MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM
(MPDES)

Fact Sheet

Permittee:	City of Great Falls
Permit No.:	MT0000442
Receiving Water:	Missouri River
Facility Information:	
Name	Great Falls Water Treatment Plant
Location	1300 Upper River Road Great Falls, MT 59405 Cascade County
Facility Contact:	Wayne Lovelis, Plant Manager PO Box 5021 1300 Upper River Road Great Falls, MT 59403-5021
Fee Information:	
Number of Outfalls	2
Outfall – Type	001 – Process Water 002 – Process Water

I. Permit Status

This fact sheet has been drafted for renewal of Montana Pollutant Discharge Elimination System (MPDES) permit no. MT0000442. The existing permit was issued May 18, 2009, became effective July 1, 2009, and expired at midnight on June 20, 2014 (2009-issued permit).

The Montana Department of Environmental Quality (DEQ) received an application from the City of Great Fall for renewal of the Great Falls Water Treatment Plant (WTP) permit no. MT0000442 on December 12, 2013. DEQ deemed the application complete and the 2009-issued permit to be administratively continued in a letter dated December 27, 2013.

DEQ proposes the following changes with this renewal:

1. Total residual chlorine limit removed.
2. Dissolved aluminum limit removed.
3. Effluent monitoring for total nitrogen has been increase to monthly from July through September, the period when the total nitrogen standard applies.
4. Effluent monitoring for total dissolved solids, oil & grease and the disinfection byproducts (trihalomethanes (TTHM), haloacetic acids (HAA5), and N-nitrosodimethylamine (NDMA)) have been decreased to once per year.

II. Facility Information

A. Facility Description

The Great Falls WTP is a municipal water treatment plant classified under the Standard Industrial Classification (SIC) code 4941, "Water Supply." The WTP treats surface water from the Missouri River and serves approximately 66,000 users. The WTP is certified through DEQ's Public Water Supply (PWS) program under PWSID #MT0000525.

The WTP consists of a rapid sand filtration plant that uses coagulants (including aluminum) to settle out particulate. Great Falls uses chlorine as their primary disinfectant. Chlorine is currently added in the rapid mix basin at the beginning of the treatment process. Ammonia is added at the end of the process, after the clearwell. The addition of ammonia to the chlorinated water creates chloramines, which are considered a secondary disinfectant and maintain residual disinfection in the distribution system.

The main plant has been expanded a number of times since it was originally built in the early 1900's. The current production of potable water varies between about 8 million gallons per day (mgd) in the winter to a maximum of 35 mgd in the summer, with an annual average of approximately 12.5 mgd. [Correspondence from Wayne Lovelis, June 15, 2017].

Great Falls also has a Seasonal Treatment Plant, which is an outdoor facility built in 1971 that consists of a permanganate contact basin and additional flocculation and sedimentation basins, for use when the WTP must treat beyond the main plant's treatment capacity. The Seasonal

Treatment Plant is capable of treating up to 16 mgd. The Seasonal Treatment Plant has not been used in at least 25 years, although the drains are left open to drain storm water from the 29,000 square foot area. Because it would require some maintenance and repair to become operable, the seasonal facility would only be used due to a significant increase in water demand.

This facility's wastewater treatment system was designed to handle up to 2.4 mgd. Wastewater from the main WTP flows into a 200,000-gallon backwash surge tank which functions primarily to equalize the wastewater load, and secondarily to remove sludge for disposal via a sump pump. From the surge tank, the backwash is piped to the dechlorination vault. The facility operates an automated sodium metabisulfite dechlorination system (see **Figure 1**).

Wastewater flow is measured by a magnetic flow meter with a totalizer, prior to entering the dechlorination vault. According to Discharge Monitoring Report (DMR) records based on this meter, the average backwash wastewater flow was 0.51 mgd and the maximum was 1.24 mgd during the period of record (POR) January 2012 through April 2017.

After dechlorination, the wastewater flows to a wet well and into the backwash clarifier, prior to discharge to Outfall 001. The backwash clarifier, installed in 2003, is a concrete clarification basin with mechanical sludge separation that is rated at up to 2.4 mgd.

The Great Falls WTP has two wastewater discharge points to the Missouri River under MPDES MT0000442:

Outfall 001: A 24–inch concrete pipe that is the primary wastewater discharge from the main water treatment plant.

Outfall 002: A 30-inch concrete pipe that is supplied by a 12-inch line from the Seasonal Treatment Plant, and a 30-inch line from the flume bypass/overflow in the main treatment plant's filter building.

The main WTP wastewater discharge consists of the following sources:

- Filter backwash (Outfall 001)
- Clear well drainage (Outfall 001)
- Wash water from traveling screens (Outfall 001)
- Storm water drainage (Outfall 001)
- Backwash holding tank overflow (Outfall 001)
- Flume Overflow/Bypass (Outfall 002)
- Clarifier Bypass (Outfall 002)

Filter Backwash

The sand filters in the WTP are cleaned by backwashing with chlorinated/chloraminated potable water at periodic intervals, based on pressure drop across the filter. It takes approximately 15 minutes to backwash a filter, with a peak flow of 15,000 gallons per minute (gpm). A backwash cycle is limited to a total of 100,000 gallons, which is the capacity of the water holding tank

[Correspondence from Wayne Lovelis, June 15, 2017]. Since it takes 30 minutes to refill the holding tank (which is filled with chlorinated/ chloraminated water), the WTP cannot generate more than 200,000 gallons per hour (gph) or 4.8 mgd backwash. However, since installation of the backwash clarifier in 2003, the WTP wastewater discharge has been limited by the clarifier capacity of 2.4 mgd.

There are two ways that backwash wastewater could potentially short-circuit the wastewater treatment system. First, the backwash surge tank has an open overflow pipe, in case of an emergency overflow, that leads directly to Outfall 001. The inlet for this overflow pipe is located approximately 9.5 feet above the bottom of the tank. The WTP's Supervisory Control and Data Acquisition (SCADA) system has a level sensor with high level alarm that alerts the operator if the wastewater reaches 9.2 feet, and allows the operator to discontinue further backwashing until the system is stabilized. The SCADA system continually monitors and records the water level in this tank. There have been no overflows in at least 25 years. If there were, Great Falls would be able to obtain samples and calculate the volume of the discharge.

Secondly, the system has a clarifier bypass located after flow monitoring and dechlorination. This bypass is necessary for maintenance activities or equipment problems requiring the backwash clarifier to be taken out of service for a period of time. Great Falls would have to manually bypass the clarifier. In the event this occurred, they would be able to obtain samples and document flow. Great Falls has not bypassed the clarifier since it's installation in 2003. Discharges under either of these two scenarios would be subject to permit requirements.

Basin drainage

Basin drainage occurs during maintenance activities requiring draining the flocculation, primary sedimentation, or secondary sedimentation basins or clear wells. This activity accounts for the majority of the volume after the filter backwash.

Wash Water from Traveling Screens

Traveling screens used for the raw water intake are washed by chlorinated/chloraminated potable water. The resulting wastewater is currently added, at up to 300 gpm, to the clarifier after being reduced through two grinders. This waste stream is included in the total volume discharged by adding it to the magnetic flow meter's totalized discharge.

Storm Water Drainage

There are several manhole and storm drains located in the gravel parking area close to the backwash clarification system. In 2008 the sampling point was moved further upstream after the clarifier, therefore the storm water isn't included in flow measurement or sampling analyses for Outfall 001.

Flume Overflow/Bypass

The other potential wastewater discharge from the main WTP is from the flumes which carry settled water from the water treatment clarification basins to the sand filters as part of the water treatment process. In the case of a failure in the treatment system resulting in non-potable water, Great Falls has the ability to jettison the contaminated water from the treatment plant through the flumes to Outfall 002. Another potential scenario is the automatic overflow of the flumes to prevent flooding at the filter building. For either scenario, Great Falls will be required to comply with the relevant regulations. An overflow of these flumes has not occurred in at least 25 years.

B. Effluent Characteristics

A summary of effluent quality from facility Discharge Monitoring Reports (DMRs) is given in **Table 1**. The Period of Record (POR) is January 2012 through April 2017.

Table 1: Outfall 001 Characteristics for the POR of January 2012 through April 2017

Parameter	Location	Units	Previous Permit Limit	Minimum Value	Maximum Value	Average Value	Number of Samples
Flow, Daily Maximum	Effluent	mgd	(1)	0.01	1.24	0.51	63
Total Suspended Solids	Effluent	mg/L	30/45(2)	0/0	21.0/57.0	11.0/24.4	63
Dissolved Aluminum	Effluent	mg/L	0.52/0.71(2)	0.03/0.04	0.14/0.49	0.05/0.08	63
pH	Effluent	s.u.	6.0-9.0	6.49	7.95	--	63
Total Residual Chlorine	Effluent	mg/L	0.26/0.5(2)	0.01/0.04	0.09/0.18	0.037/0.097	63
Oil & Grease	Effluent	mg/L	(1)	0.0	1.0	0.7	10
Total Dissolved Solids	Effluent	mg/L	(1)	188.0	240.0	214.4	10
Total Ammonia, as N	Effluent	mg/L	(1)	0.05	0.19	0.10	10
Total Nitrogen	Effluent	mg/L	(1)	0.00	0.70	0.35	10
Total Trihalomethanes (TTHM)	Effluent	µg/L	(1)	35.0	43.0	39.0	2
Haloacetic Acids, 5 (HAA5)	Effluent	µg/L	(1)	28.0	39.0	33.5	2
n-Nitrosodimethylamine (NDMA)	Effluent	µg/L	(1)	ND	ND	ND	1

Footnotes: ND = non detect
(1) No limit in previous permit; monitoring requirement only.
(2) Average Monthly Limit/ Maximum Daily Limit

The seasonal plant has not operated in 25 years; therefore no effluent data from Outfall 002 is available.

C. Compliance History

DEQ performed one MPDES compliance inspection between 2009 and 2017 (March 14, 2012). No deficiencies were noted in the 2012 inspection.

Great Falls was issued a Notice of Violation and Administrative Compliance and Penalty Order (Docket No. WQ-07-08) on November 2, 2007, for exceeding the Total Suspended Solids (TSS)

& Total Residual Chlorine (TRC) permit limits. The Notice of Violation and Administrative Compliance and Penalty Order was closed on October 9, 2009.

During the POR two numeric limit exceedances were documented for Total Suspended Solids (TSS) for monitoring periods ending July 31, 2013 and June 30, 2015.

III. Technology-based Effluent Limits

A. Scope and Authority

Technology-based Effluent Limits (TBELs) represent the minimum level of control that must be imposed by a permit issued under the MPDES program. DEQ must consider technology available to treat wastewater, and effluent limits that can be consistently achieved by that technology. TBELs are based on currently available treatment technologies and allow the permittee discretion to choose applicable controls to meet those standards.

The Montana Board of Environmental Review (BER) has adopted performance standards for point source discharges to state waters. The BER adopted a series of federal agency rules that adopt TBELs for existing sources and performance standards for new sources. However, federal Effluent Limit Guidelines (ELGs) have not been promulgated under Subchapter N for discharges of treated wastewater from potable water treatment plants.

B. Proposed TBELs: Concentration-based Limits

DEQ recognizes that the most common treatment for WTP backwash wastewater is similar to treatment by domestic wastewater lagoons. Settling basins can effectively reduce TSS from wastewater at a low cost. National Secondary Standards (NSS) for domestic wastewater treatment lagoons specify the minimum level of effluent quality in terms of TSS. TSS concentrations in lagoon discharges are limited to 30 mg/L monthly average and 45 mg/L 7-day average and these limits have been demonstrated to be consistently achievable in the water treatment industry. The 2009-issued permit TSS TBELs were based on NSS, these limits will be continued with this permit renewal. The effluent limits for pH must be maintained within the range of 6.0 to 9.0 s.u.

C. Mass-based Expression of Limitations

All effluent limits should be expressed in terms of mass, except when applicable standards and limits are expressed in terms of other units of measurement. Calculation of any permit limit which is based on production must be based on a reasonable measure of actual production of the facility that corresponds to the appropriate time period. Because the Great Falls WTP is not subject to an ELG or other production- or mass-based limitation, the development of mass-based effluent limits is not required.

D. Nondegradation Load Allocations

Sources that are in compliance with the conditions of their permit and do not exceed the limits established in the permit or determined from a permit previously issued by DEQ are not considered new or increased sources.

The nondegradation 30-day average load allocation for TSS was calculated in 1999 to be 1,251 lb/day, based on the TSS effluent concentration limit of 30 mg/L and the facility's maximum flow rate of 5.0 mgd. During this permit renewal, DEQ found that the Great Falls WTP was well below the nondegradation allocated load during the POR. The nondegradation allocated load and the actual average loads discharged from the facility during the POR are presented below in **Table 2**. Actual loads for TSS were calculated based on the monthly average flow and 30-day maximum TSS reported on the facility DMRs. This permit does not authorize new or increased discharge.

Table 2: Nondegradation and Actual Loads for POR

			Actual Annual Loads					
Parameter	**Load Allocation**		**2012**	**2013**	**2014**	**2015**	**2016**	**2017(2)**
TSS - Annual Average (1)	lb/day	1,251	72	55	63	128	17	42
TSS - Maximum Month (1)	lb/day	1,251	85	76	90	236	39	49

Footnotes:
(1) The annual average load was calculated based on the reported monthly average flow TSS concentration. The maximum monthly load was calculated based on daily maximum TSS concentration.
(2) Data was analyzed through April 30th for 2017.

Since the data indicate that the facility did not exceed the nondegradation load value, and has not increased flow or undergone any modifications after 1993 that could increase the volume or nature of the discharge, DEQ has determined that the WTP discharge is not a new or increased source for the purposes of nondegradation.

IV. Water Quality-based Effluent Limits

A. Scope and Authority

Permits are required to include Water Quality-based Effluent Limits (WQBELs) when TBELs are not adequate to protect state water quality standards. Montana water quality standards require that no wastes may be discharged that can reasonably be expected to violate any state water quality standards. Montana water quality standards also define both water use classifications for all state waters and numeric and narrative standards that protect those designated uses.

B. Receiving Water

The City of Great Falls WTF discharges to the Missouri River. The segment of the Missouri River the facility discharges to is located within the Upper Missouri – Dearborn Watershed and identified by the U.S. geological Survey (UGS) Hydrologic Unit Code (HUC) 10030102 and assessment unit MT41Q001_022, MISSOURI RIVER, Sheep Creek to Sun River.

The Missouri River directly at the area of discharge is classified as B-1 according to Montana Water Use Classifications. Waters classified B-1 are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

Downstream from the discharge (approximately 800 feet) is the beginning of the reach of Missouri River after the confluence with the Sun River. The downstream segment is identified by Montana stream segment MT41Q001_011, defined as the reach from Sun River to Rainbow Dam. This stream segment is classified as B-2. The Great Falls WTP mixing zone extends into this segment.

The 2016 303(d) list identifies the Missouri River at the discharge point (MT41Q001_022) as partially supporting aquatic life. The probable cause of impairment is sedimentation and siltation. Downstream from the discharge, after the confluence with the Sun River, the 2016 303(d) list identifies this section (MT41Q001_011) as not supporting aquatic life or drinking water supply. The most relevant probable cause of impairment include sedimentation and siltation, solids (suspended-bedload), turbidity, selenium, polychlorinated biphenyls, mercury and chromium (total).

To date, a total maximum daily load (TMDL) has not been prepared for either segment MT41Q001_022 or segment MT41Q001_011.

A summary of the Missouri River ambient stream data collected above the City of Great Falls WTP is presented in **Table 3**.

Table 3: Missouri River Ambient Water Quality Data				
Parameter	**Units**	**Number of Samples**	**75th Percentile**	**Monitoring Data Source**
pH	s.u.	8	8.71	MDEQ_WQ_WQX - Montana DEQ WQPB June 2012 – October 2016
Temperature	ºC	13	17.0	
Total Ammonia as N(1)	mg/L	7	0.013	
Nitrate + Nitrite(1)	mg/L	18	0.022	
Total N(2)	mg/L	8	0.23	
Aluminum	mg/L	9	0.03	

Footnotes:
(1) Some ambient data samples were non-detect, therefore the minimum detection level of the 40 CFR 136 approved methods is used for those samples.
(2) Data analyzed from July 1 through September 30.

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 will determine the appropriateness of a mixing zone when applied for and will grant a mixing zone, deny the mixing zone, or grant an alternative or modified mixing zone.

Although certain standards may be exceeded in the mixing zone, 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 the mixing zone. Acute standards may not be exceeded in any part of the mixing zone, unless the department specifically finds that allowing minimal initial dilution will not threaten or impair existing beneficial uses.

A standard mixing zone must not extend downstream more than one-half the mixing width distance (A½) or extend downstream more than 10 times the stream width. In order to be the smallest practicable size and lacking the physical data to determine A½, DEQ will set the mixing zone at 10 times the stream width at seven-day ten-year low flow (7Q10) flow. The stream width is estimated to be 0.1 mile at the point of discharge; therefore, the chronic mixing zone length will be set at one mile (5,280 feet) and the acute mixing zone length will be set at 10% of the chronic mixing zone or 0.1 mile (528 feet) downstream from Outfall 002. These are the same chronic and acute mixing zone lengths that were calculated in the 2009-issued permit.

The amount of the 7Q10 allowed for dilution as part of the standard mixing zone is dependent on the size of the discharge relative to the receiving water flow. Because the dilution ratio is 3402:1 (1,734.7 mgd 7Q10 stream flow / 0.51 mgd mean annual discharge) and the actual mean discharge flow is less than 1 mgd, the discharge would qualify for a standard mixing zone and DEQ will grant dilution for:

- the chronic condition using 10% of the 7Q10 flow: 173 mgd for ammonia, total residual chlorine, dissolved aluminum, total trihalomethanes, haleocetic acids, and N-nitrosodimethlymine;
- the acute condition using 1% of the 7Q10 flow, 17.3 mgd for ammonia and total residual chlorine; and
- nutrients will be based on 100% of the 14Q5 flow, 2,043 mgd.

The Missouri River data from the Ulm gaging site (USGS station 06078200) will be used to determine the 7Q10 and 14Q5 used for determining Reasonable Potential (RP) and deriving limits. Because the Sun River discharges into the Missouri River 800 feet downstream of the Great Falls WTP previous permits have used a combination of low flow stats from both the Sun River and the Missouri River. DEQ is no longer using that methodology. Using only the Missouri River low flow data will provide a more conservative approach to RP and limit calculations and will eliminate any question as to whether the Missouri River and Sun River mix completely. Aerial photography shows two distinct color plumes going downstream separately for quite some distance after the convergence of the two rivers. If the Great Falls WTP does not agree with this approach they will have an opportunity to complete a local investigation and justify addition of flow from the Sun River is appropriate. The Sun River would only contribute approximately 54 mgd to the 1,734 mgd 7Q10 of the Missouri River.

DEQ will also grant the full seasonal 14Q5 dilution flow of 2,043 mgd to develop RP analyses and nutrient limits.

DEQ finds that allowing a limited acute mixing zone for TRC will not threaten or impair existing beneficial uses. This finding is based on the understanding that TRC is not persistent and typically exhibits first order decay in the receiving water. DEQ believes that limiting dilution to 1% of the critical receiving water flow for parameters such as chlorine, ammonia and dissolved oxygen for existing facilities with incomplete mixed discharges, such as the Great Falls WTP, will not result in acute lethality or block passage of migrating organisms.

D. Basis and Proposed Water Quality-based Effluent Limits

Permits are required to include WQBELs when TBELs are not adequate to protect water quality standards, and no water may be discharged that can reasonably be expected to violate any standard. Pollutants typically present in water treatment facility effluent that may exceed water quality standards include TSS, turbidity, Oil and Grease (O&G), total residual chlorine (TRC), and dissolved aluminum when aluminum products are used for flocculation. In addition, other pollutants may be present in the Great Falls WTP wastewater discharge due to the clorination/chloroamination process, including total trihalomethanes (TTHM), haloacetic acids (HAA5), and N-nitrosodimethylamine (NDMA), total ammonia as nitrogen (N), temperature, and nutrients (TN and TP).

TBELs implemented in this permit renewal will be protective of the receiving waters for pollutants of concern including solids, turbidity and sedimentation and siltation. Given the nature of the Great Falls WTP and the additives used in the treatment process, selenium, polychlorinated biphenyls, mercury and chromium (total) are not expected to be present in the effluent; therefore, these parameters are not considered pollutants of concern for this facility.

DEQ develops WQBELs for any pollutant of concern (POC) for which there is reasonable potential (RP) to cause or contribute to exceedances of instream numeric or narrative water quality standards. Pollutants and parameters are identified as POC for one or more of the following reasons:

- Listed TBELs;
- Identified as needing limits in the previous permit;
- Identified as present in the effluent through monitoring or otherwise expected present in the discharge; or
- Associated with impairment which may or may not have a WLA in a TMDL.

DEQ evaluated pollutants of concern in **Table 4**.

Table 4. Identification of POC and Need for RP Analysis

Parameter	Basis for POC Identification
Total Suspended Solids	TBELs, known present
pH	TBELs, known present
Oil & Grease	WQBEL, known present
Dissolved Aluminum	WQBEL, known present
Total Residual Chlorine	WQBEL, known present
Total Dissolved Solids	Known present
Ammonia, as N	Known present
Total Nitrogen	Known present
Total Trihalomethanes (TTHM)	Disinfection byproduct, known present
Haloacetic Acids, 5 (HAA5)	Disinfection byproduct, known present
n-Nitrosodimethylamine (NDMA)	Disinfection byproduct, known present

The need for WQBELs is determined based on a RP analysis for certain pollutants to determine if numeric or narrative water quality standards may be exceeded. RP calculations utilize the receiving water concentration; the maximum projected effluent concentration, the design flow of the wastewater treatment facility, and the applicable receiving water flow.

DEQ uses a mass balance equation to determine RP (Equation 1). Equation 1 is used to determine the concentration of a pollutant of concern after accounting for other sources of pollution in the receiving water and any dilution by an approved mixing zone.

$$C_r = \frac{C_d Q_d + C_s Q_s}{Q_s + Q_d}$$ (Equation 1)

Where:
Q_s = upstream receiving water, low flow rate available for dilution (mgd)
C_s = upstream receiving water pollutant concentration (mg/L), 75th percentile
Q_d = critical effluent flow rate (mgd), maximum monthly average (chronic) and maximum daily (acute)
C_d = critical effluent pollutant concentration (mg/L)
C_r = receiving water pollutant concentration (after dilution; mg/L)

If C_r > standard, then RP exists and a WQBEL must be developed.

The critical effluent concentration is obtained following the method recommended by the EPA *Technical Support Document for Water Quality-based Toxics Control* (TSD, 1991). A multiplier is determined using the TSD methods, based on dataset statistics (based on the data set, coefficient of variation, and sample size at the 95% confidence interval).

When no mixing or dilution in the receiving water is available or allowed and the critical effluent concentration exceeds the water quality standard, RP exists and limits are developed based on achieving the water quality standard at the point of discharge.

DEQ is proposing effluent limits for pollutants with RP for which adequate data exist, as discussed in the following section. A complete RP analysis is included in **Attachment A**.

1. Conventional Pollutants

Total Suspended Solids (TSS) – TSS is a typical effluent quality indicator for water treatment facilities and is regulated as TBELs. The facility provides a significant reduction in solids.

pH – The pH standard applies to the discharge: “Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0”. The 2009- issued permit included a pH limit of 6.0 to 9.0 s.u. This limit is protective of the standard and will be continued with this permit renewal. No separate WQBEL is necessary.

Oil and Grease (O&G) – The 2009-issued permit required O&G effluent monitoring two times per year. The maximum O&G concentration for 10 samples was 1.0 mg/L oil & 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.

RP to exceed the acute water quality standard for O&G was assessed using *Equation 1*, where:

C_r = receiving water concentration (RWC) after mixing, mg/L
C_d = maximum projected effluent concentration, 1.86 mg/L
C_s = RWC upstream of discharge, 0.0 mg/L
Q_s = applicable receiving water flow, 1% of the 7Q10, 17.3 mgd
Q_d = facility maximum daily effluent flow rate, 1.24 mgd

The projected maximum concentration for O&G (C_d) was found following the TSD Method. A multiplier of 1.86 was determined using the TSD methodology, using a CV of 0.69 and a sample size of 10. The maximum reported effluent for O&G was 1.0 mg/L. The maximum concentration times the multiplier is 1.86 mg/L (1.0 mg/L * 1.86).

$$C_r = \frac{(1.24 * 1.86) + (0 * 17.3)}{(1.24 + 17.3)} = 0.12 \text{ mg/L}$$

$C_{r\text{-acute}}$ (0.12 mg/L) is below the acute O&G standard of 10 mg/L. Similarly, RP to exceed the chronic water quality standard for O&G was assessed using *Equation 1* and $C_{r\text{-chronic}}$ (0.005mg/L) is below the chronic O&G standard of 10 mg/L.

No RP exists for this parameter. Monitoring will be reduced to once per year with this permit renewal. Extended calculations are included in **Attachment A**.

2. Nonconventional Pollutants

Total Residual Chlorine (TRC) – The Great Falls WTP practices chlorine disinfection of its "product" (potable drinking water). The 2009-issued permit includes TRC limits of 0.26 mg/L as the average monthly limit and 0.50 mg/L for the maximum daily limit. The acute and chronic water quality standards for TRC are 0.019 mg/L and 0.011 mg/L, respectively. Chlorine dissipates rapidly so there is assumed to be no background concentration of chlorine at the point of discharge from the Great Falls WTP into the Missouri River.

RP to exceed the acute water quality standard for TRC was assessed using *Equation 1*, where:

C_r = receiving water concentration (RWC) after mixing, mg/L
C_d = maximum projected effluent concentration, 0.177 mg/L
C_s = RWC upstream of discharge, 0.0 mg/L
Q_s = applicable receiving water flow, 1% of the 7Q10, 17.3 mgd
Q_d = facility maximum daily effluent flow rate, 1.24 mgd

The projected maximum concentration for TRC (C_d) was found following the TSD Method. A multiplier of 0.985 was determined using the TSD methodology, using a CV of 0.437 and a sample size of 63. The maximum reported effluent for TRC was 0.18 mg/L. The maximum concentration times the multiplier is 0.177 mg/L (0.18 mg/L * 0.985).

$$C_r = \frac{(1.24 * 0.177) + (0 * 17.35)}{(1.24 + 17.3)} = 0.012 \text{ mg/L}$$

$C_{r\text{-acute}}$ (0.012 mg/L) is below the acute TRC standard of 0.019 mg/L. Similarly, RP to exceed the chronic water quality standard for TRC was assessed using *Equation 1* and $C_{r\text{-chronic}}$ (0.0005 mg/L) is below the chronic TRC standard of 0.011 mg/L.

No RP exists for this parameter. The existing monitoring will be continued with this permit renewal. Since new information (facility, effluent data, DMR data, etc.) was available to assess RP, no TRC limit will be included with this permit renewal. Extended calculations are included in **Attachment A**.

Total Dissolved Solids (TDS) - The 2009-issued permit did not include limits for TDS, but did require monitoring for this parameter. The maximum TDS concentration observed from 10 samples was 240 mg/L. There are currently no numeric water quality standards for TDS in surface waters, but narrative water quality standards do apply. However, TDS is not being discharged in high enough concentrations to violate any general prohibitions regarding water quality. TDS monitoring will be decreased to once per year with this permit renewal for purposes of fulfilling future permit renewal application TDS sampling requirements.

Ammonia as N – Determination of RP for total ammonia as N (ammonia) and development of applicable limits are based on water quality standards that account for a combination of pH and temperature of the receiving stream during critical conditions, the presence or absence of salmonid species, and the presence or absence of fish in early life stages. Salmonid fishes and early life stages are presumed present year-round in the Missouri River at the point of discharge prior to the confluence of the Sun River and Missouri River. Ammonia water quality standards are shown below in **Table 5**.

Table 5. Total Ammonia as N Water Quality Standards for Missouri River.

Condition	Period	Salmonids Present	Early Life Stages Present	Ambient Condition (1)		Water Quality Standard(2) (mg/L)
				pH (s.u.)	Temperature (°C)	
Acute	Annual	No	NA	8.71	NA	1.46
Chronic	Annual	NA	Yes	8.71	17.0	0.66

Footnotes: NA – Not Applicable
(1) Based on 75^{th} percentile of data set.
(2) Acute - maximum daily standard; Chronic - monthly average standard.

RP to exceed the acute water quality standard for ammonia was assessed using *Equation 1*, where

C_r = receiving water concentration (RWC) after mixing, mg/L
C_d = maximum projected effluent concentration, 0.308 mg/L
C_s = RWC upstream of discharge, < 0.013 mg/L

Q_s = applicable receiving water flow, 1% of the 7Q10, 17.35 mgd
Q_d = facility maximum daily effluent flow rate, 1.24 mgd

The projected maximum concentration for total ammonia (C_d) was found following the TSD Method. A multiplier of 1.62 was determined using the TSD methodology, using a CV of 0.52, and a sample size of 10. The maximum reported effluent concentration for total ammonia was 0.19 mg/L. The maximum concentration times the multiplier is 0.31 mg/L (0.19 mg/L * 1.62).

$$C_r = \frac{(1.24 * 0.308) + (0.013 * 17.35)}{(1.24 + 17.3)} = 0.033 \text{ mg/L}$$

$C_{r\text{-acute}}$ (0.033 mg/L) is below the acute ammonia standard of 1.46 mg/L for the Missouri River. Similarly, RP to exceed the chronic water quality standard for ammonia was also assessed using *Equation 1* and $C_{r\text{-chronic}}$ (0.014 mg/L) is below the chronic ammonia standard of 0.66 mg/L. Therefore a permit limit will not be necessary for this permit renewal.

Extended calculations are included in **Attachment A**. Existing effluent monitoring will be continued with this permit renewal.

Total Nitrogen – In July 2014, Montana adopted base numeric nutrient standards in Department Circular DEQ-12A. For wadeable streams in the Northwest Glaciated Plains ecoregion, where the Missouri River is located, the numeric nutrient standard for total nitrogen (TN) is 1.3 mg/L (which applies from June 16 to September 30). However, the Missouri River is a large river segment which is currently excluded from the ecoregion nutrient criteria as listed in Table E-1 of this circular.

In order to perform a narrative RP evaluation on the impact from the Great Falls WTP, the seasonal receiving water concentration for TN was calculated using *Equation 1*, where:

C_r = receiving water concentration (RWC) after mixing, mg/L
C_d = maximum projected effluent concentration, 1.47 mg/L
C_s = 75th percentile RWC upstream of discharge, 0.23 mg/L
Q_s = applicable receiving water flow, 100% of the 14Q5, 2,043 mgd
Q_d = facility maximum monthly average effluent flow rate, 0.51 mgd

The projected maximum concentration for TN was found following the TSD method. A multiplier of 2.10 was determined using the TSD methodology, using a CV of 0.86 and a sample size of 10. The maximum reported effluent concentration for total nitrogen was 0.70 mg/L. The multiplier times the maximum concentration is 1.47 mg/L (2.10* 0.70 mg/L).

$$C_r = \frac{(0.51 * 1.47) + (1.65 * 2{,}043)}{(0.51 + 2{,}043)} = 0.23 \text{ mg/L}$$

The TN concentration (0.23 mg/L) in the receiving water after mixing is below the ecoregion numeric nutrient standard of 1.3 mg/L that was used for comparison. Monthly effluent monitoring during the summer season (July through September) will be required with this permit renewal and no TN limit will be included. Extended calculations are included in **Attachment A**.

3. Toxic Pollutants

Dissolved Aluminum– Dissolved aluminum is a toxic parameter with standards applicable to surface waters with a pH between 6.5 and 9.0 s.u. The chronic water quality standard for dissolved aluminum is 0.087 mg/L (87 µg/L) and the acute water quality standard for dissolved aluminum is 0.75 mg/L (750 µg/L). The 2009-issued permit includes dissolved aluminum limits of 0.52 mg/L (520 µg/L) as the average monthly limit and 0.71 mg/L (710 µg/L) for the maximum daily limit.

RP to exceed the acute water quality standard for dissolved aluminum was assessed using *Equation 1*, where:

C_r = receiving water concentration (RWC) after mixing, mg/L
C_d = maximum projected effluent concentration, 483.22 µg/L
C_s = RWC upstream of discharge, 31 µg/L
Q_s = applicable receiving water flow, 0% of the 7Q10, 0 mgd
Q_d = facility maximum daily effluent flow rate, 1.24 mgd

The projected maximum concentration for dissolved aluminum (C_d) was found following the TSD Method. A multiplier of 0.986 was determined using the TSD methodology, using a CV of 0.41 and a sample size of 63. The maximum reported effluent concentration for dissolved aluminum was 490 µg/L. The maximum concentration times the multiplier is 483.22 µg/L (490 µg/L * 0.987).

$$C_r = \frac{(1.24 * 483.22) + (31 * 0)}{(1.24 + 0)} = 483.22 \text{ µg/L}$$

$C_{r\text{-acute}}$ (483.22 µg/L) is below the acute dissolved aluminum standard of 750 µg/L for the Missouri River; therefore, acute RP does not exist for this parameter. RP to exceed the chronic water quality standard was also assessed using *Equation 1*. $C_{r\text{-chronic}}$ (32.08 mg/L) is below the chronic dissolved aluminum standard of 87 µg/L.

No RP exists for this parameter. The existing monitoring will be continued with this permit renewal. Since new information (facility, effluent data, DMR data, etc.) was available to assess RP, no dissolved aluminum limit will be included with this permit renewal. Extended calculations are included in **Attachment B**.

Disinfection Byproducts – As previously discussed the reaction of chlorine with ammonia forms chloramine compounds (chloramines, NH_2Cl). Chloramines extend the time for disinfection in the water distribution system. The chloraminated water is used for the WTP filter backwashing and is, therefore, the source of the facility backwash wastewater.

The backwash wastewater treatment system includes dechlorination by sodium metabisulfite. However, chloramines are less reactive than chlorine and may be less likely to be "dechlorinated." It is unknown how much of the chloramines are discharged, and how much are dechlorinated into chlorine byproducts, ammonia and other nitrogen-based compounds. In addition, the reaction of chlorine in the backwash water with any organic substances trapped in the filters, or in the raw water screen material wash water, may form carcinogens such as total trihalomethanes (TTHM), haloacetic acids (HAA5), or N-nitrosodimethylamine (NDMA) that would be discharged in the wastewater. RP analyses are included below for each of the three disinfection byproducts discussed earlier in this section.

The disinfectant byproducts monitored in the 2009-issued permit are subject to human health water quality standards which are allowed 25% dilution of the receiving water for RP calculations; however only 10% dilution will be used when assessing RP which will provide a more conservative approach.

a. Total Trihalomethanes (TTHM)

RP to exceed the human health water quality standard for TTHM was assessed using *Equation 1*, where:

C_r = receiving water concentration (RWC) after mixing, µg/L
C_d = maximum projected effluent concentration, 163.2 µg/L
C_s = RWC upstream of discharge, 0 µg/L
Q_s = applicable receiving water flow, 10% of the 7Q10, 173.5 mgd
Q_d = facility maximum average monthly effluent flow rate, 0.51 mgd

The projected maximum concentration for TTHM (C_d) was found following the TSD Method. A multiplier of 3.79 was determined using the TSD methodology, using a default CV of 0.6 and a sample size of 2. The maximum reported effluent concentration for TTHM was 43 µg/L. The maximum concentration times the multiplier is 163.2 µg/L (43 µg/L * 3.79).

$$C_r = \frac{(0.51 * 163.2) + (441 * 0)}{(0.51 + 441)} = 0.48 \ \mu g/L$$

C_r (0.48 µg/L) is below the human health TTHM standard of 80 µg/L; therefore, RP does not exist for this parameter. Extended calculations are included in **Attachment B**. Yearly monitoring will be required with this permit renewal.

b. Haloacetic Acids (HAA5)

RP to exceed the human health water quality standard for HAA5 was assessed using *Equation 1*, where:

C_r = receiving water concentration (RWC) after mixing, µg/L
C_d = maximum projected effluent concentration, 150 µg/L

C_s = RWC upstream of discharge, 0 µg/L
Q_s = applicable receiving water flow, 10% of the 7Q10, 176.4 mgd
Q_d = facility maximum average monthly effluent flow rate, 0.51 mgd

The projected maximum concentration for HAA5 (C_d) was found following the TSD Method. A multiplier of 3.79 was determined using the TSD methodology, using a default CV of 0.6 and a sample size of 2. The maximum reported effluent concentration for HAA5 was 39 µg/L. The maximum concentration times the multiplier is 148.0 µg/L (39 µg/L * 3.79).

$$C_r = \frac{(0.51 * 148) + (441 * 0)}{(0.51 + 441)} = 0.43\ \mu g/L$$

C_r (0.43µg/L) is below the human health HAA5 standard of 60 µg/L; therefore, RP does not exist for this parameter. Extended calculations are included in **Attachment B**. Yearly monitoring will be required with this permit renewal.

c. N-nitrosodimethylamine (NDMA)

RP to exceed the human health water quality standard for NDMA was assessed using *Equation* 1, where:

C_r = receiving water concentration (RWC) after mixing, µg/L
C_d = maximum projected effluent concentration, 0.031 µg/L
C_s = RWC upstream of discharge, 0 µg/L
Q_s = applicable receiving water flow, 10% of the 7Q10, 173.5 mgd
Q_d = facility maximum average monthly effluent flow rate, 0.51 mgd

The projected maximum concentration for dissolved aluminum (C_d) was found following the TSD Method. A multiplier of 6.2 was determined using the TSD methodology, using a default CV of 0.6 and a sample size of 1. The maximum reported effluent concentration for NDMA was < 0.005 µg/L. The maximum concentration times the multiplier is < 0.031 µg/L (0.005 µg/L * 6.2).

$$C_r = \frac{(0.51 * 0.031) + (441 * 0)}{(0.51 + 441)} = 0.000091\ \mu g/L$$

C_r (0.000091 µg/L) is below the human health NDMA standard of 0.0069 µg/L; therefore, RP does not exist for this parameter. Extended calculations are included in **Attachment B**. Yearly monitoring will be required with this permit renewal.

V. Final Effluent Limits for Outfalls 001 and 002

Final effluent limits for Outfalls 001 and 002 in **Table 6** are effective immediately upon the effective date of the permit.

Table 6: Proposed Effluent Limits for Outfalls 001 and 002 [(1)]

Parameter	Units	Sampling Location	Average Monthly Limit	Maximum Daily Limit
Total Suspended Solids	mg/L	Effluent	30	45
pH[(2)]	s.u.	Effluent	6.0 - 9.0 (Instantaneous)	

Footnotes:

(1) See Definition section at end of permit for explanation of terms.

(2) Effluent pH shall remain between 6.0 and 9.0 s.u. (instantaneous minima and maxima). For compliance purposes, any single analysis and/or measurement beyond this limitation shall be considered a violation of the conditions of this permit.

VI. Monitoring Requirements

Samples shall be collected, preserved and analyzed in accordance with approved procedures listed in 40 CFR 136. Samples will reflect the nature and volume of the discharge.

A. Effluent Monitoring - Outfall 001

Monitoring of the effluent at Outfall 001 must be representative of the volume and nature of the discharge. Outfall 001 samples must be obtained from the discharge pipe after the clarification basin, before the wastewater enters the Missouri River, unless another monitoring location is requested by Great Falls and accepted by DEQ, in writing. **Table 7** outlines monitoring requirements for Outfall 001.

Table 7: Effluent Monitoring Requirements for Outfall 001 (1)

Parameter	Unit	Frequency of Analyses (2)	Sample Type
Flow	mgd	Continuous	Instantaneous
Total Suspended Solids	mg/L	4/Week	Grab
Dissolved Aluminum	mg/L	1/Week	Grab
Total Residual Chlorine	mg/L	1/Day	Grab
pH	s.u.	4/Week	Instantaneous
Oil & Grease	mg/L	1/Year	Grab
Total Dissolved Solids (TDS)	mg/L	1/Year	Grab
Total Ammonia, as N	mg/L	2/Year	Grab
Total Nitrogen(4)(5)	mg/L	1/Month	Grab
Total Trihalomethanes (TTHM)	µg/L	1/Year	Grab
Haloacetic Acids, 5 (HAA5)	µg/L	1/Year	Grab
n-Nitrosodimethylamine (NDMA)	µg/L	1/Year	Grab

Footnotes:
(1) See Definition section at end of permit for explanation of terms.
(2) Frequency of analysis is during days of discharge.
(3) Use EPA Method 1664, Revision A:N-Hexane Extractable Material (HEM), or equivalent.
(4) Total Nitrogen is the sum of Total Kjeldahl Nitrogen (TKN) and nitrate + nitrites.
(5) Monitoring is only required during the summer months (July through September) when the water quality standards typically apply.

B. Effluent Monitoring - Outfall 002

Monitoring of the effluent at Outfall 002 must be representative of the volume and nature of the discharge. If no discharge occurs during the entire monitoring period, it shall be on the NetDMR that no discharge or overflow occurred.

Outfall 002 samples must be taken before the wastewater enters the Missouri River. **Table 8** outlines monitoring requirements for Outfall 002.

Table 8: Effluent Monitoring Requirements for Outfall 002 (1)

Parameter	Unit	Frequency of Analyses(2)	Sample Type
Flow	mgd	Continuous	Instantaneous
Total Suspended Solids	mg/L	4/Week	Grab
Dissolved Aluminum	mg/L	1/Week	Grab
Total Residual Chlorine	mg/L	1/Day	Grab
pH	s.u.	4/Week	Instantaneous

Footnotes:
(1) See Definition section at end of permit for explanation of terms.
(2) If the discharge is intermittent, samples must be taken at the beginning of the discharge event.

VII. Public Participation

a. Public Notice

DEQ issued Public Notice No. MT-17-22 dated October 23, 2017. 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 22, 2017. 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).

b. 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.

c. 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.

d. 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.

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

e. Additional Information

Requests for additional information or questions regarding this permit should be directed to the Water Protection Bureau at 406-444-3080.

VII. 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.

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

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*.

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 2014.

MPDES Permit Number MT0000442:
- Administrative Record.
- Renewal Application EPA Forms 1 and 2E, 12/12/13

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

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

2016 Integrated 303(d) Water Quality Report for Montana.

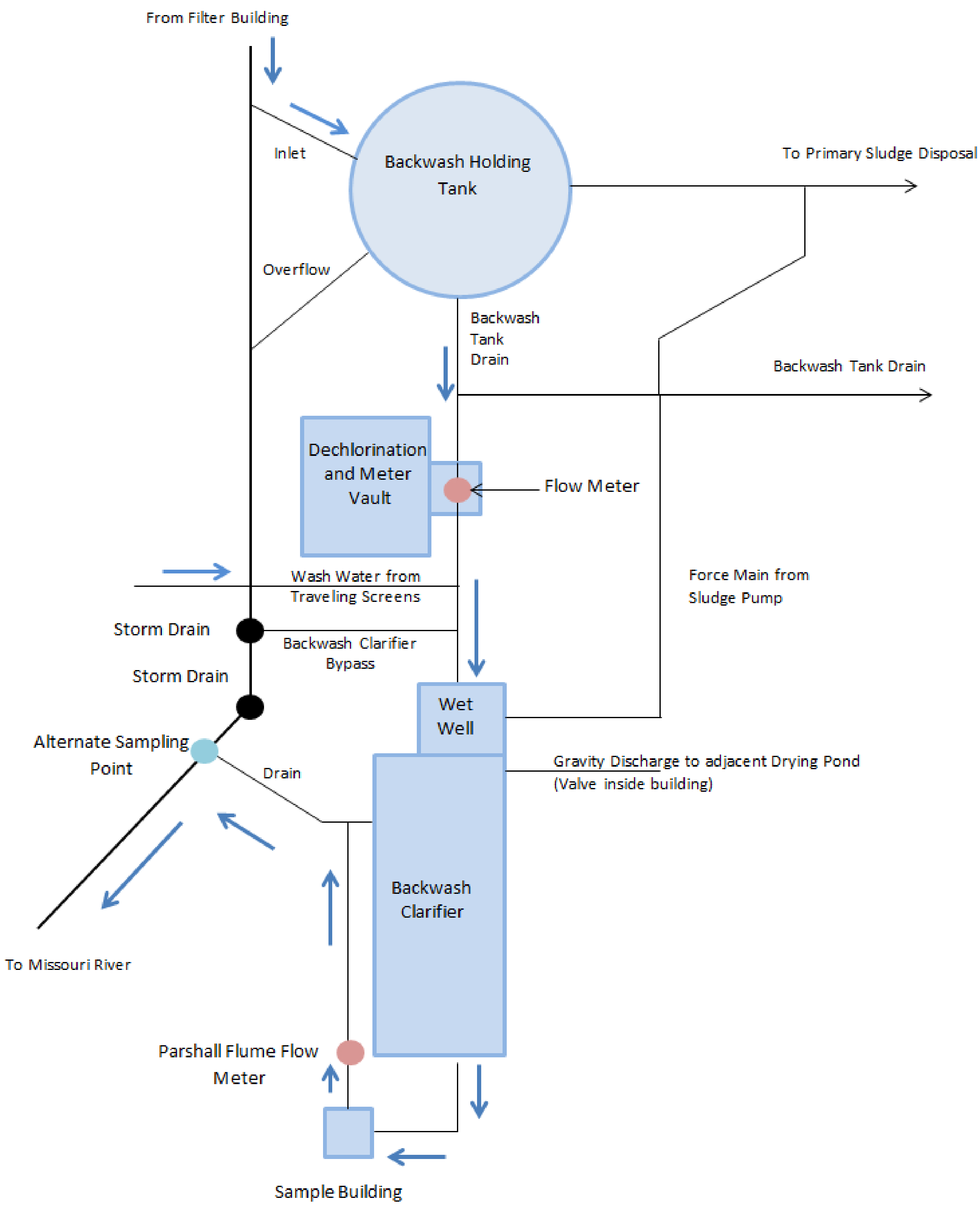
USGS 2015: *Statistical Summaries of Streamflow in Montana and Adjacent Areas, Water Years 1900 through 2009*, US Geological Survey Scientific Investigations Report 2015- Draft Manuscript (Electronic, 2015)

US EPA Region VII Policy, "*BPT Water Treatment Plants*," From Ronald D. McCutcheon, February 24, 1977.

Montana Fisheries Information System (MFISH)

Prepared By: Kaela Murphy
Date: July 2017

Figure 1: Flow diagram for Great Falls Water Treatment Plant.



Attachment A: City of Great Falls WTP Reasonable Potential Analysis (July 2017)

			Ammonia (Acute)	Ammonia (Chronic)	TRC (Acute)	TRC (Chronic)	Total Nitrogen	Oil and Grease (Acute)	Oil and Grease (Chronic)
Flow									
critical stream flow	7Q10 or seasonal 14Q5	mgd	1735	1735	1735	1735	2043	1735	1735
% of critical stream flow for dilution	as decimal	%	0.01	0.10	0.01	0.10	1.00	0.01	0.10
Q_s	resulting critical stream flow Q_s = (critical stream flow for dilution)*(% of critical stream flow provided)	**mgd**	**17.35**	**173.47**	**17.35**	**173.47**	**2043.01**	**17.35**	**173.47**
Q_d	critical effluent flow (avg. daily design flow)	**mgd**	**1.24**	**0.51**	**1.24**	**0.51**	**0.51**	**1.24**	**0.51**
Q_r	downstream flow ($Q_s + Q_d$)	mgd	18.59	173.98	18.59	173.98	2043.52	18.59	173.98
Concentrations									
C_{max}	maximum effluent concentration for POR (from application or DMR data)	mg/L	**0.19**	**0.19**	**0.18**	**0.18**	**0.7**	**1**	**1**
n	number of samples in effluent data set		10	10	63	63	10	10	10
CV	0.6 if n < 10 calculated as $\sigma_{effluent}/\mu_{effluent}$ if n ≥ 10		0.5152	0.5152	0.44	0.44	0.86	0.69	0.69
P_n	%tile for n samples at 95% confidence level		0.74	0.74	0.95	0.95	0.74	0.74	0.74
Z_{Pn}	Z-score for P_n		0.65	0.65	1.68	1.68	0.65	0.65	0.65
TSD	calculated TSD multiplier (should be close to Table 3-2 value)		1.62	1.62	0.985	0.99	2.10	1.86	1.86
C_d	critical effluent concentration - 95%tile (=max. effluent concentration * TSD multiplier)	**mg/L**	**0.308**	**0.308**	**0.177**	**0.177**	**1.47**	**1.86**	**1.86**
C_s	critical instream concentration (75%tile if n<=30, 95% UCL if n>30)	**mg/L**	**0.013**	**0.013**	**0.0**	**0.0**	**0.230**	**0.0**	**0.0**
C_r	**resulting or downstream pollutant concentration** $C_r = (C_dQ_d + C_sQ_s)/(Q_d+Q_s)$	**mg/L**	**0.033**	**0.014**	**0.012**	**0.0005**	**0.230**	**0.124**	**0.005**
WQS	**water quality standard**	**mg/L**	**1.46**	**0.66**	**0.019**	**0.011**	**1.30**	**10.00**	**10.00**
Reasonable Potential			**no**	**no**	**no**	**no**	**no**	**no**	**no**

Attachment B: City of Great Falls WTP Reasonable Potential Analysis Continued

			Dissolved Aluminum (Acute)	Dissolved Aluminum (Chronic)	Total Trihalomethanes (TTHM)	Haleocetic Acids (HAA5)	N-nitrosodimethlymine (NDMA)
Flow							
critical stream flow	7Q10 or seasonal 14Q5	**mgd**	1735	1735	1735	1735	1735
% of critical stream flow for dilution	as decimal	**%**	0.00	0.10	0.10	0.10	0.10
Q_s	resulting critical stream flow Qs = (critical stream flow for dilution)*(% of critical stream flow provided)	**mgd**	**0.00**	**173.47**	**173.47**	**173.47**	**173.47**
Q_d	critical effluent flow (avg. daily design flow)	**mgd**	**1.24**	**0.51**	**0.51**	**0.51**	**0.51**
Q_r	downstream flow (Qs + Qd)	**mgd**	1.24	173.98	173.98	173.98	173.98
Concentrations							
C_{max}	maximum effluent concentration for POR (from application or DMR data)	**µg/L**	**490**	**490**	**43**	**39**	**0.005**
n	number of samples in effluent data set		63	63	2	2	1
CV	0.6 if n < 10 calculated as σeffluent/µeffluent if n ≥ 10		0.4093	0.4093	0.6	0.6	0.6
P_n	%tile for n samples at 95% confidence level		0.95	0.95	0.22	0.22	0.05
Z_{Pn}	Z-score for Pn		1.68	1.68	-0.76	-0.76	-1.64
TSD	calculated TSD multiplier (should be close to Table 3-2 value)		0.99	0.99	3.79	3.79	6.20
C_d	critical effluent concentration - 95%tile (=max. effluent concentration * TSD multiplier)	**µg/L**	**483.22**	**483.22**	**163.18**	**148.00**	**0.03**
C_s	critical instream concentration (75%tile if n<=30, 95% UCL if n>30)	**µg/L**	**30.8**	**30.8**	**0.000**	**0.000**	**0.000**
C_r	**resulting or downstream pollutant concentration** Cr = (CdQd + CsQs)/(Qd+Qs)	**µg/L**	**483.22**	**32.08**	**0.478**	**0.434**	**0.000091**
WQS	**water quality standard**	**µg/L**	**750.0**	**87.0**	**80.0**	**60.0**	**0.0069**
Reasonable Potential			**no**	**no**	**no**	**no**	**no**