State Form 4336

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
INDIANAPOLIS

OFFICE MEMORANDUM

Date: March 8, 2013
Thru: Jerry Dittmer, Chief
Municipal NPDES Permits Section
John Elliott (Permits Branch)

To: Leigh Voss
Permits Branch

From: Gurdeo Sondhe
Industrial NPDES Permits Section

Subject: Antidegradation analysis WLA Report for the Upgrade of Carriage Estates III WWTP, Tippecanoe County, (IN0043273, WLA001954)

In a request by letter dated January 21, 2013, Mr. Edward Serowka, President, Lakeland InnovaTech requested that water quality-based effluent limitations (WQBELs) be updated for the Carriage Estates III WWTP February 2, 2012 WLA Report. This update is required to determine effluent limitations for various parameters that will not cause a significant lowering of water quality for antidegradation purposes.

The facility could not get construction permit from the Facility Construction Section (IDEM) for the expansion of the plant. The Facility Construction Section required facility to add additional CSBR tanks. The consultant/facility has decided to convert the existing CSBR system to a conventional plug flow activated sludge system by converting the CSBR basins into aeration only tanks and construction of new final sludge clarifiers and replacing chlorination/dechlorination system with **ultraviolet disinfection**. American Suburban Utilities operates Carriage Estates III WWTP. With these proposed modifications, the design flow will increase from 1.5 mgd to 6.8 mgd.

The receiving stream of the facility is Indian Creek, a tributary to the Wabash River, which has a Q7, 10 flow of 0.1 cfs. Indian Creek is covered under Rule 327 IAC 2-1, and designated for full-body contact recreation and shall be capable of supporting a well-balanced, warm water aquatic community. The proposed design flow used in the WLA analysis is 6.8 mgd.

Indian Creek (Assessment Unit INB0832_00) is not on the 2008 303(d) list. A TMDL for Indian Creek in 14 Digit HUC (05120108030020) is not done and no other TMDL is currently in progress.

The U.S. EPA Simplified steady-state mathematical water quality model was used to simulate instream water quality for dissolved oxygen (February 2, 2012 WLA Report). Based on present available information/data, WQBELs for cBOD5, ammonia-N, and DO are included in Table 1.

An antidegradation analysis was done for ammonia-N, since this pollutant is considered a regulated pollutant for antidegradation purposes, and the WQBELs at the increased design flow would result in increased loadings to Indian Creek. Antidegradation analysis for total residual chlorine was not considered as facility is going to replace the *existing chlorination/ dechlorination facility with ultraviolet disinfection* system.

The mass limits for Ammonia-N in Table 1 are greater than the existing mass limits so there will be an increase in the loading of this pollutant at the increased design flow. Therefore, antidegradation does apply to this pollutant. The result of the antidegradation analysis for ammonia-N is included in Table 2. The results show that the WQBELs for ammonia-N during the summer and winter cause a significant lowering of water quality for ammonia-N.

If the WQBELs for summer and winter for ammonia-N were pursued, an antidegradation demonstration would be required for ammonia-N. Effluent limits that do not cause a significant lowering of water quality for ammonia-N are also included in Table 2. An antidegradation demonstration would not be required if these limits are accepted.

The benchmark available loading capacity for ammonia-N for future antidegradation de minimis determinations under 327 IAC 2-1.3-4 is 74.3 lbs/day for summer and 142 lbs/day for winter. The documentation of the wasteload allocation analysis is included as an attachment.-

GSS/gss
Attachments

TABLE 1
Water Quality-based Effluent Limitations
For Carriage Estates III WWTP in Tippecanoe County
Outfall 001 to the Wabash River via Indian Creek
(IN0043273, WLA001954)

Parameter	Quality or Concentration*				Quantity or Loading*			Monthly Sampling Frequency
	Monthly Average	Daily Maximum	Daily Average	Units	Monthly Average	Daily Maximum	Units	
CBOD5				mg/l	851		lbs/day	
Summer	15			mg/l	1419		lbs/day	
Winter	25							
Dissolved Oxygen			6.0	mg/l				
Summer			5.0	mg/l				
Winter								
Total Ammonia (as N)				mg/l	91		lbs/day	30
Summer	1.6			mg/l	170		lbs/day	30
Winter	3.0							

3/8/2013

* Based on an average design flow of 6.8 mgd.

TABLE 2
Results of Antidegradation Procedure for Non-BCCs
For Carriage Estates III WWTP in Tippecanoe County
Outfall 001 to the Wabash River via Indian Creek
Proposed Average Design Flow of 6.8 mgd
(IN0043273, WLA001954)

Parameter	High Quality Water ?	Proposed Effluent Limits Cause a Significant Lowering?	Effluent Limits that Do Not Require an Antidegradation Demonstration					
			Quality or Concentration			Quantity or Loading		
			Monthly Average	Daily Maximum	Units	Monthly Average	Daily Maximum	Units
Total Ammonia (as N)								
Summer	Yes	Yes	1.2		mg/l	68		lbs/day
Winter	Yes	Yes	1.8		mg/l	102		lbs/day

3/8/2013

Documentation of Wasteload Allocation Analysis For Discharges in the Non-Great Lakes System

Analysis By: Gurdeo Sondhe
Date: March 8, 2013

Reviewed By: John Elliott
Permit Writer: Leigh Voss
WLA Number: WLA001954
Previous WLA Reports: Carriage Estates III WWTP August 2011, February 2012 WLA Reports

Facility Information

(Attachment 1)

- **Name:** Carriage Estates III WWTP
- **NPDES Permit Number:** IN0043273
- **Permit Expiration Date:** January 31, 2016
- **County:** Tippecanoe
- **Purpose of Analysis:** WLA analysis is for the upgrade of the facility.

Existing Type of Treatment: Class III, 1.5 mgd, sequential batch reactor wastewater treatment plant consisting of: lift stations, inlet coarse screens, four sequential batch reactor tanks, two sludge holding lagoons, chlorination/ dechlorination facilities, post aeration, and an effluent flow meter. Final sludge is aerobically digested and land applied by an outside contractor. The collection system is comprised of 100% separate sanitary sewers by design with no overflow or bypass points.

- **Outfall Number:** 001
- **Average Design Flow for WLA Analysis:** 6.8 mgd
- **Current Effluent Limits:** Effluent limitations (Carriage Estate III WWTP) for conventional parameters are based on the average design flow of 1.5 mgd.

Parameter	Summer (Monthly Average)		Winter (Monthly Average)	
	(mg/l)	(lbs/day)	(mg/l)	(lbs/day)
cBOD5	14	175.2	25	312.9
TSS	17	212.8	30	375.5
Ammonia-N	1.3	16.3	1.9	23.8
Dissolved Oxygen	6.0 Daily Minimum		5.0 Daily Minimum	
Total residual Chlorine	0.01 Monthly Average		0.02 Daily Maximum	

Pollutants of Concern

Parameters	Reason for Inclusion on Pollutants of Concern List
cBOD5	Requested by the permit writer/consultant
Ammonia-N	Requested by the permit writer/consultant
Dissolved Oxygen	Requested by the permit writer/consultant
Total residual Chlorine	Requested by the permit writer/consultant

Receiving Stream Information

- **Receiving Stream:** Indian Creek a tributary to the Wabash River
- **Drinking Water System Intake Downstream:** None
- **Designated Stream Use:** Indian Creek is covered under Rule 327 IAC 2-1, and designated for full-body contact recreation and shall be capable of supporting a well-balanced, warm water aquatic community
- **14 Digit HUC:** (05120108030020) [Indian Creek-Tippecanoe County]
- **Assessment Unit (2008):** INB0832_00
- **2008 303(d) List:** Indian Creek (Assessment Unit INB0832_00) is not on the 2008 303(d) list.
- **TMDL Status:** A TMDL for Indian Creek in 14 Digit HUC (05120108030020) is not done and no other TMDL is currently in progress.
- **Q7, 10 (Outfall):** 0.1 cfs (Receiving Stream: Indian Creek)
  16.4 sq.mi. (Drainage area u/s of outfall location-Indian Creek)

  Partial USGS Gaging Station 03335682 Indian Creek (Q7,10 = 0.1 cfs and Drainage Area = 29.0 sq.miles), near Green Hill in Tippecanoe County.

  The information for the above gaging station for calculating Q7,10 flow of the receiving stream was obtained from the book entitled Low-Flow Characteristics of Indiana Streams by Kathleen Fowler and John T. Wilson published in 1996 by the USGS.

Being a partial USGS gaging station, Q1, 10 and Q30, 10 flows used in the analysis were same as Q7, 10 low flow of the Indian Creek. USGS StreamStats web site used for determination of drainage area upstream of the outfall.

- **Q1,10 (Outfall):** 0.1 cfs
- **Q30,10 (Outfall):** 0.1 cfs

- **Nearby Dischargers:** There are no dischargers in the area that would have a significant impact on this wasteload allocation.

Ammonia-N and cBOD5 Analyses

There are no instream data available to calculate the 75th percentile downstream pH and temperature. Therefore, summer/winter default pH values of 7.8/7.8 s.u and typical Central Indiana summer/winter temperature values of 24/10°C were used for the determination of ammonia-N criteria with default summer/winter background ammonia-N concentration values of 0.05/0.05 mg/l. The coefficient of variation used to calculate monthly average and daily maximum WQBELs was set equal to the default value of 0.6. The number of samples per month used to calculate monthly average WQBELs for ammonia-N was set equal to the value of 30 (Reference: Samples/Month are based on the ISBH Technical Release 71-3-R1 December 1971). The spreadsheet that was used to calculate the ammonia-N effluent limits is included in **Attachment 2**.

Dissolved Oxygen Analysis

The U.S. EPA Simplified steady-state mathematical water quality model was used to simulate instream water quality for ammonia-N, cBOD5 and dissolved oxygen. Detailed model was run for maximum design flow of 6.8 mgd **(Referred to February 2, 2012 WLA Report).**

A summary of the water quality-based effluent limitations for respective design flows that are protective of instream-dissolved oxygen are shown in the following table:

Water Quality-based Effluent Limitations Protective of Instream Dissolved Oxygen at a Design Flow of 6.8 mgd (Table 1)				
Parameter	**Summer (Monthly Average)**		**Winter (Monthly Average)**	
	(mg/l)	**(lbs/day)**	**(mg/l)**	**(lbs/day)**
cBOD5	15	851	25	1419
Ammonia-N	1.6	91	3.0	170
Dissolved Oxygen	6.0	Daily Average		5.0

Antidegradation Analysis for Non-BCCs

The proposed increase in average design flow will result in an increase in the monthly average loading limits for the regulated pollutants ammonia-N. Therefore, antidegradation was considered for ammonia-N.

High Quality Water Determination

High Quality Water Determination		
Pollutant	**High Quality Water? Yes/No**	**Rationale for Determination**
Ammonia-N	Yes	There are no data available for Indian Creek, but IDEM fixed station WB-303 is on Wabash River at confluence of Indian Creek-Wabash River (CR 700W). Data for this station is included in **Attachment 3**. Data shows that Wabash River is a high quality water for ammonia-N. Therefore, Indian Creek will be considered a high quality water for ammonia-N.

Significant Lowering Determination

A determination was made whether the proposed increased loading would cause a significant lowering of water quality based on the definition in 327 IAC 2-1.3-2(50). To cause a significant lowering, the proposed increased loading would have to result in an increase in the ambient concentration of the regulated pollutant in the receiving stream and be greater than a de minimis lowering of water quality, unless an exemption other than de minimis under 2-1.3-4 applies.

Increase in Ambient Concentration

An increase in the ambient concentration of the regulated pollutant in the receiving stream will occur if the increased loading results in a proposed downstream concentration of the regulated pollutant (C_{sp}) that is greater than the existing downstream concentration of the regulated pollutant (C_{se}). The following calculation was used to make this determination:

If $C_{sp} > C_{se}$, then there is a calculated increase in the downstream concentration of the regulated pollutant.

$$C_{sp} = \frac{(C_p * Q_p) + (C_b * Q_{s1})}{Q_p + Q_{s1}}$$ (Proposed downstream concentration of the regulated pollutant.)

$$C_{se} = \frac{(C_e * Q_e) + (C_b * Q_{s1})}{Q_e + Q_{s1}}$$ (Existing downstream concentration of the regulated pollutant.)

C_p = Proposed monthly average concentration limit (in mg/l).

C_e = Existing monthly average concentration limit (in mg/l).

Q_p = Proposed average design flow (in mgd).

Q_e = Existing average design flow (in mgd).

Q_{s1} = The stream design flow that is the basis of the minimum total loading capacity or, if there is no applicable water quality criterion, the Q7,10 flow (in mgd).

C_b = Background concentration used in the calculation of the WLA (in mg/l).

If $C_p = C_{se} + [(Q_{s1}/Q_p) * (C_{se} - C_b)]$, then there is not a calculated increase in the downstream concentration of the regulated pollutant.

De minimis Equations:

Total Loading Capacity (TLC) = (Stream Design Flow (mgd) + Existing Effluent Flow (mgd) + Proposed increase in Effluent Flow (mgd)) * Water Quality Criterion (mg/l) * 8.345

Used Loading Capacity (ULC) = Stream Design Flow (mgd) * Background Conc. (mg/l) * 8.345 + Existing Monthly Average Mass Limit (lbs/day)

Available Loading Capacity (ALC) = Total Loading Capacity (minimum for all applicable criteria) – Used Loading Capacity

Benchmark Available Loading Capacity = 0.9 * (ALC established at the time of the request for the initial increase in the loading of the regulated pollutant); this is the first increase under the new antidegradation rule so the Benchmark ALC was not used in the de minimis determination, but will be documented for any future increase of the regulated pollutant.

Results for Ammonia-N:

Ambient Concentration Increase:

The summer and winter limits are, not the same for both the existing and proposed discharges so separate calculations were done.

Summer

Cp = 1.6 mg/l; Ce = 1.3 mg/l; Qp = 6.8 mgd; Qe = 1.5 mgd; Qs1 = 0.1 cfs (0.0646 mgd) (the minimum TLC is based on the 30-day average chronic criterion for which the Q30,10 is the stream design flow); Cb = 0.05 mg/l

Csp = [(1.6 mg/l * 6.8 mgd) + (0.05 mg/l * 0.0646 mgd)]/ (0.0646 mgd + 6.8 mgd)

= 1.59 mg/l

Cse = [(1.3 mg/l * 1.5 mgd) + (0.05 mg/l * 0.0646 mgd)]/ (0.0646 mgd + 1.5 mgd)

= 1.25 mg/l

Csp > Cse so there is an ambient increase. To not cause an ambient increase, the following concentration limit would be required:

Cp = 1.25 mg/l + [(0.0646 mgd)/ (6.8 mgd)]*(1.25 mg/l – 0.05 mg/l)

= 1.2 mg/l (rounded down)

Winter

Cp = 3.0 mg/l; Ce = 1.9 mg/l; Qp = 6.8 mgd; Qe = 1.5 mgd; Qs1 = 0.1 cfs (0.0646 mgd) (the minimum TLC is based on the 30-day average chronic criterion for which the Q30, 10 is the stream design flow); Cb = 0.05 mg/l

Csp = [(3.0 mg/l * 6.8 mgd) + (0.05 mg/l * 0.0646 mgd)]/ (0.0646 mgd + 6.8 mgd)

= 2.97 mg/l

Cse = [(1.9 mg/l * 1.5 mgd) + (0.05 mg/l * 0.0646 mgd)]/ (0.0646 mgd + 1.5 mgd)

= 1.82 mg/l

Csp > Cse so there is an ambient increase. To not cause an ambient increase, the following concentration limit would be required:

Cp = 1.82 mg/l + [(0.0646 mgd)/ (6.8 mgd)]*(1.82 mg/l – 0.05 mg/l)

= 1.8 mg/l (rounded down)

De minimis Lowering of Water Quality:

Total Loading Capacity

A stream design flow for acute criteria is not specified in 327 IAC 5-2-11.1 so the Q1, 10 flow was used. The Q30, 10 is the stream design flow for chronic ammonia-N criteria.

Summer

Chronic Aquatic TLC = (0.0646 mgd + 6.8 mgdl) * 1.727 mg/l * 8.345

= 98.9 lbs/day

Acute Aquatic TLC = (0.0646 mgd + 6.8 mgd) * 12.14 mg/l * 8.345

= 695 lbs/day

Winter

Chronic Aquatic TLC = (0.0646 mgd + 6.8 mgd) * 3.182 mg/l * 8.345

= 182 lbs/day

Acute Aquatic TLC = (0.0646 mgd + 6.8 mgd) * 12.14 mg/l * 8.345

= 695 lbs/day

Used Loading Capacity

The minimum TLC is based on the chronic criterion so the Q30, 10 (0.0646 mgd or 0.1 cfs) was used.

Summer ULC = 0.0646 mgd * 0.05 mg/l * 8.345 + 16.3 = 16.3 lbs/day

Winter ULC = 0.0646 mgd * 0.05 mg/l * 8.345 + 23.8 = 23.8 lbs/day

Available Loading Capacity

Summer ALC = 98.9 lbs/day – 16.3 lbs/day = 82.6 lbs/day

Winter ALC = 182 lbs/day – 23.8 lbs/day = 158 lbs/day

10 % of Available Loading Capacity

Summer: 0.1 * 82.6 lbs/day = 8.26 lbs/day

Winter: 0.1 *158 lbs/day = 15.8 lbs/day

Proposed Increase in Mass

Summer: 91 lbs/day – 16.3 lbs/day = 74.7 lbs/day

Winter: 170 lbs/day – 23.8 lbs/day = 146 lbs/day

The proposed increase for summer is greater than 10% of the Available Loading Capacity. To be a de minimis lowering of water quality, the following mass and concentration limits would be required.

De minimis Lowering of Water Quality

Summer Mass: 16.3 lbs/day + 8.26 lbs/day = 24.6 lbs/day

Summer Mass = 24 lbs/day (rounded down)

Summer Concentration: (24 lbs/day)/ (6.8 mgd * 8.345) = 0.42 mg/l

Winter Mass: 23.8 lbs/day + 15.8 lbs/day = 39.6 lbs/day

Winter Mass = 39 lbs/day (rounded down)

Winter Concentration: (39 lbs/day)/ (6.8 mgd * 8.345) = 0.68 mg/l

Limits that will not Cause a Significant Lowering:

The less stringent of the limits that will not cause an increase in the ambient concentration and the de minimis limits can be accepted to not cause a significant lowering of water quality. In this case, the limits that will not cause an increase in the ambient concentration are less stringent.

Effluent Flow = 6.8 mgd

Monthly Average Summer Concentration: 1.2 mg/l

Monthly Average Summer Mass: 68 lbs/day

Monthly Average Winter Concentration: 1.8 mg/l

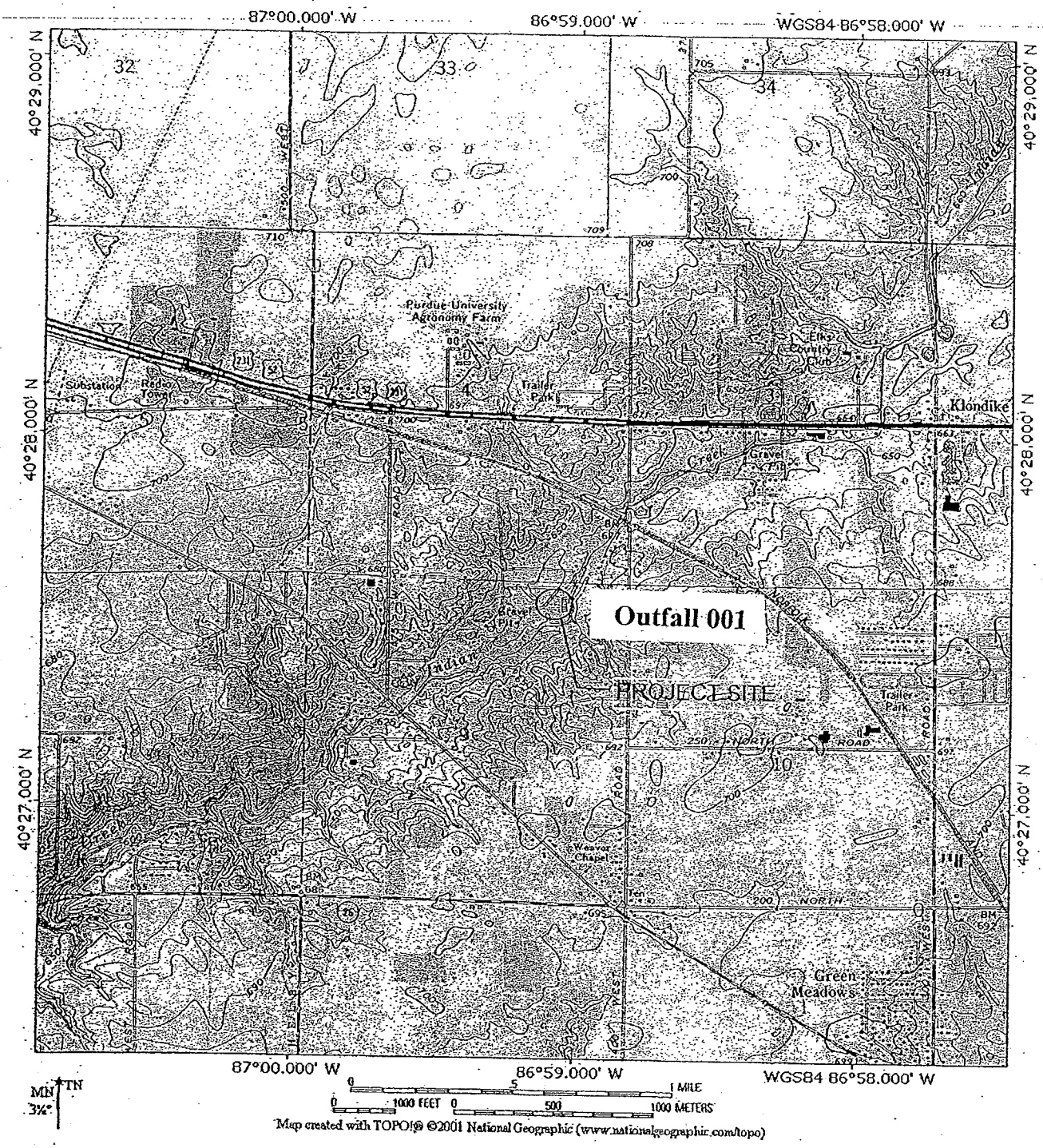
Monthly Average Winter Mass: 102 lbs/day

Benchmark Available Loading Capacity:

Summer: 0.9 * 82.6 lbs/day = 74.3 lbs/day

Winter: 0.9 * 158 lbs/day = 142 lbs/day

Attachment 1



TOPOGRAPHIC
CARRIAGE III ESTATES WWTP
4100 BRIDGEWAY DRIVE
WEST LAFAYETTE, IN 47906

ATTACHMENT 2

Calculation of Preliminary Effluent Limitations for Discharges in the Non-Great Lakes System (Excluding Discharges to the Ohio River)

General Information	
Facility Name:	Carriage Estates III WWTP
County:	Tippecanoe
NPDES Number:	IN0043273
WLA Number:	001954
WLA Report Date:	3/8/2013
Outfall:	001
Receiving Stream:	Wabash River via Indian Creek

Ambient Downstream Water Quality Characteristics		
Acute Ammonia-N		
Summer pH (75th percentile)	=	7.8 s.u.
Winter pH (75th percentile)	=	7.8 s.u.
Chronic Ammonia-N		
Summer Temperature (75th percentile)	=	24 C
Summer pH (75th percentile)	=	7.8 s.u.
Winter Temperature (75th percentile)	=	10 C
Winter pH (75th percentile)	=	7.8 s.u.

Receiving Stream Questions (Yes or No)	
Acute Mixing Zone Allowed?	No
Public Water System (PWS) Intake Downstream?	No
Put-and-Take Trout Fishing?	No
Fish Early Life Stages Present?	Yes

Effluent Flow		
	=	6.8 mgd

Receiving Stream Design Flows		
Q7,10 (Outfall)	=	0.1 cfs
Q7,10 (Public Water System Intake)	=	cfs
Q30,10 (Outfall)	=	0.10 cfs
Q50 (Outfall)	=	cfs
Q50 (Public Water System Intake)	=	cfs

Mixing Zone Dilution			
Dilution Factor (for acute mixing zo	=		
		Dilution Fraction	**Flow**	**Location**
Chronic Aquatic Life (Except Ammc	=	50%	Q7,10	Outfall
Chronic Aquatic Life (Ammonia Onl	=	50%	Q30,10	Outfall
Human Noncancer Drinking Water	=	100%	Q7,10	PWS Intake
Human Noncancer Nondrinking Wat	=	50%	Q7,10	Outfall
Human Cancer Drinking Water	=	100%	Q50	PWS Intake
Human Cancer Nondrinking Water	=	25%	Q50	Outfall
Public Water Supply	=	100%	Q7,10	PWS Intake

Source of Criteria [1]							Background (Outfall) (ug/l)	Background (Intake) (ug/l)	Remove Mixing Zone? (Yes or Blank)	Samples/ Month	CV	Facility Specific CV? (Yes or No)	CAS Number	Parameters	Indiana Water Quality Criteria for the Non-Great Lakes System (ug/l)							Preliminary Effluent Limitations					
															A	B	C	D	E	F	G						
															Aquatic Life Criteria		Human Health		Human Health		PWS	Concentration (ug/l)		Mass (lbs/day)		Criteria Type	Basis
A	B	C	D	E	F	G									Acute (AAC)	Chronic (CAC)	Drinking (HNC-D)	Non drinking (HNC-N)	Drinking (HCC-D)	Non drinking (HCC-N)	(WC)	Average	Maximum	Average	Maximum		
													7664424	Total Ammonia (as N)													
														Summer	12138.81	1726.88						1600	4200	91	240	Tier I	CAC
2	2						50			30	0.6	No		Winter	12138.81	3182.28						3000	7800	170	440	Tier I	CAC
2	2						50			30	0.6	No															

[1] Source of Criteria
1) Indiana numeric water quality criterion in 327 IAC 2-1-6(a)(3), Table 6-1.
2) Acute (1-hour average) and chronic (30-day average) criteria for total ammonia nitrogen in "1999 Update of Ambient Water Quality Criteria for Ammonia," EPA-822-R-99-014, December 1999.

[2] The monthly average PEL was set equal to the most stringent WLA because the calculated monthly average PEL exceeded the most stringent WLA and a facility specific CV was not determined.

Last revised: October 15, 2009

Downstream Station Selected : WB-303, (WLV030-0003), Wabash River (05120108030030), CR 700 W, Near Lafayette, Tippecanoe County

ATTACHMENT 3

Nitrogen, Ammonia (mg/L)			Year-Round	Summer	Winter
Sample Date	Lab Value				
8/20/2007	S<	0.1	0.05	0.05	
9/25/2007	S<	0.1	0.05	0.05	
10/9/2007	S<	0.1	0.05	0.05	
11/26/2007	S		0.5	0.5	
12/11/2007	W<	0.1	0.05		0.05
1/7/2008	W<	0.1	0.05		0.05
2/14/2008	W		0.1		0.1
3/11/2008	W<	0.1	0.05		0.05
4/2/2008	W<	0.1	0.05		0.05
5/28/2008	S<	0.1	0.05	0.05	
6/24/2008	S<	0.1	0.05	0.05	
7/29/2008	S<	0.1	0.05	0.05	
8/26/2008	S<	0.1	0.05	0.05	
9/23/2008	S<	0.1	0.05	0.05	
10/28/2008	S<	0.1	0.05	0.05	
11/19/2008	S<	0.1	0.05	0.05	
12/22/2008	W<	0.1	0.05		0.05
1/26/2009	W<	0.1	0.05		0.05
2/10/2009	W		0.2		0.2
3/11/2009	W<	0.1	0.05		0.05
4/29/2009	W<	0.1	0.05		0.05
5/13/2009	S<	0.1	0.05	0.05	
6/1/2009	S<	0.1	0.05	0.05	
7/15/2009	S<	0.1	0.05	0.05	
8/19/2009	S<	0.1	0.05	0.05	
9/8/2009	S<	0.1	0.05	0.05	
10/7/2009	S<	0.1	0.05	0.05	
11/2/2009	S<	0.1	0.05	0.05	
12/7/2009	W<	0.1	0.05		0.05
1/4/2010	W<	0.1	0.05		0.05
2/22/2010	W<	0.1	0.05		0.05
3/24/2010	W<	0.1	0.05		0.05
4/12/2010	W<	0.1	0.05		0.05
5/20/2010	S<	0.1	0.05	0.05	
6/1/2010	S<	0.1	0.05	0.05	
7/26/2010	S<	0.1	0.05	0.05	
8/25/2010	S<	0.1	0.05	0.05	
9/7/2010	S<	0.1	0.05	0.05	
10/21/2010	S<	0.1	0.05	0.05	
11/8/2010	S<	0.1	0.05	0.05	
12/13/2010	W<	0.1	0.05		0.05
1/4/2011	W		0.1		0.1
2/24/2011	W		0.1		0.1
3/7/2011	W<	0.1	0.05		0.05
4/11/2011	W<	0.1	0.05		0.05
5/4/2011	S<	0.1	0.05	0.05	
6/6/2011	S<	0.1	0.05	0.05	
7/19/2011	S<	0.1	0.05	0.05	
8/15/2011	S<	0.1	0.05	0.05	
9/26/2011	S<	0.1	0.05	0.05	
10/24/2011	S<	0.1	0.05	0.05	
11/30/2011	S<	0.1	0.05	0.05	
12/13/2011	W<	0.1	0.05		0.05
1/24/2012	W<	0.1	0.05		0.05
2/16/2012	W<	0.1	0.05		0.05
3/5/2012	W<	0.1	0.05		0.05
4/17/2012	W<	0.1	0.05		0.05
5/1/2012	S<	0.1	0.05	0.05	
6/12/2012	S<	0.1	0.05	0.05	
7/17/2012	S<	0.1	0.05	0.05	

pH (Field) (SU)		Year-Round	Summer	Winter
Sample Date				
9/25/2007	S	8.24	8.24	
10/9/2007	S	8.54	8.54	
11/26/2007	S	8.66	8.66	
12/11/2007	W	8.38		8.38
1/7/2008	W	8.49		8.49
2/14/2008	W	8.01		8.01
3/11/2008	W	8.3		8.3
4/2/2008	W	7.92		7.92
5/28/2008	S	8.31	8.31	
6/24/2008	S	8.33	8.33	
7/29/2008	S	8.2	8.2	
8/26/2008	S	8.45	8.45	
9/23/2008	S	8.34	8.34	
10/28/2008	S	8.8	8.8	
11/19/2008	S	9	9	
12/22/2008	W	8.47		8.47
1/26/2009	W	8.33		8.33
2/10/2009	W	8.03		8.03
3/11/2009	W	8.18		8.18
4/29/2009	W	8.19		8.19
5/13/2009	S	8.15	8.15	
6/1/2009	S	8.44	8.44	
7/15/2009	S	8.32	8.32	
8/19/2009	S	7.94	7.94	
9/8/2009	S	8.31	8.31	
10/7/2009	S	8.68	8.68	
11/2/2009	S	8.21	8.21	
12/7/2009	W	8.62		8.62
1/4/2010	W	9.09		9.09
2/22/2010	W	8.43		8.43
3/24/2010	W	8.46		8.46
4/12/2010	W	8.35		8.35
5/20/2010	S	8.5	8.5	
6/1/2010	S	7.96	7.96	
7/26/2010	S	8.11	8.11	
8/25/2010	S	8.39	8.39	
9/7/2010	S	8.41	8.41	
10/21/2010	S	8.71	8.71	
11/8/2010	S	8.84	8.84	
12/13/2010	W	8.44		8.44
1/4/2011	W	8.25		8.25
2/24/2011	W	8.35		8.35
3/7/2011	W	8.42		8.42
4/11/2011	W	8.29		8.29
5/4/2011	S	7.86	7.86	
6/6/2011	S	7.67	7.67	
7/19/2011	S	8.58	8.58	
8/15/2011	S	8.19	8.19	
9/26/2011	S	8.4	8.4	
10/24/2011	S	8.5	8.5	
11/30/2011	S	8.46	8.46	
12/13/2011	W	8.66		8.66
1/24/2012	W	8.24		8.24
2/16/2012	W	8.37		8.37
3/5/2012	W	8.39		8.39
4/17/2012	W	8.57		8.57
5/1/2012	S	8.56	8.56	
6/12/2012	S	8.47	8.47	
7/17/2012	S	8.5	8.5	
8/20/2012	S	8.68	8.68	

Nitrogen, Ammonia (mg/L)		Summe	Winter
Samples	60	35	25
Minimum	0.05	0.05	0.05
Average	0.06	0.06	0.062
Maximum	0.5	0.5	0.2
STD_Deviation	0.06	0.08	0.03
CV	0.98	1.21	0.53
Percentile 50%			
Geometric MEAN	0.06	0.05	0.06

pH (Field) (SU)		Summer	Winter
Samples	60	35	25
Minimum	7.67	7.67	7.92
Average	8.4	8.4	8.4
Maximum	9.09	9	9.09
STD_Deviation	0.26	0.28	0.23
CV	0.03	0.03	0.03
Percentile 50%	8.4	8.4	8.4
Geometric MEAN			