Water Quality Division
Montana Pollutant Discharge Elimination System (MPDES) ▪ Fact Sheet

Permit Number:	MT0021920
Permittee:	City of Great Falls
Receiving Water:	Missouri River
Facility Information:	City of Great Falls Wastewater Treatment Plant 1600 6th St. NE, Great Falls, MT 59404
Facility Contact(s):	Dana Audet, Plant Manager, Veolia North America 1600 6th St. NE, Great Falls, MT 59404
Type of Facility:	Major Publicly Owned Treatment Works
Type of Treatment:	Conventional activated sludge treatment system with ultraviolet (UV) disinfection and anaerobic sludge digestion process
Number of Outfalls:	1
Outfall Type:	003 – Major Publicly Owned Treatment Works (POTW) with Industrial Pretreatment Program
Outfall Location:	latitude 47.520333 N, longitude 111.297119 W
Fact Sheet Date:	September 2018

I. Summary of Proposed Changes

DEQ proposes to renew the Montana Pollutant Discharge Elimination System (MPDES) permit for City of Great Falls Wastewater Treatment Plant, MT 0021920. This fact sheet documents the legal requirements and technical rationale that serve the decision-making process involved with developing effluent limits, monitoring and reporting requirements, and special conditions which are specific to Great Falls.

A. Facility Developments Since the Last Permit

- On April 11, 2013 DEQ issued a major modification of the 2010-issued permit in response to Great Falls. The major modification included the following changes to the 2010-issued permit:
  - A source-specific mixing zone for ammonia, nitrate plus nitrite, and total recoverable metals.
  - A change to the date on final permit limits to correlate with completion of facility upgrades.
  - A decrease in the design flow from 21 million gallons per day (mgd) to 13.3 mgd.
- 2013 – 2015 upgrades include retrofitting the plant to include three bioreactor basins, ultraviolet disinfection, flow monitoring for all influent and effluent (including internal locations), two influent pumps, and five blowers for the bioreactor basin.
- 2016 – 2017 upgrades include two new lift stations and improvements to the dissolved air floatation.

B. Proposed Changes to Effluent Limits and Monitoring Requirements

- The existing permit limits and monitoring requirements for E. coli are maintained in this renewal, and Great Falls has the option to report organisms/100 mL instead of colony forming units/100 mL.
- The monitoring requirement for total residual chlorine and total dissolved solids will be removed.
- The monitoring frequency for oil and grease, total nitrogen, total phosphorus, ammonia, dissolved oxygen, total recoverable metals, volatile organic compounds, acid-extractable compounds, and base neutral compounds will be reduced.
- The permit limits for total recoverable copper will be removed.
- New limits and monitoring requirements for arsenic, cyanide, 1,2-dichloroethane, and di(2-ethylhexyl) phthalate will be included in the permit.
- Ambient/upstream monitoring will be required.

II. Facility Information

Great Falls Wastewater Treatment Plant serves the residents and businesses of the City of Great Falls, Town of Black Eagle, and Malmstrom Air Force Base. Black Eagle and Malmstrom maintain their own collection system. Treated wastewater is discharged to the Missouri River approximately 1.5 mile above Black Eagle Dam. Great Falls has a pretreatment program and maintains coverage under the Multi-Sector General Permit for Storm Water Discharges Associated with Industrial Activity, MTR000452.

A. Permit Status and Details Leading to Administrative Extension of the Permit

- December 1, 2010 2010-issued permit became effective
- April 11, 2013 Major Modification of 2010-issued permit
- November 30, 2015 2010-issued permit expired
- August 6, 2015 2010-issued permit administratively extended

B. Facility Description and Design Criteria Summary

- Conventional activated sludge treatment system with ultraviolet (UV) disinfection and anaerobic sludge digestion process
- Daily design flow rate of 13.3 mgd
- Headworks with screening and grit removal
- Two primary clarifiers, three bioreactor basins, four final clarifiers, and two UV disinfection units
- Sludge handling process includes a primary dissolved air floatation (DAF), sludge thickener, two anaerobic digesters, and two centrifuges for dewatering
- Influent flow and sample location:
  - Raw wastewater from two pump stations flows through a channel with an influent composite sampler and into influent flow meters
- Effluent sample location and discharge:
  - Effluent flows through a channel and a Parshall Flume with an ultrasonic flow meter that is linked to SCADA system
  - An automatic composite sampler is located after the effluent flow meter
  - Grab samples are collected from a spigot off the composite sampler

C. Existing Permit Requirements

The 2013-major permit modification phased interim permit limits to account for several facility upgrades Great Falls had planned during the permit cycle. Final permit limits, presented in **Table 1**, became effective November 2015 to provide time for Great Falls to optimize the wastewater treatment and gather information on post-construction effluent quality.

Table 1: 2013-Major Modification Final Permit Limits – Outfall 003

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	25	40	-
	lb/day	4,377	7,005	-
	% Removal		85 %	
Total Suspended Solids (TSS)	mg/L	30	45	-
	lb/day	4,500	7,881	-
	% Removal		85 %	
pH	s.u.	Within the range of 6.0 to 9.0 (instantaneous)		
E. coli Bacteria, Summer	cfu/100mL	126	252	-
E. coli Bacteria, Winter	cfu/100 mL	630	1260	-
Oil and Grease	mg/L	-	-	10
Total Residual Chlorine	mg/L	0.026	-	0.035
Total Ammonia as N	mg/L	2.86	-	4.50
Arsenic, Total Recoverable	µg/L	13.7	-	16.0
Copper, Total Recoverable	µg/L	22.5	-	49.4

D. Effluent Quality

Effluent data from November 2015-May 2018 were selected to represent the period of record (POR), and are representative of the facility's effluent quality. **Table 2** summarizes effluent quality as reported on discharge monitoring reports and to satisfy the requirements of EPA application Form 2A.

Table 2. Great Falls Effluent [1] Characteristics November 2015 through May 2018 – Outfall 003

Parameter	Units	Minimum Value	Maximum Value	Average Value	Sample Size
Effluent Flow Rate	mgd	7.7	13.4	9.4	31
Influent Flow Rate	mgd	7.8	14.6	9.0	31
Temperature	°C	11.1	22.4	15.8	31
Conventional Pollutants:					
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	2.5	6.4	3.3	31
	% removal	97.3	98.6	98.0	31
	lb/day	193	509	259	31
Influent $CBOD_5$	mg/L	120	232	166	31
Total Suspended Solids (TSS)	mg/L	2.0	10	4.2	31
	% removal	96.8	99.0	98.2	31
	lb/day	197	907	334	31
Influent TSS	mg/L	188	332	231	31
E. coli, April – October	cfu/100mL	3	49	14 [2]	16
E. coli, November – March	cfu/100 mL	4	238	14 [2]	15
Oil Sheen	Visual	None Present		-	-
Oil and Grease	mg/L	0	2.2	2.2	31
pH	s.u.	6.7	7.9	7.0	31
Nonconventional Pollutants:					
Total Ammonia as N	mg/L	0.1	2.4	0.5	31
Nitrate + Nitrite	mg/L	3.0	9.8	6.4	31
Total Kjeldahl Nitrogen	mg/L	1.3	3.3	2.1	31
Dissolved Oxygen	mg/L	3.6	5.0	4.3	31
Total Nitrogen, Summer [3]	mg/L	7.1	9.7	8.4	12
	lb/day	487	830	696	12
Total Phosphorus, Summer [3]	mg/L	0.2	2.9	1.6	12
	lb/day	21	254	133	12
Total Dissolved Solids (TDS)	mg/L	720	820	771	16
Hardness, Cyanide, and Total Recoverable Metals					
Cyanide, Total	µg/L	5.0 [5]	270	32	10
Total Hardness, as CaCO3	mg/L	-	440	325	17
Antimony	µg/L	0.66	1.0	0.82	10
Arsenic	µg/L	5.8	33	17	31
Beryllium	µg/L	0.5 [4]	0.5 [4]	0.5	10
Cadmium	µg/L	0.05	0.1	0.075	10
Chromium	µg/L	0.35	0.73	0.48	9
Copper	µg/L	4.1	14	6.8	31
Lead	µg/L	0.43	1.1	0.64	9
Mercury	µg/L	0.0016	0.020	0.0047	7
Nickel	µg/L	1.7	2.4	2.1	8
Selenium	µg/L	1.4	2.8	2.1	31

Table 2. Great Falls Effluent [1] Characteristics November 2015 through May 2018 – Outfall 003					
Parameter	Units	Minimum Value	Maximum Value	Average Value	Sample Size
Silver	µg/L	0.11 [4]	1.0	0.66	9
Thallium	µg/L	0.05	0.2	0.16	31
Zinc	µg/L	31	49	40.	7
Organic Compounds					
Total Phenols	µg/L	0.010 [4]	0.099	0.023	16
Chloroform	µg/L	0.43	1.2	0.79	10
Dichlorobromo-methane [6]	µg/L	0.6	0.6	0.6	10
1,2-Dichloroethane	µg/L	0.5 [4]	5.0	1.0	10
Toluene	µg/L	0.13 [4]	1.0	0.75	10
Di(2-ethylhexyl) phthalate	µg/L	2.0 [4]	3.0	2.1	10
Acute Whole Effluent Toxicity Tests					
Acute 48-hour *Ceriodaphnia*	Pass/Fail		Passed All		10
Acute 96- hour *P. promelas*	Pass/Fail		Passed All		10

(1) All data is for Outfall 003 effluent characteristics, unless indicated as influent
(2) Geometric mean
(3) Nutrient standards are applied seasonally (July 1 – September 30), so summer data was summarized. Data range was expanded to June – September in order to have 10 samples for the statistical analysis.
(4) Below detection. Value listed is the Reporting Limit

III. Receiving Water: Missouri River

The Great Falls Wastewater Treatment Plant discharges to the Missouri River, which has been identified as impaired. A total maximum daily load has not been completed for this section of the Missouri River.

A. Receiving Water Summary

The following information is used to develop water quality based effluent limits.

- Water Use Classification: B-2
- Watershed: Missouri River
- Waterbody Name/Location Missouri River, Sun River to Rainbow Dam
- Montana Stream Segment: MT41Q001_011
- USGS Hydrologic Unit Code: 10030102
- USGS Gauging Stations: Missouri River at Ulm 06078200
  Sun River at Vaughn 06089000
- 7Q10: 1,763 mgd (2,729.3 cfs)
- Seasonal 14Q5 (for Nutrients): 2,029 mgd (3,141 cfs)
- Dilution Ratio: 132:1
- Ecoregion (for Nutrients): Northwestern Glaciated Plains
- Identified as Impaired: Draft 2018 & 2016 303(d) List
- Total Maximum Daily Load (TMDL): None
- Salmonids and early life stages Present

B. Water Use Classification

According to Montana Water Use Classifications, the Missouri River is classified as B-2. The goal of the state of Montana is to maintain B-2 class waters suitable for:

- drinking, culinary, and food processing purposes, after conventional treatment;
- bathing, swimming, and recreation;
- growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers;
- and agricultural and industrial water supply.

C. Impairments

The 2016 303(d) list shows this segment of the river as not fully supporting aquatic life or drinking water.

Pollutants identified as causing impairments:

- Metals: mercury, selenium, total chromium
- Polychlorinated biphenyls
- Sedimentation/Siltation, solids (suspended/bedload), and turbidity

Probable Sources of impairments:

- Contaminated sediments
- Dam construction (other than upstream flood control projects)
- Industrial point source discharge
- Industrial/commercial site stormwater discharge (permitted)
- Irrigated crop production

D. Applicable Water Quality Standards

Each waterbody classification has numeric and narrative water quality standards designed to ensure that the beneficial uses are protected. Discharges to B-2 classified waters are subject to the specific water quality standards of:

- Administrative Rules of Montana 17.30 Subchapter 6
- Department Circular DEQ-7, Numeric Water Quality Standards
- Department Circular DEQ-12A, Base Numeric Nutrient Standards

Water quality standards for ammonia and some total recoverable metals are dependent on background conditions:

- The aquatic life standards for metals are expressed as a function of hardness (mg/L $CaCO_3$), with water quality standards based on the 25th percentile of waterbody hardness.
- The numeric water quality standards for ammonia account for a combination of receiving water characteristics such as the presence/absence of salmonids and early life stages of fish, the 75th percentile of pH, and the 75th percentile of temperature.

E. Ambient Stream Conditions

Ambient (instream/upstream) water quality data for the Missouri River are summarized in **Table 3.** The instream critical condition of the receiving water is the 75th percentile. Arsenic and lead ambient concentration levels (shown in bold) are higher than the water quality standards. A discussion on this is detailed in the final pollutant evaluation **(Section VI).**

Table 3. Missouri River Upstream Water Quality and Comparison to Water Quality Standards

Parameter	Receiving Water Quality [1]		Water Quality Standards [2]		
	Sample Size	75th Percentile	Aquatic Life Acute	Aquatic Life Chronic	Human Health
Total Ammonia (mg/L)	14	0.081	2.59	1.21	-
Dissolved Oxygen (mg/L)	18	7.4 [3]	Weekly Mean: 6.5	1-Day Minimum: 5.0	
Hardness, as $CaCO_3$ (mg/L)	37	153 [3]	No Standard		
Nitrate + Nitrite (mg/L)	25	0.24	-	-	10
Total Nitrogen (mg/L)	29	0.50	1.3 July – September		
Total Phosphorus (mg/L)	29	0.059	0.110 July - September		
pH (s.u.)	56	8.4	6.0 – 9.0		
Temperature (°C)	28	15.5	Varies		
Antimony (µg/L)	6	50. [4]	-	-	5.6
Arsenic (µg/L)	25	**22 / 18.8**	340	150	**10.0**
Beryllium (µg/L)	data unavailable		-	-	4.0
Cadmium (µg/L)	28	0.1 [4]	2.9	1.1	5

Table 3. Missouri River Upstream Water Quality and Comparison to Water Quality Standards

Parameter	Receiving Water Quality (1)		Water Quality Standards (2)		
	Sample Size	75th Percentile	Aquatic Life Acute	Aquatic Life Chronic	Human Health
Chromium (µg/L)	data unavailable		2554	122	100
Copper (µg/L)	43	3.0	20.9	13.4	1300
Cyanide (µg/L)	data unavailable		22.0	5.2	4.0
Lead (µg/L)	30	**5.8**	140	**5.5**	15
Mercury (µg/L)	data unavailable		1.7	0.91	0.5
Nickel (µg/L)	data unavailable		672	75	100
Selenium (µg/L)	9	0.95	20	5	50
Silver (µg/L)	data unavailable		8.4	-	100
Thallium (µg/L)	10	0.15	-	-	0.24
Zinc (µg/L)	27	10 (4)	172	172	7400

(1) Monitoring Stations: Montana NorthWestern Energy MTNWE-MM-9, Montana DEQ M12MISSR15, City of Great Falls at Central St Bridge
(2) Circular DEQ-7, Circular DEQ-12A for nutrients
(3) 25th percentile
(4) No detection reported on all samples, reporting level (RL) represents the 75th percentile
(5) 75th percentile / 25th percentile

IV. Technology Based Effluent Limits

Technology-based effluent limitations (TBELs) represent the minimum treatment requirements implemented in MPDES permits. The limits are based on actual, available control technologies to treat pollutants, and must be met prior to dilution. The Montana Board of Environmental Review has adopted by reference 40 CFR 133, which defines minimum requirements for secondary treatment for publicly owned treatment works.

Secondary treatment is defined in terms of effluent quality as measured by pH, carbonaceous 5-day biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), and percent removal of $CBOD_5$ and TSS. These standards are based on application of biological treatment.

A. Applicable Effluent Limits

Great Falls will be held to **National Secondary Standards** for $CBOD_5$ and TSS:

- The monthly average shall not exceed 25 mg/L for $CBOD_5$ and 30 mg/L for TSS.
- The weekly average shall not exceed 40 mg/L for $CBOD_5$ and 45 mg/L for TSS.
- The monthly average percent removal for $CBOD_5$ and TSS shall not be less than 85 percent.
- The effluent limits for pH must be maintained within the range of 6.0 to 9.0.

B. Mass-Based Expression of Limits

Effluent limits must be expressed in terms of mass, identified as load (pounds/day). Great Fall's mass-based load limits were calculated by multiplying the facility's average daily design flow and the national secondary treatment standards for each pollutant by a conversion factor:

- *$CBOD_5$ monthly average load = 13.3 mgd x 25* $\frac{mg}{L}$ *x 8.34* $\frac{lb \bullet L}{Mgal \bullet mg}$ *= 2773* $\frac{lb}{day}$
- *$CBOD_5$ weekly average load = 13.3 mgd x 40* $\frac{mg}{L}$ *x 8.34* $\frac{lb \bullet L}{Mgal \bullet mg}$ *= 4437* $\frac{lb}{day}$
- *TSS monthly average load = 13.3 mgd x 30* $\frac{mg}{L}$ *x 8.34* $\frac{lb \bullet L}{Mgal \bullet mg}$ *= 3328* $\frac{lb}{day}$
- *TSS weekly average load = 13.3 mgd x 45* $\frac{mg}{L}$ *x 8.34* $\frac{lb \bullet L}{Mgal \bullet mg}$ *= 4991* $\frac{lb}{day}$

Load limits for $CBOD_5$ and TSS will apply to the effluent and will be maintained at the more stringent of the TBELs shown above or the nondegradation load allocations discussed next.

C. Nondegradation

Montana's Nondegradation Policy prevents degradation of state waters and ensures that existing uses continue to be achieved. Sources that comply with the conditions of their permit and do not exceed the limits are not considered new or increased sources.

Nondegradation load values were calculated for Great Falls as part of the renewal of permit in 2000. These values are compared to the actual average loads discharged from the facility from the past four years:

Nondegradation Allocated Limits		Actual Average Monthly Load (lb/day)			
Parameter	Load (lb/day)	2014	2015	2016	2017
$CBOD_5$	4,377	428	241	254	325
TSS	4,500	498	341	312	359

Great Falls did not exceed the nondegradation load values for $CBOD_5$ and TSS. The renewed permit will retain load limits based on the current design flow of the facility.

D. Final Technology-Based Effluent Limits

Table 4. Technology-Based Effluent Limits [1] for Outfall 003

Parameter	Units	Average Monthly Limit	Average Weekly Limit
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	25	40
	%	85	-
	lb/day	2773	4437
Total Suspended Solids (TSS)	mg/L	30	45
	%	85	-
	lb/day	3328	4991
pH	s.u.	6.0 - 9.0 (instantaneous)	

[1] See Definition section at end of permit for explanation of terms.

V. Water Quality-Based Effluent Limits

Permits are required to include Water Quality-Based Effluent Limits (WQBELs) when TBELs are not adequate to protect state water quality standards. WQBELs are developed for each parameter demonstrating reasonable potential to cause or contribute to an excursion from any water quality standard.

A. Scope and Authority

The Montana Water Quality Act states that a permit may only be issued if DEQ finds that it will not result in pollution of any state waters. No wastes may be discharged that can reasonably be expected to violate any state water quality standards. Montana water quality standards define both water use classifications for all state waters and numeric and narrative standards that protect those designated uses. MPDES permit limitations must control all pollutants which will cause or have reasonable potential (RP) to cause or contribute to an excursion above any state water quality standard, including narrative criteria.

B. Pollutants of Concern

Pollutants and parameters are identified as a pollutant of concern for the following reasons:

- Listed as TBELs
- Identified as needing WQBELs in the previously issued permit
- Identified as present in effluent monitoring or otherwise expected present in the discharge
- Associated with impairment which may or may not have a wasteload allocation (WLA) in a TMDL

Parameters typically present in municipal wastewater that may cause or contribute to a violation of water quality standards include those found in **Table 5.** Identification of a pollutant of concern (POC) is not an indication that WQBELs are necessary, but an indication that further evaluation is required.

Table 5. Identification of Pollutants of Concern	
Parameter	**Basis for POC Identification**
Conventional Pollutants:	
$CBOD_5$, TSS, and pH	TBEL, Previous Permit
E. coli, Oil and Grease	Previous Permit
Nonconventional Pollutants:	
Total Ammonia	Previous Permit
Total Phosphorus, Total Nitrogen, Nitrate Nitrite	Permit Monitoring
Toxic Pollutants:	
Arsenic, Copper, Thallium (Total Recoverable)	Previous Permit
Chromium, Mercury, Selenium (Total Recoverable)	EPA Application Form 2A, Impairment
Total Cyanide	EPA Application Form 2A
Antimony, Arsenic, Beryllium, Cadmium, Lead, Nickel, Selenium, Silver, Thallium, Zinc (Total Recoverable)	EPA Application Form 2A
Organic Compounds:	
Chloroform, Dichlorobromo-methane, 1,2-Dichloroethane, Toluene, Di(2-ethylhexyl) phthalate	Permit Monitoring

C. Mixing Zone

A mixing zone is an area where the effluent mixes with the receiving water and certain water quality standards may be exceeded. Mixing zones must have the smallest practicable size, a minimum practicable effect on water uses, and definable boundaries. DEQ set the available dilution flow on a parameter-by-parameter basis to assess RP and to achieve acute, chronic, and human health standards.

1. ***Mixing Zone Requirements:***
   - Acute water quality standards for aquatic life may not be exceeded in any portion of the mixing zone unless the Department finds that allowing minimal initial dilution will not threaten or impair existing uses.
   - An effluent in its mixing zone may not block passage of aquatic organisms nor may it cause acutely toxic conditions.
   - No mixing zone will be granted that will impair beneficial uses.
   - Aquatic life-chronic, aquatic life-acute and human health standards may not be exceeded outside of a designated mixing zone.
   - DEQ may require information from the permittee before determining appropriate mixing and the conditions which should be applied.

2. ***Great Falls' Mixing Zone Boundaries:*** In 2012, Great Falls requested a major modification of the 2010-issued permit to include a source-specific mixing zone for ammonia, nitrate plus nitrite, arsenic, copper, selenium, and thallium. In support of the request, Great Falls submitted a mixing zone study completed by Morisson-Maierle. DEQ evaluated the mixing zone study in the January 2013 Fact Sheet and granted a source specific mixing zone with the defined boundaries of:
   - *Chronic:* A segment of the Missouri River extending 4,800 feet downstream from Outfall 003
   - *Acute:* A segment of the Missouri River extending 80 feet long x 20 feet wide

   DEQ determined that it would be appropriate to carry this mixing zone into the next permit cycle because receiving water conditions have remained consistent.

3. ***Standard Mixing for Nutrients:*** For this permit renewal, DEQ will allow full dilution for nutrients:
   - Total phosphorus: 100% of the 14Q5
   - Total nitrogen: 100% of the 14Q5

4. ***Source Specific Mixing Zone:*** Based on the 2012 mixing zone study, DEQ will allow dilutions for this permit renewal for the following parameters if necessary:
   - Total ammonia, acute aquatic life: up to 1.2% of the 7Q10
   - Total ammonia, chronic aquatic life: up to 12% of the 7Q10
   - Nitrate plus Nitrite, human health: up to 12% of the 7Q10
   - Total recoverable metals, acute aquatic life: up to 1.2% of the 7Q10
   - Total recoverable metals, chronic aquatic life: up to 12% of the 7Q10
   - Cyanide, acute aquatic life: up to 1.2% of the 7Q10
   - Cyanide, chronic aquatic life, human health: up to 12% of the 7Q10

D. Reasonable Potential Analysis

DEQ uses a statistical approach outlined in Chapter 3 of EPA's *Technical Support Document for Water Quality-based Toxics Control* (TSD) to determine reasonable potential for individual pollutants to exceed water quality standards:

1. ***Critical Effluent Concentration (C_d) Calculation:*** The facility's maximum reported effluent concentration (C_{max}) is converted into the projected critical effluent concentration (C_d). This accounts for variation in effluent concentration **(Table 6).**
   - First, the statistical TSD 3-2 multiplier is determined by the data set, coefficient of variation (CV) and sample size at the 95th percentile confidence interval. A default CV of 0.6 is used if there are less than 10 samples.
   - Then the TSD 3-2 multiplier is applied to the facility's maximum reported effluent concentration (C_{max}) to determine the critical effluent concentration (C_d).

2. ***Comparison of C_d to the Water Quality Standards:*** The calculated C_d values for each parameter and their comparison to applicable water quality standards are demonstrated in **Table 6.** If the projected critical effluent concentration is greater than the water quality standard (C_d > WQS), further analysis is needed.
   - **Table 6** shows that **ammonia, total nitrogen, total phosphorus, arsenic, copper, cyanide, 1,2 dichloroethane,** and **di(2-ethylhexyl)phthalate** have a C_d value that is greater than WQS. Further analysis is needed.

Table 6. Comparison of Projected Critical Effluent Concentration with the Water Quality Standard

	Projected Critical Effluent Concentration (C_d)					Water Quality Standard		
	CV	Sample Size →	3-2 TSD Mult.	• C_{max} =	C_d	Aquatic Life Acute	Aquatic Life Chronic	Human Health
Nonconventional Pollutants:			-	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Ammonia	0.79	31	1.25	2.4	3.0	**2.59**	**1.21**	-
Oil & Grease	5.57	31	1.80	2.2	4.0	Shall not exceed 10.0		
Nitrate + Nitrite	0.25	31	1.08	9.8	10	-	-	10
Total Nitrogen, Seasonal	0.098	12	1.09	9.7	**10.6**		**1.3**	
Total Phosphorus, Seasonal	0.59	12	1.61	2.9	**4.7**		**0.110**	
Total Recoverable Metals and Cyanide:			-	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Antimony	0.136	10	1.14	1.0	1.1	-	-	5.6
Arsenic	0.38	31	1.12	33.0	**37.1**	340	150	**10**
Beryllium	0	10	1.00	0.50	0.50	-	-	4
Cadmium	0.25	10	1.27	0.16	0.20	2.9	1.1	5
Chromium	0.6	9	1.81	0.73	1.3	2554	122	100
Copper	0.34	31	1.11	14.2	**15.8**	20.9	**13.4**	1300
Cyanide	2.66	10	4.23	270	**1143**	**22**	**5.2**	**4**
Lead	0.6	9	1.81	1.1	2.0	140	5.5	15
Mercury	0.6	7	2.01	0.02	0.040	1.7	0.91	0.5
Nickel	0.6	8	1.90	2.4	4.6	672	75	100
Selenium	0.18	31	1.06	2.8	3.0	20	5	50

Table 6. Comparison of Projected Critical Effluent Concentration with the Water Quality Standard								
	Projected Critical Effluent Concentration (C_d)					Water Quality Standard		
	CV	Sample Size	→ 3-2 TSD Mult.	• C_{max} =	C_d	Aquatic Life Acute	Aquatic Life Chronic	Human Health
Silver	0.6	9	1.81	1.0	1.8	8.4	-	100
Thallium	0.36	31	1.12	0.20	0.2	-	-	0.24
Zinc	0.6	7	2.01	49.0	98.3	172	172	7400
Organic Compounds:	-	-	-	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Phenols	1.22	16	1.94	99.0	129	-	-	4000
Chloroform	0.37	10	1.43	1.2	1.7	-	-	60
Dichlorobromo-methane	0	10	1.00	0.6	0.6	-	-	9.5
1,2-Dichloroethane	1.41	10	2.84	5.0	**14.2**	-	-	**5**
Toluene	0.54	10	1.66	1.0	1.7	-	-	57
Di(2-ethylhexyl)phthalate	*0.156*	*10*	1.17	3.0	**3.5**	-	-	**3.2**

3. ***Parameters Not Allowed Dilution****:* If the C_d > WQS, reasonable potential exists and WQBELs must be established.
   - **1,2-Dichloroethane** and **Di(2-ethylhexyl)phthalate:** Ambient data is unavailable for these parameters, so dilution will not be considered in the reasonable potential analysis or WQBEL development. These parameters' C_d values exceed the human health water quality standard. Reasonable potential exists and WQBELs must be established.

4. ***Parameters Allowed Dilution:*** The steady-state mass balance model (**Equation 1)** is used to determine the projected receiving water concentration (C_r). If this value exceeds the water quality standard (C_r > WQS), reasonable potential exists and WQBELs must be established.

   DEQ will allow dilution with the receiving water for ammonia, total nitrogen, total phosphorus, arsenic, copper, cyanide, as explained in **Part V.C.** This process is detailed in **Table 7.**
   - **Total recoverable arsenic** and **cyanide** demonstrate reasonable potential to exceed water quality standards, because C_r > WQS. WQBELs must be established for these parameters.

Equation 1. Using the Mass Balance Equation to Determine Reasonable Potential

Mass Balance Equation: $\boldsymbol{Q_s C_s + Q_d C_d = Q_r C_r}$

Receiving Water Pollutant Concentration used for RP Development: $\boldsymbol{C_r = \frac{Q_d C_d + Q_s C_s}{(Q_r)}}$

Variable:	Calculated As:
$Q = flow$	
$Q_s = upstream\ flow$	$Q_s = dilution\ flow\ from\ \boldsymbol{Part\ V.C}$
$Q_d = discharge\ flow$	$Q_d = average\ daily\ design\ flow$
$Q_r = receiving\ flow\ after\ discharge$	$Q_r = Q_s + Q_d$
$C = concentration\ (conc.)$	
$C_s = upstream\ pollutant\ conc.$	$C_s = 75th\ percentile\ critical\ instream\ conc.$
$C_d = discharge\ pollutant\ conc.$	$C_d = max\ effluent\ concentration \cdot TSD\ multiplier$

Table 7. Reasonable Potential Analysis for Pollutants with Allowed Dilution										
		Projected Receiving Water Conc. (C_r)					Reasonable Potential			
	Dilution	C_s	• Q_s	+ C_d	• Q_d	/ Q_r	C_r	< or >	WQS	RP?
Nonconventional:	%	(mg/L)	(mgd)	(mg/L)	(md)	(mgd)	(mg/L)	< or >	(mg/L)	(yes/no)
Ammonia, Acute	1.2	0.081	21.2	3.0	13.3	34.5	1.2	<	2.59	no
Ammonia, Chronic	12	0.081	212	3.0	13.3	225	0.3	<	1.21	no
Total Nitrogen	100	0.50	2764	10.6	13.3	2777	0.5	<	1.3	no
Total Phosphorus	100	0.059	2764	4.7	13.3	2777	0.1	<	0.11	no
Metals & Cyanide:	(%)	(µg/L)	(mgd)	(µg/L)	(mgd)	(mgd)	(µg/L)	< or >	(µg/L)	(yes/no)
Arsenic, HH	12	22.0	212	37.1	13.3	225	**22.9**	**>**	**10**	**yes**
Copper, Chronic	12	3.0	212	15.8	13.3	225	3.8	<	13.4	no
Cyanide, Acute	1.2	3.0	21.2	1143	13.3	34	**443**	**>**	**22**	**yes**
Cyanide, Chronic	12	3.0	212	1143	13.3	225	**70.4**	**>**	**5.2**	**yes**
Cyanide, HH	12	3.0	212	1143	13.3	225	**70.4**	**>**	**4**	**yes**

5. ***Other Considerations***:
   - **Total Recoverable Lead:** The 75th percentile lead concentration in the receiving water is greater than the chronic water quality standard (**Table 3**), but a limit is not necessary because the maximum projected effluent concentration does not exceed the water quality standard.

E. *Water Quality-Based Effluent Limits*

WQBELs are expressed as **maximum daily limit (MDL)** and **average monthly limit (AML).** The MDL and AML are derived from wasteload allocations. DEQ uses a statistical approach outlined in Chapter 5 of EPA's TSD Manual to develop WQBELs for each pollutant. This statistical approach involves three major steps, which are outlined below. First, the wasteload allocation is determined. Second, the long-term average concentration for each wasteload allocation is calculated and the minimum LTA is selected. Third, the maximum daily limit and average monthly limit are determined from the minimum LTA.

1. ***Wasteload Allocations for Parameters Demonstrating Reasonable Potential:*** The appropriate wasteload allocations (WLAs) for the point source discharge are based on acute and chronic aquatic life water quality criteria and human health water quality criteria. The individual WLA is the concentration of a pollutant that the point source can discharge, conforming to DEQ implementation policies such as Montana's dilution and mixing zone policies while still assuring applicable water quality standards are attained in the receiving water. WLA determination for each parameter is detailed in **Table 8**.
   - If the waterbody is impaired, a WLA can be determined from a Total Maximum Daily Load.
   - Where no mixing zone has been granted, there is no need for the mass balance equation because the WLA is set equal to the numeric water quality standard or numeric translation of the narrative standard.
     - The WLA for **1,2-dichloroethane** is set to the human health water quality standard.
     - The **human health** WLA for **arsenic** is set equal to the 25th percentile of ambient conditions (discussion in **Part VI.C**).
   - When a mixing zone has been granted and a dilution factor has been determined, the mass-balance equation is modified to directly calculate the WLA, as demonstrated in **Figure 2**.
     - This method is used for determining an acute and chronic WLA for **arsenic**, as well as acute, chronic, and human health WLAs for **cyanide**.

Equation 2. Using the Mass Balance Equation to Determine Wasteload Allocations (WLAs)

Mass Balance Equation: $\boldsymbol{Q_s C_s + Q_d C_d = Q_r C_r}$

WLA Designed to Meet Numeric Water Quality Standards: $\boldsymbol{C_d = \frac{Q_r C_r - Q_s C_s}{Q_d}}$

Variable:	Calculated As:
$Q = flow$	
$Q_s = upstream\ flow$	$Q_s = dilution\ flow\ from\ \boldsymbol{Part\ V.C}$
$Q_d = discharge\ flow$	$Q_d = average\ daily\ design\ flow$
$Q_r = receiving\ flow\ after\ discharge$	$Q_r = Q_s + Q_d$
$C = concentration\ (conc.)$	
$C_s = upstream\ pollutant\ conc.$	$C_s = 75th\ percentile\ critical\ instream\ conc.$
$C_r = resulting\ downstream\ pollutant\ conc.$	$C_r = water\ quality\ standard\ for\ pollutant\ conc.$
$\boldsymbol{C_d = WLA}$	$\boldsymbol{C_d = \frac{Q_r C_r - Q_s C_s}{Q_d}}$ **(Rearranged mass balance equation.)**

Table 8. WLA development for Pollutants Demonstrating Reasonable Potential

	Critical Stream Flow (Q_s)			**Wasteload Allocation ($C_{d\text{-}WLA}$)**					
	Low Flow •	Percent Dilution =	**Q_s**	(Q_r • C_r) –	(Q_s) •	(C_s) /	Q_d =	**$C_{d\text{-}WLA}$**	
	(mgd)	(%)	(mgd)	(mgd)	(µg/L	(mgd)	(µg/L)	(mgd)	(µg/L)
Arsenic, Acute	1763	1.2	21.2	34.5	340	21.2	22.0	13.3	846
Arsenic,	1763	12	212	224.9	150	211.6	22.0	13.3	2186
Arsenic, HH	1763	0	0	WLA set equal to 25th Percentile Critical Instream					**18.8**
Cyanide, Acute	1763	1.2	21.2	34.5	22	21.2	3.0	13.3	52
Cyanide,	1763	12	212	224.9	5.2	211.6	3.0	13.3	40
Cyanide, HH	1763	12	212	224.9	4	211.6	3.0	13.3	**20**
1,2-Dichloroethane	Dilution not allowed			WLA Set Equal to Water Quality Standard					**5.0**
Di(2-ethylhexyl) phthalate	Dilution not allowed			WLA Set Equal to Water Quality Standard					**3.2**

2. ***Long-Term Average Concentrations for Each Acute and Chronic WLA:*** The long-term average (LTA) is calculated from the WLA to account for effluent variability. Because a WLA is generally based on the acute and chronic aquatic life criteria, two LTAs are determined to ensure the effluent concentration is nearly always below both the acute, chronic, and human health WLA. This process is outlined below and in **Table 9**:
   - The acute and chronic WLA multipliers (TSD 5-1 Multiplier) in the TSD Manual's Table 5-1 are determined from the coefficient of variation (CV) and the 99th percentile for all parameters except nutrients, to which the 95th percentile is applied. If the sample size is less than 10, then a default CV of 0.6 is used.
   - Each TSD 5-1 Multiplier is then multiplied by the acute and chronic WLA to determine the LTA.
   - The human health LTA is set equal to the human health WLA Circular DEQ-7 Footnote 16 requires that no single sample shall exceed the human health water quality standard.

   WQBELs are based on a single performance expectation for a facility, so the most protective LTA is used to calculate final WQBELs in the next step.
   - **Table 9** shows in bold, that the **human health** WLA/LTA is more protective than the acute and chronic LTAs for all four parameters. Surface or groundwater concentrations may not exceed these values.

3. ***Maximum Daily Limit (MDL) and Average Monthly Limit (AML):*** All water quality based effluent limits are expressed as both AMLs and MDLs, unless impracticable.
   - The maximum daily limit (MDL) is the highest allowable discharge measured during a calendar day or 24-hour period representing a calendar day.
   - The average monthly limit (AML) is the highest allowable value for the average of daily discharges over a calendar month.

   When establishing WQBELS for human health protection:
   - DEQ sets the AML equal to the human health WLA.
   - Because surface or groundwater concentrations may not exceed the human health water quality standard, the MDL is set equal to the AML.
   - Human health limits are compared to any other calculated WQBELs and antidegradation and anti-backsliding requirements determine the final limits that meet all technology and water quality standards.

   Table 9 demonstrates development of average monthly limits and maximum daily limits for arsenic, cyanide, 1,2-dichloroethane, and di(2-ethylhexyl)phthalate.

Table 9 Final WQBEL Development

	Long Term Average (LTA)				Final WQBEL
	CV	TSD5-1 multiplier	$C_{d\text{-}WLA}$	LTA	
	-	-	(µg/L)	(µg/L)	(µg/L)
Arsenic, Acute	0.38	0.46	846	389	18.8 = MDL
Arsenic, Chronic	0.38	0.66	2186	1443	18.8 = AML
Arsenic, HH	0.38	0.66	18.8	**18.8**	
Cyanide, Acute	0.6	0.32	52.2	16.8	19.9 = MDL
Cyanide, Chronic	0.6	0.53	40.2	21.2	19.9 = AML
Cyanide, HH	0.6	0.53	19.9	**19.9**	
1,2-Dichloroethane, HH	1.41	0.15	5	**5**	5.0 = MDL 5.0 = AML
Di(2-ethylhexyl) phthalate, HH	0.156	0.71	3.2	**3.2**	3.2 = MDL 3.2 = MDL

VI. Final Pollutant Evaluation

A. Conventional Pollutants:

1. **$CBOD_5$, TSS, and pH**: These parameters are typical effluent quality indicators for domestic wastewater treatment facilities and are regulated as TBELs. The facility provides a significant reduction in biological material and solids through secondary treatment.
   - No additional limits are necessary - TBELs adequately control these pollutants.

2. ***Escherichia coli* (*E. coli*) Bacteria:** Pathogens are known municipal wastewater contaminants. *E. coli* standards protect beneficial uses of receiving waters for pathogens. State waters must be free from substances that are harmful or toxic to humans. The standards for B-2 classified waters are:
   - Summer: April 1 through October 31 of each year
     - The geometric mean number must not exceed 126 organisms per 100 milliliters (org/100 mL)
     - 10% of the total samples may not exceed 252 org/100 mL during any 30-day period
   - Winter: November 1 through March 31 of each year
     - The geometric mean number of *E. coli* must not exceed 630 org/100 mL
     - 10% of the total samples may not exceed 1,260 org/100 mL during any 30-day period

   The existing permit limits and monitoring requirements for *E. coli* are maintained in this renewal, and Great Falls has the option to report org/100 mL instead of cfu/100mL.

3. **Oil and Grease:** Montana regulations require state waters be free from substances attributable to municipal discharges that will result in concentrations of oil and grease at or in excess of 10 mg/L.
   - This limit will be retained in the proposed permit.
   - The requirement to observe the discharge each day for an oil and grease sheen and to collect and analyze an oil and grease sample if a sheen is observed will remain in the permit.
   - Monitoring is reduced to twice per year or when an oil sheen is observed.

B. Nonconventional Pollutants:

1. **Total Ammonia:** DEQ calculates water quality standards (based on Circular DEQ-7) that account for a combination of receiving water characteristics such as the presence/absence of salmonids and early life stages of fish, pH, and temperature.
   - Reasonable potential does not exist, and this permit renewal will not include an ammonia limit.
   - The monitoring requirement will be reduced to monthly.
   - Semi-annual upstream monitoring of ammonia, pH and temperature will be required to provide a data set for determining reasonable potential in the next permit cycle.

   Anti-backsliding Concerns for Total Ammonia:
   Through anti-backsliding, the Clean Water Act prohibits the reissuance of an existing permit containing limits less stringent than those established in the previous permit. Anti-backsliding regulations allow for exceptions including permit renewals in which substantial alterations or additions to the permitted facility occurred after permit issuance, which is the case for Great Falls (**Section II**).
   - The projected maximum effluent concentration (C_d) calculated in the 2013-fact sheet was significant and demonstrated reasonable potential to exceed water quality standards.
   - Since that time, Great Falls has upgraded the facility, significantly reducing the ammonia concentrations:
     - 2013-calculated C_d = 45.6 mg/L 2018-calculated C_d = 3.0 mg/L

   Removing the ammonia effluent limits will not cause degradation of the Missouri River.

2. **Nitrate Plus Nitrite (N+N):** Nitrate and nitrite are toxic components of total nitrogen, which is a common constituent of domestic wastewater. The human health standard for N+N is 10 mg/L.
   - Reasonable potential does not exist, and this permit renewal will not include a limit.
   - Monthly effluent monitoring will be continued.

3. **Dissolved Oxygen (DO):** Circular DEQ-7 characterizes freshwater aquatic life standards by the fishery (warm-water for this receiving water) and by the presence or absence of aquatic life in early life stages:
   - Weekly Mean: 6.5 mg/L
   - 1-Day Minimum Mean: 5.0 mg/L
   - The minimum DO concentrations reported during the POR ranged from 3.6 mg/L to 4.4 mg/L in the effluent.

   Although the effluent concentrations (ranging 3.6 mg/L - 4.4 mg/L) are below the water quality standards, adequate dilution is provided by the high dilution ratio between the Missouri River and the design flow of the facility as well as the high (7.4 mg/L) DO ambient concentration. Therefore, the DO levels in the Great Falls effluent are not expected to be a concern.
   - Monitoring requirement will be reduced to weekly.

4. **Nutrients, Total Nitrogen and Total Phosphorus:** In July 2014, Montana adopted base numeric nutrient standards for the Northwest Glaciated Plains Ecoregion:
   - Total Nitrogen: 1300 µg/L from July 1 – September 30
   - Total Phosphorus: 110 µg/L from July 1 – September 30

   Seasonal effluent data was used to assess reasonable potential for total nitrogen and total phosphorus. The seasonal data range was expanded to June – September 2015-2017 to increase sample size.
   - Reasonable potential does not exist, and a limit is not necessary for this permit renewal.
   - Monthly effluent monitoring will be required from July 1 to September 30.
   - Monthly upstream monitoring will be required from July 1 to September 30 to provide a data set for determining reasonable potential in the next permit cycle.

5. **Total Dissolved Solids:** The 2010-issued permit required monitoring for total dissolved solids. This permit renewal will not require monitoring because there is no numeric water quality standard or concern for this parameter in this part of the Missouri River.

C. Toxic Pollutants

Total Recoverable Metals and Cyanide

All metals discussions refer to the metals in their "total recoverable" fraction. Water quality standards for metals and cyanide are specified in Circular DEQ-7. Cadmium, copper, chromium, lead, nickel, silver, and zinc water quality standards depend on hardness (mg/L $CaCO_3$) with water quality standards based on waterbody hardness using the 25th percentile to be protective of the receiving water year-round. This segment of the Missouri River is impaired for chromium, mercury, and selenium.

1. **Arsenic:** The 2010-issued final permit limits for arsenic as of November 2015. Since the final permit limits became effective, Great Falls has struggled to meet the arsenic limit. On May 18, 2018 Great Falls submitted the Arsenic Summary Report in response to a requirement from a DEQ Compliance Evaluation Inspection. The report focused on investigating potential arsenic sources and summarizing progress toward removing arsenic exceedances. The findings of the report were inconclusive, but Great Falls is continuing the investigation.

   The final arsenic limits in the 2010-issued permit were calculated using the 25th percentile of background concentration. DEQ will continue this approach here with an updated background dataset.

   DEQ did not allow dilution for human health when determining the wasteload allocation (WLA) for human health criteria:
   - DEQ set the human health WLA equal to the 25th percentile instream arsenic concentration (18.8 µg/L).
   - AML = 18.8 µg/L
   - MDL = 18.8 µg/L
   - Monthly monitoring will be required.
   - Semi-annual upstream monitoring will be required to provide a data set for determining reasonable potential in the next permit cycle.

2. **Total Recoverable Copper:** The 2013-Major Permit Modification incorporated an AML and MDL for copper, but the effluent data for the current period of record does not demonstrate reasonable potential to exceed water quality standards. A limit is not necessary for this permit renewal.
   - Monitoring will be required quarterly.
   - Semi-annual upstream monitoring will be required to provide a data set for determining reasonable potential in the next permit cycle.

   Anti-backsliding Concerns for Total Recoverable Copper:

   Through anti-backsliding, the Clean Water Act prohibits the reissuance of an existing permit containing limits less stringent than those established in the previous permit. Anti-backsliding regulations allow for exceptions including permit renewals in which substantial alterations or additions to the permitted facility occurred after permit issuance, which is the case for Great Falls (**Section II**):
   - The projected maximum effluent concentration (C_d) calculated in the 2013-fact sheet was significant and demonstrated reasonable potential to exceed water quality standards.
   - Since that time, Great Falls upgraded the facility, significantly reducing the projected effluent copper concentration:
     - 2013-calculated C_d: 79 µg/L 2018-calculated C_d: 15.8 µg/L

   Removing the copper effluent limits will not cause degradation of the Missouri River.

3. **Total Cyanide:** Reasonable potential exists, and limits will be implemented for this permit cycle.
   - MDL = 19.9 µg/L
   - AML = 19.9 µg/L
   - Monitoring will be required monthly.
   - Semi-annual upstream monitoring will be required to provide a data set for determining reasonable potential in the next permit cycle

4. **Total Recoverable Lead:** The 75th percentile lead concentration in the receiving water is greater than the chronic water quality standard, but a limit is not necessary because the maximum projected effluent concentration does not exceed the water quality standard (**Tables 3 and 6**).
   - Monitoring will be required quarterly.
   - Semi-annual upstream monitoring will be required to provide a data set for determining reasonable potential in the next permit cycle.

5. **All other Total Recoverable Metals:** Reasonable potential was assessed for all metals reported as present in the facility effluent.
   - Effluent quality for all of these parameters are below the water quality standard at the end of pipe, so consideration of dilution is not necessary.
   - For beryllium, chromium, lead, mercury, nickel, and silver, reasonable potential does not exist. Water quality-based effluent limits will not be developed for this permit renewal.
   - Effluent monitoring for these parameters will be reduced to twice per year during the years of 2022 and 2023 to fulfill the requirements of Application form 2A, Part D.
   - Semi-annual upstream monitoring will be required to provide a data set for determining reasonable potential in the next permit cycle

Organic Compounds: EPA Application Form 2A requires permittees to monitor organic compounds in the effluent. In the permit renewal application, Great Falls reported several organic substances as present above the laboratory detection limit: phenols, chloroform, dichlorobromo-methane, toluene, 1,2-dichloroethane, and di(2-ethylhexyl)phthalate.

1. **1,2-Dichloroethane:** Reasonable potential exists, and limits will be implemented this permit cycle.
   - MDL = 5.0 µg/L
   - AML = 5.0 µg/L
   - Effluent and Upstream monitoring will be required monthly

   Because ambient data is unavailable, the reasonable potential analysis was completed without considering dilution. Great Falls will have the option to provide DEQ with representative ambient data and request this parameter be re-evaluated with mixing.

2. **Di(2-ethylhexyl)phthalate:** Reasonable potential exists, and effluent limits will be implemented in this permit cycle:
   - MDL = 3.2 µg/L
   - AML = 3.2 µg/L
   - Effluent and Upstream Monitoring will be required monthly

   Because ambient data is unavailable, the reasonable potential analysis was completed without considering dilution. Great Falls will have the option to provide DEQ with representative ambient data and request this parameter be re-evaluated with mixing.

3. **Phenols, chloroform, dichlorobromo-methane and toluene:** EPA Application Form 2A requires permittees to monitor organic compounds in the effluent. Phenols, chloroform, dichlorobromo-methane and toluene were reported as present in the effluent, but the projected critical effluent concertation of each is less than the lowest applicable standard.
   - Reasonable potential does not exist for these parameters, and effluent limits will not be developed.
   - Effluent monitoring for these parameters will be reduced to twice per year during the years of 2022 and 2023 to fulfill the requirements of Application form 2A, Part D.

D. Whole Effluent Toxicity Testing

Water quality standards require that state water be free from substances attributable to municipal waste that create conditions which are harmful or toxic to human, animal, plant or aquatic life, and provides the basis for whole effluent toxicity (WET) requirements in MPDES permits. The following endpoints define acute and chronic toxicity as measured in a WET test:

- During an acute WET test acute toxicity occurs when 50 percent mortality is observed for any tested species at any effluent concentration (i.e., LC50 < 100% effluent)
- During a chronic WET test chronic toxicity occurs when the 25% inhibition concentration (IC25) for any tested species is less than or equal to the percent effluent represented by the effluent concentration in the receiving water after accounting for any allowable dilution.

Great Falls passed all WET tests performed during the period of record and will not have a WET limit. WET monitoring will be required. If DEQ determines there is reasonable potential for a discharge to cause acute and/or chronic toxicity during this permit cycle, the MPDES permit may be updated to included limits for WET based on one, or both, of the endpoints above.

- Because the dilution ratio is greater than 100:1, the appropriate WET test is for acute toxicity.
- Quarterly acute WET testing using two species will be required of the facility starting the first full quarter after the permit effective date.
- Confirmation of acute toxicity in the effluent will trigger the standard toxicity identification/toxicity reduction (TIE/TRE) requirements of the permit.
- If the results for four consecutive quarters of testing indicate no acute toxicity, Great Falls may request for DEQ to reduce acute WET monitoring to semi-annual two species and DEQ may grant the request in writing. If approved, DEQ will process the request as a minor modification of the permit.

Standard WET language will be included in the permit and will describe the test methods, test conditions, endpoints, test acceptability criteria, reporting requirements, and accelerated testing-TIE/TRE requirements.

VI. Final Effluent Limits

The final effluent limits are a combination of the more stringent of the technology-based and water quality-based effluent limits developed. The final effluent limits in **Table 10** will be applied to the discharge at Outfall 001 beginning on the permit effective date and lasting through the term of the permit.

Table 10. Final Effluent Limits – Outfall 003

Parameter	Units	Average Monthly Limit [1]	Average Weekly Limit [1]	Maximum Daily Limit [1]
Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	25	40	-
	lb/day	2773	4437	-
	Percent Removal	85	-	-
Total Suspended Solids (TSS)	mg/L	30	45	-
	lb/day	3328	4991	-
	Percent Removal	85	-	-
E. coli, April - October	org/100 mL	126 [2]	252 [2]	-
E. coli, November - March	org/100 mL	630 [2]	1,260 [2]	-
Oil and Grease	mg/L	-	-	10.0
pH	s.u.	6.0-9.0 instantaneous minimum and maximum		
Total Recoverable Arsenic	µg/L	18.8	-	18.8
Total Recoverable Cyanide	µg/L	19.9	-	19.9
1,2-Dichloroethane	µg/L	5.0	-	5.0
Di(2-ethylhexyl) phthalate	µg/L	3.2	-	3.2

[1] See Definitions section at the end of the permit for explanation of terms.
[2] Geometric Mean

There shall be no discharge of floating solids or visible foam other than in trace amounts.

- There shall be no discharge which causes visible oil sheen in the receiving stream.
- There shall be no discharge that settles to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines.

VII. Monitoring and Reporting Requirements

A. Requirement to Monitor and Report

Great Falls must monitor their effluent. The samples collected and analyzed must be representative of the volume and nature of the facility's discharge. The Required Reporting Value is DEQ's best determination of a level of analysis that can be achieved by the majority of commercial, university, or governmental laboratories using EPA-approved methods or methods approved by DEQ, unless another reporting level is specified by DEQ, in writing.

- Monitoring will start with the effective date of the permit and last for the duration of the permit cycle.
- All analytical procedures must comply with the specifications of 40 CFR Part 136.
- Great Falls must submit NetDMR results for each month by the 28th of the following month.

B. Monitoring Locations, Frequency, Sample Type, and Calculations

The monitored parameters, their respective monitoring locations, and the reporting requirements are presented in **Table 11.**

1. ***Influent Monitoring***
   Influent monitoring is needed to calculate percent removal for $CBOD_5$ and TSS. Influent samples will be collected at the influent composite sampler and flow meters.

2. ***Effluent Monitoring***
   Effluent samples will reflect the nature and effect of the discharge at the frequency presented in **Table 11.** Effluent samples will be collected at the automatic composite sampler after the flow meter and grab samples will be collected from a spigot off the composite sampler.

Table 11. Self-Monitoring Requirements for Influent and Outfall 003

Parameter [1]	Unit [2]	Sample Frequency	Sample Type [3]	Reporting Requirement	Required Reporting Value
Effluent Flow	mgd	Continuous	Calculated	Daily Average Daily Maximum	0.01
Influent Flow	mgd	Continuous	Calculated	Daily Average Daily Maximum	0.01
Carbonaceous Biochemical Oxygen Demand, ($CBOD_5$)	mg/L	5/Week	Composite	Monthly Average Weekly Average	5
	% Removal	1/Month	Calculated	Monthly Average	0.1
	lbs/day	1/Month	Calculated	Monthly Average	0.1
Influent $CBOD_5$	mg/L	5/Week	Composite	Monthly Average	5
Total Suspended Solids (TSS)	mg/L	5/Week	Composite	Monthly Average Weekly Average	10
	%	1/Month	Calculated	Monthly Average	0.1
	lbs/day	1/Month	Calculated	Monthly Average	0.1
Influent TSS	mg/L	5/Week	Composite	Monthly Average	10
pH	s.u.	Daily	Instantaneous	Daily Minimum Daily Maximum	0.1
Temperature	°C	1/Day	Instantaneous	Monthly Average Daily Maximum	0.1

Table 11. Self-Monitoring Requirements for Influent and Outfall 003

Parameter [1]	Unit [2]	Sample Frequency	Sample Type [3]	Reporting Requirement	Required Reporting Value
E. coli	org/100 mL	5/Week	Grab	Monthly Average Weekly Average	1/100 mL
Oil and Grease	Presence	Daily	Observation	Present/Absent	NA
	mg/L	1/Quarter [4]	Grab	Monthly	1
Total Ammonia, as N	mg/L	1/Month	Composite	Monthly Average	0.07
Nitrate + Nitrite, as N	mg/L	1/Month	Composite	Monthly Average	0.02
Kjeldahl Nitrogen, as N	mg/L	1/Month [5]	Composite	Monthly Average	0.225
Total Nitrogen, as N [6]	mg/L	1/Month [5]	Calculated	Monthly Average	0.245
	lbs/day	1/Month [5]	Calculated		NA
Total Phosphorus, as P	mg/L	1/Month [5]	Composite	Monthly Average	0.003
	lbs/day	1/Month [5]	Calculated		NA
Dissolved Oxygen	mg/L	1/Week	Grab	Single Sample	0.3
Arsenic, Total Recoverable	µg/L	1/Month	Composite	Monthly Average Daily Maximum	1
Copper, Total Recoverable	µg/L	1/Quarter	Composite	Monthly	2
Cyanide, Total Recoverable	µg/L	1/Month	Composite	Monthly Average Daily Maximum	3
Lead, Total Recoverable	µg/L	1/Quarter	Composite	Monthly Average	0.3
1,2-Dichloroethane	µg/L	1/Month	Composite	Monthly Average Daily Maximum	0.5
Di(2-ethylhexyl) phthalate	µg/L	1/Month	Composite	Monthly Average Daily Maximum	2
Whole Effluent Toxicity	% Effluent	1/Quarter	Composite	Pass/Fail	NA
Expanded Effluent Testing Data – Required for EPA Application 2A Form D					
Metals, Total Recoverable	µg/L	2/Year [7]	Composite	Single Sample	[8]
Hardness, Total (as $CaCO_3$)	mg/L	2/Year [7]	Grab	Single Sample	10
Volatile Organic Compounds	µg/L	2/Year [7]	Composite	Single Sample	[8]
Acid-Extractable Compounds	µg/L	2/Year [7]	Composite	Single Sample	[8]
Base Neutral Compounds	µg/L	2/Year [7]	Composite	Single Sample	[8]

(1) All parameters are effluent unless otherwise noted.
(2) See narrative discussion in this section of permit for additional details on calculating load and percent removal.
(3) See Definition section at end of permit for explanation of terms.
(4) Oil and grease analysis must be conducted once per quarter or when a visual sheen is observed in the effluent.
(5) Must be sampled once per month during the applicable season (July 1 – September 30).
(6) Calculated as the sum of nitrate + nitrite (as N) and total Kjeldahl nitrogen concentrations.
(7) Samples must be analyzed two times per year during the years of 2022 and 2023, at least four months apart. A copy of the analytic laboratory report must be submitted (results will not be entered into NetDMR).
(8) See Circular DEQ-7 for minimum RRVs.

3. ***Upstream/Ambient Monitoring***
   - Great Falls will be required to monitor ambient data **for three full years of permit coverage - 2019, 2020, and 2021** as specified in **Table 12.**
   - Monitoring must take place at a consistent location upstream and outside the influence of Outfall 003 with the sample type, frequency, and required reporting values (RRVS) as identified in **Table 12.** The value will be reported on the facility's discharge monitoring reports.
   - Great Falls may choose to collect ambient data for additional parameters during the permit term if they plan to request a mixing zone for that parameter.

Table 12. Upstream/Ambient Monitoring and Reporting Requirements

Parameter	Unit	Sample Type [1]	Reporting Requirement	Required Reporting Value [2]
Parameters With Monitoring Required Quarterly from 2019 - 2021				
pH	s.u.	Instantaneous	Minimum, Maximum	0.1
Temperature	°C	Instantaneous	Minimum, Maximum	0.1
Total Ammonia, as N	mg/L	Grab	Single Sample	0.07
Hardness, as $CaCO_3$	µg/L	Grab	Single Sample	0.1
Nitrate + Nitrite, as N [3]	mg/L	Grab	Single Sample	0.02
Antimony, Total Recoverable	µg/L	Grab	Single Sample	0.5
Arsenic, Total Recoverable	µg/L	Grab	Single Sample	1
Beryllium, Total Recoverable	µg/L	Grab	Single Sample	0.8
Cadmium, Total Recoverable	µg/L	Grab	Single Sample	0.03
Chromium, Total Recoverable	µg/L	Grab	Single Sample	3
Copper, Total Recoverable	µg/L	Grab	Single Sample	2
Cyanide, Total Recoverable	µg/L	Grab	Single Sample	3
Lead, Total Recoverable	µg/L	Grab	Single Sample	0.3
Mercury, Total Recoverable	µg/L	Grab	Single Sample	0.005
Nickel, Total Recoverable	µg/L	Grab	Single Sample	2
Selenium, Total Recoverable	µg/L	Grab	Single Sample	1
Silver, Total Recoverable	µg/L	Grab	Single Sample	0.2
Thallium, Total Recoverable	µg/L	Grab	Single Sample	0.2
Zinc, Total Recoverable		Grab	Single Sample	8
Parameters (Nutrients) with Monitoring Required July, August, September from 2019 – 2021				
Nitrate + Nitrite, as N	mg/L	Grab	Single Sample	0.02
Kjeldahl Nitrogen, as N	mg/L	Grab	Single Sample	0.225
Total Nitrogen, as N [3]	mg/L	Calculated	Single Sample	0.245
Total Phosphorus, as P	mg/L	Grab	Single Sample	0.003

[1] See Definition section at end of permit for explanation of terms.
[2] See Circular DEQ-7 for minimum RRVs.
[3] May be determined by persulfate digestion (grab sampling) or calculated as the sum of nitrate + nitrite (as N) and total Kjeldahl nitrogen concentrations. If persulfate digestion is used, then it is not required to sample total Kjeldahl nitrogen.

VII. Public Participation

DEQ issued Public Notice No. MT-18-22 dated October 22, 2018. The public notice states that a tentative decision has been made to issue an MPDES permit to the Permittee and that a draft permit, fact sheet and environmental assessment (EA) have been prepared. Public comments are invited any time prior to the close of the business on November 23, 2018. Comments may be directed to:

Department of Environmental Quality
Water Protection Bureau
PO Box 200901
Helena, MT 59620
or
DEQWPBPublicComments@mt.gov

All comments received or postmarked prior to the close of the public comment period will be considered in the formulation of the final permit. DEQ will respond to all substantive comments and issue a final decision within sixty days of the close of the public comment period or as soon as possible thereafter.

All persons, including the applicant, who believe any condition of a draft permit is inappropriate or that DEQ's tentative decision to deny an application, terminate a permit, or prepare a draft permit is inappropriate, shall raise all reasonably ascertainable issues and submit all reasonably available arguments supporting their position by the close of the public comment period (including any public hearing).

A. Notification of Interested Parties

Copies of the public notice were mailed to the discharger, state and federal agencies and interested persons who have expressed an interest in being notified of permit actions. A copy of the distribution list is available in the administrative record for this permit. In addition to mailing the public notice, a copy of the notice and applicable draft permit, fact sheet and EA were posted on DEQ's website for 30 days.

Any person interested in being placed on the mailing list for information regarding this MPDES permit should contact DEQ, reference this facility, and provide a name, address, and email address.

B. Public Hearing

During the public comment period provided by the notice, DEQ will accept requests for a public hearing. A request for a public hearing must be in writing and must state the nature of the issue proposed to be raised in the hearing.

C. Permit Appeal

After the close of the public comment period, DEQ will issue a final permit decision. A final permit decision means a final decision to issue, deny, modify, revoke and reissue, or, terminate a permit. A permit decision is effective 30 days after the date of issuance unless a later date is specified in the decision, a stay is granted, or the applicant files an appeal pursuant to 75-5-403, MCA.

The Applicant may file an appeal within 30 days of DEQ's action to the following address:

Secretary, Board of Environmental Review
Department of Environmental Quality
1520 East Sixth Avenue
PO Box 200901
Helena, Montana 59620-0901

D. Additional Information

Requests for additional information or questions regarding this permit should be directed to the Water Protection Bureau at 406-444-5546.

VIII. Information Sources

Federal Water Pollution Control Act (Clean Water Act), 33 U.S.C. §§ 1251-1387, October 18, 1972, as amended 1973-1983, 1987, 1988, 1990-1992, 1994, 1995 and 1996.

Montana Code Annotated (MCA), Title 75-5-101, *et seq*., "Montana Water Quality Act,".

Administrative Rules of Montana Title 17 Chapter 30 - Water Quality
Subchapter 2 - *Water Quality Permit and Application Fees.*
Subchapter 5 - *Mixing Zones in Surface and Ground Water*.
Subchapter 6 - *Montana Surface Water Quality Standards and Procedures*.
Subchapter 7- *Nondegradation of Water Quality*
Subchapter 12 - *MPDES Standards.*
Subchapter 13 - *MPDES Permits*.

City of Great Falls. *Great Falls Arsenic Summary Report.* May 15, 2018.

Montana Department of Environmental Quality. *Circular DEQ-7, Montana Numeric Water Quality Standards.* May 2017.

Montana Department of Environmental Quality. *Circular DEQ-12A, Montana Base Numeric Nutrient Standards*. July 2017.

Montana Department of Environmental Quality. *Montana Draft 2018 and 2016 Integrated Report and 303(d) List. A Compilation of Impaired and Threatened Water bodies in Need of Water Quality Restoration. Part A. Water Quality Assessment Results*.

Montana Pollutant Discharge Elimination System Permit Number MT0021920:
- Administrative Record
- Renewal Application EPA Form 1 and 2A, June 2015

Morrison-Maierle, Inc. *Mixing Zone Study, City of Great Falls.* October 26, 2012.

Morrison-Maierle, Inc. and HDR. *Wastewater Treatment Plant Capacity Evaluation.* November 8, 2012.

US Code of Federal Regulations, 40 CFR Parts 122-125, 130-133, 136 and 442.

US EPA NPDES *Permit Writers' Manual*, EPA 833-B-96-003, September 2010.

US EPA. *EPA Region VIII Mixing Zones and Dilution Policy*. December 1994 (Updated September 1995)

US EPA *Technical Support Document for Water Quality-Based Toxics Control*, EPA/505/2-30-001, March 1991.

US Geological Survey. *The StreamStats Program*. Online at http://streamstats.usgs.gov/. Accessed on July 12, 2018.

Prepared by: Joanna McLaughlin
Date: September 2018

Appendix 1. Waterbody-Based Standards (from Department Circular DEQ-7, May 2017)

Ambient Total Hardness (as $CaCO_3$) **153** **mg/L***

Cadmium		Copper		Chromium(III)		Lead	
Acute	*Chronic*	*Acute*	*Chronic*	*Acute*	*Chronic*	*Acute*	*Chronic*
Calculated Standard:		*Calculated Standard:*		*Calculated Standard:*		*Calculated Standard:*	
2.9 (µg/L)	**1.1 (µg/L)**	**20.9 (µg/L)**	**13.4 (µg/L)**	**2554 (µg/L)**	**122 (µg/L)**	**140 (µg/L)**	**5.5 (µg/L)**
0.0029 (mg/L)	0.0011 (mg/L)	0.0209 (mg/L)	0.0134 (mg/L)	2.554 (mg/L)	0.1221 (mg/L)	0.1403 (mg/L)	0.0055 (mg/L)

Nickel		Silver		Zinc	
Acute	*Chronic*	*Acute*	*Chronic*	*Acute*	*Chronic*
Calculated Standard:		*Calculated Standard:*		*Calculated Standard:*	
672 (µg/L)	**75 (µg/L)**	**8 (µg/L)**	**N/A (µg/L)**	**172 (µg/L)**	**172 (µg/L)**
0.672 (mg/L)	0.0748 (mg/L)	0.0084 (mg/L)	NA (mg/L)	0.172 (mg/L)	0.172 (mg/L)

Ammonia Ambient Water Quality Standard (mg/L ammonia-N)

	Temperature (75th percentile)	pH (75th percentile)	Salmonids present	Salmonids absent	Fish early lifestages present*	Fish early lifestages absent*
CMC (acute)	N/A	8.4	**2.59**	3.88	N/A	N/A
CCC (chronic)	15.5	8.4	N/A	N/A	**1.21**	1.21

*At 15C and above, the criterion for fish early life stages absent is the same as the criterion for fish early life stages present

Appendix 2. General Information Used to Develop Effluent Limits for Great Falls Wastewater Treatment Plant

Facility				
Facility Status	Permit Renewal			
Average Daily Design Flow	13.32 mgd			
Actual Average Daily Flow	9.31			
Discharge Method	Continuous			
Period of Record	November 2015 – May 2018			
Outfall 003 Location	47°31'13" N 111°17'49" or			
Nondegradation				
New or Increased Source	No			
Receiving Water Characteristics, Missouri River				
Water Use Classification	B-2			
Watershed	Upper Missouri			
Waterbody Name/Location	Missouri River – Sun River to Rainbow Dam			
Montana Stream Segment	MT41Q001_011			
USGS Hydrologic Unit Code (HUC)	10030102			
USGS Gauging Station	Sun R. at Vaughn 0608900, Missouri R. Near Ulm 06078200			
Ambient Monitoring Stations				
7Q10	Sun 84.3 cfs + Missouri 2645 cfs = 2729 cfs = **1763 mgd**			
14Q5	Sun 119 cfs + Missouri 3022 cfs = 3141 cfs = **2029 mgd**			
Dilution ratio (7Q10 : Design Flow)	132:1			
Salmonids/Early Life Stages	Present/Present			
Impairment				
Identified as Impaired	Yes. Not fully supporting aquatic life or drinking water			
303(d) List	2016 and Draft 2018			
Total Maximum Daily Load (TMDL)	None			
Probable Causes of Impairment	Mercury, selenium, total chromium, polychlorinated biphenyls,			
Probable Sources of Impairment	Contaminated sediments, dam construction (other than upstream			
Dilution Granted				
Parameter	*Flow*	*Mixing*	*Chronic/HH*	*Acute*
Ammonia	7Q10	Source Specific	Up to 12%	Up to 1.2%
Nitrate + Nitrite	7Q10	Source Specific	Up to 12%	Up to 1.2%
Total Recoverable Metals	7Q10	Source Specific	Up to 12%	Up to 1.2%
Total Nitrogen	14Q5	Standard/Nutrients	100%	-
Total Phosphorus	14Q5	Standard/Nutrients	100%	-
Mixing Zone				
Chronic Mixing Zone Size	Segment of the Missouri River extending 4,800 feet downstream			
Acute Mixing Zone Size	Segment of the Missouri River extending 80 feet long x 20 feet			
Nutrients				
Discharger Category:	Mechanical Treatment, greater than 1.0 mgd			
Ecoregion:	Northwestern Glaciated Plains			
Total Nitrogen:	560 µg/L from July 1 – September 30			
Total Phosphorus:	80 µg/L from July 1 – September 30			