

PERMIT FACT SHEET

General Information		
Permittee	Village of Birnamwood	Permit No: WI-0022691
Address	359 State Road Birnamwood WI	
Discharge Location	NE1/4 of NE1/4, Sec. 7, T28N-R11E, Shawano Co. Middle and South Branches of Embaraas River Watershed (WR11)	
Receiving Stream	Wetland tributary to Railroad Creek	Q7,10 = not defined
Stream Classification	Limited Aquatic Life	
Influent Loading	Design	Actual (Jul 2015 thru Nov 2015) *
Flow -Average	0.110 MGD	0.104 MGD
BOD ₅ - Influent	204 #'s/day	218 #'s/day
* There has been little data collected since the upgrade but flow and loading may be a concern.		
Significant Industrial Loading: None identified in the permit application.		
Operator Certification	Required Certification	Basic - A1, B, C
	Operator-in-Charge Certification	Adv - A1, B, C, D & P (Chris Jensen)
Facility Description		
<p>The recently (completed in 2015) constructed treatment system includes fine screening, a new wetwell and pumps, a sequencing batch reactor unit, aerobic digestion and biosolids storage. The effluent outfall is at a new structure very near the previous location.</p> <p>Treated effluent is discharged through Outfall 002 to a ditch flowing to a wetland area that eventually connects to Railroad Creek, approximately one mile downstream from the outfall.</p>		
Sample Point Designations		
Sample Point	Description	Location
701	Influent	Composite samples of the influent shall be collected at the splitter box just prior to the SBR tanks.
002	Effluent	Composite and grab samples of the effluent shall be collected at the effluent Parshall flume manhole.
003	Biosolids	Representative composite samples of aerobically digested liquid sludge shall be collected at the sludge storage structure.
<p>Changes from previous permit: Sample points 701 and 002 have both changed as a result of the recent treatment plant upgrade. Since the effluent outfall structure was only slightly relocated the Outfall Number (002) was not changed.</p>		

Proposed Permit Changes & Explanations

Permit Monitoring – Influent (701)

Parameter	Unit	Sample Frequency	Sample Type
Flow	MGD	Daily-Continuous	
BOD ₅	mg/L	3 x Weekly	24-hour FPC
Suspended Solids	mg/L	3 x Weekly	24-hour FPC

Changes from previous permit: An influent flow meter has been installed.

Permit Monitoring and Limits – Effluent (002)

	Existing			Proposed		
	Limits		Sampling Frequency	Limits		Sampling Frequency
Flow			Daily-Continuous			Daily-Continuous
BOD ₅ (monthly/weekly)	20/30 mg/l		3 x Weekly	20/30 mg/l		3 x Weekly
TSS (monthly/weekly)	20/30 mg/l		3 x Weekly	20/30 mg/l		3 x Weekly
Dissolved Oxygen (min.)	4.0 mg/l		3 x Weekly	4.0 mg/l		3 x Weekly
pH (range)	6-9 S.U.		3 x Weekly	6-9 S.U.		3 x Weekly
Ammonia Nitrogen	Weekly	Monthly		Weekly	Monthly	
April	39 mg/L	15 mg/L	Weekly	39 mg/L	15 mg/L	Weekly
May		15 mg/L	Weekly		15 mg/L	Weekly
June-September	17 mg/L	6.7 mg/L	Weekly	17 mg/L	6.7 mg/L	Weekly
October	Monitor	Monitor	Weekly	Monitor	Monitor	Weekly
November-March	27 mg/L		Weekly	27 mg/L		Weekly
Phosphorus ¹				Monitor		Monthly
WET ² (Acute and Chronic)	Once per permit			Quarterly first year and once 4 th year		

Changes from previous permit:

1 - Phosphorus issues are discussed later in this report.

2 - There have been past issues with Whole Effluent Toxicity. WET testing was suspended until the treatment plant upgrade was completed. The reissued permit should include quarterly acute and chronic WET tests during the first year of the permit and one acute and chronic test during the fourth year.

See the June 21, 2013 WQBEL memo for more information.

No variances were requested by the permittee.

Biosolids (Outfall 003)

Biosolids Type	Class B. Aerobically digested liquid biosolids.
Annual Production	Average of 3.0 metric tons, therefore annual biosolids monitoring recommended.
Pathogen Reduction	Met by reduction of fecal coliform.
Vector Attraction	Met by incorporation of biosolids when land applied.
Biosolids Storage	Adequate (55,000 gallons in storage structure plus storage in digester).
Radium in biosolids?	No.

Monitoring Requirements and Limitations

Parameter	Limit and/or Unit Type		Sample Frequency	Sample Type
	High Quality	Ceiling		
Solids, Total	Percent		Annual	Composite
Arsenic Dry Wt	41 mg/kg	75 mg/kg	Annual	Composite
Cadmium Dry Wt	39 mg/kg	85 mg/kg	Annual	Composite
Copper Dry Wt	1,500 mg/kg	4,300 mg/kg	Annual	Composite
Lead Dry Wt	300 mg/kg	840 mg/kg	Annual	Composite
Mercury Dry Wt	17 mg/kg	57 mg/kg	Annual	Composite
Molybdenum Dry Wt		75 mg/kg	Annual	Composite
Nickel Dry Wt	420 mg/kg	420 mg/kg	Annual	Composite
Selenium Dry Wt	100 mg/kg	100 mg/kg	Annual	Composite
Zinc Dry Wt	2,800 mg/kg	7,500 mg/kg	Annual	Composite
PCB Total Dry Wt	10 mg/kg	50 mg/kg	Once *	Composite
Nitrogen, Total Kjeldahl	Percent		Annual	Composite
Nitrogen, Ammonium (NH ₄ -N) Total	Percent		Annual	Composite
Phosphorus, Total	Percent		Annual	Composite
Phosphorus, Water Extractable	% of Tot P		Annual	Composite
Potassium, Total Recoverable	Percent		Annual	Composite

* The PCB analysis should be conducted during the second year of the reissued permit.

Changes from previous permit: None

Compliance Schedules

None necessary.

Other Comments

Influent Loading – The influent composite sampler was moved as part of the plant upgrade in 2015. A new influent flow meter was also installed and the effluent meter was replaced. Data collected since start-up of the new facility indicates increases in plant loading (see chart at the end of this report). This may be due to past monitoring under representing the load or current monitoring not being representative. Once more data is collected it may be necessary to review the monitoring procedures.

Phosphorus – The need for Water Quality based effluent limits for phosphorus was evaluated as part of preparation of the June 21, 2013 WQBEL memo. It was determined that limits were not necessary at this time however there were some concerns for downstream impacts as well as impacts to the wetland itself. For that reason monthly phosphorus monitoring was recommended. There is potential for a phosphorus limit to be imposed in the future therefore it would be advantageous for the Village to maximize treatment efficiency. To protect the wetland it would also be advantageous to reduce the flow to the treatment plant. The chart at the end of this report indicates an upward trend in flow as well as some fluctuations. The Village should be looking at its collection system to reduce infiltration and inflow.

Permit End Date

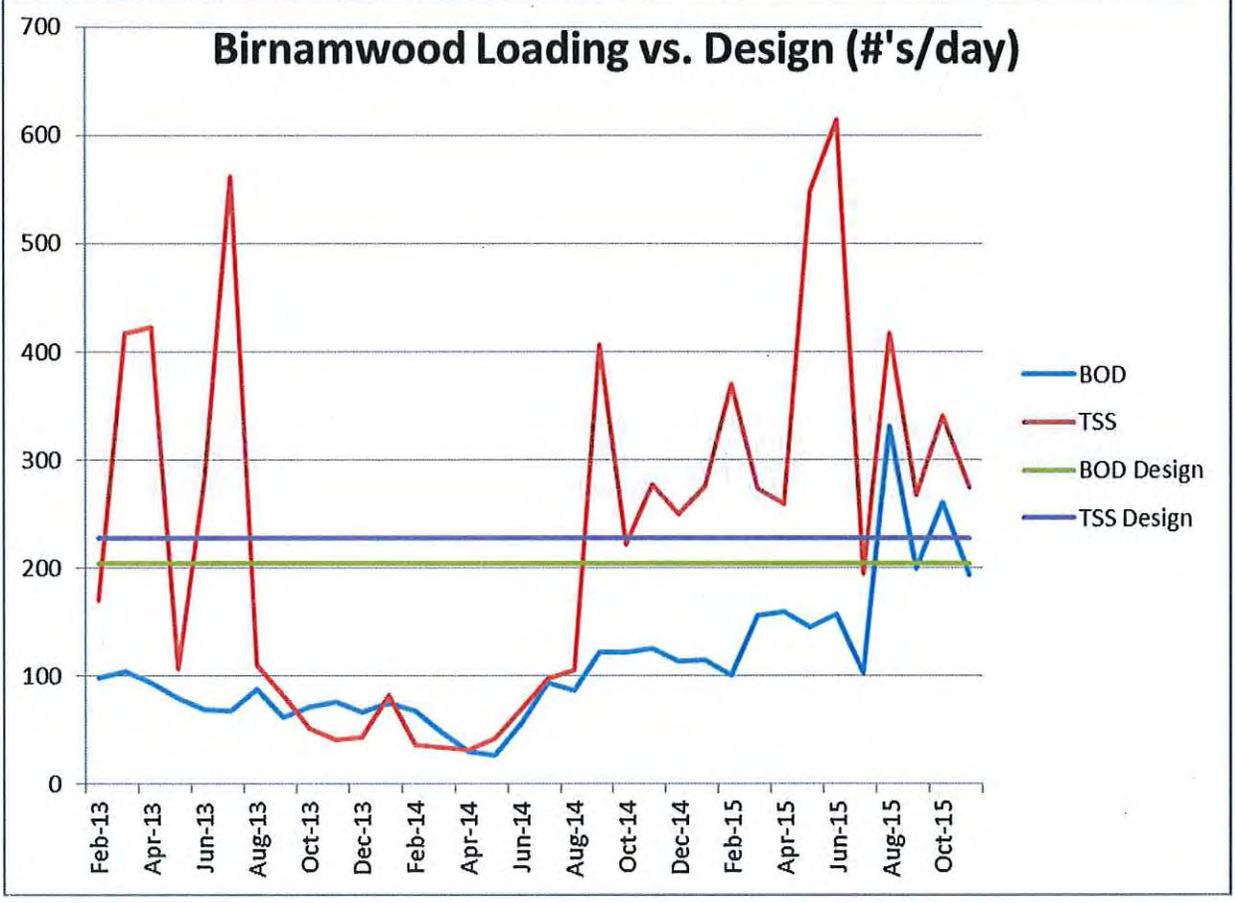
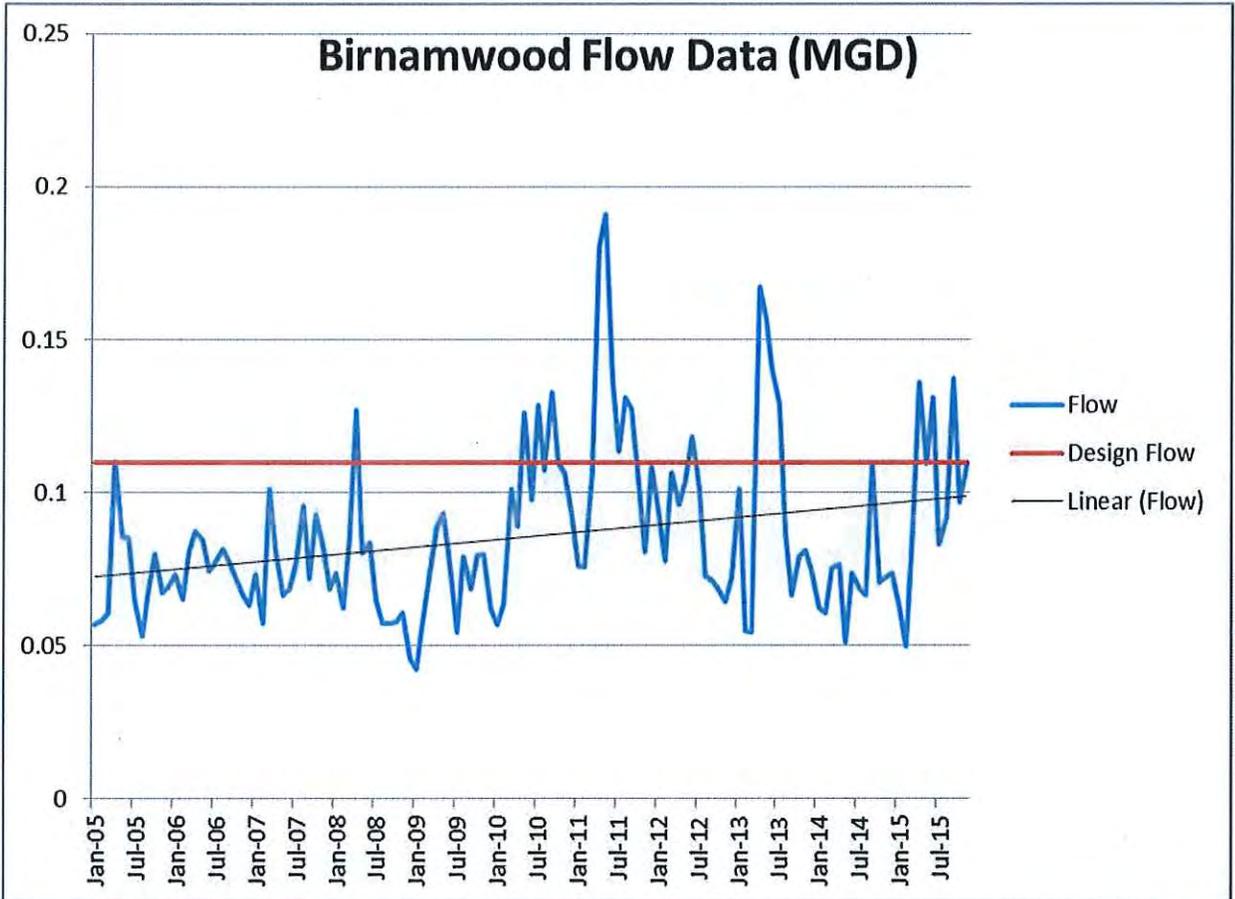
Five years after reissuance.

Prepared by



Bruce S Oman
715-582-5012

Date January 19, 2016



CORRESPONDENCE / MEMORANDUM

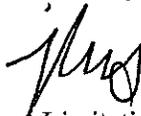
State of Wisconsin

DATE: June 21, 2013

FILE REF: 3200

TO: Dick Sachs – East District / Green Bay

FROM: Jim Schmidt – WQ/3



SUBJECT: Water Quality-Based Effluent Limitations for Birnamwood Wastewater Treatment Facility (WPDES Permit # WI-0022691)

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 Birnamwood 's discharge to a wetland tributary to Railroad Creek. This facility is located in the "Middle and South Branches Embarrass River Watershed" (WR11) in the Wolf River basin. The evaluation of the permit recommendations is discussed in more detail in the attached report. Based on our review, the following recommendations are made on a chemical-specific basis for Outfall 002:

<u>Substance</u>	<u>Effluent Limitations</u>
BOD5	20 mg/L monthly average, 30 mg/L weekly average
Total Susp. Solids	20 mg/L monthly average, 30 mg/L weekly average
Dissolved Oxygen	4.0 mg/L daily minimum
pH	6.0 – 9.0 s.u. daily range
Temperature	Monitoring only, May – November for one year
Total Phosphorus	Monitoring only, once per month
Ammonia:	
April	15 mg/L monthly average, 39 mg/L weekly average
May	15 mg/L monthly average
June – September	6.7 mg/L monthly average, 17 mg/L weekly average
October	No limits
November – March	27 mg/L weekly average

The attached report also contains a daily maximum limit table for ammonia with variable limits based on effluent pH. This table is not recommended at this time, but may be used as a reference point for future establishment in permits depending on reported effluent ammonia and pH variability.

The permittee has the option of postponing the remaining thermal monitoring until after the plant upgrade is completed. After the results of the remainder of the year of monitoring are submitted, the Department shall re-evaluate the need for permit limits based on protection of the wetland and/or downstream water bodies.

Along with the chemical-specific recommendations mentioned above, acute and chronic whole effluent toxicity testing is recommended for this permittee with four tests (batteries of acute and chronic tests) each in the first year following completion of the treatment plant upgrade, and one more again during the fourth year of the upcoming permit term. 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: Bruce Oman – East District / Peshtigo

**Water Quality-Based Effluent Limitations for
Birnamwood WWTF
WPDES Permit # WI-0022691
Prepared by:
Jim Schmidt - WQ/3**

Existing Permit Limitations (WPDES Permit # WI-0022691-08, effective October 1, 2008 and expiring June 30, 2013):

Outfall 002: Currently effluent from an activated sludge plant, although plant is being upgraded

<u>Substance</u>	<u>Effluent Limitations</u>
BOD5	20 mg/L monthly average, 30 mg/L weekly average
Total Susp. Solids	20 mg/L monthly average, 30 mg/L weekly average
Dissolved Oxygen	4.0 mg/L daily minimum
pH	6.0 – 9.0 s.u. daily range
Ammonia:	
April	15 mg/L monthly average, 39 mg/L weekly average
May	15 mg/L monthly average
June – September	6.7 mg/L monthly average, 17 mg/L weekly average
October	No limits
November – March	27 mg/L weekly average

No changes are recommended in the limits for BOD5, Total Suspended Solids, Dissolved Oxygen, ammonia and pH at this time since the receiving water classification has not changed; limits for those parameters were provided in an August 25, 2011 planning limit letter from myself to Jerry Dorriott (representing the SEH engineering consultant firm). This report shall address evaluations of any other detected substances from the most recent WPDES permit application.

Information for Permit Reissuance Evaluation:

Receiving Water Information

Name: Wetland tributary to Railroad Creek (WBIC = 5011352 for tributary stream, 309500 for Railroad Creek)

Classification: Discharge is to a wetland classified as a Limited Aquatic Life waterbody. The wetland's outlet (about ¼ mile from the outfall) is an un-named tributary to Railroad Creek; the tributary is classified as a Limited Forage Fish community. Just over 1/2 mile below that point, the tributary flows into Railroad Creek, which is classified as a Class 1 trout stream (Coldwater Community) and therefore is considered to be an Exceptional Resource Water. Total distance from the outfall to Railroad Creek is approximately one mile. None of these waters are classified as public water supplies.

NOTE: For bioaccumulative chemicals of concern (BCCs), criteria are based on a classification as a coldwater community and public water supply since this permittee is located in the Great Lakes basin. However, no BCCs were detected in the discharge.

Flows:

 (Wetland and Railroad Creek tributary) Background flow is zero
 Railroad Creek)
 7Q10 = 0.40 cfs
 7Q2 = 0.66 cfs

Source of background concentration data = Not needed in wetland and tributary due to zero flow.
Background concentrations for Railroad Creek = Embarrass River and branches in Shawano County for

hardness, Wolf River at Langlade (nearby site) for everything else. Note that chloride background levels aren't needed because the criteria are the same in all waterbodies, meaning the most stringent limits will be in the wetland with zero background flow.

Background results used in limit calculations:

<u>Substance</u>	<u>Result</u>	<u>Substance</u>	<u>Result</u>
Cadmium	0.083 ug/L	Chromium	0.125 ug/L
Copper	0.26 ug/L	Lead	0.182 ug/L
Zinc	0.631 ug/L	Hardness	183 PPM

Effluent Information

Actual Flow (10/1/2008 – 4/30/2013)*:

Peak daily =	0.331 MGD (5/6/2011)
Peak 7-day average =	0.231 MGD (8/4 – 8/10/2011)
Peak 30-day average =	0.195 MGD (4/30 – 5/29/2011)
Peak 365-day average =	0.122 MGD (2/15/2011 – 2/14/2012)

* A daily flow of 0.814 MGD was reported on 1/11/2013, which would normally represent the peak daily flow. However, it is assumed this is a typographical or transcription error since flows near this were never reported on other days. In fact, on the days surrounding 1/11, reported flows were in the 0.065 – 0.1 MGD range, so it was assumed the value on 1/11/2013 was 0.0814 MGD rather than 0.814 MGD. Peak values were determined accordingly.

Proposed Design Flow for Upgraded Treatment Facility:

Peak annual average =	0.11 MGD
Peak monthly average =	0.201 MGD
Peak weekly average =	0.209 MGD
Peak daily =	0.341 MGD

Acute dilution factor used = Not applicable

Effluent concentration data:

Substances tested:

During current permit term = Daily maximum temperature (addressed later in this report), ammonia November and December 2012 data from WPDES permit application = chloride, hardness, phosphorus, copper, arsenic, cadmium, chromium, lead, nickel, zinc

Results:

For the substances reported in the permit application, non-detected substances include arsenic, cadmium, chromium, lead and nickel. Limits won't be needed for those since there is no reasonable potential for exceedance of water quality criteria. A single test result was reported for zinc; that result is summarized below alongside calculated zinc limits. Multiple results are available for the remaining substances and are summarized as follows:

Date	Chloride (mg/L)	Hardness (PPM)
11/7/2012	180	370
11/12/2012	180	340
11/13/2012	180	340
11/14/2012		340
11/18/2012	190	
Mean	182.5	347

Date	Phosphorus (mg/L)	Date	Phosphorus (mg/L)	Date	Phosphorus (mg/L)
11/7/2012	1.8	11/19/2012	2.0	12/4/2012	1.3
11/12/2012	2.1	11/25/2012	2.0	12/10/2012	1.6
11/14/2012	2.0	11/27/2012	2.0	12/11/2012	1.6
11/18/2012	2.0	12/3/2012	2.1	12/12/2012	1.7

Mean = 1.85 mg/L
 1-day P99 = 2.51 mg/L
 4-day P99 = 2.16 mg/L
 30-day P99 = 1.96 mg/L

Date	Copper (ug/L)	Date	Copper (ug/L)	Date	Copper (ug/L)
11/7/2012	8.1	11/18/2012	7.8	11/26/2012	16
11/12/2012	7	11/19/2012	6.4	11/27/2012	20
11/13/2012	7.4	11/20/2012	7.2	11/28/2012	12
11/14/2012	6.5	11/25/2012	14		

Mean = 10.22 ug/L
 1-day P99 = 25.37 ug/L
 4-day P99 = 16.74 ug/L
 30-day P99 = 12.33 ug/L

Because of the large number of ammonia results, only the mean and P99s are summarized here.

Ammonia:

of Results = 235 (all detects)
 Mean = 9.30 mg/L
 Maximum = 27.4 mg/L (12/18/2012)
 1-day P99 = 28.11 mg/L
 4-day P99 = 17.28 mg/L
 30-day P99 = 11.82 mg/L

NOTE: In reality, the ammonia data didn't need to be summarized since facility planning limits were already calculated for the plant upgrade (no change from current permit). The ammonia results are, therefore, provided merely for informational purposes.

"P99" values above represent the 99th upper percentile values calculated using the procedures in s. NR 106.05(5) when 11 or more detected results are available.

Effluent Limit Summary

Only the detected substances are evaluated here. Concentrations are in units of ug/L unless noted otherwise. Limits are provided below based on protection of the wetland. Where criteria are more stringent in the downstream waters, those limits are evaluated as well.

DAILY MAXIMUM LIMITS based on ACUTE TOXICITY CRITERIA

Substance	Crit- erion	Effl. Limit	1/5 of Limit	Effluent Concentrations		
				Mean	P99	Max.
Chloride (mg/L)	757	1514	302.80	182.5		190
Copper	50.26 *	100.52			25.37	20
Zinc	344.68	689.36	137.87	30		

* - Acute criteria are based on an effluent hardness of 347 PPM for copper, and since that exceeds the application threshold for zinc in Table 2A of ch. NR 105, a hardness of 333 PPM for zinc.

WEEKLY AVERAGE LIMITS based on CHRONIC TOXICITY CRITERIA – Limited Aquatic Life

<u>Substance</u>	<u>Crit- erion</u>	<u>Effl. Limit</u>	<u>1/5 of Limit</u>	<u>Effluent Concentrations</u>	
				<u>Mean</u>	<u>P99</u>
Chloride (mg/L)	395	395	79	182.5	
Copper	30.05 *	30.05			16.74
Zinc	344.68 *	344.68	68.94	30	

* - Chronic criteria are based on an effluent hardness of 347 PPM because no dilution flow is provided from background. The 347 PPM basis applies for copper, and since that exceeds the application threshold for zinc in Table 2A of ch. NR 105, a hardness of 333 PPM is used for zinc.

WEEKLY AVERAGE LIMITS based on CHRONIC TOXICITY CRITERIA – Coldwater Community

<u>Substance</u>	<u>Crit- erion</u>	<u>Effl. Limit</u>	<u>1/5 of Limit</u>	<u>Effluent Concentrations</u>	
				<u>Mean</u>	<u>P99</u>
Copper	17.36 *	27.41			16.74
Zinc	204.20	323.81	64.76	30	

* - Chronic criteria for Railroad Creek are based on an estimated receiving water hardness of 183 PPM.

Since there is a non-zero streamflow in Railroad Creek, the chronic toxicity-based limit for chloride will be higher than that in the wetland, meaning the wetland limit is the most protective.

No evaluations were needed based on wildlife, human threshold, or human cancer criteria because none of the substances with those criteria were detected at Birnamwood.

Permit Recommendations:

A weekly average limit is potentially needed for chloride because the mean effluent concentration of 182.5 mg/L exceeds 1/5 of the weekly average limit. However, pursuant to s. NR 106.85(3), the need for chloride limits shall be based upon comparison of the limit to the 99th upper percentile (P99) value. One is not available based on 2012 data since only four results are reported. Either additional chloride monitoring should be recommended to get the 11 detects which enable a P99 value calculation, or previously reported data can be used if the results are still representative of the current discharge. The following table summarizes the data available from the previous two limit evaluations, based on one result from 2007 and eleven from 2002. As the results are similar to those reported in 2012, the databases can be combined.

Sample Date	Chloride mg/L	Sample Date	Chloride mg/L	Sample Date	Chloride mg/L
08/08/2002	120	08/21/2002	180	09/06/2002	150
08/12/2002	130	08/24/2002	170	10/18/2002	230
08/15/2002	140	08/27/2002	160	10/22/2002	220
08/18/2002	120	09/03/2002	110	09/20/2007	150

Combining these twelve results and the four from 2012, P99 values could be calculated.

# of Results =	16 (all detects)	Mean =	163.12 mg/L
Maximum =	230 mg/L (10/18/2002)	1-day P99 =	260.57 mg/L
4-day P99 =	207.72 mg/L	30-day P99 =	178.45 mg/L

The maximum and 1-day P99 values are still far below the daily maximum limit of 1,514 mg/L, but more importantly the 4-day P99 of 207.72 mg/L is below the weekly average limit of 395 mg/L in the wetland. As a result, chloride limits are not required at Birnamwood, and no limits or monitoring are recommended for inclusion in the reissued permit.

Other Evaluations:

Temperature) For a discharge to a limited aquatic life waterbody, the effluent limit in s. NR 106.56(4) is 86°F. However, that section of the code separates out wetlands. In ss. NR 106.55(4) and 106.56(7), narrative standards require protection of the wetland on a case-by-case basis but the limits are not to exceed 120°F. Birnamwood has done some thermal monitoring so far under the provisions of ch. NR 106. Monitoring began at the end of November, 2012 and has continued through April, 2013. That data has shown the following:

Month	Calculated Peak Weekly Average Temp. (°F)	Peak Daily Temperature (°F)
November	NA *	60.35
December	58.82	64.13
January	60.49	68.06
February	51.93	58.8
March	52.2	58.1
April	52.84	60.9

* - Not applicable, only three days of testing were done in November so not enough results to calculate a weekly average.

The above temperatures do not jump out as being obvious major concerns here. The January numbers may be a little higher than what is expected in a wetland during the winter, but whether or not this is a problem has yet to be confirmed.

There may also be a need to assess potential downstream impacts below the wetland, but given the distances involved and with these results being during colder months, it's likely that these temperatures will be even closer to typical seasonal ambient levels by the time the flow reaches the Railroad Creek tributary stream as well as Railroad Creek itself.

Finally, there is also the issue of the plant upgrade and whether or not the above results will be representative of future conditions. Given all of this, the recommendation is for Birnamwood to complete its year of thermal monitoring as originally requested by the Department (May – November), but if Birnamwood wants to wait on the remainder of the sampling until the upgrade is completed, that would also be an acceptable option. After the remaining thermal data is submitted, the Department will re-evaluate the results to determine if permit limits or additional monitoring are needed.

Ammonia: As noted earlier, no changes are recommended to the facility planning limits. However, it is noted from the effluent data submitted during the current permit term that effluent pH has varied from a low of 6.9 s.u. on 1/10/2012 to a high of 8.98 s.u. on 4/12/2012. Ammonia is more toxic at higher pH values (resulting in tighter effluent limits). Over the reported effluent pH range, equivalent daily maximum ammonia limits would vary from 4.2 mg/L at pH 8.98 up to 120 mg/L at pH 6.90 based on criteria for Limited Aquatic Life streams. In comparison, effluent ammonia at Birnamwood has also varied greatly during the current permit term, from 0.09 mg/L in September of 2010 up to 27.4 mg/L in December of 2012. When the 27.4 mg/L value was reported, though, the effluent pH was only around 7.5 which is equivalent to a daily limit of 61 mg/L, meaning there was no apparent acute ammonia

toxicity-based water quality issue at that time. Given the variation in both parameters, though, it may be advisable for the Department and/or the permittee to consider a variable pH/daily maximum limit table for inclusion in the permit. For Birnamwood's discharge, such a table would look like the following:

Daily Maximum Ammonia Nitrogen (NH₃-N) Limits
Limited Aquatic Life

Effluent pH - s.u.	NH ₃ -N Limit - mg/L	Effluent pH - s.u.	NH ₃ -N Limit - mg/L
pH ≤ 7.7	No Limit	8.3 < pH ≤ 8.4	12
7.7 < pH ≤ 7.8	37*	8.4 < pH ≤ 8.5	9.9
7.8 < pH ≤ 7.9	31*	8.5 < pH ≤ 8.6	8.2
7.9 < pH ≤ 8.0	26*	8.6 < pH ≤ 8.7	6.8
8.0 < pH ≤ 8.1	21*	8.7 < pH ≤ 8.8	5.7
8.1 < pH ≤ 8.2	18	8.8 < pH ≤ 8.9	4.8
8.2 < pH ≤ 8.3	15	8.9 < pH ≤ 9.0	4.1

* During the months of May through October if the pH is less than or equal to 8.1 there is no daily maximum limit for NH₃-N for municipal WWTF's treating primarily domestic wastewater. Under s. NR 106.33(2), municipal permits do not need ammonia limits when the calculated limits are above 20 mg/L in May – October or 40 mg/L in November – April. Limits shown in the table above with an asterisk* apply from November through April only.

Although the above table is not required at this time, it is provided for informational or advisory purposes because ammonia and pH conditions in the discharge may change from the above assessment once the treatment plant upgrade is completed. Therefore, the table can be used as a tool to determine permit limit needs in the future depending on effluent variability for both ammonia and pH.

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 Birnamwood contains no technology-based phosphorus limit of 1.0 mg/L monthly average. The following table summarizes annual average effluent flows and phosphorus concentrations over recent years.

Calendar Year	Annual Average Effluent Flow (MGD)	Annual Average P Concentration (mg/L)	Estimated Annual Total P Loading (lbs/year)
2008	0.0713	0.36 *	78
2009	0.0712	0.36 *	78
2010	0.101	0.36 *	111
2011	0.119	0.36 *	130
2012	0.0872	1.85	492

* - Phosphorus was not tested in Birnamwood's effluent between 2008 and 2011. The average concentration assumed for those years was set equal to the most recent year before 2008 with effluent data, which was an annual average of 0.36 mg/L in 2007 (calculated from the permit reissuance application that year).

Annual loadings are below 150 pounds per month or 1,800 pounds per year, so no technology-based limit is recommended for Birnamwood at this time.

Phosphorus – Water Quality Based: Revisions to the administrative rules for phosphorus discharges took effect on December 1, 2010. These revisions require an evaluation of the need for water quality based effluent limits. For Birnamwood, the new rules specify a water quality criterion (WQC) for phosphorus of 75 ug/L pursuant to s. NR 102.06(3)(b) downstream of the wetland in both the Railroad Creek tributary and Railroad Creek itself, since these are not among the listed streams in s. NR 102.06(3)(a). As for the wetland itself, no water quality criteria are applicable for either wetlands or any stream with the Limited Aquatic Life classification, pursuant to s. NR 102.06(6)(c) and (d).

Several potential concerns are evident here, though. First, effluent test results have shown a five-fold increase in the 2012 data from those most recently reported in 2007. It is not clear if this increase is a function of increased inputs in the community, the existing treatment plant being 5 years older, seasonal variation (2012 results were from the months of November and December while the 2007 results were from the months of September and October), or any combination thereof.

Along with the issue of effluent concentrations, though, is the issue of potential impacts on downstream uses in the Railroad Creek system, since the criterion applicable below the wetland is 0.075 mg/L. The following text regarding phosphorus is copied from the August 25, 2011 planning limit letter from myself to Jerry Dorriott.

“The receiving water at the discharge point is classified as limited aquatic life and the criteria in s. NR 102.06 do not apply to limited aquatic life waters [s. NR 102.06 (6) (d)]. These waters were not included in the USGS/WDNR stream and river studies and, therefore, the Department lacked the technical basis to determine and propose applicable criteria. At some time in the future, the Department may adopt phosphorus criteria based on new studies focusing on limited aquatic life waters. Draft guidance suggests that during the interim, water quality based effluent limitations should be based on the criteria and flow conditions for the next stream segment downstream (or downstream lake or reservoir, if appropriate). However, at Birnamwood the recent patterns of effluent diffusion suggest the downstream impacts are not likely to be an issue. This assessment is based on the recommendations for the other discharge parameters discussed above. As a result, no limits are recommended at this time, but this may change in the future based on not only the status of future studies on limited aquatic life waters in general as mentioned earlier in this paragraph, but also the wetland evaluation recommended for Birnamwood as a means of assessing the proposed discharge increase.”

The wetland evaluation showed no significant impact based on flow, but there is still the issue relating to the increased effluent concentration between 2007 and 2012. Although the effluent diffusion patterns mentioned above exist, the question is whether or not the apparent increase in loading is routine or just an isolated event.

As a result, it is recommended that the reissued permit include regular effluent phosphorus monitoring (as opposed to waiting until the next permit application). The proposed monitoring frequency is once per month to be consistent with other discharges of this size in the vicinity. Along with that, it is proposed that the Department consider adding Railroad Creek (and/or its tributary) to the list of instream monitoring projects for future years, as a way to verify the degree of influence that the discharge from Birnamwood has on downstream locations. Although this stream monitoring is not something required of Birnamwood, it's worth mentioning this recommendation in the hopes that we'll start having some valid current effluent data to associate with any future activities in the streams.

NOTE: The downstream monitoring may also be used to assess the need for ammonia limits based on downstream uses. This item may be considered along with the ammonia evaluation earlier in this report.

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 002 is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC₅₀ greater than 100% effluent.

Chronic WET: In order to assure that the discharge from outfall 002 is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC₂₅ 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 61% shown in the WET Checklist summary below was calculated according to the following equation:

$$IWC \text{ (as \%)} = 100 \times \frac{Q_e}{(1-f) Q_e + Q_s}$$

Q_e = annual average design flow for the upgraded treatment plant = 0.11 MGD = 0.17 cfs

f = fraction of the Q_e withdrawn from the receiving water = 0

Q_s = 1/4 of the 7Q₁₀ = 0.40 cfs / 4 = 0.10 cfs (7Q₁₀ of 0.40 cfs for Railroad Creek as it is the nearest downstream waterbody classified for fish and aquatic life uses)

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 002 shall be a grab sample collected from Railroad Creek, 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: See note below regarding representative data. Data from the previous permit term are summarized here, but are not used in RPF calculations for the reasons indicated below. Below is a tabulation of all available WET data for outfall 002.

Date Initiated	Acute Results LC ₅₀ (% survival in 100% effluent)				Chronic Results IC ₂₅					Footnotes
	<i>C. dubia</i>	Fathead minnow	Pass or Fail ?	Use in RPF ?	<i>C. dubia</i>	Fathead Minnow	Algae	Pass or Fail ?	Use in RPF ?	
8/7/2012	100	100	Pass		78.2	29.8		Fail		
9/25/2012					19.5	25.5				Retest
11/27/2012					40	34.4				Retest

RPF = Reasonable Potential Factor

Representative Data. Efforts have been made to insure that decisions about WET monitoring and limits have been made based on representative data. Data which is thought to no longer be representative of the discharge being evaluated have not been included in RPF calculations. Test results are assumed not to be representative of the discharge after the treatment plant is upgraded (completion anticipated in 2014). Past test failures along with high results reported for BOD5, TSS, and ammonia are contributing factors to the need for the treatment plant upgrade.

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. 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>).

Because of the plant upgrade, testing is not recommended until after the upgrade is completed. Rather than fill out the checklist based on past information that may no longer be representative of the discharge, testing recommendations will be made based on the conditions that may have contributed to the upgrade in the first place. There has been a history of ammonia limit exceedances here based on primarily chronic toxicity criteria, as well as the potential for levels of other pollutants contributing to the whole effluent toxicity test failures in 2012. The actual cause(s) of toxicity have not yet been identified, and additionally there appears to be a changing nature in toxicity based on the results reported in 2012 (prior to the upgrade) which may suggest multiple toxicant sources. Based on these various issues, and after consultation with the Department's biomonitoring program coordinator, it is recommended that additional toxicity testing be performed following completion of the plant upgrade. To that end, it is recommended that quarterly acute and chronic tests be done in the first year following completion of the upgrade (following consideration of any start-up period) to determine whether toxicity is still evident and if it varies throughout the year. One acute and one chronic test battery shall also be recommended in the fourth year of the permit. That schedule will enable any retesting to be accommodated within the permit term if necessary. 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). Given the lack of industrial contributors, the lack of need for permit limits on other parameters based on acute or chronic toxicity criteria, and the discharge being to a tributary to Railroad Creek rather than a direct discharge, hopefully this amount of testing should be sufficient to define any post-upgrade toxicity issues.



DATE: March 23, 2016
TO: File
FROM: Richard Sachs
SUBJECT: Birnamwood WWTF Sludge Monitoring for Radium-226

The Department's Drinking Water System was reviewed for Radium-226 results from the Birnamwood Waterworks. The most recent results therein for Wells #3 & 4 are from April 2, 2009 and September 3, 2014, as summarized in the table below.

Date	Well #3	Well #4
April 2, 2009	Non-detect	4.07
September 3, 2014	Non-detect	3.42

According to pumping results provided by the Village of Birnamwood to the Department, Wells #3 and 4 are used on a split-duty basis to provide approximately equal volumes of water to the Village.

Department guidance recommends that sludge monitoring requirements for Radium-226 be included in WPDES permits for municipal wastewater treatment facilities when the Radium-226 activity level in the water supply exceeds 2 pCi/L. Based upon the well monitoring results for Radium-226 and the usage of the Village of Birnamwood's two wells, the Department has determined that the Radium-226 activity level in the Village's water supply may exceed 2 pCi/L. Accordingly, the Department is recommending that a sludge monitoring requirement for Radium-226 be included in the reissued WPDES permit for the Birnamwood WWTF (Permit No. WI-0022691-09-0).

CORRESPONDENCE / MEMORANDUM**State of Wisconsin**

DATE: April 6, 2016

TO: Dick Sachs – East Water District / Green Bay

FROM: Jim Schmidt – WY/3 

SUBJECT: UPDATED Water Quality-Based Effluent Limitations for Temperature at the Birnamwood Wastewater Treatment Facility (WPDES Permit # WI-0022691)

The purpose of this memo is to update the effluent limit recommendations for temperature that were made in my memo to you dated June 21, 2013. In that document, monitoring was recommended for the months of May through November during one year because at the time, data had only been reported for the months of December through April. In order to make a determination of whether there was a reasonable potential for this discharge to exceed thermal water quality standards in May through November, monitoring was recommended.

This information has now been submitted, and based on the results, **neither thermal limits nor monitoring are recommended in Birnamwood's effluent as part of the reissued permit.** Daily maximum temperature data are now available for the periods of November 28, 2012 through July 31, 2013 and October 8, 2013 through December 9, 2013. Over that period, the maximum daily temperature reported to the Department was 68.06°F on January 11, 2013. The calculated effluent limitation for Birnamwood is 86°F year-round, pursuant to s. NR 102.245(3)(c) since this is a discharge to a water body classified for limited aquatic life that is not an effluent channel or wetland. Since the reported temperatures are all far below the 86°F limit, permit limits won't be needed.

Two issues come out of this database, though. First, it seems a little curious that the highest effluent temperature would come during the coldest month of the year, but it is possible the high result from January of 2013 may be an outlier. There was a period for about three days (January 11 – 13) that the reported temperatures were in the range of 63 to 68°F, but for the rest of the winter the temperatures were several degrees lower. Overall, the results are similar to temperatures reported at other municipal facilities in that part of the state, so again given that the results are all far below the limits this isn't really a concern. Second, it is noted that with the gap in data, no results were available for the months of August and September. Given that the temperatures for the months of July and October were all in the range of 57 to 63°F, it is possible that a warmer August and September could have occurred, but again the results are so far below the limit that it seems unlikely that temperatures would be 25 degrees higher in those months than in surrounding months. Again, comparing this information with nearby municipal facilities also having temperature data supports this assumption.

Based on all of this, there is no need for thermal limits or monitoring in the reissued permit. No changes are recommended to limits for other parameters based on this evaluation.

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

cc: Bruce Oman – East District / Peshtigo