WQBEL BIOLOGIST RECOMMENDATIONS

Ludington Waste Water Treatment Plant WWTP - (MI0021334- REISSUANCE)

PREPARED BY: Darrin McCullough

11/10/2020

Background

The City of Ludington submitted a National Pollutant Discharge Elimination System (NPDES) permit application in September 2020 for reissuance of the Ludington WWTP located in Ludington, Michigan, Mason County. The current NPDES permit was issued on September 24, 2015, took effect on October 1, 2015, and expired on October 1, 2020 but has been extended. The current NPDES permit authorizes to discharge treated municipal wastewater from Monitoring Point 001A through Outfall 001 to an unnamed oxbow wetland tributary to the Pere Marquette River at a design flow of 4.5 million gallons per day (MGD) (but this flow is not to be considered a limitation or actual capacity). The current NPDES permit also authorizes to discharge treated municipal wastewater from Monitoring Point 002A through Outfall 002. Outfall 002 discharges to the Pere Marquette River North Branch at a design flow of 4.5 million gallons per day (MGD) but is not to be considered a limitation or actual capacity. Outfall 002 is a new outfall location that began discharge in July 2018, replacing Outfall 001. Outfall 001 previously discharged to a no stream flow oxbow of the Pere Marquette River North Branch. The Pere Marquette River North Branch has a 95 percent exceedance, harmonic mean, and 90dQ10 low flows of 260, 460, and 290 cubic feet per second (cfs), respectively [EGLE Low Flow Database File No. 9518].

The Pere Marquette River North Branch near the Ludington WWTP is not designated as public drinking water supply source. The Pere Marquette River North Branch, which flows into Pere Marquette Lake, is a designated coldwater trout stream.

A receiving water body hardness of 150 milligrams per liter (mg/l) was used for this review and was collected upstream of Outfall 001 during a September 2009 Compliance Sampling Inspection (CSI). This hardness value is consistent with additional hardness samples collected in upstream locations of the Pere Marquette watershed as part of the Water Contaminant Monitoring Program (WCMP).

The 2020 Water Quality and Pollution Control in Michigan Sections 303(d), 305(b), and 314 Integrated Report indicates the Pere Marquette River North Branch (Assessment Unit ID (AUID) 040601010509-06) is Fully Supporting Water Quality Standards (WQS) for the Navigation, Industrial Water Supply, and Agriculture designated uses. The Pere Marquette River North Branch is Not Supporting the Fish Consumption designated use due to polychlorinated biphenyls (PCBs) in the fish tissue water column. All other designated uses are listed as not assessed or insufficient information. A Total Maximum Daily Load (TMDL) for PCBs was developed in 2008.

A search of available information for endangered, threatened, or sensitive species for the Pere Marquette River North Branch near Outfall 002 and downstream Pere Marquette Lake found the following aquatic species identified as endangered, threatened, or sensitive species:

Common Name	Scientific Name	Status	Date Last Observed
Paper pondshell	*Utterbackia imbecillis*	Special Concern	Historical
Pickerel frog	*Lithobates palustris*	Special Concern	Historical

Sources

Sources of information used for this review to develop the WQBELs include the facility's NPDES permit reissuance application, the current NPDES permit, the Permits Section Toxics facility file, discharge monitoring report data from October 2015 through November 2020, a September 2009 Compliance Sampling Inspection, and United States Geological Survey topographical maps. Based upon our review of this information, we have the following recommendations:

Recommendations

1) We recommend the conditions in the current NPDES permit in Part I.A.1 for Monitoring Point 001A, Outfall 001 to be removed from the draft NPDES permit as the facility no longer discharges through Outfall 001.

2) The current NPDES permit includes a daily monitoring requirement for final effluent flow for Outfall 002. Final effluent flow ranged from 0.0 MGD to 5.9 MGD, averaging 2.3 MGD. Final effluent flow exceeded the 4.5 MGD design flow on 26 days during the period of this review. **Based on this information, we recommend the current daily monitoring and reporting requirement of final effluent flow be retained in the draft permit.**

3) The current NPDES permit includes daily minimum and maximum pH limits of 6.5 to 9.0 Standard Units (S.U.) measured daily as grab samples. Levels of pH in the Outfall 002 final effluent ranged from 5.9 to 7.7 S.U., averaging 6.7 S.U. The daily minimum pH limit was exceeded on 3 days during the period of this review. **Based on this information, we recommend the current daily monitoring requirements be retained in the draft permit with daily minimum and maximum pH limits of 6.5 to 9.0 S.U.**

4) The current NPDES permit includes a daily maximum final effluent concentration limit for total residual chlorine of 0.038 mg/l with compliance monitoring collected as daily grab samples. Total residual chlorine concentrations in the Outfall 002 final effluent ranged from non-detect [QL < 0.01 milligrams per liter (mg/l)] to 0.03 mg/l. Based on this information, we recommend the current daily monitoring requirements as well as the daily maximum final effluent limit of 0.038 mg/l for total residual chlorine be retained in the draft permit. However, we recommend the final effluent limit be changed to 38 micrograms per liter (ug/l).

5) The current NPDES permit includes a daily maximum final effluent concentration limit for total copper of 61 ug/l, a monthly average concentration limit of 20 ug/l, a daily maximum loading limit of 2.3 pounds per day (lbs/day), and a monthly average loading limit of 0.8 lbs/day with compliance monitoring collected as monthly 24-hour composite samples. Concentrations of total copper ranged from 4.8 ug/l to 48 ug/l, averaging 12 ug/l. Based on this information, there is not a reasonable potential for total copper to be discharged in exceedance of Michigan WQS. **We recommend the current limits and monitoring requirements for total copper be removed from the draft permit but included in the Additional Monitoring Requirements in the draft permit.**

    a. It appears the current permit limits and loading requirements for total copper are based on the discharge from Outfall 001 to the no stream flow oxbow of the Pere Marquette River North Branch. As Outfall 001 has been decommissioned and Outfall 002 discharges directly to the Pere Marquette River North Branch, there is not a reasonable potential for total copper to be discharged in exceedance of Michigan WQS.

6) The current NPDES permit includes a Whole Effluent Toxicity (WET) daily maximum limit of 1.0 acute toxicity units (TUa) and a monthly average limit of 6.6 chronic toxicity units (TUc) for *Ceriodaphnia dubia (C. dubia)* and fathead minnow with monthly compliance monitoring on both organisms. Acute toxicity for all testing events for *Ceriodaphnia dubia* (*C. dubia*) were reported as 0.0 TUa. Chronic toxicity for *C. dubia* ranged from 0.0 TUc to 1.7 TUc. Acute toxicity for all testing events for fathead minnow were reported as 0.0 TUa. Chronic toxicity for fathead minnow ranged from 0.0 TUc to 1.7 TUc. Based on this information, there is not a reasonable potential for the Outfall 002 final effluent to be acutely and/or chronically toxic to aquatic organisms. **We recommend the draft NPDES permit remove the current permit limits and monitoring requirements for fathead minnow and include WET testing requirements in the Additional Monitoring Requirements with testing conducted on fathead minnow for a total of four tests. Additionally, based on persistent low level chronic toxicity to *C. dubia*, we recommend the draft NPDES permit include a quarterly compliance monitoring requirement for *C. dubia*.**

    a. Testing and reporting requirements shall follow procedures contained in EPA-821-R-02-013, "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to

Freshwater Organisms (Fourth Edition). Samples for WET shall be collected as 24-hour composite samples.

b. The current permits chronic toxicity limit of 6.6 TUc was based on a design flow of 7.5 MGD.
c. The allowable level of chronic toxicity, based on the requested 4.5 MGD design flow, would be 10.3 TUc.
d. We do not recommend monitoring frequency reduction language be included in the draft permit to develop an adequate dataset for the next permit cycle.

7) The current NPDES permit includes a monthly average total phosphorus concentration limit of 1.0 mg/l with 5X weekly compliance monitoring as a 24-hour composite sample. In addition, the current permit includes a monthly average loading limit of 29 lbs/day. Outfall 002 is located immediately upstream of Pere Marquette Lake. Concentrations of total phosphorus in the Outfall 002 final effluent ranged from 0.2 to 2.2 mg/l, averaging 0.75 mg/l. Loading of total phosphorus ranged from 3.0 to 65 lbs/day, averaging 13 lbs/day. The monthly average concentration limit and the monthly average loading limit were never exceeded during the period of this review. **Based on this information and to protect the Pere Marquette River and Pere Marquette Lake from excessive nutrients, we recommend the current 5X weekly monitoring requirements for total phosphorus as well as the current monthly average concentration limit of 1.0 mg/l and the monthly average loading limit of 29 lbs/day be retained in the draft permit.**

   a. The current loading limit of 29 lbs/day has been in the facility's NPDES permit for multiple permit cycles.

   b. We recommend retaining the current loading limit of 29 lbs/day as the facility has regularly met this loading limit and to also ensure continued protection of Pere Marquette Lake from nutrient enrichment.

   c. We do not recommend monitoring frequency reduction language be included in the draft permit to develop an adequate dataset for the next permit cycle.

8) The current NPDES permit includes a Level Currently Achievable (LCA) 12-Month rolling average concentration limit of 3.0 nanograms per liter (ng/l) for total mercury and a 12-Month rolling average loading limit of 0.00011 lbs/day with compliance samples collected as quarterly grab samples. Part I.A.4. of the current NPDES permit also describes the requirements for the Pollutant Minimization Program (PMP) for total mercury. Concentrations of total mercury in the Outfall 001 and Outfall 002 final effluent from August 2015 to July 2020 ranged from non-detect (QL <0.5 ng/l) to 3.2 ng/l. The 12-month rolling average concentration of total mercury as of July 2020 is 1.3 ng/l, which includes a non-detect of <0.5 ng/l. The non-detect value was entered as 0.5 ng/l to determine the current 12-month rolling average. Based on the final effluent data for total mercury, there is a reasonable potential for total mercury to be discharged from Outfall 002 at levels exceeding Michigan WQS. **Based on this information, we recommend the draft permit include a LCA 12-Month rolling average concentration limit of 2.0 ng/l for total mercury and a 12-Month rolling average loading limit of 0.00007 lbs/day.** Monitoring for total mercury shall be quarterly with samples collected as grab samples using USEPA method 1669 and analyzed using USEPA method 1631 with a quantification level of 0.5 ng/l. In addition, we recommend the PMP requirements be retained in the draft permit.

   a. Review of total mercury final effluent data and reasonable potential analysis was consistent with Water Resources Division, Policy and Procedure, WRD-004, Calculation of Level Currently Achievable (LCA) for Mercury in Proposed National Pollutant Discharge Elimination System (NPDES) Permits.

   b. The "n" value in the PEL Sheet was put at 4 instead of 30.

c. Quarterly monitoring is recommended as the facility has consistently demonstrated low concentrations of total mercury and compliance with the current LCA.

d. We do not recommend monitoring frequency reduction language be included in the draft permit to develop an adequate dataset for the next permit cycle.

e. The current loading limit of 0.00011 lbs/day is based on the current design flow of 4.5 MGD.

f. The loading limit of 0.00007 lbs/day is based on the current design flow of 4.5 MGD and an LCA of 2.0 ng/l.

9) The current NPDES permit does not include a monitoring requirement for Perfluorooctanoic Acid (PFOA). However, effluent samples have been collected as part of the ongoing IPP initiative to identify and reduce sources of PFAS from municipal WWTPs. Concentrations of PFOA were reported to range from non-detect (QLs ranged from <6.1 ng/l to <8.0 ng/l) to 8.88 ng/l. Based on the available data, there is not a reasonable potential for PFOA to be discharged at concentrations exceeding Michigan WQS. Based on this information, we have no recommendations for PFOA.

    a. The theoretical WQBEL for PFOA is 210 ug/l (7.9 lbs/day) as a Monthly Average WQBEL and 15,000 ug/l (560 lbs/day) as a Daily Maximum WQBEL.

10) The current NPDES permit does not include a monitoring requirement for Perfluorooctane Sulfonate (PFOS). However, effluent samples have been collected as part of the ongoing IPP initiative to identify and reduce sources of PFAS from municipal WWTPs. Ludington WWTP was required to sample for PFOS biannually since October of 2018. Levels of PFOS in the final effluent ranged from non-detect (QLs ranged from <6.1 ng/l to <8.0 ng/l) to 6.6 ng/l. Based on this information, there is a reasonable potential for PFOS to be discharged at levels exceeding Michigan WQS.

    a. Based on the available data, the facility would fall into Bin 2 of the Municipal NPDES Permitting Strategy for PFOS and PFOA. As such, we recommend a twice annual monitoring requirement with appropriate trigger language consistent with the Municipal NPDES Permitting Strategy for PFOS and PFOA.

    b. After the submittal of 60 months of monthly data or at least 10 equally spaced data points over a minimum of 3 months, the permittee may request, in writing, Department approval of a reduction in monitoring frequency for PFOS. This request shall contain an explanation as to why the reduced monitoring is appropriate.

The recommendations contained herein are based on the Part 4 Water Quality Standards and Part 8 Water-Quality Based Effluent Limit Development for Toxic Substances. Treatment methods or economic concerns have not been addressed. We understand that other considerations may be used in deciding permit limits and requirements.

All other data reviewed indicated there was not a reasonable potential for these parameters to be discharged at concentrations exceeding Michigan WQS. These data were either provided with the NPDES permit application or in the facility's Daily Monitoring Report (DMR) data. Parameters with results reported as all Not Detected were also reviewed. Based on this information, we have no recommendations for these parameters. Refer to the PEL sheet and permit application for a list of other parameters reviewed.

NPDES PERMIT REVIEW SUMMARY

Facility:	Ludington WWTP
Permit Number:	MI0021334
Reviewer:	Darrin McCullough
Date:	11/10/2020

Outf.	Authorized Flow mgd	cfs	Disch. Type *	Receiving Water	Lake?	FLOWS (cfs) 95% Exc.	H. Mean	90Q10	pH	Hardness
002	4.5	6.97	s	Pere Marquette River	☐	260.0	460.0	290.0	7	150

* P = Process; N = Noncontact Cooling; C = Contact Cooling; S = Sanitary; ST = Storm Water; GW = Groundwater Purge

SOURCES REVIEWED

TYPE OF REVIEW: (NPDES Permit Reissuance)

LOW FLOW FILE NO.: 9518

HARDNESS SOURCE: 2009 Compliance Sampling Inspection. Hardness samples not collected upstream during 2019 CSI.

PEL SHEET VERSION: 2/1/2020

Review the Following Information Sources

x **Permit Application**

x **Facility/VGW File**

x **MiWaters Documents & Files**

x **Current Permit**

WTA's

Staff Report #'s

x **WET Tests**

Other

REASONABLE POTENTIAL: CHEMICAL SPECIFIC (p. 1 of 2)

*concentration values in ug/L except as noted

Facility:	Ludington WWTP	Hardness:	150 mg/L CaCO3
Outfall:	2	pH:	7
Date:	11/10/2020	Drinking Water:	n

Parameter	CAS #	Water Quality Values										Diss. Met. Translator	Background Conc.
		FCV	vd	HNV	vd	HCV	vd	WV	vd	FAV	vd		
Mercury @	7439976	0.77	1199707	0.0018	1199707	NA	0	0.0013	1199707	2.8	1199707	1	**
Copper	7440508	12.66403219	1199707	38000	1200512	NA	0	NA	0	39.38345326	1199707	1.5	4
Perfluorooctane sulfonate @	1763231	140	2201408	0.012	1201403	NA	0	NA	0	1600	2201408	1	0
Perfluorooctanoic acid	335671	880	2201007	12	1201105	NA	0	NA	0	15000	2201007	1	0
Boron	7440428	7200	1201511	330000	1201511	NA	0	NA	0	69000	1201511	1	0
Barium	7440393	677.631923	2201912	470000	1202001	NA	0	NA	0	3842.599056	2201912	1	0
Nickel	7440020	73.28771162	1199707	210000	1199706	NA	0	NA	0	1319.677459	1199707	1.1	3
Selenium	7782492	5	1199707	2700	1199704	NA	0	NA	0	120	1199808	1	0
Zinc	7440666	166.5694535	1199707	16000	1200510	NA	0	NA	0	330.4359543	1199707	2.1	13
Acrylonitrile #	107131	66	2201010	320	1200708	1.2	1200708	NA	0	1200	2201010	1	0
Chloroform #	67663	630	2201501	11000	1201509	*	201509	NA	0	11000	1201509	1	0
Azobenzene #	103333	4.1	3201004	ID*	201004	6	2201004	NA	0	74	3201004	1	0
Pentachlorophenol #	87865	6.692583681	1199707	450	1199710	2.8	1199710	NA	0	17.44664176	1199707	1	0
Phenanthrene	85018	1.7	2201411	ID*	199706	NA	0	NA	0	11	2201411	1	0
Cyanide, free	57125	5.2	1199707	48000	1199707	NA	0	NA	0	44	1199707	1	0
Fluoranthene	206440	1.6	2201411	18	2199901	NA	0	NA	0	28	1201411	1	0
#N/A	1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

= Carcinogen

** = Background exceeds standards.

REASONABLE POTENTIAL: CHEMICAL SPECIFIC (p. 2 of 2)

**concentration values in ug/L except as noted; loads in lb/d*

Facility:	Ludington WWTP	Disch. Rate:	6.97 cfs	95% Ex. Flow:	260 cfs		Conc.	**Load (lbs/day)**
Outfall:	002			H. Mean Flow:	460 cfs	***Hg Loading Calculated based on LCA (ng/L) of :***	2	**0.00007506**
Date:	11/10/2020			90Q10 Flow:	290 cfs	***TP Loading based on concentration (mg/L) of :***	1	**37.53**

Parameter	Monthly Average PEL								Daily Max PEL		PEQ		DECISION	
	FCV	load	HNV	load	HCV	load	WV	load	conc	load	Avg	Max	Avg	Max
Mercury @	0.77	0.028898	0.0018	6.76E-05	NA	#VALUE!	0.0013	4.8789E-05	2.8	0.105084	PEQ>10 0.00165	0.002325	Reasonable Potential. Recommend LCA of 2.0 ng/l(0.000075 lbs/day). Quarterly monitoring.	
Copper	158.925841	5.964487	665271.742	24967.65	#VALUE!	#VALUE!	#VALUE!	#VALUE!	59.07518	2.217092	PEQ>10 14.17571	24.8991	No Reasonable Potential. Recommend removing limit and monitoring requireemnt from draft permit limits page. Include copper in Additional Monitoring requirements.	
Perfluorooctane sulfonate @	140	5.2542	0.012	0.00045	#VALUE!	#VALUE!	#VALUE!	#VALUE!	1600	60.048	0.017082	0.017082	Reasonable Potential. Bill 2 according to Municipal PFAS Strategy. 2X annual monitoring with trigger language.	
Perfluorooctanoic acid	9091.377778	341.1994	210.106667	7.885303	#VALUE!	#VALUE!	#VALUE!	#VALUE!	15000	562.95	0.023088	0.023088	No Reasonable Potential. No recommendations.	
Boron	74384	2791.632	5777933.33	216845.8	#VALUE!	#VALUE!	#VALUE!	#VALUE!	69000	2589.57	546	546	No Reasonable Potential. No recommendations.	
Barium	7000.690689	262.7359	8229177.78	308841	#VALUE!	#VALUE!	#VALUE!	#VALUE!	3842.599	144.2127	54.6	54.6	No Reasonable Potential. No recommendations.	
Nickel	804.8645076	30.20656	3676817.14	137990.9	#VALUE!	#VALUE!	#VALUE!	#VALUE!	1451.645	54.48024	18.2	18.2	No Reasonable Potential. No recommendations.	
Selenium	51.65555556	1.938633	47274	1774.193	#VALUE!	#VALUE!	#VALUE!	#VALUE!	120	4.5036	6.76	6.76	No Reasonable Potential. No recommendations.	
Zinc	3492.475371	131.0726	279927.607	10505.68	#VALUE!	#VALUE!	#VALUE!	#VALUE!	693.9155	26.04265	41.6	41.6	No Reasonable Potential. No recommendations.	
Acrylonitrile #	681.8533333	25.58996	5602.84444	210.2748	21.01067	0.78853	#VALUE!	#VALUE!	1200	45.036	0	0	No Reasonable Potential. Sufficiently sensitive QL. No recommendations.	
Chloroform #	6508.6	244.2678	192597.778	7228.195	#VALUE!	#VALUE!	#VALUE!	#VALUE!	11000	412.83	4.94	4.94	No Reasonable Potential. No recommendations.	
Azobenzene #	42.35755556	1.589679	#VALUE!	#VALUE!	105.0533	3.942652	#VALUE!	#VALUE!	74	2.77722	0	0	No Reasonable Potential. Sufficiently sensitive QL. No recommendations.	
Pentachlorophenol #	69.14182563	2.594893	7879	295.6989	49.02489	1.839904	#VALUE!	#VALUE!	17.44664	0.654772	0	0	No Reasonable Potential. Sufficiently sensitive QL. No recommendations.	
Phenanthrene	17.56288889	0.659135	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	11	0.41283	0	0	No Reasonable Potential. Sufficiently sensitive QL. No recommendations.	
Cyanide, free	53.72177778	2.016178	840426.667	31541.21	#VALUE!	#VALUE!	#VALUE!	#VALUE!	44	1.65132	31.2	31.2	No Reasonable Potential. No recommendations.	
Fluoranthene	16.52977778	0.620363	315.16	11.82795	#VALUE!	#VALUE!	#VALUE!	#VALUE!	28	1.05084	0	0	No Reasonable Potential. Sufficiently sensitive QL. No recommendations.	
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0		
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0		
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0		
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0	0		

** SILVER - Appropriate Dissolved Metal Translator must be entered in PEL 1*

PEQ -- Effluent Data Summary

(all values in ug/L)

DATA ENTRY

Parameter:	Mercury @	Source	Copper	Source	Perfluorooctane sulfonate @	Source	Perfluorooctanoic acid	Source	Boron	Source
No. Nondetect	**3**		**0**		**2**		**2**		**0**	
Data	0.0018	7/16/2020	48	9/14/2020	0.00657	6/21/2019	0.00888	6/21/2019	170	8/26/2019
	0.0011	1/16/2020	17	7/16/2020	0.00492	10/29/2018	0.00482	10/29/2018	180	3/20/2018
	0.0019	7/17/2019	16	6/22/2020					160	5/16/2017
	0.0018	1/22/2019	28	5/27/2020					210	10/14/2016
	0.00057	10/10/2018	27	4/20/2020						
	0.00097	7/17/2018	19	3/9/2020						
	0.00071	4/12/2018	13	1/16/2020						
	0.0009	1/23/2018	11	12/18/2019		Non-Detect		Non-Detect		
	0.00054	7/17/2017	21	11/25/2019		6/3/2020 QL < 6.14 ng/l		6/3/2020 QL < 6.14 ng/l		
	0.0032	4/10/2017	8.8	10/1/2019		12/19/2019 QL < 7.97 ng/l		12/19/2019 QL < 7.97 ng/l		
	0.0008	1/12/2017	9.7	9/26/2019						
	0.0006	10/13/2016	12	8/26/2019						
	0.0005	7/11/2016	6	7/16/2019						
	0.00063	4/12/2016	13	6/19/2019						
	0.00073	1/7/2016	10	5/20/2019						
	0.00078	10/5/2015	14	4/10/2019						
	0.0012	8/12/2015	14	3/10/2019						
			14	2/18/2019						
			15	1/21/2019						
			14	12/19/2018						
		Non-Detect	13	11/26/2018						
		QL < 5.0 ng/l	7.6	10/9/2018						
		10/10/2019	5.8	9/11/2018						
		4/10/2019	12	8/5/2018						
		10/10/2017	10	7/12/2018						
			9.1	6/11/2018						
			13	5/14/2018						
			12	4/12/2018						
			12	3/20/2018						
			8.7	2/14/2018						
			7.5	1/23/2018						
			12	12/20/2017						
			13	11/16/2017						
			5.7	10/9/2017						
			8	9/24/2017						
			7.4	8/16/2017						
			5.1	7/16/2017						
			4.8	6/15/2017						
			6.9	5/16/2017						
			13	4/10/2017						
			14	3/12/2017						
			13	2/12/2017						
			11	1/9/2017						
			20	12/14/2016						
			10	11/10/2016						

PEQ -- Effluent Data Summary
(all values in ug/L)

Parameter:	Barium	Source	Nickel	Source	Selenium	Source	Zinc	Source	Acrylonitrile #	Source	Chloroform #	Source	Azobenzene #	Source
No. Nondetect	**0**		**1**		**2**		**0**		**4**		**3**		**4**	
Data	12	8/26/2019	7	8/26/2019	1.4	8/26/2019	5.4	8/26/2019			1.9	8/26/2019		
	21	3/20/2018	6.2	3/20/2018	2.6	3/20/2018	16	3/20/2018						
	19	5/16/2017	5.6	5/16/2017			7.9	5/16/2017						
	15	10/14/2016					11	10/14/2016						
				Non-Detect QL <5.0 ug/l 10/14/2016		Non-Detect QL <1.3 ug/l 5/16/2017 10/14/2016				Non-Detect QL <10 ug/l 8/26/2019 3/20/2018 5/16/2017 10/14/2016		Non-Detect QL <1.0 ug/l 3/20/2018 5/16/2017 10/14/2016		Non-Detect QL <5 ug/l 8/26/2019 3/20/2018 5/16/2017 10/14/2016

PEQ -- Effluent Data Summary
(all values in ug/L)

Parameter:	Pentachlorophenol #	Source	Phenanthrene	Source	Cyanide, free	Source	Fluoranthene	Source	#N/A	Source	#N/A	Source	#N/A	Source
No. Nondetect	**4**		**4**		**1**		**4**		**0**		**0**		**0**	
Data					4.4	8/26/2019								
					4.8	5/16/2017								
					12	10/14/2016								
		Non-Detect		Non-Detect		Non-Detect		Non-Detect						
		QL <5 ug/l		QL <5 ug/l		QL <2.0 ug/l		QL <5 ug/l						
		8/26/2019		8/26/2019		3/20/2018		8/26/2019						
		3/20/2018		3/20/2018				3/20/2018						
		5/16/2017		5/16/2017				5/16/2017						
		10/14/2016		10/14/2016				10/14/2016						

PROJECTED EFFLUENT QUALITY ANALYSIS (<10 Detectable):

* all values in ug/l

	Mercury @	Copper	Perfluorooctane sulfonate @	Perfluorooctanoic acid	Boron	Barium	Nickel	Selenium	Zinc	Acrylonitrile #	Chloroform #	Azobenzene #	Pentachlorophenol #	Phenanthrene	Cyanide, free	Fluoranthene	#N/A	#N/A	#N/A	#N/A
Sample Max.	0.0019	48	0.00657	0.00888	210	21	7	2.6	16	0	1.9	0	0	0	12	0	0	0	0	0
Total Samples	12	9	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0	0	0	0
Multiplier	1.6	1.8	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	0	0	0	0
PEQ:	**0.00304**	**86.4**	**0.017082**	**0.023088**	**546**	**54.6**	**18.2**	**6.76**	**41.6**	**0**	**4.94**	**0**	**0**	**0**	**31.2**	**0**	**0**	**0**	**0**	**0**

PROJECTED EFFLUENT QUALITY ANALYSIS (>=10 Detectable):

PARAMETER:	Mercury @		Copper		Perfluorooctane sulfonate @		Perfluorooctanoic acid		Boron		Barium	
TOTAL NO. VALUES:	**20**		**58**		**4**		**4**		**4**		**4**	
DETECTED:	**17**		**58**		**2**		**2**		**4**		**4**	
NON-DETECTED:	**3**		**0**		**2**		**2**		**0**		**0**	
d (% data<detect)	0.15		0		0.5		0.5		0		0	
m (mean of data >detect)	0.001101765		12.03276		0.005745		0.00685		180		16.75	
std dev	0.000707268		6.79539		0.001167		0.002871		21.602469		4.0311289	
n	1	4	1	30	1	30	1	30	1	30	1	30
d^n	0.15	0.000506	0	0	0.5	9.31323E-10	0.5	9.31323E-10	0	0	0	0
p	0.941176471	0.949975	0.95	0.95	0.9	0.95	0.9	0.95	0.95	0.95	0.95	0.95
std normal dist fn (Z)	2.380425737	2.44754	2.447747	2.447747	2.145966	2.44774683	2.145966	2.44774683	2.4477468	2.4477468	2.4477468	2.4477468
Z_p	1.565053709	1.644966	1.645211	1.645211	1.281729	1.64521144	1.281729	1.64521144	1.6452114	1.6452114	1.6452114	1.6452114
1+(s/m)^2	1.412088253	1.412088	1.318932	1.318932	1.041244	1.04124372	1.175647	1.175647078	1.0144033	1.0144033	1.0579194	1.0579194
(sigma_d)^2	0.345069639	0.34507	0.276822	0.276822	0.040416	0.040415883	0.161819	0.1618187	0.0143006	0.0143006	0.0563041	0.0563041
mu_d	-6.98337693	-6.983377	2.349222	2.349222	-5.179633	-5.179633309	-5.064416	-5.064415977	5.1858066	5.1858066	2.7902462	2.7902462
(sigma_dn)^2	0.345069639	0.152489	0.276822	0.010575	0.040416	0.035447173	0.161819	0.044058165	0.0143006	0.00048	0.0563041	0.0019288
mu_dn	-6.98337693	-7.049099	2.349222	2.482345	-5.179633	-5.870296134	-5.064416	-5.698682889	5.1858066	5.1927169	2.7902462	2.8174339
P_95 exponent	-6.06402324	-6.406742	3.214832	2.65153	-4.921958	-5.560545272	-4.548819	-5.353352402	5.382549	5.2287614	3.18063	2.8896881
P_95 (PEQ)	**0.002325028** Max	**0.00165** Average	**24.8991** Max	**14.17571** Average	**0.007285** Max	**0.003846678** Average	**0.01058** Max	**0.00473226** Average	**217.57618** Max	**186.56159** Average	**24.061907** Max	**17.987699** Average

NOTES: For purposes of this summary, ^ represents an exponent or superscript while _ represents a subscript.
Variables are defined in Part 12, Rule 1225 (3) (a).

Nickel		Selenium		Zinc		Acrylonitrile #		Chloroform #		Azobenzene #		Pentachlorophenol #	
4		**4**		**4**		**4**		**4**		**4**		**4**	
3		**2**		**4**		**0**		**1**		**0**		**0**	
1		**2**		**0**		**4**		**3**		**4**		**4**	
0.25		0.5		0		1		0.75		1		1	
6.2666667		2		10.075		#DIV/0!		1.9		#DIV/0!		#DIV/0!	
0.7023769		0.8485281		4.56608877		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
1	30	1	30	1	30	1	30	1	30	1	30	1	30
0.25	8.674E-19	0.5	9.313E-10	0	0	1	1	0.75	0.00017858	1	1	1	1
0.9333333	0.95	0.9	0.95	0.95	0.95	#DIV/0!	#DIV/0!	0.8	0.94999107	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
2.3272517	2.4477468	2.145966	2.4477468	2.44774683	2.44774683	#DIV/0!	#DIV/0!	1.79412258	2.44767387	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.5013852	1.6452114	1.2817288	1.6452114	1.64521144	1.64521144	#DIV/0!	#DIV/0!	0.84145672	1.64512482	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.0125622	1.0125622	1.18	1.18	1.20539913	1.20539913	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0.012484	0.012484	0.1655144	0.1655144	0.18681074	0.18681074	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.8290026	1.8290026	0.61039	0.61039	2.21665174	2.21665174	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
0.012484	0.0116019	0.1655144	0.0443358	0.18681074	0.00682331	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.8290026	1.5417616	0.61039	-0.022168	2.21665174	2.30664545	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
1.9967551	1.7189706	1.1318416	0.324249	2.92773857	2.44254535	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
7.3651179	**5.5787824**	**3.1013628**	**1.3829916**	**18.6853272**	**11.5022809**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average

Phenanthrene		**Cyanide, free**		**Fluoranthene**		**#N/A**		**#N/A**		**#N/A**		**#N/A**	
4		**4**		**4**		**0**		**0**		**0**		**0**	
0		**3**		**0**		**0**		**0**		**0**		**0**	
4		**1**		**4**		**0**		**0**		**0**		**0**	
1		0.25		1		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
#DIV/0!		7.06666667		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
#DIV/0!		4.27707065		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
1	30	1	30	1	30	1	30	1	30	1	30	1	30
1	1	0.25	8.6736E-19	1	1	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	0.93333333	0.95	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	2.32725168	2.44774683	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	1.50138519	1.64521144	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	1.36632253	1.36632253	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	0.31212285	0.31212285	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	1.79932747	1.79932747	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	0.31212285	0.02702366	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	1.79932747	1.65419499	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	#DIV/0!	2.63812068	1.92464925	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
#DIV/0!	**#DIV/0!**	**13.9868931**	**6.85274462**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average	Max	Average

REASONABLE POTENTIAL ANALYSIS: WET

Facility: Ludington WWTP
Outfall: 2

			PEL		PEQ*	
Qe	Qr	RWC	TU_C	TU_A	TU_C	TU_A
6.965944272	65	9.68	10.331111	1	1.87	0.00

* PEQ (enter data for most sensitive species only):

Chronic

Total n =	38	Quant n =	19	CV =	0.3
TUc effluent =	1.7	MF =	1.1	PEQ TUc =	1.87

Acute

Total n =	38	Quant n =	0	CV =	0.6
TU_A effluent =	0	MF =	1.1	PEQ TU_A =	0.00

Decision (WET limits/conditions):

WQBEL				Monitoring	
Monthly Avg	Daily Max	Species	TI/RE	Short term	Long term

Basis of decision:
No Acute WET RP for either test species. No Chronic WET RP

Based on Chronic results for C. dubia, C. dubia is the more sensitive species. RP was evaluated using the C. dubia results. These results indicate no RP to exceed Chronic WET.
Recommend Chronic and Acute WET testing for FHM in Additional Monitoring section. 4 tests over 5 years.
Recommend quarterly monitoring for Chronic and Acute WET for C. dubia due to persistant low level toxicity.
Remove limit from draft permit.

WET Data Summary

Species 1: fathead minnow

		TU		
Lab	Test Date	Acute	Chronic	Reference
ERM	9/10/2020	0	0	
ERM	8/4/2020	0	0	
ERM	7/14/2020	0	0	
ERM	6/2/2020	0	0	
ERM	5/12/2020	0	0	
ERM	4/14/2020	0	0	
ERM	3/17/2020	0	0	
ERM	2/18/2020	0	0	
ERM	1/15/2020	0	0	
ERM	12/10/2019	0	0	
ERM	11/12/2019	0	0	
ERM	10/3/2019	0	0	
ERM	9/5/2019	0	0	
ERM	8/13/2019	0	0	
ERM	7/16/2019	0	0	
ERM	6/11/2019	0	0	
ERM	5/21/2019	0	0	Modified 10/4/00

ERM	4/2/2019	0	0	
ERM	3/1/2019	0	0	
ERM	2/19/2019	0	0	
ERM	1/8/2019	0	0	
ERM	12/11/2018	0	0	
ERM	11/6/2018	0	0	
ERM	10/10/2018	0	0	
ERM	9/11/2018	0	0	
ERM	8/14/2018	0	1.7	
ERM	7/26/2018	0	0	

Species 2: C dubia

		TU			Coefficient of Variation and Multiplying Factor Calculation	
Lab	Test Date	Acute	Chronic	Reference	Test Date	TUc values for CV Calc
ERM	9/10/2020	0	1.7		9/10/2020	1.7
ERM	8/4/2020	0	1.1		8/4/2020	1.1
ERM	7/14/2020	0	1.7		7/14/2020	1.7
ERM	6/2/2020	0	0		6/2/2020	1
ERM	5/12/2020	0	0		5/12/2020	1
ERM	4/14/2020	0	0		4/14/2020	1
ERM	3/17/2020	0	0		3/17/2020	1
ERM	2/18/2020	0	1.7		2/18/2020	1.7
ERM	1/15/2020	0	1.7		1/15/2020	1.7
ERM	12/10/2019	0	1.7		12/10/2019	1.7
ERM	11/12/2019	0	0		11/12/2019	1
ERM	10/3/2019	0	0		10/3/2019	1
ERM	9/5/2019	0	1.7		9/5/2019	1.7
ERM	8/13/2019	0	1.7		8/13/2019	1.7
ERM	7/16/2019	0	1.7		7/16/2019	1.7
ERM	6/11/2019	0	0		6/11/2019	1
ERM	5/21/2019	0	0		5/21/2019	1
ERM	4/2/2019	0	0		4/2/2019	1
ERM	3/1/2019	0	1.7		3/1/2019	1.7
ERM	2/19/2019	0	1.1		2/19/2019	1.1
ERM	1/8/2019	0	1.7		1/8/2019	1.7
ERM	12/11/2018	0	0		12/11/2018	1
ERM	11/6/2018	0	1.7		11/6/2018	1.7
ERM	10/10/2018	0	1.7		10/10/2018	1.7
ERM	9/11/2018	0	1.7		9/11/2018	1.7
ERM	8/14/2018	0	1.1		8/14/2018	1.1
ERM	7/26/2018	0	0		7/26/2018	1
ERM	4/10/2018	0	0		4/10/2018	1
ERM	1/23/2018	0	0		1/23/2018	1
ERM	10/17/2017	0	1.1		10/17/2017	1.1
ERM	7/11/2017	0	1.1		7/11/2017	1.1
ERM	4/11/2017	0	0		4/11/2017	1
ERM	1/24/2017	0	0		1/24/2017	1
ERM	10/11/2016	0	0		10/11/2016	1
ERM	7/14/2016	0	1.7		7/14/2016	1.7
ERM	4/19/2016	0	0		4/19/2016	1
ERM	1/19/2016	0	0		1/19/2016	1
ERM	12/1/2015	0	0		12/1/2015	1
					Standard Deviation	0.33361889
					Mean	1.27105263
					Effluent-Specific CV	0.26247449

=0.3