CORRESPONDENCE / MEMORANDUM **State of Wisconsin**

DATE: August 1, 2014 FILE REF: 3200

TO: Laura Dietrich – South Water District East / Milwaukee

FROM: Jim Schmidt – WQ/3

SUBJECT: Water Quality-Based Effluent Limitations for the Burlington Wastewater Treatment Facility (WPDES Permit # WI-0022926) – CORRECTED

NOTE: One correction was made to the January 21, 2014 memo in the section on ammonia limits.
This is in response to your request for an evaluation of water quality-based effluent limitations using chs. NR 102, 105, 106, 207, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the Burlington wastewater treatment facility to the Fox River in Racine County. The evaluation of the permit recommendations is discussed in more detail in the attached report. Based on our review, the following recommendations are made for Outfall 001 (treatment plant effluent) on a chemical-specific basis:

Substance	Effluent Limitations
BOD5	30 mg/L monthly average, 45 mg/L weekly average
Total Suspended Solids	30 mg/L monthly average, 45 mg/L weekly average
pH	6.0 s.u. daily minimum, 9.0 s.u. daily maximum
Fecal Coliforms	400 colonies / 100 mL monthly geometric mean, May - September
Total Phosphorus:	
Interim	1.0 mg/L monthly average
Water Quality-based	0.1 mg/L six-month average (May – October, November – April), 0.3 mg/L monthly average, 3.0 lbs/day annual average
Ammonia	10 mg/L daily maximum, November – April only, 13 mg/L monthly average October only
Mercury:	
Water Quality-based	1.3 ng/L monthly average
Proposed Variance	3.1 ng/L daily maximum based on 1-day P99

Along with the chemical-specific recommendations mentioned above, acute and chronic whole effluent toxicity testing is recommended for this permittee. Following the guidance provided in the most recent version of the Department's Whole Effluent Toxicity Program Guidance Document, acute and chronic whole effluent toxicity test batteries are recommended at a frequency of once per year each, in rotating quarters. This recommendation is the same frequency as the previous WPDES permit. Please consult the attached report regarding relevant monitoring conditions that relate to this discharge.

If there are any questions or comments, please contact Jim Schmidt at (608) 267-7658 or via e-mail at jamesw.schmidt@wisconsin.gov.

Attachment
cc: Nick Lent – South Water District East / Milwaukee
Tim Thompson - South Water District East / Milwaukee

Water Quality-Based Effluent Limitations for
Burlington WWTF
WPDES Permit # WI-0022926
Prepared by:
Jim Schmidt - WQ/3

Existing Permit Limitations (WPDES Permit #WI-0022926-08, effective July 1, 2009 and expiring March 31, 2014):

Outfall 001 = Effluent from activated sludge plant with ultraviolet disinfection and ferric chloride addition for phosphorus removal

Substance	Effluent Limitations
BOD5	30 mg/L monthly average, 45 mg/L weekly average
Total Suspended Solids	30 mg/L monthly average, 45 mg/L weekly average
pH	6.0 s.u. daily minimum, 9.0 s.u. daily maximum
Fecal Coliforms	400 colonies / 100 mL monthly geometric mean in May - September
Total Phosphorus	1.0 mg/L monthly average
Ammonia	10 mg/L daily maximum year-round, 9.1 mg/L monthly average in May – September
Mercury	5.8 ng/L daily maximum (variance limit)
Bis(2-ethylhexyl)phthalate	13 ug/L and 0.38 lbs/day weekly average, 0.76 lbs/day weekly average as an alternative wet-weather limit

The above-mentioned limits for BOD5, TSS, pH and fecal coliforms will not be re-evaluated as part of this report. Since the design effluent flows, the appropriate river low flows, and the relevant water quality standards have not changed for those parameters, the limits will be the same as in the current WPDES permit. The other parameters limited in the current permit, as well as those monitored as part of the recently submitted permit reissuance application, are evaluated in this report along with any potential updates in the whole effluent toxicity testing requirements.

Information for Permit Reissuance Evaluation:

Receiving Water Information

Name: Fox (IL) River, WBIC = 742500
Classification: Warmwater sportfish community, not designated as a public water supply
Flows:
7Q10 = 44 cfs
7Q2 = 82 cfs
Estimated Harmonic Mean Flow = 185 cfs
% of Flow used to calculate limits = 25 (default)

Background results used in limit calculations: Fox River at highway 1, Waukesha County (results on next page) except for hardness which is from the ambient water used in Burlington's WET tests during the current permit term.

Substance	Result	Substance	Result
Chloride	194.4 mg/L	Lead	1.64 ug/L
Beryllium	0.02 ug/L	Nickel	3.95 ug/L
Chromium	1.27 ug/L	Selenium	1.86 ug/L
Copper	3.22 ug/L	Silver	0.0182 ug/L
Hardness	276.5 PPM	Zinc	9.72 ug/L
Mercury	4.7 ng/L (from previous effluent limit evaluation in 2009)		

Effluent Information

Actual Flow (7/1/2009 – 11/30/2013):

Annual average = 3.09 MGD (most recent = 6/10/2010 – 6/9/2011)
Peak daily = 7.433 MGD (4/19/2013)
Peak weekly = 6.16 MGD (4/18 – 4/24/2013)
Peak monthly = 4.50 MGD (4/9 – 5/8/2013)

Design Flow:

Annual average = 3.55 MGD (same as basis for current WPDES permit)
Peak daily = 8.54 MGD (7.433 MGD X 3.55 / 3.09)
Peak weekly = 7.08 MGD (6.16 MGD X 3.55 / 3.09)
Peak monthly = 5.17 MGD (4.50 MGD X 3.55 / 3.09)

Acute dilution factor used = Not applicable

Effluent concentration data:

Substances tested) Since Burlington's annual average design flow is above 1.0 MGD, it is considered to be a "major municipal discharger" and is therefore required to test each of the substances on EPA's priority pollutant list. That testing took place during the summer of 2013. Single test results were provided for each of those substances. Multiple test results are available throughout the current permit term for ammonia, mercury and bis(2-ethylhexyl)phthalate since those substances are limited in the current permit, and multiple results are available in the application for chloride, hardness, and copper.

Results) The only parameters that were detected include the following:

Single test results = Antimony, hexavalent chromium, nickel, zinc, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. These results are summarized alongside the calculated limits where available.

Multiple test results = All of the substances with multiple test results were detected at least once. Those results are summarized below.

Date	Chloride (mg/L)	Hardness (PPM)	Additional Data from WET tests	Hardness (PPM)
8/1/2013	320	370	8/20/2009 (average of 3 results)	415
8/5/2013	310	370	3/18/2010 (average of 3 results)	387
8/9/2013	340	380	12/6/2011 (average of 3 results)	341
8/11/2013		370	5/8/2012 (average of 3 results)	384
8/13/2013	350			
Mean	330		Mean (of all 8 results)	377

Date	Copper (ug/L)	Date	Copper (ug/L)	Date	Copper (ug/L)
8/1/2013	7.9	8/21/2013	8.6	9/11/2013	54
8/5/2013	6.4	8/25/2013	6		
8/9/2013	10	8/29/2013	6.6	Mean	12.93
8/13/2013	12	9/3/2013	9.4	1-day P99	67.25
8/17/2013	13	9/6/2013	8.3	4-day P99	36.56

Date	Mercury (ng/L)	Date	Mercury (ng/L)	Date	Mercury (ng/L)
8/26/2009	1.6	7/19/2011	1	8/20/2013	1.7
10/15/2009	2.6	10/11/2011	1.4	10/29/2013	1.9
3/16/2010	0.89	2/28/2012	1.9		
6/29/2010	1	4/24/2012	0.62	Mean	1.32
8/3/2010	0.21	8/8/2012	0.88	1-day P99	3.11
10/5/2010	1.5	10/3/2012	1.7	4-day P99	2.09
3/8/2011	1.2	2/6/2013	1.5	30-day P99	1.57
5/3/2011	0.94	5/15/2013	1.2		

Date	Bis(2-ethylhexyl) phthalate (ug/L)	Date	Bis(2-ethylhexyl) phthalate (ug/L)	Date	Bis(2-ethylhexyl) phthalate (ug/L)
8/19/2009	13.4	7/19/2011	0.99	8/19/2013	0.01 *
10/21/2009	16	10/11/2011	0.99	10/29/2013	0.01 *
3/24/2010	1.3	2/28/2012	0.99		
6/29/2010	3.6	4/24/2012	0.01 *	Mean	3.75
9/15/2010	0.99	8/8/2012	0.01 *	1-day P99	25.55
10/5/2010	0.99	10/3/2012	0.01 *	4-day P99	13.91
3/8/2011	0.99	2/5/2013	0.01 *	30-day P99	6.68
5/3/2011	0.99	5/14/2013	0.01 *		

* - The 0.01 ug/L results for bis(2-ethylhexyl)phthalate are questionable since the reported level of detection on these days was 0.99 ug/L, far above the reported value of 0.01 ug/L. The mean and 99th percentile values are calculated after excluding these questionable results, though they may be considered in determining the future permit recommendations.

Because of the large number of test results for ammonia and phosphorus, only the statistics are summarized here.

	Ammonia (mg/L) Year-round	Ammonia (mg/L) May – September only *	Phosphorus (mg/L)
# of Results	688	301	692
# of Detected Results	225	129	692
Maximum	17.2 (5/25/2011)	17.2 (5/25/2011)	3.76 (12/23/2011)
Mean	0.24	0.32	0.66
1-day P99	3.70	4.74	1.39
4-day P99	2.23	2.97	0.98
30-day P99	0.96	1.30	0.77

* - May – September ammonia results are summarized separately because a monthly average limit applies only during those months.

In the above tables, the term "P99" refers to a 99th upper percentile value that was calculated using the procedures in s. NR 106.05(5) when eleven or more detected results are available.

Effluent Limit Summary

Only the detected substances with criteria in ch. NR 105 or secondary values that can be calculated using chs. NR 105 or 106 are summarized here. Results are in units of ug/L unless noted otherwise. Boldfaced text represents substances potentially needing limits in the upcoming permit; those substances are discussed following the limit tables.

DAILY MAXIMUM LIMITS based on ACUTE TOXICITY CRITERIA

Substance	Crit-erion	Effl. Limit	1/5 of Limit	Effluent Concentrations Mean	P99	Max.
Chromium (total or +3)	4445.84 *	8891.68	1778.34	< 0.67		
Chromium (+6)	**16.02**	**32.04**	**6.41**	**9.2**		
Copper	54.28 *	108.56			67.25	54
Mercury	0.83	1.66			0.00311	0.0026
Nickel	1048.88 *	2097.76	419.55	3.5		
Zinc	344.68 *	689.36	137.87	17		
Chloride (mg/L)	**757**	**1514**	**302.80**	**330**		**350**
SECONDARY VALUES:						
Bis(2-ethylhexyl)phthalate		33.92			25.55	16

* - Criteria are based on a mean effluent hardness of 377 PPM. For total chromium, nickel, and zinc, the hardness value used in calculating acute criteria is the maximum value of the range listed in Table 2A of ch. NR 105, since the effluent value was higher than the upper endpoint of the range in the table. Criteria were based on a hardness of 301 PPM for total chromium, 268 PPM for nickel, and 333 PPM for zinc.

WEEKLY AVERAGE LIMITS based on CHRONIC TOXICITY CRITERIA

Substance	Crit-erion	Effl. Limit	1/5 of Limit	Effluent Concentrations Mean	P99
Chromium (total or +3)	325.75 *	975.56	195.11	< 0.67	
Chromium (+6)	**10.98**	**32.97**	**6.59**	**9.2**	
Copper	31.12 *	86.99			36.56
Mercury	0.44	1.31			0.00209
Nickel	120.18 *	352.94	70.59	3.5	
Zinc	344.68 *	1015.48	203.10	17	
Chlorides (mg/L)	**395**	**796.73**	**159.35**	**330**	
SECONDARY VALUES:					
Bis(2-ethylhexyl)phthalate	**4.36**	**13.09**			**13.91**

* - Criteria are based on a mean receiving water hardness of 362 PPM. For total chromium, nickel, and zinc, the hardness value used in calculating acute criteria is the maximum value of the range listed in Table 2A of ch. NR 105, since the effluent value was higher than the upper endpoint of the range in the table. Criteria were based on a hardness of 301 PPM for total chromium, 268 PPM for nickel, and 333 PPM for zinc.

MONTHLY AVERAGE LIMITS based on WILDLIFE CRITERIA

Substance	Crit-erion	Effl. Limit	1/5 of Limit	Effluent Concentrations Mean	P99
Mercury	**0.0013**	**0.0013 #**			**0.00157**

- Limit equals criterion because background levels in the receiving water exceed the criterion.

MONTHLY AVERAGE LIMITS based on HUMAN THRESHOLD CRITERIA

Substance	Crit-erion	Effl. Limit	1/5 of Limit	Effluent Concentrations Mean	P99
Antimony	373	3514	703	0.73	
Chromium (+6)	7636	71932	14386	9.2	
Mercury	**0.0015**	**0.0015 #**			**0.00157**
Nickel	43000	405031	81006	3.5	

- Limit equals criterion because background levels in the receiving water exceed the criterion.

MONTHLY AVERAGE LIMITS based on HUMAN CANCER CRITERIA

Substance	Crit-erion	Effl. Limit	1/5 of Limit	Effluent Concentrations Mean	P99
SECONDARY VALUES:					
Bis(2-ethylhexyl)phthalate	6.9	65			6.68

Permit Recommendations

The substances potentially in need of permit limits based on the above comparisons are chloride, chromium (+6), bis(2-ethylhexyl)phthalate, and mercury.

Chloride] Daily maximum and weekly average chloride limits are potentially needed in the reissued permit because the mean effluent concentration exceeds 1/5 of both limits. However, under s. NR 106.85(3), only the upper 99th percentile (or P99) value can be used to determine the need for chloride limits in permits. Since only four chloride samples were taken during 2013, this suggests the need to request more monitoring in the reissued permit until such time that 11 or more detected results are available and P99 values can be calculated. However, additional results were available from the previous (-07) permit term, and those results may be considered here along with the 2013 data since the results are similar. The following table summarizes data from 2007 and 2008 along with the 2013 values, and calculated P99 values from that using s. NR 106.05(5).

Date	Chloride (mg/L)	Date	Chloride (mg/L)	Date	Chloride (mg/L)
2/14/2007	380	8/6/2007	380	8/5/2013	310
3/1/2007	380	9/26/2007	540	8/9/2013	340
4/9/2007	290	10/8/2007	370	8/13/2013	350
5/9/2007	340	11/12/2007	350	Mean	384.67
6/1/2007	450	1/4/2008	410	1-day P99	601.42
7/27/2007	560	8/1/2013	320	4-day P99	484.23

Using the 2007 – 2008 data along with the 2013 data, the 1-day P99 of 601.42 mg/L is less than the daily maximum limit of 1514 mg/L, and the 4-day P99 of 484.23 mg/L is less than the weekly average limit of 796.73 mg/L. Therefore, chloride limits are not recommended for inclusion in the reissued WPDES permit for Burlington.

Chromium (+6)] Daily maximum and weekly average chloride limits are potentially needed in the reissued permit because the mean effluent concentration exceeds 1/5 of both limits. This situation has come up n the past with several permittees, though. As it turns out, the reported level of detection for chromium (+6) is much higher than it is for total chromium, 3.5 and 0.67 ug/L respectively according to Burlington's effluent data. With a lower level of detection, the total chromium test is considered to be much more precise. In fact, with total chromium at Burlington being less than (or non-detectable) at 0.67

ug/L, it follows that the chromium (+6) concentration must be less than 0.67 as well since +6 must be equal to or less than the total. Since 0.67 ug/L is less than 1/5 of the calculated daily maximum and weekly average limits, limits and monitoring of chromium (+6) are not necessary in the reissued permit for Burlington.

Mercury] The previous permit contained a 5.7 ng/L variance based on the 1-day P99 of effluent data at the time, which was developed in response to an exceedance of the 1.3 ng/L limit based on the wildlife criterion (based on background concentrations in excess of the limit). No new background mercury data are available for the Fox River based on the Department's SWIMS database, so the limits themselves have not changed. Effluent concentrations are a little lower now, though, but the 30-day P99 of 1.57 ng/L is still slightly above the 1.3 ng/L monthly average limit based on the wildlife criterion and the 1.5 ng/L monthly limit based on the human threshold criterion. The 1.3 ng/L monthly average is still recommended as a water quality-based limit, which would be accompanied by a mass limit of 0.000039 lbs/day based on the annual average design flow of 3.55 MGD. If the permittee wishes to renew the variance instead (which is proposed based on the permit reissuance application), the starting point for proposing a new variance limit would be the 1-day P99 based on current data, which is 3.1 ng/L.

Bis(2-ethylhexyl)phthalate] the previous permit contained weekly average limits of 13 ug/L and 0.38 lbs/day based upon the available secondary value calculated using ch. NR 105 and applied under s. NR 106.05(1)(b). No additional toxicity data are available for this compound, so the calculated limit based on the secondary chronic value is still 13 ug/L weekly average after rounding. The 4-day P99 of 13.91 ug/L is slightly over that limit based on data reported between August 2009 and February 2012. S noted earlier, several additional results are available after February 2012 but were not originally considered because the reported effluent concentrations of 0.01 ug/L for all seven samples was far below the reported level of detection of 0.99 ug/L, which does not make sense on an analytical basis. However, it is possible that a lower level of detection was used in those seven samples that was incorrectly noted on the application **OR** the permittee noted non-detected samples by reporting an artificial value of "0.01 ug/L." Either one is potentially the case just because samples going back to mid-2010 also had the reported 0.99 ug/L level of detection even though the reported results exceeded 0.99. Rather than exclude the most recent seven results, the alternative approach is to recalculate the P99 values based on the "accepted" results listed earlier in this report and non-detects for the most recent seven results. The impact of this adjustment is as follows:

	8/2009 – 2/2012 Database	8/2009 – 10/2013 Database
# of Results	11	18
# of Detected Results	11	11
Maximum	16 ug/L (10/21/2009)	16 ug/L (10/21/2009)
Mean	3.75 ug/L	2.29 ug/L
1-day P99	25.55 ug/L	20.82 ug/L
4-day P99	13.91 ug/L	11.39 ug/L
30-day P99	6.68 ug/L	4.96 ug/L

Including those seven results as no-detects, the new 4-day P99 is less than the 13 ug/L limit which suggests bis(2-ethylhexyl)phthalate could be removed from the reissued permit. In order to guard against the impression that we're "playing with numbers' to avoid a permit limit, one must also consider the factors listed under s. NR 106.05(1)(b) which could be used to justify a secondary value-based permit

limit. Of the factors listed in NR 106, the only one that appears to have supporting information available at this time is s. NR 106.05(1)(b)3, which states that the necessity for limits be supported based on "other information that the industrial category or subcategory of the point source or the industrial or other sources discharging to a publicly owned treatment works discharges the substance." In other words, it must be shown that either the treatment works or the industries discharging to the treatment works must be considered to be a source or use of bis(2-ethylhexyl)phthalate.

According to the information available on bis(2-ethylhexyl)phthalate, the primary sources include the textile industry, pulp and paper mills, oil refineries, landfill leachates, and the plastics industry. Although there is a landfill from which Burlington accepts some waste (according to the permit application), this is a very minor flow component of the over-3 MGD actual annual flow, none of the other industries are represented in Burlington. In reality, the most documented source above all of these is as an artifact of laboratory analyses themselves, which may explain the variability in reported results over time. Since "lab artifact" isn't really a source associated with the industries discharging to the Burlington sewer system, it is debatable whether or not Burlington meets the requirements of s. NR 106.05(1)(b). Taking that along with the results from all the samples including the most recent seven results, it is recommended that neither limits nor monitoring are needed during the upcoming permit term at Burlington.

NOTE: If the seven results after February 2012 were considered to be detected at 0.01 ug/L (suggesting a level of detection that is different than 0.99 ug/L for those samples), the P99 values are as follows:

	8/2009 – 2/2012 Database	8/2009 – 10/2013 Database (with seven no-detects)	8/2009 – 10/2013 Database (assuming seven detects @ 0.01 ug/L)
# of Results	11	18	18
# of Detected Results	11	11	18
Maximum	16 ug/L (10/21/2009)	16 ug/L (10/21/2009)	16 ug/L (10/21/2009)
Mean	3.75 ug/L	2.29 ug/L	2.29 ug/L
1-day P99	25.55 ug/L	20.82 ug/L	19.72 ug/L
4-day P99	13.91 ug/L	11.39 ug/L	11.32 ug/L
30-day P99	6.68 ug/L	4.96 ug/L	4.93 ug/L

As expected, the 4- and 30-day P99 values were affected little by the 0.01 ug/L results while the 1-day P99 was actually lower than if the results were treated as no-detects. The reason for that is when the 0.01 ug/L results are factored in as detects, the overall database variability increases but is basically offset by the reduced mean of the detected results. Either way, the P99 results are below the comparable limits and therefore no permit limits are recommended for bis(2-ethylhexyl)phthalate.

Other Evaluations

Phosphorus – Technology Based: Wisconsin Administrative Code, ch. NR 217, requires municipal wastewater dischargers that discharge greater than 150 pounds of Total Phosphorus per month to comply with a Monthly Average limit of 1.0 mg/L – or an approved Alternative Concentration limit – unless a more restrictive WQBEL is applicable. The current permit for Burlington contains a technology-based phosphorus limit of 1.0 mg/L monthly average. The effluent flow and concentration data reported during the previous permit term are summarized in the following table.

Calendar Year	Mean Annual Effluent Flow (MGD)	Annual Average P Concentration (mg/L)	Estimated Annual Total P Loading (lbs/year)
2009	3.22	0.68	6665
2010	3.00	0.67	6119
2011	2.78	0.67	5670
2012	2.14	0.69	4507
2013 (so far)	2.64	0.62	4983

Since the previous permit contained the 1.0 mg/L limit, it is recommended that this limit be retained in the reissued permit pending the evaluation of water quality-based limits.

Phosphorus – Water Quality Based: Revisions to the administrative rules for phosphorus discharges took effect on December 1, 2010. For the Fox (IL) River, s. NR 102.06(3)(a)15 specifies a water quality criterion (WQC) of 100 ug/L for phosphorus. The nearest upstream site with phosphorus data is at highway I in Waukesha County, located downstream of Waukesha and upstream of Mukwonago. All twelve results collected between the months of May and October in the past five years (to be consistent with s. NR 217.13(2)(d)) are in excess of 100 ug/L, meaning the median value also exceeds 100 ug/L. This finding is consistent with the basis for listing the Fox River as an Impaired Water for phosphorus. Since the median background phosphorus concentration exceeds 100 ug/L, the water quality-based limit is set equal to the criterion, or 0.1 mg/L. Pursuant to s. NR 217.14(2) and subsequent guidance, the recommended water quality-based phosphorus limits for Burlington are 0.1 mg/L as a six-month average (November – April and May – October) and 0.3 mg/L as a monthly average. A water quality-based mass limit of 3.0 lbs/day is also recommended based on the 0.1 mg/L concentration and the 3.55 MGD design flow; the mass limit is expressed as an annual average.

It is noted that with the Impaired Water status in the Fox River for phosphorus, someday a Total Maximum Daily Load (TMDL) evaluation will be done which may affect all of the point source discharges within the Fox River basin. There is no current timeline regarding the development of a TMDL for the Fox (IL) River. Based on TMDL evaluations done elsewhere in Wisconsin, this may eventually result in mass limits that will replace the 0.1 and 0.3 mg/L limits.

With this effort in mind, the conclusion of which may not take place for years, the recommended approach at this time related to Burlington's permit reissuance is to keep the technology-based limit of 1.0 mg/L in the permit as a monthly average, but to refer to it as an "interim limit" that may be revised at some point in the future based on the Fox (IL) River basin TMDL effort. That way, the previous permit limit would be retained as a means of maintaining control of this discharge and also make the affected parties aware of potential revisions in the future that may impact other discharges besides just Burlington.

Ammonia: The existing permit contains a daily maximum limit of 10 mg/L based upon acute toxicity criteria in ch. NR 105 at an effluent pH 99th upper percentile value of 8.27 s.u., which came from data reported over the period of 1999 – 2003, as discussed in the Department's effluent limit evaluation on February 4, 2004. Effluent pH did not change significantly during the subsequent permit term, so no change was recommended to the 10 mg/L limit in the next effluent limit evaluation in 2008. Burlington has continued to monitor effluent pH because of the pH limits in its permit, and since the current permit was reissued on July 1, 2009, effluent pH has decreased significantly. From a total of 1,612 values

reported during the current permit term, the upper 99th percentile value (as represented by the 16th highest value in this database) is only 7.8 s.u. At a pH of 7.8, the daily maximum ammonia limit is 24 mg/L, or over twice the current permit limit. This limit may be included in the reissued permit subject to an antidegradation evaluation under ch. NR 207 since the limit is increased from the current permit. During the current permit term, the 10 mg/L limit was exceeded on only two occasions, which happened to be on consecutive days. Those results were 12.1 mg/L on May 24, 2011 and 17.2 mg/L on May 25, 2011. Even with only two exceedances of the limit, that still represents a demonstration of need for increased ammonia limits under s. NR 207.04(1)(a), especially since the reported effluent pH on both days was even lower than the 99th percentile value, namely 7.5 on both days. The only exceedances took place during the month of May, in all remaining months the permittee was able to meet the 10 mg/L daily maximum limit during the current permit term. From 2009 through 2013, the highest ammonia concentration reported between the months of November and April was 5.5 mg/L on November 25, 2009.

The ammonia limit calculation also warrants evaluation of weekly and monthly average limits based on chronic toxicity criteria for ammonia, since those limits relate to the assimilative capacity of the receiving water. The current permit contains only a 9.1 mg/L monthly average limit for the months of May – September, meaning the calculated weekly and monthly average limits for other months exceeded the 10 mg/L daily maximum. As noted earlier, ammonia limits were last calculated in February of 2004. At that time, default stream pH and temperatures were used to calculate limits. At this time, though, more specific information is available for both parameters which warrant a re-calculation of Burlington's weekly and monthly average limits. New default temperature data are available for relatively small warmwater streams such as the Fox River as part of the state's new thermal standards; the new default ambient stream temperatures are contained in Table 2 of ch. NR 102. For the Fox River in Waukesha County (upstream of Burlington), seasonal mean pH values are now available. The new ambient values are used in conjunction with the effluent and river low flows to re-calculate Burlington's limits using the procedure in s. NR 106.32, as noted in the following table.

	April – June	July – September	October – December	January - March
7Q10 (cfs)	44	44	44	44
7Q2 (cfs)	82	82	82	82
Ambient ammonia (mg/L)	0.07	0.25	0.09	0.05
Ambient temperature (deg F)	66	69	50	38
Ambient pH (s.u.)	7.77	7.87	8.00	7.74
% of river flow used	100	100	25	25
4-day chronic criteria (mg/L):				
Early life stages absent			8.14	13.88
Early life stages present	6.22	4.93		
30-day chronic criteria (mg/L):				
Early life stages absent			2.43	3.42
Early life stages present	2.49	1.97		

(Continued on next page)

	April – June	July – September	October – December	January - March
Weekly average ammonia limits (mg/L):				
Early life stages absent			24.27	41.57
Early life stages present	55.53	42.43		
Monthly average ammonia limits (mg/L):				
Early life stages absent			13.30	23.01
Early life stages present	33.20	23.83		

As in the 2004 evaluation, "early life stage absent" criteria are used for the months of October through March because burbot have not been shown to be an important resident of the Fox River. Based on the re-calculated limits, only the monthly average limits in October – December and January – March are less than the new daily maximum limit of 24 mg/L. It is noted that the weekly average limit in October – December and the monthly average limit in July – September are equal to 24 mg/L after rounding to two significant digits. After rounding, the new monthly average limits are 13 mg/L in October – December and 23 mg/L in January – March. Those limits are not subject to the antidegradation provisions in ch. NR 207 because there were no existing monthly average permit limits during the months of October through March; the initial imposition of monthly average limits is exempt from antidegradation under s. NR 207.02(6)(b). These concentrations can be used to determine significant lowering of water quality as relates to the 24 mg/L daily maximum limit mentioned earlier, however.

It is also noted that in s. NR 106.33(2), ammonia limits are not included in WPDES permits for municipal discharges when the calculated limits exceed 20 mg/L in May – October or 40 mg/L in November – March. The reason for this exemption is that it is expected that secondary treatment plants would be able to meet seasonal limits above 20 and 40 mg/L without any extra-added ammonia treatment capability. Based on these exemptions and the rounding mentioned earlier, the preliminary results of the re-calculation of ammonia limits at Burlington are as follows:

April	24 mg/L daily maximum
May – September	No limits recommended, all calculated limits exceed 20 mg/L
October	13 mg/L monthly average, all remaining limits exceed 20 mg/L
November – December	24 mg/L daily maximum, 13 mg/L monthly average
January – March	24 mg/L daily maximum, 23 mg/L monthly average

Since the only exceedances during the current permit term occurred during the month of May (two results above the current permit limit of 10 mg/L daily maximum), and all the ammonia limits now drop out of the permit for May (as well as June - October) because the new limits exceed 20 mg/L in those months, the permittee is in fact unable to demonstrate the need for increased limits during the months of November through April. When the need for increased limits cannot be demonstrated, s. NR 207.04(2)(a) states that the limitations shall remain unchanged. Based on the above evaluation, the only ammonia limits recommended for the reissued WPDES permit at Burlington are 10 mg/L daily

maximum, but only for the months of November through April, and 13 mg/L monthly average for only the month of October.

NOTE: To clarify, antidegradation does not apply when current permit limits are removed from the permit and replaced with no limits at all. Antidegradation only applies when permit limits are increased from one value to another.

Temperature: New surface water quality standards for temperature took effect on October 1, 2010. These new regulations are detailed in Chapter NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. The following table is used to screen the need to calculate limitations for temperature:

Warm Water aud Limited Forage Fish designated Waters	Cold Water Designated Waters	Effluent Temperature Limitation
$Q_s:Q_e \geq 20:1$	$Q_s:Q_e \geq 30:1$	120°F (no calculation needed)
$20:1 > Q_s:Q_e > 2:1$	$30:1 > Q_s:Q_e > 2.5:1$	120°F or the sub-lethal WQBEL (calculation needed), whichever is lower
$Q_s:Q_e \leq 2:1$	$Q_s:Q_e \leq 2.5:1$	Sub-Lethal and Acute WQBELs (calculation needed)

For unilateral (stream) flow Q_s is determined by using 25% of the ${}_7Q_{10}$. Q_e is the design effluent flow.

Determination of $Q_s:Q_e$ for Burlington:

${}_7Q_{10}$ (cfs)	Q_s (25% of ${}_7Q_{10}$) (cfs)	Q_e	$Q_s:Q_e$
44	11	3.55 MGD = 5.49 cfs	2 : 1

Limits are calculated for each month of the year, using the effluent flows reported since July 1, 2009. Those limits are summarized in the table on the following page because of the size of the table. Where effluent data exist, the need for thermal limits on discharges can be evaluated based on the new rules that became effective in chs. NR 102 and 106, Wis. Adm. Code, on October 1, 2010.

Burlington began measuring effluent temperature on May 1, 2013 using the continuous monitoring procedure suggested in s. NR 106.54. A year's worth of data was requested of Burlington, so since data are only available through the end of November, that means only 7 of the 12 months have effluent data. Fortunately, the May – November period covers the warmest part of the year so it may be possible to make some generalizations based on the results of the data.

Effluent temperatures are compared to the calculated limits. Peak daily temperatures are compared to the daily maximum limit in each month, while the peak weekly average (Sunday – Saturday average of peak daily results) are compared to the weekly average limits. Below the limit calculation table on the next page is a summary of the effluent data compared to the limits for May – November.

Temperature Limit Calculation - Burlington

Month	Water Quality Criteria			Receiving Water Flow Rate (Qs)	Representative Highest Effluent Flow Rate (Qe)		**Calculated Effluent Limit**	
	Ta (default)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Qesl)	Daily Maximum Flow Rate (Qea)	**Weekly Average Effluent Limitation**	**Daily Maximum Effluent Limitation**
	(°F)	(°F)	(°F)	(cfs)	(mgd)	(mgd)	(°F)	(°F)
JAN	33	49	76	44.00	3.238	3.528	84	120
FEB	34	50	76	44.00	3.501	3.680	82	120
MAR	38	52	77	44.00	4.285	4.301	75	120
APR	48	55	79	44.00	6.162	7.433	63	109
MAY	58	65	82	44.00	3.413	3.547	80	120
JUN	66	76	84	44.00	3.564	3.691	96	119
JUL	69	81	85	44.00	4.413	4.562	100	110
AUG	67	81	84	44.00	3.773	4.120	107	113
SEP	60	73	82	44.00	3.103	3.624	103	120
OCT	50	61	80	44.00	2.894	3.074	88	120
NOV	40	49	77	44.00	2.552	2.861	74	120
DEC	35	49	76	44.00	2.546	2.644	88	120

May – November 2013 Effluent Data Comparison - Burlington

Month	Peak 7-day Average Temperature (°F)	Weekly Average Effluent Limit (°F)	Peak Daily Temperature (°F)	Daily Maximum Effluent Limit (°F)
MAY	59.8	80	63.5	120
JUN	63.7	96	64.1	119
JUL	67.5	100	68.9	110
AUG	68.9	107	70.1	113
SEP	68.6	103	70.1	120
OCT	66.4	88	68.3	120
NOV	60.3	74	62.5	120

Over this period, the peak 7-day average temperatures are below the weekly average limits in each month, while the peak daily effluent temperatures are far below the daily maximum limits. No limits or monitoring are needed in the future for the months of May – November. It is also noted that the peak 7-day and daily results for the months of May and November are below the limits for each of the remaining months with no data, namely December through April. It is likely that the temperatures for December – April would be equal to or lower than those calculated for May and November because of seasonal variability. The peak 7-day temperature for May is "close to" the weekly average limit for April, but in reality it is expected that the 7Q10 for April, if available, would be well above the 44 cfs year-round 7Q10. If seasonal low flows were requested of USGS by the permittee, it is expected that the actual weekly average thermal limit for April would be well above 63°F. Therefore, if the effluent temperatures for April were close to those for May or even November, there should be no concern over thermal discharges in April.

Based on this analysis, no thermal limits are recommended for the reissued Burlington permit. No

additional monitoring is necessary and the permittee may discontinue its current thermal monitoring program.

Whole Effluent Toxicity Evaluation:
WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time. Acute tests predict the concentration that causes lethality of aquatic organisms during a 48-96 hour exposure. Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven day exposure.

Acute WET: In order to assure that the discharge from outfall 001 is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} greater than 100% effluent.

Chronic WET: In order to assure that the discharge from outfall 001 is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} greater than the instream waste concentration (IWC). The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of 33% shown in the WET Checklist summary below was calculated according to the following equation:

$$\text{IWC (as \%)} = 100 \times \frac{Qe}{(1-f)\,Qe + Qs}$$

Qe = annual average design flow = 3.55 MGD = 5.49 cfs
f = fraction of the Q_e withdrawn from the receiving water = 0
Q_s = 1/4 of the 7-Q_{10} = 44 cfs / 4 = 11 cfs

Dilution Series: According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Wis. Adm. Code), the default acute dilution series is: 6.25, 12.5, 25, 50, 100%, and the default chronic dilution series is 100, 75, 50, 25, 12.5%. Other dilution series may be chosen by the permittee or Department staff, but alternate dilution series must be specified in the WPDES permit. For guidance on selecting an alternate dilution series, see Chapter 2.11 of the WET Guidance Document.

Receiving water: According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Wis. Adm. Code) receiving water must be used as the dilution water and primary control in WET tests, unless the use of another dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on outfall 001 shall be a grab sample collected from the Fox River, upstream/out of the influence of the mixing zone and any other known discharge. The receiving water location must be specified in the WPDES permit.

Historical WET Data: Below is a tabulation of all available WET data for outfall 001 during the current permit term. Data collected prior to March 31, 2011 are not included in this evaluation when that information was generated by S-F Analytical,

Date Initiated	Acute Results LC_{50} (% survival in 100% effluent)				Chronic Results IC_{25}					Footnotes
	C. dubia	Fathead minnow	Pass or Fail ?	Use in RPF ?	*C. dubia*	Fathead Minnow	Algae	Pass or Fail ?	Use in RPF ?	
12/6/11	100	100	Pass	Yes	93.9	100		Pass	Yes	
5/8/12	100	100	Pass	Yes	100	100		Pass	Yes	

RPF = Reasonable Potential Factor

WET Checklist. Department staff use the WET Checklist when deciding whether WET limits and monitoring are needed. As toxicity potential increases, more points accumulate and more monitoring is needed to insure that toxicity is not occurring. The Checklist recommends acute and chronic WET limits (as needed) based on the Reasonable Potential Factor (RPF), as required by s. NR 106.08, Wis. Adm. Code, and monitoring frequencies based on points accumulated during the Checklist analysis. The completed WET Checklist and monitoring recommendations are summarized in the table below. (For more on the RPF and WET Checklist, see Chapter 1.3 of the WET Guidance Document, at: http://www.dnr.state.wi.us/org/water/wm/ww/biomon/biomon.htm).

WHOLE EFFLUENT TOXICITY (WET) CHECKLIST SUMMARY

	ACUTE	CHRONIC
1. INSTREAM WASTE CONC.	1A. Not Applicable **TOTAL POINTS = 0**	1B. IWC = 33% **TOTAL POINTS = 0**
2. HISTORICAL DATA	2A. 2 tests used in RPF, both passed; RPF = 0 **TOTAL POINTS = 0**	2B. 2 tests used in RPF, both passed; RPF = 0 **TOTAL POINTS = 0**
3. EFFLUENT VARIABILITY	3A. Little variability, no violations or upsets, consistent WWTF operations **TOTAL POINTS = 0**	3B. Same as Acute **TOTAL POINTS = 0**
4. STREAM CLASSIFICATION	4A. Warmwater sport fish community **TOTAL POINTS = 5**	4B. Same as Acute **TOTAL POINTS = 5**
5. CHEMICAL SPECIFIC DATA	5A. The only limits recommended based on reasonable potential for exceedance of acute toxicity criteria is ammonia (5 pts). Other detected substances with acute toxicity criteria that do not warrant permit limits include chloride, copper, hexavalent chromium, mercury, nickel, and zinc (3 pts). Other detected substances not having acute toxicity criteria include antimony, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and bis(2-ethylhexyl)phthalate (2 pts). **TOTAL POINTS = 8**	5B. Same as acute, except no chronic toxicity-based limits are needed for ammonia based on reasonable potential. The only chronic toxicity-based limit is a monthly average and it's included because it's under the NR 106.33(2) though it has not been exceeded in the actual effluent. Permittee gets 3 pts. for the substances with criteria and 2 pts. For the remaining substances. **TOTAL POINTS = 5**

	ACUTE	CHRONIC
6. ADDITIVES	6A. Ferric chloride added for phosphorus removal. **TOTAL POINTS** = 1	6B. Additives used more than once per 4 days, same points as acute **TOTAL POINTS** = 1
7. DISCHARGE CATEGORY	7A. 7 industrial contributors were identified, but none of them have reported process discharges in the industrial categories that warrant points in the checklist. **TOTAL POINTS** = 0	7B. Same as Acute **TOTAL POINTS** = 0
8. WASTEWATER TREATMENT	8A. Secondary Treatment **TOTAL POINTS** = 0	8B. Same as Acute **TOTAL POINTS** = 0
9. DOWNSTREAM IMPACTS	9A. None attributable to discharge **TOTAL POINTS** = 0	9B. Same as Acute **TOTAL POINTS** = 0
TOTAL POINTS	14	11

WET Monitoring and Limit Recommendations: Based on historical WET data and RPF calculations (as required in s. NR 106.08, Wis. Adm. Code), neither acute nor chronic limits are required. Based upon the point totals generated by the WET Checklist, other information given above, and Chapter 1.3 of the WET Guidance Document, acute and chronic toxicity testing are recommended. No additional testing is recommended beyond the once per year testing normally required of major municipal dischargers with design discharge rates above 1 MGD. Tests should be done in rotating quarters, in order to collect seasonal information about this discharge. When including recommended monitoring frequencies in the WPDES permit, staff should specify required quarters (e.g., Jan-Mar, Apr-Jun, Jul-Sep, or Oct-Dec).