



CITY OF YELLOWKNIFE

May 6, 2016

Mackenzie Valley Land and Water Board
Box 2130, 7th Floor - 4910 50th Avenue
Yellowknife, NT X1A 2P6

Attention: Miki Ehrlich, Regulatory Officer

**RE: Water License No. MV2009L3-0007
Request to modify the Fiddler's Lake Treatment System sampling program**

Dear Ms. Ehrlich,

The City of Yellowknife is requesting a change to its current Surveillance Network Program by eliminating the BOD testing requirement at the 0032-F1 and 0032-F3 sampling points. Data to support this request was presented in Appendix E – “BOD₅ – CBOD₅ Study” of the Fiddler's Lake Treatment System Plan, submitted to the MVLWB on September 23, 2014 (and attached to this submission). In the October 27, 2015 meeting that was held to discuss that report, the MVLWB requested that the City submit three full years of data to back up the submission as only one year of data had been included originally.

To support this request, we have tabulated three years of BOD and CBOD data and have plotted both values on graphs for each location. The tables and graphs are attached for your review. The graphs clearly show a correlation between the two sample results, and we are confident that moving forward CBOD testing will provide sufficient data to ensure effluent from the treatment system is within our water license discharge limits. This data is being submitted to fulfill Condition D, Part 21 of MV2009L3-0007.

We look forward to your response, if you have any questions or concerns regarding this information, please contact me at 920-5697 or by email at rmakohoniuk@yellowknife.ca.

Sincerely,

Reuben Makohoniuk
Municipal Works Engineer, Public Works and Engineering

Attachments: Appendix E – “BOD₅ – CBOD₅ Study” of the Fiddler's Lake Treatment System Plan

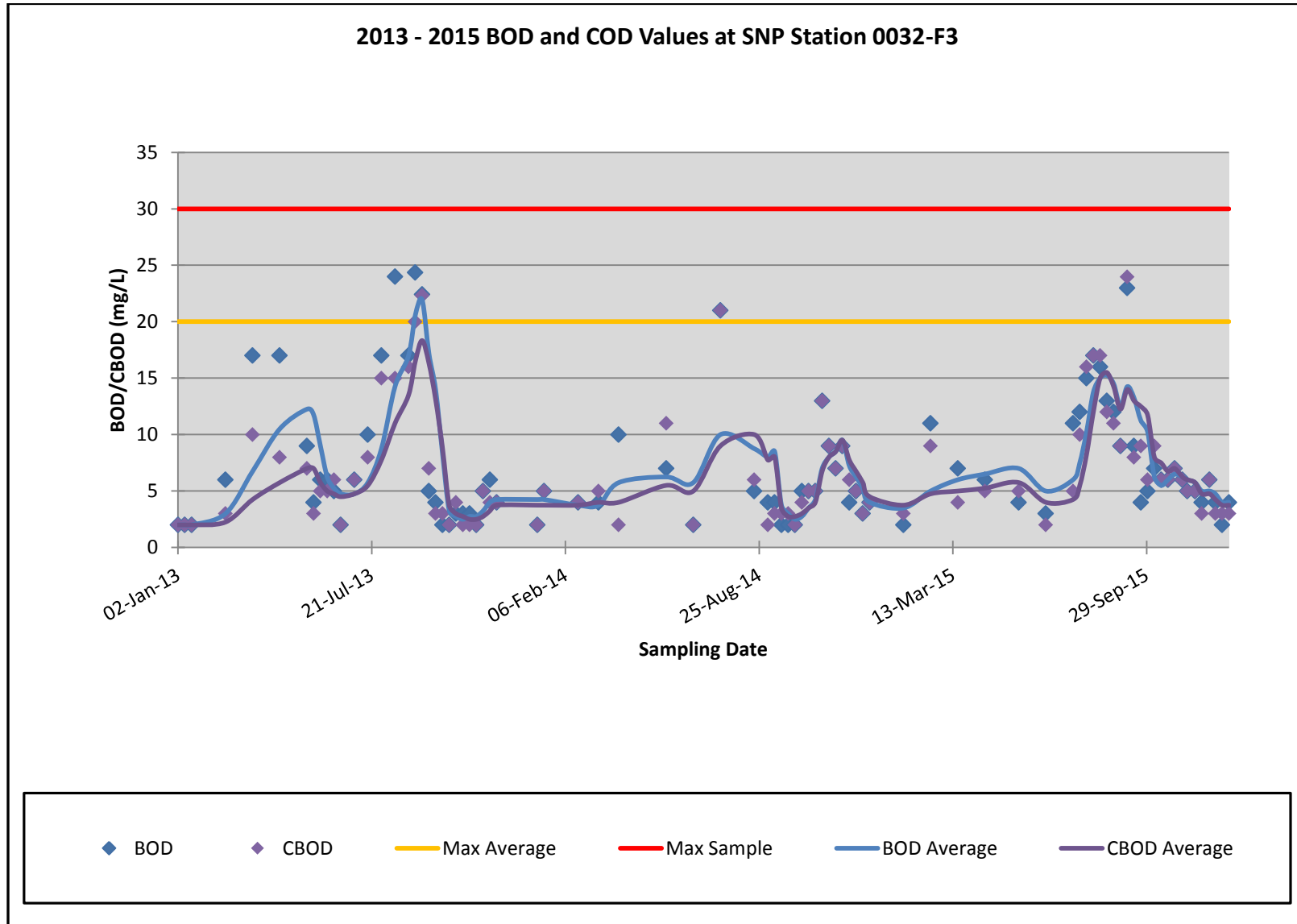


Figure 1: 2013 - 2015 BOD and COD Values at SNP Station 0032-F3



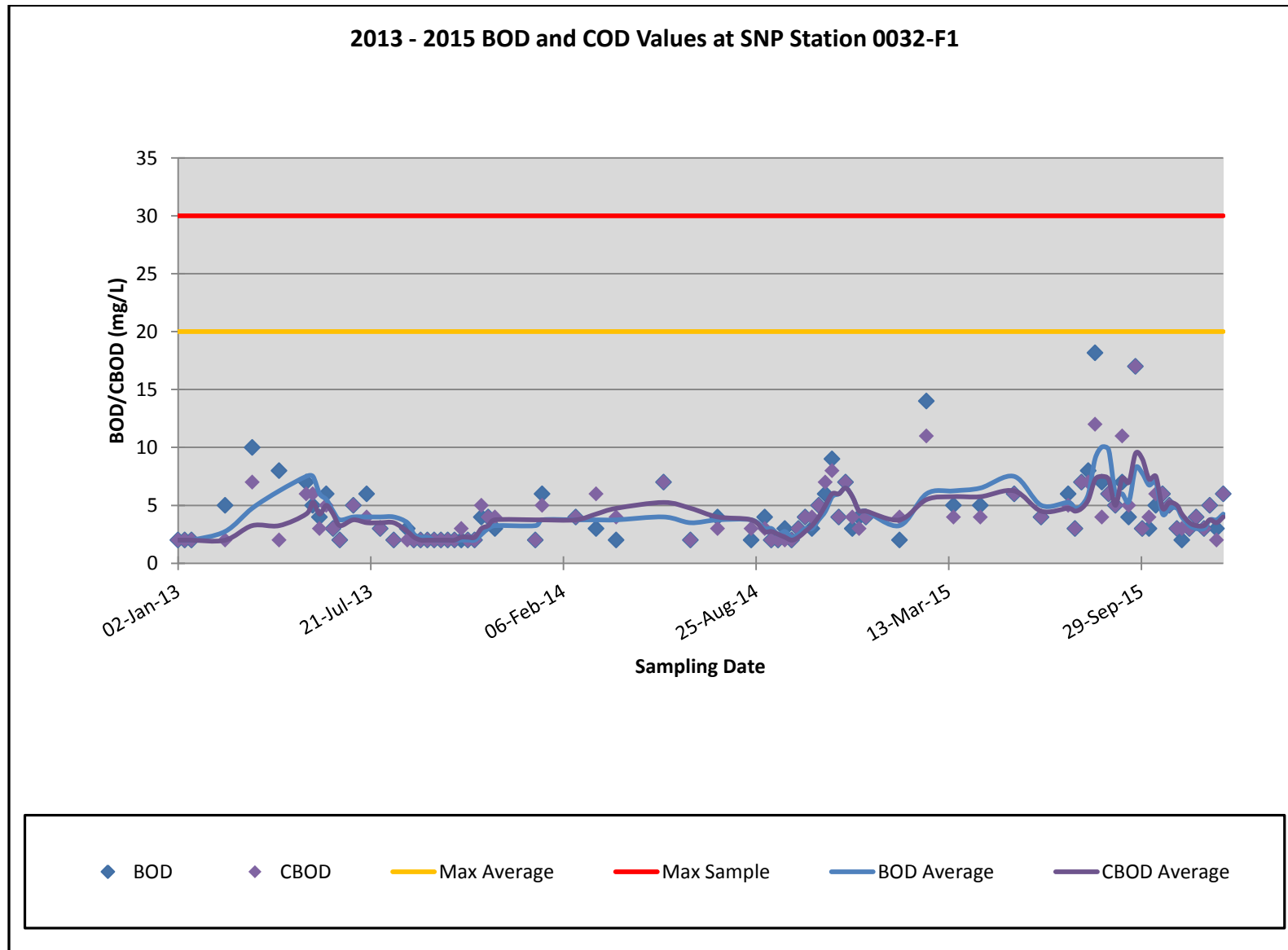


Figure 2: 2013 - 2015 BOD and COD Values at SNP Station 0032-F1



| | | | | | | | | | | | | | | | | | |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0032-F3 | 02-Jan-13 | 09-Jan-13 | 16-Jan-13 | 20-Feb-13 | 20-Mar-13 | 17-Apr-13 | 15-May-13 | 22-May-13 | 29-May-13 | 05-Jun-13 | 12-Jun-13 | 19-Jun-13 | 03-Jul-13 | 17-Jul-13 | 31-Jul-13 | 14-Aug-13 | 28-Aug-13 |
| BOD | <2 | <2 | <2 | 6 | 17 | 17 | 9 | 4 | 6 | 6 | 5 | <2 | 6 | 10 | 17 | 24 | 17 |
| BOD Average | 2 | 2 | 2 | 3 | 6.75 | 10.5 | 12.25 | 11.75 | 9 | 6.25 | 5.25 | 4.75 | 4.75 | 5.75 | 8.75 | 14.25 | 17 |
| CBOD | <2 | <2 | 2 | 3 | 10 | 8 | 7 | 3 | 5 | 5 | 6 | <2 | 6 | 8 | 15 | 15 | 16 |
| CBOD Average | 2 | 2 | 2 | 2.25 | 4.25 | 5.75 | 7 | 7 | 5.75 | 5 | 4.75 | 4.5 | 4.75 | 5.5 | 7.75 | 11 | 13.5 |
| 0032-F3 | 04-Sep-13 | 11-Sep-13 | 18-Sep-13 | 25-Sep-13 | 02-Oct-13 | 09-Oct-13 | 16-Oct-13 | 23-Oct-13 | 30-Oct-13 | 06-Nov-13 | 13-Nov-13 | 20-Nov-13 | 27-Nov-13 | 08-Jan-14 | 15-Jan-14 | 19-Feb-14 | 12-Mar-14 |
| BOD | >24.36 | >22.41 | 5 | 4 | <2 | <2 | 3 | 3 | 3 | <2 | 5 | 6 | 4 | <2 | 5 | 4 | 4 |
| BOD Average | 20.59 | 21.9 | 17.2 | 13.9 | 8.4 | 3.25 | 2.75 | 2.5 | 2.75 | 2.75 | 3.25 | 4 | 4.25 | 4.25 | 4.25 | 3.75 | 3.75 |
| CBOD | 20 | >22.32 | 7 | 3 | 3 | <2 | 4 | <2 | 2 | <2 | 5 | 4 | 4 | 2 | 5 | 4 | 5 |
| CBOD Average | 16.5 | 18.33 | 16.33 | 13.08 | 8.83 | 3.75 | 3 | 2.75 | 2.5 | 2.5 | 2.75 | 3.25 | 3.75 | 3.75 | 3.75 | 3.75 | 4 |
| 0032-F3 | 02-Apr-14 | 21-May-14 | 18-Jun-14 | 16-Jul-14 | 20-Aug-14 | 03-Sep-14 | 10-Sep-14 | 17-Sep-14 | 24-Sep-14 | 01-Oct-14 | 08-Oct-14 | 15-Oct-14 | 22-Oct-14 | 29-Oct-14 | 05-Nov-14 | 12-Nov-14 | 19-Nov-14 |
| BOD | 10 | 7 | 2 | 21 | 5 | 4 | 4 | 2 | <2 | <2 | 5 | 5 | 5 | 13 | 9 | 7 | 9 |
| BOD Average | 5.75 | 6.25 | 5.75 | 10 | 8.75 | 8 | 8.5 | 3.75 | 3 | 2.5 | 2.75 | 3.5 | 4.25 | 7 | 8 | 8.5 | 9.5 |
| CBOD | 2 | 11 | 2 | 21 | 6 | 2 | 3 | 3 | 3 | 2 | 4 | 5 | 5 | 13 | 9 | 7 | 9 |
| CBOD Average | 4 | 5.5 | 5 | 9 | 10 | 7.75 | 8 | 3.5 | 2.75 | 2.75 | 3 | 3.5 | 4 | 6.75 | 8 | 8.5 | 9.5 |
| 0032-F3 | 26-Nov-14 | 03-Dec-14 | 10-Dec-14 | 17-Dec-14 | 21-Jan-15 | 18-Feb-15 | 18-Mar-15 | 15-Apr-15 | 20-May-15 | 17-Jun-15 | 15-Jul-15 | 22-Jul-15 | 29-Jul-15 | 05-Aug-15 | 12-Aug-15 | 19-Aug-15 | 26-Aug-15 |
| BOD | 4 | 5 | 3 | 4 | 2 | 11 | 7 | 6 | 4 | 3 | 11 | 12 | 15 | 17 | 16 | 13 | 12 |
| BOD Average | 7.25 | 6.25 | 5.25 | 4 | 3.5 | 5 | 6 | 6.5 | 7 | 5 | 6 | 7.5 | 10.25 | 13.75 | 15 | 15.25 | 14.5 |
| CBOD | 6 | 5 | 3 | 4 | 3 | 9 | 4 | 5 | 5 | 2 | 5 | 10 | 16 | 17 | 17 | 12 | 11 |
| CBOD Average | 7.75 | 6.75 | 5.75 | 4.5 | 3.75 | 4.75 | 5 | 5.25 | 5.75 | 4 | 4.25 | 5.5 | 8.25 | 12 | 15 | 15.5 | 14.25 |
| 0032-F3 | 02-Sep-15 | 09-Sep-15 | 16-Sep-15 | 23-Sep-15 | 30-Sep-15 | 07-Oct-15 | 14-Oct-15 | 21-Oct-15 | 28-Oct-15 | 05-Nov-15 | 10-Nov-15 | 18-Nov-15 | 25-Nov-15 | 03-Dec-15 | 09-Dec-15 | 16-Dec-15 | 23-Dec-15 |
| BOD | 9 | 23 | 9 | 4 | 5 | 7 | 6 | 6 | 7 | 6 | 5 | 5 | 4 | 6 | 4 | 2 | 4 |
| BOD Average | 12.5 | 14.25 | 13.25 | 11.25 | 10.25 | 6.25 | 5.5 | 6 | 6.5 | 6.25 | 6 | 5.75 | 5 | 5 | 4.75 | 4 | 4 |
| CBOD | 9 | >23.97 | 8 | 9 | 6 | 9 | 6 | 6 | 7 | 6 | 5 | 5 | 3 | 6 | 3 | 3 | 3 |
| CBOD Average | 12.25 | 14 | 13 | 12.5 | 11.74 | 8 | 7.5 | 6.75 | 7 | 6.25 | 6 | 5.75 | 4.75 | 4.75 | 4.25 | 3.75 | 3.75 |

Table 1: 0032-F3 BOD and CBOD averages and values 2013 - 2015



| | | | | | | | | | | | | | | | | | |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0032-F1 | 02-Jan-13 | 09-Jan-13 | 16-Jan-13 | 20-Feb-13 | 20-Mar-13 | 17-Apr-13 | 15-May-13 | 22-May-13 | 29-May-13 | 05-Jun-13 | 12-Jun-13 | 19-Jun-13 | 03-Jul-13 | 17-Jul-13 | 31-Jul-13 | 14-Aug-13 | 28-Aug-13 |
| BOD | <2 | <2 | <2 | 5 | 10 | 8 | 7 | 5 | 4 | 6 | 3 | 2 | 5 | 6 | 3 | <2 | 3 |
| BOD Average | 2 | 2 | 2 | 2.75 | 4.75 | 6.25 | 7.5 | 7.5 | 6 | 5.5 | 4.5 | 3.75 | 4 | 4 | 4 | 4 | 3.5 |
| CBOD | <2 | <2 | <2 | 2 | 7 | 2 | 6 | 6 | 3 | 5 | 3 | 2 | 5 | 4 | 3 | <2 | <2 |
| CBOD Average | 2 | 2 | 2 | 2 | 3.25 | 3.25 | 4.25 | 5.25 | 4.25 | 5 | 4.25 | 3.25 | 3.75 | 3.5 | 3.5 | 3.5 | 2.75 |
| 0032-F1 | 04-Sep-13 | 11-Sep-13 | 18-Sep-13 | 25-Sep-13 | 02-Oct-13 | 09-Oct-13 | 16-Oct-13 | 23-Oct-13 | 30-Oct-13 | 06-Nov-13 | 13-Nov-13 | 20-Nov-13 | 27-Nov-13 | 08-Jan-14 | 15-Jan-14 | 19-Feb-14 | 12-Mar-14 |
| BOD | <2 | <2 | <2 | <2 | <2 | <2 | 2 | <2 | 2 | <2 | 4 | 4 | 3 | <2 | 6 | 4 | 3 |
| BOD Average | 2.5 | 2.25 | 2.25 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2.5 | 3 | 3.25 | 3.25 | 3.75 | 3.75 | 3.75 |
| CBOD | 2 | <2 | <2 | <2 | 2 | <2 | <2 | 3 | 2 | <2 | 5 | 4 | 4 | <2 | 5 | 4 | 6 |
| CBOD Average | 2.25 | 2 | 2 | 2 | 2 | 2 | 2 | 2.25 | 2.25 | 2.25 | 3 | 3.25 | 3.75 | 3.75 | 3.75 | 3.75 | 4.25 |
| 0032-F1 | 02-Apr-14 | 21-May-14 | 18-Jun-14 | 16-Jul-14 | 20-Aug-14 | 03-Sep-14 | 10-Sep-14 | 17-Sep-14 | 24-Sep-14 | 01-Oct-14 | 08-Oct-14 | 15-Oct-14 | 22-Oct-14 | 29-Oct-14 | 05-Nov-14 | 12-Nov-14 | 19-Nov-14 |
| BOD | <2 | 7 | <2 | 4 | <2 | 4 | 2 | 2 | 3 | 2 | 3 | 4 | 3 | 5 | 6 | 9 | 4 |
| BOD Average | 3.75 | 4 | 3.5 | 3.75 | 3.75 | 3 | 3 | 2.5 | 2.75 | 2.25 | 2.5 | 3 | 3 | 3.75 | 4.5 | 5.75 | 6 |
| CBOD | 4 | 7 | 2 | 3 | 3 | 3 | <2 | 2 | <2 | 2 | 3 | 4 | 4 | 5 | 7 | 8 | 4 |
| CBOD Average | 4.75 | 5.25 | 4.75 | 4 | 3.75 | 2.75 | 2.75 | 2.5 | 2.25 | 2 | 2.25 | 2.75 | 3.25 | 4 | 5 | 6 | 6 |
| 0032-F1 | 26-Nov-14 | 03-Dec-14 | 10-Dec-14 | 17-Dec-14 | 21-Jan-15 | 18-Feb-15 | 18-Mar-15 | 15-Apr-15 | 20-May-15 | 17-Jun-15 | 15-Jul-15 | 22-Jul-15 | 29-Jul-15 | 05-Aug-15 | 12-Aug-15 | 19-Aug-15 | 26-Aug-15 |
| BOD | 7 | 3 | 4 | 4 | 2 | 14 | 5 | 5 | 6 | 4 | 6 | 3 | 7 | 8 | >18.18 | 7 | 6 |
| BOD Average | 6.5 | 5.75 | 4.5 | 4.5 | 3.25 | 6 | 6.25 | 6.5 | 7.5 | 5 | 5.25 | 4.75 | 5 | 6 | 9.05 | 10.04 | 9.8 |
| CBOD | 7 | 4 | 3 | 4 | 4 | 11 | 4 | 4 | 6 | 4 | 5 | 3 | 7 | 7 | 12 | 4 | 6 |
| CBOD Average | 6.5 | 5.75 | 4.5 | 4.5 | 3.75 | 5.5 | 5.75 | 5.75 | 6.25 | 4.5 | 4.75 | 4.5 | 4.75 | 5.5 | 7.25 | 7.5 | 7.25 |
| 0032-F1 | 02-Sep-15 | 09-Sep-15 | 16-Sep-15 | 23-Sep-15 | 30-Sep-15 | 07-Oct-15 | 14-Oct-15 | 21-Oct-15 | 28-Oct-15 | 05-Nov-15 | 10-Nov-15 | 18-Nov-15 | 25-Nov-15 | 03-Dec-15 | 09-Dec-15 | 16-Dec-15 | 23-Dec-15 |
| BOD | 5 | 7 | 4 | 17 | 3 | 3 | 5 | 6 | 5 | 3 | 2 | 3 | 4 | 3 | 5 | 3 | 6 |
| BOD Average | 6.25 | 6.25 | 5.75 | 8.25 | 7.75 | 6.75 | 7 | 4.25 | 4.75 | 4.75 | 4 | 3.25 | 3 | 3 | 3.75 | 3.75 | 4.25 |
| CBOD | 5 | 11 | 5 | 17 | 3 | 4 | 6 | 6 | 5 | 3 | 3 | 3 | 4 | 3 | 5 | <2 | 6 |
| CBOD Average | 4.75 | 6.5 | 6.25 | 9.5 | 9 | 7.25 | 7.5 | 4.75 | 5.25 | 5 | 4.25 | 3.5 | 3.25 | 3.25 | 3.75 | 3.5 | 4 |

Table 2: 0032-F1 BOD and CBOD averages and values 2013 - 2015



APPENDIX E

BOD₅ – CBOD₅ STUDY



MEMO

TO: City of Yellowknife
cc:
FROM:
DATE: July 14, 2014
SUBJECT: Fiddler's Lake Treatment System
BOD₅/CBOD₅
OUR FILE: 14-4367-5000

This memo summarizes the results of a three-year study on the characterization of wastewater effluent quality, specifically for carbonaceous biological oxygen demand (CBOD). The summary is in response to item D.21 in the City water licence, as follows:

D. 21 The Licensee shall complete monitoring of wastewater effluent quality for carbonaceous biological oxygen demand (CBOD) and biological oxygen demand (BOD) for a minimum of three years. The study findings, including a trend analysis, shall be submitted to the Board for approval August 31, 2014.

Currently, the Fiddler's Lake Treatment System is meeting all guideline limits and National Performance Standards (NPSs) for all parameters of concern including biological oxygen demand (CBOD₅) (with the exception of total phosphorus), as stated in the water licence and the CCME Canada-Wide Strategy for the Management MWWE, respectively.

The water licence maximum average and maximum grab sample effluent quality requirements are outlined in Table 1, with values for BOD₅ highlighted in bold, and the CCME National Performance Standards are shown in Table 2.

Table 1: Water Licence Effluent Quality Requirements

| Parameter (units) | Maximum Average Concentration ^(a) | Maximum Grab Sample |
|--|---|---------------------|
| Fecal Coliform (FC per 100 ml) | 200 | 400 |
| 5-day Biochemical Oxygen Demand, BOD₅ (mg/L) | 20 | 30 |
| Total Suspended Solids, TSS (mg/L) | 20 | 40 |
| Total Ammonia as Nitrogen, NH ₃ -N (mg/L) | 5 | 10 |
| Total Phosphorus, TP (mg/L) | 1.0 | 2.0 |
| pH (pH units) | 6 to 9 | 6 to 9 |
| Oil and Grease | No visible sheen | |
| Acute Toxicity | Static pass/fail bioassay test for Rainbow Trout and Daphnia Magna whereby 70% survival is considered a pass. | |

Notes:

- (a) Average concentration is the discrete average of four (4) consecutive analytical results, or if less than four analytical results, the discrete average of the analytical results collected during a batch decant.

Table 2: CCME National Performance Standards

| Parameter | Concentration (mg/L) |
|------------------------------|----------------------|
| Total Suspended Solids, TSS | 25 |
| 5-day CBOD ₅ | 25 |
| Total Chlorine Residual, TRC | 0.02 |

It should be noted that the CCME MWWE guideline limits for CBOD₅ is slightly less stringent than those stated in the water licence for the facility. However, the water licence requires the measurement of BOD₅ rather than the more sensitive CBOD₅ measurement required by the CCME MWWE guideline document. The Strategy uses carbonaceous biochemical oxygen demand (CBOD₅) as an effluent parameter rather than the traditional total BOD₅ because of concerns about the effect of nitrogenous oxygen demand.

As the duration of the Fiddler's Lake main holding lagoon cell discharge was greater than one month, samples were collected every two weeks. The compliance with the NPS CBOD₅ limit was based on the annual average of the biweekly results obtained during the discharge period.

Table 3 shows a list of the sampling stations for supernatant where BOD₅/CBOD₅ was analyzed along the wastewater discharge pathway. All wastewater samples were sent to Taiga Environmental Laboratory for analysis within 24 hours of the sampling time.

Table 3: BOD₅/CBOD₅ Analysis Sampling Stations

| Parameter | Supernatant | | | | | | | | | | Sludge | | | |
|-------------------|-------------|---------------|-----------------|-----------------|--------|---------|---------|------------------|-------------------|-------------------|---------------|---------|---------|------------------|
| | Raw | FID01 – FID05 | FID01-05 Middle | FID01-05 Bottom | Decant | Lake F5 | Lake F4 | Lake F3 - Middle | Lake F3 (0032-F3) | Lake F1 (0032-F1) | FID01 – FID05 | Lake F5 | Lake F4 | Lake F3 - Middle |
| BOD ₅ | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| CBOD ₅ | | | | | | ■ | ■ | ■ | ■ | ■ | | | | |
| sBOD ₅ | ■ | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | |

The full and detailed results of the wastewater sampling analysis and historical operating data provided by the City of Yellowknife can be found in the Effluent Characterization Report by Dillon Consulting Limited (2014).

BOD₅ in Influent

A profile of the contaminant average concentrations of the influent was generated and compared to standard literature values for raw wastewater (Metcalf & Eddy, 4th ed, 2003). It was determined that the average mass load for the 2011 study period was 1,836 kg/d of BOD₅, resulting in an average unit loading of 91 g/cap-d (based on a population of 20,248 for the year 2011, Northwest Territories Bureau of Statistics, 2011). This value is in agreement with reported literature values, with typical unit loading ranging from 50-120 g/cap-d for similar sized wastewater systems.

BOD₅ in the Lagoon

Samples from the main holding cell were collected every two weeks during the open water season from five sampling stations down the holding cell. The average concentrations for BOD₅ during that time period are shown in Table 4.

Table 4: Average BOD₅ Concentrations for FID01 to FID05 from June 7, 2011 to October 13, 2011

| Parameter (units) | FID01 | FID02 | FID03 | FID04 | FID05 |
|-------------------------|-------|-------|-------|-------|-------|
| BOD ₅ (mg/L) | 55.44 | 63.92 | 60.00 | 60.46 | 57.62 |

BOD₅ concentrations for all sampling locations within the main holding cell over the sampling season are shown in Figure 1. The dashed vertical lines represent the decant period. Seasonal variations are noted, with the highest values recorded in February, and lowest values recorded mid-summer and in mid-September.

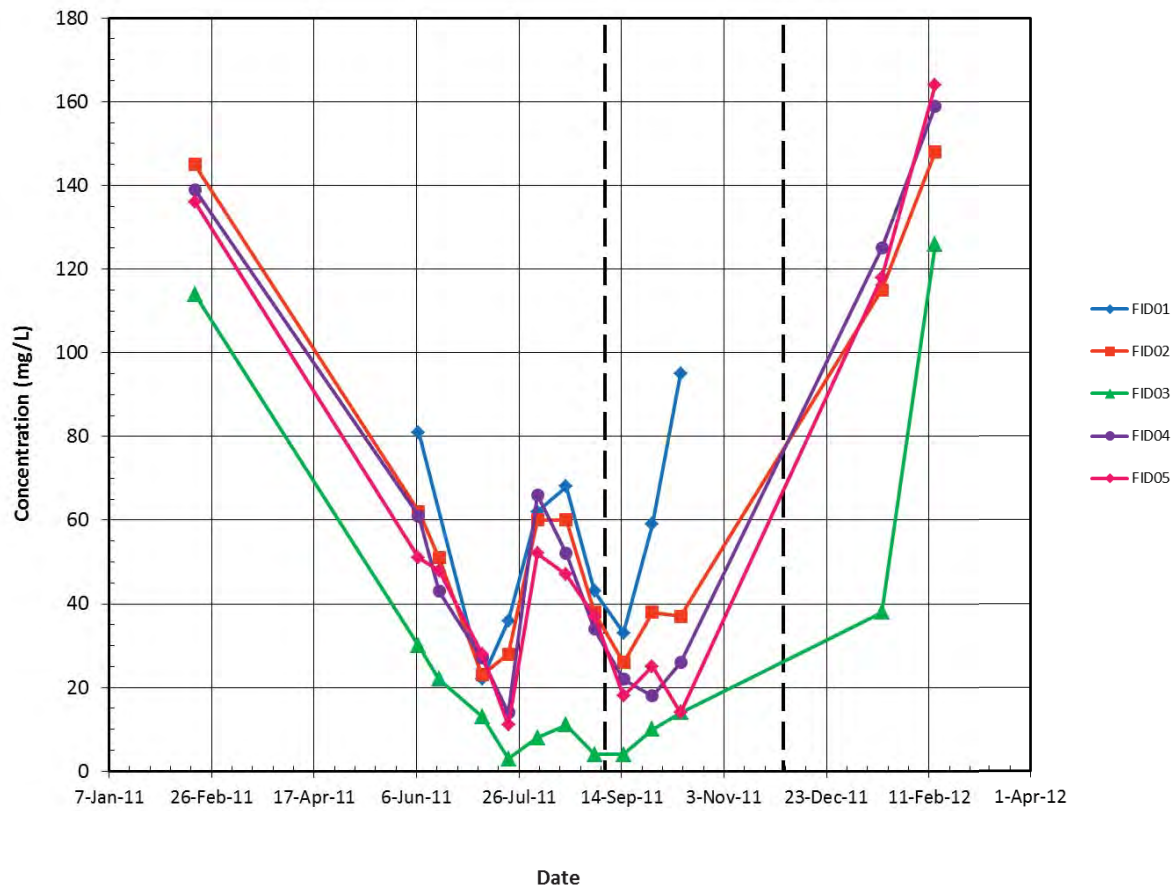


Figure 1: Trends in BOD₅ Concentrations for Main Lagoon Cell: FID01 to FID05

BOD₅/CBOD₅ in Wetland

The average BOD₅ concentrations in the supernatant were measured for Lake F5, Lake F4 and Lake F3 for the decant period and full year. Observations are listed in Table 5.

Table 5: Average BOD₅/CBOD₅ Concentration for Supernatant at Lakes F5, F4 and F3

| Sampling point | Parameter (units) | Year ^(a) | | | Decant Period ^(b) |
|----------------|--------------------------|---------------------|-----|-----|------------------------------|
| | | Average | Min | Max | Sept 26, 2011 |
| Lake F5 | CBOD ₅ (mg/L) | 15.09 | 1 | 66 | 3.5 |
| | BOD ₅ (mg/L) | 17.42 | 1 | 77 | 8 |
| Lake F4 | CBOD ₅ (mg/L) | 38.3 | 1 | 92 | 1 |
| | BOD ₅ (mg/L) | 57.5 | 2 | 156 | 6 |
| Lake F3 | CBOD ₅ (mg/L) | 4.67 | 1 | 13 | 3.33 |
| | BOD ₅ (mg/L) | 5.00 | 2 | 11 | 3.00 |

Notes:

- (a) The yearly averages were calculated based on the values from February 16, 2011 to February 15, 2012. This is based on four samples.

- (b) Decant period was from September 6 to December 2, 2011. The averages calculated for the decant period were based on the values taken from September 14 to November 30, 2011, which equates to one sample.

BOD₅/CBOD₅ at Compliance Point at Lake F3 and Lake F1 station

The quality of the effluent at Lake F3 at compliance point (0032-F3) and Lake F1 (0032-F1) stations were relatively similar in terms of average concentrations and grab sample concentrations over the observed sampling period. However, there were periods the BOD₅/CBOD₅ was higher at one sampling station than the other. This is likely due to higher than normal visible solids and organic material in the water body at the time of sampling. The higher than normal visible solids were from the natural occurring plants within the wetland lakes.

However, at the compliance point, the BOD₅/CBOD₅ parameter for wastewater treatment was consistently below the specified limits as stated in the water licence as well as CCME MWWWE guideline for both the decant and holding periods, as shown in Table 6.

Table 6: Average, 95th Percentile, Minimum, and Maximum Concentrations for BOD₅/CBOD₅ at Lake F3 Compliance Point (0032-F3)

| Parameter (units) | Year ^(a) | | | | Decant ^(b) | | | | Water Licence ^(c) | CCME Guideline Limit |
|--------------------------|---------------------|-----------------------------|-----|-----|-----------------------|-----------------------------|-----|-----|------------------------------|----------------------|
| | Average | 95 th Percentile | Min | Max | Average | 95 th Percentile | Min | Max | | |
| CBOD ₅ (mg/L) | 2.5 | 6 | 1 | 6 | 2.1 | 4.0 | 1 | 6 | - | 25 ^(d) |
| BOD ₅ (mg/L) | 3.9 | 12 | 1 | 18 | 2.5 | 5.0 | 1 | 6 | 20 | - |

Notes:

- (a) The yearly averages were calculated based on the values from February 16th, 2011 to February 15th, 2012.
- (b) Decant period was from September 6th to December 2nd, 2011. The averages calculated for the decant period were based on the values taken from September 14th to November 30th, 2011.
- (c) Maximum average concentration.
- (d) CCME Management of MWWWE, National Performance Standards.
- (e) CCME Water Quality Guidelines for the Protection of Freshwater Aquatic Life.

Additionally, all BOD₅ concentrations for the 0032-F3 and 0032-F1 stations, as illustrated in Figure 2 and Figure 3, were below the water licence maximum grab sample concentration of 30 mg/L.

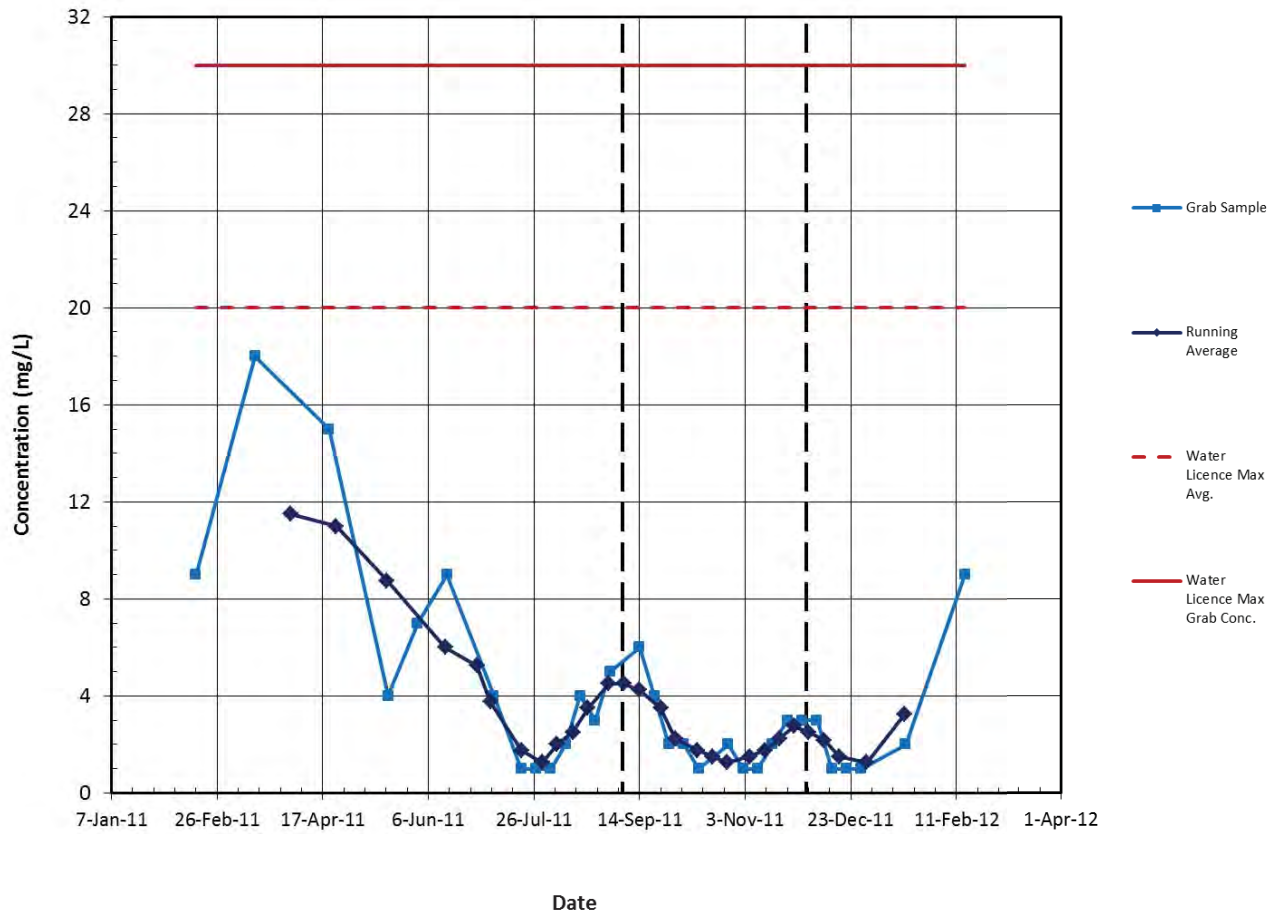


Figure 2: Trends in BOD5 Concentrations at Lake F3 Compliance Point (0032-F3)

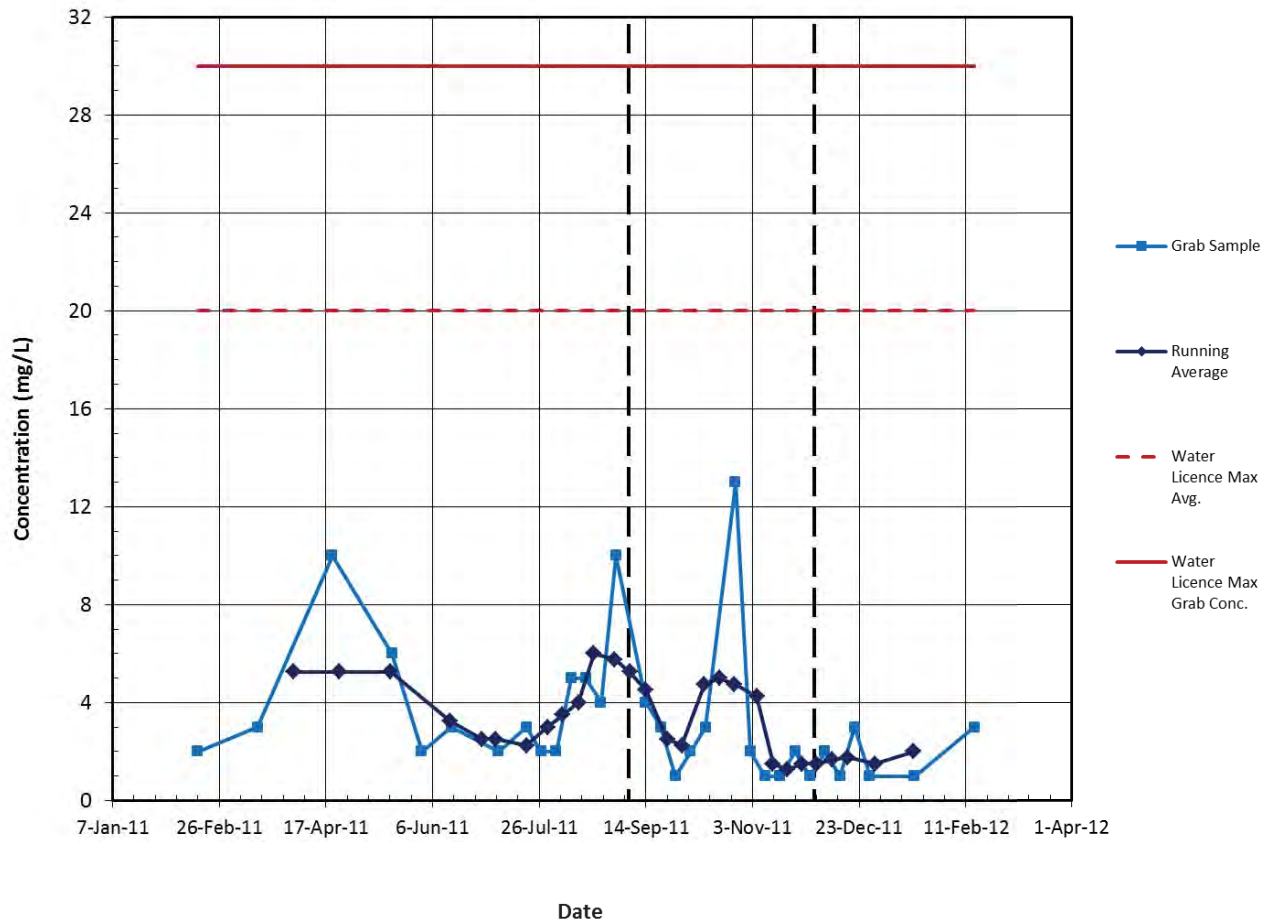


Figure 3: Trends in BOD₅ Concentrations at Lake F1 (0032-F1)

Similarly to BOD₅, CBOD₅ concentrations for both stations were well below the CCME MWWE NPS limit of 25 mg/L, ranging from below laboratory detection limits up to 18 mg/L as illustrated in Figure 4 and Figure 5. The correlation between TSS and BOD₅ concentrations (TSS:BOD₅) was not stable over the entire sampling period. Therefore, the observed higher BOD₅ concentrations were not the result of washout of the organic solids.

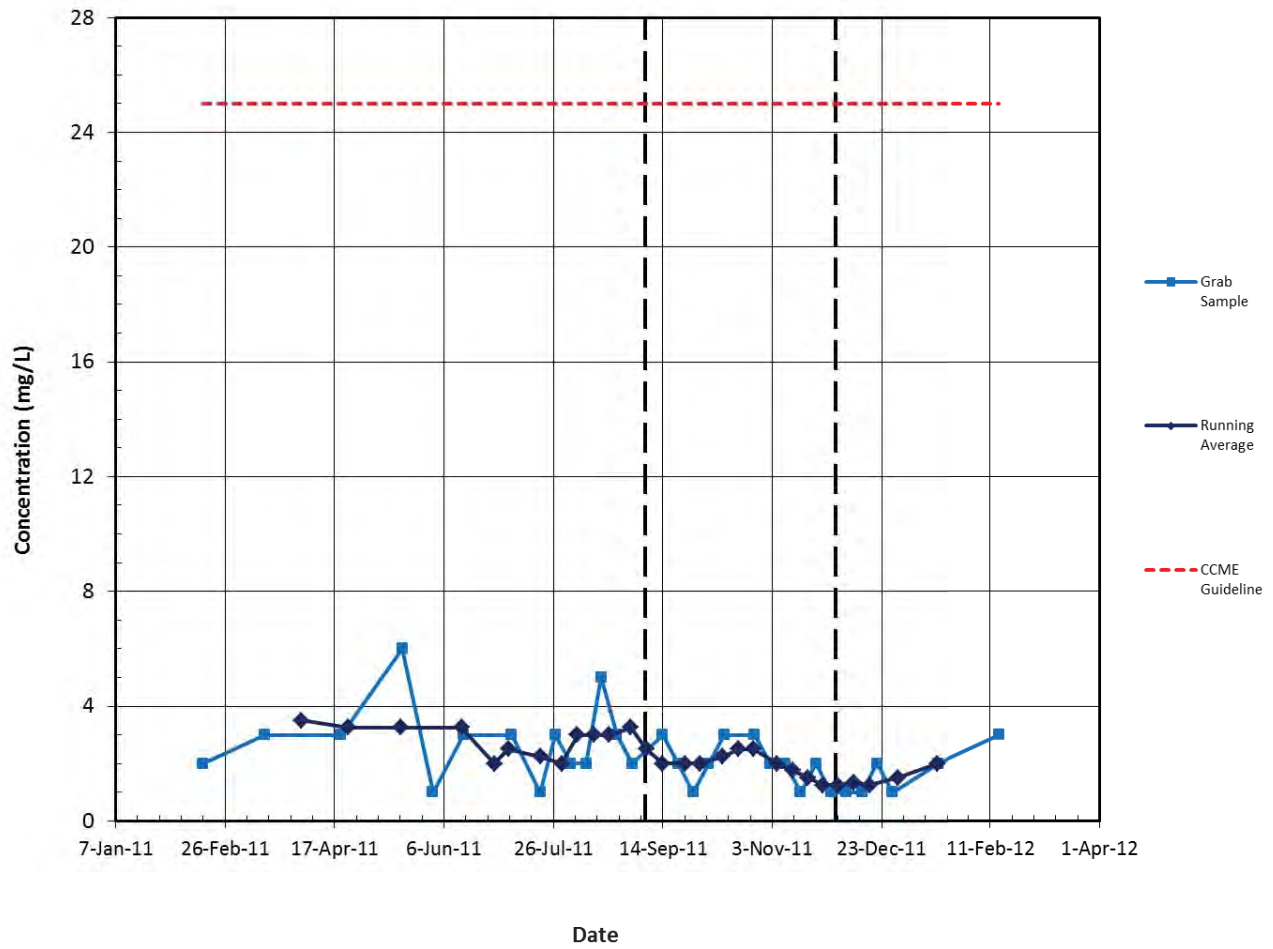


Figure 4: Trends in CBOD5 Concentration at Lake F3 Compliance Point (0032-F3)

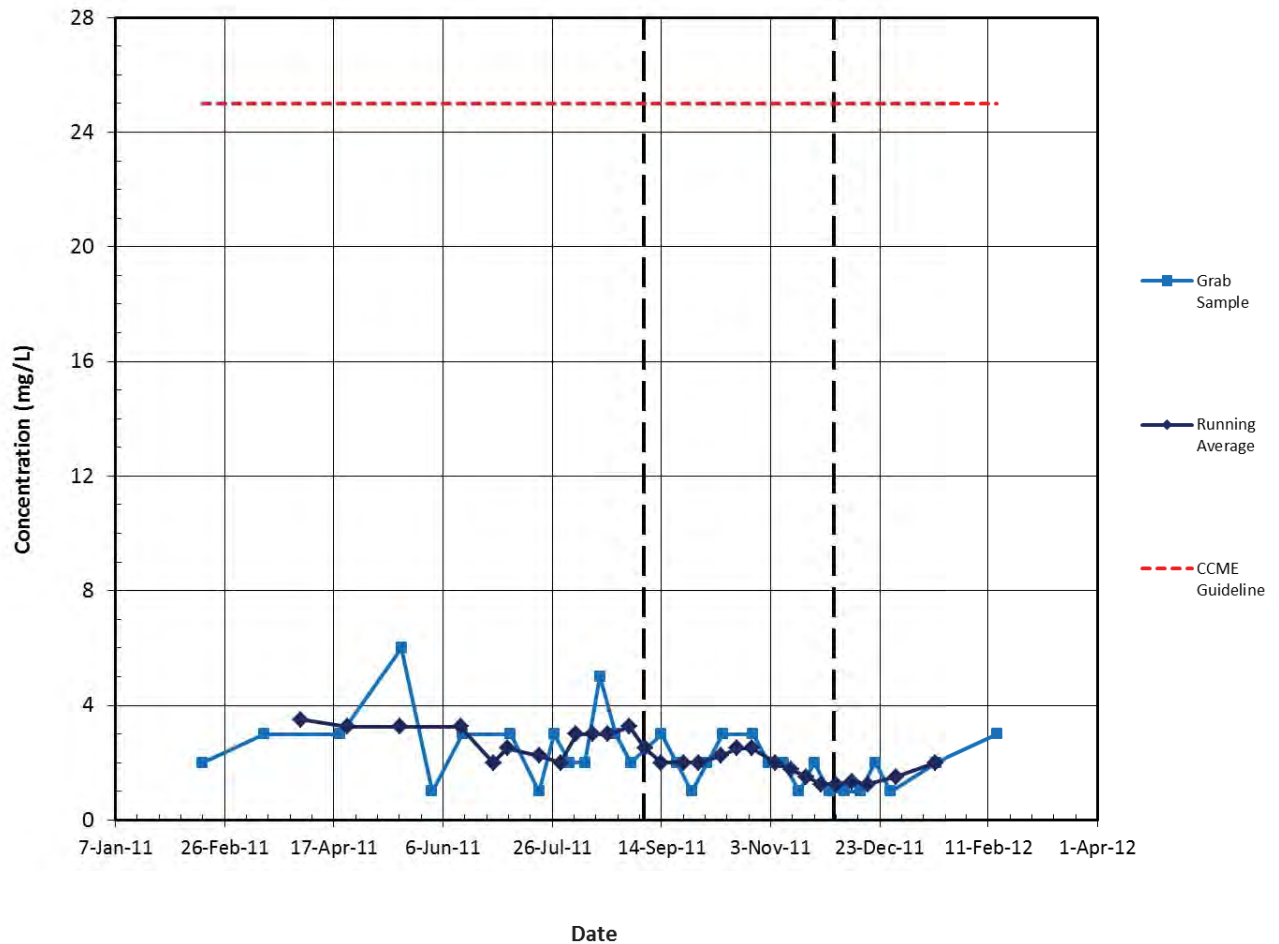


Figure 5: Trends in CBOD₅ Concentration at Lake F1 (0032-F1)

Annual percent removal of BOD₅ from the raw influent to the decant structure of the main lagoon cell, to Lake F3 at the compliance point (0032-F3) sampling station and to Lake F1 (0032-F1) sampling station is shown in Table 7 below.

Table 7: Annual Average Percent Removal for BOD₅

| Parameter | Year | | | Open Water ^(a) | | |
|------------------|--|---|-------------------------------|--|---|-------------------------------|
| | From Raw to Decant Structure of Main Lagoon Cell | From Raw to Lake F3 at Compliance Point (0032-F3) | From Raw to Lake F1 (0032-F1) | From Raw to Decant Structure of Main Lagoon Cell | From Raw to Lake F3 at Compliance Point (0032-F3) | From Raw to Lake F1 (0032-F1) |
| BOD ₅ | 71.7 | 97.0 | 98.5 | 78.1 | 96.8 | 98.2 |

Notes:

(a) Sampling data from June 1, 2011 to October 13, 2011.

The majority of the BOD₅ removal occurred in the main lagoon cell. There was removal of BOD occurring year round at the front end of the lagoon. However, the percent removal during the winter season was between 30% and 40% whereas during the open water treatment season, percent removal ranged between 59.1% and 89.3% from mid-June to early November. The lowest and highest BOD percent removal was observed in early August and late October, respectively. It was possible that the water quality water at the decant structure was still of high quality as a result of summer treatment season prior to the start of decant. Overall, there was very little variance between the open water season removal percentages versus the annual average removal percentages.

Conclusion

Based on the Environmental Risk-Based Approach flow diagram, the BOD levels in effluent from Fiddler's Lake Lagoon meet the National Performance Standards and EDOs as set out in the water licence issued by the Mackenzie Valley Land and Water Board. The moving average concentrations at the Lake F3 compliance point (0032-F3) sampling location were well below the water licence effluent limits and the NPS limits.

Annual percent removal of BOD from the raw influent to the decant structure of the main lagoon cell, to Lake F3 at the compliance point (0032-F3) sampling station and to Lake F1 (0032-F1) sampling station was determined to be over 98%.