



Water Protection Bureau
 P.O. Box 200901
 Helena, MT 59620-0901

PERMIT FACT SHEET

MONTANA GROUND WATER POLLUTION CONTROL SYSTEM (MGWPCS)

Permittee:	Red Creek Sewer, Inc.
Permit Number:	MTX000297
Permit Type:	Domestic wastewater
Application Type:	New
Facility Name:	Red Creek Ranch Wastewater Facility
Facility Location:	T12S, R4E, Section 11, NE ¼ Gallatin County Latitude: 44.80892° Longitude: -111.20131°
Facility Address:	16990 Hebgen Lake Rd, West Yellowstone, MT 59758
Facility Contact:	Ellen Hogeson, Controller
Treatment Type:	Engineered wetland system
Receiving Water:	Class I Ground Water
Number of Outfalls:	1
Outfall / Type:	001 / siphon dosed drain fields
Effluent Type:	Domestic strength wastewater
Mixing Zone:	Standard
Effluent Limit Type:	WQBEL
Effluent Limits:	Total nitrogen: 3.9 lbs/day
Flow Rate:	Design maximum: 39,480 gpd Design average: 9,400 gpd
Effluent sampling:	EFF-1, monthly
Ground water sampling:	MW-1, quarterly
Fact Sheet Date:	May 2024
Prepared By:	Melinda Horne

1.0 PERMIT INFORMATION

The following fact sheet outlines the basis for issuing a new Montana Ground Water Pollution Control System (MGWPCS) wastewater discharge permit to Red Creek Sewer, Inc. (Permittee) for the Red Creek Ranch Wastewater Facility. The MGWPCS permit application and supplemental materials provide the information that serves as the basis for the development of the effluent limits and the monitoring requirements outlined within this fact sheet. The scope of this permitting action is for the construction, operation, and maintenance of the wastewater treatment and disposal system.

DEQ issues MGWPCS permits for a period of five years. The permit may be renewed at the end of the period, subject to timely application, reevaluation of compliance, water quality, and operations and maintenance.

1.1 APPLICATION

This facility was covered under the MGWPCS permit MTX000119 from 2001-2022. This permit expired on April 30, 2022 due to failure to reapply. DEQ received an application for renewal of the expired permit on February 16, 2023. DEQ received an updated application and fees for a new permit on August 13, 2023. DEQ reviewed the submittal and issued a completeness letter on September 1, 2023.

2.0 FACILITY INFORMATION

2.1 LOCATION

The Red Creek Ranch Wastewater Facility is located in the Madison Valley on the north shore of where Hebgen Lake meets the Grayling Arm (**Figure 1** and **Figure 2**).

RED CREEK RANCH - VICINITY MAP

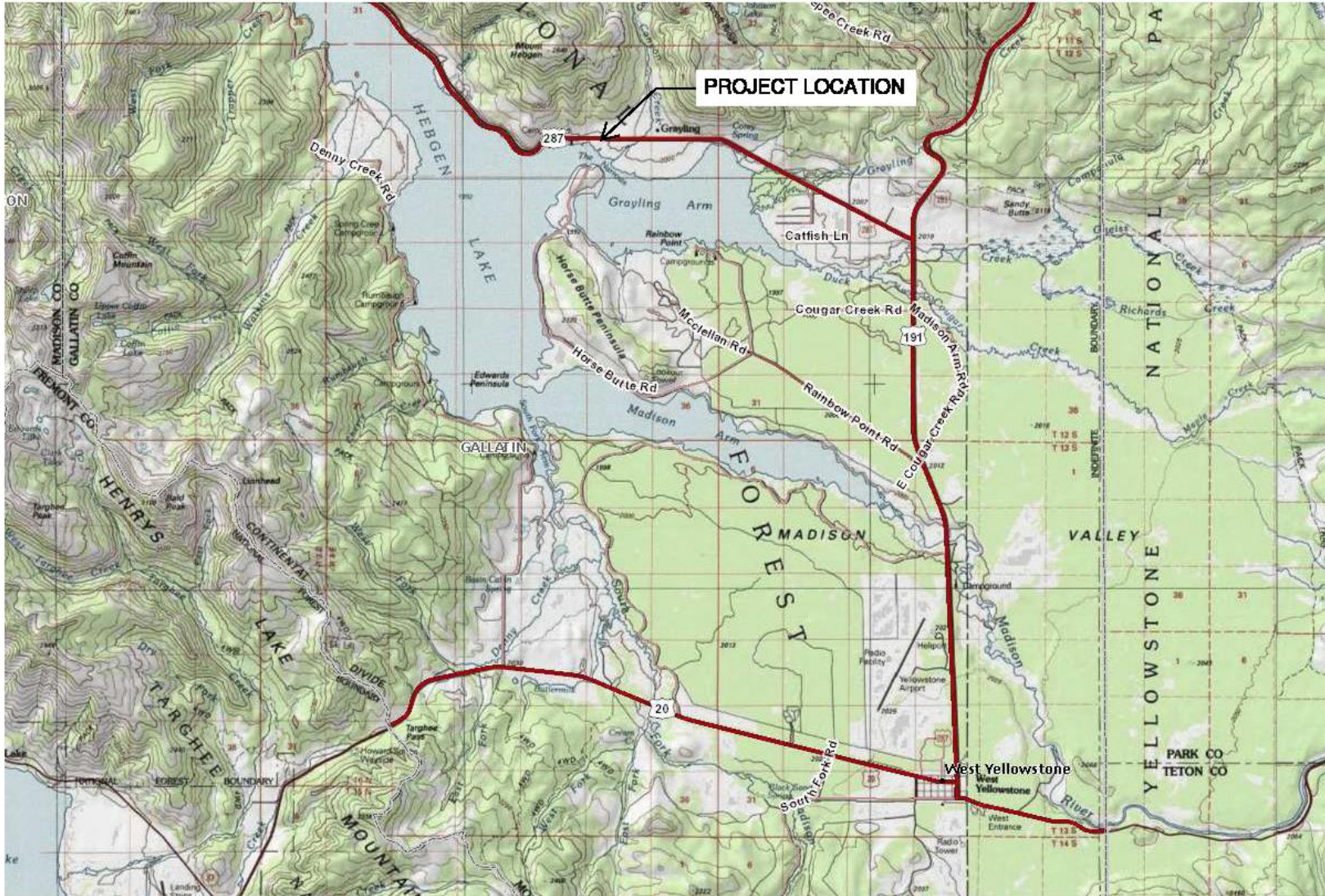


Figure 1: Location of Red Creek Ranch

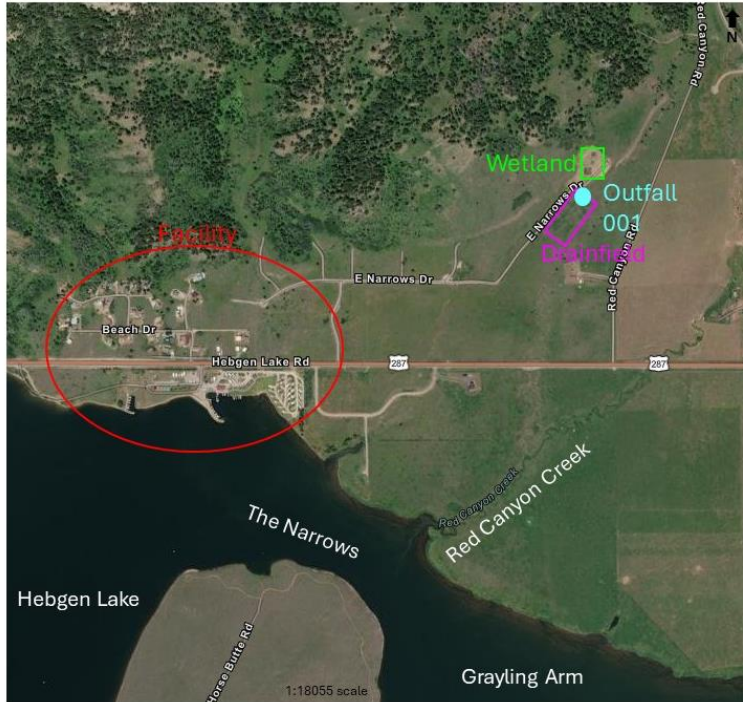


Figure 2: Red Creek Ranch vicinity map

The wastewater treatment system serves a recreational community consisting of commercial retail, rental cabins, a recreational vehicle park, and a marina on the north-shore of Hebgen Lake. The contributing wastewater flows are: 800 gpd from the Yellowstone Holiday Marina & Resort, 600 gpd from the Yellowstone Marina Cabin Sites, and 1500 gpd from the Yellowstone Holiday Marina RV – East.

2.2 OPERATIONS

The treatment system consists of gravity collection to two concrete 4000-gallon septic tank effluent pumps (STEP tanks) and one fiberglass 6,000-gallon septic tank and pump. These tanks pump through a low pressure force main to 12 siphoned dosed drain fields.

The facility added an engineered wetland system in 2018 prior to discharge for secondary treatment. The wetland system consists of two 45 ft square vertical flow wetland beds in series followed by one 85 ft square horizontal flow wetland bed. The two vertical flow beds operate in an unsaturated, pulsed flow scheme and function to remove BOD and carry out nitrification. The horizontal flow bed functions to facilitate denitrification.

In 2020, after the facility finalized the implementation of the wetland system, the Department removed the required effluent monitoring from the RV Park, Main Lodge and Cabin STEP tanks (listed as Outfalls 002, 003 and 004), and also ground water monitoring from MW-2 (Sankey Well) from MTX000119. Effluent monitoring is now completed after the wetland treatment, capturing effluent quality for the whole system.

Figure 2 and **Figure 3** displays the facility layout. **Figure 4** is a line drawing of the collection, treatment, and disposal process. System operations are summarized below in **Table 1**.



Figure 3: Facility site layout

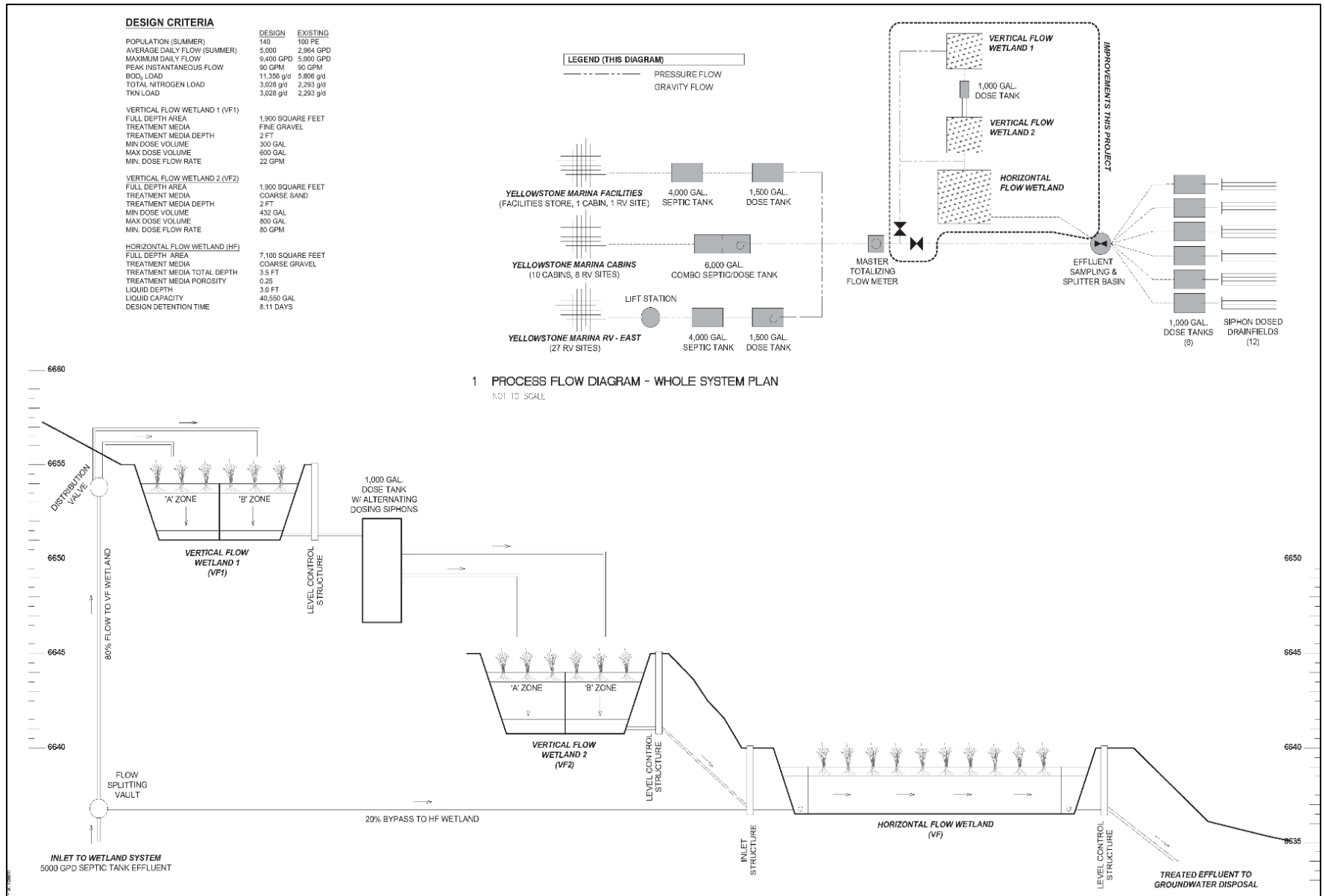


Figure 4: Wastewater Treatment System Line Diagram

Table 1: Operations Summary	
Sources and Treatment	
Contributing Sources of Wastewater: Domestic-in-Nature, Residential Strength Standard Industrial Code(s) (SIC) of contributing sources: 4952 Treatment System: Constructed wetland Location of System: Northeast Section 11, Township 12 South, Range 04 East Latitude: 44.80892, Longitude: -111.20131 Gallatin County	
Sampling/Monitoring	
Wastewater System: EFF-001: Located at splitter at end of force main, after constructed wetland and before dose tanks. FM-001: Effluent flow meter located in the monitoring and diversion vault at the end of the low pressure main prior to the wetland system.	
Disposal Operation	
Outfall 001 - Subsurface Drainfield Method of Disposal: Pressure dosed subsurface infiltration to groundwater. Location: Northeast Section 11, Township 12 South, Range 04 East Latitude: 44.809044, Longitude: -111.201390 Design Capacity: Average Daily Flow (gpd): 9,400 Maximum Daily Flow (gpd): 39,480	

2.3 GEOLOGY/HYDROGEOLOGY/HYDROLOGY

A summary of the site geology and ground water characteristics are provided in **Table 2**. A geologic map is provided in **Figure 6**.

Table 2: Geology/Hydrogeology/Hydrology Summary	
Geology	<p>The Hebgen Lake region contains a 2,000 ft Paleozoic and Mesozoic sedimentary sequence on top a metamorphic basement (Witkind et al., 1964). The late Cretaceous Laramide orogeny overturned this basement and uplifted the Hebgen ridge north of the facility.</p> <p>More recent extension associated with the Centennial Tectonic Belt began in the Miocene and lead to a series of normal faults that created grabens and half-grabens (Figure 5a). The facility is located near the eastern terminus of the Hebgen fault (Figure 5b).</p> <p>In 1959, the Hebgen Lake area experienced a magnitude 7.2 earthquake that involved measurable (20+ ft) surface slip on multiple separate normal faults, causing a huge landslide that resulted in 28 fatalities and the creation of Quake Lake. This remains to be one of the largest recorded continental normal faulting earthquakes in the last 125 years (Johnson et al., 2018).</p> <p>The geologic units immediately upland of the facility are overturned sedimentary strata Cambrian to Mississippian in age, with exposed basement of mica schist dating to the late Archean (Figure 6; O'Neill and Christiansen, 2004).</p>

	The facility overlies Holocene alluvial fan system formed by Red Canyon Creek thought to be a mile long and two miles wide (Figure 6 ; MDHES, 1979). Test pits done at the facility previously identified gravel with silt and sand as the predominant subsoils, with gravelly lenses of red sandy clay (BEI, 1998).
Hydrogeology	Ground water reserves in this area are found within the surficial alluvial fill and the limestone bedrock. Ground water levels within the alluvium near the Grayling Arm of Hebgen Lake appear to be strongly influenced by water levels in the lake (DEQ, 2009).
Ground Water Flow	Hydraulic conductivity in the shallow aquifer ranges from 121 to 171 ft/day, with an average of 137 ft/day, based on data from aquifer slug tests conducted in monitoring well MW1. A “measured” hydraulic gradient at the site of 0.019 ft/ft to the S23°W was used when the facility originally applied for MGWPCS coverage (DEQ, 2000).
Hydrology	The Narrows, which separates the greater Hebgen Lake from the Grayling Arm (Figure 6), is approximately 4,000 ft from Outfall 001 in the direction of groundwater flow.

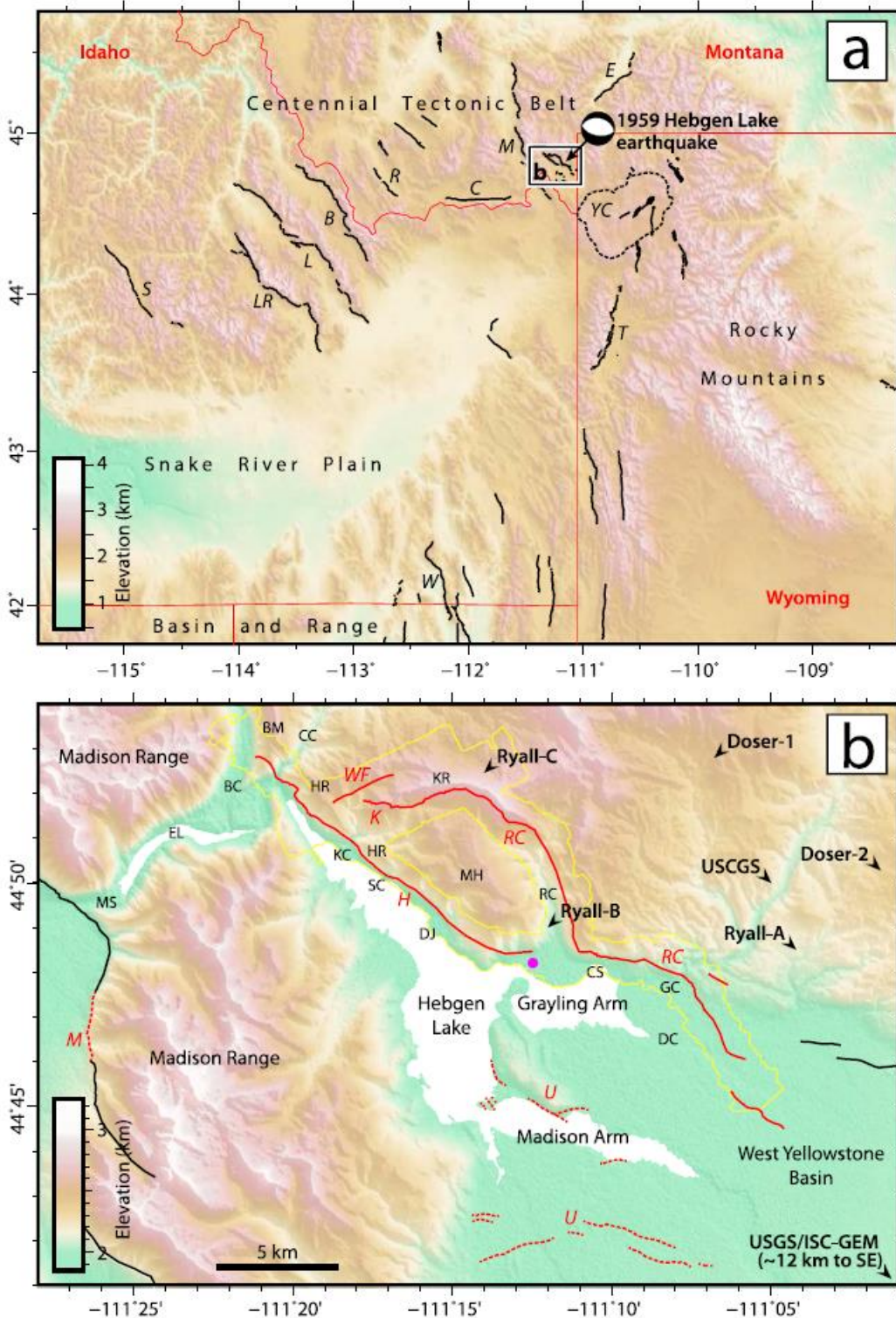


Figure 5: Regional tectonic maps created by Johnson et al. (2018). Figure 5a displays the Centennial Tectonic Belt series of NW/SE trending Quaternary normal faults from Haller et al. (2004). Figure 5b displays the epicentral region of the 1959 earthquake with the surface rupture traces in red. Relevant notations from Figure 5b: H = Hebgen fault rupture trace, MH = Mount Hebgen, RC = Red Canyon Creek, fuchsia dot = facility location.

If a DEQ-approved monitoring well is abandoned, destroyed or decommissioned, or is no longer able to be sampled due to fluctuations in the ground water table, the permittee must install or designate a new well to replace the abandoned, destroyed, decommissioned, or non-viable well.

2.5 QUALITY INFORMATION

The facility has a conventional wastewater treatment system augmented by a constructed wetland system. A summary of the effluent characteristics from summer time seasonal discharge in 2020-2022 is provided in **Table 4. Appendix A** is a submission from the facility's consultant discussing the effectiveness of the wetland system.

Downgradient monitoring of the aquifer over the previous permit cycle from MW-1 is summarized in **Table 5**. Ambient ground water quality characteristics of the shallow aquifer were collected from MW-2 (Sankey's well) and summarized in **Table 5**. Based on the 889 microSiemens per centimeter ($\mu\text{S}/\text{cm}$) specific conductance, the receiving water is Class I ground water.

Table 4: Effluent Quality – Outfall 001								
Parameter ⁽¹⁾	Location	Units	Reported Minimum Value	Reported Average Value	Reported Maximum ⁽²⁾ Value	# of Samples	Source of Data	2016 Permit Limit
Biochemical Oxygen Demand (BOD ₅)	EFF-001	mg/L	10	57	110	14	DMR	
Flow rate, Discharge	FM-001	gpd	772	2,592	3,760	14	DMR	
Nitrogen, Nitrate + Nitrite (as N)	EFF-001	mg/L	ND	0.036	0.060	14	DMR	
Nitrogen, Total Ammonia (as N)	EFF-001	mg/L	46	69	108	14	DMR	
Nitrogen, Total Kjeldahl (as N)	EFF-001	mg/L	45	72	111	14	DMR	
Nitrogen, Total (as N)	EFF-001	mg/L	45.0	73.0	111.0	13	DMR	50
		lbs/day	0.92	1.60	2.40	13	DMR	
Phosphorus, Total (as P)	EFF-001	mg/L	3.3	8.2	13.4	13	DMR	
		lb/d	0.06	0.2	0.3	13	DMR	
		lb/yr	23	26	29	3	DMR	

Footnotes:
DMR = Self Reported Discharge Monitoring Reports
EFF-001: See **Table 1**.
FM-001: See **Table 1**.
Period of Record: May-September seasonally 2020-2022.
ND = Non-detect
(1) Conventional and nonconventional pollutants only, table does not include all possible toxics.
(2) Maximum value recorded of all quarterly reported Daily Maximum Values.

Table 5: Ground Water Monitoring Results							
Source ⁽¹⁾	Parameter	Units	Reported Minimum Value	Reported Average Value	Reported Maximum ⁽²⁾ Value	# of Samples	Data Source
MW-1	<i>Escherichia coli</i> Bacteria	CFU/100 ml	1.00	1.00	2.00	10	DMR
	Nitrogen, Nitrate + Nitrite (as N)	mg/L	0.76	1.58	2.78	10	DMR
	Nitrogen, Total Kjeldahl (as N)	mg/L	ND	0.7	0.7	10	DMR
	Specific Conductivity (@ 25°C)	µS/cm	623	666	696	10	DMR
	Static Water Level (SWL)	ft-bgs	62.30	62.40	62.60	10	DMR
MW-2	Ammonia (as N)	mg/L	0	0	0	5	APP
	<i>Escherichia coli</i> Bacteria	CFU/100 ml	<1	1.00	<1	5	APP
	Nitrogen, Nitrate + Nitrite (as N)	mg/L	0.22	0.25	0.23	5	APP
	Nitrogen, Total Kjeldahl (as N)	mg/L	0	0	0	5	APP
	Specific Conductivity (@ 25°C)	µS/cm	851	889	872	5	APP
Footnotes: APP = Application Form GW-2 and supplemental materials. bgs = below ground surface CFU = Colony Forming Units DMR = Self Reported Discharge Monitoring Reports ND = Not Detected Period of Record: quarterly 03/2929-12/2022 s.u. = standard units (1) MW-1 represents downgradient water quality and MW-2 represents ambient water quality. See locations in Table 3 . (2) Maximum value recorded of all monthly or quarterly reported values.							

3.0 WATER QUALITY STANDARDS

Part of DEQ's mission is to protect and sustain the quality of state waters. Water quality standards provide the basis for limitations that protect state waters. These include beneficial use maintenance, specific water quality standards, and the nondegradation policy. DEQ protects all designated uses of state water by basing effluent limitations on the most restrictive water quality standards intended to protect the most sensitive uses.

3.1 BENEFICIAL USES

The receiving state water is Class I ground water which is a high quality water of the state. The current and future beneficial uses of the aquifer will be protected. The beneficial uses and water quality standards are listed below.

Beneficial uses:

- Public and private water supplies;
- Culinary and food processing purposes;
- Irrigation;
- Drinking water for livestock and wildlife; and,
- Commercial and industrial purposes.

Water quality standards are established to protect these beneficial uses. Standards are as follows:

- Ground water human health;
- Harmful, detrimental, or injurious activity; and,
- Nondegradation provisions.

DEQ protects all the assigned beneficial uses by protecting the most sensitive. The most restrictive standard will be used in formulating limitations (**Section 5.0**). The corresponding numeric and narrative standards are listed in **Table 6**.

Table 6: Water Quality Standards				
Parameter⁽¹⁾	Units	Ground Water Human Health Standards	Pollutant Category⁽²⁾	Nonsignificance Criteria⁽³⁾
Bacteria [<i>Escherichia coli</i>]	CFU/100mL	< 1	-	-
Nitrogen, Nitrate + Nitrite [as N]	mg/L	10.0	T	5.0 ⁽⁴⁾
Nitrogen, Total (TN) ⁽⁵⁾	mg/L	10.0	-	5.0 ⁽⁴⁾
Phosphorus, Total Inorganic	-	-	H	Surface water breakthrough time greater than 50 years ⁽⁶⁾

Footnotes:
 CFU = Colony Forming Unit
 These standards establish the allowable changes in ground water quality and are the basis for limiting discharges to ground water.
 (1) The list includes identified parameters of interest.
 (2) Circular DEQ-7: Carcinogen (C), Harmful (H), and Toxic (T) parameter. Toxic pollutant with a Bioconcentrator (B) factor.
 (3) Criteria indicates threshold for a significant activity that may lead to degradation.
 (4) Nitrate nonsignificance criteria is 5.0 mg/L for domestic sewage effluent discharged from a conventional septic system (ARM 17.30.715).
 (5) DEQ conservatively assumes all forms of nitrogen will convert to nitrates within the aquifer. DEQ recognizes that other nitrogen forms may be harmful to the beneficial uses therefore will use Total Nitrogen for projecting impacts and in formulation of compliance efforts (limitations).
 (6) Changes in receiving ground water quality are not significant if water quality protection practices approved by the DEQ have been fully implemented and if the listed nonsignificance criteria is met.

3.2 NONDEGRADATION

Montana's nondegradation policy is intended to preserve the existing condition of high-quality state waters. Any water with existing conditions better than the water quality standards must be maintained at that high quality. The nondegradation policy allows discharges to cause only nonsignificant changes in water quality.

Activities that cause a significant change in water quality may not be authorized without an authorization to degrade. See 75-5-303(3), MCA. The permittee has not requested nor received an authorization to degrade.

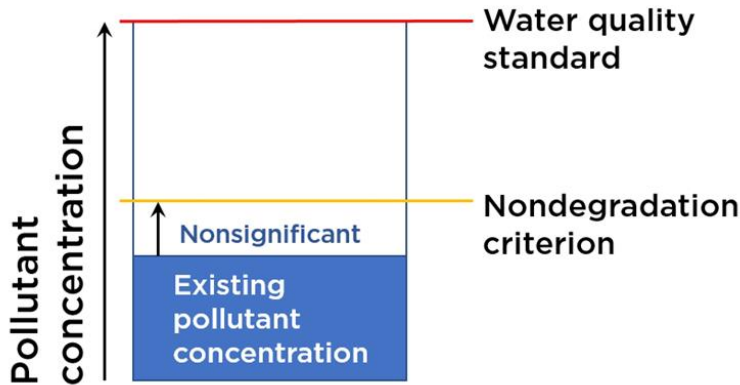


Figure 7: Nonsignificance schematic

3.3 SIGNIFICANCE DETERMINATION AND REASONABLE POTENTIAL

The 2001 Statement of Basis for MTX000119 included a significance determination analysis. The results estimated a nitrate concentration of 4.23 mg/L at the end of the mixing zone, meeting the 5.0 mg/L nitrate nonsignificance criteria for conventional treatment, and a phosphorus breakthrough of 50.4 years (**Appendix B**). Therefore, the discharge from the existing facility was found to be a nonsignificant activity under the Montana Water Quality Act.

Furthermore, these projections demonstrate that this discharge will not directly impact surface water or cause degradation of surface water.

All major discharge permitting actions, including the current action and any future actions, will include any substantive information derived from public input relating to potential impacts on the human environment and on water quality. All future actions related to this current action will be addressed by DEQ through additional discharge permitting process procedures. Any actions that are outside the purview of the discharge permit may not be addressed by DEQ until the next permitting action takes place.

The permittee must comply with the limitations established in this permit on a long-term basis.

3.4 CUMULATIVE EFFECTS

DEQ considered the direct, secondary, and cumulative environmental impacts of the construction and operation of the facility and found no significant adverse effects on water quality, the human environment, and the physical environment. The DEQ analysis included the cumulative impact from other past and present actions.

All major discharge permitting actions, including the current action and any future actions, will include any substantive information derived from public input relating to potential impacts on the human environment and on water quality. All future actions related to this current action will be addressed by DEQ through additional discharge permitting process procedures. Any actions that are outside the purview of the discharge permit may not be addressed by DEQ until the next permitting action takes place.

To protect beneficial uses, there shall be no increase of a pollutant to a level that renders the waters harmful, detrimental, or injurious. Therefore, no wastewaters may be discharged such that the wastewater either alone or in combination with other wastes will violate or can reasonably be expected to violate any standard.

The allowable discharge will be derived from a mass-balance equation that determines the assimilative capacity of the receiving aquifer. This factors in the cumulative impacts of all existing upgradient discharges in the receiving aquifer.

Testing of the aquifer was completed to determine the existing impacts of all upgradient discharge sources. The resulting ambient nitrogen levels were used to determine the assimilative capacity to ensure limitations were achieved that factors in these existing sources.

A ground water monitoring network has been established that will provide for long-term monitoring of the aquifer both upgradient and downgradient of the discharge. The ground water data collected will provide continual monitoring of the aquifer including the cumulative impacts of any nutrient source upgradient and downgradient of the permitted dischargers. This data is available to the public and used by DEQ to update future permit limitations. In addition, any update to limitations, including cumulative effect analyses, will be noticed to the public and will undergo public comment. Long-term monitoring, reporting, renewed analysis and updates of permit conditions, and public notice and comment procedures is a public benefit to having a system that is covered under a pollution control system permit.

Long-term monitoring and reporting, continual analysis and updates of permit conditions, and public notice and comment procedures is a benefit to having a system that is covered under a discharge permit.

4.0 MIXING ZONE

A mixing zone is an area of the receiving shallow ground water where the aquifer is able to assimilate wastewater pollutants. It is a specifically defined area of the receiving aquifer where water quality standards may be exceeded. The availability of dilution is based on the site-specific aquifer characteristics and the drainfield dimensions. The allowable level of dilution is limited by the permit to ensure that water quality standards are met at the end of the mixing zone.

The applicant requested a standard mixing zone for this discharge. A standard mixing zone extends 500 feet downgradient from the source. The upgradient boundary is equal to the width of the source (measured perpendicular to the ground water flow direction). The mixing zone widens in the downgradient direction by 5° on either side. The width of the downgradient boundary is calculated by adding the increased width for each side (the tangent of 5° (0.0875) times the mixing zone length) to the width of the upgradient boundary. Standard mixing zones extend 15 feet below the top contact of the ground water table. A map of the mixing zone is provided in **Figure 3**.

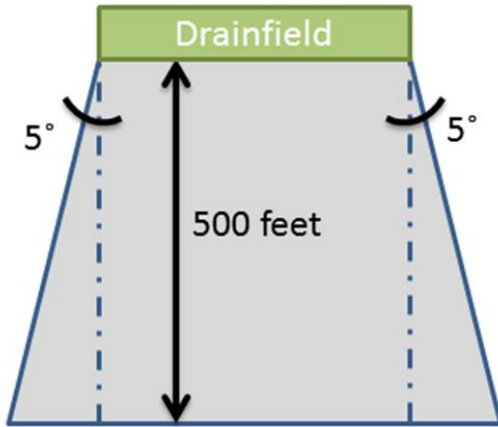


Figure 8: Mixing zone schematic

Information below provides details on how DEQ calculates the available dilution of the receiving aquifer. A summary is provided in **Table 7**.

Based on the dimensions of the mixing zone, and the hydrogeologic characteristics (**Section 2.0**), the volume of ground water (Q_{gw}) available to mix with the wastewater is calculated using Darcy's Equation:

$$Q_{gw} = KIA$$

Where Q_{gw} = ground water flow volume (ft³/day); K = hydraulic conductivity (ft/day); I = hydraulic gradient (ft/ft); and, A = cross-sectional area (ft²) of flow at the downgradient boundary of the mixing zone.

Modern drainfield systems are designed to minimize the likelihood of the subsurface transport of pathogenic bacteria. Pathogens are a direct existential threat to public and environmental health. In general, DEQ recognizes that replacement of older drainfields with a newly designed one may have environmental benefits.

Parameter	Units	Value
Mixing Zone Type	-	Standard
Authorized Parameters	-	Total Nitrogen
Ambient Ground Water Concentration, Nitrate + Nitrite (C_{gw})	mg/L	0.25
Ground Water Flow Direction	azimuth/bearing	S23°W
Length of Mixing Zone	ft	500
Thickness of Mixing Zone	ft	15
Outfall Width, Perpendicular to Ground Water Flow Direction	ft	400
Width of Mixing Zone at Down Gradient Boundary	ft	487.5
Cross Sectional Area of Mixing Zone (A)	ft ²	7312.5
Hydraulic Conductivity (K)	ft/day	137

Hydraulic Gradient (I)	ft/ft	0.019
Volume of Ground Water Available for Mixing (Q_{gw})	ft ³ /day	19,034

5.0 LIMITATIONS

Discharge permits include conditions that ensure compliance with the Montana Water Quality Act and the regulations used to implement it. These conditions include effluent limits as well as any special conditions that DEQ deems necessary to protect the quality of the receiving water.

5.1 NITROGEN

To protect beneficial uses, there shall be no increase of a pollutant to a level that renders the waters harmful, detrimental, or injurious. Therefore, no wastewaters may be discharged such that the wastewater either alone or in combination with other wastes will violate or can reasonably be expected to violate any standard. DEQ will establish an effluent limitation for nitrogen within this permit. The limit will conservatively be based on the projection that the entire nitrogen load in the wastewater stream may ultimately be converted to nitrate.

The allowable discharge will be derived from a mass-balance equation which is a simple steady-state model that determines the assimilative capacity of the receiving aquifer. The equation factors in cumulative impacts of existing upgradient discharges in the receiving aquifer and any available dilution within the mixing zone. The mass-balance equation derived for ground water is as follows:

$$Q_{gw}C_{gw} + Q_{eff}C_{eff} = Q_{comb}C_{proj}$$

Where Q_{gw} = ground water available for mixing; C_{gw} = ambient receiving ground water concentration; Q_{eff} = design capacity of wastewater system; C_{eff} = effluent pollutant concentration; Q_{comb} = combined ground water and effluent volume; and, C_{proj} = projected pollutant concentration (after available dilution).

The mass-balance equation has been arranged to calculate the maximum amount of nitrogen that can be added to the aquifer without causing or contributing to an exceedance of the water quality standard:

$$C_{limit} = C_{std} + \frac{Q_{gw}}{Q_{eff}}(C_{std} - C_{gw})$$

Where C_{limit} = concentration-based effluent limit; C_{std} = water quality standard concentration (5.0 mg/L; **Table 6**); Q_{gw} = ground water available for mixing (19,034 ft³/d; **Table 7**); Q_{eff} = average daily design capacity of wastewater system (1,257 ft³); and, C_{gw} = ambient receiving ground water concentration (0.25 mg/L; **Table 5**).

The resulting concentration-based nitrate limit is:

$$C_{limit} = 77.0 \text{ mg/L}$$

However, to be conservative, in this permit we will continue with an allowable concentration of 50.0 mg/L, as established in the 2001 permit under MTX000119.

Numeric effluent limits are often expressed as loads which regulates both volume and strength of the discharge. The load limit ensures compliance with the ground water standard at the end of the mixing zone.

$$L_{limit} = C_{limit} Q_{eff} f_{con}$$

Where L_{limit} = load-based effluent limit (lb/day); C_{limit} = concentration-based effluent limit (50 mg/L); Q_{eff} = design capacity of wastewater system (9,400 gpd); and, f_{con} = conversion factor of 8.34×10^{-6} .

The final load-based nitrate limit for this permit is:

$$L_{limit} = 3.9 \text{ lbs/day}$$

DEQ evaluates and recalculates the limits using updated water quality data as part of every permit renewal cycle. In this way, DEQ protects the receiving water quality by continually assessing impacts to the receiving water.

5.2 PHOSPHORUS

As discussed in **Section 3.3**, the phosphorus breakthrough analysis estimated the phosphorus breakthrough to occur in 50.4 years. Predicted phosphorus breakthrough greater than 50 years is considered nonsignificant. Therefore, a limit has not been developed.

5.3 FINAL EFFLUENT LIMITS

The effluent limitations for this permit are summarized in **Table 8**.

Table 8: Effluent Limitations – Outfall 001		
Parameter	Units	Quarterly Average
Nitrogen, Total [as N]	lbs/day	3.9
Quarterly load calculation: The quarterly average of all individual daily concentrations and the quarterly flow total must be used in the load calculations. Calculation rules are provided within the Wastewater Monitoring Tables.		

6.0 MONITORING AND REPORTING

Long-term monitoring and reporting of wastewater and ground water will be established as a condition of the permit. Monitoring of the wastewater characteristics before and after treatment will help ensure operation, maintenance, and compliance with the permit limitations. Wastewater monitoring and reporting requirements are provided in **Table 9**.

Ground water monitoring will provide DEQ with ongoing information on the current and future health of the aquifer. Ground water monitoring and reporting requirements are provided in **Table 10**.

Reporting must be completed with the use of Discharge Monitoring Reports (DMRs). The permittee or operator will file DMRs electronically through the online NetDMR program. Information and contacts for this program can be found here: <https://deq.mt.gov/water/assistance>.

Table 9: Effluent Monitoring and Reporting Requirements						
Parameter/Method	Monitor Location	Units	Sample Type ⁽¹⁾	Minimum Sample Frequency*	Reporting Requirements ⁽¹⁾⁽²⁾⁽³⁾	Report Frequency
Flow Rate, Effluent ⁽⁴⁾	FM-001	gpd	Continuous	Continuous	Daily Maximum Monthly Average	Quarterly
Nitrogen, Nitrate+nitrite (as N)	EFF-001	mg/L	Grab	Monthly	Daily Maximum Monthly Average	Quarterly
Nitrogen, Total Ammonia (as N)	EFF-001	mg/L	Grab	Monthly	Daily Maximum Monthly Average	Quarterly
Nitrogen, Total Kjeldahl (TKN) (as N)	EFF-001	mg/L	Grab	Monthly	Daily Maximum Monthly Average	Quarterly
Nitrogen, Total (as N) ⁽⁵⁾	EFF-001	mg/L	Calculate	Monthly	Daily Maximum Monthly Average	Quarterly
		lbs/day ⁽⁶⁾	Calculate	Monthly	Daily Maximum ⁽⁷⁾ Monthly Average ⁽⁸⁾	Quarterly
Phosphorus, Total (as P)	EFF-001	mg/L	Grab	Monthly	Monthly Average	Quarterly
		lbs/day ⁽⁶⁾	Calculate	Monthly	Monthly Average ⁽⁸⁾	Quarterly
		lbs/year ⁽⁹⁾	Calculate	Monthly	Annual Maximum ⁽¹⁰⁾	Annual ⁽¹¹⁾
BOD ₅	EFF-001	mg/L	Grab	Monthly	Daily Maximum Monthly Average	Quarterly

Footnotes:

***Monthly effluent sampling is required only from April through September.**

EFF-001: located at splitter at end of force main and prior to dose tanks
 FM-001: located between wastewater sumps and prior to release into the collection tank.

(1) See definitions in Part V of the permit.
 (2) Daily Maximum: Report highest measured daily value for the reporting period on Discharge Monitoring Report (DMR) form.
 (4) Requires recording device or totalizing meter, must record daily effluent volume.
 (5) Total Nitrogen is the sum of Nitrate + Nitrite and Total Kjeldahl Nitrogen.
 (6) Load calculation: lbs/day = (mg/L) x flow (gpd) x [8.34 x 10⁻⁶].
 (7) Daily Maximum Load calculation: lbs/day = the maximum of all calculated individual daily average loads (lbs/day) recorded during the reporting period.
 (8) Monthly Average Load calculation: lbs/day = the average of all calculated individual daily average loads (lbs/day) recorded during the reporting period.
 (9) Annual Load calculation: lbs/year = (mg/L) x flow (gpd) x [8.34 x 10⁻⁶] x 365 (days/year).
 (10) Annual Load calculation: lbs/year = the total average of all calculated individual daily average loads (lbs/day) recorded during the calendar year, multiplied by 365 (days/year).
 (11) Annual maximum load shall be reported (DMR) on an annual basis (due January 28 each year of the permit cycle).

Table 10: Ground Water Monitoring and Reporting Requirements						
Parameter/Method	Monitor Location ⁽¹⁾	Units	Sample Type ⁽²⁾	Minimum Sampling Frequency ⁽³⁾	Reporting Requirements ⁽²⁾⁽³⁾⁽⁴⁾	Reporting Frequency
<i>Escherichia coli</i> Bacteria	MW-1	CFU/100ml	Grab	Monthly	Daily Maximum Quarterly Average ⁽⁵⁾	Quarterly
Nitrogen, Nitrate + Nitrite (as N)	MW-1	mg/L	Grab	Monthly	Daily Maximum Quarterly Average ⁽⁵⁾	Quarterly
Nitrogen, Total Ammonia (as N)	MW-1	mg/L	Grab	Monthly	Daily Maximum Quarterly Average ⁽⁵⁾	Quarterly
Nitrogen, Total Kjeldahl (TKN) (as N)	MW-1	mg/L	Grab	Monthly	Daily Maximum Quarterly Average ⁽⁵⁾	Quarterly
Specific Conductivity @ 25°C	MW-1	µS/cm	Grab or Instantaneous	Monthly	Daily Maximum Quarterly Average ⁽⁵⁾	Quarterly
Static Water Level (SWL) ⁽⁶⁾	MW-1	ft.-bmp	Instantaneous	Monthly	Daily Maximum Quarterly Average ⁽⁵⁾	Quarterly

Footnotes:
 CFU = Colony Forming Units
 ft.-bmp = feet below measuring point
 µS/cm = micro-Siemens per centimeter
 If any monitoring well(s) are abandoned, destroyed or decommissioned, or are no longer able to be sampled due to fluctuations in the ground water table; the permittee shall install a new well to replace the abandoned, destroyed, decommissioned, or non-viable well(s).
 Parameter analytical methods shall be in accordance with the Code of Federal Regulations, 40 CFR Part 136, unless specified above.
 (1) A description of the monitoring well can be found in **Table 3** of the Fact Sheet.
 (2) See definitions in Part V of the permit.
 (3) Sampling from MW-1 will be done monthly from April through September. Submittal of DMRs will be required quarterly for the second and third quarter of each year.
 (4) Daily Maximum: Report highest measured daily value for the reporting period on Discharge Monitoring Report (DMR).
 (5) The geometric mean must be reported if more than one sample is taken during a reporting period.
 (6) Measuring point (point of reference) for SWL measurements shall be from top of inner casing or as established by the Operational Manual and measured to within 1/100th of one foot

7.0 SPECIAL CONDITIONS

7.1 MONITORING WELL VIABILITY

The permittee shall monitor and collect representative ground water samples from the receiving ground water aquifer. If any of the wells are abandoned, destroyed, decommissioned, or non-viable; or are no longer able to be monitored due to obstructions or fluctuations in the ground water table; the permittee shall rehab the non-viable well or replace with the installation of a new well.

7.2 MONITORING WELL REPLACEMENT, REHABILITATION, AND ABANDONMENT

If for any reason a monitoring well needs to be replaced, rehabilitated, or abandoned, the permittee shall submit a plan to DEQ for approval prior to the action taking place. The plan must document existing site-specifics and the reasoning behind the proposed action. The plan must detail the specific steps to take place during deconstruction, drilling, workover, and/or construction of the respective wells.

Written permission from DEQ is needed prior to the abandonment of any monitoring well. At minimum, monitoring well abandonment activities must be done in accordance with ARM 36.21.810(2-5). If the monitoring well is located in or around any collection, storage, treatment, disposal, land application, and/or mixing zone workings (or similar) additional actions may be required to prevent preferential subsurface flows, cross contamination, and to mitigate against any unauthorized wastewater releases. All new well installations must have detailed drilling, lithology, geospatial, and well construction information. A follow-up report summarizing all actions and details must be submitted to DEQ within 30 calendar days.

7.3 ANNUAL REPORT

Submit an annual report by January 28th each year that discusses the effectiveness of the treatment system and documenting actions taken toward the improvement of effluent quality at the Red Creek Ranch Wastewater Facility.

8.0 COMPLIANCE SCHEDULE

The actions listed in **Table 11** must be completed on or before the respective scheduled completion date. Unless otherwise stated, completion of all actions or deliverables must be reported to DEQ in accordance with Part II and Part IV.G of the permit.

Table 11: Compliance Schedule			
Action	Frequency	Completion Date of Action	Reporting Due Date
Submit an annual report discussing the effectiveness of the treatment system and documenting actions taken toward the improvement of effluent quality at the Red Creek Ranch Wastewater Facility.	Annual event	<i>Annually by the 28th of January</i>	Annually by the 28th of January

9.0 PUBLIC NOTICE

Legal notice information for water quality discharge permits are listed at the following website: <http://deq.mt.gov/Public/notices/wqnotices>. Public comments on this proposal are invited any time prior to close of business on **July 11, 2024**. Comments may be directed to DEQWPBPublicComments@mt.gov or to

Montana Department of Environmental Quality
Water Protection Bureau
PO Box 200901
Helena, MT 59620

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 pertinent to this permitting action and may issue a final decision within thirty days of the close of the public comment period.

All persons, including the applicant, who believe any condition of the 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). All public comments received for this draft permit will be included in the administrative record and will be available for public viewing during normal business hours.

Copies of the public notice are mailed to the applicant, state and federal agencies, and interested persons who have expressed interest in being notified of permit actions. A copy of the distribution list is available in the administrative record for this draft permit. Electronic copies of the public notice, draft permit, fact sheet, and draft environmental assessment are available at the following website: <http://deq.mt.gov/Public/notices/wqnotices>.

Any person interested in being placed on the mailing list for information regarding this permit may contact the DEQ Water Protection Bureau at (406) 444-5546 or email DEQWPBPublicComments@mt.gov. All inquiries will need to reference the permit number (MTX000297), and include the following information: name, address, and phone number.

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.

10.0 REFERENCES

Administrative Rules of Montana, Title 17, Chapter 30, Water Quality:

Subchapter 2 - Water Quality Permit Fees.

Subchapter 5 – Mixing Zones in Surface and Ground Water.

Subchapter 7 – Nondegradation of Water Quality.

Subchapter 10 – Montana Ground Water Pollution Control System.

Subchapter 13 – Montana Pollutant Discharge Elimination System.

Bridger Engineers, Inc., "Red Creek Ranch Wastewater Collection, Treatment & Disposal System Improvements", Sheet 1 of 2, 7/29/98.

Department of Environmental Quality, Water Quality Circulars:

Circular DEQ-2 – Design Standards for Wastewater Facilities.

Circular DEQ-4 – Montana Standards for On-Site Subsurface Sewage Treatment Systems.

Circular DEQ-7 – Montana Numeric Water Quality Standards, Required Reporting Values, and Trigger Values.

Department of Environmental Quality, Administrative Record for permit MTX000119

2000 Statement of Basis, Final Permit

2009 Statement of Basis, Final Permit

2016 Fact Sheet, Final Permit

2023 Renewal Application

Haller, K. M., Machette, M. N., Dart, R. L., & Rhea, B. S. (2004). US Quaternary fault and fold database released. *Eos, Transactions of the American Geophysical Union*, 85(22), 218–218.

Johnson, K. L., Nissen, E., & Lajoie, L. (2018). Surface rupture morphology and vertical slip distribution of the 1959 Mw 7.2 Hebgen Lake (Montana) earthquake from airborne lidar topography. *Journal of Geophysical Research: Solid Earth*, 123, 8229–8248. <https://doi.org/10.1029/2017JB015039>

Montana Department of Health and Environmental Sciences, Final Environmental Impact Statement with Comments and Responses for Ski Yellowstone in Gallatin County, October 5, 1979.

Montana Bureau of Mines and Geology, Ground-Water Information Center, GWIC state well database, Online at: <http://mbmgwic.mtech.edu>.

Montana Code Annotated, Title 75, Chapter 5, *Montana Water Quality Act*, 2011.

O’Neill, J.M., and Christiansen, R.L., 2004. Geologic map of the Hebgen Lake 30' x 60' quadrangle, Beaverhead, Madison, and Gallatin counties, Montana, Park and Teton counties, Wyoming, and Clark and Fremont counties, Idaho. US Geological Survey, Scientific investigations map 2816, scale 1:100,000.

U.S. Environmental Protection Agency, 2010. NPDES Permit Writers’ Manual, 833-K-10-001.

APPENDIX A 2023 APPLICATION COVER LETTER

February 13, 2023

Montana Department of Environmental Quality
Water Protection Bureau
1520 East Sixth Ave.
PO Box 200901
Helena, MT 59620-0901

Attn: Chris Boe

**Re: Red Creek Ranch – MTX000119 Discharge Permit
Hebgen Lake, Gallatin County, Montana**

RECEIVED

FEB 16 2023

DEQ WATER QUALITY DIVISION

Dear Chris:

This letter and accompanying attachments shall collectively serve as the complete **renewal application** for the Red Creek Ranch (RCR) Sewer Users Association's groundwater discharge permit (MTX000119). This permit expired on March 30, 2022. The RCR sewer users association owns and operates the wastewater collection, treatment, and disposal system (WW C, T & D) serving the Yellowstone Holiday Resort and Marina (YHRM), the Lookout Subdivision, and Red Creek Ranch.

Since the last permit renewal, the system added a treatment wetlands system (E.Q. #18-1822) that functions primarily to lower total nitrogen concentration in the wastewater delivered to the drainfield outfall. The wastewater is high strength due to the primary use of the facility being RV hookups. Typical raw wastewater total nitrogen concentrations range from approximately 100 to 200 mg/L as N. BOD and TSS are also higher than typical residential wastewater but nitrogen is the regulated constituent so that will be the focus of this narrative for simplicity. The existing permit sets a total nitrogen concentration limit of 50 mg/L as N. The treatment wetland system is significantly lowering the total nitrogen concentration at the outfall, but operational difficulties make it difficult to strictly meet that 50 mg/L effluent limit. Specific difficulties are as follows:

1. **Representative Sampling:** The system is in a remote location. Samples must be collected in the morning, driven two hours, and overnighted to Energy Labs in Billings for analysis. This forces the grab sample to be collected during a high flow time of day, and cannot be expected to truly represent wastewater characteristics over the course of a day. Rather, it is expected that the peak concentrations are being measured.
2. **Evapotranspiration:** Flow is being measured at the influent side of the treatment wetland system. It is not feasible to measure flow in the gravity piping on the effluent side of the wetland. It is expected that during the summer up to 30% of the influent flow may be lost to evapotranspiration. This has been observed anecdotally where no effluent flow is observed mid-day even when the wetland is receiving wastewater. This loss to evapotranspiration can concentrate dissolved wastewater constituents such that measured total nitrogen concentrations are high, even though the load in lbs/day total N would still be

greatly decreased by the wetland. Since there is not currently a way to measure the true outfall flow rate this phenomenon has yet to be quantified, but it can be said with some level of certainty that effluent concentrations are being influenced by evapotranspiration to some degree. Please note that average day flows ranged from approximately 2,000 – 3,000 gpd during the recent summer seasons (2020 to 2022) as shown in Figure 1. Flows are well below the permitted levels at this time.

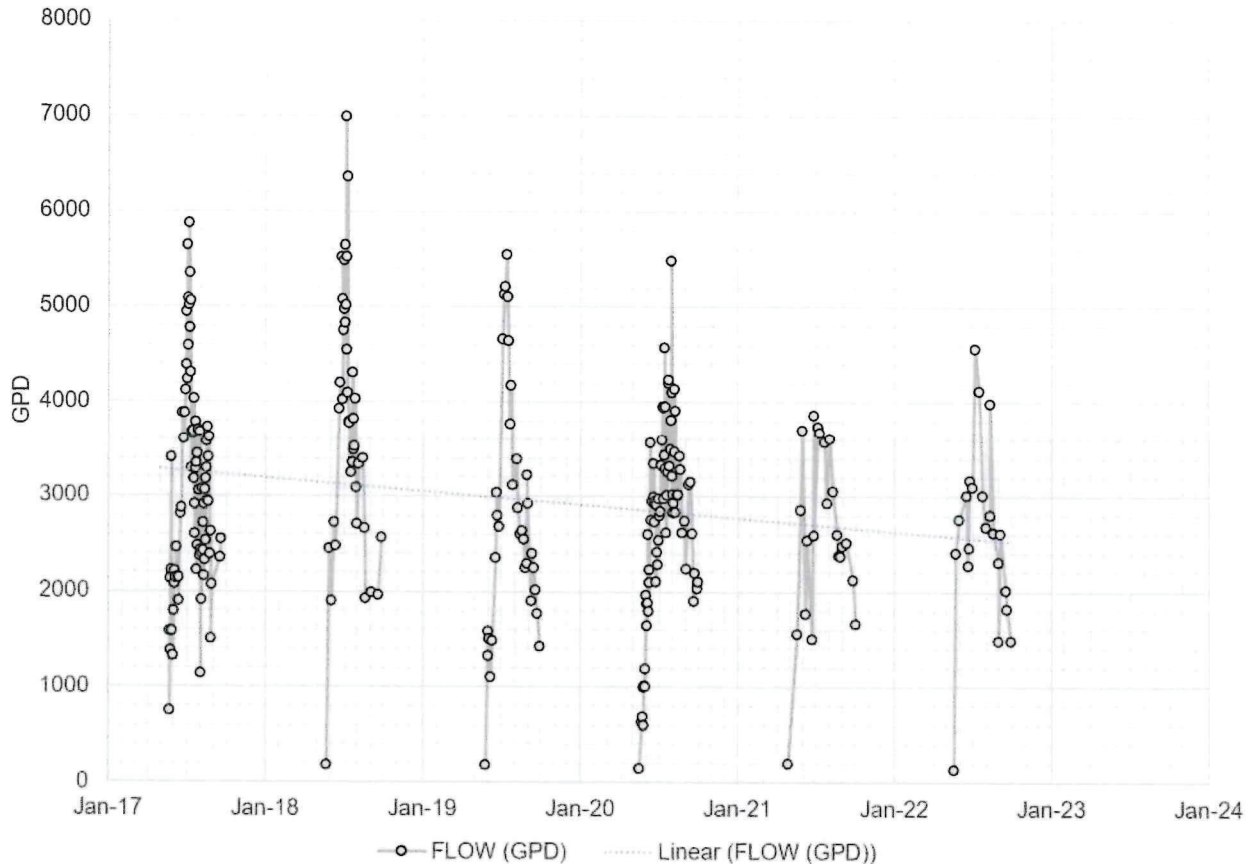


Figure 1 - Master totalizing flow meter data in gallons per day with linear trend line showing a general decrease over time (2017-2022).

- 3. Seasonality:** System use is highly seasonal with virtually all flow happening during the summer recreation season (Memorial Day to Labor Day). This causes the system to be in a constant state of readjustment. Prior to the installation of the wetland system the resulting spikes in concentration were delivered directly to the outfall. The wetlands have been successful in tempering these spikes but to date the strict 50 mg/L total N limit has been difficult to meet even though total nitrogen loading to the outfall has been significantly reduced.
- 4. Wetland Maturity:** The seasonal nature of the system has delayed the establishment of mature wetlands plants. Extreme variation in both quantity and strength of the influent wastewater has caused plantings to fail in the first wetland cell, and has delayed progress in the second. The third horizontal flow cell has established a robust plant community. Slow maturation in both of the

vertical flow wetland cells has limited nitrification in the system as a whole. Even still, a 50% removal of total nitrogen is being observed on average.

Taking the above into account it is still plainly evident that the new constructed wetland treatment system is functioning to lower the nitrate concentration observed at the end of the mixing zone.

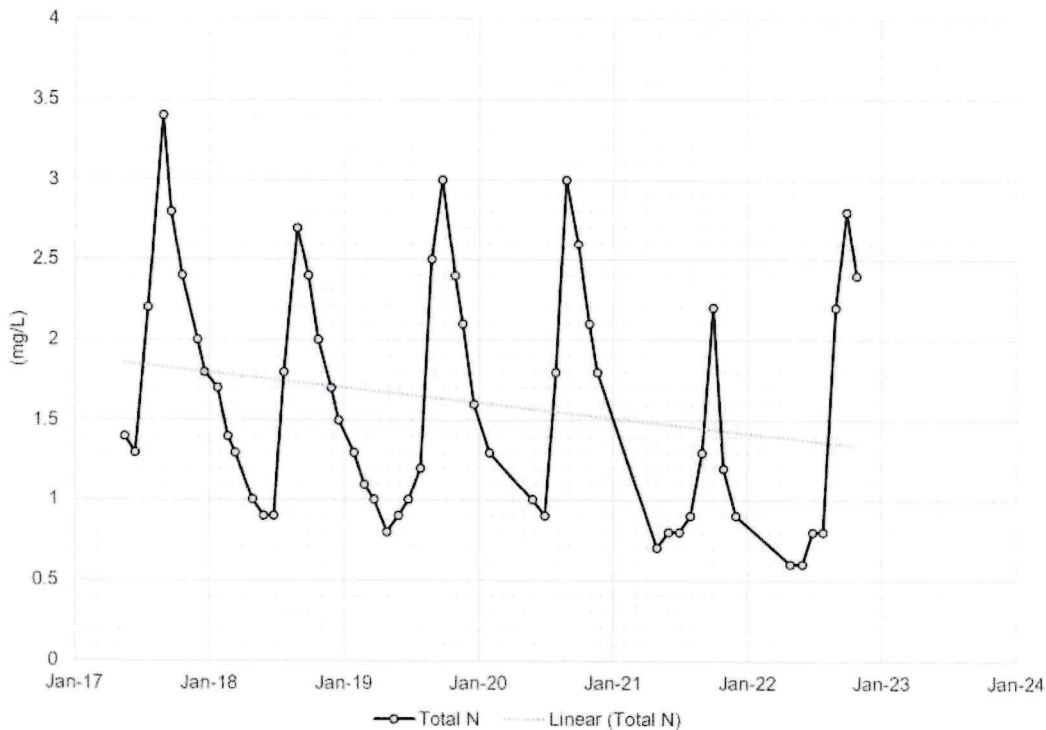


Figure 2 – Total Nitrogen concentration time series at MW1 with a linear regression trend line.

Figure 2 shows a clear trend in total nitrogen concentration at MW1, which is directly down gradient of the mixing zone. This result clearly demonstrates that even though there have been difficulties meeting the 50 mg/L total nitrogen limit, the system is functioning to improve groundwater nitrogen concentrations. We would argue that the new treatment system has been functioning as intended to lower nitrogen load to the aquifer, but it has proven difficult to meet the specific concentration limit based on monthly grab samples. We believe that a load-based limit for total nitrogen is more appropriate for this particular system given the apparent results at MW1.

The wetlands have been closely monitored for performance. Results of the monitoring are summarized in Figures 3-5. The effect of the constructed wetlands on effluent concentrations at the outfall (DFFS) is clear with all constituents showing a downward trend over time. The wetlands are removing approximately half of the total nitrogen currently, and it is expected that performance can be increased with some minor modifications to O&M procedures. TSS and BOD5 show even more dramatic removal percentages which will help the drainfield disposal system perform better and last longer.

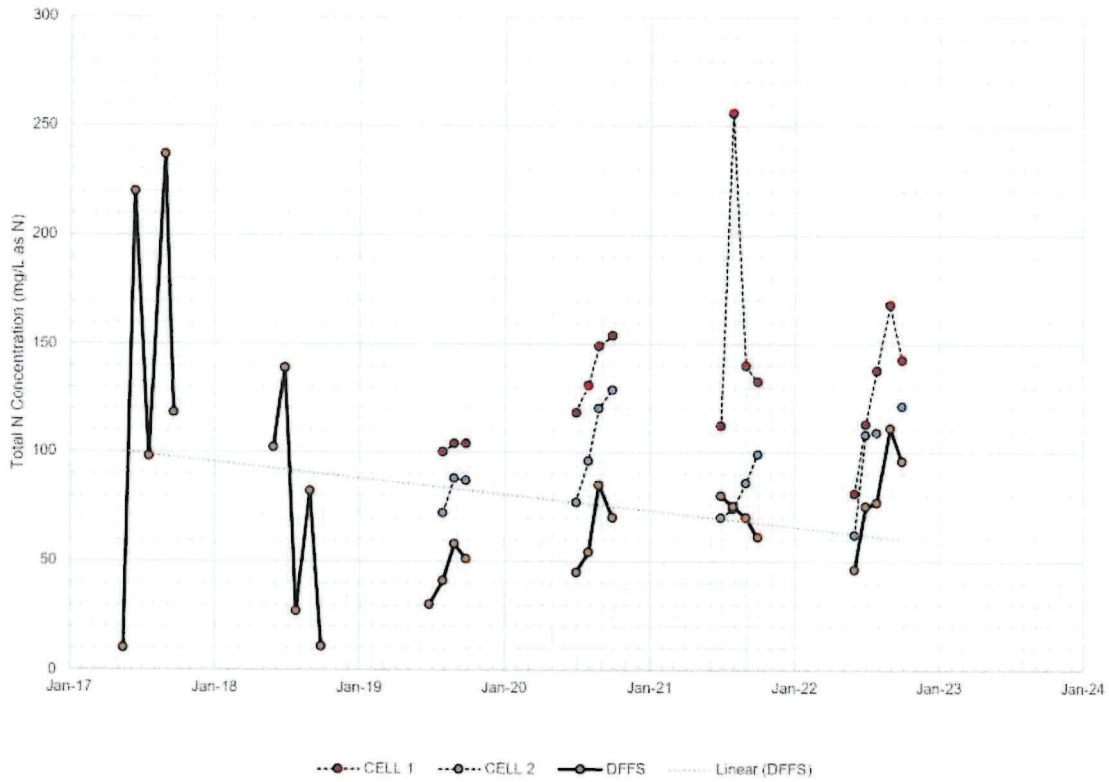


Figure 3 - Total N concentration time series at locations throughout the wetland treatment system. Note the 2017 and 2018 data do not have wetland data points because the system did not exist.

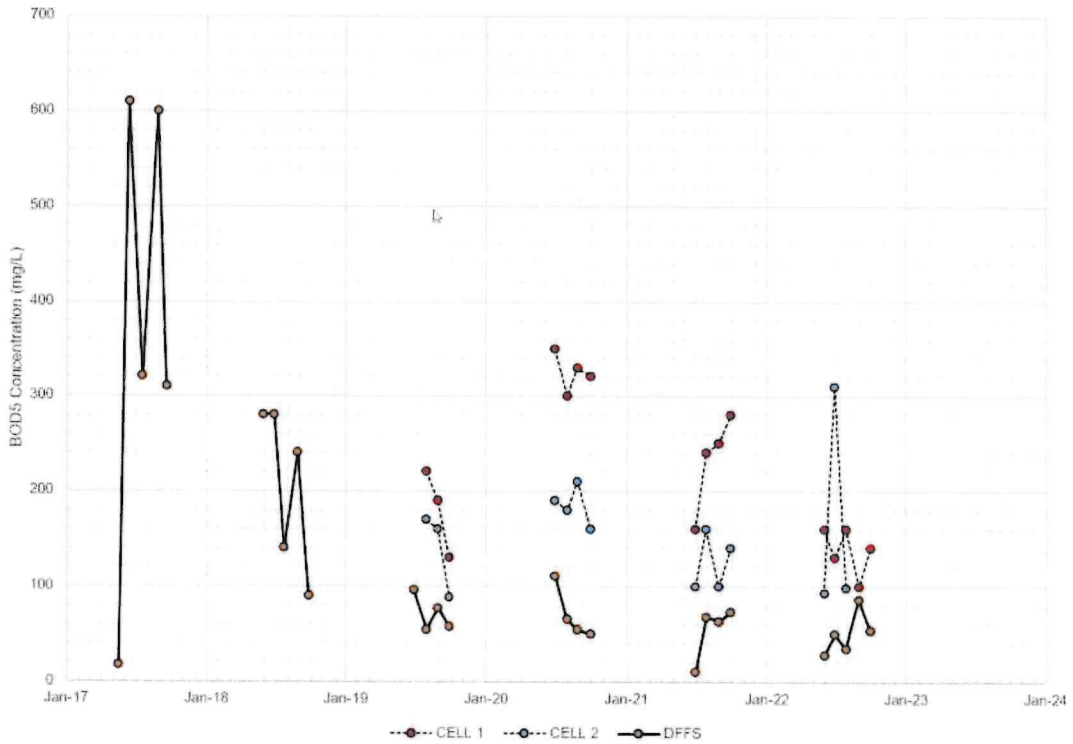


Figure 4 – BOD5 concentration time series at locations throughout the wetland treatment system. Note the 2017 and 2018 data do not have wetland data points because the system did not exist.

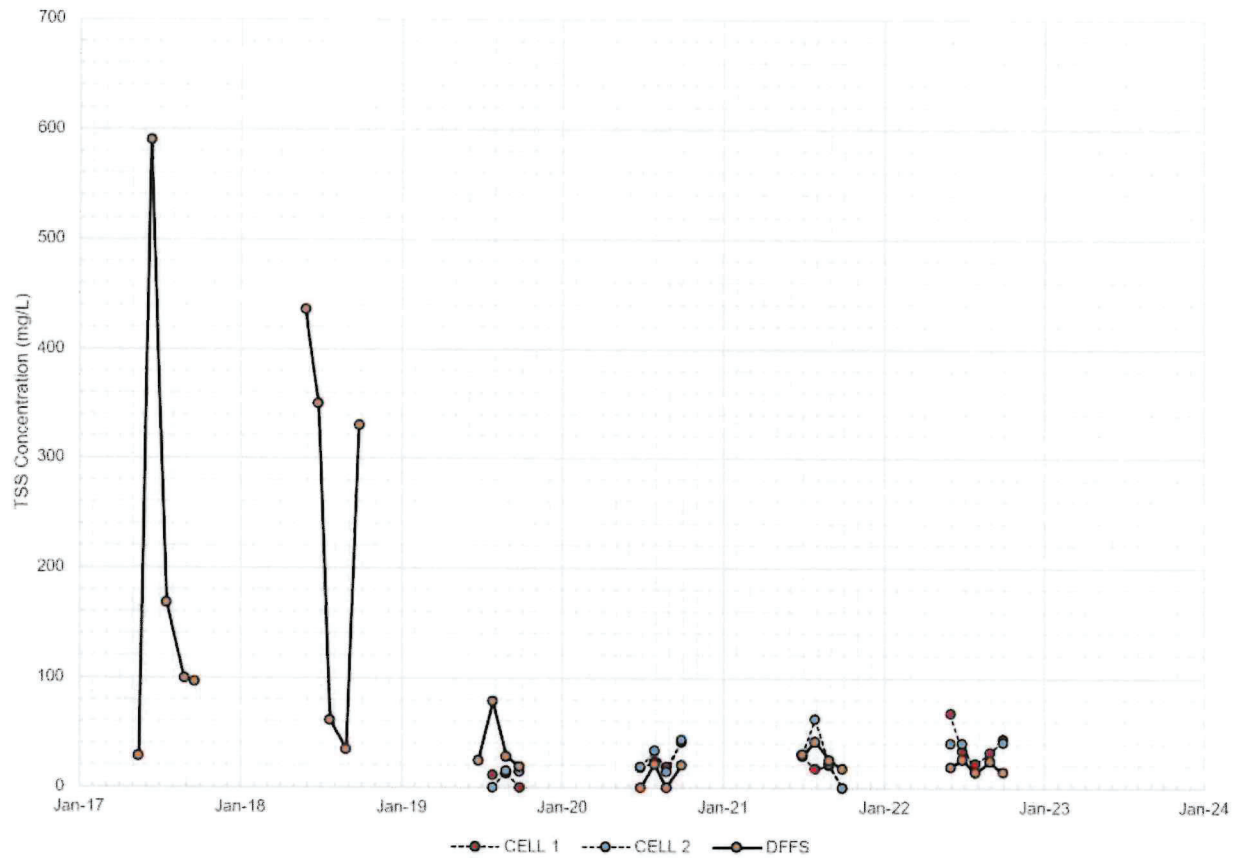


Figure 5 – Total suspended solids (TSS) concentration time series at locations throughout the wetland treatment system. Note the 2017 and 2018 data do not have wetland data points because the system did not exist.

Please see attached existing permit with redlines for anticipated modifications for this permit renewal. We will continue to sample EFF-01, along with MW 1 and provide annual report after each season. As previously discussed in annual reports we plan to sample MW 1 monthly, unless conditions preclude access to the monitoring site. Recently the months of December, January, February, and some March are snowed in and access to the MW is available.

As discussed in the annual report provided in January, we are and will continue to improve the overall treatment process. Given the higher than normal discharge concentrations in 2022, we completed a site inspection of the system the first of October of 2022 to see if there were issues unseen, and out of the normal given the maturity of the system. During that inspection we exposed portions the vertical flow cell laterals to observe flow through orifices, etc. During that time, we observed that some of the orifices were clogged limiting proper distribution and aeration. We opened inspection ports and flushed the system and found this to improve orifice clogging. We are working with the operator to have a more detailed opening of the system next year, i.e. increased flushing, etc. and then periodically through the 2023 season. We are also looking at increasing the orifice spacing to utilize more the filter media and improve aeration. We believe the system was short-cutting and not using the entire filter media. Prior to this we were having good success with the treatment, so we will monitor close next season to bring the system back into the treatment standards expected. I think we have a good handle on that coming up for the next season.

If you have questions or need any additional information please feel free to give me a call at 587-2781 or email to mstenberg@hyaliteeng.com.

Sincerely,



Mike Stenberg, PE
Principal

Enclosures: Effluent and MW Sampling Results

cc: File – 021011
Owner

RECEIVED
FEB 16 2023
DEQ WATER QUALITY DIVISION

APPENDIX B 2000 STATEMENT OF BASIS EXCERPT – SIGNIFICANCE DETERMINATION

F. WATER QUALITY STANDARDS DISCUSSION

Nondegradation:

The proposed disposal system is a new source (ARM 17.30.702 (16)) and is subject to the nondegradation standard (ARM 17.30.705 (1)). Ground water beneath the property is Class I. Class I ground water is suitable for public and private water supplies, culinary and food processing purposes, irrigation, drinking water for livestock and wildlife and for industrial and commercial uses. Secondary and human health standards apply to concentrations of dissolved substances in Class I ground waters. Ground water quality standards apply at the down-gradient mixing zone boundary in the unconfined aquifer.

The applicable nondegradation standard at the end of the mixing zone for this system is 5.0 mg/L (ARM 17.30.715(1)(d)(ii)).

Nitrate:

The total inorganic nitrogen (NO_3+NO_2 as N and ammonia as N) concentration in the drainfield discharge is estimated in order to determine whether the applicable ground water quality standard can be met down-gradient of the source. A sensitivity analysis estimates the ground water nitrogen concentration that would result from the discharge. This estimate is derived from a dilution calculation according to the equation (Bauman and Schafer 1984):

$$C_r = \frac{(Q_d)(C_d) + (Q_s)(C_s) + (Q_p)(C_p)}{(Q_d + Q_s + Q_r)}$$

where:

- C_r = Concentration of nitrate-nitrogen ($\text{NO}_3+\text{NO}_2\text{-N}$) in receiving ground water at the end of the mixing zone
- Q_d = Discharge volume
- C_d = Discharge concentration ($\text{NO}_3+\text{NO}_2\text{-N}$)
- Q_s = Ground water volume mixing with the discharge
- C_s = Ambient ground water $\text{NO}_3+\text{NO}_2\text{-N}$ concentration
- Q_p = Recharge volume from precipitation
- C_p = Recharge $\text{NO}_3+\text{NO}_2\text{-N}$ concentration

The conventional wastewater treatment system is estimated to discharge total inorganic nitrogen (TIN) to the drainfield at 54 mg/L. The drainfield is estimated to remove 7% of the nitrate leaving 50 mg/L to percolate to groundwater. The nitrate sensitivity analysis (attachment 1) is based on a discharge to groundwater of 50 mg/L TIN.

The design wastewater discharge volume (Q_d) is 9,400 gpd. The ground water volume mixing with the discharge (Q_s) is estimated using the Darcy equation:

$$Q_s = K I A$$

where:

Q_s = ground water flow volume (ft³/day)

K = hydraulic conductivity (ft/day)

I = hydraulic gradient

A = cross-sectional area (ft²) of flow at the down-gradient boundary of a 500-foot mixing zone.

The value of Q_s is ft³/day assuming an aquifer K value of 137 ft/day, a measured gradient of 0.019 ft/ft and a cross-sectional area of 7,995 ft². The ambient concentration of nitrate nitrogen in the ground water (C_s) was determined to be 0.28 mg/L based on analysis of a sample from an on-site well. It is assumed that the entire nitrogen load in the seepage effluent from the drainfield converts to nitrate and enters the ground water. The dilution equation, mixing the discharge with the underlying ground water and precipitation recharge gives a result for the nitrate concentration at the end of the mixing zone of 4.23 mg/L (Regensburger, 2000, attachment 1).

Phosphorous:

From a conventional system it is estimated that a single family home will contribute 6.44 lbs of phosphorous per year. The completed development was estimated to be equivalent to 68 homes. The Department has analyzed the phosphorous breakthrough rate to Hebgen Lake at 50.4 years. A breakthrough rate of greater than 50 years is considered nonsignificant degradation (ARM 17.30.715(1)(e)).