Montana Department of Environmental Quality

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

# PERMIT FACT SHEET

## MONTANA GROUND WATER POLLUTION CONTROL SYSTEM (MGWPCS)

| | |
|---|---|
| Permittee: | Turah Meadows County Sewer and Water District |
| Permit Number: | MTX000146 |
| Permit Type: | Domestic wastewater |
| Application Type: | Renewal |
| Facility Name: | Turah Meadows Subdivision |
| Facility Location: | Missoula County<br>Latitude: 46.83494° Longitude: -113.83313°<br>Section 35, Township 13 North, Range 18 West |
| Facility Address: | 11505 Cattail Way |
| Facility Contact: | John Fitzpatrick, President |
| Treatment Type: | Level 2 |
| Receiving Water: | Class I Ground Water |
| Number of Outfalls: | 1 |
| Outfall / Type: | 001 / Pressurized Drainfield |
| Effluent Type: | Domestic strength wastewater |
| Mixing Zone: | Standard |
| Effluent Limit Type: | WQBEL |
| Effluent Limits: | Total nitrogen: 4.15 lbs/day |
| Flow Rate: | Design maximum: 21,000 gpd<br>Design average: 9,725 gpd |
| Effluent sampling: | Samples representative of effluent quality must be collected from the drainfield dose tank immediately prior to the drainfield dosing pumps |
| Ground water sampling: | MW-1A: quarterly, MW-2A: semi-annually (every six months) |
| Fact Sheet Date: | July 2018 |
| Prepared By: | Darryl Barton |

# 1.0 PERMIT INFORMATION

DEQ issues MGWPCS permits for a period of five years. The permit may be reissued at the end of the period, subject to reevaluation of the receiving water quality and permit limitations. This fact sheet provides the basis for DEQ's decision to renew a MGWPCS wastewater discharge permit to TURAH MEADOWS COUNTY SEWER AND WATER DISTRICT for the TURAH MEADOWS SUBDIVISION wastewater treatment system.

## 1.1 APPLICATION

DEQ received an application for renewal of the permit on May 23, 2016. Renewal fees accompanied the application. DEQ reviewed the submittal and issued a completeness letter on June 15, 2016.

## 1.2 PERMIT HISTORY

The most recent permit was issued on March 1, 2012. Interim effluent limit for Total Nitrogen (TN) (26 mg/L) went into effect for two years followed by final effluent limits (24 mg/L, March 1, 2014). Total phosphorus limit is 693.5 pounds per year (lbs/year). Effluent monitoring and reporting requirements were typical for a system of this type except for the requirement of monthly sampling. Special conditions included the construction of a second monitoring well for measuring ambient upgradient water quality. Monitoring well (MW-2A) was constructed on September 10, 2014 (within the compliance schedule).

## 1.3 CHANGES TO THIS PERMIT

TN effluent limit will be measured in a load limit of 4.15 pounds per day based on calculations using ambient water quality data from MW-2A. Effluent limits are discussed in greater detail in **Section 5**. Effluent parameters currently measured monthly will be monitored quarterly as outlined in **Table 10.** The monthly effluent sample frequency in the previous permit was established to coincide with the nutrient reduction program associated with the Clark Fork River. Biochemical Oxygen Demand ($BOD_5$) and Total Suspended Solids (TSS) will not be effluent monitoring requirements.

# 2.0 FACILITY INFORMATION

## 2.1 LOCATION

The TURAH MEADOWS SUBDIVISION is located about eight miles southeast of Missoula off Interstate-90, at the corner of the intersection of Rustic Road and the Interstate-90 underpass for the Turah exit **(Figure 1)**.

The subdivision encompasses approximately 46 acres and consists of 70 lots with 67 single-family residential lots and three commercial lots. Currently, 22 of the residential lots and none of the commercial lots are developed. The wastewater treatment system is located just southeast of the subdivision **(Figure 2)**.

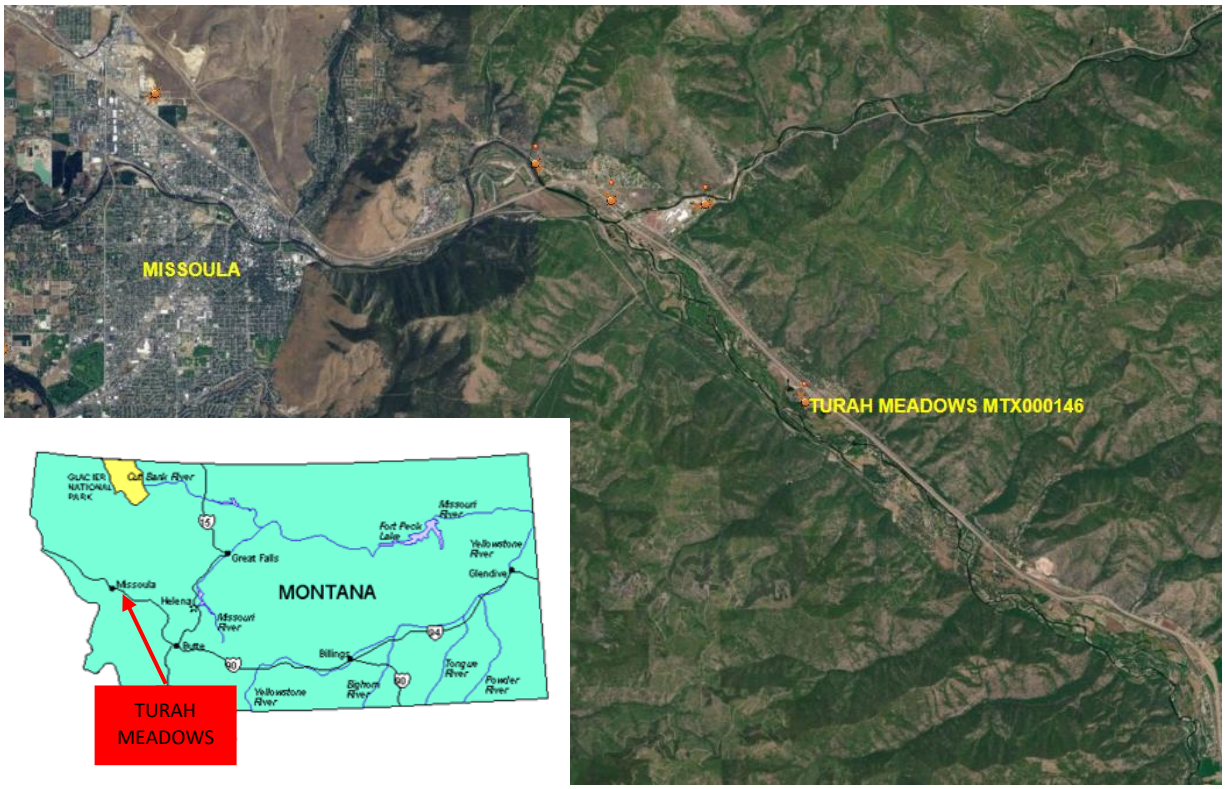



**Figure 1. Location of the TURAH MEADOWS SUBDIVISION**


**Figure 2. Location of the TURAH MEADOWS SUBDIVISION wastewater system**

## 2.2 OPERATIONS

System operations are summarized below in **Table 1**.

| **Table 1. Collection, Treatment, and Disposal System Summary** | |
|---|---|
| **Inflows** | |
| Contributing Sources of Wastewater: Domestic In-Nature<br>Standard Industrial Code(s) (SIC) of contributing sources: 4952<br>The number of connected residences: 22 single-family residences / 67 maximum design<br>The number of connected business: 0 commercial connections / 3 maximum design | |
| **Treatment** | |
| Septic tanks for primary treatment followed by advanced treatment in a recirculating sand filter (RSF). | |
| Treatment Level: Level 2 | |
| Location: 46.83494° Latitude and -113.83313 ° Longitude | |
| **Disposal System** | |
| Disposal Structure: Pressure-dosed subsurface drainfield (Outfall 001) | |
| Method of Disposal: Infiltration to ground water | |
| Location: 46.83471° Latitude and -113.83250° Longitude | |
| Average Daily Design Flow (gpd): 9,725 | Daily Maximum Design Flow (gpd): 21,000 |
| Effluent Sampling Location: EFF-001: Outfall 001 - Dose Tank | |
| Flow Monitoring Equipment: FM-001: Master Meter – Dirlog 2 – Flow meter located between dose tank and the pressure dosed drainfield. | |

Gravity-flow sewer collection lines move raw sewage from the individual lots to the wastewater treatment system. Primary wastewater treatment begins with two series of two septic tanks (15,000-gallon followed by 10,000-gallon capacity). Septic tanks provide anaerobic treatment as well as removing floatable and settleable solids. Gravity-flow sewer lines move the wastewater from the final (in the series) community septic tanks to a 35,000-gallon recirculation tank. Level 2 treatment is an advanced wastewater treatment, which occurs in four recirculating sand filters (RSF) covering approximately 6,000 ft². 80% of the treated wastewater goes back to the recirculation tank. 20% of the treated wastewater is routed to an 8,000-gallon capacity dose tank. Effluent samples are collected from the dose tank (the last point of control). Effluent is pressure-dosed from the dose tank to the subsurface drainfield following metering for flow.

The daily maximum design capacity flow for the wastewater treatment system is 21,000 gallons per day (gpd). Average daily design flow is 9,725 gpd.

Monitoring and sampling requirements are further discussed in **Section 6**.

**Figure 3** is a line drawing of the collection, treatment, and disposal process.

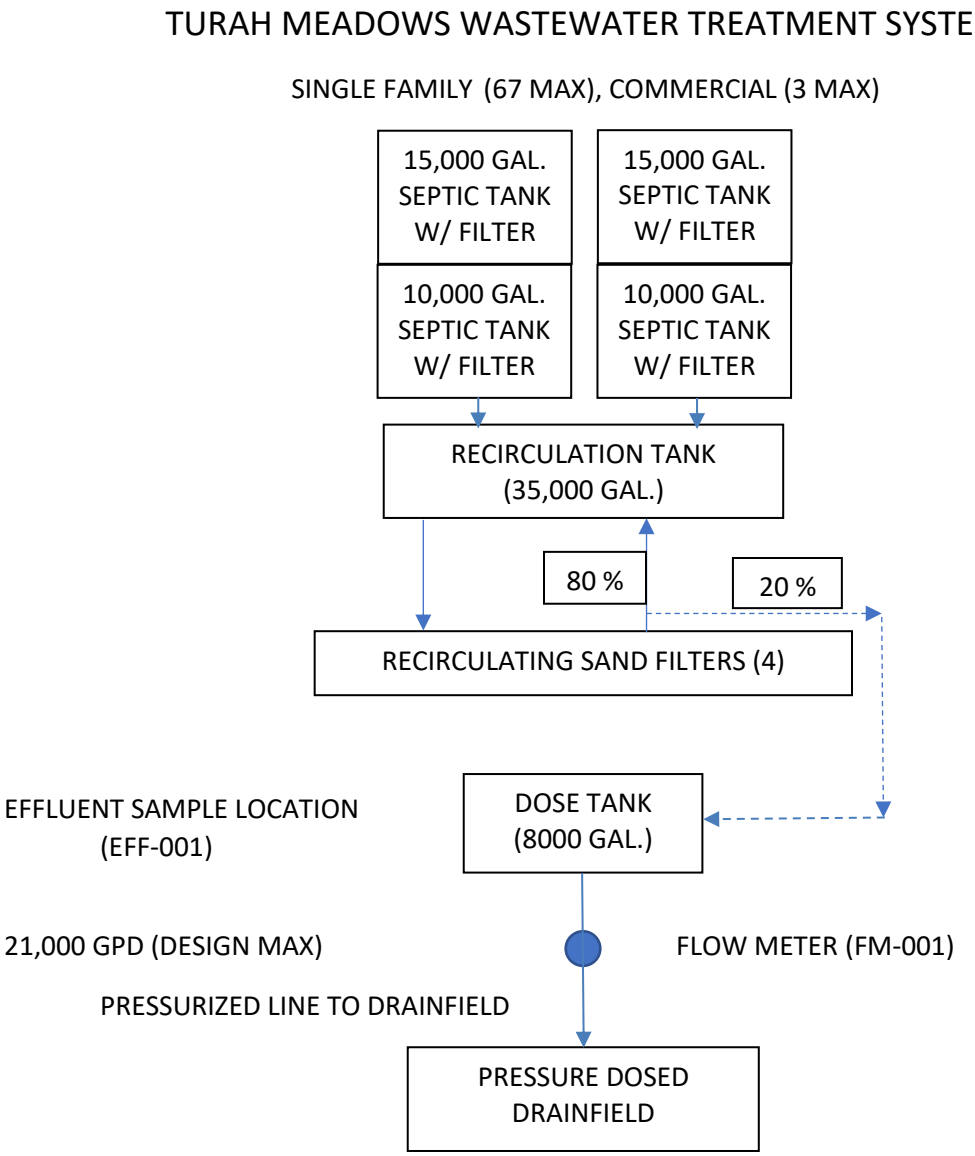



**Figure 3. Turah Meadows Wastewater System Line Drawing.**

## Compliance History

The Department has conducted three compliance evaluation inspections at the site. The most recent inspection was 4/06/2017. During the inspection there were no findings of deficiency in the physical wastewater system. The following findings were identified by the inspector in review of records:

- Facility has had four nitrogen exceedances (2012 – 2016)
- Facility has had seven late DMR submittals (2012 – 2016)

In review of DMR information, there have been violations for Nitrogen daily effluent concentration in 12.5% of the samples (9 out of 72, May 2012 – May 2018). Average daily effluent concentration for the past six years is 19.3 mg/L (26 mg/L limit 2012, 24 mg/L limit 2014). Average daily load for Nitrogen is 0.5 pounds per day.

## 2.3 EFFLUENT CHARACTERISTICS

DEQ requires a permit applicant to disclose the quality of the effluent so that DEQ may evaluate the potential for pollution of state water. During the previous permit cycle, the facility sampled and reported effluent quality criteria to DEQ in the form of discharge monitoring reports (DMRs). These data are summarized below in **Table 2**. Most of the concentrations are reported in units of milligrams per liter (mg/L), which is equivalent to one part per million. Flow rate is reported in gallons per day (gpd). Phosphorus limit for previous permit was 693.5 pounds per year (lbs/yr), so pounds per year are reflected in the table for the past five years.

**Effluent Quality Data – Outfall 001 - Reported DMR values**

| Parameter[1] | Units | Reported Minimum Value | Reported Average Value | Reported Maximum[2] Value | # of Samples | 2012 Permit Limit |
|---|---|---|---|---|---|---|
| Biochemical Oxygen Demand ($BOD_5$) | mg/L | 46.00 | 106.57 | 190.00 | 28 | |
| Chloride (as Cl) | mg/L | 249.00 | 530.71 | 780.00 | 72 | |
| Flow rate, Discharge | gpd | 2248.00 | 5219.78 | 13709.00 | 72 | 21000 |
| Nitrogen, Nitrate + Nitrite (as N) | mg/L | 0.56 | 7.70 | 15.30 | 72 | |
| Nitrogen, Total Ammonia (as N) | mg/L | 2.76 | 8.42 | 30.30 | 72 | |
| Nitrogen, Total Kjeldahl (as N ) | mg/L | 4.90 | 12.24 | 45.20 | 72 | |
| Nitrogen, Total (as N) | mg/L | 10.90 | 19.30 | 45.80 | 72 | 26 / 24 (2014) |
| | lbs/day | 0.23 | 0.50 | 1.30 | 72 | |
| Phosphorus, Total (as P)[3] | lbs/yr | 43.73 | 56.00 | 80.48 | 5 | 693.5 |
| | mg/L | 4.88 | 6.75 | 11.80 | 16 | |
| Total Suspended Solids (TSS) | mg/L | 10.00 | 71.40 | 530.00 | 63 | |

Footnotes:

DMR = Self-Reported Discharge Monitoring Reports

Period of Record: June 2011 through June 2018.

(1) Conventional and nonconventional pollutants only, table does not include all possible toxics.

(2) Maximum value recorded of all quarterly reported Daily Maximum Values.

(3) Phosphorus values (mg/L) calculated from past 16 monthly averages

## 2.4 GEOLOGY

Soils in the location of the subsurface drainfield are classified in the Grantdale and Moeise series which consist of deep, well-drained very coarse gravel in a loamy sand matrix. These soils are sandy and extremely gravelly with loam in the upper portions and sand and gravel in the lower portions (NRCS). Bedrock in the area consists of the Missoula group of the Belt Supergroup (late Precambrian), which is composed of red, maroon and purple argillite, sandy-quartzitic argillite, and quartzite (Lewis, 1998). Sedimentary deposits are composed of alluvium, fan and terrace gravel, and gravel deposits (NRCS).

## 2.5 HYDROGEOLOGY

Shallow ground water is found in the alluvial-terrace deposits. Ground water averages 17-feet and ranges from 8-feet to 27-feet below the top of the well casing (TOC) at MW-1A (DMR 2012 – 2018), the hydraulically down gradient monitoring well which was drilled to a total depth of 22.5 feet and screened from 12.5 to 22.5 feet below the TOC. Although the well is drilled into the bedrock (purple, green, white Missoula rock – well log, 2005), the well completion is primarily in sand, poorly sorted gravel and fine brown sand, above the bedrock.

The hydraulic conductivity (K) of the shallow alluvial-fluvial aquifer will remain at 289 ft/day. This was established in the original permit from data collected during an eight-hour aquifer pump test conducted in May 1997. The pumping well and the observation well were completed in the unconfined sand and gravel aquifer. Calculations were based on the Thiem equation that uses the steady state drawdown values at two different distances from the center of pumping (i.e., radius of the well and the distance to the observation well).

In May 1997, the shallow ground water flow direction and the hydraulic gradient (I) was mapped using Well#1 (east test well), the trailer house well, and the pond (fence post gauge). The direction of shallow ground water flow was northwest at a hydraulic gradient of 0.0035 ft/ft. In January of 2003, the measurements were updated, and the direction of flow was more to the north-northwest and the hydraulic gradient was 0.0034 ft/ft. The permit renewal will use the most recent hydraulic gradient of 0.0034 ft/ft, with the direction of shallow ground water flow to the N40°W. the nearest hydraulically downgradient surface water to Outfall 001 is the Clark Fork River (of the Columbia River drainage basin), approximately 4,000 feet to the west.

Important hydrogeologic characteristics are summarized below in **Table 3**.

| **Table 3: Hydrogeologic Summary** | |
|---|---|
| Average depth to ground water | 17 feet |
| General ground water flow direction | N40°W |
| Hydraulic conductivity | 289 feet per day |
| Hydraulic gradient | 0.0034 feet/feet |
| Nearest downgradient surface water | Clark Fork River (4,000 feet) |

## 2.6 GROUND WATER MONITORING WELLS

There are two monitoring wells associated with this permit: MW-1A and MW-2A. Both of these wells are plotted on **Figure 2**. Monitoring well construction details are provided below in **Table 4**. MW-1A is 500-feet downgradient of discharge at the Outfall; it is used to measure groundwater quality post mixing zone. MW-2A is upgradient of the Outfall and used to measure ambient water quality. MW-2A was constructed since the previous permit on September 10, 2014. Driller's logs for monitoring wells are attached as **Appendix B**.

**Table 4. Monitoring Well Summary**

| | |
|---|---|
| **Monitoring Well MW-1A** | |
| MBMG GWIC ID: | 218818 |
| Location: | Latitude: 46.83589° Longitude: -113.83415° |
| Rationale: | Post mixing zone water quality |
| Notes: | 500-feet downgradient of the drainfield (northwest) |
| **Monitoring Well MW-2A** | |
| MBMG GWIC ID: | 280551 |
| Location: | Latitude: 46.83428° Longitude: -113.83252° |
| Rationale: | Upgradient / Ambient receiving water quality |
| Notes: | Well was constructed on September 10, 2014 per permit conditions |

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.

## 2.7 GROUND WATER QUALITY CHARACTERISTICS

Water sampling results from Monitoring Wells MW-1A and MW-2A are provided below in **Table 5**.

**Table 5 - Ground Water Monitoring Results - per DMR**

| Monitor Source[(1)] | Representation | Parameter | Units | Reported Minimum Value | Reported Average Value | Reported Maximum[(2)] Value | # of Samples |
|---|---|---|---|---|---|---|---|
| MW-1A | Post Mixing Zone Ground Water Quality<br><br>Shallow ground water, 500- feet downgradient from Outfall 001 | Chloride (as Cl) | mg/L | 4 | 8 | 13 | 24 |
| | | Specific Conductivity (@ 25°C) | µS/cm | 289 | 328.54 | 376 | 24 |
| | | *Escherichia coli* Bacteria | CFU/100 ml | <1 | <1 | <1 | 24 |
| | | Nitrogen, Nitrate + Nitrite (as N) | mg/L | 0.12 | 0.50 | 0.88 | 24 |
| | | Nitrogen, Total Kjeldahl (as N ) | mg/L | ND | 0.23 | 0.50 | 24 |
| | | Static Water Level (SWL) | ft-bgs | 8.00 | 17.10 | 27.00 | 24 |
| | | | | | | | |
| MW-2A | Ambient Ground Water Quality<br><br>Shallow ground water, 200-feet upgradient from Outfall 001 | Chloride (as Cl) | mg/L | 4 | 4.83 | 6 | 6 |
| | | Specific Conductivity (@ 25°C) | µS/cm | 266 | 314 | 376 | 6 |
| | | *Escherichia coli* Bacteria | CFU/100 ml | <1 | <1 | <1 | 6 |
| | | Nitrogen, Nitrate + Nitrite (as N) | mg/L | 0.02 | 0.102 | 0.22 | 6 |
| | | Nitrogen, Total Kjeldahl (as N ) | mg/L | ND | 0.08 | 0.50 | 6 |
| | | Static Water Level (SWL) | ft-bgs | 7.30 | 13.48 | 25.00 | 6 |
| | | | | | | | |

Footnotes:
CFU = Colony Forming Units
DMR = Self-Reported Discharge Monitoring Reports
ND = Not Detected
Period of Record: 09/30/2012 through 06/30/2018.
(1) Refer to Section 2 of the Fact Sheet for the location of the monitoring wells
(2) Maximum value recorded of all monthly or quarterly reported values.

Ambient Nitrogen, nitrate + nitrite was calculated using DMR data from December 2015 to June 2018. Six samples were reported with an average of 0.102 mg/L.

# 3.0 WATER QUALITY STANDARDS AND NONDEGRADATION

Ground water is a water of the state. The State of Montana uses several water quality measures to protect, sustain, and improve the quality of state waters. These water quality limitations provide the basis for effluent limits that DEQ applies to discharge permits (**Section 5**). DEQ protects all designated uses of state water by basing effluent limits on the most restrictive water quality limitations, intended to protect the most sensitive uses.

## 3.1 BENEFICIAL USES

With a specific conductivity of 314 µS/cm (**Table 5** above), the receiving water is Class I ground water and therefore a high-quality water of the State. Class I ground waters must be maintained suitable for the following uses with little or no treatment:

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

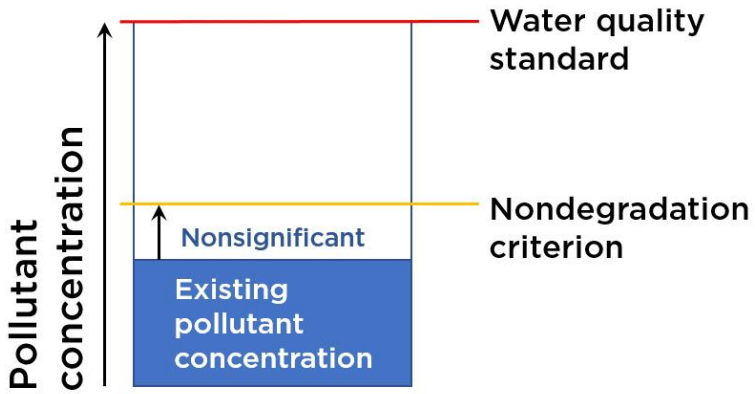
DEQ protects all the assigned beneficial uses by protecting the most sensitive. Drinking water is the most sensitive use of this receiving water.

## 3.2 HUMAN HEALTH STANDARDS

DEQ's ground water standard for nitrate is 10.0 mg/L, as is the standard for nitrate + nitrite (as nitrogen). Class I ground water must be maintained suitable for use as a drinking water supply with little or no treatment, and therefore must meet the corresponding human health standard of 10.0 mg/L total nitrogen. These water quality standards may not be exceeded outside a designated mixing zone (**Section 4**).

## 3.3 NONDEGRADATION

Montana's nondegradation policy is intended to preserve high-quality state waters. Any water whose existing condition is better than the water quality standards must be maintained in that high quality. Nondegradation policy states that certain types of common activities cause nonsignificant changes in water quality, and provides criteria for determining whether changes in water quality are significant.



Nonsignificant changes do not require further nondegradation review. Therefore, DEQ must determine whether the proposed discharge will result in significant changes in water quality.

## 3.4 NONSIGNIFICANCE

When developing the prior permit (2012), DEQ determined that discharges in compliance with this permit result in nonsignificant changes in water quality. This discharge has not increased since this determination, and therefore DEQ did not perform a new significance determination for this permit renewal. DEQ determined that the discharge continues to meet ground water nonsignificance/nondegradation criteria (described below) at the end of the mixing zone (**Section 4**). DEQ used these criteria and updated ground water quality data to establish effluent limits (discussed below in **Section 5**).

### 3.4.1 Ground Water Nonsignificance Criteria

For this discharge to ground water, the following nonsignificance criteria are relevant:

#### *Nitrogen*

Under Montana statute, ground water total nitrogen at or below 7.5 mg/L at the downgradient end of the mixing zone (see **Section 4**) is a nonsignificant change in water quality, so long as the discharge does not cause degradation of surface water. Using the nonsignificance criterion of 7.5 mg/L, DEQ established effluent limits that cause the discharge to comply with ground water nonsignificance/nondegradation criteria at the end of the mixing zone. This is discussed in detail in **Section 5.1**.

#### *Phosphorus*

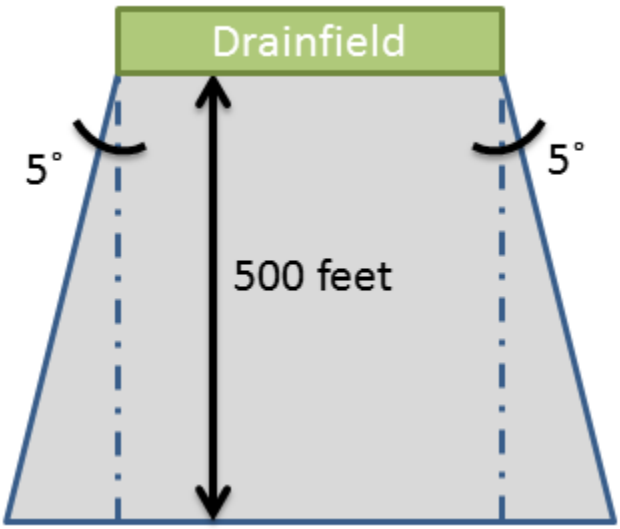
A total phosphorus surface water breakthrough time of greater than 50 years is a nonsignificant change in water quality. The phosphorus criterion requires an analysis to determine a breakthrough time. Breakthrough occurs when the subsurface soils lose their capability to adsorb any more phosphorus, and it reaches surface water.

A phosphorus breakthrough analysis conducted by DEQ in 2004 estimated the phosphorus breakthrough to occur in 57 years. Phosphorus breakthrough time of greater than 50 years is considered nonsignificant. As this discharge of phosphorus is nonsignificant, this permit does not include a phosphorus limit.

# 4.0 MIXING ZONE

A mixing zone is a specifically defined area of the receiving water where water quality standards may be exceeded. DEQ evaluates the suitability according to criteria established in the Administrative Rules of Montana. The mixing zone is then defined in the permit. The applicant requested a standard mixing zone for this discharge, consistent with previous permit cycles.

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 of 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 ground water table.




The volume of ground water ($Q_{GW}$) available to mix with the effluent is calculated using Darcy's Equation: $Q_{GW} = KIA$

Where:
$Q_{GW}$ = ground water flow volume (feet$^3$/day)
K = hydraulic conductivity (feet/day)
I = hydraulic gradient (feet/feet)
A = cross-sectional area (feet$^2$) at the downgradient boundary of the mixing zone.

**Table 6** summarizes the variables used in Darcy's equation and the resulting volume of ground water available to mix at Outfall 001. These values are drawn from the previous fact sheet and monitoring well data.

**Table 6: Hydrogeologic and Mixing Zone Information - Outfall 001**

| Parameter | Units | Value |
|---|---|---|
| Mixing Zone Type | - | Standard |
| Authorized Parameters | - | Total Nitrogen |
| Length of Mixing Zone | feet | 500 |
| Thickness of Mixing Zone | feet | 15 |
| Outfall Width, Perpendicular to Ground Water Flow Direction | feet | 329 |
| Width of Mixing Zone at Down Gradient Boundary | feet | 416.5 |
| Cross Sectional Area of Mixing Zone (A) | $ft^2$ | 6247.5 |
| Hydraulic Conductivity (K) | feet/day | 289 |
| Hydraulic Gradient (I) | ft/ft | 0.0034 |
| Volume of Ground Water Available for Mixing ($Q_{gw}$) | $ft^3$/day | 6,139 |

To determine whether a mixing zone is allowable, DEQ calculates a predicted concentration at the downgradient end of the mixing zone. This mixing calculation follows the following procedure:

- Volume of ground water times the concentration of the parameter = existing load;
- Volume of discharge times the concentration of the parameter = waste load; and
- (Existing load + waste load) / total volume = predicted concentration.

Because the predicted concentration must satisfy the most stringent nonsignificance criterion (**Section 3**), DEQ can calculate water quality based effluent limits (WQBELs) by rearranging the equation and solving for the effluent concentration (**Section 5**).

# 5.0 PERMIT CONDITIONS

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.

Montana's numeric water quality standards are published in Circular DEQ-7. Water quality criteria applicable to this permit are summarized below in **Table 7**. The permit establishes effluent limits that will meet water quality standards and nondegradation criteria, thereby protecting beneficial uses and existing high-quality waters. The most restrictive criteria in **Table 7** provide the basis for the effluent limits.

**Table 7. Applicable Ground Water Quality Criteria**

| Parameter | Human Health Standard | Beneficial Use Support | Nondegradation Criteria |
|---|---|---|---|
| Nitrate plus nitrite (as Nitrogen[N]) | 10 mg/L | - | - |
| Total Nitrogen | - | 10 mg/L | **7.5 mg/L** |
| Total Phosphorus | - | - | **>50-year breakthrough** |

This discharge permit includes numeric WQBELs that restrict the strength and volume of the discharge. The ground water nonsignificance criteria (**Section 3.4.1**) provide the basis for the limits. DEQ calculates WQBELs by rearranging the mixing zone equation (**Section 4**) and solving for the effluent concentration that satisfies the water quality criteria. 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 cumulative impacts to the receiving water.

DEQ calculated the effluent limits using the same method as for the previous permit. DEQ uses updated ambient ground water quality data to re-evaluate the receiving water quality and the assimilative capacity for dilution.

## 5.1 TOTAL NITROGEN EFFLUENT LIMIT

The nonsignificance criterion of 7.5 mg/L is the most restrictive of the water quality criteria applicable to this permit; therefore, it is the water quality target for this effluent limit. DEQ established the final WQBEL for this discharge by back-calculating the effluent concentration that results in 7.5 mg/L at the end of the mixing zone, given the available dilution. Available dilution is determined by recent ground water quality sampling of the receiving water. Ambient total nitrogen averaged 0.102 mg/L (**Section 2.7**). DEQ calculates an effluent limit that protects receiving water quality and beneficial uses according to the following equation:

$$\underline{\text{Equation 1:}}\ C_{lmt} = C_{std} + D(C_{std} - C_{gw})$$

Where:

$C_{lmt}$ = effluent limitation concentration
$C_{std}$ = limiting water quality criterion = 7.5 mg/L
$C_{gw}$ = ambient receiving ground water concentration = 0.102 mg/L
D = dilution ratio ($Q_{gw} / Q_{eff}$) = (6,139 / 2,807) = 2.187

$Q_{gw}$ =ground water flux at the end of the mixing zone = 6,139 $ft^3$/day
$Q_{eff}$ = average maximum daily discharge = 21,000 gpd = 2,807 $ft^3$/day

Using the values provided above in **Table 6**, the result for $C_{lmt}$ is 23.68 mg/L. This is the final WQBEL expressed as a concentration. Load limits are more appropriate for discharges to ground water since the long-term loading is the greater concern in absence of aquatic life considerations. Additionally, load limits inherently control both the strength and volume of the discharge. A discharge of 21,000 gallons per day containing 23.68 mg/L total nitrogen is equivalent to **4.15 pounds per day**. The limit calculations are provided in detail in **Appendix A**.

## 5.2 TOTAL PHOSPHORUS EFFLUENT LIMIT

DEQ previously determined (2004, 2012) that phosphorous discharged to ground water would reach the surface water the Clark Fork River in 57 years. Phosphorus breakthrough time of greater than 50 years is considered nonsignificant. As this discharge of phosphorus is nonsignificant, this permit does not include a phosphorus limit.

Based on the information and analyses presented above, DEQ proposes the following numerical effluent limitations in **Table 8** below.

**Table 8. Final Numeric Effluent Limits – Outfall 001.**

| Parameter | Units | Daily Maximum(1) |
|---|---|---|
| Total Nitrogen – Load(2) (3) | lbs/day | 4.15 |

Footnotes:
(1) See definitions, Part I.A of the permit
(2) Load calculation: lb/d = [(mg/L) x flow (gpd) x ($8.34 \times 10^{-6}$)]
(3) Detailed Load calculations are found in Appendix A

# 6.0 MONITORING AND REPORTING REQUIREMENTS

DEQ requires effluent and ground water monitoring to assure compliance with the effluent limitations and therefore water quality standards. Effluent monitoring and ground water monitoring is required as a condition of this permit. Effluent monitoring requirements are detailed in **Table 9**. Groundwater monitoring requirements from monitoring wells are detailed in **Table 10**. All monitoring and sampling required by this permit must be representative; therefore, the permit identifies specific monitoring locations. Monitoring requirements and rationale are summarized below.

## 6.1 EFFLUENT MONITORING

This permit includes numeric effluent limitations with specific magnitudes and durations to ensure the discharge will not cause or contribute to an exceedance of an applicable water quality standard (see **Section 3**). Accordingly, the permittee is required to monitor and report at a specified frequency to demonstrate compliance with these limitations.

Effluent samples and discharge flow measurements must be representative of the nature and volume of the effluent. The effluent sample location (EFF-001) is located at the dose tank as shown in **Figure 3**. The permittee is

required to install, maintain and report flow measurements using a flow-measuring device capable of measurements that are within 10 percent of the actual flow. The flow meter is located between the dose tank and the drainfield (**Figure 3**).

Effluent monitoring and reporting requirements are summarized in **Table 9** below. All analytical methods must be in accordance with the Code of Federal Regulations, 40 CFR Part 136 for each monitored parameter.

**Table 9: Effluent Monitoring and Reporting Requirements – Outfall 001**

| Parameter | Monitoring Location | Units | Sample Type[1][2] | Minimum Sampling Frequency | Reporting Requirements[1][3] | Report Frequency | Rationale |
|---|---|---|---|---|---|---|---|
| Flow Rate[4][5] | Flow Meter | gpd | Continuous | Continuous | Daily Max and Quarterly Average | Quarterly | Permit Compliance/ Effluent Characterization |
| Nitrate + Nitrite (as N) | Dose Tank | mg/L | Grab | Quarterly | Daily Max and Quarterly Average | Quarterly | Permit Compliance/ Proper O&M |
| Total Ammonia (as N) | Dose Tank | mg/L | Grab | Quarterly | Daily Max and Quarterly Average | Quarterly | Proper O&M |
| Total Kjeldahl Nitrogen (as N) | Dose Tank | mg/L | Grab | Quarterly | Daily Max and Quarterly Average | Quarterly | Permit Compliance |
| Total Nitrogen (as N)[5][6] | Dose Tank | mg/L | Calculate | Quarterly | Daily Max and Quarterly Average | Quarterly | Permit Compliance |
| | | lbs/day[7] | | | | | |
| Total Phosphorus (as P)[5] | Dose Tank | mg/L | Grab | Quarterly | Daily Max and Quarterly Average | Quarterly | Effluent Characterization |

Footnotes:

NA = Not Applicable

(1) See definitions in Part IV of the permit.

(2) Grab sample will represent concentration for a 24-hour period.

(3) Daily Maximum: Report highest measured daily value for the reporting period on Discharge Monitoring Report (DMR) form.

(4) If no discharge occurs during the reporting period, "No Discharge" shall be recorded on the DMR report form.

(5) Requires recording device or totalizing meter, must record daily effluent volume.

(6) Total Nitrogen is the sum of the Nitrate + Nitrite and Total Kjeldahl Nitrogen parameters.

(7) Quarterly Average Load calculation: lbs/day = the average of all calculated individual daily average loads (lbs/day) recorded during the reporting period.

## 6.2 GROUND WATER MONITORING

A condition of this permit requires ground water monitoring to provide long term ambient and downgradient characterization of the aquifer. Ground water monitoring is required at monitoring wells MW-1A and MW-2A. Data collected via ground water monitoring will be used for mixing zone evaluation and aquifer characterization

in future permit renewals. Ground water monitoring and reporting requirements are summarized **Table 10**. Sampling and reporting requirements shall continue through the duration of the permit.

Ground water monitoring was established in the previous permit (DEQ 2012).

All analytical methods must be in accordance with the Code of Federal Regulations, 40 CFR Part 136 for each monitored parameter.

**Table 10. Ground Water Monitoring and Reporting Requirements**

| Parameter, units[1] | Location[2] | Minimum Sample Frequency | Reporting Frequency | Sample Type[3] | Reporting Requirements[6][7][8] |
|---|---|---|---|---|---|
| Static Water Level (SWL)[4], feet | MW-1A | Quarterly | Quarterly | Instantaneous | Quarterly Average |
| | MW-2A | 1/Six Months | 1/Six Months | | Semi annual Average |
| Specific Conductivity, µS/cm @ 25°C | MW-1A | Quarterly | Quarterly | Grab or Instantaneous | Quarterly Average |
| | MW-2A | 1/Six Months | 1/Six Months | | Semi annual Average |
| Nitrate + Nitrite (as N), mg/L | MW-1A | Quarterly | Quarterly | Grab | Daily Maximum Quarterly Avg. |
| | MW-2A | 1/Six Months | 1/Six Months | | Semi annual Average |
| Total Kjeldahl Nitrogen (TKN), mg/L | MW-1A | Quarterly | Quarterly | Grab | Daily Maximum Quarterly Avg. |
| | MW-2A | 1/Six Months | 1/Six Months | | Semi annual Average |
| Chloride, mg/L | MW-1A | Quarterly | Quarterly | Grab | Quarterly Average |
| | MW-2A | 1/Six Months | 1/Six Months | | Semi annual Average |
| *Escherichia Coli*, <1 CFU[5]/100mL | MW-1A | Quarterly | Quarterly | Grab | Daily Maximum Quarterly Avg. |
| | MW-2A | 1/Six Months | 1/Six Months | | Semi annual Average |

Footnotes:

1. Each monitor well to be individually sampled and analyzed for each respective parameter listed
2. Refer to Figure 2 and Table 4 of the Fact Sheet for the existing location of the monitoring wells
3. See definitions provided in the permit
4. Measuring point (point of reference) for SWL measurements shall be from top of casing within 1/100$^{th}$ foot.
5. Colony forming units
6. Daily Maximum: Report highest measured daily value for the reporting period on Discharge Monitoring Report
7. Submittal of DMRs will be required, regardless of the installation status of each individual monitoring well. If the monitoring well(s) is not installed for an individual monitoring period, the following shall be stated upon each applicable DMR: "monitoring well has not been installed".
8. The geometric mean must be reported if more than one sample is taken during a reporting period.

# 7.0 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 November 9, 2018.
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) 444-3080 or email DEQWPBPublicComments@mt.gov. All inquiries will need to reference the permit number (MTX000146), 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.

# 8.0 REFERENCES

40 CFR § 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants. 2017.

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.

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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, “How to Perform a Nondegradation Analysis for Subsurface Wastewater Treatment Systems (SWTS), October 2015.

Driscoll, F.G., 1986. Groundwater and Wells (2nd ed.), Johnson Filtration Systems, Inc., St. Paul, Minnesota.

Fetter, C.W., 2001. Applied Hydrogeology (4th ed.), Prentice-Hall, Upper Saddle River, New Jersey.

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NRCS, Soil Survey (Web), Lewis and Clark County, https://websoilsurvey.nrcs.usda.gov/app/, 2018.

NRCS, Soil Survey, Lewis and Clark County. 2003.

Russell Properties, L.P. (September 18, 2003), Montana Ground Water Pollution Control System Application and Supplemental Materials.

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U.S. Environmental Protection Agency, Guidance Manual for Developing Best Management Practices <http://www.epa.gov/npdes/pubs/owm0274.pdf>, 1993.

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

U.S. Environmental Protection Agency, Nitrification, 625/R-00/008, Office of Ground Water and Office of Water. 2002.

U.S. Environmental Protection Agency, *Onsite Wastewater Treatment Systems Manual*, 625/R-00/008, Office of Research and Development and Office of Water. 2002.

U.S. Geological Survey, Basic Ground Water Hydrology, http://pubs.usgs.gov/wsp/2220/report.pdf, 2016.

U.S. Geological Survey, Groundwater Basics, http://water.usgs.gov/ogw/basics.html, 2016.

# Appendix A – EFFLUENT LIMIT CALCULATIONS

Water Quality Based Effluent Limitations – Nitrogen

The system consists of a Recirculating Sand Filter (RSF) system (Class 2 method for nitrogen treatment).

To protect beneficial uses [ARM 17.30.1006(1)(b)(ii)], there shall be no increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses. Therefore, no wastes may be discharged such that the waste either alone or in combination with other wastes will violate or can reasonably be expected to violate any standard. DEQ will establish the effluent limitations for nitrogen based on the projection that the entire nitrogen load in the wastewater stream may ultimately be converted to nitrate (USEPA, 2002a).

The allowable discharge concentrations are derived from a mass-balance equation (ARM 17.30.517) which is a simple steady-state model, used to determine concentration after accounting for other sources of pollution in the receiving water and any dilution as provided by a mixing zone. The mass-balance equation (Equation 1) derived for ground water is as follows:

Equation 1:

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

Where:

| | | |
|---|---|---|
| $Q_{gw}$ | = | ground water available for mixing |
| $C_{gw}$ | = | ambient receiving ground water concentration |
| $Q_{eff}$ | = | maximum design capacity of wastewater system |
| $C_{eff}$ | = | effluent pollutant concentration |
| $Q_{comb}$ | = | combined ground water and effluent ($Q_{comb} = Q_{gw} + Q_{eff}$) |
| $C_{proj}$ | = | projected pollutant concentration (after available mixing) |

The mass-balance equation has been arranged to calculate effluent limits so that the discharge does not cause or contribute to an exceedance of the most restrictive water quality standard. This equation can be applied to any effluent and receiving water where the applicable dilution ratio is known. This equation will only be used for nitrogen which has been authorized mixing (Section III).

Equation 2:

$$C_{lmt} = C_{std} + D(C_{std} - C_{gw})$$

Where:
$C_{lmt}$ = effluent limitation concentration
$C_{std}$ = water quality standard concentration = 7.5 mg/L
$C_{gw}$ = ambient receiving ground water concentration = 0.102 mg/L
D = dilution ratio ($Q_{gw} / Q_{eff}$) = 6139 / 2807

$$C_{lmt} = 7.5 + (6139/2807)(7.5 - 0.102) = \mathbf{23.68\ mg/L}$$

A mass-balance approach is used to calculate the effluent quality of the discharge that meets the most restrictive water quality standard at the end of the mixing zone. Numeric effluent limitations are expressed as loads since this type of limitation inherently regulates both volume and strength of the effluent as prescribed by 75-5-402(3), MCA. Load limits ensure compliance with the ground water standards at the end of the mixing zone. Based on the proposed design capacity, the respective load effluent limitation is:

**4.15 lb/day**

[$(8.34*10^{-6})$* 23.68 mg/L*21,000gpd]

as based on the following equation:

Equation 3:

$$L_{lmt} = CON * C_{eff} * DC_{eff}$$

Where:

$L_{lmt}$ = effluent limitation-load

$C_{eff}$ = allowable effluent concentration

$DC_{eff}$ = design capacity of wastewater treatment system (gpd)

CON = conversion factor [$8.34*10^{-6}$]

The Final Effluent Limits are summarized in Table 8 for Outfall 001.

# APPENDIX B – MONITORING WELL SUMMARY

Monitoring Well MW-2A Turah Meadows

## MONTANA WELL LOG REPORT

Form No. 603 R2-99 Well ID # 14-401

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. **This form is to be completed by the driller and filed with DNRC within 60 days of completion of the work. Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.** Well log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena). For fields that are not applicable, enter NA. ***Optional fields are in Italics.*** Record additional information in the REMARKS section.

**1. WELL OWNER:**
Name Norm LLC c/o- Turah Meadows Sewer & Water District
Mailing address 11505 Cattail Way
Missoula, Mt 59802

**2. WELL LOCATION:** List ¼ from smallest to largest
____ ¼ ____ ¼ SE ¼ SE ¼, Section 35
Township 13 N Range 18 W County Missoula
*Lot 1 A Tract/Blk ____ Subdivision Name Turah Meadows*
*GPS Yes X No*
*Well Address Cattail Way, Common Areas Less Portion A of Lot 20A*
*Latitude N ° ' Longitude W ° '*
*Error as reported by GPS locator ( ± feet) Elav*
*Horizontal datum X NAD27 ☐ WGS84*

**3. PROPOSED USE:** Domestic ☐ Stock Irrigation
Public water supply X Other: Monitoring Well

**4. TYPE OF WORK:**
New Well X ☐ Deepen existing well Abandon existing well
Method: ☐ Cable X Rotary ☐ Other

**5. WELL CONSTRUCTION DETAILS:**
**Borehole:**
Dia. 6" in. from GL ft. to 33 ft.
Dia. ____ in. from ____ ft. to ____ ft.
Dia. ____ in. from ____ ft. to ____ ft.
**Casing:**
Steel: Wall thickness ☐ Threaded X Welded
Dia. 6" in. from +2 ft. to 4' (Final) ft.
Dia. 6" in. from +2 ft. to 33' (Removed) ft.

Plastic: Pressure Rating Flush PVC ☐ Threaded Welded
Dia. 2" in. from +2 ft. to 33' ft.

**Perforations/Slotted Pipe:**
Type of perforator used Monitor Casing – Factory Slotted (.010)
Size of perforations/slots ____ in. by ____ in.
____ no. of perforations/slots from ____ ft. to 42 ft.
____ no. of perforations/slots from 28 ft. to 33 ft.
**Screens:** Yes X No
Material ____
Dia. ____ Slot size ____ from ____ ft. to ____ ft.
Dia. ____ Slot size ____ from ____ ft. to ____ ft.
**Gravel Packed:** X Yes No
Size of gravel 10-20 Silica Sand
Gravel placed from 24 ft. to 33 ft.
**Packer:** Yes X No
Type ____ Depth(s) ____
**Grout:** Material used Bentonite Surface Seal
Depth from GL ft. to 24' ft. – (3/8" Betonite)

**6. WELL TEST DATA:**
A well test is required for all wells. *(See details on well log report cover.)*
Static water level 8'
ft. below top of casing **or**
☐ Closed-in artesian pressure ____ psi.
How was test flow measured:
bucket/stopwatch, weir, flume, flowmeter, etc ____
Yellowstone groundwater closure area only - Water Temperature ____ °F
☐AQUIFER TEST DATA FORM ATTACHED
Test - 1 hour minimum

Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing.
Time of recovery is hours/minutes since pumping stopped.
**Air test***
____ gpm with drill stem set at ____ ft. for ____ hours
Time of recovery ____ hrs/min. Recovery water level ____ ft.
**OR Bailer test***
____ gpm with ____ ft. of drawdown after ____ hours
Time of recovery ____ hrs/min. Recovery water level ____ ft.

**OR Pump test***
Depth pump set for test ____ ft.
____ gpm pump rate with ____ in. of drawdown after ____ hrs pumping
Time of recovery ____ min. Recovery water level ____ ft.

**OR Flowing Artesian***
____ gpm for ____ hours
Flow controlled by ____
**During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

**7. WELL LOG:**

| Depth, Feet | | Material: Color/rock and type/descriptor (example: blue/shale/hard, or brown gravel/water, or brown/sand/heaving) |
|---|---|---|
| From | To | |
| 0 | 1 | Soil |
| 1 | 8 | Sand Gravel & Cobbles |
| 8 | 33 | Sand & Gravel with Water |

☐ADDITIONAL SHEETS ATTACHED

**8. DATE WELL COMPLETED:** September 10, 2014

**9. *REMARKS:*** ____

**10. DRILLER/CONTRACTOR'S CERTIFICATION:**
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.
Name, firm, or corporation (print) Camp Well Drilling & Pump Service
Address 10366 Mocassin Lane - Missoula, Mt 59808
Signature ____
Date: September 10, 2014 License no. 7

MBMG ID # ____

Montana DNRC P.O. BOX 201601 HELENA, MT 59620-1601 444-6610

5/9/2016

Monitoring Well MW-1A Turah Meadows

**MONTANA W. _ LOG REPORT**

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

**Other Options**

Return to menu
Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View scanned well log (4/8/2009 8:06:40 AM)

**Site Name: TURAH MEADOWS**
**GWIC Id: 218818**

**Section 1: Well Owner(s)**
1) TURAH MEADOWS (MAIL)
PO BOX 23
MILLTOWN MT 59851 [03/24/2005]

**Section 2: Location**

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 13N | 18W | 35 | SW¼ SE¼ |

County: MISSOULA
Geocode:

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.8359 | 113.834 | NAV-GPS | NAD27 |

Ground Surface Altitude: Method: Datum: Date:

Addition: Block: Lot:

**Section 3: Proposed Use of Water**
MONITORING (1)

**Section 4: Type of Work**
Drilling Method: ROTARY
Status: NEW WELL

**Section 5: Well Completion Date**
Date well completed: Thursday, March 24, 2005

**Section 6: Well Construction Details**

Borehole dimensions

| From | To | Diameter |
|---|---|---|
| 0 | 22.5 | 6 |

Casing

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| -2 | 22.5 | 6 | 0.250 | | WELDED | STEEL |
| 2 | 22.5 | 4 | | 220.00 | THREADED | PVC |

Completion (Perf/Screen)

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 12.5 | 22.5 | 4 | | .0020 | SCREEN-CONTINUOUS-PVC |

Annular Space (Seal/Grout/Packer)

| From | To | Description | Cont. Fed? |
|---|---|---|---|
| 8.5 | 11.5 | BENTONITE | Y |
| 11.5 | 22.5 | 10-20 COLORADO SAND | |

**Section 7: Well Test Data**

Total Depth: 22.5
Static Water Level: 19.05
Water Temperature:

**Air Test ***

7 gpm with drill stem set at 22 feet for _ hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

**Section 8: Remarks**

**Section 9: Well Log**
**Geologic Source**
400BELT - BELT SUPERGROUP

| From | To | Description |
|---|---|---|
| 0 | 3 | FILL (MIXED TOPSOIL AND GRAVEL) |
| 3 | 13 | SAND AND ANGULAR POORLY SORTED GRAVEL |
| 13 | 14.5 | FINE BROWN SAND |
| 14.5 | 22.5 | PURPLE, GREEN, WHITE MISSOULA ROCK |

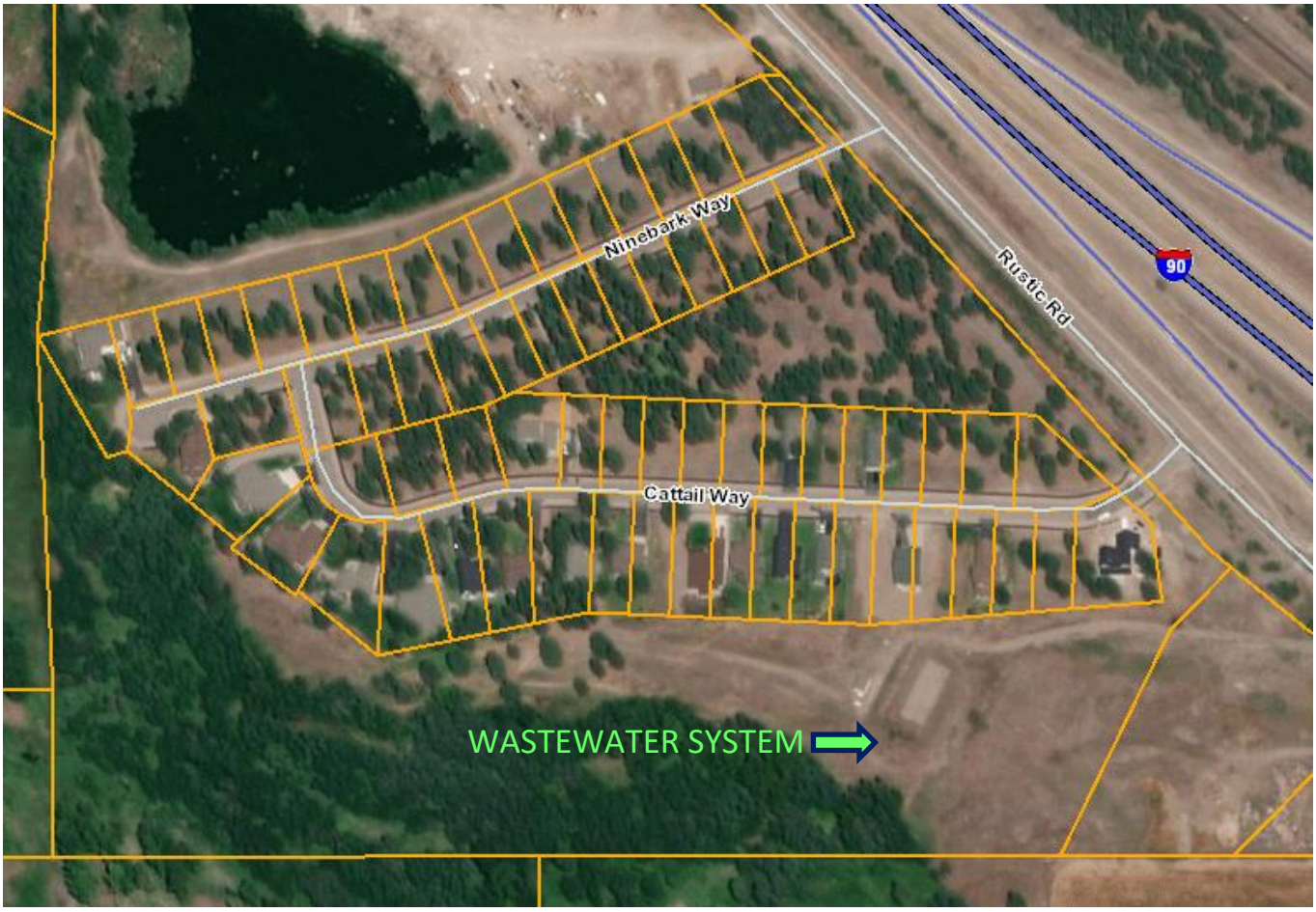
**Driller Certification**
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: EAGLE DRILLING AND PUMP SERVICE
License No: WWC-572
Date Completed: 3/24/2005

# APPENDIX C – TURAH MEADOWS CONTACTS (2018)

**Home Owners Association (HOA)**
John Fitzpatrick, President
11505 Cattail Way
Missoula, MT 59802
(406)240-7781
Email: xxxxx@gmail.com

**Wastewater Operator**
Derek Dennehy
Territorial Landworks, Inc.
1817 South Avenue, Suite A
PO Box 3851
Missoula, MT 59806
(406)721-0142
Email: derekd@territorial.com




**Turah Meadows Lot Layout** Source: Montana Cadastral 2018, http://svc.mt.gov/msl/mtcadastral/