01 | ** | ** | 33.9 | 33.90 |
| MPCA CLMP | 10/12/2002 | ** | ** | 20.01 | ** | ** | 33.9 | 33.90 |
| MPCA CLMP | 4/29/2003 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 5/7/2003 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 5/12/2003 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 5/25/2003 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 6/1/2003 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 6/9/2003 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 6/15/2003 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 6/23/2003 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 7/1/2003 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 7/6/2003 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 7/13/2003 | ** | ** | 16.50 | ** | ** | 36.7 | 36.70 |
| MPCA CLMP | 7/19/2003 | ** | ** | 16.50 | ** | ** | 36.7 | 36.70 |
| MPCA CLMP | 7/28/2003 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 8/3/2003 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 8/9/2003 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 8/18/2003 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 8/24/2003 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 9/1/2003 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 9/7/2003 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 9/15/2003 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 9/23/2003 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 10/4/2003 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 10/17/2003 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 5/15/2004 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 5/28/2004 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 6/6/2004 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 6/12/2004 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 7/3/2004 | ** | ** | 15.49 | ** | ** | 37.6 | 37.60 |
| MPCA CLMP | 7/11/2004 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 7/17/2004 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 7/25/2004 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 7/31/2004 | ** | ** | 11.52 | ** | ** | 41.9 | 41.90 |
| MPCA CLMP | 8/8/2004 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 8/14/2004 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 8/22/2004 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 9/4/2004 | ** | ** | 14.50 | ** | ** | 38.6 | 38.60 |
| MPCA CLMP | 9/26/2004 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 10/9/2004 | ** | ** | 18.01 | ** | ** | 35.5 | 35.50 |
| MPCA CLMP | 5/23/2005 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 5/30/2005 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 6/19/2005 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 6/25/2005 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 7/3/2005 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 7/12/2005 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 7/24/2005 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 7/31/2005 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 8/7/2005 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 8/15/2005 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 8/22/2005 | ** | ** | 11.52 | ** | ** | 41.9 | 41.90 |
| MPCA CLMP | 9/7/2005 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 9/11/2005 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 9/21/2005 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 10/10/2005 | ** | ** | 18.01 | ** | ** | 35.5 | 35.50 |
| MPCA CLMP | 10/15/2005 | ** | ** | 18.01 | ** | ** | 35.5 | 35.50 |
| MPCA CLMP | 4/23/2006 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 5/2/2006 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 5/8/2006 | ** | ** | 11.52 | ** | ** | 41.9 | 41.90 |
| MPCA CLMP | 5/19/2006 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 5/28/2006 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 6/4/2006 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 6/11/2006 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 6/22/2006 | ** | ** | 12.50 | ** | ** | 40.7 | 40.70 |
| MPCA CLMP | 6/29/2006 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 7/5/2006 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 7/10/2006 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 7/15/2006 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 7/25/2006 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 7/29/2006 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 8/8/2006 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 8/20/2006 | ** | ** | 8.99 | ** | ** | 45.5 | 45.50 |
| MPCA CLMP | 8/26/2006 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 9/3/2006 | ** | ** | 8.99 | ** | ** | 45.5 | 45.50 |
| MPCA CLMP | 9/12/2006 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 9/17/2006 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 10/2/2006 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 10/17/2006 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 10/26/2006 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 5/10/2007 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 5/19/2007 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 5/21/2007 | 12 | 5 | 12.99 | 40 | 46.4 | 40.2 | 42.20 |
| MPCA CLMP | 5/27/2007 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 6/9/2007 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 6/18/2007 | 16 | 7 | 10.99 | 44.1 | 49.7 | 42.6 | 45.47 |
| MPCA CLMP | 6/25/2007 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |
| MPCA CLMP | 7/1/2007 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 7/9/2007 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 7/15/2007 | 15 | 4 | 14.50 | 43.2 | 44.2 | 38.6 | 42.00 |
| MPCA CLMP | 7/20/2007 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 7/30/2007 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 8/19/2007 | 23 | 9 | 12.99 | 49.4 | 52.2 | 40.2 | 47.27 |
| MPCA CLMP | 9/5/2007 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 9/16/2007 | 15 | 2 | 14.99 | 43.2 | 37.4 | 38.1 | 39.57 |
| MPCA CLMP | 10/4/2007 | ** | ** | 18.01 | ** | ** | 35.5 | 35.50 |
| MPCA CLMP | 10/12/2007 | ** | ** | 16.99 | ** | ** | 36.3 | 36.30 |
| MPCA CLMP | 5/18/2008 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 5/18/2008 | 9 | 5 | 14.01 | 35.8 | 46.4 | 39.1 | 40.43 |
| MPCA CLMP | 5/27/2008 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 6/15/2008 | 13 | 5 | 12.99 | 41.1 | 46.4 | 40.2 | 42.57 |
| MPCA CLMP | 6/18/2008 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 7/3/2008 | ** | ** | 10.99 | ** | ** | 42.6 | 42.60 |
| MPCA CLMP | 7/17/2008 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 7/20/2008 | 13 | 3 | 14.01 | 41.1 | 41.4 | 39.1 | 40.53 |
| MPCA CLMP | 8/17/2008 | 12 | 4 | 13.48 | 40 | 44.2 | 39.6 | 41.27 |
| MPCA CLMP | 8/24/2008 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 9/16/2008 | 11 | 4 | 16.99 | 38.7 | 44.2 | 36.3 | 39.73 |
| MPCA CLMP | 9/28/2008 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 5/17/2009 | 13 | 3 | 14.11 | 41.1 | 41.4 | 39 | 40.50 |
| MPCA CLMP | 5/24/2009 | ** | ** | 12.99 | ** | ** | 40.2 | 40.20 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 6/3/2009 | ** | ** | 10.01 | ** | ** | 43.9 | 43.90 |
| MPCA CLMP | 6/9/2009 | ** | ** | 11.52 | ** | ** | 41.9 | 41.90 |
| MPCA CLMP | 6/14/2009 | 12 | 1 | 16.01 | 40 | 30.6 | 37.2 | 35.93 |
| MPCA CLMP | 6/22/2009 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 7/5/2009 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 7/13/2009 | ** | ** | 14.99 | ** | ** | 38.1 | 38.10 |
| MPCA CLMP | 7/19/2009 | 13 | 3 | 12.99 | 41.1 | 41.4 | 40.2 | 40.90 |
| MPCA CLMP | 8/8/2009 | ** | ** | 12.01 | ** | ** | 41.3 | 41.30 |
| MPCA CLMP | 8/16/2009 | 14 | 4 | 12.47 | 42.2 | 44.2 | 40.8 | 42.40 |
| MPCA CLMP | 8/22/2009 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 8/30/2009 | ** | ** | 13.48 | ** | ** | 39.6 | 39.60 |
| MPCA CLMP | 9/6/2009 | ** | ** | 14.01 | ** | ** | 39.1 | 39.10 |
| MPCA CLMP | 9/15/2009 | ** | ** | 16.01 | ** | ** | 37.2 | 37.20 |
| MPCA CLMP | 9/20/2009 | 12 | 2 | 16.40 | 40 | 37.4 | 36.8 | 38.07 |
| MPCA CLMP | 10/5/2009 | ** | ** | 18.50 | ** | ** | 35.1 | 35.10 |
| MPCA CLMP | 4/18/2010 | ** | ** | 15.09 | ** | ** | 38 | 38.00 |
| MPCA CLMP | 5/16/2010 | ** | ** | 13.12 | ** | ** | 40 | 40.00 |
| MPCA CLMP | 5/23/2010 | 12 | 1 | 13.45 | 40 | 30.6 | 39.7 | 36.77 |
| MPCA CLMP | 6/2/2010 | ** | ** | 14.11 | ** | ** | 39 | 39.00 |
| MPCA CLMP | 6/20/2010 | 13 | 8 | 10.01 | 41.1 | 51 | 43.9 | 45.33 |
| MPCA CLMP | 7/18/2010 | 14 | 6 | 12.01 | 42.2 | 48.2 | 41.3 | 43.90 |
| MPCA CLMP | 8/6/2010 | ** | ** | 11.15 | ** | ** | 42.4 | 42.40 |
| MPCA CLMP | 8/16/2010 | 16 | 4 | 12.14 | 44.1 | 44.2 | 41.1 | 43.13 |
| MPCA CLMP | 8/20/2010 | ** | ** | 13.12 | ** | ** | 40 | 40.00 |
| MPCA CLMP | 9/19/2010 | 14 | 5 | 14.99 | 42.2 | 46.4 | 38.1 | 42.23 |
| MPCA CLMP | 9/26/2010 | ** | ** | 20.01 | ** | ** | 33.9 | 33.90 |
| MPCA CLMP | 5/22/2011 | 13 | 5 | 11.48 | 41.1 | 46.4 | 41.9 | 43.13 |
| MPCA CLMP | 6/19/2011 | 13 | 9 | 9.84 | 41.1 | 52.2 | 44.2 | 45.83 |
| MPCA CLMP | 7/17/2011 | 18 | 12 | 8.53 | 45.8 | 55 | 46.2 | 49.00 |
| MPCA CLMP | 8/14/2011 | 20 | 5 | 10.50 | 47.3 | 46.4 | 43.2 | 45.63 |
| MPCA CLMP | 9/19/2011 | 20 | 6 | 13.12 | 47.3 | 48.2 | 40 | 45.17 |
| MPCA CLMP | 6/16/2012 | 12 | 2 | 11.48 | 40 | 37.4 | 41.9 | 39.77 |
| MPCA CLMP | 7/15/2012 | 15 | 4 | ** | 43.2 | 44.2 | ** | 43.70 |
| MPCA CLMP | 8/18/2012 | ** | ** | 7.87 | ** | ** | 47.4 | 47.40 |
| MPCA CLMP | 8/19/2012 | 23 | 7 | 7.87 | 49.4 | 49.7 | 47.4 | 48.83 |
| MPCA CLMP | 9/15/2012 | ** | ** | 7.55 | ** | ** | 48 | 48.00 |
| MPCA CLMP | 9/16/2012 | 23 | 8 | 7.55 | 49.4 | 51 | 48 | 49.47 |
| MPCA CLMP | 6/15/2013 | 17 | 2 | 10.50 | 45 | 37.4 | 43.2 | 41.87 |
| MPCA CLMP | 7/22/2013 | ** | ** | 7.55 | ** | ** | 48 | 48.00 |

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| Sampled By | Date | TP (µg/L) | Chla (µg/L) | Secchi (ft) | TSI (P) | TSI (C) | TSI (S) | Average TSI |
|-------------------|-------------|----------------------|------------------------|------------------------|----------------|----------------|----------------|------------------------|
| MPCA CLMP | 7/23/2013 | 22 | 8 | 6.89 | 48.7 | 51 | 49.3 | 49.67 |
| MPCA CLMP | 8/18/2013 | 20 | 8 | 6.89 | 47.3 | 51 | 49.3 | 49.20 |
| MPCA CLMP | 9/15/2013 | 33 | 12 | 6.89 | 54.6 | 55 | 49.3 | 52.97 |
| MPCA CLMP | 5/18/2014 | 22 | 5 | 10.17 | 48.7 | 46.4 | 43.7 | 46.27 |
| MPCA CLMP | 7/19/2014 | 19 | 7 | 8.86 | 46.6 | 49.7 | 45.7 | 47.33 |
| MPCA CLMP | 8/17/2014 | 14 | 7 | 6.56 | 42.2 | 49.7 | 50 | 47.30 |
| MPCA CLMP | 9/14/2014 | 14 | 3 | 8.53 | 42.2 | 41.4 | 46.2 | 43.27 |
| Sarah - AWRL | 5/27/2015 | 12 | 5 | 12.5 | 40 | 46.4 | 40.7 | 42.37 |
| Sarah - AWRL | 6/22/2015 | 16 | 7 | 8 | 44.1 | 49.7 | 47.2 | 47.00 |
| Sarah - AWRL | 8/4/2015 | 19 | 7 | 8.5 | 46.6 | 49.7 | 46.3 | 47.53 |
| Sarah - AWRL | 9/22/2015 | 17 | 1 | 12 | 45 | 30.6 | 41.3 | 38.97 |

**No Data