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

Fact Sheet for permit modification

Permittee:	City of Big Timber
Permit No.:	MT0020753
Receiving Water:	Boulder River
Facility Information:	City of Big Timber Wastewater Treatment Facility
Mailing Address:	1600 E. 3rd Ave Big Timber MT 59011
Contact:	Richard Gibby, Public Works Director Kristian Novotny, Assistant Public Works Director PO Box 416 Big Timber MT 59011
Fee Information:	
Type:	Minor Publicly-Owned Treatment Works
Number of Outfalls:	1 (For Fee Determination only)
Outfall - Type:	001 – Treated wastewater to surface water (fee)

I. Permit Status

The City of Big Timber MPDES permit MT0020753 became effective on May 1, 2012, and expires April 30, 2017.

This major modification is initiated by the Montana Department of Environmental Quality (DEQ) pursuant to the Administrative Rules of Montana (ARM) 17.30.1361(2)(b). The major modification incorporates new information and revisions to the 2009 *Boulder River Watershed Total Maximum Daily Load* (TMDL) that were not available at the time the permit was issued and would have justified the application of different permit conditions.

This permit modification is limited to the conditions specifically described in this Fact Sheet. All other aspects of the permit remain in effect and are not reopened by this modification [ARM 17.30.1365(4)(b)].

II. Proposed Modification

A. Effluent Limits and Requirements for Total Recoverable Copper, Lead, and Iron

The permit currently includes final effluent limitations for total recoverable copper, lead, and iron that implement waste load allocations (WLAs) developed in the 2009 *Boulder River Watershed Total Maximum Daily Load* (TMDL). These metals limits become effective on May 1, 2016. In March 2016, DEQ developed an addendum to the TMDL that allows implementation of the TMDL-derived WLA in stages so that additional data and information may be collected to assist the permittee in complying with the WLA-based effluent limits. The addendum to the TMDL states "The TMDL document does not include a timeline for implementing the City of Big Timber waste load allocations. Iron waste load allocations are currently being met. Meeting the City of Big Timber copper and lead waste load allocations can be staged during multiple permit cycles…"; "…The staged approach to meeting the waste load allocations will allow for additional evaluation of the sources of elevated copper and lead, along with the development of potential solutions to address these sources."

This permit modification changes the effective date for the total recoverable copper and lead limits from May 1, 2016 to May 1, 2024. The final effluent limitations table in the permit will be adjusted to reflect this change and is shown in Part III of this Fact Sheet.

In the interim, additional special conditions will be implemented in this and future permit cycles requiring the City of Big Timber to address the elevated metals concentrations, especially copper and lead, in the wastewater treatment facility (WWTF) effluent (see below).

Modification of the MPDES permit is necessary for the following reasons:

- Additional modification to the TMDL beyond the March 2016 addendum may be forthcoming and the final effluent limits may change.
- At low flow conditions, DEQ needs additional information on the facility discharge and additional characterization of the Boulder River to ensure the correct effluent limits are developed for copper and lead. Given that the TMDL-derived WLA are developed based on an impaired condition at high flows when the Big Timber discharge is an insignificant source at high flows, the MPDES permit effluent limits based on low flow conditions should be reassessed. Low flow-based limits may result in effluent limitations that are less stringent than those provided in the TMDL.
- The City of Big Timber is in the Preliminary Engineering Report phase of a potential facility redesign or upgrade and needs additional time to determine how to best address the final copper and lead limits.

In anticipation of the TMDL document being further modified in the future to reflect current conditions in the Boulder River and establish assimilative capacity for copper and lead in

the Boulder River, DEQ reviewed the WWTF effluent data, the available 7Q10 Boulder River flow and ambient data, and any dilution that may be available in the event the Boulder River stream is later determined to have assimilative capacity. This information is summarized in the following tables.

Copper, iron, and lead data reported by the facility on Discharge Monitoring Report (DMR) forms is summarized in Table 1.

Table 1: Effluent DMR Metals Characteristics May 2012 through February 2016

Parameter	Units	Average	Maximum	Number of Samples
Copper, Total Recoverable	µg/L	42.7	61	45
Lead, Total Recoverable	µg/L	2.27	60 (1)	45
Iron, Total Recoverable	µg/L	160	310	45

Footnotes:
1. Outlier. The permittee did not seek any explanation for this result from the laboratory. The next highest result was 2.0 µg/L. Omitting the outlier resulted in an average concentration of 0.96 µg/L.

Boulder River ambient data is summarized in Table 2. This data is more recent than that used to assess the stream as impaired and is more representative of current conditions.

Table 2: Boulder River Copper, Iron and Lead Data, 2008 - 2015

Parameter	Units	Minimum	Maximum	75th Percentile	Number of Samples
Copper, Total Recoverable	µg/L	< 1	1	1	12
Lead, Total Recoverable	µg/L	< 0.3	< 0.5	< 0.5	14
Iron, Total Recoverable	µg/L	20	460	150	13

The Fact Sheet for the current permit established the water quality standards for copper, iron, and lead based on 25 mg/L hardness. These values are shown in Table 3.

Table 3: Boulder River Copper and Lead Water Quality Standards (25 mg/L hardness)

Parameter	Units	Aquatic Life Chronic	Aquatic Life Acute
Copper, Total Recoverable	µg/L	2.85	3.79
Lead, Total Recoverable	µg/L	0.545	13.98

The 7Q10 of the receiving water is 38 cubic feet per second (cfs) or 24.56 million gallons per day (mgd) and the current facility design flow is 0.603 cfs (0.39 mgd). This results in an available dilution ratio of approximately 63:1. At a dilution ratio less than 100:1 and a design flow less than 1 mgd, the discharge is eligible for a standard mixing zone that utilizes 25% of the 7Q10 flow (9.5 cfs) for dilution to meet chronic standards [ARM 17.30.516(3)(b)]. Acute aquatic life standards may not be exceeded in any portion of a mixing zone unless DEQ finds that allowing minimal initial dilution will not threaten or impair existing beneficial uses. When granting an acute mixing zone allowance, DEQ typically limits the acute mixing zone to no more than 10% of the chronic mixing zone unless specific information and modeling results show that allowing a larger area for acute mixing will not threaten or impair existing beneficial uses. To grant a mixing zone and also to determine if minimal initial dilution is appropriate for achieving the acute standards, DEQ must receive the information required by ARM 17.30.506. Also, in order to grant minimal initial dilution for acute standards DEQ typically requires the installation of an effluent diffuser to ensure that mixing is as rapid and complete as possible.

Given the limited ambient data in Table 2, it appears the Boulder River has assimilative capacity and that revised effluent limits would be appropriate if the required mixing zone information is provided to DEQ. Assuming this information is provided and approved by DEQ, the following tables show an estimated reasonable potential (RP) analysis and estimated effluent limits that would apply to the City of Big Timber WWTF discharge. The reasonable potential calculations are based on a simple mass balance equation:

$$C_r = [C_d Q_d + C_s Q_s] / [Q_s + Q_d]$$

Where:

Q_s	=	receiving water low flow rate above point of discharge (mgd)
C_s	=	upstream receiving water pollutant concentration (mg/L)
Q_d	=	effluent flow rate (0.39 mgd)
C_d	=	critical effluent pollutant concentration (mg/L)
Q_r	=	receiving water flow rate after discharge (Qr = Qs + Qd; mgd)
C_r	=	receiving water pollutant concentration (after dilution; mg/L)

Where C_r is greater than the water quality standard, there is reasonable potential for the discharge to cause an exceedance of the water quality standard and an effluent limit is necessary. Table 4 summarizes estimated RP analyses. These analyses assume that the City of Big Timber applies for acute and chronic mixing zones and DEQ grants mixing zones during a subsequent permit renewal.

Table 4: Estimated Reasonable Potential Analysis

Parameter	Water Quality Standard		C_d	C_s	Acute Dilution Flow (mgd)	Chronic Dilution Flow (mgd)	Projected Receiving Water Conc. Acute (C_r)	Projected Receiving Water Conc. Chronic (C_r)	RP
	Acute	Chronic							
Copper, µg/L	3.79	2.85	61	1	0.614	6.14	24.3	4.58	Yes
Lead, µg/L	13.98	0.545	2.0	0.5	0.614	6.14	1.08	0.590	Yes

Based on the above, it appears that the Big Timber discharge has RP for both copper and lead at low flow conditions and water quality-based effluent limits (WQBEL) are necessary. When developing WQBELs, DEQ rearranges the equation above to develop a waste load allocation and develops effluent limits based on the methods described in the *Technical Support Document for Water Quality-based Toxics Control* (U.S. EPA 1991). The equation for developing the WLA is as follows:

$$WLA = C_d = [Q_rC_r - Q_sC_s] / Q_d$$

Where:
C_r = Water quality standard
Q_r = Flow in the receiving water downstream of the discharge
C_d = Maximum allowable effluent concentration in the discharge
C_s = Instream concentration of POC upstream of the discharge
Q_s = Applicable low flow available for dilution or mixing (upstream of discharge)
Q_d = Design flow of discharge

For toxic parameters, WLAs are characterized as a level of effluent quality that can never be exceeded. A long term average (LTA) is calculated from the WLA and represents the average level of effluent quality the facility must achieve in order to ensure the WLA is not exceeded. The LTA is a back calculation of the WLA and is calculated by multiplying the WLA by the TSD WLA multiplier. The WLA multiplier is a statistically-based factor derived from the ratio of the WLA, set at a specific percentile value, to the LTA. The value of the multiplier varies depending on the coefficient of variation (CV) of the data set (calculated from the permittee's DMRs or assumed according to TSD standards as 0.6), the percentile value for the WLA (e.g., 99th percentile), and whether the WLA is based on an acute (1-hour average) or chronic (typically, 4-day average) water quality standard.

DEQ sets the WLA at the 99th percentile (95th percentile for nutrients) on the lognormal distribution and the equation below to determine the LTA for each pollutant of concern. The EPA's TSD procedures provide reference Table 5-1 for the WLA multipliers.

LTA=WLA x WLA multiplier

The acute and chronic LTAs for a pollutant of concern may be directly compared to each other to select the most protective of aquatic life. Both WLAs are ensured to be met with the selection of the most protective LTA (attains both acute and chronic criteria) and sets one basis for facility performance.

The process of deriving permit limits for toxic parameters must consider effluent variability with the assumptions that effluent discharge is continuous and the WLA value will never be exceeded. The lowest LTAs are used to calculate a Maximum Daily Limit (MDL) and Average Monthly Limit (AML). Both MDL and AML are calculated from the two equations below. The TSD provides reference Table 5-2 for the LTA multipliers that are based on a lognormal distribution and reflect a statistical relationship (MDL-99th percentile occurrence probability; AML-95th percentile occurrence probability). The EPA's TSD verifies this method of deriving permit limits as protective of aquatic life because the MDL and AML consider effluent variability. The MDL and AML would be proposed as the final effluent limits.

MDL=LTA x MDL Multiplier

AML=LTA x AML Multiplier

Estimated WQBEL for the Big Timber discharge, at low flow conditions, are shown in Table 5.

Table 5: Estimated Water Quality-based Effluent Limits for Copper and Lead for Discharge to Boulder River

Parameter	Units	Acute Wasteload Allocation	Chronic Wasteload Allocation	Coefficient of Variation (CV)	Acute Long Term Average	Chronic/HH Long Term Average	Minimum Long Term Average	AML/MDL Multiplier	AML	MDL
Copper, Total Recoverable	µg/L	8.2	32	0.2	5.3	25.5	5.3	1.17 / 1.55	6.2	8.2
Lead, Total Recoverable	µg/L	35.2	1.25	0.4	15.5	0.8	0.8	1.36 / 2.27	1.1	1.8

The effluent limits shown in Table 5 are estimates of the effluent limits that would be developed for the WWTF discharge should future revisions to the TMDL occur that would allow these limits to replace the current TMDL WLA-based limits. The limits also require that DEQ have adequate information to grant the mixing zones and dilution allowances used in the calculations.

Based on this, DEQ is adding a Special Condition to this permit modification that requires the City to begin a mixing zone study designed to provide DEQ with the information listed in ARM 17.30.506. The study must also provide a description of the actual mixing that takes place, or will take place, between the receiving water and the WWTF discharge. This requirement is typically fulfilled by modeling the effluent discharges interaction with the receiving water. As part of the mixing zone study, the collection of additional instream water quality samples for copper, lead, and hardness are encouraged.

The modified permit requirements are shown in the following sections.

III. Modifications to Final Effluent Limitations

Final Effluent Limits

Effective May 1, 2016, unless noted otherwise in the footnotes, and continuing the term of the permit the quality of the effluent discharged by the facility though Outfall 001, shall as a minimum, meet the limitations as set forth below:

Final Effluent Limits for Outfall 001				
Parameter	**Units**	**Average Monthly Limit** (1)	**Average Weekly Limit** (1)	**Maximum Daily Limit** (1)
Biochemical Oxygen Demand (BOD_5)	mg/L	30	45	--
	lb/day	68	102	--
BOD_5 Removal	%	85	--	--
Total Suspended Solids (TSS)	mg/L	30	45	--
	lb/day	77	116	--
TSS Removal	%	85	--	--
E. coli bacteria(2)	cfu/100mL	126	252	--
E. coli bacteria (3)	cfu/100mL	630	1260	--
Total Residual Chlorine (TRC) (4)	mg/L	0.021	--	0.031
Ammonia	mg/L	8.2	14.5	
Copper (total recoverable) (6)	µg/L	2.6	--	3.8
	lb/day	0.0062	--	0.0090
Lead (total recoverable) (6)	µg/L	0.8	--	1.1
	lb/day	0.0014	--	0.0020
Iron (total recoverable)	µg/L	1400	--	2000
	lb/day	2.23	--	3.26
pH (s.u.)	Within the range of 6.0 to 9.0 (onsite) (5)			

Footnotes:
1. See Definition section at end of permit for explanation of terms.
2. Geometric mean applies April 1 through October 31.
3. Geometric mean applies November 1 through March 31.
4. If chlorine is used for disinfection. Sampling of effluent with analytical results less than 0.1 mg/l will be considered in compliance with the chlorine limit.
5. Must be instantaneous
6. Effective May 1, 2024

pH: Effluent pH from Outfall 001 shall remain between 6.0 and 9.0 standard units (instantaneous minimum and instantaneous maximum). For compliance purposes, any single analysis or measurement beyond this limitation shall be considered a

violation of the conditions of this permit, unless a variation is due to natural biological processes.

85 Percent (%) Removal Requirement for $CBOD_5$: The arithmetic mean of the $CBOD_5$ for effluent samples collected in a period of 30 consecutive days shall not exceed 15% of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period (85% removal). This is in addition to the concentration limitations on BOD_5.

65 Percent (%) Removal Requirement for TSS: The arithmetic mean of the TSS for effluent samples collected in a period of 30 consecutive days shall not exceed 35% of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period (65% removal). This is in addition to the concentration limitations on TSS.

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

There shall be no discharge which causes visible oil sheen in the receiving stream.

IV. Modifications to Special Conditions

The following Special Conditions are added to the permit:

Copper and Lead – Source Investigation and Control Report

The existing treatment system has elevated levels of copper and lead. Compliance with the final copper and lead limits will require additional treatment, source reduction, or a combination of both. Copper and lead are present in the effluent at levels exceeding the final limits. The presence or absence of significant industrial users and the source(s) of the copper and lead are not known. However, in many municipal drinking water systems corrosion of copper pipes commonly used in water distribution and residential plumbing systems has been found to be a source of copper and other metals.

Phase I - Source Investigation: The purpose of this phase is to investigate and determine the source of copper and lead. Possible sources include but are not limited to source water, distribution system, corrosion, industrial users, trucked and hauled waste, or other inputs into the sanitary system, including infiltration and inflow. In addition to qualifying copper and lead loading into the system, the permittee shall collect additional information as necessary to determine the nature and extend of copper and lead corrosion, including but not limit to: pH, alkalinity, dissolved inorganic carbonate, hardness, orthophosphate concentration, and dissolved and total copper concentrations. A final report shall be submitted to DEQ no later than the expiration date of this permit.

Phase II - Copper and Lead Control and Treatment Evaluation Report: Based on the results and findings of the source investigation completed in Phase I, the permittee shall evaluate treatment and control technologies that will reduce the copper and lead concentration to comply with the final effluent limits for copper and lead. The Phase II report shall also contain a schedule for implementing the copper and lead reduction strategy that is most appropriate for the facility. A final report and schedule for achieving compliance with the final limits shall be submitted no later than May 1, 2018.

Mixing Zone Study

The permittee must initiate a mixing zone study no later than the expiration date of this permit. The mixing zone study must provide the information required in the Administrative Rules of Montanan (ARM) 17.30.506. The mixing zone study should include a description of the mixing characteristics at the facility's outfall, and should incorporate appropriate modeling results. The mixing zone study should address the proposed design of any effluent diffuser that will be installed. As part of the mixing zone study, the permittee should also collect additional monitoring data in the receiving water, upstream of the discharge, for copper, lead, and hardness. Annual progress reports describing the status of the mixing zone study must be submitted annually, postmarked by January 31st.