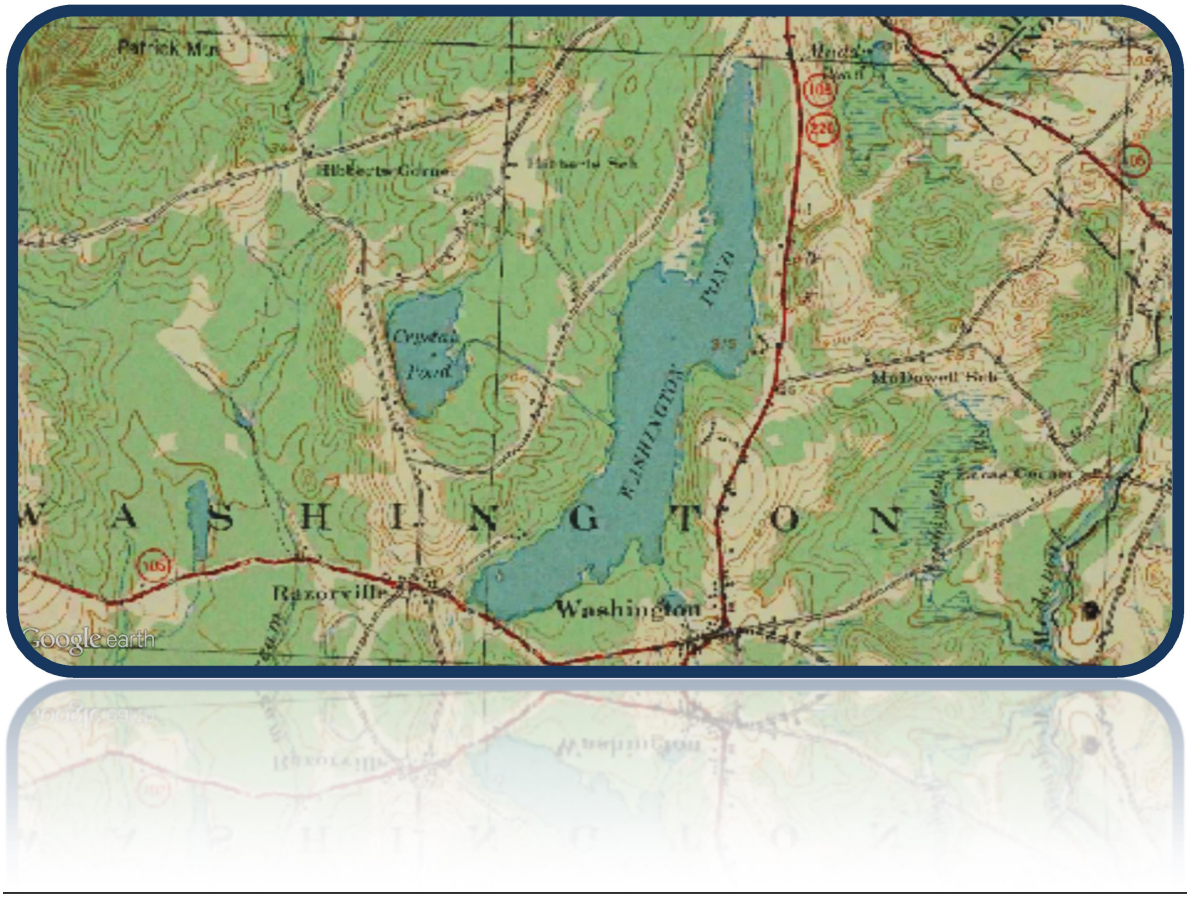

2016 Washington Lakes Water Quality Report

Prepared November 2016
by
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Special Thanks to Rob Stenger of WLWA and Garrison Beck of Midcoast Conservancy

Executive Summary

We continued for 2016 the increased sampling frequency started in 2015, with WLWA being responsible for Water Quality Measurement, rather than employing a professional on a once every three year basis. Our goal is to have a more consistent and complete monitor on water quality which will enable earlier recognition of both positive and negative influences on water quality. Unfortunately, manpower limited our detailed data gathering to primarily Washington Pond, with a single complete analysis of Crystal Lake in August.

2016 continues to create our baseline data set. Many past years have featured only a few data points, if any, especially on Crystal Lake, and so comparison and trend analysis over the entire open water season as a whole is difficult except on a grand scale.

In general, however, 2016 shows that both Washington Pond and Crystal Lake maintain above average water quality, with water quality indicators maintained at a constant level or possible improving in some parameters, although annual weather variations make long-term trend analysis difficult in this regard. Based on this limited data, phosphorus levels seem to be about average both water bodies. Chlorophyll is in line with historical averages. Both of these parameters help us monitor potential for algae bloom.

Dissolved oxygen depletion in the lower, colder regions of both water bodies was less significant in the later summer weeks until "turnover" in mid- to late-September. This oxygen depletion has been observed historically in both water bodies and is also somewhat normal for shallow lakes. However, oxygen levels below 5 ppm can also stress fish populations, according to Inland Fisheries and Wildlife biologist Scott Davis, who presented at the 2015 annual meeting of WLWA. The observed lack of any cold water regions containing oxygen levels above this threshold is a concern for the viability of cold water fish stocking programs on Washington Pond, but Davis has recorded population "holdover" from one year to the next on this lake in the past, and cold water species such as trout have also been caught in Crystal Pond. It is now believed that springs on the bottom of both lakes are providing "holdover havens" for cold water fish species during the end of the summer.

2016 was a particularly hot and dry summer. We originally thought that this combination might contribute to a higher potential for algae bloom, but now think that the negligible runoff reduces the addition of phosphorous and hence reduces algae production. Chlorophyll levels, especially in Washington Pond were lower than historical averages. Water clarity was almost constant over the summer based on monthly averages.

Both ponds were also inspected by a trained plant identification volunteer in and around the public access points. No evidence of invasive aquatic plants was noted in the species found present.

This statement taken from Scott Williams' 2012 Water Quality report is worth repeating:

> *The most effective way to insure that all indicators of water quality remain stable or even improve over time – is through watershed stewardship. This includes raising awareness among landowners about ways in which the effects of development on water quality can*

be minimized, and developing a community plan to protect and manage the watershed. Citizen watershed surveys can be very effective in raising community awareness and identifying and resolving land use problems. The Maine Volunteer Lake Monitoring Program offers workshops for groups interested in conducting watershed surveys. The LakeSmart program offered by Maine Congress of Lakes [and WLWA] is also an excellent way to effect positive change in lake watersheds.

Sampling Methodology

During the 2016 summer season, Washington Lakes Watershed Association (WLWA) volunteers took water clarity readings at least every two weeks on Washington Pond Regular surface grabs for phosphorus levels on Washington Pond which were collected over the past two years were discontinued because it was felt that their cost exceeded their benefit, since we do a detailed annual water column measurement.

2016 WLWA transferred their collaborative equipment loan arrangement from the Damariscotta Lake Watershed Association (DLWA) to the Midcoast Conservancy (which merged with DWLA last winter) in an effort to engage in regular dissolved oxygen monitoring of both Washington Pond and Crystal Lake. In August, WLWA continued with the Midcoast Conservancy comprehensive testing of regular and historical baseline water quality parameters.

All water quality monitoring and sampling was completed by certified volunteer lake monitors and was completed in accordance with standard procedures for the monitoring of Maine lakes and ponds established by the Maine Department of Environmental Protection and the Maine Volunteer Lake Monitoring Program. We owe a great debt of gratitude to MVLMP for their support and training for certified monitors. The 2016 sampling was done in a manner consistent with the historical sampling of these bodies of water, and the results are comparable.

2016 Weather Influences

Weather conditions can strongly influence indicators of water quality. Taking readings several times each year as opposed to the previous regime of once every three years, helps to average out the effects of individual phenomena. However, 2016 temperatures were uniformly much higher than normal (Exhibit 1) with rainfall levels running over 10 inches below normal for the prior 12 month period ending September (see Exhibit 2). We originally thought that this combination might contribute to a higher potential for algae bloom, but now think that the reduced runoff slows the addition of phosphorous and other nutrients to the lakes thus reducing algae production.

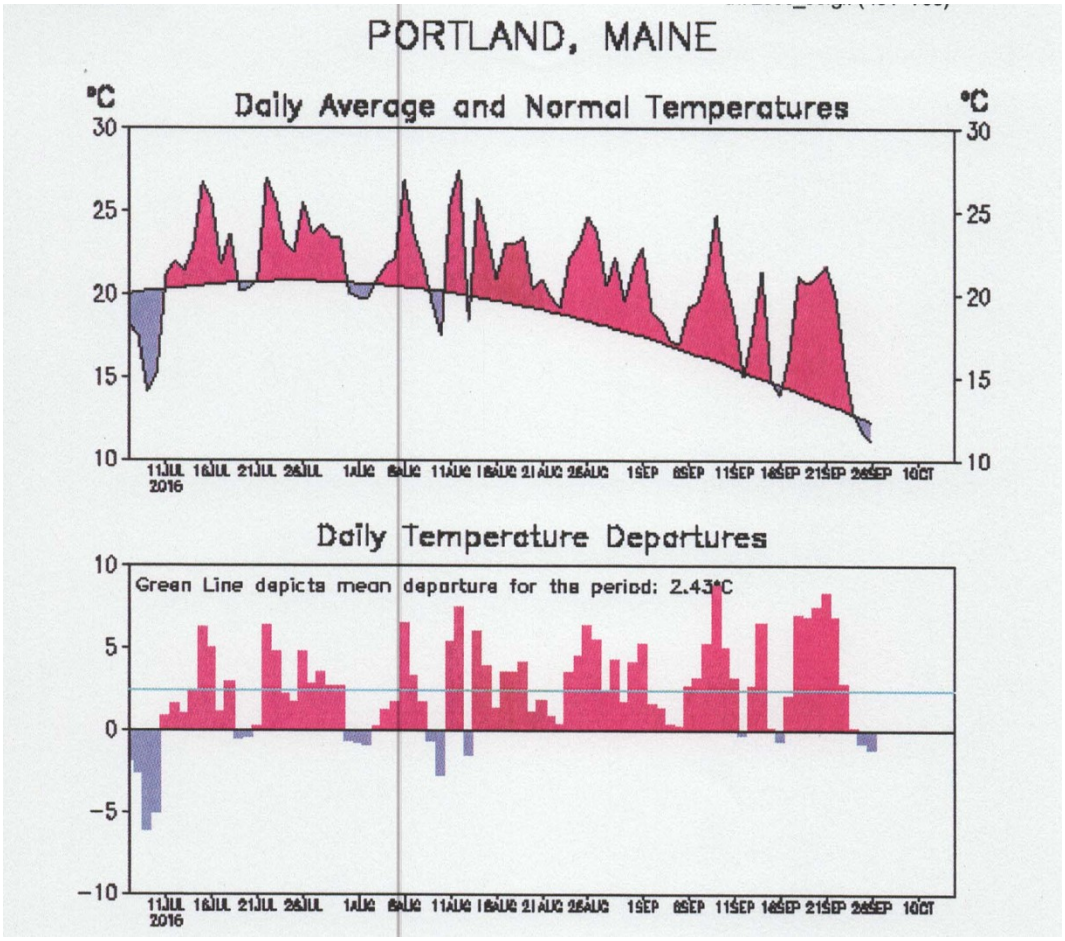

Exhibit 1

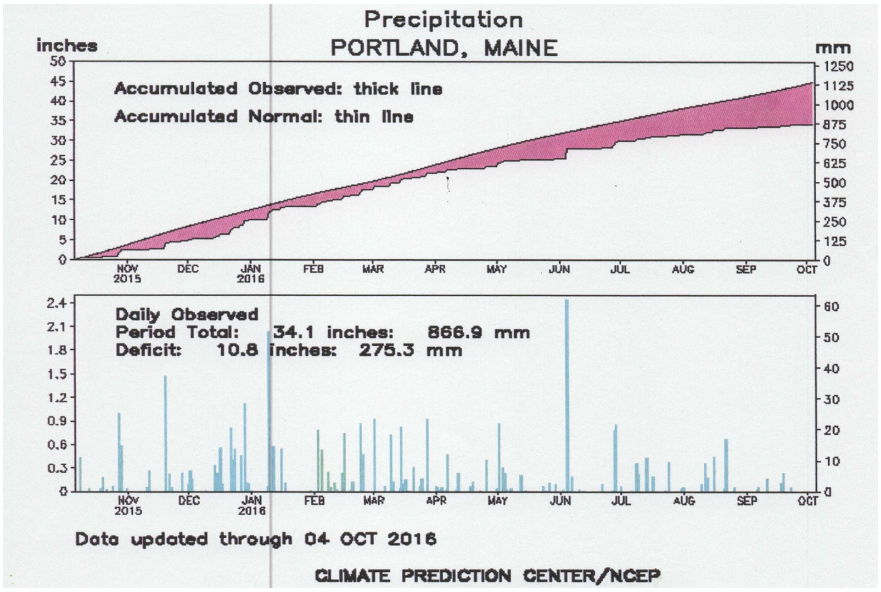

Exhibit 2

Washington Pond

Water Clarity

Water clarity readings are made using a Secchi disk and monitoring scope to determine the depth at which the disk can still be seen. The higher the number (deeper sight depth) the clearer the water. Readings were taken multiple times per month during the 2016 season and for several prior years on Washington Pond. The following graph (exhibit 3) indicates monthly averages for the past five years. 2015 (light blue) had an unusually higher set of readings and 2016 (red) returned to historical averages. Water clarity is an important measure of lake quality, and this measurement keeps our lakes in the upper percentiles of Maine lakes.

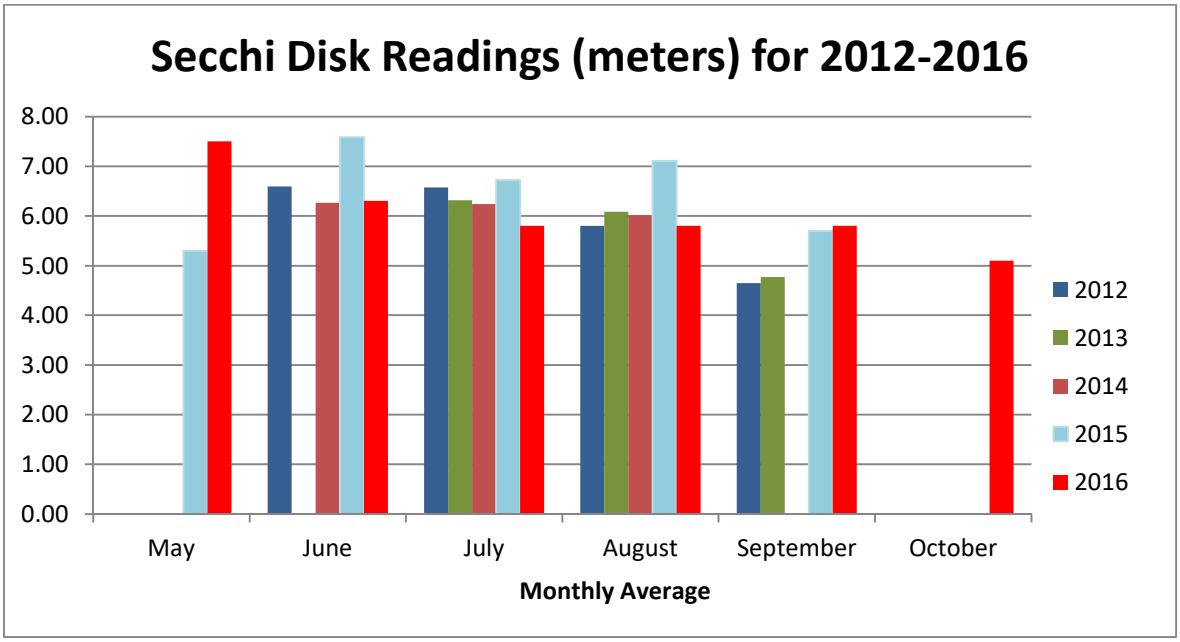

Exhibit 3

Phosphorus

A phosphorus sample taken from a 8-meter core grab measured 6 parts per billion (ppb), matching historical average of 6 ppb in core grabs 5 meters and above. As phosphorus is the nutrient that most directly influences the growth of algae in lakes and ponds and phosphorus concentrations in the 12-15 ppb range have been associated with algal blooms in some Maine lakes, these lower sample concentrations are a good trend. A bottom sample was not taken this year. In retrospect we believe that in succeeding years we should do both specific depth phosphorus measurements as well as a bottom sample if the equipment can be available to us.

Chlorophyll

Samples from a 8 meter core sample in August showed Chlorophyll at 2.4 ug/l, lower than last year but well within historical range of 1.8 to 5 putting it as average. Chlorophyll-a (CHL) is the pigment measured in lake water that is used to determine the concentration of algae in the water. The 2016 sample is low, suggesting little algal growth this season. Clorophyll is a good predictor of potential for algal bloom, so having it lower than historical average confirms the

slightly improved quality, probably most influenced by the low rainfall amounts, reducing the available nutrients.

Dissolved Oxygen

We have the advantage that dissolved oxygen profiles were taken in 2012 on Washington Pond as well as those taken four times (our new test regimen) each the summer of 2015 and 2016 by the WLWA water quality team. The following graph (exhibit 4) shows ***improving*** (lines to the right indicate more oxygen at greater depths) dissolved oxygen for 2015 (green family lines) and 2016 (red family lines)when compared with the 2012 data (blue family lines).

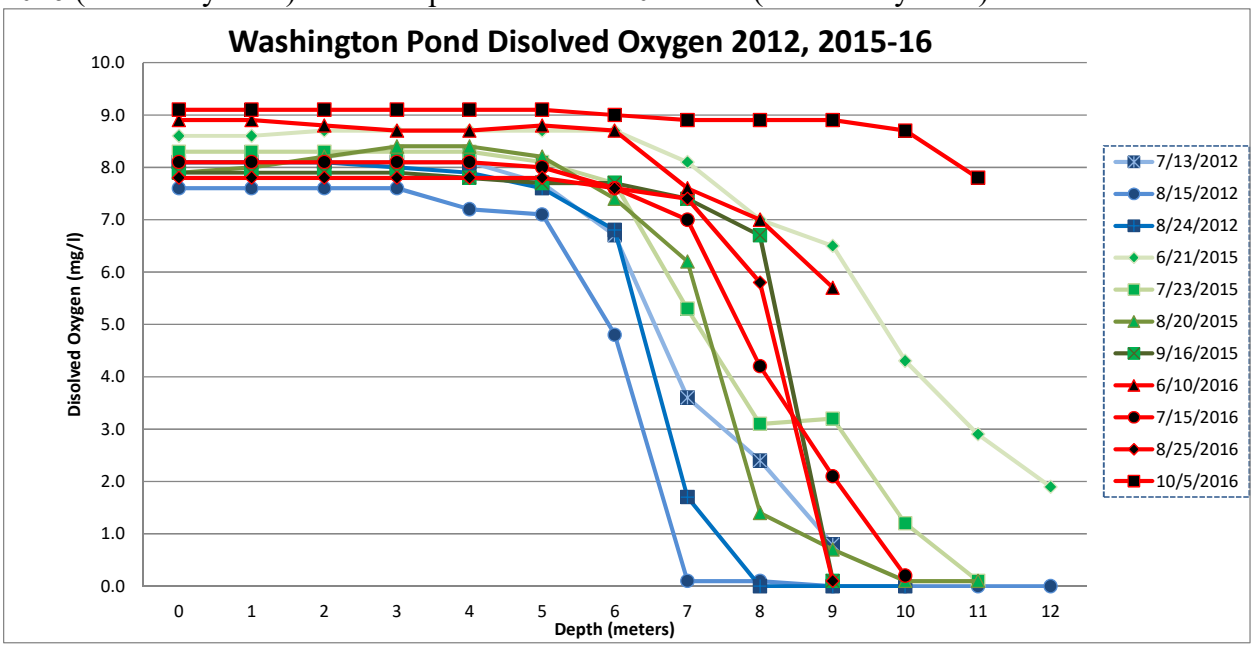

Exhibit 4

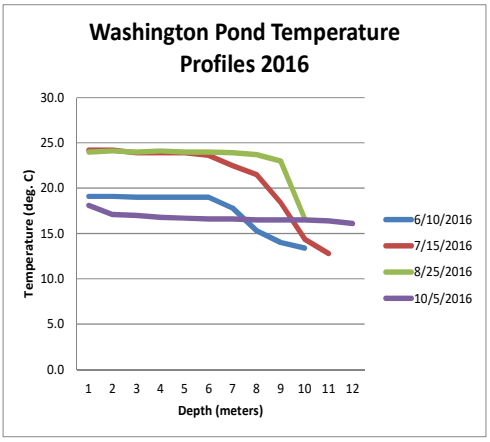

Exhibit 5

Higher DO concentrations is good news. The oxygen levels throughout the lake were high in early and late summer, while the oxygen depletion became more significant in the latter part of the summer in waters with temperature of 17 degrees Celsius or lower, the region desired by cold water fish such as trout. Exhibit 5 shows the temperature profiles that we saw for the four DO readings in 2016.

This means that these fish are stressed in the latter part of the summer. In general we are pleased with the profiles taken, as they show somewhat higher oxygen levels than in 2012. It will be instructive to take a full set of profiles each future summer, as we plan to do.

It is clear that the springs which feed Washington Pond are a significant water source for the lake. Although water levels were lower than usual, the springs help counteract the normal

evaporation when there is no rainfall. They also, no doubt, supply cool water for the spots where cold water fish can congregate at levels that still have adequate oxygen.

It is also important to note that readings in June and again in early October showed good oxygenation levels, better than seen in previous years. More data over future years is needed to see if all of this results in a long term positive trend.

Alkalinity was 5.0, same as historical average. The pH of the sample was 6.4, unchanged from 2015 and slightly lower than historical average.

Color was also unchanged at 7, slightly lower than historical average.

Trophic State Index

Trophic State calculations (TSI) using collected data indicates a TSI based upon Secchi data at 34, based on Chlorophyll at 39 and based on phosphorus at 30. This places Washington Pond in an Oligotrophic State with an anoxic hyperlimnia due to bottom oxygen depletion. We would like to keep the TSI under 40. Above 40 would push our classification into Mesotrophic. Oligotrophic lakes are clearest and often suitable for unfiltered water supply.

Algae sighted

Gloeotricchia echinulata, a planktonic blue-green algae that has been on the increase in Maine lakes in recent years was sighted in Washington Pond for only about two weeks in late August. This is the first time it has been recorded in Washington Pond. It is not considered (yet) as a significant indicator of problems.

Crystal Lake

Water Clarity

Water clarity readings using a Secchi disk and monitoring scope were taken only once during our comprehensive test in August at 6.40 meters, almost the equal of last year's, but lower than the average in 2012, the last year when readings were taken. However, in 2012 only one reading was taken, and so not a necessarily valid indicator of average conditions. The historical average since 1997, when readings were first taken, is 5.65 meters. Thus water clarity readings were above average in 2016, although substantially less historical data are available for this body of water, compared to Washington Pond.

Phosphorus

A phosphorus sample taken from a 5-meter core grab measured 5 parts per billion (ppb), compared to a historical average of 9 ppb in core samples 5 meters and above. No bottom sample was taken this year. However, both this year's core sample and the last one in 2012 were lower than average. As phosphorus is the nutrient that most directly influences the growth of algae in lakes and ponds and phosphorus concentrations in the 12-15 ppb range have been

associated with algal blooms in some Maine lakes, these lower sample concentrations are a good trend.

Chlorophyll

The core sample indicated 4.4 ppb, higher than last year at 2.3 ppb. This may be a negative indicator, and we must carefully monitor this next year as this is the highest reading obtained on Crystal Lake, the previous high being 4.2 in 1999. Historical readings average 3.4 ppb.

Dissolved Oxygen

The August reading of Dissolved Oxygen was identical to the very closely nested readings of 2015, (Exhibit 6) and consistent with similar shallow lakes and with historical late summer profiles taken in past years, Crystal Pond shows severe oxygen depletion in the deepest area of the pond, from 5 meters down, shown in the graph below. However this may be mitigated (at least for fish) by springs as noted in the above commentary.

Other parameters of water color, total alkalinity, and pH were within historical ranges on August 25, 2016

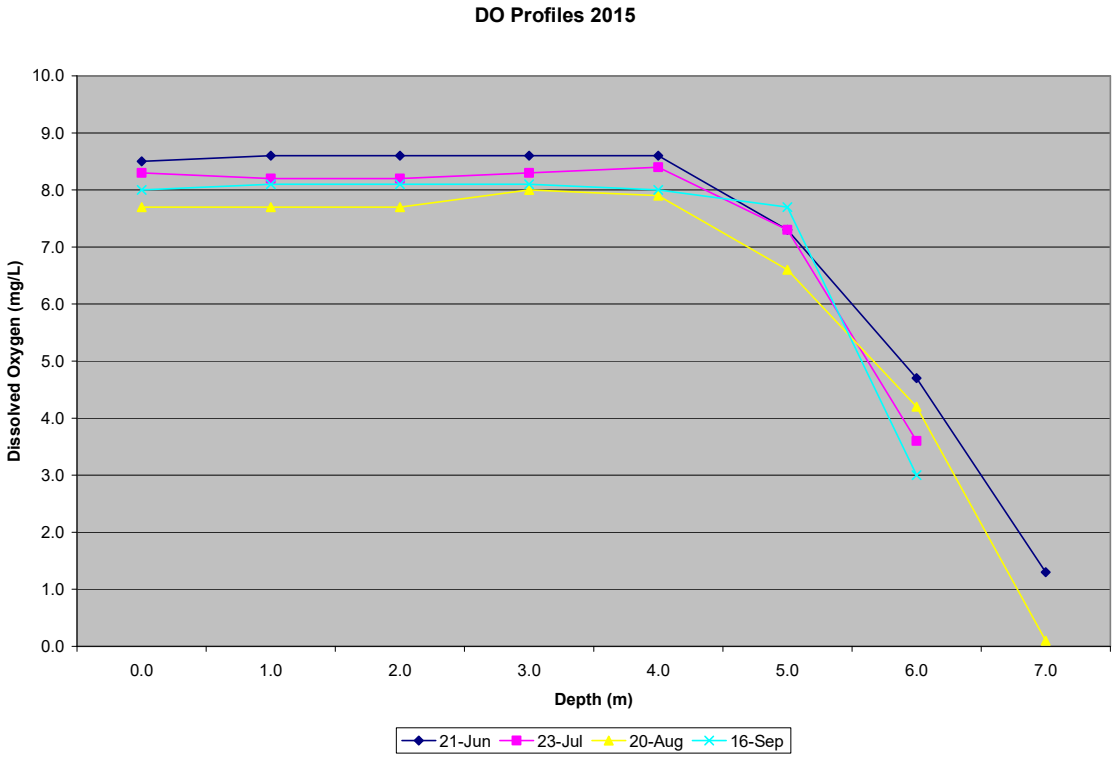

Exhibit 6