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:	Lakeside County Water & Sewer District
Permit Number:	MTX000307
Permit Type:	Domestic wastewater
Application Type:	New
Facility Name:	LCWSD Rapid Infiltration System
Facility Location:	T 27N, R 21W, S 11N Flathead County Latitude: 48.1127610° Longitude: -114.225111°
Facility Address:	Wiley Dike Rd, Kalispell, MT 59901
Facility Contact:	Rodney Olson, General Manager
Treatment Type:	Advanced
Receiving Water:	Class I Ground Water
Number of Outfalls:	One (for fee purposes only)
Outfall / Type:	001 / Rapid infiltration basin #1 002 / Rapid infiltration basin #2 003 / Rapid infiltration basin #3
Effluent Type:	Domestic strength wastewater
Mixing Zone:	Source-specific
Effluent Limit Type:	WQBEL
Effluent Limits:	001 Total nitrogen: 5.4 lbs/day Total phosphorus: 291 lbs/year 002 Total nitrogen: 4.3 lbs/day Total phosphorus: 337 lbs/year 003 Total nitrogen: 4.5 lbs/day
Flow Rate:	Design maximum: 200,000 gpd Design average: 200,000 gpd
Wastewater sampling:	Monthly: effluent, influent, and flows.
Ground water sampling:	Monthly: MW-1, MW-2, MW-3, MW-4, MW-5, MW-6
Fact Sheet Date:	July 31, 2024
Prepared by:	Melinda Horne

Contents

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 Lakeside County Water and Sewer District (Permittee) for the Lakeside County Water and Sewer District Rapid Infiltration System. 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

DEQ received an application for the permit on August 8, 2023 with sufficient fees. DEQ reviewed the submittal and sent a Notice of Deficiency on September 8, 2023. The applicant submitted a final report on May 9, 2024. DEQ determined the application to be complete on May 13, 2024.

1.2 SEWER DISTRICT

Lakeside County Water and Sewer District (LCWSD) formed in 1988 and provides sewage disposal for the town of Lakeside, Montana and surrounding area residents. The collection system is 100% sanitary sewer. LCWSD serves a population of 1860, 810 households, and 18 business connections. The district also operates and maintains four drinking water systems.

The current wastewater treatment system includes lagoon treatment and disposal via land application. The proposed treatment system will replace the lagoons with a mechanical treatment plant and add disposal to ground water in addition to land-applying during the summer months.

2.0 FACILITY INFORMATION

2.1 LOCATION

The LCWSD Rapid Infiltration System is located in the southwest portion of the Flathead Valley close to the town of Somers, between Flathead Lake and the Flathead River (**Figure 1**)

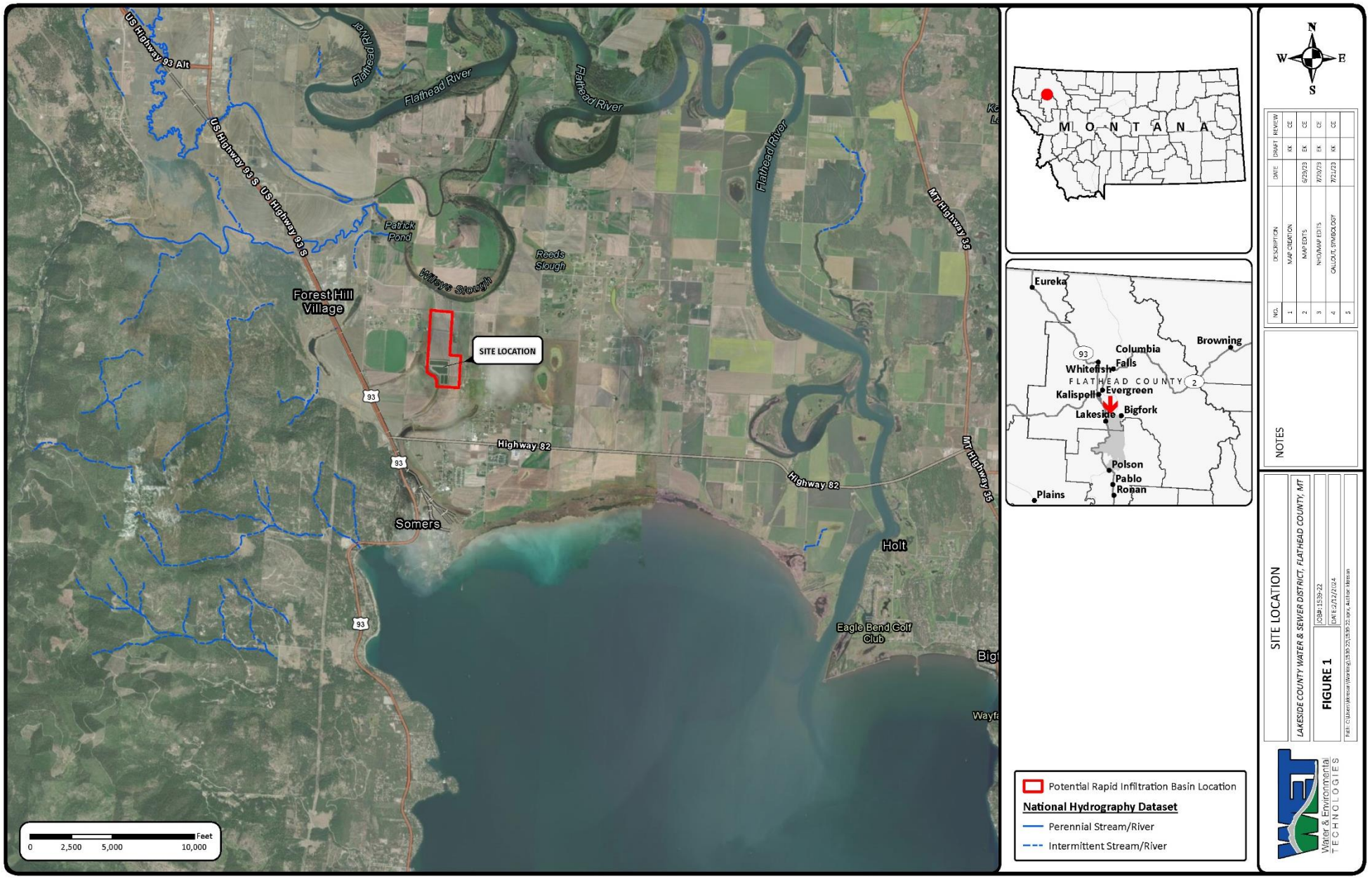

Figure 1: Location of the LCWSD Rapid Infiltration System.

2.2 OPERATIONS

The current wastewater treatment system includes a collection system, lift stations, a seven-mile-long force transmission main from Lakeside to the disposal site, aerated lagoon treatment, and land application disposal.

On March 19, 2024, LCWSD signed an interlocal agreement with Flathead County to accept, treat, and handle wastewater and biosolids from septage pumpers. This engineering design was combined with existing plans to update LCWSD's wastewater treatment facility. **Figure 2** displays the geographic locations of the proposed septage unloading facility and wastewater treatment plant, and the existing wastewater treatment facility and land application.

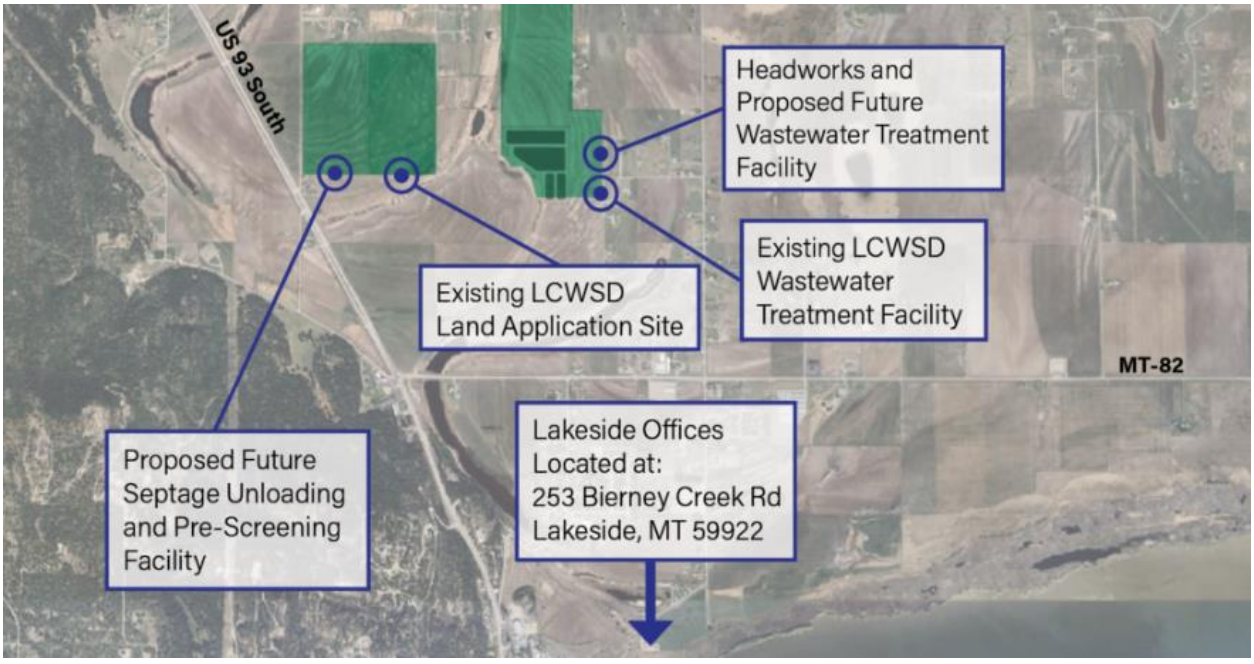

Figure 2: Locations of current and proposed operations.

The septage will be unloaded into the septage receiving facility. It will be mechanically screened and have grit removal prior to being pumped to an aerated flow equalization tank, where it can be inspected and be probed for water chemistry. If the septage is found to be irregular, it will be pumped back into a truck and not go to the WWTP. Industrial wastes will not be accepted.

Septage will be mixed into the county's municipal wastewater at a fixed rate to maintain a steady state. Influent samples will be taken at this point after mixing. It will then flow into the facility's headworks building, where it will undergo more screening and grit removal. From there, the combined waste flows will go into the secondary wastewater treatment facility, which will have a design treatment capacity of 900,000 gpd. The wastewater treatment facility will be a mechanical treatment plant utilizing sequencing batch reactor technology with biochemical nutrient reduction capabilities.

Following treatment, the effluent will be split into two paths. In the summer months, effluent will be pumped to a storage pond and land applied at the existing land application site and possibly other sites. Land application is regulated by DEQ's engineering department and DEQ Circular 2. Year round, effluent will also be pumped to the rapid infiltration basins (RIBs) proposed. Effluent will be applied to one RIB at

a time until it meets capacity, and then a splitter valve will automatically shut flow to that RIB and send the effluent to the next RIB. The treatment plant's sludge will be dewatered with a press; the resulting water will be rerouted into the WWTP and the dewatered sludge will be disposed of at a landfill.

System operations are summarized below in **Table 1**. **Figure 3** displays the layout and dimensions of the proposed RIBs. **Figure 4** displays the outfall locations. **Figure 5** is a line drawing of the collection, treatment, and disposal process.

This permitting action is for the disposal of domestic-in-nature, residential strength wastewaters to ground water. The permittee is responsible for ensuring that all effluent accepted is domestic in nature, and properly equalized to residential strength. The permittee is required to develop and submit an operations manual for receiving and handling septage (**Section 7.1**). The permittee must comply with the effluent limits and general conditions of the permit.

Table 1: Operations Summary

Sources

Contributing Sources of Wastewater: Domestic-in-Nature, Residential Strength
Number of connections: 18 businesses (listed below) and 810 households

Wastewater connection SIC Code	Average Daily Flow (gpd)	Wastewater connection SIC Code	Average Daily Flow (gpd)
Blacktail Grocery 5411	1933	Sliters Hardware 5251	433
Mavericks Bar 5812	1933	Spinnaker Bar & Casino 5812, 7999	1000
Homestead Café 5812	700	Spirit Fire Hotel 7011	5000
Lakeside Business Center 6022, 6531, 2499	400	Tamarack Brew Pub 2082, 5812	7167
Lakeside Dental 8021	133	Treasure State Coffee 5812	300
Lakeside Marina 5812	1567	White Oak 5541	933
Lakeside Mercantile 6531, 5812	267	Youth With a Mission 8249	22167
Lakeside School 8211	767	Short Branch Saloon 5812, 7999	400
Pure West Real Estate 6531	33	FH Gaming 7999, 5541	533

Treatment

Treatment System: Mechanical treatment using sequencing batch reactor technologies with biochemical nutrient reduction capabilities.
Location of System:
Township 27N, Range 21W, Section 11N
Latitude: 48.1127610, Longitude: -114.225111
Flathead County

Sampling/Monitoring

Wastewater System:
Influent sampling:
The influent wastewater sample point will be located after the equalization tank and prior to the drum screens/grit removal tank.

INF-00A: Influent sample representative of all outfalls.

Effluent sampling:

The effluent wastewater sample point will be located after the secondary treatment system but prior to the splitter valve that sends effluent to the different RIBs. The effluent samples are representative of all outfalls.

EFF-00A: Effluent sample representative of all outfalls.

EFF-001: Reported load-based parameters from Outfall 001 (RIB #1)

EFF-002: Reported load-based parameters from Outfall 002 (RIB #2)

EFF-003: Reported load-based parameters from Outfall 003 (RIB #3)

Flow meters:

The effluent flow meter will be located at the splitter that divides wastewater between the RIBs and irrigation ponds. One effluent flow meter will capture effluent flows to all three RIB cells.

FM-001: Reported flows to Outfall 001 (RIB #1)

FM-002: Reported flows to Outfall 002 (RIB #2)

FM-003: Reported flows to Outfall 003 (RIB #3)

The permittee is required to develop and implement a Wastewater Sampling, Analysis, and Reporting Plan for their community system (**Section 7.0**).

Disposal Operation

Outfall 001 - Rapid infiltration basin 1
Method of Disposal: Infiltration/percolation
Design capacity (gpd): 80,000
Location: Township 27N, Range 21W, Section 11N
Latitude: 48.114901, Longitude: -114.225956

Outfall 002 - Rapid infiltration basin 2
Method of Disposal: Infiltration/percolation
Design Capacity (gpd): 60,000
Location: Township 27N, Range 21W, Section 11N
Latitude: 48.112962, Longitude: -114.225929

Outfall 003 - Rapid infiltration basin 3
Method of Disposal: Infiltration/percolation
Design Capacity (gpd): 60,000
Location: Township 27N, Range 21W, Section 11N
Latitude: 48.10735, Longitude: -114.223019

Design Capacity (Total):
Average Daily Flow (gpd): 200,000
Maximum Daily Flow (gpd): 200,000

Figure 3: Facility site layout with monitoring wells and proposed RIBs. The mechanical treatment plant will replace lagoons present.

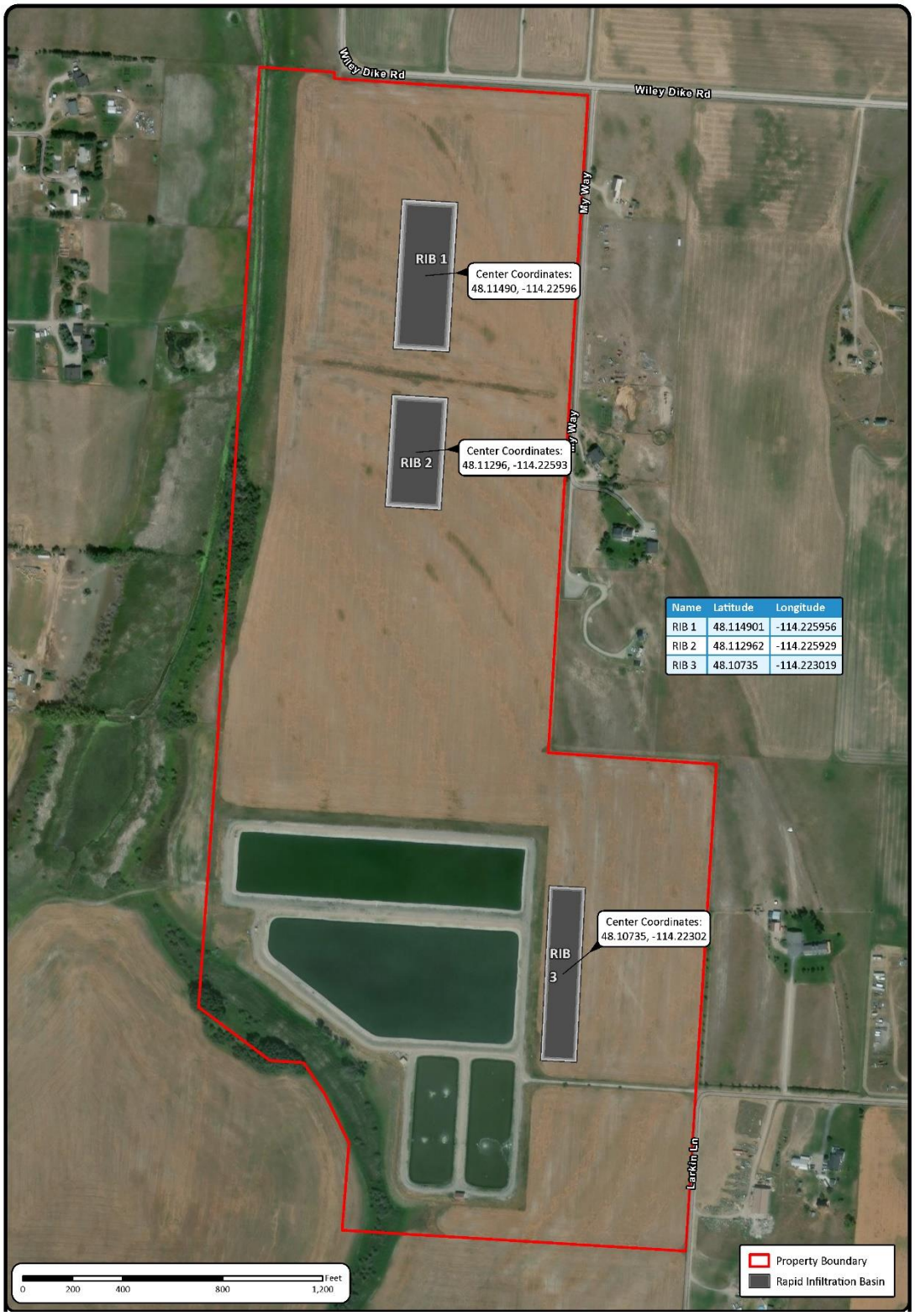

Figure 4: Outfall locations map.

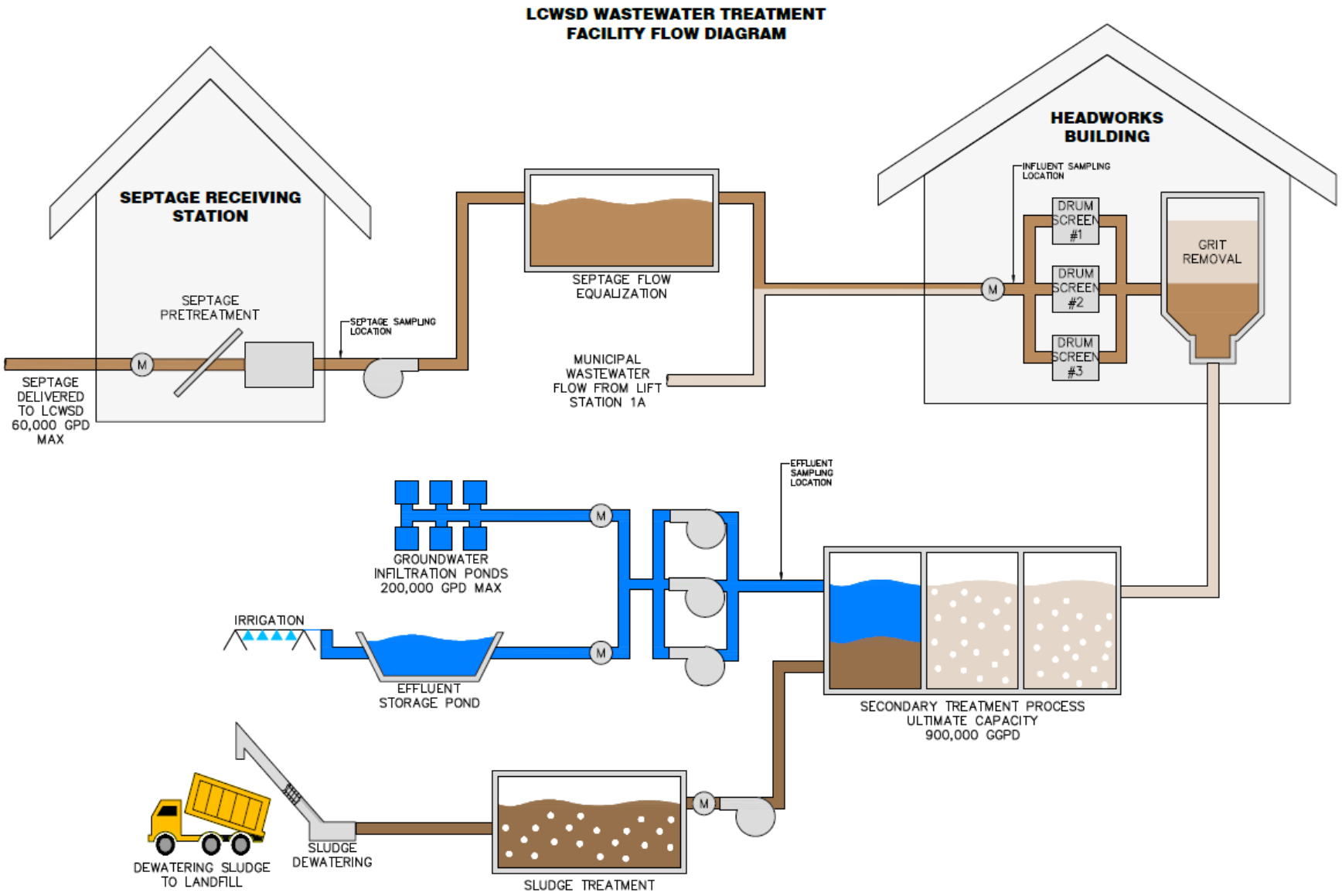

Figure 5: Wastewater treatment system flow diagram with design flow, flow meters (M), and effluent/influent monitoring locations.

2.3 GEOLOGY

The Flathead Valley is located at the southern end of the Rocky Mountain Trench, which extends over 1,000 miles north into the Yukon Territory. The trench formed from extensional tectonics that created a series of closely spaced normal faults along this length, causing a near-continuous valley structure. The Flathead valley is bounded by the normal Swan-Whitefish fault located at the base of the Swan Mountains to the east and the Salish mountains to the west (Harrison et al., 1992).

In the Flathead Valley, the basement is made up of the Belt Supergroup, a huge sequence of metasedamentary rocks 1.4-1.5 billion years in age. The valley fill overlying the basement is thought to be more than 3,000 feet thick in places, comprised of poorly lithified sedimentary rocks ranging from Tertiary to Quaternary in age, and alluvial, fluvial, and glacial in origin (LaFave et al., 2004). A geologic map is provided as **Figure 6A**, with a cross sectional view of the lower Flathead Valley hydrogeologic units in **Figure 6B**.

The facility is located between a large meander in Flathead River and Flathead Lake. In this area, the landscape is marked by ancestral oxbows and flowpaths created by the Flathead River. The landscape and geology show the Flathead River used to flow into the lake near Somers, Montana before migrating eastward as a result of fault movement dropping the eastern side of the basin lower. These processes left behind aggrading fluvial and deltaic deposits (Noble & Sanford, 1986).

At the facility site, five soil borings were drilled and completed as monitoring wells between September 6 and September 8, 2022. The results show poorly graded silty sand between five and 33 to 39 feet below ground surface, which is typical of the deltaic deposits left from the Flathead River flowing into Flathead Lake. See **Appendix A – Attachment B** for more information and the monitoring well drill logs.

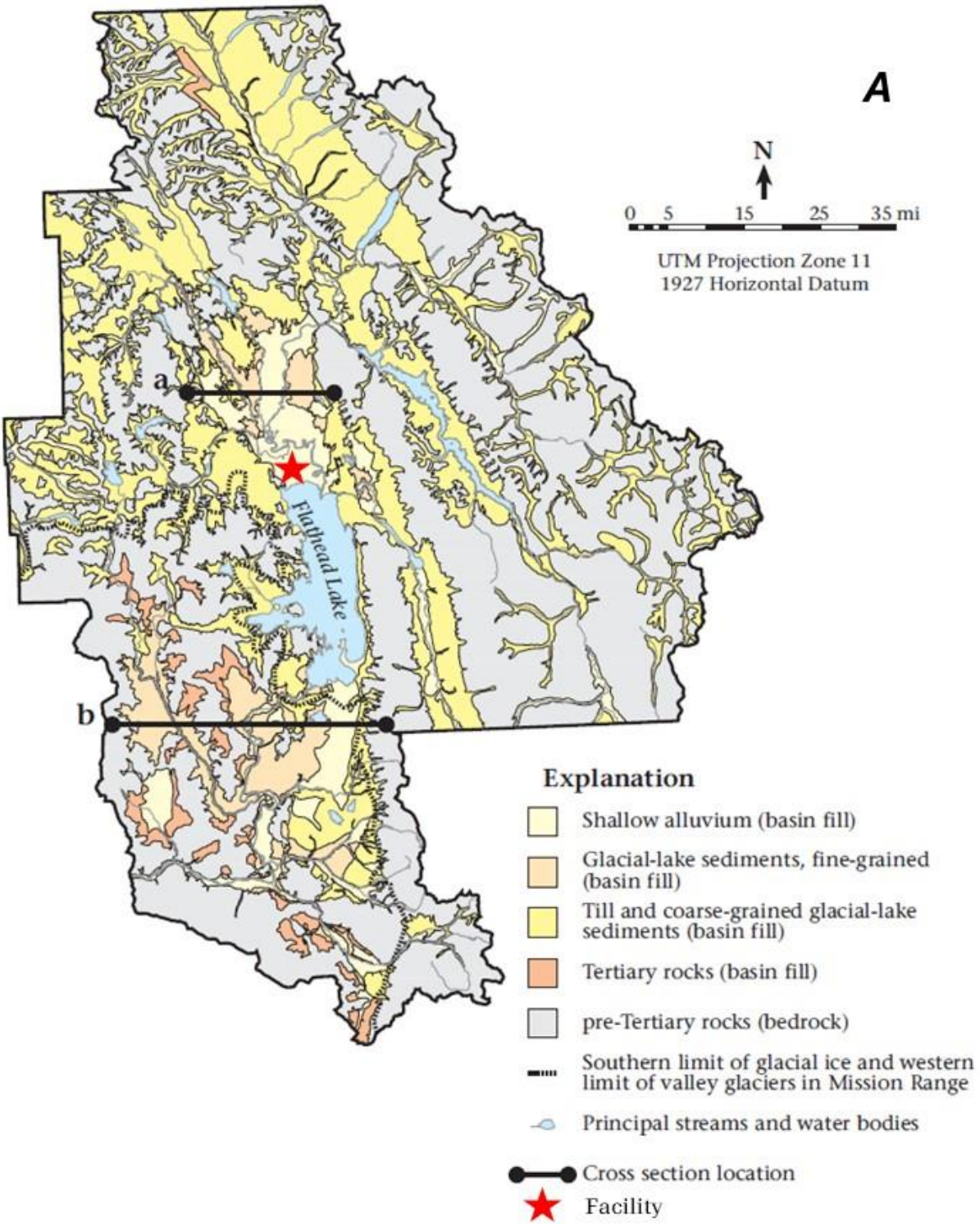

Figure 6A: Simplified Geologic map from LaFave et al., 2004.

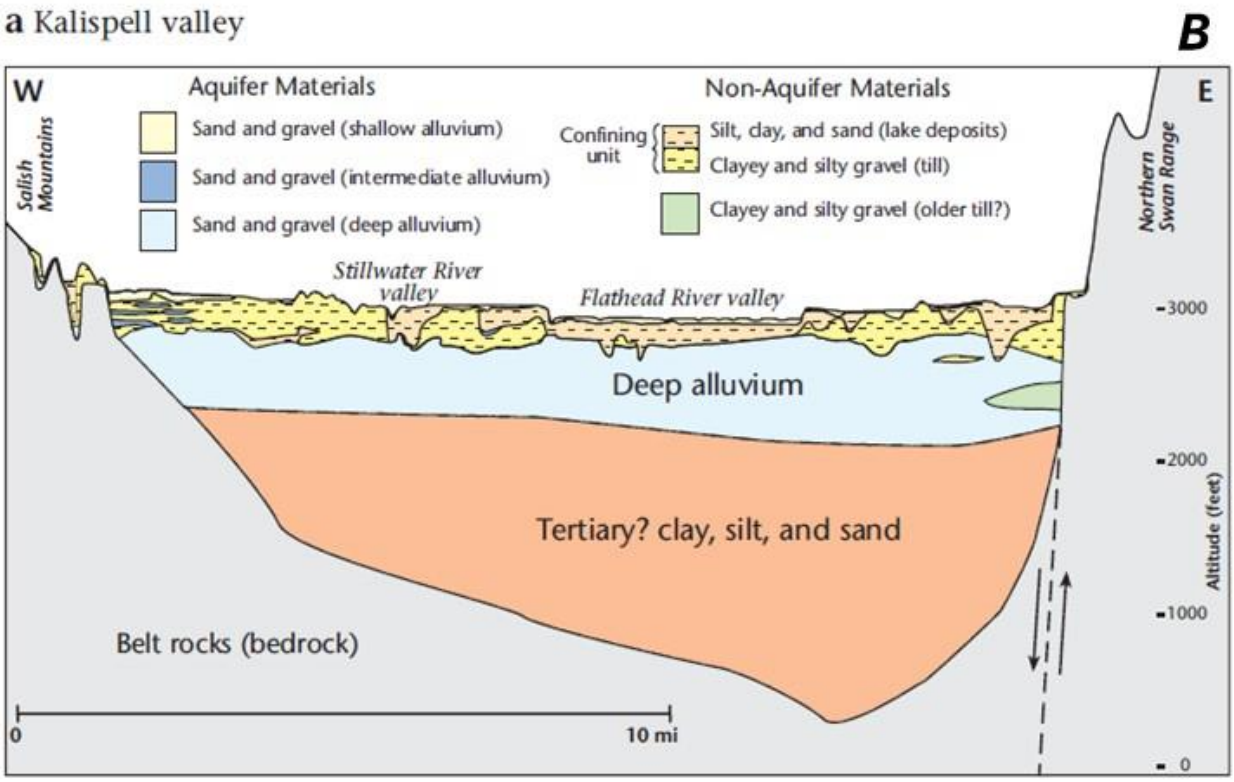

Figure 6B: Simplified geologic cross section from LaFave et al., 2004.

2.4 HYDROGEOLOGY

The hydrogeologic framework of the Flathead Valley includes shallow aquifers in recent alluvium, intermediate saturated confining units, and deep aquifers in pre-glacial gravels (LaFave et al., 2004; **Figure 6B**). In the vicinity of the facility, production wells are usually 100-200 feet deep to tap into the deep alluvial aquifer, which is located in pre-glacial sand and gravel deposits (LaFave et al., 2004). The deep alluvial aquifer is primarily recharged from snowmelt infiltration in the surrounding mountain ranges, and the flow direction is from west to east (from margin toward center of the valley) at a gradient of approximately 0.004 feet/feet (LaFave, 2000).

The receiving water underlying the facility is the Delta aquifer, which is well-studied. The Delta aquifer is a shallow unconfined aquifer found in the lower Flathead Valley between the Flathead River and Flathead Lake. The Delta aquifer (McDonald and LaFave, 2004; LaFave et al., 2004) is also recognized as the “sand aquifer” (Konizeski et al., 1968) and the “Deltaic sand aquifer” (Noble and Stanford, 1986). This aquifer is hydrologically connected to surface waters, including Flathead Lake and the Flathead River, but is thought to be hydrologically separated from other shallow aquifers to the north and east, and also the deeper aquifer by a confining unit comprised of glacial lake deposits.

The Delta aquifer consists of fine to medium grain sand and silt deposits due to the deltaic depositional environment it formed in. This results in a relatively low permeability, and therefore a lower transmissivity than other aquifers in the area (Noble and Sanford, 1986). This limited movement in turn creates a lower water quality caused by ions dissolved during longer residence times. Noble and Sanford (1986) found the water chemistry to be either magnesium bicarbonate or sodium bicarbonate, with

zoning that indicates low horizontal permeability causes limited or slow ground water – surface water interactions.

The Delta aquifer has a median depth to water of 16 feet and median well depth of 26 feet (LaFave et al., 2004). Water levels rise about 2 feet March-June, and then fall 2 feet in July for the rest of the year (LaFave et al., 2004; Noble and Sanford, 1986). Ground water flow directions vary greatly depending on proximity to surface water and season (Noble and Sanford, 1986; Konizeski et al., 1968).

Noble and Sandford (1986) created quarterly potentiometric maps in the Delta aquifer that show that ground water flows towards the Flathead River and Lake when those surface waters have low stages (February and April), and that ground water flows away from surface waters during high stage (June and August).

Noble and Sanford (1986) concluded the following of the Delta aquifer:

> The aquifer is seasonally mounded, inhibiting down-gradient flow, and correspondingly, there is minimal ground water inflow along the north shore of Flathead Lake. We conclude that the deltatic sand aquifer has no measurable impact on the nutrient mass balance of the lake, and, hence, is not contributing to the eutrophication problem.

Figure 7 displays the shallow aquifers identified by LaFave at al., 2004, and **Figure 8** displays the Delta aquifer potentiometric map from Konizeski et al., 1968.

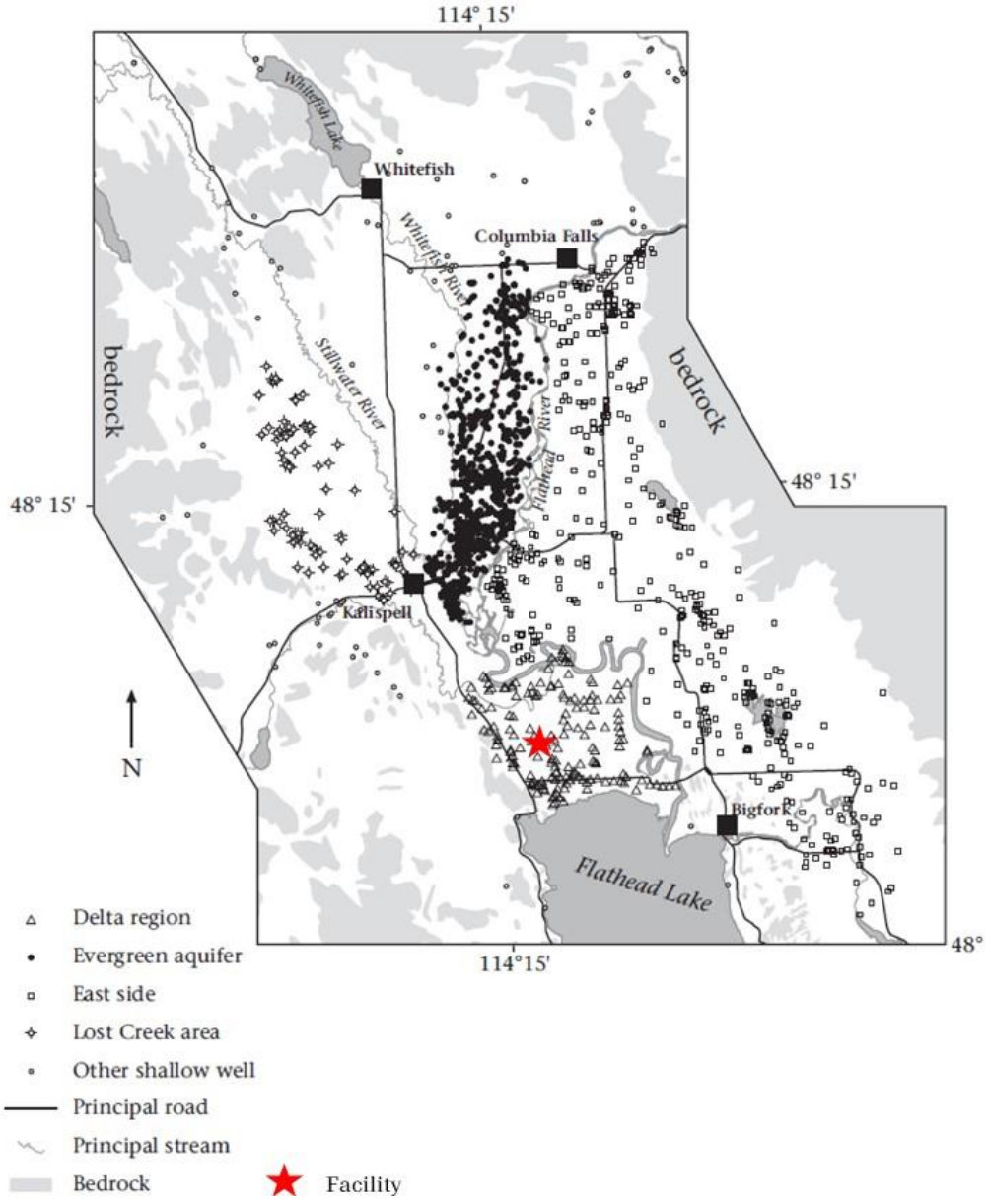

Figure 7: Shallow aquifers of the Flathead Valley from LaFave et al., 2004.

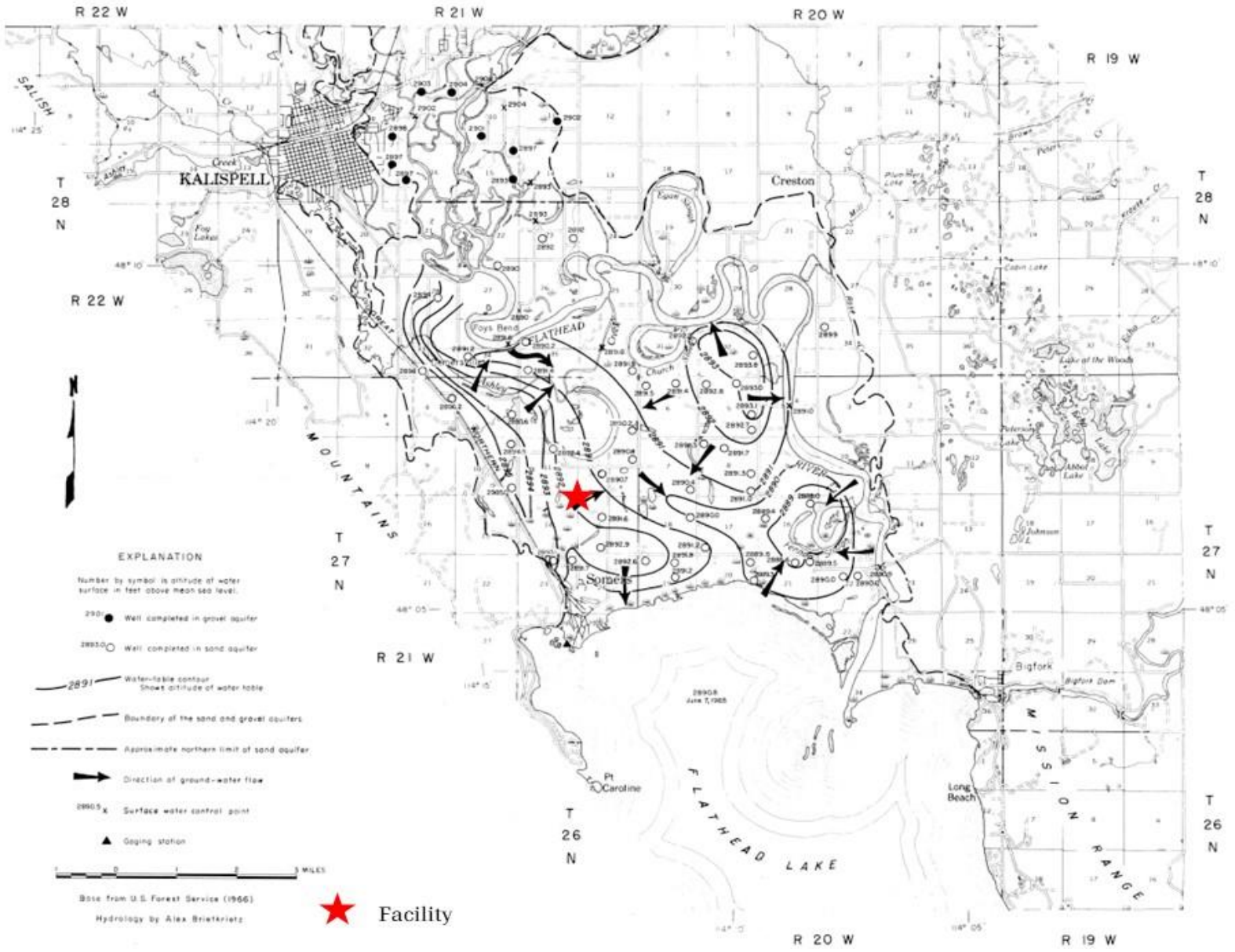

Figure 8: Potentiometric map of the Delta aquifer from Konizeski et al., 1968.

2.5 GROUND WATER DATA & MONITORING NETWORK

Given the complexities of ground water flow in the area, it was important to collect a thorough suite of site specific hydrogeologic data to develop this permit. Five monitoring wells were installed at the site and hydrogeological characteristics were collected by Water & Environmental Technologies (WET). See **Figure 3** for monitoring well locations, and **Table 2** for well details, and **Appendix A – Attachment B** for drill logs.

Ground water elevations were sampled monthly between September 2022 and July 2023, and the results show that the groundwater flow direction rotated between approximately S60°E in September to N60°E in April. The hydraulic gradient was flattest at 0.0002 ft/ft in June 2023, corresponding to peak stages of Flathead Lake and the Flathead River. The steepest gradient calculated was 0.003 ft/ft. **Figure 9** contains monthly potentiometric maps that display this seasonal variation. These results are consistent with the quarterly potentiometric maps created by Noble and Sanford (1986) and the potentiometric map created by Konizeski et al. (1968) of the Delta aquifer.

Three slug tests were completed in each well and an average hydraulic conductivity of 122 ft/day was calculated. Using an estimated aquifer thickness of 10 feet (from the wells' screen length), the transmissivity value of 1,2240 ft^2/d falls within the middle range of transmissivities found by Noble and Sanford (1986) in the Delta aquifer (1-3,700 ft^2/d) . WET used AQTESOLV, by HydroSOLV, Inc., and the Bouwer-Rice solution to analyze the slug test data. See **Appendix A – Attachment G** for the slug test solutions.

Ambient ground water characteristics were collected from MW-5 and the results are summarized in **Table 4**. The ambient average nitrate+nitrite concentration was calculated to be 0.11 mg/L.

Appendix A contains the details of all hydrogeologic work completed at the facility site. Additional wells will be required for long term aquifer monitoring as part of this permit's Special Conditions (**Section 7.0**).

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.

Table 2: Monitoring Well Summary
Monitoring Well: MW-1
MBMG GWIC #: -
Use: Monitoring of the shallow unconfined aquifer.
Permit Status: Active. Constructed on September 6, 2022.
Location: Near northwest corner of the property, just south of Wiley Dike Rd. Latitude: 48.11680 Longitude: -11422756
Representation: This well represents shallow ground water. It will used to monitor water quality near the end of the northern mixing zone at Outfall 001/RIB #1.
Monitoring Well: MW-2
MBMG GWIC #: -
Use: Monitoring of the shallow unconfined aquifer.
Permit Status: Active. Constructed on September 6, 2022.
Location: Near northeast corner of the property, just south of Wiley Dike Rd. Latitude: 48.11689 Longitude: -114.22363

Representation: This well represents shallow ground water. It will be used to monitor water quality near the end of the northern mixing zone at Outfall 001/RIB #1.
Monitoring Well: MW-3
MBMG GWIC #: -
Use: Monitoring of the shallow unconfined aquifer.
Permit Status: Active. Constructed on September 7, 2022.
Location: On western border of property, near northwest corner of existing lagoons. Latitude: 48.10997 Longitude: -114.22375
Representation: This well represents shallow ground water. It is not located within a mixing zone so it may be used for additional or ambient water quality at the site.
Monitoring Well: MW-4
MBMG GWIC #: -
Use: Monitoring of the shallow unconfined aquifer.
Permit Status: Active. Constructed on September 7, 2022.
Location: On western border of property, near northeast corner of existing lagoons. Latitude: 48.10999 Longitude: -114.22870
Representation: This well represents shallow ground water. It will used to monitor water quality near the end of the southern mixing zone at Outfall 001/RIB #2.
Monitoring Well: MW-5
MBMG GWIC #: -
Use: Monitoring of the shallow unconfined aquifer.
Permit Status: Active. Constructed on September 8, 2022.
Location: Center of the facility site. Latitude: 48.11323 Longitude: -114.22598
Representation: This well was used to provide ambient aquifer characteristics. It will likely need to be decommissioned to make way for RIB #2.

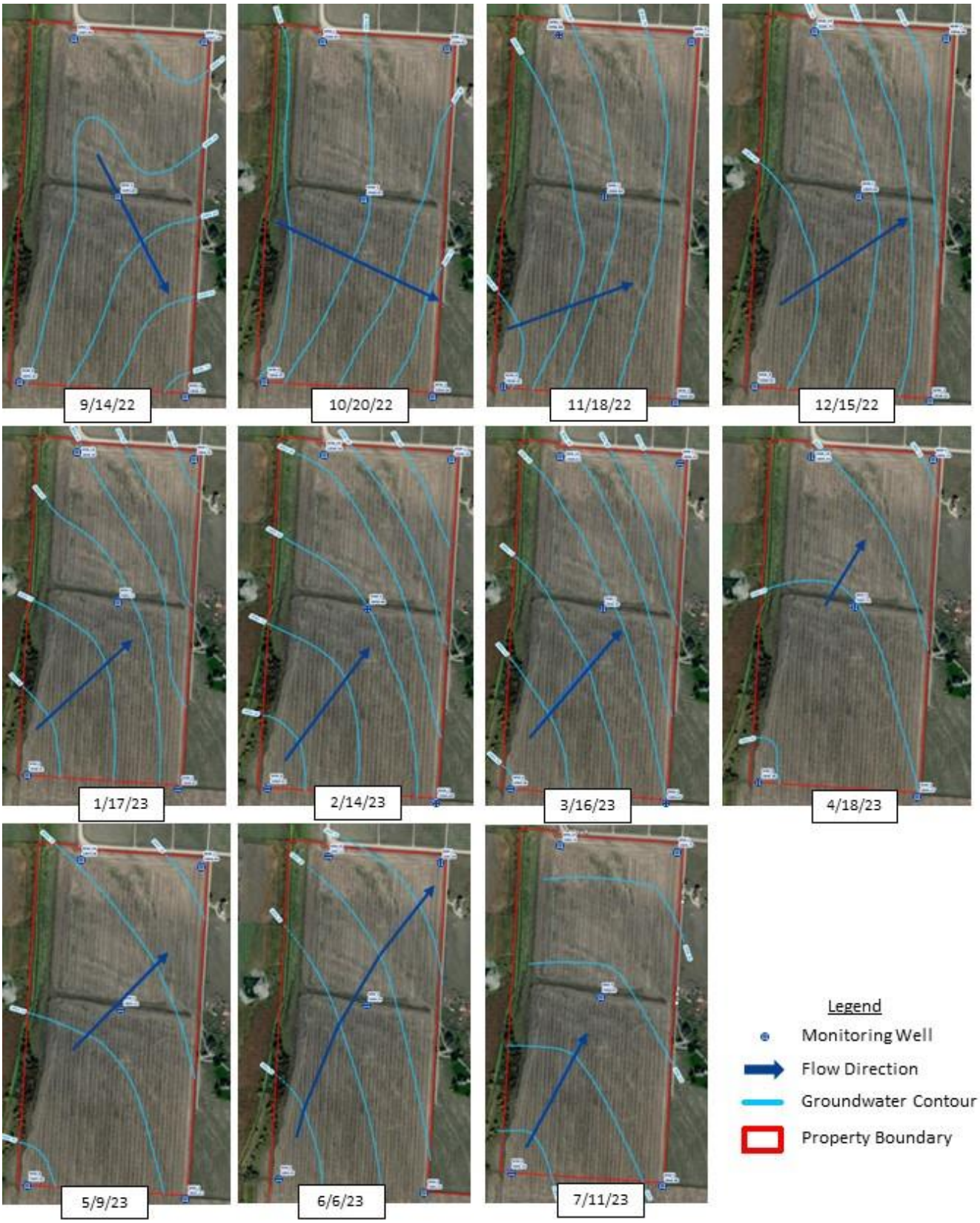

Figure 9: Groundwater flow maps from the facility's five monitoring wells from WET, 2024 (Appendix A).

2.6 SURFACE WATERS

The Delta aquifer is hydrologically connected to surface waters. There are many surface waters within a one-mile radius of the facility (**Figure 10**). The nearest surface waters are Wiley's Slough ¼ mile to the north from the property boundary, a wetland/pond immediately to the east within the property boundary (called "Pond 4" in this document), and a wetland/pond ½ mile to the southeast from the property boundary (called "Pond 7").

The water table maps in **Figure 9** demonstrate that under ambient conditions, ground water will flow from the facility site to Wiley's Slough and Pond 7 depending on the season. However, because the water table gradient is small and the discharge from this facility will be great, water table mounding will occur, pushing effluent out radially in all directions, including to Pond 4.

Pond 4 was sampled on 10/23/23. The results of the surface water quality are in **Table 4**. The surface waters in the vicinity of the facility are expected to have high nutrient and total organic carbon concentrations, especially during the summer months.

Wiley Slough is connected to lower Ashley Creek. Lower Ashley Creek (HUC 1700208, assessment MT76O002_030) is within the Columbia basin, Pend Oreille watershed, Northern Rockies ecosystem, and the Flathead-Stillwater Total Maximum Daily Load (TMDL) planning area. It has a use-class of C-2, and the corresponding beneficial uses are: bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

This segment of Ashley Creek was found to be impaired for aquatic life and primary contact recreation (2020 303(d) list). See **Table 3** for the probable causes and sources of these impairments.

Pollutants associated with the proposed facility are nitrate + nitrite, total nitrogen, and total phosphorus. The Flathead-Stillwater Planning Area Nutrient, Sediment, and Temperature TMDLs and Water Quality Improvement Plan (Montana DEQ, 2014) identified an allowable load for nonpoint sources and natural background of 13.98 lbs/day total nitrogen (91% reduction) and 1.27 lbs/day total phosphorus (66% reduction). The TMDL does not break out load allocations by each nonpoint source, intending to give stakeholders flexibility in identifying reduction measures.

The facility's proposed system will be able to take on more wastewater connections, thereby improving nonpoint source loading because the proposed advanced treatment system will produce considerably cleaner effluent than conventional treatment systems. The results of the nitrogen attenuation and phosphorus breakthrough analyses in **Section 3.3** and the reasonable potential analyses in **Section 3.4** demonstrate that the effluent discharge should have no impact on the nutrient loading in lower Ashley Creek.

The Flathead River, from the headwaters to Flathead Lake, has not been assessed for impairments.

Table 3: Ashley Creek (Kalispell Airport Road to mouth) impairment information		
Probable Causes	**Probable Sources**	**TMDL Completed**
Alteration in stream-side or littoral vegetative covers	Crop production (irrigated)	N
Chlorophyll-a	Crop production (irrigated) Municipal point source discharges	N
Dissolved Oxygen	Discharges from Municipal Separate Storm Sewer Systems (MS4) Municipal point source discharges	Y
Sedimentation/Siltation	Channelization Crop production (irrigated) Upstream source	Y
Temperature	Discharges from Municipal Separate Storm Sewer Systems (MS4) Loss of riparian habitat Upstream Source	Y
Nitrate/Nitrite	Crop production (irrigated) Municipal point source discharges Upstream source	Y
Total Nitrogen	Crop production (irrigated) Municipal point source discharges Upstream source	Y
Total Phosphorus	Crop production (irrigated) Municipal point source discharges Upstream source	Y

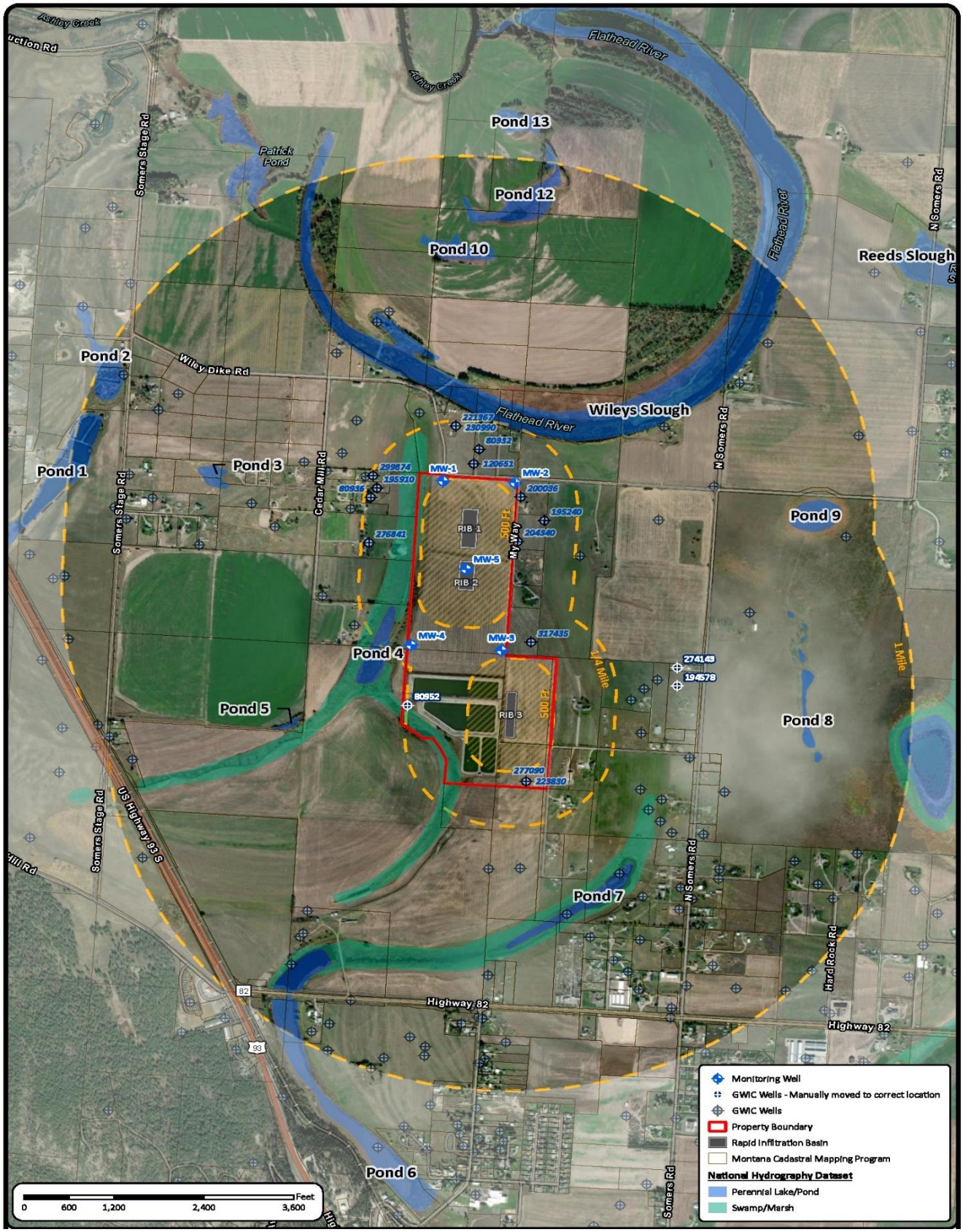

Figure 10: Locations of wells and surface waters near to the facility site, including setbacks.

2.7 QUALITY INFORMATION

The Sewer District has proposed an advanced wastewater treatment system capable of removing 80% of the total nitrogen load, 70% of the total phosphorus load, 70% of the pathogens, and 95% of the 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) loads. Biochemical nutrient reduction technology will be used to achieve total phosphorus concentrations of 1.5 mg/L. The proposed mechanical treatment plant is estimated to reduce the total nitrogen concentration output of the system by 73% compared to the existing lagoon treatment. This is also 85% reduction when compared to conventional septic treatment.

Ambient ground water data collected from MW-5 shows an average Nitrate + Nitrite value in the receiving water of 0.11 mg/L. Based on the 595 microsiemens per centimeter (µS/cm) specific conductance, the receiving water is Class I ground water.

Table 4 contains a summary of the effluent quality of the existing and proposed treatment systems, the water quality standards that apply to this facility, and the ambient water quality for ground and surface waters. Lab reports for the MW-5 and Pond 4 samples are located in **Appendix A – Attachment D.**

Table 4: Quality Summary

Analyte/Measurement	units	Treated Wastewater Design Criteria		Ground Water Quality Standards	Ambient Water Quality	
		Existing System (Lagoon[(1)])	Proposed Treatment System (Advanced[(2)])		Ground Water (MW-5[(3)])	Surface Water (Pond 4[(4)])
Biochemical Oxygen Demand (BOD_5)	mg/L	30	10			
	% removal	85	95			
Escherichia coli Bacteria	CFU/100ml		2400	<1	<1	
Chloride [as Cl]	mg/L		248		8	179
Nitrogen, Kjeldahl, total [as N]	mg/L				<0.05	2.8
Nitrogen, Nitrite + Nitrate [as N]	mg/L			10	0.11	0.02
Nitrogen, Total [as N]	mg/L	30	8		<0.05	2.8
	lbs/day		13[(5)]			
	% removal	Negligible	80			
Organic Carbon, Total	mg/L				3.5	15.6
pH	s.u.		7		7.4	7.4
Phosphorus, Total [as P]	mg/L	8	1.5	**Table 6**		0.26
	lbs/day					
	% removal	Negligible	75			
Specific Conductivity [SC] @ 25°C	µS/cm		1770		595	1190
Solids, Total Dissolved (TDS)	mg/L		600		337	690
Sulfate	mg/L				6	2

Footnotes:
CFU = Colony Forming Units
s.u.: standard units
Empty cells represent constituents not provided (if design criteria) or not analyzed (if water quality data).
(1) The existing effluent characteristics are the design criteria for the facility's aerated lagoon system.
(2) Proposed effluent characteristics from a mechanical treatment plant using SBR technology with BNR capabilities. Prior to dilution within an authorized mixing zone.
(3) Averages from samples taken from MW-5 on 9/22/22, 11/17/22, 3/15/23, and 5/1/23.
(4) One sample taken from Pond 4 on 10/23/23.
(5) Load based on the average design flow of 200,000 gpd.

2.8 GROUND WATER MOUNDING MODEL

To demonstrate that the surface waters adjacent to the facility will not be affected by the effluent discharge, the permittee was asked to complete a fate and transport study of total nitrogen and pathogens. Using MOUNDSOLV, created by HydroSOLVE, Inc., WET developed a model of the effluent mound. MOUDSOLV uses Zlotnick et al.'s (2017) analytical steady state solution for a rectangular recharge source overlying horizontal or uniformly sloping unconfined aquifers.

See **Appendix A** for full details of the ground water mounding model with higher-resolution figures, and including **Attachments I and J** for MOUNDSOLV documentation.

2.8.1 Model Inputs

Figure 11 displays the input parameters used for the model, including measured hydrogeologic characteristics and proposed RIB dimensions and discharge rate. RIB #1 has a modeled recharge of 80,000 gpd, RIBs #2 and #3 are modeled with 60,000 gpd each. Each RIB is sized so that the average discharge rate is 0.59 gpd per square foot. A forward solution was performed for five years, at which time, due to the constant head boundary of the Flathead River and Flathead Lake, the system is believed to achieve stabilized conditions.

Aquifer Data

Property	Value	
Horizontal hydraulic conductivity, *K* (ft/d)	122.4	
Specific yield, *Sy*	0.27	
Initial saturated thickness, h_0 (ft)	14.7	
Maximum allowable water-table rise, σ (ft)	0	
Dip, *i* (ft/ft)	-0.0002	
Slope rotation from x axis, γ (°)	17.7	or -61

Recharge Sources

Property	Source 1	Source 2	Source 3
X coordinate at center, *X* (ft)	1161	1127	1669
Y coordinate at center, *Y* (ft)	1784	1077	-1025
Dimension along x* axis, *L* (ft)	225	225	145
Dimension along y* axis, *W* (ft)	600	450	700
Rotation from slope direction, ϕ (°)	-17.7	-17.7	-17.7
Recharge rate, *Q* (ft^3/d)	10694	8021	8021
Infiltration rate, *q* (ft/d)	0.07921481481	0.07921975309	0.07902463054

Figure 11: MOUNDSOLV input parameters.

Two scenarios were considered with the mound model: ambient ground water flows to the south-east and to the north-east (Slope rotation from x axis, y(°) = 17.7 and -61). The purpose of having the two scenarios was to incorporate the changing head boundaries that occur seasonally in the lower Flathead Valley, as discussed in **Section 2.4**, and see if the natural flow variations affect the predicted effluent mound.

Figure 12 displays that the modeled water table pre-effluent disposal reasonably matches the measured water table (in the NE ground water flow direction scenario). As such, the model is believed to adequately represent the development of a groundwater mound beneath the proposed RI basins at the site.

2.8.2 Predicted Water Table Changes

Figure 13 is the resulting water table with a full 200,000 gpd discharge from the three RIBs, including the two water flow direction scenarios. Blue lines represent the predominant ground water flow direction to the NE, and purple lines represent the flow direction towards Flathead Lake to the SE. Note that both purple and blue lines have the same 1-ft contours. **Figure 13** illustrates that the seasonal variation in ground water flow direction will be dominated by the effluent mound; mounding will force the effluent

to flow radially, rather than specifically NE or SE. The two mounding scenarios confirm that the location of the RI basins, relatively flat hydraulic gradient, and hydraulic conductivity of the Delta aquifer ultimately control the size and shape of the mound developing beneath the proposed RI basin areas at the Site, and thus the fate and transport of phosphorous, pathogens, and nitrogen.

Figure 14 is a set of graphs that show the water table rise predicted by the model. Under RIBs #1 and #2, the water table is expected to rise 4.99 ft, leaving an unsaturated zone of approximately 9 ft. Under RIB #3, the water table is expected to rise 3.65 ft, leaving an unsaturated zone of 7.8 ft. To be conservative, an unsaturated thickness of 4 ft was used for phosphorus breakthroughs and pathogen reduction.

Understanding that the proposed discharge will cause an elevated water table, the depth to ground water for the immediate vicinity was predicted using the MOUNDSOLV model and the land surface elevation (**Figure 15**). This model scenario considered the seasonal high ground water data collected June 6, 2023. This figure shows that water levels near the boundary of the facility site are predicted to be between 2,897.5 and 2,898.5 ft above mean sea level (amsl), representing an approximate increase of 2.5 ft in the on-site monitoring wells. The water level rise predicted by the modeled mound decreases with distance, and the maximum predicted water level rise off the facility site is approximately 3.5 ft, occurring immediately east of RI basin #1 and #2. Modeled depth to water is predicted to exceed 10 ft in all but the low-lying areas associated with historic channels of the Flathead River, where depth to ground water is typically near surface under current conditions.

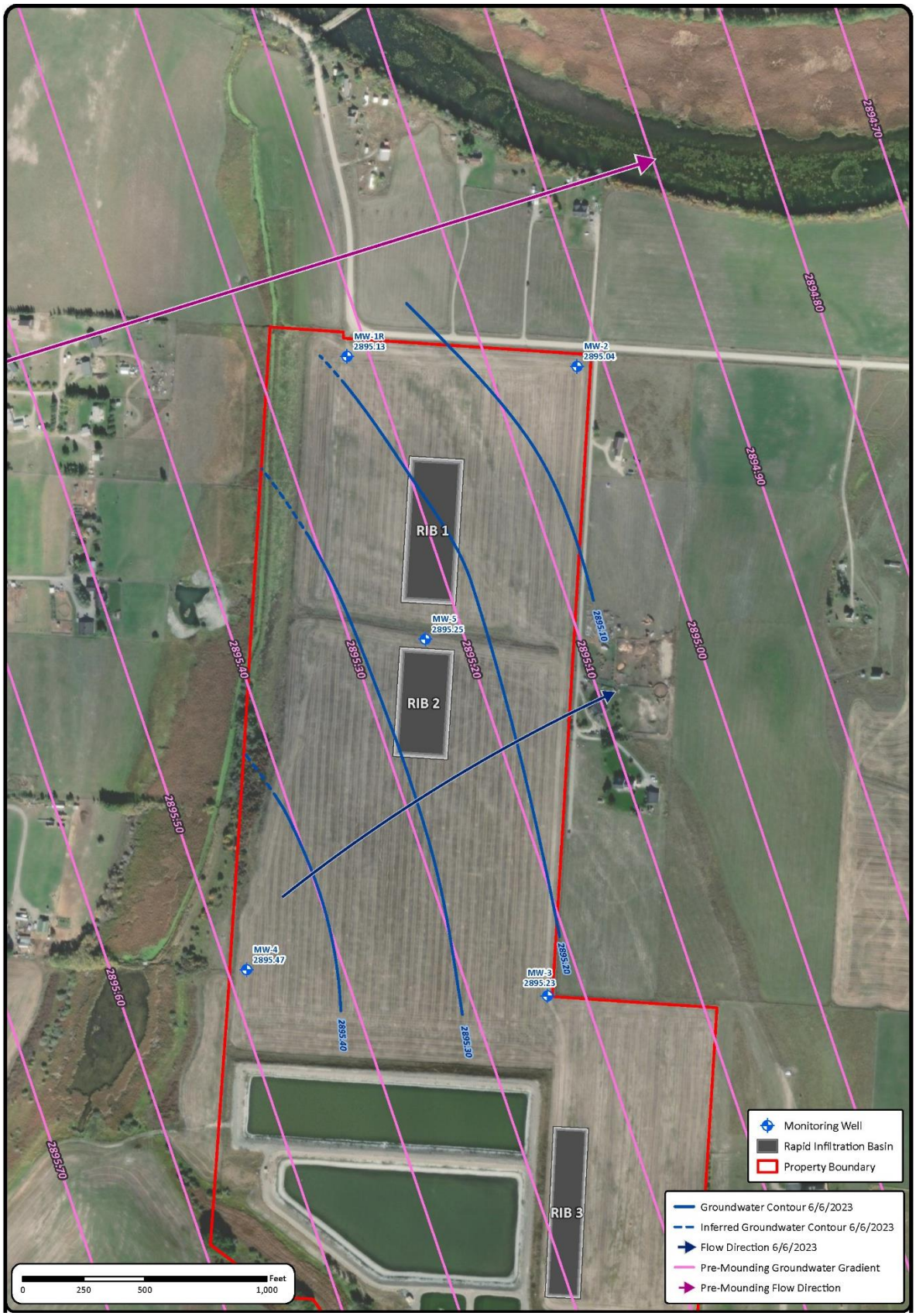

Figure 12: Modeled water table initial conditions (NE ground water flow scenario).

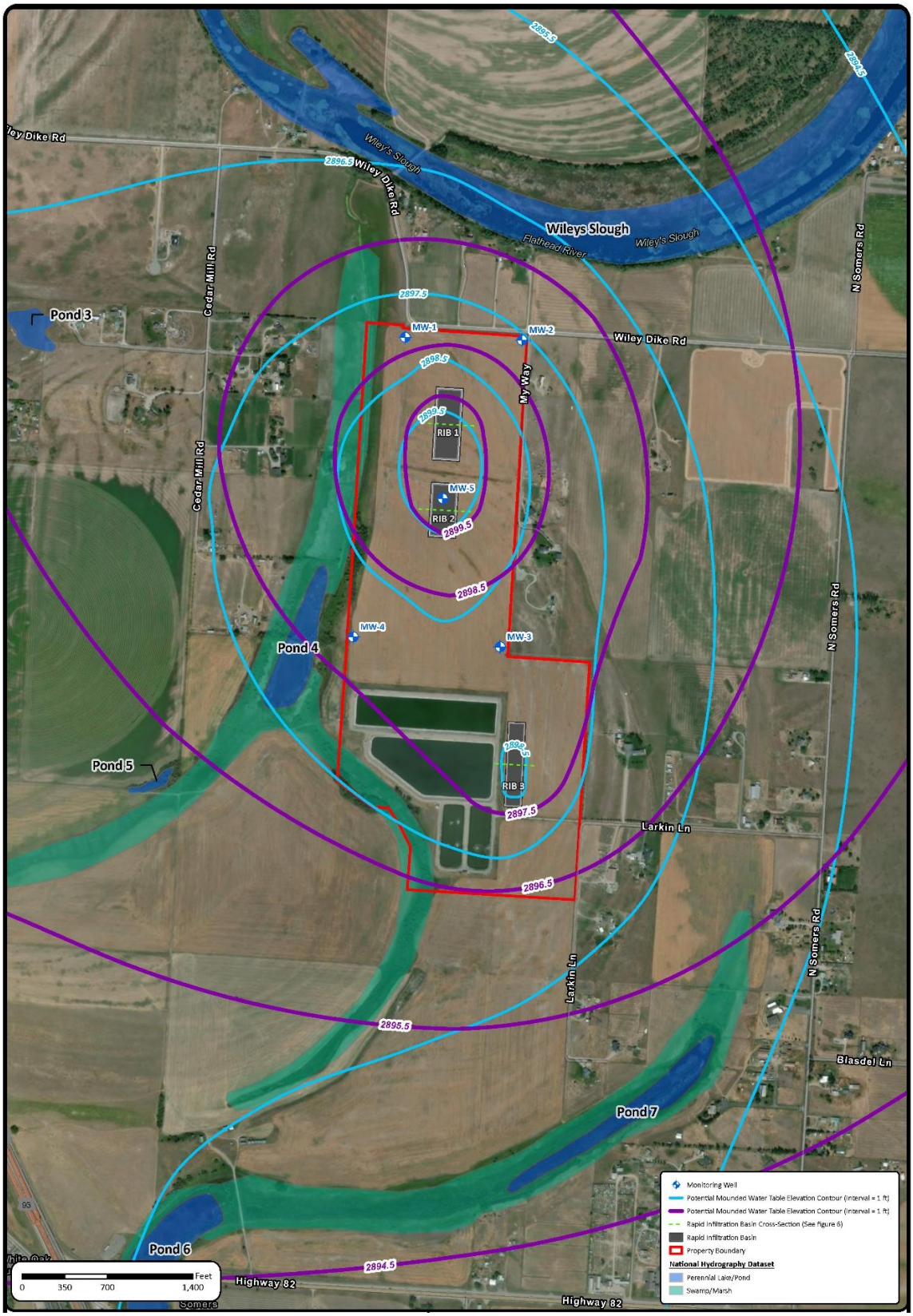

Figure 13: Modeled water table results after incorporating the proposed discharge. Purple lines represent the water table when flow is to the SE, blue lines represent flow to the NE.

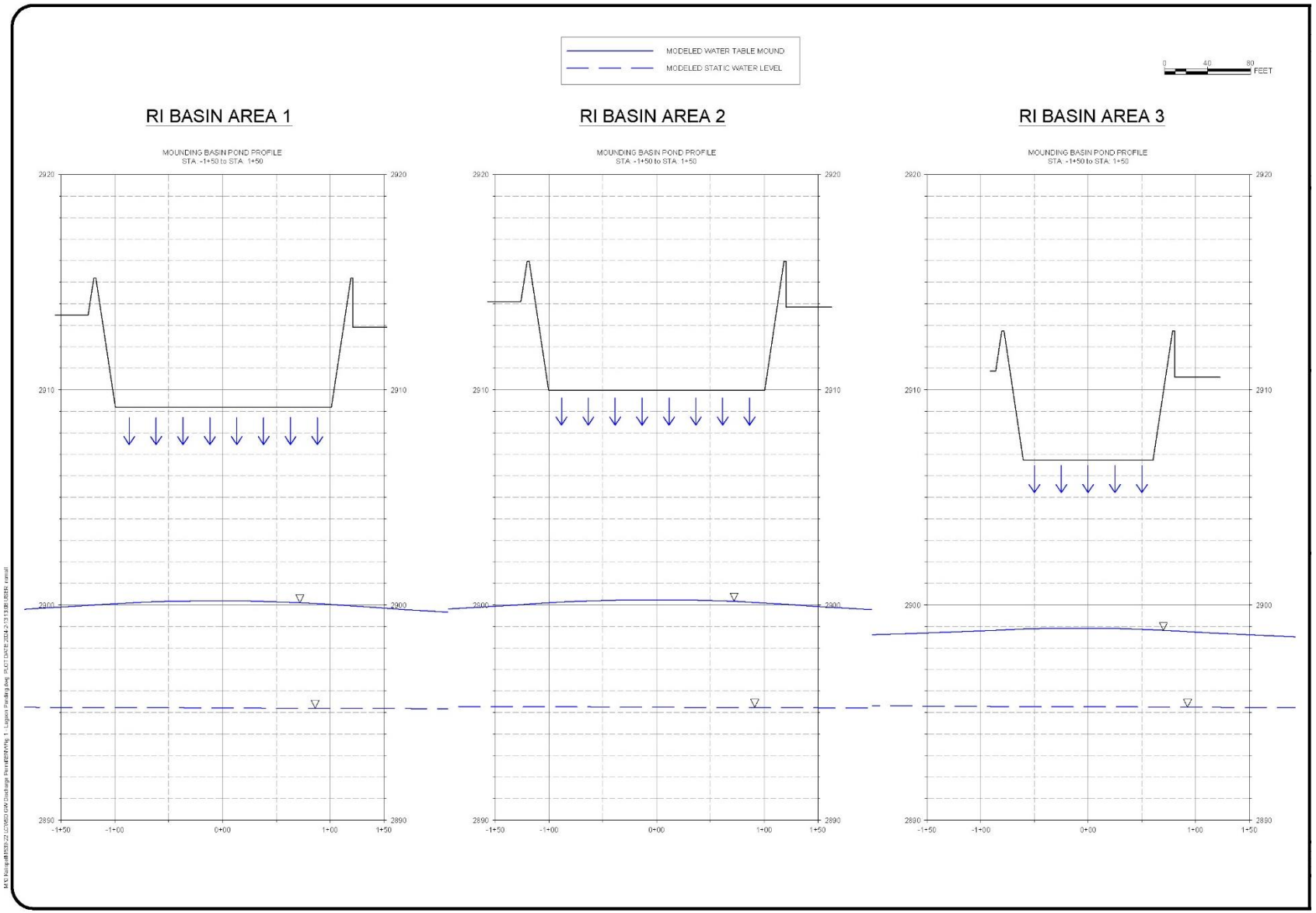

Figure 14: Predicted water table rise underneath the RIBs.

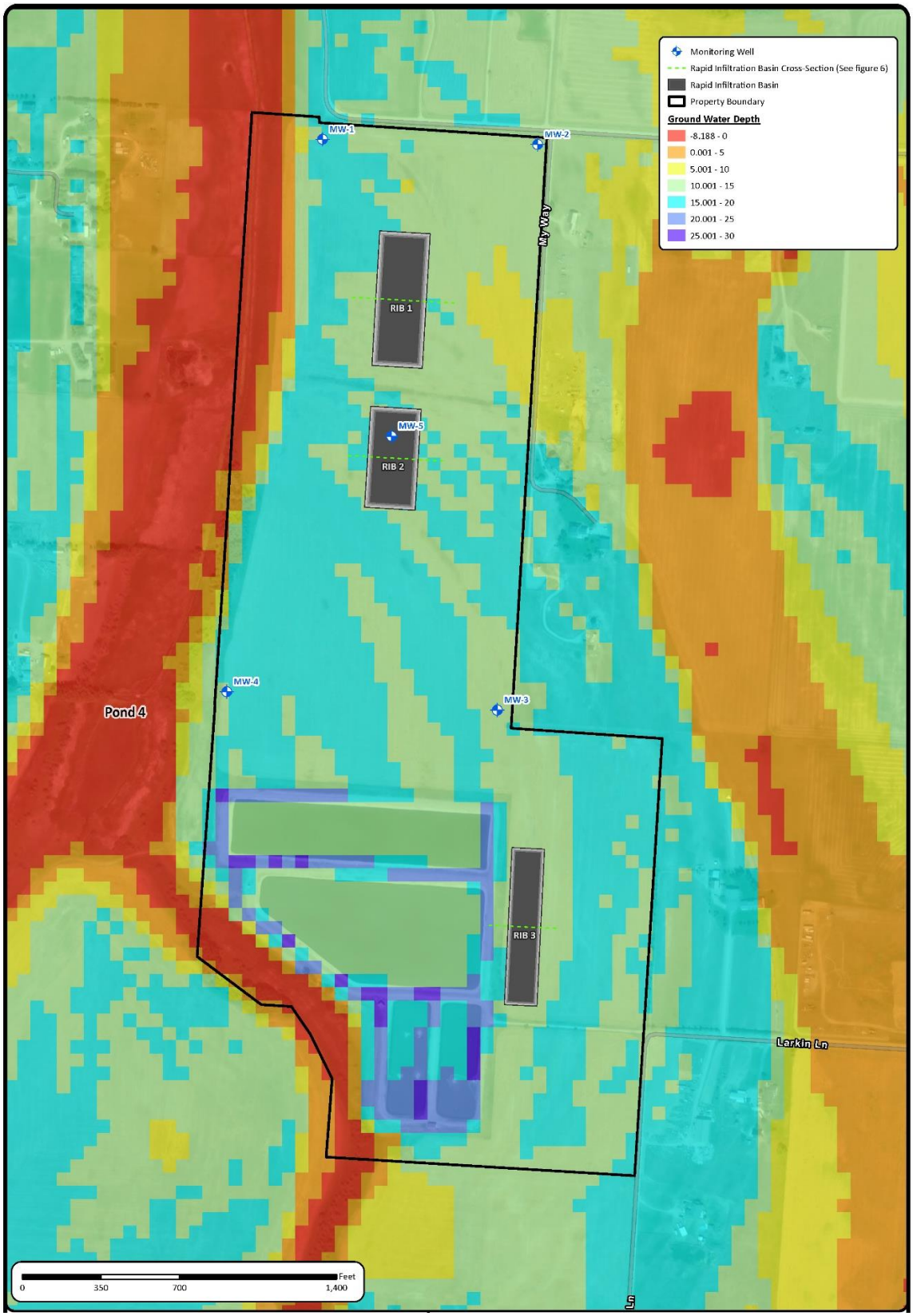

Figure 15: Predicted depth to ground water in the vicinity of the facility, using the ground water mounding model output for high ground water conditions.

2.8.3 Pollutant Fate and Transport

In addition to modeling the predicted impacts the discharge will have on the water table elevation and flow directions, the ground water mounding model was used to determine the fate and transport of pollutants from the proposed facility.

The dashed yellow areas featured in **Figure 16** display the possible effluent flow paths from each RIB to the nearest surface water bodies. The dashed orange line represents the shortest flow path a particle of water may take to the surface water along the steepest ground water gradient produced by the mounding. The direction and distances represented by the orange line were used for the nonsignificance analyses and mixing zone designations (**Table 5**; **Sections 3.3** and **4.0**).

Table 5: Effluent Flowpaths to the Nearest Surface Water

Location	RIB #1 to Wiley Slough	RIB #2 to Pond 4	RIB #3 to Pond 7
Distance (ft)	1335	1160	2540
Direction (bearing)	N 15° E	S 50° W	S 40° E

WET calculated phosphorus breakthroughs with the above information and the RIB dimensions. The results of these breakthroughs are found to be greater than 50 years and therefore nonsignificant (**Section 3.3**); however, to be conservative, total phosphorus effluent limits were developed (**Section 5.2**). See **Appendix D** for phosphorus breakthrough calculations.

The impacts of pathogens on downgradient drinking water wells were also assessed. Using the same aquifer characteristics as the mounding analysis, WET used DEQ's Pathogen Transport Model spreadsheet which utilizes both vertical and horizontal travel to calculate pathogen removal. A conservative four-foot unsaturated zone was assumed beneath the RI basin areas. A volumetric soil moisture content of 0.1 mL/cm^3 was assumed for the unsaturated soil, which is the default value of the spreadsheet.

The results of the pathogen transport spreadsheet showed that 4-log microbiological attenuation typically occurs within 200 days. A small amount of virus inactivation occurs in the short travel time (5.8 days) between the bottom of the RI basin areas and the top of the water table mound (0.11 logs). However, even at the steepest gradients occurring immediately adjacent to the water table mound (0.003 feet or 0.9 feet/300 feet), 4-log microbial inactivation or removal of 99.99-percent of virus is achieved within 305 feet of each RIB. No wells are within 500 feet of the proposed RIBs. As such, LCWSD requested a source specific mixing zone of 305 feet, which is the minimum required distance to achieve 4-log microbial inactivation (**Figure 17**). See **Appendix A – Attachment H** for pathogen transport model results.

Finally, WET addressed nitrogen reductions via denitrification. The steepest hydraulic gradient of 0.003 was utilized to calculate the time of travel required for denitrification processes to result in a nitrate concentration of 7.5 mg/L. Utilizing the hydraulic gradient near the edges of the mound, the average groundwater flow velocity is 1.36 ft/day and nitrate concentrations are calculated to be below 7.5 mg/L within 110 feet of each RIB. Nitrate concentrations are calculated to be below 5.0 mg/L within 335 to 670 feet from the proposed RIB and are estimated to reach near background conditions of 0.11 mg/L

within 640-1,200 feet of the proposed RIBs. See **Section 3.3** for discussion of the nitrate nonsignificance determination for each RIB, and **Appendix A** for the reported results.

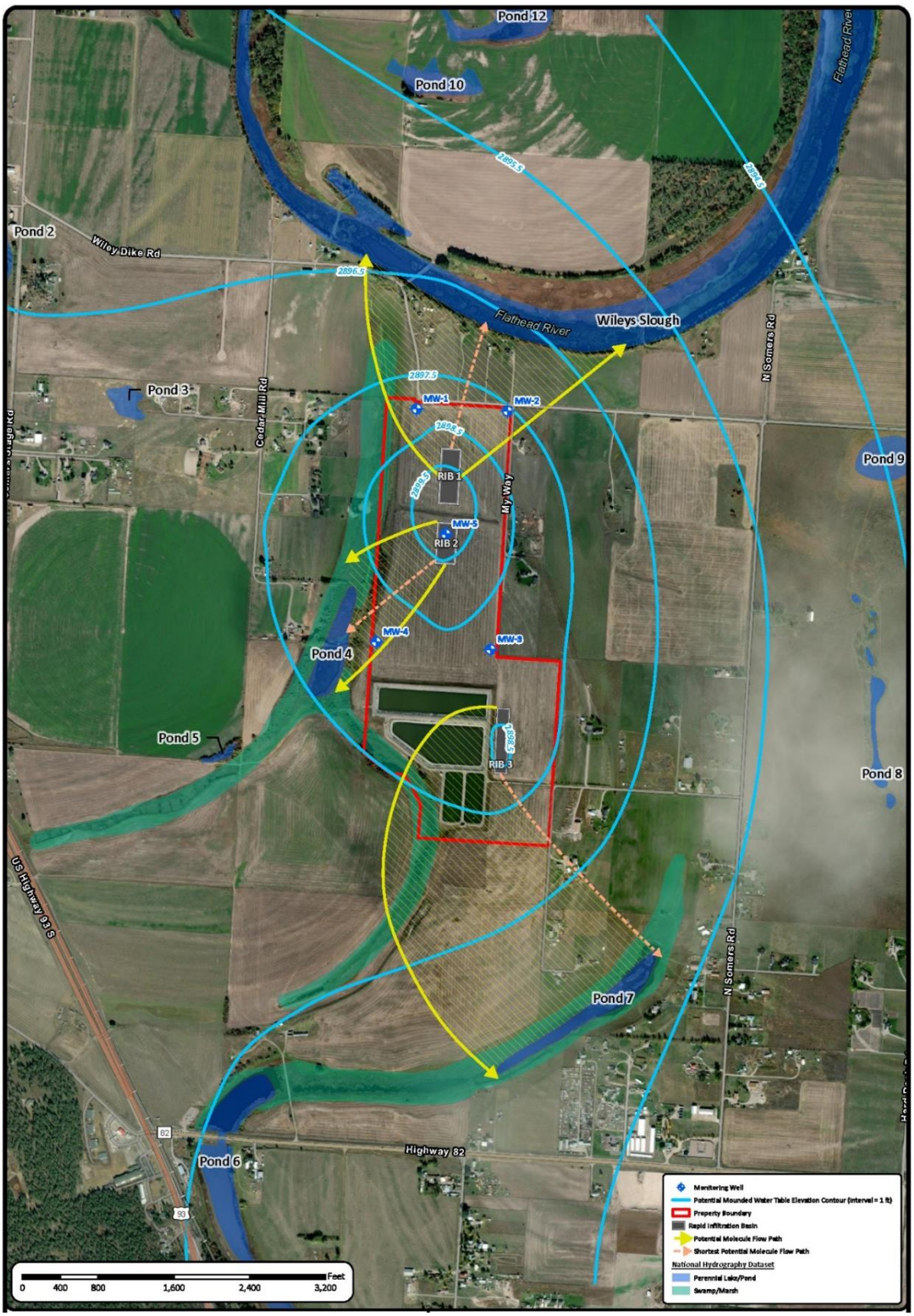

Figure 16: Predicted flow paths from each RIB to the nearest surface water body used in phosphorus and nitrogen nonsignificance calculations.

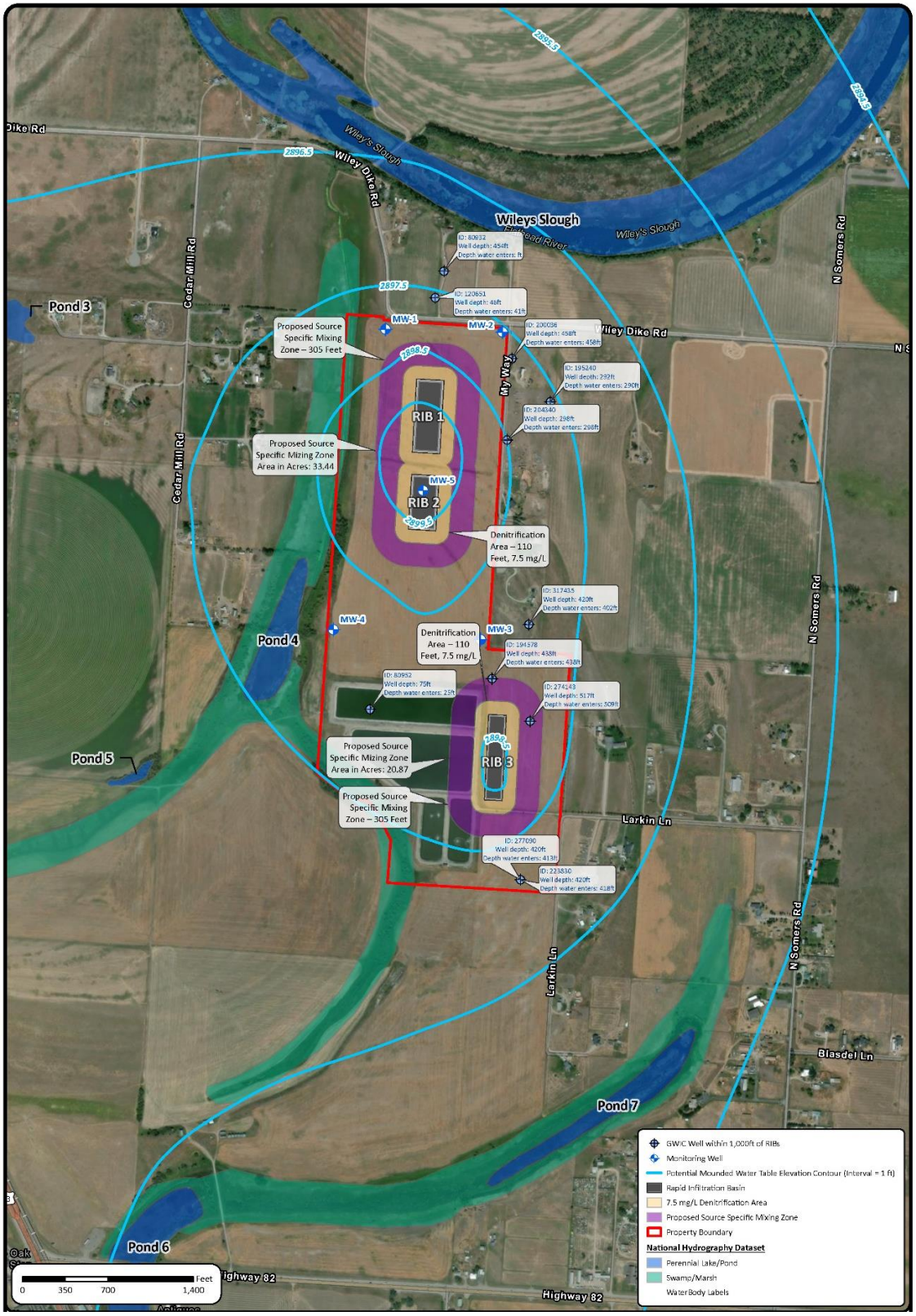

Figure 17: Proposed source specific mixing zone dimensions. Purple zones are the extent at which 4-log microbial deactivation is achieved, tan zones are the distance at which 7.5 mg/L total nitrogen is achieved. Also pictured are nearby wells with depth and screen interval labeled.

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 of Class I ground waters are:

- 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. The water quality standards include:

- 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 (*Escherichia coli*)	CFU/100mL	< 1	-	-
Nitrogen, Nitrate + Nitrite (as N)	mg/L	10.0	T	7.5
Nitrogen, Total (TN)[4]	mg/L	10.0	-	7.5
Phosphorus, Total Inorganic	-	-	H	Surface water breakthrough time greater than 50 years[5]

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) 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).
(5) 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 that has existing conditions better than the water quality standards must be maintained in 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.

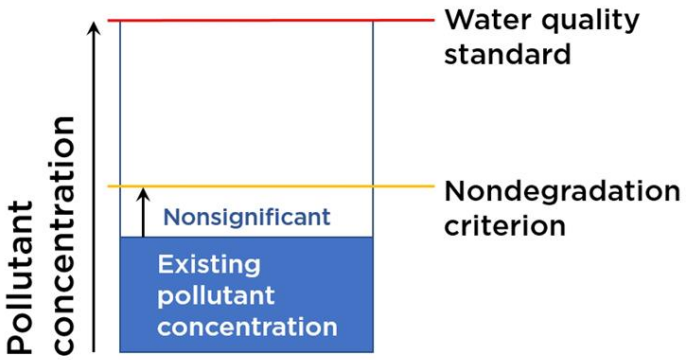

Figure 18: Nonsignificance schematic

DEQ performed a significance determination analysis for the proposed project and found that it is not a significant activity.

3.3 SIGNIFICANCE CRITERIA AND DETERMINATION

3.3.1 Nitrogen

Changes of nitrate as nitrogen in ground water are nonsignificant if the discharge will not cause degradation of surface water and the predicted concentration of nitrate as nitrogen at the boundary of the ground water mixing zone does not exceed 7.5 mg/L. Using the nonsignificance criterion of 7.5 mg/L, DEQ will establish effluent limitations and long-term monitoring requirements for compliance at the end of the mixing zone (**Sections 5.0 and 6.0**).

The proposed SBR treatment alone is nearly capable of meeting the nonsignificance criteria for nitrogen. DEQ did however perform a significance determination in predicting nitrate values downgradient of the proposed discharge structure. The new wastewater system design along with on-site ground water characteristics (**Section 2.7**), dilution estimates (**Section 4.0**), and attenuation estimates (**Appendix C**) were used in these projections.

If we look at dilution alone, the proposed mixing zones will result in nitrogen concentrations lower than the nonsignificance criteria of 7.5 (**Appendix B**). The nitrate concentrations at the end of a 305-ft mixing zone are: 7.45 mg/L for RIB #1, 7.04 mg/L for RIB #2, and 6.65 mg/L for RIB #3. The volume of ground water available for dilution is based on only a portion of the 305-ft radial mixing zone. See **Section 4.0** for a discussion of available dilution.

DEQ also considered natural nitrogen losses in the subsurface. Nitrogen attenuation will result in nitrate degradation to 0.9 mg/L at the end of the 305-ft mixing zone, which is well below the 7.5 mg/L nonsignificance criteria. Additionally, the surface water standard (0.275 mg/L) will be achieved at 469 ft away from the RIBs, and non-detect levels (0.01 mg/L) will be achieved at 930 ft away from the RIBs. The attenuation estimate used first-order denitrification rates of the aquifer to determine nitrogen losses. These results are consistent with WET's nitrate attenuation calculations (**Appendix A**). The attenuation estimates demonstrate that the discharge likely will not affect the nearby surface waters.

To be conservative, the proposed total nitrogen effluent limit will be calculated solely on the predicted amount of dilution from a portion of the 305-ft radial source specific mixing zone, and not on attenuation or the total mixing zone area. Additional attenuation sources may include a 25% reduction in the vadose zone for the designed RIBs and hyporheic losses within riparian zones of the nearby surface waters. Between all of these denitrification zones, we consider the Water Quality Based Effluent Limit to be protective and unlikely to lead to exceedances of surface water nonsignificance criteria in nearby water bodies.

Ongoing monitoring will be used to quantify the attenuation projections to ensure that any permitted future increase in wastewater loading will meet significance criteria at the end of the mixing zone.

3.3.2 Phosphorus

For phosphorus, a 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 based on the adsorption capacity of the soil. Breakthrough occurs when the subsurface soils lose their capability to adsorb any more phosphorus, and it has a potential to reach surface water.

WET conducted a phosphorus breakthrough analysis as part of the 2024 Technical Memo (**Appendix A – Attachment K**). They assumed that half of the discharge from each RIB will flow to the nearest surface water due to the radial flow that will result from the ground water mounding. They used an effluent discharge of 40,000 gpd for RIB #1 and found a breakthrough of 60 years, 30,000 gpd for RIB#2 and found a breakthrough of 92 years, and 30,000 gpd for RIB #3 and found a breakthrough of 300 years.

To be conservative, DEQ assumed all the effluent will flow to the nearest surface water. Using the full design capacities of each RIB in **Table 1**, RIB dimensions provided by WET, and distances to nearest surface water in **Table 5**, DEQ calculated a breakthrough of 30 years for RIB #1, 46 years for RIB #2, and 150 years for RIB #3. See **Appendix D** for these projections.

Because breakthrough times less than 50 years are considered significant, DEQ developed total phosphorus limits for Outfalls 001 and 002 based on a projected 50-year breakthrough. This will prevent degradation of downgradient surface water to ensure that changes in water quality are nonsignificant. Limit development is discussed in **Section 5.2**. The discharge permit requires that the permittee complies with these established limitations on a long-term basis.

3.4 REASONABLE POTENTIAL

The phosphorus breakthrough analysis is based upon distance and time to nearest surface water, inherently addressing the potential for degradation of surface water. Therefore, the analysis of reasonable potential for surface water degradation in this section is limited to nitrogen.

DEQ recognizes that ground water and surface waters are hydraulically connected in the lower Flathead Valley. See **Sections 2.4 and 2.6** for further discussion of ground water and surface water interactions near the facility. DEQ evaluated the fate of nitrogen (in the form of nitrate) associated with the discharge of wastewater from the proposed facility.

DEQ performed attenuation calculations to determine potential losses of nitrogen due to naturally occurring denitrifying conditions in the subsurface. The result of the evaluation is as follows. Using Darcy's Law, the ground water velocity ranges between 0.32 and 1.49 ft/day, with an average of 0.9 ft/day. Given this velocity, it will take approximately 337 days for the discharge to reach the end of a 305 ft mixing zone. Using the distances from **Table 5**, it will take on average 4 years for ground water to flow from RIB #1 to Wiley Slough, 3.5 years for ground water from RIB #2 to reach Pond 4, and 7.7 years for ground water from RIB #3 to reach Pond 7. During that time, nitrate naturally decays from biogeochemical processes that occur in the aquifer (McCray, 2005).

The results show that nitrate may decay to the numeric surface water quality standard (0.275 mg/L) at an average distance of 469 feet away from the RIBs. Furthermore, nitrate will decay to minimum detection levels (0.01 mg/L) at an average distance of 930 ft away from the RIBs, which is still several hundred feet from the nearest surface water from each RIB. At the end of the 305 ft mixing zone, nitrate will decay down to 0.9 mg/L. These projections demonstrate that the nitrogen discharged to ground water may not result in measurable impacts to surface water.

The nitrogen attenuation projections are located in **Appendix C**. DEQ was conservative in these projections. Additional sources of attenuation not used may include a 25% reduction in the vadose zone for the designed rapid infiltration basins (outfall), and hyporheic losses within riparian zones of nearby wetlands. DEQ will require monitoring within the next permit cycle to quantify these reductions.

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.

3.5 CUMULATIVE EFFECTS

As discussed in **Section 3.4**, DEQ evaluated the fate of nitrogen (in the form of nitrate) associated with the discharge of wastewater from the proposed facility. DEQ predicts that nitrate will decay to the surface water quality standard within 469 feet of the outfalls, and to non-detect levels within 930 feet of the outfalls. This is still several hundred feet from each outfall to the nearest surface water (**Table 5**). DEQ was conservative in these predictions as it did not include additional reduction that may occur in the vadose and hyporheic zones. These projections are included in **Appendix C.**

There are approximately five houses located between Outfall 001 and Wiley Slough, zero houses between Outfall 002 and Pond 4, and six houses between Outfall 003 and Pond 7. Aquifer impacts from the discharge of these septic systems within this large area are seen as negligible due to dilution and natural attenuation. In addition, impacts from any potential upgradient source may also be negligible as ambient nitrate concentrations are very low (0.11 mg/L; **Table 4**).

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. These data are 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.

Based on the dimensions of the mixing zone and the hydrogeologic characteristics (**Section 2**), 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 (ft^3/day); K = hydraulic conductivity (ft/day); I = hydraulic gradient (ft/ft); and A = cross-sectional area (ft^2) of flow at the downgradient boundary of the mixing zone.

The applicant requested a source specific mixing zone for this discharge. The source specific mixing zone extends from each RIB by 305 feet. The radial source specific mixing zone accounts for the radial flow resulting from the ground water mound and will ensure setbacks are maintained at an appropriate distance from the mound.

However, only a portion of the source specific mixing zone will be used for dilution purposes; the portion that demonstrably flows to surface water. This is protective because it assumes that the entire discharge will flow to surface water and uses overall less dilution, leading to more stringent effluent limits. Biotic processes and attenuation are not considered as part of the effluent limit calculation.

A schematic of the proposed mixing zone is provided in **Figure 19**. The volume of available dilution is represented by the red outline.

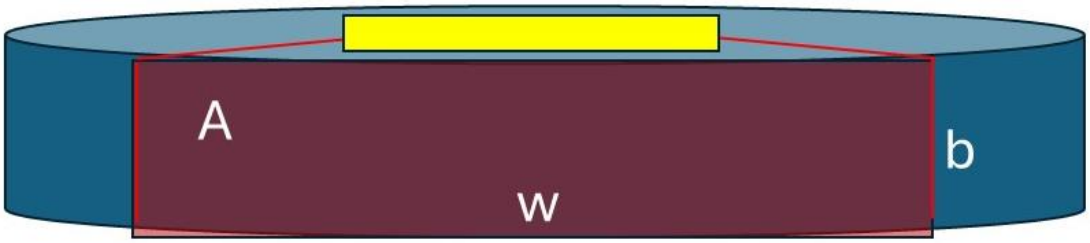

Figure 19: Mixing zone schematic. The yellow rectangle is a RIB, and the blue cylinder is the source specific mixing zone extending from the RIB with a radius of 305 ft. The red box *A* is the cross-sectional area of a downgradient slice of aquifer, where *b* is the aquifer thickness and *w* is an estimate of the width of the mixing zone that will travel to surface water.

The cross-sectional area is found by multiplying the downgradient width of the mixing zone, which is typically the width of the source in the direction of ground water flow plus the tangent of the dispersion angle on both sides, by the aquifer thickness. A standard dispersion angle of 5 degrees was used for 002

and 003, but WET found a dispersion angle of 12.5 degrees to be more appropriate for 001 (**Table 7**; **Appendix A**).

A summary of aquifer characteristics, mixing zone dimensions, and dilution calculations are provided in **Table 7**. See **Figure 20** for the dilution area illustrated over the source-specific mixing zone. The aquifer test information is provided in **Appendix A.**

Required ground water monitoring will lead to more information regarding the effects the mound will have on dilution and effluent concentrations downgradient. Future permits may address the suitability of the circular source specific mixing zone and reevaluate the geometry of the portion used for dilution.

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.

Table 7: Hydrogeologic and Mixing Zone Information		
All Outfalls		
Parameter	**Units**	**Value**
Mixing Zone Type	-	Source Specific
Authorized Parameters	-	Total Nitrogen
Ambient Ground Water Concentrations, Nitrate + Nitrite	mg/L	0.11
Hydraulic Conductivity (K)	feet/day	49.0
Hydraulic Gradient (I)	ft/ft	0.0030
Outfall 001		
Ground Water Flow Direction	azimuth/bearing	N 15° E
Length of Mixing Zone	feet	305
Thickness of Mixing Zone	feet	15
Outfall Width, Perpendicular to Ground Water Flow Direction	feet	225
Dispersion angle	degrees	12.5
Width of Mixing Zone at Down Gradient Boundary	feet	360
Cross Sectional Area of Mixing Zone (A)	ft^2	5,404
Volume of Ground Water Available for Mixing (Q_{gw})	ft^3/day	794
Outfall 002		
Ground Water Flow Direction	azimuth/bearing	S 50° W
Length of Mixing Zone	feet	305
Thickness of Mixing Zone	feet	15
Outfall Width, Perpendicular to Ground Water Flow Direction	feet	450
Dispersion angle	degrees	5
Width of Mixing Zone at Down Gradient Boundary	feet	503
Cross Sectional Area of Mixing Zone (A)	ft^2	7,551
Volume of Ground Water Available for Mixing (Q_{gw})	ft^3/day	1,110
Outfall 003		
Ground Water Flow Direction	azimuth/bearing	S 40° W
Length of Mixing Zone	feet	305
Thickness of Mixing Zone	feet	15
Outfall Width, Perpendicular to Ground Water Flow Direction	feet	700
Dispersion angle	degrees	5
Width of Mixing Zone at Down Gradient Boundary	feet	753
Cross Sectional Area of Mixing Zone (A)	ft^2	11,301
Volume of Ground Water Available for Mixing (Q_{gw})	ft^3/day	1,661

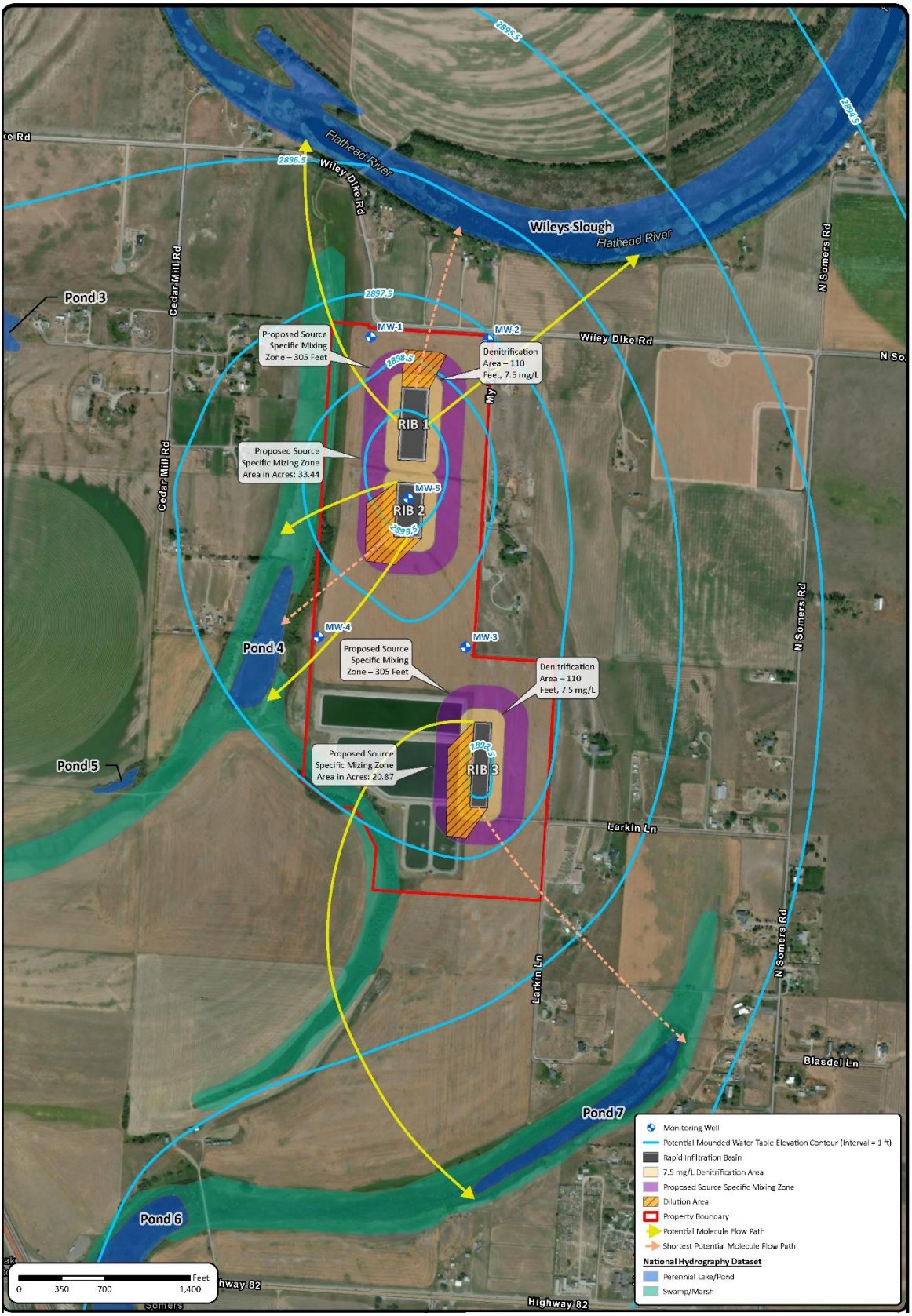

Figure 20: Mixing zone map with dilution area in orange.

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:

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

Where C_{limit} = concentration-based effluent limit; C_{std} = water quality standard concentration; Q_{gw} = ground water available for mixing; Q_{eff} = design capacity of wastewater system; and C_{gw} = ambient receiving ground water concentration.

Numeric effluent limits are often expressed as loads which inherently 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 (mg/L); Q_{eff} = design capacity of wastewater system (gpd); and, f_{con} = conversion factor of 8.34×10^{-6}.

See **Appendix E** for the total nitrogen effluent limit calculations. See **Table 8** for final effluent limitations.

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 3.3.2**, the phosphorus breakthrough analysis estimated the phosphorus breakthrough to occur in 30 years for 001 and 46 years for 002. Therefore, a limit has been developed for Outfalls 001 and 002 based on a predicted 50-year breakthrough. This will prevent degradation of downgradient surface water to ensure that changes in water quality are nonsignificant. The phosphorus breakthrough analysis and supporting calculations are provided in **Appendix D**.

To develop the total phosphorus limits, DEQ back-calculates the annual load required to produce a 50-year breakthrough given the adsorption capacity of the soils between the source and surface waters. This is described by the following equation:

$$Pt = \frac{P1}{BT}$$

Where Pt is the total phosphorus load (lbs/yr), $P1$ is the total phosphorus adsorption of soils (lbs), and BT is the breakthrough time of 50 years.

See **Appendix F** for total phosphorus calculations. See **Table 8** for the final effluent limits.

5.3 FINAL EFFLUENT LIMITATIONS

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

Table 8: Final Effluent Limitations

Outfall	Parameter	Units	Quarterly Average	Annual Average
001	Nitrogen, Total (as N)	lbs/day	5.4	-
	Phosphorus, Total (as P)	lbs/year	-	291
002	Nitrogen, Total (as N)	lbs/day	4.3	-
	Phosphorus, Total (as P)	lbs/year	-	337
003	Nitrogen, Total (as N)	lbs/day	4.5	-
	Phosphorus, Total (as P)	lbs/year	-	-

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.
Annual load calculation: The annual average of all individual daily concentrations and total annual flows must be used in the load calculations. Calculation rules are provided within the Wastewater Monitoring Tables.

6.0 MONITORING AND REPORTING

6.1 EFFLUENT MONITORING

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**. The permittee must develop and implement a Wastewater Sampling, Analysis, and Reporting Operation Manual. This manual is further discussed in **Section 7.1**.

Table 9: Influent and Effluent Monitoring and Reporting Requirements

Analyte/Measurement	Monitor Location	Units	Sample Type(1)	Minimum Sample Frequency	Reporting Requirements(1)(2)	Report Frequency
Escherichia coli Bacteria	INF-00A EFF-00A	CFU/100ml	Grab	1/Month	Monthly Average(3)	Monthly
Flow Rate, Effluent(4)	FM-001 FM-002 FM-003	gal/day	Contin-uous	Contin-uous	Daily Maximum Monthly Average(5)	Monthly
	FM-001 FM-002 FM-003	gal/month	Contin-uous	Contin-uous	Monthly Total	Monthly
	FM-001 FM-002 FM-003	gal/year	Contin-uous	Contin-uous	Annual Total	Annually(9)
Nitrogen, Nitrite+Nitrate [as N]	INF-00A EFF-00A	mg/L	Grab	1/Month	Daily Maximum Monthly Average	Monthly
Nitrogen, Total Ammonia [as N]	INF-00A EFF-00A	mg/L	Grab	1/Month	Daily Maximum Monthly Average	Monthly
Nitrogen, Total Kjeldahl (TKN)[as N]	INF-00A EFF-00A	mg/L	Grab	1/Month	Daily Maximum Monthly Average	Monthly
Nitrogen, Total [as N](6)	INF-00A EFF-00A	mg/L	Calculate	1/Month	Daily Maximum Monthly Average	Monthly
	EFF-001 EFF-002 EFF-003	lbs/day(7)	Calculate	1/Month	Daily Maximum Monthly Average	Monthly
Phosphorus, Total [as P]	INF-00A EFF-00A	mg/L	Grab	1/Month	Daily Maximum Monthly Average	Monthly
	EFF-001	lbs/day(7)	Calculate	1/Month	Monthly Average	Monthly
	EFF-002 EFF-003	lbs/year(8)	Calculate	1/Month	Annual Average	Annually(9)

Footnotes:
See **Table 1** for a description of the different monitoring locations.
CFU = Colony Forming Units
If no discharge occurs throughout the reporting period, "no discharge" shall be recorded on the wastewater Discharge Monitoring Report (DMR) report forms.
Parameter analytical methods shall be in accordance with the Code of Federal Regulations, 40 CFR Part 136, unless specified above or within a deviation authorized by DEQ.
(1) See definitions in Part V of the permit unless defined within this table or by a permit condition.
(2) Monthly Average: The average of all individual daily concentrations (mg/L) analyzed during the monthly reporting period.
(3) The geometric mean must be reported if multiple samples are taken during a reporting period.
(4) Requires recording device and/or totalizing meter. Equipment must be capable of recording daily, quarterly, and annual effluent volumes.
(5) Monthly Average Flows: determine total flows (gal/month) that occurred during the month reporting period. Divide total flow by the number of calendar days in the monthly reporting period to get a unit of daily flow (gal/day).

(6) Total Nitrogen is the sum of Nitrate + Nitrite and Total Kjeldahl Nitrogen.
(7) Monthly Load Calculation. Determine concentration (mg/L): use the average of all individual daily concentrations (mg/L) analyzed during the monthly reporting period. Determine totalized monthly flows (gal/month): total flow that occurred during the monthly reporting period. Convert to a daily flow average (gal/day): divide the total quarterly flow (gal/month) by the total calendar days (days) of the monthly reporting period. Calculate monthly load (lbs/day): concentration (mg/L) x flow (gal/day) x [$8.34x10^{-6}$].
(8) Annual Load Calculation. Determine concentration (mg/L): use the average of all reported daily concentrations (mg/L) reported during the annual reporting period. Determine totalized annual flows (gal/year): total flow that occurred during the annual reporting period. Convert to daily flows (gal/day): divide the total annual flow (gal/year) by the total calendar days (days) of the reporting annual period. Calculate annual load (lbs/year): = concentration (mg/L) x flow (gal/day) x [8.34×10^{-6}] x 365 (days/year).
(9) Annual average load and annual flows shall be reported (DMR) on an annual basis (due January 28 each year of the permit cycle).

6.2 GROUND WATER MONITORING

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**. The permittee must develop and implement a Ground Water Monitoring, Analysis, and Reporting Operational Manual. This manual is further discussed in **Section 7.3**.

Reporting must be completed in 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 10: Ground Water Monitoring and Reporting Requirements

Analyte/Measurement	Monitor Location	Units	Sample Type(1)	Minimum Sampling Frequency	Reporting(2) Requirements	Report Frequency
Chloride [as Cl]	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	mg/L	Grab	1/Month	Monthly Average	Monthly
Escherichia coli Bacteria	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	CFU/100ml	Grab	1/Month	Monthly Average(3)	Monthly
Nitrogen, Nitrite + Nitrate [as N]	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	mg/L	Grab	1/Month	Monthly Average	Monthly
Nitrogen, Total Ammonia [as N]	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	mg/L	Grab	1/Month	Monthly Average	Monthly
Nitrogen, Total Kjeldahl (TKN)[as N]	MW-1 MW-2 MW-3 MW-4 MW-6	mg/L	Grab	1/Month	Monthly Average	Monthly

	MW-7					
Nitrogen, Total [as N][4]	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	mg/L	Calculate	1/Month	Monthly Average	Monthly
Specific Conductivity @ 25°C	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	µS/cm	Grab or Instant-aneous	1/Month	Monthly Average	Monthly
Temperature	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	°C	Instant-aneous	1/Month	Monthly Average	Monthly
Static Water Level (SWL)[5]	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	ft-bmp	Instant-aneous	1/Month	Monthly Average	Monthly
Well Depth[5]	MW-1 MW-2 MW-3 MW-4 MW-6 MW-7	ft-bmp	Instant-aneous	1/Month	Monthly Average	Monthly

Footnotes:
CFU = Colony Forming Units
ft-bmp = feet below measuring point
Monitoring for MW-1, MW-2, MW-3, and MW-4 commences upon the permit effective date.
Monitoring for MW-6 and MW-7 shall commence on the Completion Date listed in the Compliance Table.
A description of each monitoring well can be found in **Table 2** of the Fact Sheet.
At no time shall the permittee mark or state "no discharge" on any monitoring well DMR form.
Each monitor well to be individually monitored and sampled for the analyte and measurements respectively listed.
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.
Samples must not be collected until after the well casing is properly purged as determined by the DEQ approved Ground Water Monitoring Operational Manual.
Submittal of discharge monitoring report forms (DMRs) will be required, regardless of the operational status of the facility or of each individual monitoring well.
(1) See definitions in Part V of the permit unless defined within this table or by a permit condition.
(2) Monthly Average: The average of all individual daily concentrations (mg/L) analyzed during the monthly reporting period.
(3) The geometric mean must be reported if more than one sample is taken during a reporting period.
(4) Total Nitrogen is the sum of Nitrate + Nitrite and Total Kjeldahl Nitrogen.
(5) 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 SEPTAGE HANDLING AND TREATMENT OPERATION MANUAL

The permittee shall use best management practices (BMPs) in developing standard operating procedures (SOPs) for handling and treating high-strength influent from septage pumpers. The manual needs to be site-specific and maintained at the facility at all times. The manual must include procedures for:

- Handling and treating the septage.
- Ensuring that there are no unexpected wastes in the septage, including: industrial wastes, chemicals or chemical dumping, or any other wastes that may be injurious to the treatment system and/or receiving water.
- Equalizing the high-strength septage into the residential-strength municipal waste stream.
- General safety for operational personnel.

The completion and submittal date for the manual is listed in **Section 8.0.** The manual must be reviewed and approved by DEQ prior to implementation. Influent monitoring requirements are detailed in **Section 6.1**. All subsequent amended manuals must be reported to DEQ within 30 calendar days.

7.2 WASTEWATER SAMPLING, ANALYSIS, AND REPORTING OPERATION MANUAL

The permittee shall use BMPs in developing SOPs for sampling, analyzing, and reporting wastewater characteristics from the wastewater system. The manual needs to be site-specific and result in monitoring and reporting that is representative of the nature of the wastewater streams. The manual must be used as a guide in:

- Equipment calibration.
- Preparing and collecting wastewater influent (INF-00A) and effluent (EFF-00A) wastewater samples.
- Analyte calculations (**Table 9**).
- Recording and reporting wastewater characteristics.
- Recording and reporting wastewater flows (FM-001, FM-002, FM-003)
- Calculating and reporting wastewater loads (EFF-001, EFF-001, EFF-003).

The completion and submittal date for the manual is listed in **Section 8.0.** The manual must be reviewed and approved by DEQ prior to implementation. The permittee shall maintain a copy of the operational manual, sampling, and calibration records at the facility at all times. Wastewater monitoring requirements are detailed in **Section 6.1**. All subsequent amended manuals must be reported to DEQ within 30 calendar days.

7.3 GROUND WATER MONITORING, ANALYSIS, AND REPORTING OPERATIONAL MANUAL

The permittee shall use Best Management Practices (BMPs) in developing SOPs (Standard Operating Procedures) for sampling, analyzing, and reporting ground water characteristics. The SOP manual must be site-specific and result in monitoring and reporting that is representative of the nature of the shallow ground water bearing zone. The manual must provide for consistent identification, development,

monitoring, sampling, calculating, recording, and reporting of the monitoring wells. The manual must provide guidance on determining and documenting dry-well occurrences; and determining future well viability. DEQ recommends using the Montana Bureau of Mines and Geology Open-File Report 746 titled Standard Procedures and Guidelines for Field Activities (MBMG, 2021) as a reference in developing a site-specific operational manual.

The completion and submittal date of the manual is listed in **Section 8.0**. The manual must be reviewed and approved by DEQ prior to implementation. The permittee shall maintain a copy of the manual, monitoring well development records, dry well occurrence records, sampling records, and calibration records at the facility at all times. Ground water monitoring requirements are discussed in **Section 6.2**. All subsequent amended manuals must be reported to DEQ within 30 calendar days.

7.4 MONITORING WELL INSTALLATION PLAN

Submit for approval an installation plan for a minimum of two additional monitoring wells. At least one monitoring well (MW-6) must be built on or near the downgradient boundary of the proposed mixing zone between RIB #2 and Pond 4. At least one monitoring well (MW-7) must be built on or near the downgradient boundary of the proposed mixing zone extending from RIB #3 in the direction of Pond 7. Well locations should take setbacks into account. The well must be constructed to be representative of ground water occurring in the top twenty feet of the shallow aquifer or as otherwise approved.

The plan needs to be approved prior to installation of the monitoring well(s). All monitoring wells must be secured, maintained, labeled, and monitored for long-term viability. The completion and submittal date of the plan is listed in **Section 8.0**.

The installation date for the additional monitoring wells is also provided in **Section 8.0**. A post construction report documenting lithology, drilling and construction techniques, well construction information and diagram, surveyed spatial location and measuring point is due two months after installation. All new wells must be reported to the Montana Bureau of Mining and Geology's Ground Water Information Center.

Installation and post construction reports are required for all subsequent well installation and modification actions.

DEQ recognizes the challenges faced with well installation efforts in the field. Upon approval, modification to the plan can be made when challenging field conditions occur.

7.5 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.

7.6 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.

8.0 COMPLIANCE SCHEDULE

The actions listed in **Table 11** must be completed on or before the respective scheduled completion date. A report documenting each respective action must be received by DEQ on or before the scheduled reporting 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
Develop and implement a **Septage Handling and Treatment Operation Manual**.	Single event	Within one (1) year of the effective date of the permit or upon finalizing the WWTP design, whichever is sooner.	Due on or before the 28th day of the month following the completion date.
Develop and implement a **Wastewater Sampling, Analysis, and Reporting Operation Manual.**	Single event	Within one (1) year of the effective date of the permit or upon finalizing the WWTP design, whichever is sooner.	Due on or before the 28th day of the month following the completion date.
Develop and implement a **Ground Water Monitoring, Analysis, and Reporting Operational Manual.**	Single event	Within one (1) year of the effective date of the permit or upon finalizing the WWTP design, whichever is sooner.	Due on or before the 28th day of the month following the completion date.
Complete a **Monitoring Well Installation Plan**.	Single event	Within one (1) year of the effective date of the permit or upon finalizing the WWTP	Due on or before the 28th day of the month following the completion date.

		design, whichever is sooner.	
Complete the installation of the monitoring well(s).	Single event	Within two (2) years of the effective date of the permit or prior to finalizing the WWTP construction, whichever is sooner.	Due on or before the 28th day of the month following the completion date.
Commence monitoring and reporting of the newly installed monitoring well(s).	Single event	Within two (2) years of the effective date of the permit or prior to commencing discharge, whichever is sooner.	Due on or before the 28th day of the month following the completion date.
Complete a **Monitoring Well Installation Report**.	Single event	Within two (2) years of the effective date of the permit or prior to commencing discharge, whichever is sooner.	Due on or before the 28th day of the month following the completion date.
Complete a **Well Abandonment Report.**	Single event	Within two (2) years of the effective date of the permit or prior to finalizing the WWTP construction, whichever is sooner.	Due on or before the 28th day of the month following the completion date.

9.0 PUBLIC NOTICE

Legal notice information for water quality discharge permits is 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 **December XX, 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 (MTX000307), 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

FR § 136. 2011. Guidelines Establishing Test Procedures for the Analysis of Pollutants.

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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- Circular DEQ-2 – Design Standards for Wastewater Facilities.
  - Appendix A: Handling and Treatment of Septage at a Wastewater Treatment Plant
- 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.

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APPENDIX A TECHNICAL MEMORANDUM, WET 2024

See Page 70.

APPENDIX B NITRATE DILUTION PROJECTIONS

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

Montana Ground Water Pollution Control System

Ground Water Dilution Projection (GWDP) - Nondegradation Significance Analysis

These projections estimate the parameter concentrations in the aquifer downgradient of the subsurface discharge. After dilution with ground water, the projected concentration is compared to the respective significance criteria in determining nonsignificant changes in water quality (ARM 17.30.715).

Site Name:	LCWSD Rapid Infiltration System
Location:	Wiley Dike Rd, Kalispell, MT 59901
Permit #:	MTX000307, **Outfall 001 (RIB #1)**
Notes:	Design Capacity = 80,000 gpd; 10,694 ft^3/d
-	These calculations are for the following parameter of interest: Nitrate
-	These calculations use the most restrictive ground water standard.
-	These calculations do not credit potential losses due to chemical transformation.
-	These calculations do not credit potential losses due to attenuation.

Projected Concentration Calculation

$$Cr = \frac{(Qd)(Cd) + (Qs)(Cs)}{Qd + Qs}$$

The Activity is Not Significant if Cr < Significance Criteria

GWDP(a) - Ground Water Nitrate Projection at the End of the Mixing Zone.

Qd =	**10694**	ft^3/d	Design capacity - effluent flow rate
Cd =	**8.0**	mg/L	Concentration - effluent (treated wastewater)
	305	ft	Length of ground water dilution zone
	15	ft	Thickness of dilution zone
	225	ft	Outfall width, perpendicular to ground water flow direction
	12.5	°	Dispersion angle
	360	ft	Projected width of downgradient dilution zone
	5404	ft^2	Cross sectional area of dilution zone (A)
	49	ft/d	Hydraulic conductivity (K)
	0.0030	ft/ft	Hydraulic gradient (I)
Qs(Qgw) =	**794**	ft^3/d	Ground water volume (Qgw)
Cs =	**0.105**	mg/L	Ambient nitrate concentration in ground water
Cr =	**7.45**	mg/L	Projected concentration - end of the mixing zone
Sign. Criteria =	**7.5**	mg/L	Nonsignificance Criteria, ARM 17.30.715
Sign. Activity?	**< 7.5**	mg/L	**The activity is not significant**

By Melinda Horne, July 2024

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

Montana Ground Water Pollution Control System

Ground Water Dilution Projection (GWDP) - Nondegradation Significance Analysis

These projections estimate the parameter concentrations in the aquifer downgradient of the subsurface discharge. After dilution with ground water, the projected concentration is compared to the respective significance criteria in determining nonsignificant changes in water quality (ARM 17.30.715).

Site Name:	LCWSD Rapid Infiltration System
Location:	Wiley Dike Rd, Kalispell, MT 59901
Permit #:	MTX000307, **Outfall 002 (RIB #2)**
Notes:	Design Capacity = 60,000 gpd; 8,021 ft^3/d
-	These calculations are for the following parameter of interest: Nitrate
-	These calculations use the most restrictive ground water standard.
-	These calculations do not credit potential losses due to chemical transformation.
-	These calculations do not credit potential losses due to attenuation.

Projected Concentration Calculation

$$Cr = \frac{(Qd)(Cd) + (Qs)(Cs)}{Qd + Qs}$$

The Activity is Not Significant if Cr < Significance Criteria

GWDP(a) - Ground Water Nitrate Projection at the End of the Mixing Zone.

Qd =	**8021**	ft^3/d	Design capacity - effluent flow rate
Cd =	**8.0**	mg/L	Concentration - effluent (treated wastewater)
	305	ft	Length of ground water dilution zone
	15	ft	Thickness of dilution zone
	450	ft	Outfall width, perpendicular to ground water flow direction
	5	°	Dispersion angle
	503	ft	Projected width of downgradient dilution zone
	7551	ft^2	Cross sectional area of dilution zone (A)
	49	ft/d	Hydraulic conductivity (K)
	0.0030	ft/ft	Hydraulic gradient (I)
Qs(Qgw) =	**1110**	ft^3/d	Ground water volume (Qgw)
Cs =	**0.105**	mg/L	Ambient nitrate concentration in ground water
Cr =	**7.04**	mg/L	Projected concentration - end of the mixing zone
Sign. Criteria =	**7.5**	mg/L	Nonsignificance Criteria, ARM 17.30.715
Sign. Activity?	**<7.5**	mg/L	**The activity is not significant**

By Melinda Horne, July 2024

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

Montana Ground Water Pollution Control System

Ground Water Dilution Projection (GWDP) - Nondegradation Significance Analysis

These projections estimate the parameter concentrations in the aquifer downgradient of the subsurface discharge. After dilution with ground water, the projected concentration is compared to the respective significance criteria in determining nonsignificant changes in water quality (ARM 17.30.715).

Site Name:	LCWSD Rapid Infiltration System
Location:	Wiley Dike Rd, Kalispell, MT 59901
Permit #:	MTX000307, **Outfall 003 (RIB #3)**
Notes:	Design Capacity = 60,000 gpd; 8,021 ft^3/d
-	These calculations are for the following parameter of interest: Nitrate
-	These calculations use the most restrictive ground water standard.
-	These calculations do not credit potential losses due to chemical transformation.
-	These calculations do not credit potential losses due to attenuation.
-	

Projected Concentration Calculation

$$Cr = \frac{(Qd)(Cd) + (Qs)(Cs)}{Qd + Qs}$$

The Activity is Not Significant if Cr < Significance Criteria

GWDP(a) - Ground Water Nitrate Projection at the End of the Mixing Zone.

Qd =	**8021**	ft^3/d	Design capacity - effluent flow rate
Cd =	**8.0**	mg/L	Concentration - effluent (treated wastewater)
	305	ft	Length of ground water dilution zone
	15	ft	Thickness of dilution zone
	700	ft	Outfall width, perpendicular to ground water flow direction
	5	°	Dispersion angle
	753	ft	Projected width of downgradient dilution zone
	11301	ft^2	Cross sectional area of dilution zone (A)
	49	ft/d	Hydraulic conductivity (K)
	0.0030	ft/ft	Hydraulic gradient (I)
Qs(Qgw) =	**1661**	ft^3/d	Ground water volume (Qgw)
Cs =	**0.105**	mg/L	Ambient nitrate concentration in ground water
Cr =	**6.65**	mg/L	Projected concentration - end of the mixing zone
Sign. Criteria =	**7.5**	mg/L	Nonsignificance Criteria, ARM 17.30.715
Sign. Activity?	**<7.5**	mg/L	**The activity is not significant**

By Melinda Horne, July 2024

APPENDIX C NITRATE ATTENTUATION PROJECTIONS

GW Velocity and Travel Time

Darcy's Law: $GW_v = K * I / n$

K =	49.5	ft/dy
I =	0.003	ft/ft
n =	0.1	low
	0.46	high
GW_v =	0.32	ft/d low
	1.49	ft/d high
	0.90	**ft/d average**

Effective Porosity (Woessner)

Type of Bedrock/Unconsolidated Sediment	Range of n	
Limestone/Dolomite	0.01	0.24
Sandstone	0.10	0.30
Siltstone	0.21	0.41
Clay	0.01	0.18
Silt	0.01	0.39
Sand, fine	0.01	0.46
Sand, medium	0.16	0.46
Sand, coarse	0.18	0.43
Gravel	0.13	0.44

	RIB to end of SSMZ	RIB #1 to Wiley Slough	RIB #2 to Pond 4	RIB #3 to Pond 7
Distance (ft)	305	1335	1160	2540
Travel time (days)	337	1477	1283	2810
Travel time (years)	0.9	4.0	3.5	7.7

Footnotes:

t *travel/residence time*
GW_v *ground water velocity*
K *Hydraulic Conductivity*
I *Hydraulic Gradient*
n *Porosity (effective)*

Conservative, equation considers only horizontal movement
Distance = feet to downgradient (gaining) surface water
Time = travel/residence time in the aquifer
Effective porosity is based on aquifer lithology
Choose porosity based on the primary (major) sediment of the matrix
Use both the low and high porosity values (when a range is provided)
Sources: Brady and Weil, 2002; Woessner and Poeter, 2021.

First-Order Denitrification Rate for Nitrogen (Horizontal Flow)		
0.004 to 2.27	1/day	McCray, Kirkland
0.0065	1/day @ 25th percentile	DEQ, Regensburger

0.275 mg/L	TN standard for surface water
0.01 mg/L	Typical detection level
0.11 mg/L	Ambient level

Integrated Rate Law - First Order Reaction

$\ln[A]_t - \ln[A]_o = -kt$

$(\ln[A]_t - \ln[A]_o) / -k = t$

Rearranged to graph line

First order decline = straight line: y = mx + b

$\ln[A]_t = -kt + \ln[A]_o$

ln	*Natural log*
$[A]_o$	*Initial concentration*
$[A]_t$	*Future concentration*
t	*Travel/residence time*
k	*Decay rate constant*
GW_v	*Ground water velocity*

Total reduction		
$[A]_o$	8	%
$[A]_{t\text{-}MZ}$	0.9	88.75
$[A]_{t\text{-}max}$	0.275	96.56
$[A]_{t\text{-}min}$	0.01	99.88
Range of Reduction %		
	88.75	**99.88**

Time for Reduction to 0.275 mg/L		
$[A]_o$	8	mg/l
$[A]_t$	0.275	mg/l
k	0.0065	1/day
t	**519**	days
Distance for Reduction to 0.275 mg/L		
GW_v avg	0.90	ft/day
Distance avg	**469**	**ft**

Time for Reduction to 0.01 mg/L		
$[A]_o$	8	mg/l
$[A]_t$	0.01	mg/l
k	0.0065	1/day
t	**1028**	days
Distance for Reduction to 0.01 mg/L		
GW_v avg	0.90	ft/day
Distance avg	**930**	**ft**

Denitrification at 305 ft		
$[A]_o$	8	mg/l
$[A]_t$	0.9	mg/l
k	0.0065	1/day
t	**336**	days
Distance for Reduction to 0.9 mg/L		
GW_v avg	0.90	ft/day
Distance avg	**304**	**ft**

Footnotes:
LRL = lab reporting level
RRV = DEQ Circular 7 required reporting value
Conservative, equation considers only horizontal movement
Sources: Brady and Weil, 2002; Kirkland, 2001; Martin and Focht, 1977; McCray et al., 2005; McCray et al., 2009; Parry et al., 2000; & Woessner and Poeter, 2020.

APPENDIX D PHOSPHORUS BREAKTHROUGHS

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME:	LCWSD Rapid Infiltration System - Outfall 001 (RIB #1)
COUNTY:	Flathead
Permit #:	MTX000307
NOTES:	Variables used are based on WET's Technical Memo (2024).
	Design Capacity = 80,000 gpd = 10,694 ft^3/day
	Design total phosphorus concentration = 2.00 mg/L

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	225	ft
L	Length of Primary Drainfield's Long Axis	300	ft
W	Width of Primary Drainfield's Short Axis	225	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4	ft
D	Distance from Drainfield to Surface Water	1335	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils,	1.0	ft
Ne	1.0 ft for fine soils)**		
Sw	Soil Weight (usually constant)	100	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200	ppm
#l	Number of proposed wastewater treatment systems	1	
CONSTANTS			
Pl	Phosphorous Load per proposed wastewater treatment system	487	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
Pt	Total Phosphorous Load = (Pl)(#l)	487	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	27000000	lbs
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	45631969	lbs
P1	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	14526	lbs
SOLUTION			
BT	**Breakthrough Time to Surface Water = P / Pt**	**30**	**years**

NOTES: ** Depth to limiting layer is typically based on depth to water in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*

By Melinda Horne, July 2024

REV. 04/2000

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME:	LCWSD Rapid Infiltration System - Outfall 002 (RIB #2)
COUNTY:	Flathead
Permit #:	MTX000307
NOTES:	Variables used are based on WET's Technical Memo (2024).
	Design Capacity = 60,000 gpd = 8,021 ft^3/day
	Design total phosphorus concentration = 2.00 mg/L

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	450	ft
L	Length of Primary Drainfield's Long Axis	450	ft
W	Width of Primary Drainfield's Short Axis	113	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4	ft
D	Distance from Drainfield to Surface Water	1160	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils, 1.0 ft for fine soils)**	1.0	ft
Ne			
Sw	Soil Weight (usually constant)	100	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200	ppm
#I	Number of proposed wastewater treatment systems	1	
CONSTANTS			
Pl	Phosphorous Load per proposed wastewater treatment system	366	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
Pt	Total Phosphorous Load = (Pl)(#I)	366	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	20250000	lbs
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	63974000	lbs
P1	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	16845	lbs
SOLUTION			
BT	**Breakthrough Time to Surface Water = P / Pt**	46	years

NOTES: ** Depth to limiting layer is typically based on depth to water in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*

By Melinda Horne, July 2024

REV. 04/2000

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME:	LCWSD Rapid Infiltration System - Outfall 003 (RIB #3)
COUNTY:	Flathead
Permit #:	MTX000307
NOTES:	Variables used are based on WET's Technical Memo (2024).
	Design Capacity = 60000 gpd = 8,021 ft^3/day
	Design total phosphorus concentration = 2.00 mg/L

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	700	ft
L	Length of Primary Drainfield's Long Axis	700	ft
W	Width of Primary Drainfield's Short Axis	145	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4	ft
D	Distance from Drainfield to Surface Water	2540	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils, 1.0 ft for fine soils)**	1.0	ft
Ne			
Sw	Soil Weight (usually constant)	100	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200	ppm
#I	Number of proposed wastewater treatment systems	1	
CONSTANTS			
Pl	Phosphorous Load per proposed wastewater treatment system	366	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
Pt	Total Phosphorous Load = (Pl)(#I)	366	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	40600000	lbs
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	234251500	lbs
P1	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	54970	lbs
SOLUTION			
BT	**Breakthrough Time to Surface Water = P / Pt**	150	years

NOTES: ** Depth to limiting layer is typically based on depth to water in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*

By Melinda Horne, July 2024

REV. 04/2000

APPENDIX E TOTAL NITROGEN WQBEL DEVELOPMENT

MASS BALANCE EQUATION ALLOWABLE DISCHARGE CONCENTRATION DETERMINATION		
	L = C2 (mg/L) Q2 (gpd) Fcon (8.34 x 10^{-6})	
L	**Load-based effluent limit (lbs/day)**	**5.37**
	C2 = [C3(Q1+Q2)-C1Q1] / Q2	
C1	Ambient ground water (background) concentration (mg/L)	0.11
C2	**Allowable discharge concentration (mg/L)**	**8.05**
C3	Ground water concentration limit for pollutant (from Circular WQB-7) at the end of the mixing zone.	7.50
Q1	Ground water volume (ft3/day)	**794**
Q2	Average flow of discharge (design capacity of system in ft3/day)	10694
	Q1 = K I A	
Q1	**Ground water flow volume (ft3/day)**	**794**
K	hydraulic conductivity (ft/day)	49
I	hydraulic gradient (ft/ft)	0.0030
A	cross-sectional area (ft2) of flow at the down-gradient boundary of a standard 500-foot mixing zone.	5404
Outfall 001 - MTX000307, July 2024		

MASS BALANCE EQUATION ALLOWABLE DISCHARGE CONCENTRATION DETERMINATION		
	L = C2 (mg/L) Q2 (gpd) Fcon (8.34 x 10^{-6})	
L	**Load-based effluent limit (lbs/day)**	**4.26**
	C2 = [C3(Q1+Q2)-C1Q1] / Q2	
C1	Ambient ground water (background) concentration (mg/L)	0.11
C2	**Allowable discharge concentration (mg/L)**	**8.52**
C3	Ground water concentration limit for pollutant (from Circular WQB-7) at the end of the mixing zone.	7.50
Q1	Ground water volume (ft3/day)	**1110**
Q2	Average flow of discharge (design capacity of system in ft3/day)	8021
	Q1 = K I A	
Q1	**Ground water flow volume (ft3/day)**	**1110**
K	hydraulic conductivity (ft/day)	49
I	hydraulic gradient (ft/ft)	0.0030
A	cross-sectional area (ft2) of flow at the down-gradient boundary of a standard 500-foot mixing zone.	7551
Outfall 002 - MTX000307, July 2024		

MASS BALANCE EQUATION ALLOWABLE DISCHARGE CONCENTRATION DETERMINATION		
	L = C2 (mg/L) Q2 (gpd) Fcon (8.34 x 10^{-6})	
L	**Load-based effluent limit (lbs/day)**	**4.52**
	C2 = [C3(Q1+Q2)-C1Q1] / Q2	
C1	Ambient ground water (background) concentration (mg/L)	0.11
C2	**Allowable discharge concentration (mg/L)**	**9.03**
C3	Ground water concentration limit for pollutant (from Circular WQB-7) at the end of the mixing zone.	7.50
Q1	Ground water volume (ft3/day)	**1661**
Q2	Average flow of discharge (design capacity of system in ft3/day)	8021
	Q1 = K I A	
Q1	**Ground water flow volume (ft3/day)**	**1661**
K	hydraulic conductivity (ft/day)	49
I	hydraulic gradient (ft/ft)	0.0030
A	cross-sectional area (ft2) of flow at the down-gradient boundary of a standard 500-foot mixing zone.	11301
Outfall 003 – MTX000307, July 2024		

APPENDIX F TOTAL PHOSPHORUS WQBEL DEVELOPMENT

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

PHOSPHORUS WQBEL

SITE NAME:	LCWSD Rapid Infiltration System - Outfall 001 (RIB #1)
COUNTY:	
Permit #:	MTX000307
NOTES:	Variables used are based on WET's Technical Memo (2024).
-	Design Capacity = 80,000 gpd = 10,694 ft³/day
-	Design total phosphorus concentration = 2.00 mg/L

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	225	ft
L	Length of Primary Drainfield's Long Axis	300	ft
W	Width of Primary Drainfield's Short Axis	225	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4	ft
D	Distance from Drainfield to Surface Water	1335	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils,	1.0	ft
Ne	1.0 ft for fine soils)**		
Sw	Soil Weight (usually constant)	100	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200	ppm
#I	Number of proposed wastewater treatment systems	1	
CONSTANTS			
Pl	Phosphorous Load per proposed wastewater treatment system	487	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
BT	**Breakthrough Time to Surface Water**	**50**	yr
Pt	Total Phosphorous Load = (Pl)(#I)	487	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	27000000	lbs
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	45631969	lbs
P1	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	14526	lbs
SOLUTION			
Pt	**Total Phosphorous Load = (P1)/(BT)**	**291**	**lbs/yr**

NOTES: ** Depth to limiting layer is typically based on depth to water in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*

REV. 04/2000

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

PHOSPHORUS WQBEL

SITE NAME:	LCWSD Rapid Infiltration System - Outfall 002 (RIB #2)
COUNTY:	
Permit #:	MTX000307
NOTES:	Variables used are based on WET's Technical Memo (2024).
	Design Capacity = 60,000 gpd = 8,021 ft³/day
	Design total phosphorus concentration = 2.00 mg/L

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	450	ft
L	Length of Primary Drainfield's Long Axis	450	ft
W	Width of Primary Drainfield's Short Axis	113	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4	ft
D	Distance from Drainfield to Surface Water	1160	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils,	1.0	ft
Ne	1.0 ft for fine soils)**		
Sw	Soil Weight (usually constant)	100	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200	ppm
#l	Number of proposed wastewater treatment systems	1	
CONSTANTS			
Pl	Phosphorous Load per proposed wastewater treatment system	366	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
BT	**Breakthrough Time to Surface Water**	**50**	yr
Pt	Total Phosphorous Load = (Pl)(#l)	366 2025000	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	0 6397400	lbs
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	0	lbs
P1	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	16845	lbs
SOLUTION			
Pt	**Total Phosphorous Load = (P1)/(BT)**	**337**	**lbs/yr**

NOTES: ** Depth to limiting layer is typically based on depth to water in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*

REV. 04/2000

Appendix A – Technical Memorandum, WET 2024.

TECHNICAL MEMORANDUM

To: Melinda Horne, Montana DEQ

From: Brad Bennett, PG – Senior Hydrogeologist, Water & Environmental Technologies
Christina Eggensperger, MS – Project Engineer, Water & Environmental Technologies

Copy: Brad Koenig, PE – Robert Peccia & Associates
Rodney Olson, General Manager, Lakeside County Water & Sewer District

Date: February 14, 2024; updated May 7, 2024

Re: Non-Degradation Assessment – MGWPCS Permit Application Lakeside County Water Sewer District Rapid Infiltration System Permit MTX000307 (pending)

Introduction

Lakeside County Water and Sewer District (LCWSD) is in the process of designing a new sewage wastewater treatment facility to improve LCWSDs ability to treat wastewater and increase the systems overall capacity. As part of the facility upgrades LCWSD seeks to obtain a Montana Groundwater Pollution Control System (MGWPCS) permit from the Montana Department of Environmental Quality (DEQ) to allow for utilization of rapid infiltration (RI) basins discharging up to 200,000 gallons per day (GPD) of treated wastewater. Currently, LCWSD utilizes treatment lagoons and land application for disposal of municipal wastewater. Utilization of RI basins allows for year-round discharge and mitigates the need for additional storage facilities as LCWSDs service increases.

LCWSD is working with Robert Peccia and Associates (RPA) to complete design of the sewage treatment system. Water and Environmental Technologies (WET) has been retained to evaluate the hydrogeologic significance of discharging treated wastewater via RI basins. LCWSD identified portions of their property in the E½ SE¼ Section 11 and NW¼ NW¼ Section 13, Township 27 North, Range 21 West, Flathead County (Site) as potentially suitable for the proposed RI basins. **Figure 1** illustrates LCWSD's current wastewater treatment site relative to the general features of the area.

Hydrogeologic Setting

LCWSD's proposed RI basin systems are in the southwest portion of the Flathead Valley in northwest Montana. The Flathead Valley is a northwest trending intermontane basin forming the southern extension of the Rocky Mountain Trench. The valley is bounded on the east by the Swan-Whitefish fault located along the base of the Swan Range and on the west by the Kalispell fault at the base of the Salish Mountains. The mountains rise abruptly 4,500 feet above the valley floor.

Two aquifers are recognized at the Site: (1) the shallow Delta aquifer; and (2) the deep alluvial

aquifer. Potable water is commonly diverted from the deep alluvial aquifer in this area and the Delta aquifer is the receiving water for the proposed discharge via the RI basins.

The primary source of potable water within the vicinity of the Site is the deep alluvial aquifer. The aquifer is primarily recharged from snowmelt infiltration in the surrounding mountain ranges. The top of the deep alluvial aquifer in this area is generally encountered between 100 to 200 feet below ground surface (bgs). The predominant flow direction of the deep alluvial aquifer in this area is from west to east (from margin toward center of the valley) at a gradient of approximately 0.004 (LaFave, 2000).

The Site overlies the Delta Aquifer in the southern portion of the valley. The Delta aquifer (McDonald and LaFave, 2004 and LaFave and others, 2004) is also recognized as the sand aquifer (Konizeski and others, 1968) and the Deltaic sand aquifer (Noble and Stanford, 1986). The aquifer consists of fine- to medium-grained sand deposited between the north shore of Flathead Lake to a distinct topographic break, which occurs at an elevation of approximately 2,910 feet above mean sea level (amsl). This elevation represents one of the final still-stands of the ancestral glacial lake.

A map illustrating the areal extent of the Delta aquifer is provided in **Attachment A**. As shown, the aquifer extends throughout the entire lower Kalispell Valley. The LCWSD proposed RI basin system is near the aquifer's southwest extent. The groundwater flow direction near the Site is generally east-northeast toward the Flathead River. Wells completed in the Delta aquifer can be as deep as 75 feet below land surface, but the median depth is 26 feet (LaFave and others, 2004).

Well yields are generally lower, around five to ten gallons per minute (GPM). Noble and Stanford (1986) completed four aquifer tests in the Delta aquifer and reported values of aquifer transmissivity ranging from 1.0 to 3,700 ft^2/day. Water quality is typically fair to poor due to the occurrence of elevated levels of iron, nitrate, and other undesirable constituents present in the groundwater.

Hydrogeologic Investigation

Soil Boring Advancement

Five soil borings were drilled and completed as monitoring wells at the Site between September 6 and September 8, 2022. Soil boring and monitoring well locations are illustrated on **Figure 2**. Soil borings were drilled by Alpine Geotechnical with a CME 45B auger drill rig. Soil samples were collected at five-foot intervals as drilling proceeded to characterize the subsurface conditions. Sediment types were identified and described using the Unified Soil Classification System in accordance with the American Society for Testing Materials (ASTM) procedure D2487. Copies of the soil boring logs are provided as **Attachment B**. The boring logs for MW-1, MW-2, MW-3, MW-4, and MW-5 indicate that subsurface soil generally consists of poorly graded silty sand (typical of the Delta aquifer) between five and 33 to 39 feet bgs.

Monitoring Well Installation

Monitoring wells are completed with two-inch schedule 40 PVC well casing and well screen. Sections of 0.020-slot manufactured well screen were set at or near the base of the Delta aquifer for each monitoring well. The monitoring wells are completed to depths between 33 feet and 39 feet. The borehole filter pack consists of 10-20 Colorado® silica sand extending a minimum of two feet above the screen. A surface seal was installed using 3/8-inch bentonite "hole plug" from the top of the filter-pack extending to ground surface. Well construction details are documented on the soil boring logs provided as **Attachment B**.

Groundwater Monitoring

After construction, the monitoring wells were developed by bailing and surging utilizing a stainless-steel bailer. Well development via surging and bailing serves to agitate the water column, establish the hydraulic connection between the well and aquifer, and remove silt and fine sand from the well and filter pack. All wells were developed for a minimum of one hour. Static water levels (SWLs) in the five onsite monitoring wells were measured and recorded by WET personnel biweekly between September 8, 2022, and July 11, 2023. Results of the water-level data are presented in **Attachment C**.

Quarterly water quality samples were collected from well MW-5. Analytical data summary reports from each sampling event, along with a table summarizing the data, are included in **Attachment D**. Additionally, a surface water sample was collected from Pond 4 and the analytical data from that sample is also included in **Attachment D**.

Slug Testing

Rising-head slug tests were conducted in the five monitoring wells (MW-1, MW-2, MW-3, MW-4 and MW-5) between March 8 and March 10, 2023. A pressure transducer in each well recorded the change in recovering water levels at one-second intervals during the tests. Groundwater data from the slug tests were analyzed using AQTESOLV© software (Duffield, 2007). Individual hydraulic conductivity estimated from the slug tests ranged from 7.1 ft/day to 392.4 ft/day (**Table 1**). The mean hydraulic conductivity estimated from slug testing the five on-site monitoring wells is 122.4 ft^2/day.

Table 1. Estimated Hydrologic Parameters from Slug Tests

Well ID	Hydraulic Conductivity (ft/day) Derived from Type-Curve Match Utilizing Bouwer-Rice (1976)			Average
MW-1	6.7	7.0	7.6	7.1
MW-2	415.7	490.5	270.9	392.4
MW-3	49.9	42.9	42.9	45.2
MW-4	41.9	57.0	49.9	49.6
MW-5	121.4	111.6	120.0	117.7

Average	122.4
Median	49.6

Rapid Infiltration Basin Site Analysis

After completion of groundwater monitoring, the proposed placement and design of the RI basins were evaluated. As further analysis regarding the fate and transport of the discharge has been completed, the proposed size, location, and volume of discharge has been refined. The location of the proposed RI basins is illustrated in **Figure 2**. A setback analysis is depicted on **Figure 3**, along with an inventory of wells within ¼-mile of the proposed discharge and surface water bodies within one-mile of the proposed discharge. As shown, no drinking water wells are within 500 feet of the proposed RI basin area locations. The Montana Bureau of Mines and Geology (MBMG) Ground Water Information Center (GWIC) database was queried to identify potential wells located within ¼-mile of the proposed RI basin areas. Initially three wells plotted within 500 feet of the proposed RI basin areas; further research confirmed that these wells are more than 500 feet from the proposed outfalls (RI basin areas). The approximate location of the wells is identified on **Figure 3**. The GWIC Well Log Reports for all wells that are mapped within ¼ mile of the proposed RI basins by the GWIC database are provided in **Attachment E**.

Site Specific Hydrogeologic Conditions

The proposed RI basin discharge system for LCWSD shall be keyed approximately 2.0 to 4.0 feet into the sediment above the saturated portion of the unconfined Delta aquifer. Seepage is anticipated to migrate vertically through the vadose zone before reaching the water table, where it will develop a mound and migrate horizontally in a downgradient direction. Regionally, the Delta aquifer is hydraulically connected to the Flathead River and Flathead Lake, and water levels are controlled by the stage of Flathead Lake. The following aquifer characteristics, provided in **Table 2**, were assumed for the aquifer in this area and were utilized to model the influence of the proposed RI basin system (discharge) on the aquifer to calculate the fate and transport of nitrates, phosphorous, and pathogens.

Table 2. Aquifer Characteristics

Estimated Aquifer Properties of the Shallow Alluvial Aquifer Somers, Montana	
Confinement:	Unconfined *
Groundwater Flow Direction:	East/Northeast (Approximately 17.7°) ^
Aquifer Thickness:	14.7 feet ^
Hydraulic Gradient:	0.0002 feet/feet ^
Hydraulic Conductivity:	122.4 feet/day ^
Effective Porosity:	27 percent *

** indicates referenced value, ^ indicates measured value*

Aquifer Thickness

Aquifer saturation (aquifer thickness) was approximated from the five (5) on-site monitoring wells. The on-site wells vary in completion depth from 33 to 39 feet bgs. Water levels were monitored biweekly between September 2022 and July 2023. In this calculation, each of the monitoring wells is assumed to be completed at the base of the Delta aquifer at the contact with the underlying confining unit. Well logs for the monitoring wells utilized in estimating the aquifer thickness are listed in **Table 3** and boring and well construction logs are provided as **Attachment B**. Water level data collected in the on-site monitoring wells is provided as **Attachment C**. As shown, the average saturated thickness of the aquifer is 14.68 feet. A value of 14.7 feet was utilized within the MOUNDSOLV© modeling software model.

Table 3. Well Log Summary

Assessment of Aquifer Saturation			
Well ID	**TD (ft)**	**Average SWL (ft)**	**Average Aquifer Thickness (ft)**
MW-1	35	20.97	14.03
MW-2	33	18.59	14.41
MW-3	35	20.02	14.98
MW-4	39	21.24	17.76
MW-5	35	22.81	12.19
Average	**35.4**	**20.72**	**14.68**

Hydraulic Gradient

Near the proposed RI basins, the groundwater flow direction over the monitoring period was generally to the northeast. However, the direction of groundwater flow varied between approximately 61 degrees to the southeast and 61 degrees to the northeast. The hydraulic gradient varies seasonally as the water level in Flathead Lake (and Flathead River) fluctuates. Regionally, the Delta aquifer is hydraulically connected to the Flathead River and Flathead Lake, and water levels are controlled by the stage of Flathead Lake. In general, water from the aquifer discharges to the Flathead River or Flathead Lake when the lake and river are low and from the lake and river to the aquifer when water levels are high. Monthly groundwater contour maps from September 2022 to July 2023 are included as **Attachment F**. As expected, the hydraulic gradient was flattest (0.0002 feet/feet) in June 2023 when Flathead Lake and Flathead River stage were at their peak. With all other factors being held constant, the flattest gradient will result in the highest potential for groundwater mounding beneath the RI basin areas. As such, the flattest gradient (0.0002 feet/feet) was utilized to model potential impacts of the proposed RI basins. **Figure 4** illustrates the water table observed on June 6, 2023, which is the hydraulic gradient utilized in this evaluation.

Hydraulic Conductivity

Hydraulic conductivity is estimated from slug tests completed on the on-site monitoring wells.

Estimates of aquifer hydraulic conductivity range from 7.1 to 392.4 ft/day. A value of 122.4 ft/day (average from 15 tests) was selected for utilization in this assessment. Type-curve matches for the slug test analyses are provided as **Attachment G**. This value is less than the 569 ft/day allowed for a medium sand aquifer and is closer to the 51 ft/day allowed for fine sand aquifer and 45 ft/day allowed for a silty sand aquifer per ARM 17.30.1702(6)(a)(i).

Effective Porosity

An effective porosity of 0.27 (27-percent) is assumed for the Delta aquifer, which is based on aquifer testing completed by Noble and Stanford (1986). This value is consistent with the default value for loamy sand and silty sand in DEQ's *Draft – Pathogen Reduction Model for Setbacks between Sewage Lagoons and Water Wells* spreadsheet. Per the spreadsheet, the values represent the 90th percentile of published values from numerous reference sources. A copy of DEQ's spreadsheet is provided as **Attachment H**. Note that the lagoon leakage rate has been modified to reflect the proposed infiltrative rate of the planned RI basin areas.

Modeling Treated Wastewater Transport

Initial Inputs

The site specific hydrogeologic conditions outlined above were utilized to evaluate the development of a groundwater mound beneath the proposed RI basin locations. An analytical solution by Zlotnik et al. (2017) and the MOUNDSOLV© software were utilized to evaluate the height of the water table mound beneath the proposed RI basins and ensure adequate unsaturated thickness remains beneath each RI basin area. The unsaturated thickness between the RI basins and the top of the water table mound is utilized to evaluate the fate and transport of phosphorous and pathogens.

Initially, the estimated aquifer properties were input into the model without a proposed recharge source to confirm the modeled water levels at the site are consistent with those observed during June 2023. As shown in **Figure 4**, the modeled water table (pink contours) provides a reasonable match to the measured water levels and approximate water table (blue contours). As such, the model is believed to adequately represent the development of a groundwater mound beneath the proposed RI basins at the site.

Groundwater mounding was modeled for the proposed RI basin areas using the Zlotnick et al. (2017) analytical solution with the site specific hydrogeologic data input and RI basin data representative of 200,000 GPD. RI basin area one has a modeled recharge of 80,000 GPD, RI basin area two and three are modeled with 60,000 GPD each. Each RI basin area is sized so that the average discharge rate is 0.59 GPD per square foot of RI basin area. A forward solution was performed for five years, at which time, due to the constant head boundary of the Flathead River and Flathead Lake, the system is believed to achieve stabilized conditions. **Figure 5** illustrates the modeled water table resulting from continual discharge of 200,000 GPD at the Site. A MOUNDSOLV© generated report documenting the model inputs and results is provided in **Attachment I**. Note that water table height utilized in modeling (14.7 feet) is equal to a water table elevation of 2,895.20 feet amsl.

Assessment of Groundwater Flow Direction

Between September 2022 and July 2023 groundwater flow at the Site was predominantly to the northeast toward the Flathead River. However, the direction of groundwater flow varied between approximately 61 degrees (northeast) and 61 degrees (southeast). On September 14, 2022, the groundwater flow direction was to the southeast (approximately 61-degrees) toward Flathead Lake. Following the September 2022 groundwater monitoring event, the direction of groundwater flow rotated to the northeast toward the Flathead River, where it ultimately remained through July 2023. This observation is consistent with published reports documenting flow conditions in the Delta aquifer. In general, water from the aquifer discharges to the Flathead River or Flathead Lake when the lake and river are low and from the lake and river to the aquifer when water levels are high. Monthly groundwater contour maps from September 2022 through July 2023 are included as **Attachment F**.

An alternate mounding scenario was modeled to evaluate the effect groundwater flow direction has on the mound that forms below the RI basins. An alternate groundwater mounding scenario was modeled for the proposed RI basin areas using the same analytical solution (Zlotnick et al., 2017), site specific hydrogeologic data, and RI basin data representative of 200,000 GPD that was used in the primary model. The direction of groundwater flow was modified from 17.7-degrees (east-northeast) to -61-degrees to represent the southeastern flow direction observed in September 2022. As illustrated in **Figure 6**, the predicted groundwater mound that develops under southeasterly flow conditions (purple contours) is very similar to the mound predicted at the Site from the primary model (blue contours). This alternate mounding evaluation confirms that the location of the RI basins, relatively flat hydraulic gradient, and hydraulic conductivity of the Delta aquifer ultimately control the size and shape of the mound developing beneath the proposed RI basin areas at the Site, and thus the fate and transport of phosphorous, pathogens, and nitrogen. In both scenarios, the developed mound results in radial flow from the RI basin areas.

Water Table Mound Assessment (Unsaturated Conditions Beneath Mound)

The resulting groundwater mound peaks beneath RI basin areas one and two at an elevation of 2,900.24 feet amsl (rise of 4.99 feet). At the northern end of RI basin three, the water table elevation is anticipated to be 2,898.92 feet amsl (rise of 3.65 feet). As noted above, the Delta aquifer is hydraulically connected to the Flathead River and Flathead Lake, and water levels are effectively controlled by the stage of Flathead Lake. Water levels in the Delta aquifer peak when Flathead Lake is held at or near full pool. Groundwater monitoring performed through July 2023 confirms that overall, water levels peaked in early June 2023. The proposed RI basin system for LCWSD is anticipated to be keyed between 2.0 to 4.0 feet into the sediment above the saturated portion of the unconfined Delta aquifer. Per the mounding assessment, at minimum, 7.81 feet of unsaturated sediment is calculated to remain beneath the proposed RI basin area three. As a conservative measure, a value of 4.0 feet was utilized for the unsaturated thickness in calculations addressing phosphorous breakthrough and pathogen reduction. **Figure 7** illustrates the MOUNDSOLV© predicted water table mound beneath each of the RI basin areas.

Phosphorous Breakthrough

Phosphorous breakthrough to surface water was evaluated utilizing the proposed discharge volume of 200,000 GPD. As shown in **Figures 5,** discharge through the proposed RI basins is anticipated to result in a water table mound that forces water radially in all directions from RI basins. The water table mound results in a groundwater divide that splits the RI basin areas and forces half of the discharge to the western portion of the mound and half to the eastern portion of the mound. As a result, the amount of discharge with the potential to be intercepted by various surface water bodies is variable depending upon the direction of flow.

Pond 4

RI basin area two is designed to discharge up to 60,000 GPD; of that, approximately 30,000 GPD will flow in a westerly direction. As shown in **Figure 8**, a portion (less than half) of the discharged water from RI basin area two has the potential to reach Pond 4. In a conservative (worst-case) scenario, WET modeled the phosphorous breakthrough to Pond 4, assuming all discharges on the western portion of RI basin two (30,000 GPD) will flow toward Pond 4. The proposed phosphorous concentration of 2.0 mg/L was utilized in the calculations, resulting in 183 pounds per year of phosphorous load. As noted above, a conservative four-foot unsaturated zone was assumed beneath RI basin area two and a flow path of 1,160 feet. A conservative dispersion angle of five degrees was assumed. The calculated phosphorous breakthrough to Pond 4 is 92 years.

Wiley's Slough

RI basin area one is designed to discharge up to 80,000 GPD; of that, about 40,000 GPD will flow in a northerly direction, with a portion of that potentially reaching Wiley's Slough. As shown in **Figure 8**, a portion (less than half) of the discharged water from RI basin one can reach Wiley's Slough. In a conservative (worst-case) scenario, WET modeled the phosphorous breakthrough to Wiley's Slough, assuming all discharges on the northern portion of RI basin area one (40,000 GPD) will flow toward Wiley's Slough. The proposed phosphorous concentration of 2.0 mg/L was utilized in the calculations, resulting in 244 pounds per year of phosphorous load. As noted above, a conservative four-foot unsaturated zone was assumed beneath RI basin area one and a flow path of 1,335 feet. A more representative, but still conservative dispersion angle of 12.5-degrees was assumed in the calculations. The calculated phosphorous breakthrough to Wiley's Slough is 78.7 years.

Pond 7

RI basin area three is designed to discharge up to 60,000 GPD; of that, approximately 30,000 GPD will flow in a southerly direction toward Pond 7. As shown in **Figure 8**, a portion (less than half) of the discharged water from RI basin three can reach Pond 7. In a conservative (worst-case) scenario, WET modeled the phosphorous breakthrough to Pond 7, assuming all discharges on the western side of RI basin area three (30,000 GPD) will flow toward Pond 7. The proposed phosphorous concentration of 2.0 mg/L was utilized in the calculations, resulting in 183 pounds per year of phosphorous load. As noted above, a conservative four-foot unsaturated zone was

assumed beneath RI basin area three and a flow path of 2,540 feet. A conservative dispersion angle of five-degrees was assumed. The calculated phosphorous breakthrough to Pond 7 is 300.4 years.

The resulting calculations indicate that phosphorous breakthrough to the adjacent surface water bodies will not occur within 50 years and impacts to surface water bodies are not anticipated. The results of year-round discharge are summarized below in **Table 4;** phosphorus breakthrough calculations can be found in **Attachment J**.

Table 4. Phosphorus Breakthrough Calculation Summary

Surface Water Body	LCWSD Discharge at 2.0 mg/L (GPD)	Phosphorous Breakthrough (years)
Pond 4	30,000	92.0
Wiley's Slough	40,000	78.7
Pond 7	30,000	322.2

Pathogen Removal

An assessment of potential pathogen impacts to downgradient drinking water wells was completed as part of this assessment. Pathogen removal was estimated utilizing the same aquifer characteristics as the mounding analysis. A conservative four-foot unsaturated zone was assumed beneath the RI basin areas. A volumetric soil moisture content of 0.1 mL/cm^3 was assumed for the unsaturated soil. This value (0.1 mL/cm^3) is consistent with the default value for loamy sand and silty sand in DEQ's *Draft – Pathogen Reduction Model for Setbacks between Sewage Lagoons and Water Wells* spreadsheet. Per the spreadsheet, the values represent the 90th percentile of published values from numerous reference sources. A copy of DEQ's Pathogen Transport Model spreadsheet is provided as **Attachment H**. Nearby drinking water wells were assigned a conservative demand of 3,000 GPD in the model.

DEQ's Pathogen Transport Model spreadsheet utilizes both vertical and horizontal travel to calculate pathogen removal. 4-log microbiological attenuation typically occurs within 200 days. A small amount of virus inactivation occurs in the short travel time (5.8 days) between the bottom of the RI basin areas and the top of the water table mound (0.11 logs). However, even at the steepest gradients occurring immediately adjacent to the water table mound (0.003 feet or 0.9 feet/300 feet), 4-log microbial inactivation or removal of 99.99-percent of virus is achieved within 305 feet of each RI basin area. As noted above, no wells are within 500 feet of the proposed RI basin areas. As such, LCWSD seeks a Source Specific Mixing Zone (SSMZ) of 305 feet, which is the minimum required distance to achieve 4-log microbial inactivation. The location and extent of the proposed SSMZ is illustrated in **Figure 9**.

Nitrogen Reduction

An assessment of potential nitrogen impacts to downgradient water wells and select surface water features was completed as part of this assessment. Nitrogen removal via denitrification (reduction of nitrate [NO3-] to nitrogen gas [N2]) primarily accounts for the decay of nitrate between the discharge point and nearby surface water bodies. WET repurposed the horizontal time of travel models utilized in the Pathogen Transport Model spreadsheet and a first-order denitrification rate of 0.0065 day^{-1}, (25^{th} percentile value of published values, Kirkland, 2001). Assuming the first-order denitrification rate of 0.0065 day-1 and a nitrate discharge concentration of 8.0 mg/L, nitrate concentrations are calculated to be below 7.5 mg/L within 78 days of discharge and return to background values (0.11 mg/L) within 1,216 days (about 3.5 years).

Area Groundwater Wells

The steepest hydraulic gradient of 0.003 (0.9 feet/300 feet), which occurs near the edges of the proposed RI basin areas was utilized to calculate the time of travel required for denitrification processes to result in a nitrate concentration of 7.5 mg/L. Utilizing the hydraulic gradient near the edges of the mound, the average groundwater flow velocity is 1.36 ft/day and nitrate concentrations are calculated to be below 7.5 mg/L within 110 feet of each RI basin area. Nitrate concentrations are calculated to be below 5.0 mg/L within 335 to 670 feet from the proposed RI basin areas. Nitrogen concentrations will be between 8.0 mg/L and 5.0 mg/L within the proposed SSMZ; concentrations are calculated to be below 7.5 mg/L at the end of the proposed mixing zone. The location and extent of the proposed SSMZ is illustrated in **Figure 9**.

Nitrate concentrations are estimated to reach near background conditions of 0.11 mg/L within 640 to 1,200 feet of the proposed RI basin areas. As shown on **Figure 9**, the hydraulic gradient resulting from the modeled water table mound, which develops beneath the proposed RI basin areas, controls the time of travel in each direction. Groundwater flow is fastest in the initial (pre-discharge) direction of groundwater flow, and the time of travel is slowest in the opposite direction of pre-discharge groundwater flow.

Pond 4

A hydraulic gradient of 0.0016 (1.15 feet/720 feet) was used to calculate time of travel between RI basin two and Pond 4. Utilizing the predicted hydraulic gradient for this portion of the mound, the average groundwater flow velocity is 0.72 ft/day. The shortest flow path to Pond 4 is estimated to be 1,160 feet and nitrate concentrations are calculated to return to background levels within 880 feet from the southwest corner of RI basin two, prior to groundwater from the RI basin areas potentially discharging to Pond 4.

Wiley's Slough

A hydraulic gradient of 0.0022 (1.96 feet/910 feet) was used to calculate time of travel between RI basin area one and Wiley's Slough. Based on the modeled hydraulic gradient north of RI basin area one, the average groundwater flow velocity is 0.98 ft/day. The shortest flow path to Wiley's Slough is estimated to be 1,335 feet and nitrate concentrations are calculated to return to

background levels within 1,185 feet from the northern edge of RI basin one, before groundwater discharged via RI basin area one discharges to Wiley's Slough.

Pond 7

A hydraulic gradient of 0.0019 (1.14 feet/595 feet) was used to calculate time of travel between RI basin area three and Pond 7. Based on the hydraulic gradient of the water table mound south of RI basin area three, the average groundwater velocity is 0.87 ft/day. The shortest flow path to Pond 7 is estimated to be 2,540 feet and nitrate concentrations are calculated to return to background levels within 1,050 feet from the south edge of RI basin three, well before groundwater discharged via RI basin area three discharges to Pond 7.

Utilizing a first-order denitrification rate of 0.0065 day-1 and the proposed nitrate discharge concentration of 8.0 mg/L, nitrate concentrations are calculated to return to background values (0.11 mg/L) within 1,216 days. This first-order denitrification rate results in nitrate concentrations returning to background levels before groundwater discharging from the RI basin areas has the potential to reach surface water.

Mounding Effect to Shallow Groundwater

Water level monitoring completed at the Site suggests that water levels varied between 2,894.2 and 2,895.5 feet amsl between September 2022 and July 2023. On June 6, 2023 water levels on the eastern margin of the Site were measured at 2,895.05 (MW-2) and 2,895.23 (MW-3) and on the western margin of the site at 2,895.13 (MW-1) and 2,895.47 (MW-4). As illustrated in **Figures 5 and 6**, the post-mound water levels near the boundary of the Site are predicted to be between 2,897.5 and 2,898.5 feet amsl, representing an approximate increase of 2.5 feet in the on-site monitoring wells. The water level rise predicted by the modeled mound decreases with distance, and the maximum predicted water level rise off the Site is approximately 3.5 feet, occurring immediately east of RI basin area one and two. **Figure 10** illustrates the predicted depth to water based on the modeled groundwater mound and water level data from June 6, 2023. Modeled depth to water is predicted to exceed ten feet in all but the low-lying areas associated with historic channels of the Flathead River, where depth to groundwater is typically near surface under current conditions.

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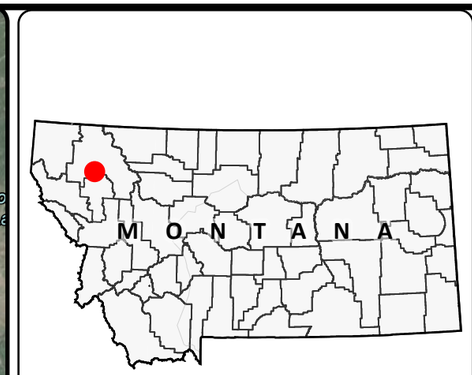
Figures



Potential Rapid Infiltration Basin Location

National Hydrography Dataset

Perennial Stream/River

Intermittent Stream/River

N
W E
S

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION		KK	CE
2	MAP EDITS	6/29/23	EK	CE
3	NHD/MAP EDITS	7/20/23	EK	CE
4	CALLOUT, SYMBOLOGY	7/21/23	KK	CE
5				

NOTES

SITE LOCATION

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 1

JOB#: 1539-22

DATE:2/12/2024

Path: C:\Users\kkresan\Working\1539-22\1539-22.aprx, Author: kkresan

Water & Environmental TECHNOLOGIES

Water & Environmental TECHNOLOGIES

SITE FEATURES & RAPID INFILTRATION BASIN LAYOUT

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 2

JOB#: 1539-22

DATE:2/12/2024

Path: C:\Users\kkresan\Working\1539-22\1539-22.aprx, Author: kkresan

NOTES

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5				

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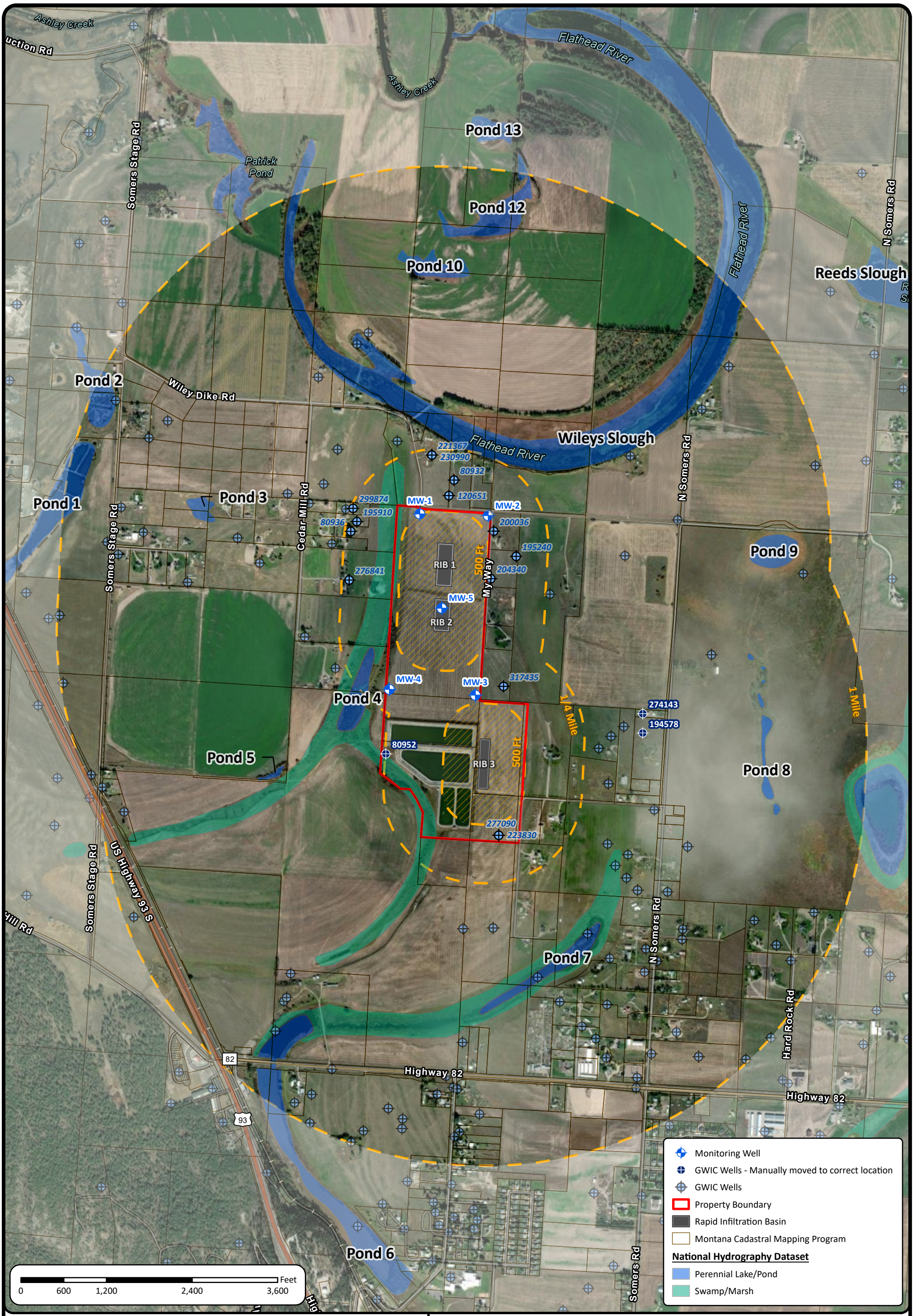

Water & Environmental TECHNOLOGIES

SETBACK & INVENTORY

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 3

JOB#: 1539-22

DATE:2/12/2024

Path: C:\Users\kkresan\Working\1539-22\1539-22.aprx, Author: kkresan

NOTES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
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N W E S

Water & Environmental TECHNOLOGIES

TYPICAL GROUNDWATER FLOW

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 4

JOB#: 1539-22

DATE:2/13/2024

Path: C:\Users\kkresan\Working\1539-22\1539-22.aprx, Author: kkresan

NOTES

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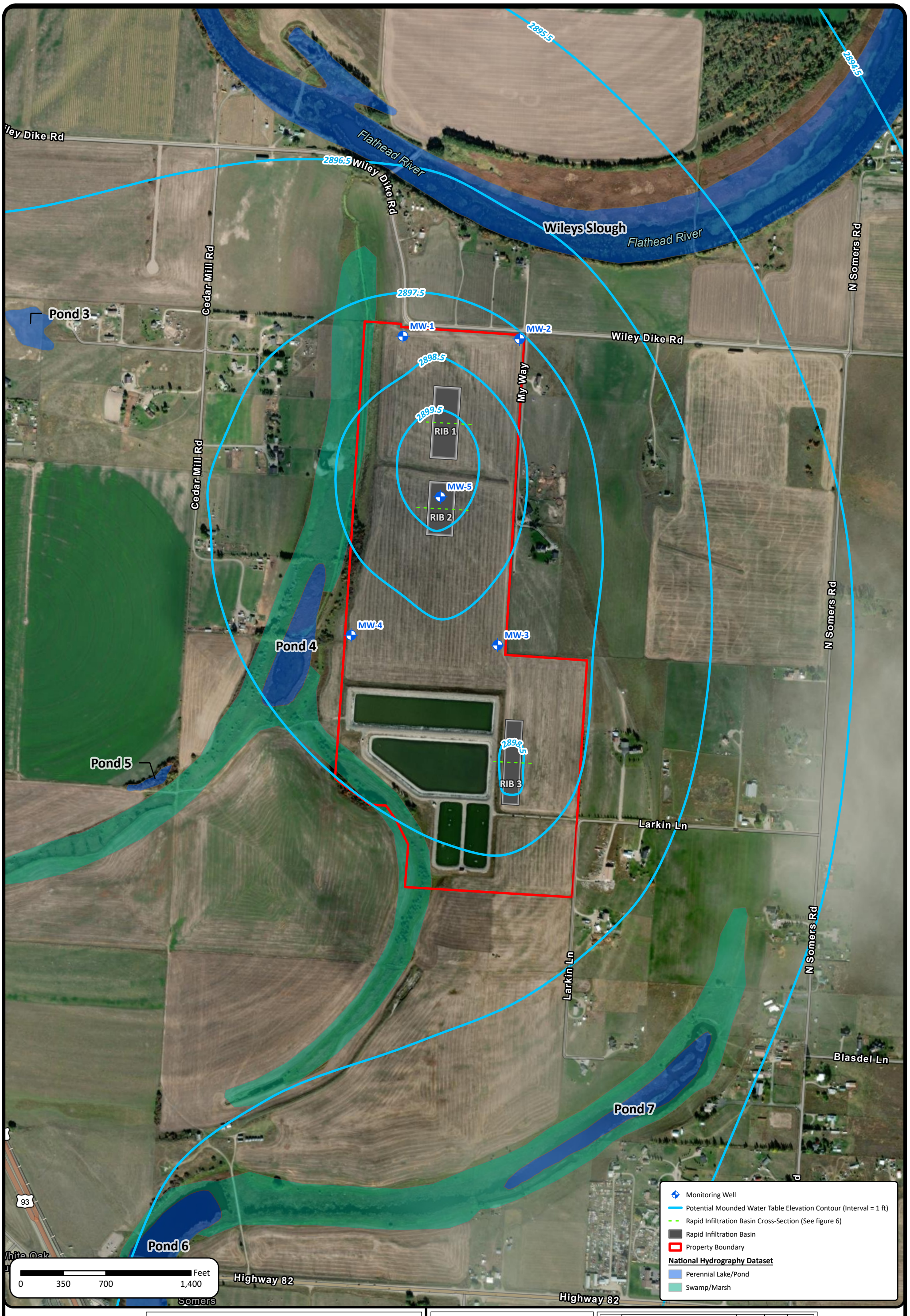

Water & Environmental TECHNOLOGIES

MODELED WATER TABLE ELEVATION

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 5

JOB#: 1539-22

DATE:2/12/2024

Path: C:\Users\kkresan\Working\1539-22\1539-22.aprx, Author: kkresan

NOTES:
Contours represent water-table elevation above base of aquifer beneath the center of primary recharge source

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	2/6/24	KK	CE
2	MOLECULE FLOW PATHS	2/12/24	KK	CE/BB
3				
4				
5				

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MODELED WATER TABLE ELEVATION

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 6

JOB#: 1539-22

DATE:5/8/2024

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: jleprowse

Water & Environmental TECHNOLOGIES

NOTES:
Contours represent water-table elevation above base of aquifer beneath the center of primary recharge source

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	2/6/24	KK	CE
2	MOLECULE FLOW PATHS	2/12/24	KK	CE/BB
3				
4				
5				

N W E S

Feet
0 350 700 1,400

Monitoring Well
Potential Mounded Water Table Elevation Contour (Interval = 1 ft)
Potential Mounded Water Table Elevation Contour (Interval = 1 ft)
Rapid Infiltration Basin Cross-Section (See figure 6)
Rapid Infiltration Basin
Property Boundary
National Hydrography Dataset
Perennial Lake/Pond
Swamp/Marsh

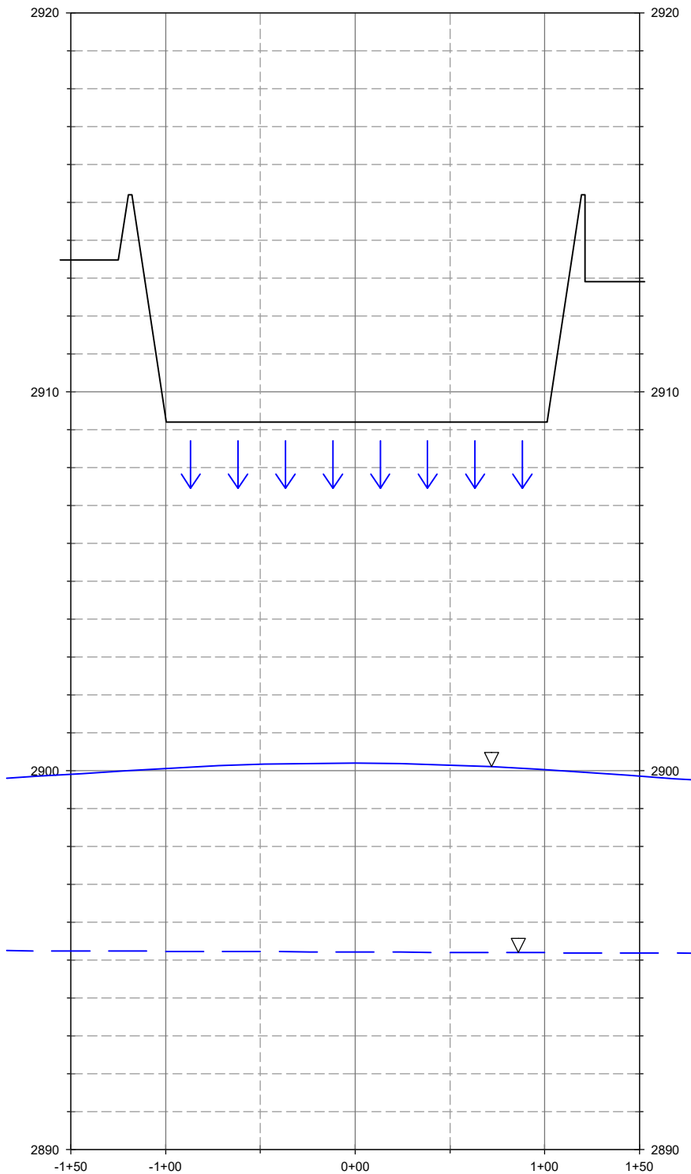
MODELED WATER TABLE MOUND

MODELED STATIC WATER LEVEL

0 40 80 FEET

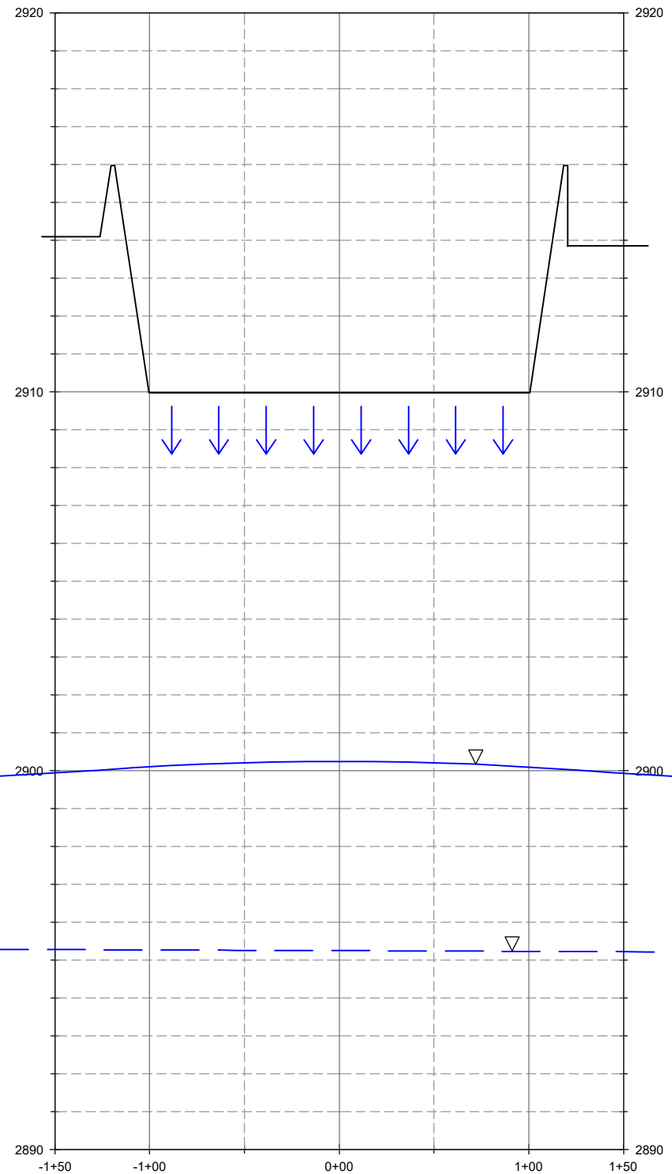
RI BASIN AREA 1

MOUNDING BASIN POND PROFILE
STA: -1+50 to STA: 1+50



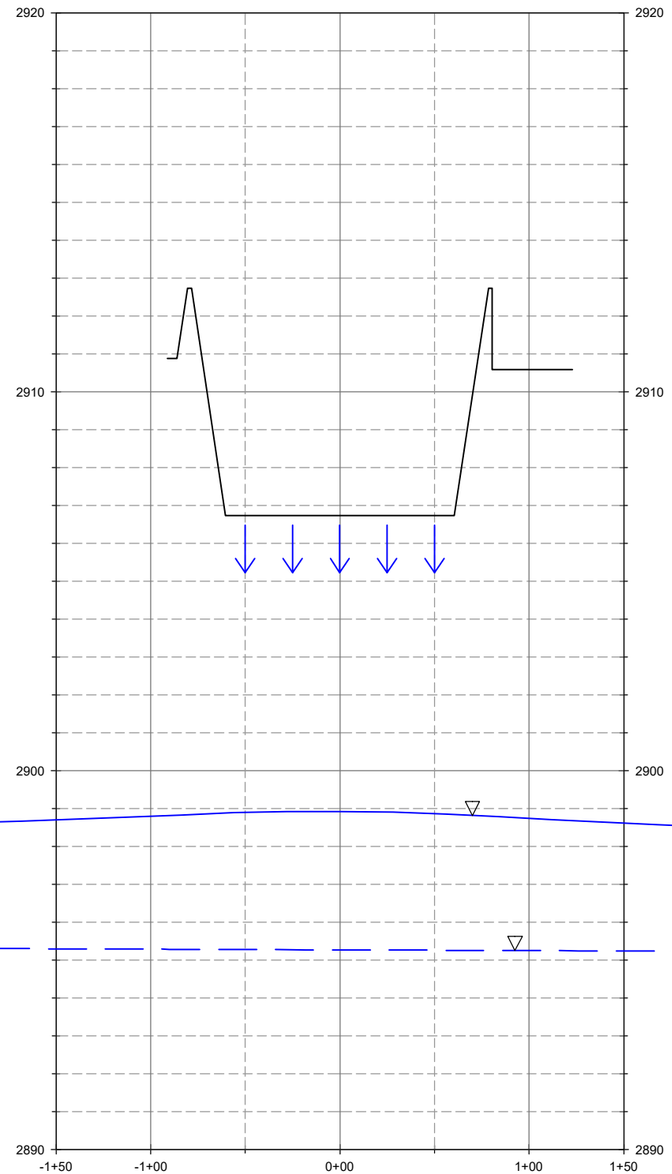
RI BASIN AREA 2

MOUNDING BASIN POND PROFILE
STA: -1+50 to STA: 1+50



RI BASIN AREA 3

MOUNDING BASIN POND PROFILE
STA: -1+50 to STA: 1+50



No	Description	Date	Drawn By

Water & Environmental TECHNOLOGIES
502 Cooperative Way
Suite 101
Kalispell, MT 59901
(406) 309-6085
waterenvtech.com

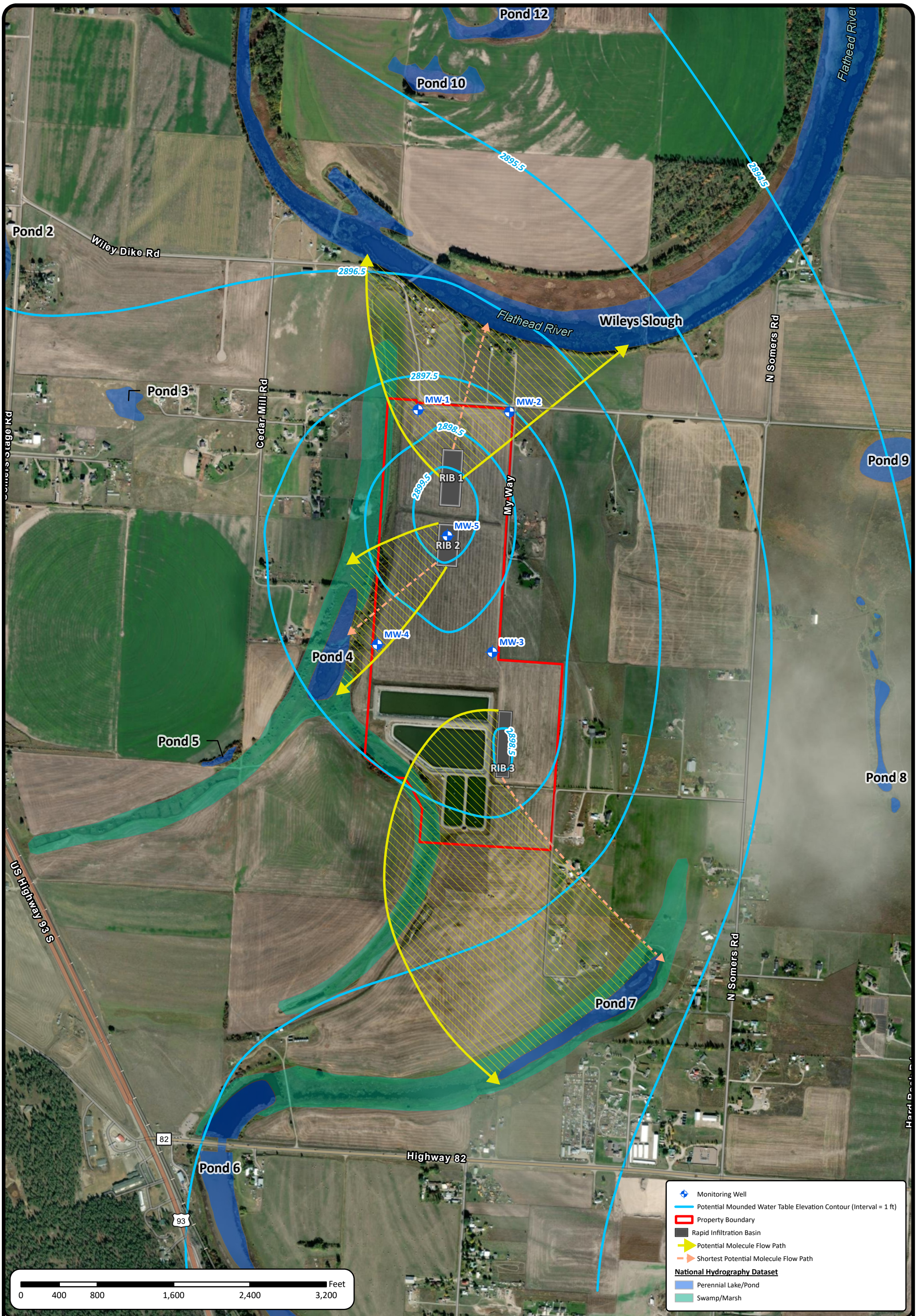
MODELED WATER TABLE CROSS SECTION

PROJECT NAME: LCWSD Discharge Assessment
LOCATION: Kalispell, Montana
FILE NO. Fig. 1 - Lagoon Ponding.dwg

JOB NO:	1539-22
DATE:	2/13/24
DRAFTER:	NS
CHECKED BY:	BB

SHEET
FIG. 7

M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\ENV\Fig. 1 - Lagoon Ponding.dwg PLOT DATE:2024-2-13 13:08 USER: rsmall



Water & Environmental TECHNOLOGIES

MODELED WATER TABLE ELEVATION AND FLOW PATHS

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 8

JOB#: 1539-22

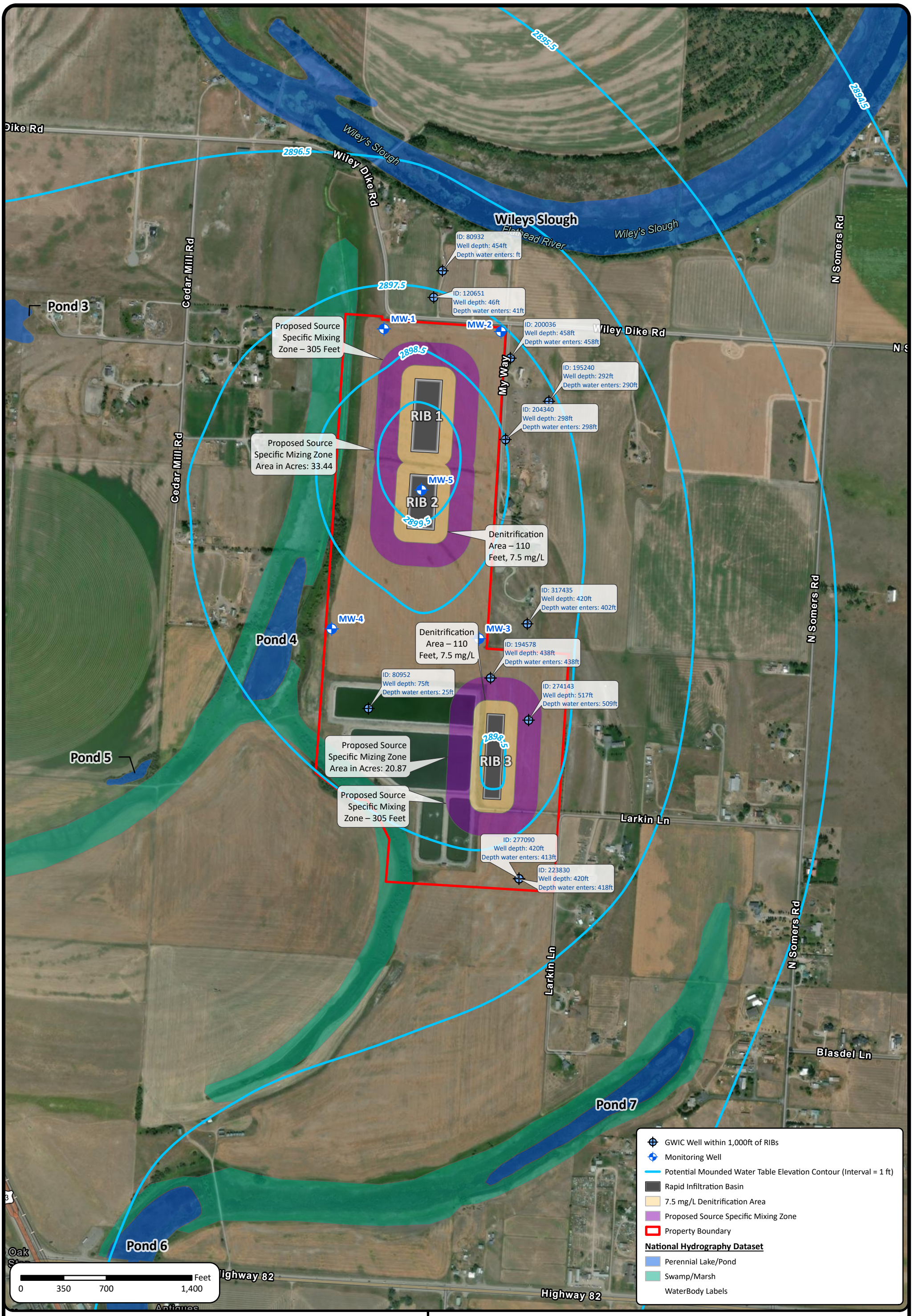
DATE:2/12/2024

Path: C:\Users\kkresan\Working\1539-22\1539-22.aprx, Author: kkresan

NOTES:
Contours represent water-table elevation above base of aquifer beneath the center of primary recharge source

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	2/6/24	KK	CE
2	MOLECULE FLOW PATHS	2/12/24	KK	CE/BB
3				
4				
5				

N
W E
S



Water & Environmental TECHNOLOGIES

PROPOSED SOURCE SPECIFIC MIXING ZONE

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 9

JOB#: 1539-22

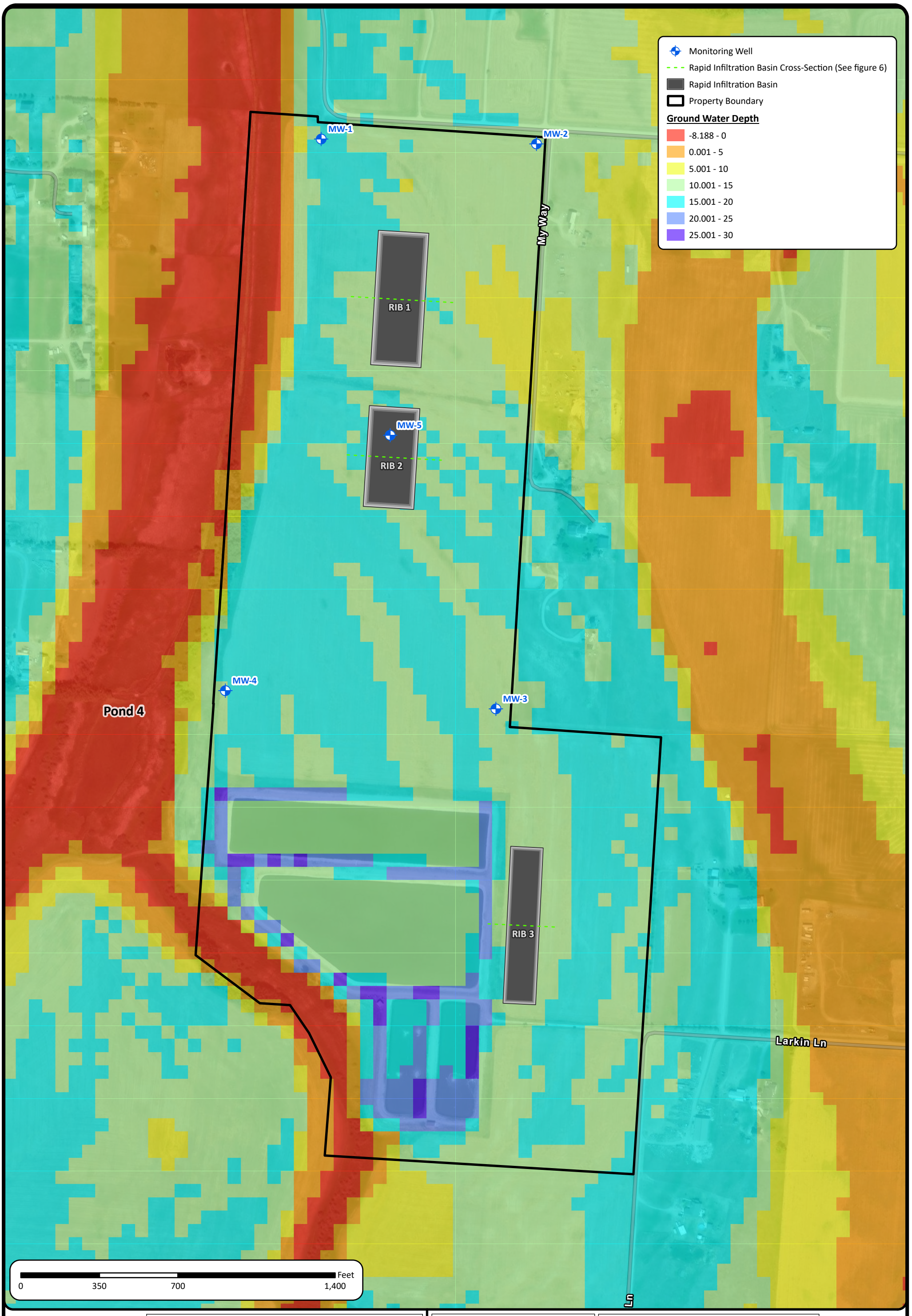
DATE:4/1/2024

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: lgeorge

NOTES:
Contours represent water-table elevation above base of aquifer beneath the center of primary recharge source

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	2/6/24	KK	CE
2	MOLECULE FLOW PATHS	2/12/24	KK	CE/BB
3				
4				
5				

N
W
E
S



MODELED DEPTH TO GROUNDWATER

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 10

JOB#: 1539-22

DATE:5/8/2024

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: jleprowse

NOTES:
Contours represent water-table elevation above base of aquifer beneath the center of primary recharge source

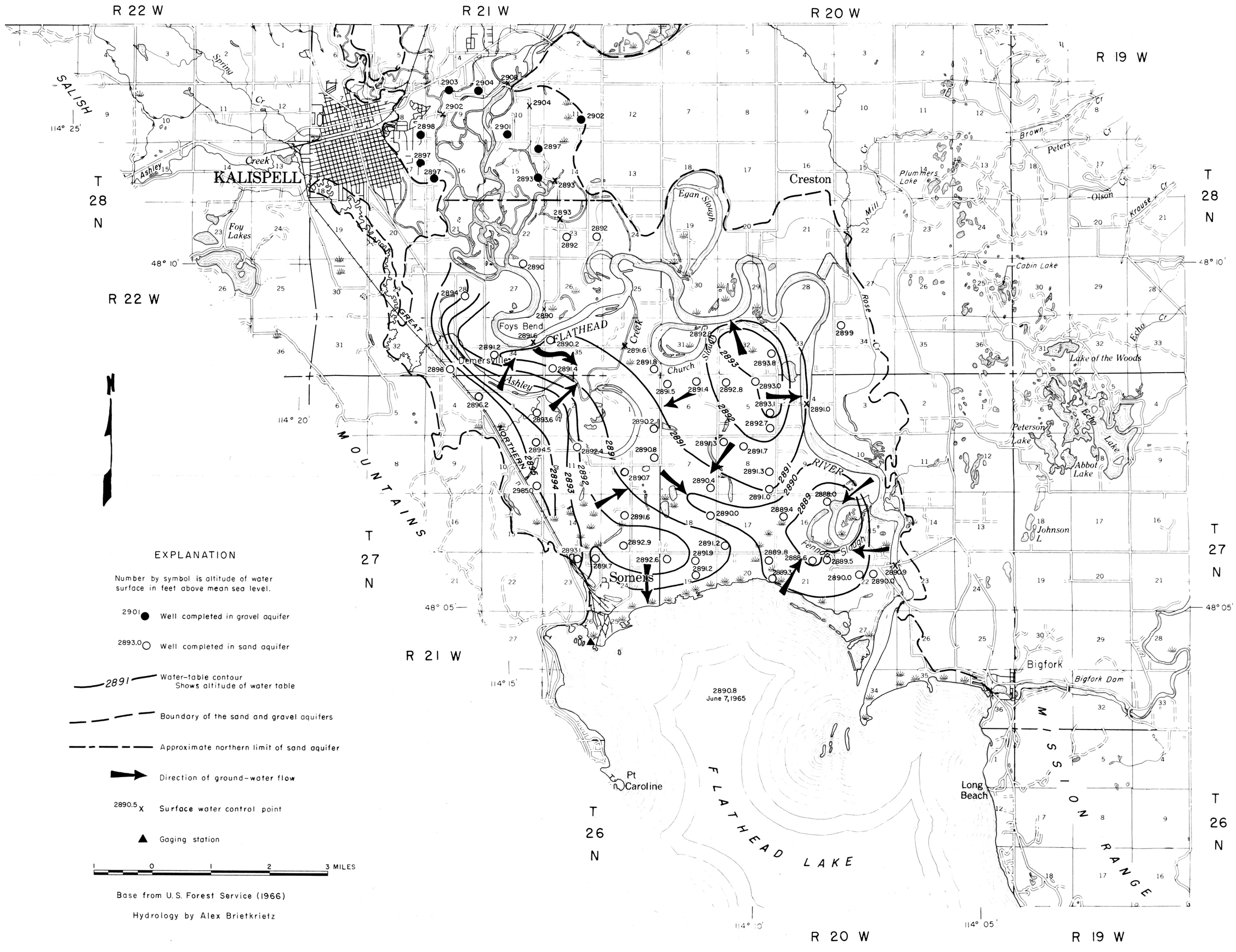
NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	2/6/24	KK	CE
2	MOLECULE FLOW PATHS	2/12/24	KK	CE/BB
3	MODELED DEPTH TO GROUNDWATER	5/8/24	JL	BB
4				
5				

N
W
E
S

Attachment A

Map of Delta Aquifer

(MBMG Bulletin 68)



EXPLANATION

Number by symbol is altitude of water surface in feet above mean sea level.

- 2901 ● Well completed in gravel aquifer
- 2893.0 ○ Well completed in sand aquifer
- 2891 Water-table contour — Shows altitude of water table
- Boundary of the sand and gravel aquifers
- Approximate northern limit of sand aquifer
- Direction of ground-water flow
- 2890.5 X Surface water control point
- ▲ Gaging station

1 0 1 2 3 MILES

Base from U.S. Forest Service (1966)

Hydrology by Alex Brietkrietz

CONTOURS ON THE WATER TABLE IN THE SAND AQUIFER DURING RISING STAGE IN FLATHEAD LAKE, JUNE 5—10, 1965

3 REPORTER PRTG. & SUPPLY CO.

Attachment B

Site Monitoring Well Logs

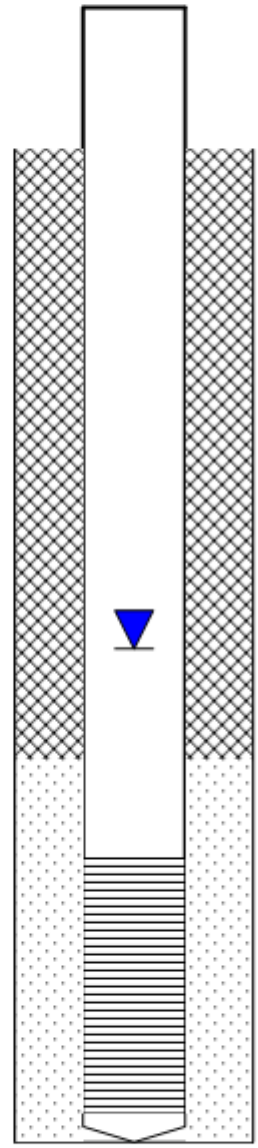
BORING AND WELL CONSTRUCTION LOG

Boring/Well # : MW-1
Project Name: LCWD GW STUDY
Project No: 1539-22

DRILL METHOD: AUGER	LOGGED BY: CHRISTINA EGGENSPERGER	DATE STARTED: 9/6/2022
DRILLED BY: ALPINE GEOTECHNICAL	SURFACE COMPLETION: PIEZOMETER	DATE COMPLETED: 9/6/2022
CASING TYPE: SCH 40 PVC/2"	FROM -5 TO 25 FT.	TOC ELEV.: 2915.96 amsl (NAVD 88)
SCREEN TYPE: SCH 40 PVC 0.010" SLOT	FROM 25 TO 35 FT.	NORTHING: NM (MT SP-N83 IF)
SEAL: BENTONITE CHIPS 3/8"	FROM 0 TO 21.5 FT.	EASTING: NM (MT SP-N83 IF)
FILTER PACK: 10-20 SILICA SAND	FROM 21.5 TO 35 FT.	BORING DIAMETER: 8"
TD WELL: 35 FT.	TD BORING : 35 FT.	DTW: 20.21 FT. Below TOC

Depth (ft)	Blow Count	Density	Lithology Log	USCS Symbol	Lithology Description
0					
4	22 33	Medium		SM	Medium brown, fine grained, damp silty sand. Peds observed but easily broken.
8					As above, increasing moisture, non-cohesive and low plasticity.
12	33 34				As above with increasing sand and organic content. Increased cohesion and poorly graded.
16	21 23				As above, wet at approximately 18 ft.
20	22 34				As above with increased plascticity, increased fines and poorly graded.
24	12 12				Medium to dark gray silty sand, poorly graded and medium plasticity. Wet.
28					
32	21 33			SP-SM	Poorly graded wet sand with silt.
36	23 55				

Well Construction Details



Elevation (ft) (NAVD 88)	Depth (ft)
4	-4
0	0
-4	4
-8	8
-12	12
-16	16
-20	20
-24	24
-28	28
-32	32
-36	36

Lithology Key

SM SP-SM

Well Construction Key

Bentonite Chip | End Cap | 0.01" Slotted Scre
Boring | 10-20 Silica Sand | 2" PVC Riser

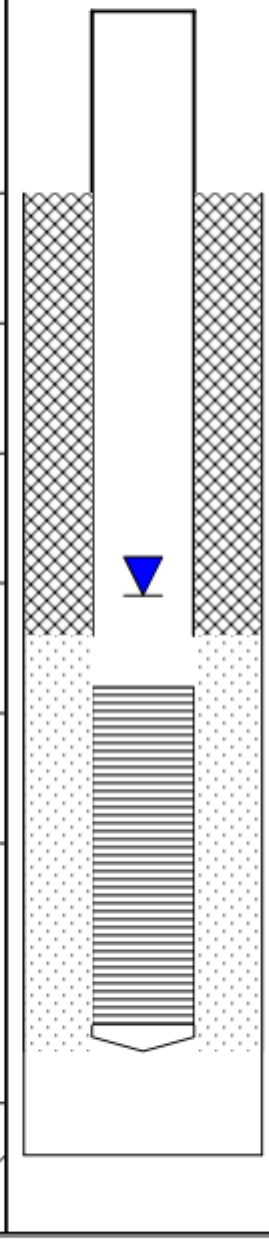
BORING AND WELL CONSTRUCTION LOG

Boring/Well # : MW-2
Project Name: LCWD GW STUDY
Project No: 1539-22

DRILL METHOD: AUGER	LOGGED BY: CHRISTINA EGGENSPERGER	DATE STARTED: 9/6/2022
DRILLED BY: ALPINE GEOTECHNICAL	SURFACE COMPLETION: PIEZOMETER	DATE COMPLETED: 9/6/2022
CASING TYPE: SCH 40 PVC/2"	FROM -7 TO 19 FT.	TOC ELEV.: 2913.26 amsl (NAVD 88)
SCREEN TYPE: SCH 40 PVC 0.010" SLOT	FROM 19 TO 33 FT.	NORTHING: NM (MT SP-N83 IF)
SEAL: BENTONITE CHIPS 3/8"	FROM 0 TO 17 FT.	EASTING: NM (MT SP-N83 IF)
FILTER PACK: 10-20 SILICA SAND	FROM 17 TO 33 FT.	BORING DIAMETER: 8"
TD WELL: 33 FT.	TD BORING : 37 FT.	DTW: 17.94 FT. Below TOC

Depth (ft)	Blow Count	Density	Lithology Log	USCS Symbol	Lithology Description
-8 to 0					
0 to 4		Medium dense		ML	Light brown to olive gray sandy silt. Sand is fine grained.Dry, non-cohesive with easily broken peds. Dry.
4 to 8	33 45			SM	Light brown to light gray fine grained, poorly graded silty sand. Non-cohesive and non-plastic. Moist.
8 to 12	22 22	Loose		Sm	Medium brown fine grained, poorly graded silty sand. Low cohesiveness and non-plastic. Moist to wet.
12 to 16	12 11			SM	As above with slightly larger grain size. Wet.
16 to 20	12 33				Gray fine grained, poorly graded silty sand. Non-cohesive to low cohesiveness and non-plastic. Wet.
20 to 28	22 33				Poor recovery due to heaving.
28 to 36	13 23	Loose		SM	Gray fine grained, poorly graded silty sand. Non-cohesive to low cohesiveness and non-plastic. Wet.
36 to 40					

Well Construction Details



Elevation (ft) (NAVD 88)	Depth (ft)
8	-8
4	-4
0	0
-4	4
-8	8
-12	12
-16	16
-20	20
-24	24
-28	28
-32	32
-36	36
-40	40

Lithology Key

SM ML

Well Construction Key

Bentonite Chip | End Cap | 0.01" Slotted Scre
Boring | 10-20 Silica Sand | 2" PVC Riser

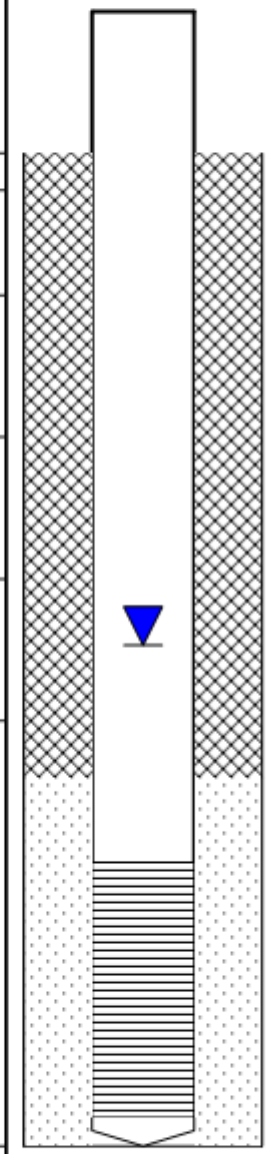
BORING AND WELL CONSTRUCTION LOG

Boring/Well # : MW-3
Project Name: LCWD GW STUDY
Project No: 1539-22

DRILL METHOD: AUGER	LOGGED BY: CHRISTINA EGGENSPERGER	DATE STARTED: 9/7/2022
DRILLED BY: ALPINE GEOTECHNICAL	SURFACE COMPLETION: PIEZOMETER	DATE COMPLETED: 9/7/2022
CASING TYPE: SCH 40 PVC/2"	FROM -5 TO 25 FT.	TOC ELEV.: 2914.93 amsl (NAVD 88)
SCREEN TYPE: SCH 40 PVC 0.010" SLOT	FROM 25 TO 35 FT.	NORTHING: NM (MT SP-N83 IF)
SEAL: BENTONITE CHIPS 3/8"	FROM 0 TO 22 FT.	EASTING: NM (MT SP-N83 IF)
FILTER PACK: 10-20 SILICA SAND	FROM 22 TO 35 FT.	BORING DIAMETER: 8"
TD WELL: 35 FT.	TD BORING : 35 FT.	DTW: 20.14 FT. Below TOC

Depth (ft)	Blow Count	Density	Lithology Log	USCS Symbol	Lithology Description
0					
4		Medium dense		ML	Dry to moist. Medium brown poorly graded fine sandy silt. Moderately cohesive and non-plastic. Dry to moist.
8	33 45	Medium			Gray, brown, and tan poorly graded fine silty sand. Low cohesion and non-plastic. Dry.
12	22 33	Medium dense to dense			Medium brown poorly graded fine silty sand. Low cohesion and non-plastic. Moist.
16	22 32	Medium			Gray brown poorly graded fine silty sand. Moderate cohesion and non-plastic. Wet.
20	12 33			SM	
24	12 22				Gray as above with increased cohesion and plasticity. Dark organic material visible @ 20 ft. Wet.
28					
32	25 43	Medium loose			
36	21 01				

Well Construction Details



Elevation (ft) (NAVD 88)	Depth (ft)
4	-4
0	0
-4	4
-8	8
-12	12
-16	16
-20	20
-24	24
-28	28
-32	32
-36	36

Lithology Key

SM ML

Well Construction Key

Bentonite Chip | End Cap | 0.01" Slotted Scre
Boring | 10-20 Silica Sand | 2" PVC Riser

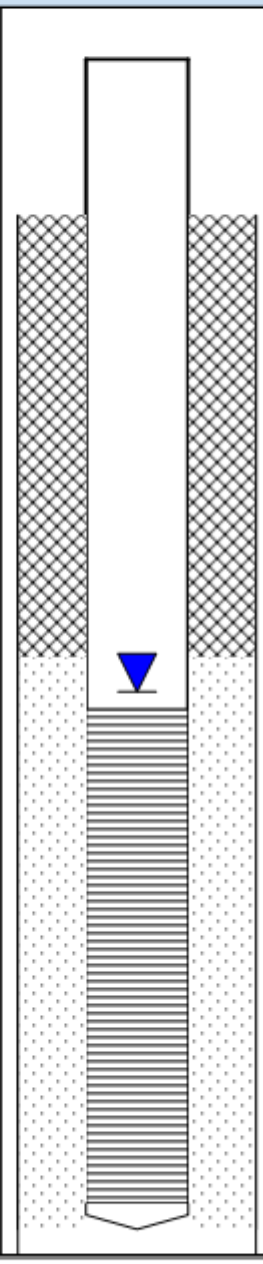
BORING AND WELL CONSTRUCTION LOG

Boring/Well # : MW-4
Project Name: LCWD GW STUDY
Project No: 1539-22

DRILL METHOD: AUGER	LOGGED BY: CHRISTINA EGGENSPERGER	DATE STARTED: 9/7/2022
DRILLED BY: ALPINE GEOTECHNICAL	SURFACE COMPLETION: PIEZOMETER	DATE COMPLETED: 9/7/2022
CASING TYPE: SCH 40 PVC/2"	FROM -6 TO 19 FT.	TOC ELEV.: 2916.41 amsl (NAVD 88)
SCREEN TYPE: SCH 40 PVC 0.010" SLOT	FROM 19 TO 39 FT.	NORTHING: NM (MT SP-N83 IF)
SEAL: BENTONITE CHIPS 3/8"	FROM 0 TO 17 FT.	EASTING: NM (MT SP-N83 IF)
FILTER PACK: 10-20 SILICA SAND	FROM 17 TO 39 FT.	BORING DIAMETER: 8"
TD WELL: 39 FT.	TD BORING : 39 FT.	DTW: 21.25 FT. Below TOC

Depth (ft)	Blow Count	Density	Lithology Log	USCS Symbol	Lithology Description
0					
0–4		Medium dense		ML	Topsoil Light brown to tan sandy silt. Peds present. Moderate cohesion and non-plastic. Dry.
4–8	22 33	Medium		SM	Light gray/brown poorly graded fine sand with silt. Non-cohesive and non-plastic. Moist at 10 ft.
8–12	22 33	Medium dense		SM	
12–16	24 43				Medium brown to gray well graded silty sand. Non-cohesive and non-plastic. Wet.
16–20	23 43			SP-SM	As above with increasing grain size and poorly graded. Medium to dark gray and wet.
20–24					
24–28	12 34				Poor recovery due to heaving.
28–32				SP-SM	Gray poorly graded silty sand. Medium to dark gray and wet.
32–36	23 44	Medium			
36–40	11 12			SM	As above with increased fines and cohesion. Non-plastic and wet.

Well Construction Details



Elevation (ft) (NAVD 88)	Depth (ft)
8	-8
4	-4
0	0
-4	4
-8	8
-12	12
-16	16
-20	20
-24	24
-28	28
-32	32
-36	36
-40	40

Lithology Key

SM | SP-SM | ML

Well Construction Key

Bentonite Chip | End Cap | 0.01" Slotted Scre
Boring | 10-20 Silica Sand | 2" PVC Riser

BORING AND WELL CONSTRUCTION LOG

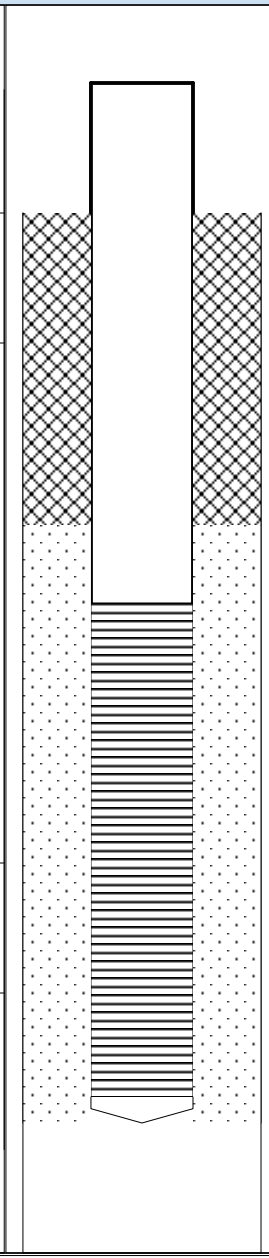
Water & Environmental TECHNOLOGIES

Boring/Well # : MW-5
Project Name: LCWD GW STUDY
Project No: 1539-22

DRILL METHOD:	AUGER	LOGGED BY:	CHRISTINA EGGENSPERGER			DATE STARTED:	9/8/2022
DRILLED BY:	ALPINE GEOTECHNICAL	SURFACE COMPLETION:	PIEZOMETER			DATE COMPLETED:	9/8/2022
CASING TYPE:	SCH 40 PVC/2"	FROM	-5	TO	15 FT.	TOC ELEV.:	2917.8 amsl (NAVD 88)
SCREEN TYPE:	SCH 40 PVC 0.010" SLOT	FROM	15	TO	35 FT.	NORTHING:	NM (MT SP-N83 IF)
SEAL:	BENTONITE CHIPS 3/8"	FROM	0	TO	12 FT.	EASTING:	NM (MT SP-N83 IF)
FILTER PACK:	10-20 SILICA SAND	FROM	12	TO	35 FT.	BORING DIAMETER:	8"
TD WELL:	35 FT.	TD BORING :	40 FT.			DTW:	NM FT. Below TOC

Depth (ft)	Blow Count	Density	Lithology Log	USCS Symbol	Lithology Description
0 to 4		Medium dense		ML	Light to medium brown sandy silt with moderate cohesion and non-plastic. Peds present. Dry.
4 to 12	12 33 22 33	Medium		SM	Brown poorly graded fine grained silty sand with increasing moisture with depth. Wet at 15 ft. Heaving and poor recovery at 20-25 ft.
12 to 16	22 44	Medium loose		SM	Brown poorly graded fine grained silty sand with increasing moisture with depth. Wet at 15 ft. Heaving and poor recovery at 20-25 ft.
16 to 20	11 22	Medium loose		SM	Brown poorly graded fine grained silty sand with increasing moisture with depth. Wet at 15 ft. Heaving and poor recovery at 20-25 ft.
20 to 24	12 22	Medium loose		SP-SM	dark gray poorly graded silty sand with moderate cohesion and non-plastic. Wet.
24 to 28	12 22	Medium loose		SP-SM	dark gray poorly graded silty sand with moderate cohesion and non-plastic. Wet.
28 to 32	11 12	Medium loose		SP-SM	dark gray poorly graded silty sand with moderate cohesion and non-plastic. Wet.
32 to 36					Poor recovery due to heaving. Advanced to 42 ft to retrieve sample.
36 to 40					Poor recovery due to heaving. Advanced to 42 ft to retrieve sample.

Well Construction Details



Elevation (ft) (NAVD 88)	Depth (ft)
8	-8
4	-4
0	0
-4	4
-8	8
-12	12
-16	16
-20	20
-24	24
-28	28
-32	32
-36	36
-40	40

Lithology Key

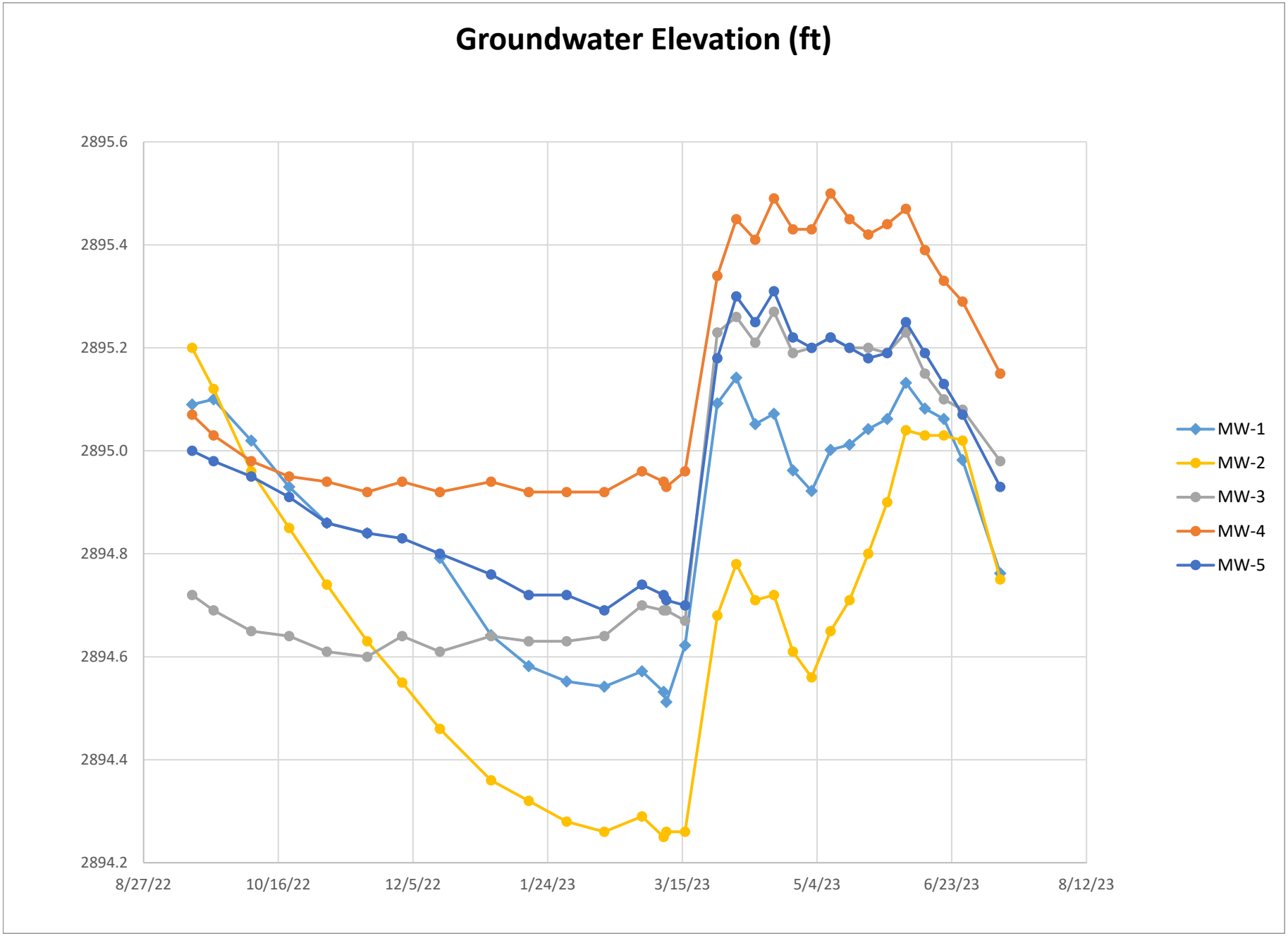
SM SP-SM ML

Well Construction Key

Bentonite Chip End Cap 0.01" Slotted Scre
Boring 10-20 Silica Sand 2" PVC Riser

Attachment C

Hydrograph with Tabulated Water Levels


Groundwater Elevation (ft)
2895.6
2895.4
2895.2
2895.0
2894.8
2894.6
2894.4
2894.2
8/27/22
10/16/22
12/5/22
1/24/23
3/15/23
5/4/23
6/23/23
8/12/23
MW-1
MW-2
MW-3
MW-4
MW-5

Project Name:	Lakeside County Water & Sewer District
Project Number:	1539-22
Activity:	Groundwater Monitoring

	MW-1	MW-2	MW-3	MW-4	MW-5
Well Depth (ft) btomp - 9/22/2022	35.66	34.62	35.79	41.02	36.82
Measuring Point Elev. (ft)	2915.44	2913.26	2914.93	2916.41	2917.80
MW-1 Resurvey	2915.96				
Ground Surface Elev. (ft)	2912.60	2910.44	2912.03	2913.45	2914.27
Stick Up (ft)	2.84	2.82	2.90	2.96	3.53

		Depth to Water (ft) btomp					Groundwater Elevation (ft)				
Date	Time	MW-1	MW-2	MW-3	MW-4	MW-5	MW-1	MW-2	MW-3	MW-4	MW-5
9/14/2022	8:00am	20.35	18.06	20.21	21.34	22.80	2895.09	2895.20	2894.72	2895.07	2895.00
9/22/2022	10:00am	20.34	18.14	20.24	21.38	22.82	2895.10	2895.12	2894.69	2895.03	2894.98
10/6/2022	12:00pm	20.42	18.30	20.28	21.43	22.85	2895.02	2894.96	2894.65	2894.98	2894.95
10/20/2022	11:45am	20.51	18.41	20.29	21.46	22.89	2894.93	2894.85	2894.64	2894.95	2894.91
11/3/2022	10:10am	20.58	18.52	20.32	21.47	22.94	2894.86	2894.74	2894.61	2894.94	2894.86
11/18/2022	11:18am	20.60	18.63	20.33	21.49	22.96	2894.84	2894.63	2894.60	2894.92	2894.84
12/1/2022	11:25am	n/a	18.71	20.29	21.47	22.97	n/a	2894.55	2894.64	2894.94	2894.83
12/15/2022	10:48am	21.17	18.80	20.32	21.49	23.00	2894.79	2894.46	2894.61	2894.92	2894.80
1/3/2023	10:55am	21.32	18.90	20.29	21.47	23.04	2894.64	2894.36	2894.64	2894.94	2894.76
1/17/2023	9:23am	21.38	18.94	20.30	21.49	23.08	2894.58	2894.32	2894.63	2894.92	2894.72
1/31/2023	11:35am	21.41	18.98	20.30	21.49	23.08	2894.55	2894.28	2894.63	2894.92	2894.72
2/14/2023	9:12am	21.42	19.00	20.29	21.49	23.11	2894.54	2894.26	2894.64	2894.92	2894.69
2/28/2023	10:47am	21.39	18.97	20.23	21.45	23.06	2894.57	2894.29	2894.70	2894.96	2894.74
3/8/2023	9:30am	21.43	19.01	20.24	21.47	23.08	2894.53	2894.25	2894.69	2894.94	2894.72
3/9/2023	10:30am	21.45	19.00	20.24	21.48	23.09	2894.51	2894.26	2894.69	2894.93	2894.71
3/16/2023	4:50pm	21.34	19.00	20.26	21.45	23.10	2894.62	2894.26	2894.67	2894.96	2894.70
3/28/2023	10:00am	20.87	18.58	19.70	21.07	22.62	2895.09	2894.68	2895.23	2895.34	2895.18
4/4/2023	11:28am	20.82	18.48	19.67	20.96	22.50	2895.14	2894.78	2895.26	2895.45	2895.30
4/11/2023	10:38am	20.91	18.55	19.72	21.00	22.55	2895.05	2894.71	2895.21	2895.41	2895.25
4/18/2023	10:05am	20.89	18.54	19.66	20.92	22.49	2895.07	2894.72	2895.27	2895.49	2895.31
4/25/2023	11:33am	21.00	18.65	19.74	20.98	22.58	2894.96	2894.61	2895.19	2895.43	2895.22
5/2/2023	10:53am	21.04	18.70	19.73	20.98	22.60	2894.92	2894.56	2895.20	2895.43	2895.20
5/9/2023	11:25am	20.96	18.61	19.71	20.91	22.58	2895.00	2894.65	2895.22	2895.50	2895.22
5/16/2023	11:55am	20.95	18.55	19.73	20.96	22.60	2895.01	2894.71	2895.20	2895.45	2895.20
5/23/2023	11:47am	20.92	18.46	19.73	20.99	22.62	2895.04	2894.80	2895.20	2895.42	2895.18
5/30/2023	11:27am	20.90	18.36	19.74	20.97	22.61	2895.06	2894.90	2895.19	2895.44	2895.19
6/6/2023	12:42pm	20.83	18.22	19.70	20.94	22.55	2895.13	2895.04	2895.23	2895.47	2895.25
6/13/2023	12:41pm	20.88	18.23	19.78	21.02	22.61	2895.08	2895.03	2895.15	2895.39	2895.19
6/20/2023	11:00am	20.90	18.23	19.83	21.08	22.67	2895.06	2895.03	2895.10	2895.33	2895.13
6/27/2023	11:22am	20.98	18.24	19.85	21.12	22.73	2894.98	2895.02	2895.08	2895.29	2895.07
7/11/2023	11:20am	21.20	18.51	19.95	21.26	22.87	2894.76	2894.75	2894.98	2895.15	2894.93

Note: MW-1 casing was damaged before the 12/1/2022 measurement and repaired with a new stick up for the 12/15/2022 measurement.

Attachment D

Analytical Data

ANALYTICAL REPORT

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904-1900
Phone: 406-755-2131 Fax: 406-257-5359 www.melab.us

Water & Environmental Tech
Water & Environmental Technologies
102 Cooperative Way, Ste 100
Kalispell, MT 59901

PWS ID:
Project: LCWSD

Client Sample ID: MW-5 **Lab ID:** 2210371-01
Matrix: DRINKING WATER **Collected:** 09/22/2022 10:10 **Received:** 09/22/2022 11:35

Coliform	Result	Units	RL	MCL	Method	Prepared	Analyzed	Analyst
Coliform Bacteria	**Present**	P/A	1	1	SM9223B	09/22/2022 14:30	09/23/2022 9:35	BSB
Coliform, Escherichia - P/A	**Absent**	P/A	1	1	SM9223B	09/22/2022 14:30	09/23/2022 9:35	BSB

MCL = Maximum Contaminant Limit ND = Not Detected
RL = Reporting Limit

MEL REVIEW:

ANALYTICAL REPORT

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904-1900
Phone: 406-755-2131 Fax: 406-257-5359 www.melab.us

Water & Environmental Tech
Water & Environmental Technologies
102 Cooperative Way, Ste 100
Kalispell, MT 59901

PWS ID:
Project: LCWSD

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904
Phone: 406-755-2131 Fax: 406-257-5359 www.melab.us

10371

Total Coliform Bacteria - Chain of Custody

Samples must arrive at the lab within 18 hours of collection.
Keep sample cool, not frozen. It is important to sample correctly.
SEE THE BACK OF THIS FORM FOR SAMPLING PROCEDURES.

PAYMENT MUST ACCOMPANY SAMPLE

Total Coliform Bacteria and E. coli test: $32
Extra copies of report, emails, faxes ($1 each): _____
If using a prepaid postage mailer tube, add $9: _____
Total enclosed: _____

Customer Name: Water + Environmental Technologies
Mailing Address: 102 Cooperative Way STE 100
City, State, Zip: Kalispell MT 59901 Phone #: (406) 756-2550

Sample Information

Physical address of property:	Sample Site (Kitchen sink, hydrant, etc.)	Sample Date	Sample Time
LCWSD	MW-5	9/22/22	10:10

One copy of the report is included in the price of the test. How would you like to receive this report?

☐ Mail to:
☒ Email to: jgraham@waterenvtech.com
☐ Fax to:
Extra copies ($1 each) to:
Extra copies ($1 each) to:

I hereby acknowledge that this sample was collected at the above location, date and time.
Sampler signature: [signature] Date: 9/22/22

This form MUST be signed

Signature of person delivering the sample: Date/Time:
Received by laboratory: 9/22/22 1135 WC Date/Time:

LABORATORY USE ONLY

Paid by:
Amount: $ EMAIL AM CC CASH CHK M C DB

MCL = Maximum Contaminant Limit ND = Not Detected
RL = Reporting Limit

MEL REVIEW: _____

ANALYTICAL SUMMARY REPORT

October 11, 2022

Water and Environmental Technologies
480 E Park St Ste 200
Butte, MT 59701-1923

Work Order: B22092240

Project Name: (1539-22) LCWSD

Energy Laboratories Inc Billings MT received the following 1 sample for Water and Environmental Technologies on 9/23/2022 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B22092240-001	MW-5	09/22/22 10:10	09/23/22	Aqueous	Conductivity Carbon, Total Organic Anions by Ion Chromatography Nitrogen, Nitrate + Nitrite Nitrogen, Total Kjeldahl pH Preparation for TDS A2540 C TKN preparation E351.2 Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

CLIENT: Water and Environmental Technologies
Project: (1539-22) LCWSD
Work Order: B22092240

Report Date: 10/11/22

CASE NARRATIVE

Tests associated with analyst identified as ELI-CA were subcontracted to Energy Laboratories, PO Box 247, Casper, WY, EPA Number WY00002.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies
Project: (1539-22) LCWSD
Lab ID: B22092240-001
Client Sample ID: MW-5

Report Date: 10/11/22
Collection Date: 09/22/22 10:10
DateReceived: 09/23/22
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.4	s.u.	H	0.1		A4500-H B	09/26/22 10:23 / fap
pH Measurement Temp	13.9	°C		1.0		A4500-H B	09/26/22 10:23 / fap
Conductivity @ 25 C	595	umhos/cm		5		A2510 B	09/26/22 10:23 / fap
Solids, Total Dissolved TDS @ 180 C	337	mg/L	D	20		A2540 C	09/27/22 09:03 / jaw
INORGANICS							
Chloride	9	mg/L		1		E300.0	10/06/22 06:06 / caa
Sulfate	4	mg/L		1		E300.0	10/06/22 06:06 / caa
AGGREGATE ORGANICS							
Organic Carbon, Total (TOC)	3.5	mg/L		0.5		A5310 C	09/30/22 11:55 / mnm
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.06	mg/L		0.01		E353.2	10/03/22 17:54 / krt
Nitrogen, Kjeldahl, Total as N	ND	mg/L		0.5		E351.2	10/04/22 15:50 / mh

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22092240 **Report Date:** 10/11/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2510 B**										Batch: R388509
Lab ID: **SC 2nd 1413**	Laboratory Control Sample					Run: PHSC _101-B_220926A				09/26/22 09:05
Conductivity @ 25 C		1410	umhos/cm	5.0	100	90	110			
Lab ID: **MBLK**	Method Blank					Run: PHSC _101-B_220926A				09/26/22 09:11
Conductivity @ 25 C		ND	umhos/cm	5						
Lab ID: **B22090504-002ADUP**	Sample Duplicate					Run: PHSC _101-B_220926A				09/26/22 09:22
Conductivity @ 25 C		1470	umhos/cm	5.0				0.6	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22092240 **Report Date:** 10/11/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: 170866
Lab ID: MB-170866		Method Blank				Run: BAL #30_220927C				09/27/22 09:01
Solids, Total Dissolved TDS @ 180 C		7	mg/L							
Lab ID: LCS-170866		Laboratory Control Sample				Run: BAL #30_220927C				09/27/22 09:01
Solids, Total Dissolved TDS @ 180 C		1030	mg/L	25	103	90	110			
Lab ID: B22092175-006A DUP		Sample Duplicate				Run: BAL #30_220927C				09/27/22 09:01
Solids, Total Dissolved TDS @ 180 C		72000	mg/L	2500				1.8	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22092240 **Report Date:** 10/11/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B									Analytical Run: PHSC _101-B_220926A	
Lab ID: pH 8	2	Initial Calibration Verification Standard							09/26/22 08:52	
pH		8.0	s.u.	0.1	100	98	102			
pH Measurement Temp		19.4	°C	1.0						
Method: A4500-H B									Batch: R388509	
Lab ID: B22092276-001ADUP	2	Sample Duplicate				Run: PHSC _101-B_220926A			09/26/22 16:07	
pH		7.7	s.u.	0.1				0.1	3	
pH Measurement Temp		17.6	°C	1.0						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22092240 **Report Date:** 10/11/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5310 C									Analytical Run: SUB-C287653	
Lab ID: CCV-11940	Continuing Calibration Verification Standard								09/29/22 16:56	
Organic Carbon, Total (TOC)		10.3	mg/L	0.50	103	90	110			
Method: A5310 C									Batch: C_R287653	
Lab ID: MBLK	Method Blank					Run: SUB-C287653			09/29/22 16:15	
Organic Carbon, Total (TOC)		ND	mg/L	0.2						
Lab ID: LCS-11923	Laboratory Control Sample					Run: SUB-C287653			09/29/22 16:39	
Organic Carbon, Total (TOC)		10.3	mg/L	0.50	103	91	111			
Lab ID: B22092175-001H	Sample Matrix Spike					Run: SUB-C287653			09/29/22 17:45	
Organic Carbon, Total (TOC)		2.80	mg/L	0.50	34	91	111			S
Lab ID: B22092175-001H	Sample Matrix Spike Duplicate					Run: SUB-C287653			09/29/22 18:15	
Organic Carbon, Total (TOC)		2.96	mg/L	0.50	38	91	111	5.6	20	S
Lab ID: C22091046-001EMS	Sample Matrix Spike					Run: SUB-C287653			09/30/22 13:21	
Organic Carbon, Total (TOC)		5.27	mg/L	0.50	105	91	111			
Lab ID: C22091046-001EMSD	Sample Matrix Spike Duplicate					Run: SUB-C287653			09/30/22 13:37	
Organic Carbon, Total (TOC)		5.38	mg/L	0.50	108	91	111	2.0	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

S - Spike recovery outside of advisory limits

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22092240 **Report Date:** 10/11/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**									Analytical Run: IC METROHM 1_221005A	
Lab ID: **ICV**	2	Initial Calibration Verification Standard							10/05/22 16:25	
Chloride		25.4	mg/L	1.0	102	90	110			
Sulfate		107	mg/L	1.0	107	90	110			
Lab ID: **CCV**	2	Continuing Calibration Verification Standard							10/06/22 04:44	
Chloride		25.8	mg/L	1.0	103	90	110			
Sulfate		109	mg/L	1.0	109	90	110			
Method: **E300.0**									Batch: R389157	
Lab ID: **ICB**	2	Method Blank				Run: IC METROHM 1_221005A			10/05/22 16:41	
Chloride		ND	mg/L	0.06						
Sulfate		ND	mg/L	0.1						
Lab ID: **LFB**	2	Laboratory Fortified Blank				Run: IC METROHM 1_221005A			10/05/22 16:58	
Chloride		26.3	mg/L	1.0	105	90	110			
Sulfate		108	mg/L	1.0	108	90	110			
Lab ID: **B22092156-015AMS**	2	Sample Matrix Spike				Run: IC METROHM 1_221005A			10/06/22 05:17	
Chloride		27.0	mg/L	1.0	104	90	110			
Sulfate		128	mg/L	1.0	110	90	110			
Lab ID: **B22092156-015AMSD**	2	Sample Matrix Spike Duplicate				Run: IC METROHM 1_221005A			10/06/22 05:33	
Chloride		27.3	mg/L	1.0	105	90	110	1.0	20	
Sulfate		129	mg/L	1.0	111	90	110	1.0	20	S

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

S - Spike recovery outside of advisory limits

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22092240 **Report Date:** 10/11/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E351.2										Analytical Run: FIA204-B_221004B
Lab ID: ICV-170281		Initial Calibration Verification Standard								10/04/22 13:57
Nitrogen, Kjeldahl, Total as N		9.01	mg/L	0.50	90	90	110			
Lab ID: CCV-171068		Continuing Calibration Verification Standard								10/04/22 15:32
Nitrogen, Kjeldahl, Total as N		9.89	mg/L	0.50	99	90	110			
Method: E351.2										Batch: 171114
Lab ID: MB-171114		Method Blank				Run: FIA204-B_221004B				10/04/22 15:35
Nitrogen, Kjeldahl, Total as N		ND	mg/L	0.3						
Lab ID: LCS-171114		Laboratory Control Sample				Run: FIA204-B_221004B				10/04/22 15:37
Nitrogen, Kjeldahl, Total as N		9.67	mg/L	0.50	97	90	110			
Lab ID: B22092164-001DMS		Sample Matrix Spike				Run: FIA204-B_221004B				10/04/22 15:40
Nitrogen, Kjeldahl, Total as N		10.4	mg/L	0.50	104	90	110			
Lab ID: B22092164-001DMSD		Sample Matrix Spike Duplicate				Run: FIA204-B_221004B				10/04/22 15:42
Nitrogen, Kjeldahl, Total as N		10.2	mg/L	0.50	102	90	110	1.9	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22092240 **Report Date:** 10/11/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E353.2**										Analytical Run: FIA203-B_221003B
Lab ID: **ICV**		Initial Calibration Verification Standard								10/03/22 17:23
Nitrogen, Nitrate+Nitrite as N		0.569	mg/L	0.010	101	90	110			
Lab ID: **CCV**		Continuing Calibration Verification Standard								10/03/22 17:42
Nitrogen, Nitrate+Nitrite as N		1.03	mg/L	0.010	103	90	110			
Method: **E353.2**										Batch: R388986
Lab ID: **MBLK**		Method Blank				Run: FIA203-B_221003B				10/03/22 17:24
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.007						
Lab ID: **LFB**		Laboratory Fortified Blank				Run: FIA203-B_221003B				10/03/22 17:26
Nitrogen, Nitrate+Nitrite as N		1.04	mg/L	0.010	104	90	110			
Lab ID: **FILTERLFB**		Laboratory Fortified Blank				Run: FIA203-B_221003B				10/03/22 17:28
Nitrogen, Nitrate+Nitrite as N		1.05	mg/L	0.010	105	90	110			
Lab ID: **B22092451-001CMS**		Sample Matrix Spike				Run: FIA203-B_221003B				10/03/22 18:01
Nitrogen, Nitrate+Nitrite as N		48.6	mg/L	0.20	103	90	110			
Lab ID: **B22092451-001CMSD**		Sample Matrix Spike Duplicate				Run: FIA203-B_221003B				10/03/22 18:02
Nitrogen, Nitrate+Nitrite as N		49.3	mg/L	0.20	107	90	110	1.4	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

Work Order Receipt Checklist

Water and Environmental Technologies B22092240

Login completed by: Tabitha Edwards
Date Received: 9/23/2022
Reviewed by: gmccartney
Received by: jdr
Reviewed Date: 10/1/2022
Carrier name: Return-FedEx Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	1.3°C On Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

Contact and Corrective Action Comments:

None

Chain of Custody & Analytical Request Record

ENERGY LABORATORIES — Trust our People. Trust our Data.

www.energylab.com

Page 1 of 1

Account Information (Billing information)

Company/Name	Water & Environmental Technologies
Contact	Lisa Johnson
Phone	(406) 756 2550
Mailing Address	102 Cooperative Way
City, State, Zip	Kalispell MT 59901
Email	ljohnson@waterenvtech.com
Receive Invoice	☐ Hard Copy ☐ Email
Receive Report	☐ Hard Copy ☒ Email
Purchase Order	
Quote	
Bottle Order	167260

Report Information (if different than Account Information)

Company/Name	
Contact	Jamie Graham
Phone	(406) 309-6084
Mailing Address	
City, State, Zip	
Email	jgraham@waterenvtech.com
Receive Report	☐ Hard Copy ☒ Email
Special Report/Formats:	☐ LEVEL IV ☐ NELAC ☐ EDD/EDT (contact laboratory) ☐ Other:

Comments

Project Information

Project Name, PWSID, Permit, etc.	(1539-22) LCWSD
Sampler Name	J. Graham
Sampler Phone	(406) 471-1205
Sample Origin State	MT
EPA/State Compliance	☐ Yes ☐ No

URANIUM MINING CLIENTS MUST indicate sample type
☐ Unprocessed Ore
☐ Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11(e)2 Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Oil
DW - Drinking Water

Analysis Requested

Sample Identification (Name, Location, Interval, etc.)	Collection Date	Collection Time	Number of Containers	Matrix (See Codes Above)	A4500H B E300.0 A2510B	A2540C	E351.2 E353.2	A5310C	See Attached	RUSH TAT	ELI LAB ID (Laboratory Use Only)
1 MW-5	9/22/22	10:10	4	W	X	X	X	X			B22092240
2											
3											
4											
5											
6											
7											
8											
9											

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

ELI is REQUIRED to provide preservative traceability. If the preservatives supplied with the bottle order were **NOT** used, please attach your preservative information with this COC.

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Jamie Graham	9/22/22 1300				
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	Signature
				B Robinson	9/23/22 910	

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check	Amount $	Receipt Number (cash/check only)

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-01/21 v.4

ENERGY LABORATORIES
Trust our People. Trust our Data.
www.energylab.com
Billings, MT 800.735.4489 • Casper, WY 888.235.0515 • Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

BOTTLE ORDER 167260

SHIPPED TO: **Water and Environmental Technologies**

Contact: Jamie Graham
102 Cooperative Way Unit 100
Kalispell MT 59901-
Phone: (406) 309-6084
Project: Lakeside Water and Sewer District

Order Created by: Darcy Chirrick
Shipped From: Billings, MT
Ship Date: 9/16/2022
VIA: FedEx in box

Bottle Size/Type	Bottles Per Samp	Method	Tests	Critical Hold Time	Preservative	Notes	Num of Samp
500 mL Plastic	1	A4500-H B E300.0 A2510 B	pH Anions by Ion Chromatography Conductivity	0.25 hrs			1
1 Liter Plastic	1	A2540 C	Solids, Total Dissolved				1
100 mL Plastic Sterile	1	E1603	Bacteria, Ecoli water - MF	8.00 hrs			1
500 mL Plastic	1	E351.2 E353.2	Nitrogen, Total Kjeldahl Nitrogen, Nitrate + Nitrite		☐ H2SO4		1
250 mL Amber Glass	1	A5310 C	Carbon, Total Organic		☐ H3PO4		1

Comments

HNO3 - Nitric Acid ☐ H2SO4 - Sulfuric Acid ☐ NaOH - Sodium Hydroxide
ZnAc - Zinc Acetate ☐ HCl - Hydrochloric Acid ☐ H3PO4 - Phosphoric Acid

We strongly suggest that the samples are shipped the same day as they are collected.

Material Safety Data Sheets(MSDS) Available @ EnergyLab.com ->Services -> MSDS Sheets

ANALYTICAL REPORT

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904-1900
Phone: 406-755-2131 Fax: 406-257-5359 www.melab.us

Water & Environmental Tech
Water & Environmental Technologies
102 Cooperative Way, Ste 100
Kalispell, MT 59901

PWS ID:
Project: 48.11678, -114.22775

Client Sample ID: Monitoring Well #5 **Lab ID:** 2212401-01
Matrix: DRINKING WATER **Collected:** 11/17/2022 14:30 **Received:** 11/17/2022 15:25

Coliform	Result	Units	RL	MCL	Method	Prepared	Analyzed	Analyst
Coliform Bacteria	**Present**	P/A	1	1	SM9223B	11/18/2022 12:30	11/19/2022 10:05	BSB
Coliform, Escherichia - P/A	**Absent**	P/A	1	1	SM9223B	11/18/2022 12:30	11/19/2022 10:05	BSB

MCL = Maximum Contaminant Limit ND = Not Detected
RL = Reporting Limit

MEL REVIEW:

ANALYTICAL REPORT

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904-1900
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Water & Environmental Tech
Water & Environmental Technologies
102 Cooperative Way, Ste 100
Kalispell, MT 59901

PWS ID:
Project: 48.11678, -114.22775

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904
Phone: 406-755-2131 Fax: 406-257-5359 www.melab.us

12401

Total Coliform Bacteria - Chain of Custody

Samples must arrive at the lab within 18 hours of collection.
SEE BACK OF FORM FOR SAMPLING INSTRUCTIONS
Keep sample cool, not frozen. It is important to sample correctly.

PAYMENT MUST ACCOMPANY SAMPLE

Total Coliform Bacteria and E. coli test: $32
For **RUSH** (next morning results) add $16: _____
Extra copies of report, emails, faxes ($1 each): _____
If using a prepaid postage mailer tube, add $9: _____

Total enclosed:$ _____

Customer Name: Water & Environmental Technologies
Mailing Address: 102 Cooperative Way, Unit 100
City, State, Zip: Kalispell, MT, 59901 Phone #: 626-993-0638

Physical address of Sample Site	Sample Site (kitchen sink, hydrant, etc.)	Sample Date	Sample Time
48.11678, -114.22775	Monitoring Well #5	11/17/22	14:30

One copy of the report is included in the price of the test. How would you like to receive this report?

☐ Mail to:
☑ Email to: nsmall@waterenvtech.com
☐ Fax to:

Extra copies ($1 each) to:

I hereby acknowledge that this sample was collected at the above location, date and time.

Sampler signature: Nathan Small **Date/Time:** 11/17/22 14:30

This form MUST be signed — **Signature of person delivering sample:** Nathan Small **Date/Time:** 11/17/22 15:14

LAB USE ONLY

Received by lab date/time: GB 11-17-22 15:25 | M (C) DB UPS | Shipping charge: $

Paid by: EMAIL ALL

Amount: $ CC CASH CHK # | Invoice

MCL = Maximum Contaminant Limit ND = Not Detected
RL = Reporting Limit

MEL REVIEW: _____

ANALYTICAL SUMMARY REPORT

November 30, 2022

Water and Environmental Technologies
480 E Park St Ste 200
Butte, MT 59701-1923

Work Order: B22111573

Project Name: Lakeside Water and Sewer District

Energy Laboratories Inc Billings MT received the following 1 sample for Water and Environmental Technologies on 11/18/2022 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B22111573-001	LCWSD MW #5	11/17/22 14:22	11/18/22	Aqueous	Conductivity Carbon, Total Organic Anions by Ion Chromatography Nitrogen, Nitrate + Nitrite Nitrogen, Total Kjeldahl Nitrogen, Total (TKN+NO3+NO2) pH Preparation for TDS A2540 C TKN preparation E351.2 Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

CLIENT: Water and Environmental Technologies
Project: Lakeside Water and Sewer District
Work Order: B22111573

Report Date: 11/30/22

CASE NARRATIVE

Tests associated with analyst identified as ELI-CA were subcontracted to Energy Laboratories, PO Box 247, Casper, WY, EPA Number WY00002.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies
Project: Lakeside Water and Sewer District
Lab ID: B22111573-001
Client Sample ID: LCWSD MW #5

Report Date: 11/30/22
Collection Date: 11/17/22 14:22
DateReceived: 11/18/22
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.4	s.u.	H	0.1		A4500-H B	11/18/22 15:08 / jaw
pH Measurement Temp	10.0	°C		1.0		A4500-H B	11/18/22 15:08 / jaw
Conductivity @ 25 C	600	umhos/cm		5		A2510 B	11/18/22 15:08 / jaw
Solids, Total Dissolved TDS @ 180 C	340	mg/L	D	20		A2540 C	11/21/22 13:38 / jaw
INORGANICS							
Chloride	7	mg/L		1		E300.0	11/21/22 19:03 / caa
Sulfate	5	mg/L		1		E300.0	11/21/22 19:03 / caa
AGGREGATE ORGANICS							
Organic Carbon, Total (TOC)	3.5	mg/L		0.5		A5310 C	11/23/22 14:20 / eli-ca
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.06	mg/L		0.01		E353.2	11/21/22 14:58 / krt
Nitrogen, Kjeldahl, Total as N	ND	mg/L		0.5		E351.2	11/23/22 16:32 / mh
Nitrogen, Total	ND	mg/L		0.5		Calculation	11/23/22 17:13 / bap

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time

QA/QC Summary Report

Prepared by Casper, WY Branch

Client: Water and Environmental Technologies **Work Order:** B22111573 **Report Date:** 11/29/22

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5310 C									Analytical Run: TOC4-C_221123A
Lab ID: CCV-11940	Continuing Calibration Verification Standard								11/23/22 11:34
Organic Carbon, Total (TOC)	4.75	mg/L	0.50	95	90	110			
Method: A5310 C									Batch: R289745
Lab ID: MBLK	Method Blank				Run: TOC4-C_221123A				11/23/22 11:03
Organic Carbon, Total (TOC)	ND	mg/L	0.2						
Lab ID: LCS-11923	Laboratory Control Sample				Run: TOC4-C_221123A				11/23/22 11:18
Organic Carbon, Total (TOC)	4.74	mg/L	0.50	95	91	111			
Lab ID: C22110761-003BMS	Sample Matrix Spike				Run: TOC4-C_221123A				11/23/22 15:55
Organic Carbon, Total (TOC)	6.10	mg/L	0.50	102	91	111			
Lab ID: C22110761-003BMSD	Sample Matrix Spike Duplicate				Run: TOC4-C_221123A				11/23/22 16:11
Organic Carbon, Total (TOC)	6.12	mg/L	0.50	102	91	111	0.3	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22111573 **Report Date:** 11/30/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2510 B**									Analytical Run: PHSC _101-B_221118A	
Lab ID: **CCV - SC 1413**		Continuing Calibration Verification Standard							11/18/22 14:20	
Conductivity @ 25 C		1420	umhos/cm	5.0	101	90	110			
Method: **A2510 B**									Batch: R391613	
Lab ID: **SC 2nd 1413**		Laboratory Control Sample				Run: PHSC _101-B_221118A			11/18/22 08:56	
Conductivity @ 25 C		1420	umhos/cm	5.0	100	90	110			
Lab ID: **MBLK**		Method Blank				Run: PHSC _101-B_221118A			11/18/22 14:23	
Conductivity @ 25 C		ND	umhos/cm	5						
Lab ID: **B22111548-002ADUP**		Sample Duplicate				Run: PHSC _101-B_221118A			11/18/22 14:28	
Conductivity @ 25 C		31800	umhos/cm	5.0				0	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22111573 **Report Date:** 11/30/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2540 C**										Batch: 172726
Lab ID: **MB-172726**		Method Blank				Run: BAL #30_221121B				11/21/22 13:37
Solids, Total Dissolved TDS @ 180 C		1	mg/L							
Lab ID: **LCS-172726**		Laboratory Control Sample				Run: BAL #30_221121B				11/21/22 13:37
Solids, Total Dissolved TDS @ 180 C		1000	mg/L	25	100	90	110			
Lab ID: **B22111548-001A DUP**		Sample Duplicate				Run: BAL #30_221121B				11/21/22 13:38
Solids, Total Dissolved TDS @ 180 C		22600	mg/L	500				1.8	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22111573 **Report Date:** 11/30/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B										Analytical Run: PHSC _101-B_221118A
Lab ID: pH 8	2	Initial Calibration Verification Standard								11/18/22 08:43
pH		8.0	s.u.	0.1	100	98	102			
pH Measurement Temp		19.2	°C	1.0						
Lab ID: CCV - pH 7	2	Continuing Calibration Verification Standard								11/18/22 14:17
pH		7.0	s.u.	0.1	100	98	102			
pH Measurement Temp		19.6	°C	1.0		0	0			
Method: A4500-H B										Batch: R391613
Lab ID: B22111548-002ADUP	2	Sample Duplicate				Run: PHSC _101-B_221118A				11/18/22 14:28
pH		6.8	s.u.	0.1				0.6	3	
pH Measurement Temp		15.7	°C	1.0						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22111573 **Report Date:** 11/30/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**										Analytical Run: IC METROHM 1_221121A
Lab ID: **ICV**	2	Initial Calibration Verification Standard								11/21/22 16:20
Chloride		24.8	mg/L	1.0	99	90	110			
Sulfate		104	mg/L	1.0	104	90	110			
Lab ID: **CCV**	2	Continuing Calibration Verification Standard								11/21/22 17:09
Chloride		26.0	mg/L	1.0	104	90	110			
Sulfate		109	mg/L	1.0	109	90	110			
Method: **E300.0**										Batch: R391758
Lab ID: **ICB**	2	Method Blank				Run: IC METROHM 1_221121A				11/21/22 16:36
Chloride		ND	mg/L	0.06						
Sulfate		ND	mg/L	0.1						
Lab ID: **LFB**	2	Laboratory Fortified Blank				Run: IC METROHM 1_221121A				11/21/22 16:52
Chloride		25.0	mg/L	1.0	100	90	110			
Sulfate		105	mg/L	1.0	105	90	110			
Lab ID: **B22111469-003AMS**	2	Sample Matrix Spike				Run: IC METROHM 1_221121A				11/21/22 18:31
Chloride		244	mg/L	1.3	100	90	110			
Sulfate		1370	mg/L	2.6	97	90	110			
Lab ID: **B22111469-003AMSD**	2	Sample Matrix Spike Duplicate				Run: IC METROHM 1_221121A				11/21/22 18:47
Chloride		240	mg/L	1.3	96	90	110	1.8	20	
Sulfate		1330	mg/L	2.6	91	90	110	2.5	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22111573 **Report Date:** 11/30/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E351.2										Analytical Run: FIA204-B_221123B
Lab ID: ICV-171604		Initial Calibration Verification Standard								11/23/22 12:06
Nitrogen, Kjeldahl, Total as N		10.6	mg/L	0.50	106	90	110			
Lab ID: CCV-172790		Continuing Calibration Verification Standard								11/23/22 16:24
Nitrogen, Kjeldahl, Total as N		10.2	mg/L	0.50	102	90	110			
Method: E351.2										Batch: 172840
Lab ID: MB-172840		Method Blank				Run: FIA204-B_221123B				11/23/22 15:59
Nitrogen, Kjeldahl, Total as N		ND	mg/L	0.3						
Lab ID: LCS-172840		Laboratory Control Sample				Run: FIA204-B_221123B				11/23/22 16:01
Nitrogen, Kjeldahl, Total as N		10.3	mg/L	0.50	103	90	110			
Lab ID: B22111816-005DMS		Sample Matrix Spike				Run: FIA204-B_221123B				11/23/22 16:43
Nitrogen, Kjeldahl, Total as N		10.6	mg/L	0.50	98	90	110			
Lab ID: B22111816-005DMSD		Sample Matrix Spike Duplicate				Run: FIA204-B_221123B				11/23/22 16:44
Nitrogen, Kjeldahl, Total as N		10.1	mg/L	0.50	93	90	110	4.8	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B22111573 **Report Date:** 11/30/22

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E353.2**										Analytical Run: FIA203-B_221121B
Lab ID: **ICV**		Initial Calibration Verification Standard								11/21/22 13:47
Nitrogen, Nitrate+Nitrite as N		0.567	mg/L	0.010	100	90	110			
Lab ID: **CCV**		Continuing Calibration Verification Standard								11/21/22 14:43
Nitrogen, Nitrate+Nitrite as N		1.02	mg/L	0.010	102	90	110			
Method: **E353.2**										Batch: R391739
Lab ID: **MBLK**		Method Blank				Run: FIA203-B_221121B				11/21/22 13:49
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.007						
Lab ID: **LFB**		Laboratory Fortified Blank				Run: FIA203-B_221121B				11/21/22 13:55
Nitrogen, Nitrate+Nitrite as N		0.997	mg/L	0.010	100	90	110			
Lab ID: **FILTERLFB**		Laboratory Fortified Blank				Run: FIA203-B_221121B				11/21/22 13:56
Nitrogen, Nitrate+Nitrite as N		1.02	mg/L	0.010	102	90	110			
Lab ID: **B22111639-001DMS**		Sample Matrix Spike				Run: FIA203-B_221121B				11/21/22 15:05
Nitrogen, Nitrate+Nitrite as N		1.04	mg/L	0.010	103	90	110			
Lab ID: **B22111639-001DMSD**		Sample Matrix Spike Duplicate				Run: FIA203-B_221121B				11/21/22 15:06
Nitrogen, Nitrate+Nitrite as N		1.05	mg/L	0.010	104	90	110	1.0	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

Work Order Receipt Checklist

Water and Environmental Technologies B22111573

Login completed by: Yvonna E. Smith
Date Received: 11/18/2022
Reviewed by: cindy
Received by: lel
Reviewed Date: 11/19/2022
Carrier name: Return-FedEx Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☐	No ☑	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	0.7°C On Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

Contact and Corrective Action Comments:

The collection date/time indicated on the container label for sample LCWSD MW#5 ranges from 14:20-14:26 and on the Chain of Custody it is 14:22. Proceeded with the collection date/time as indicated on the Chain of Custody.

ENERGY LABORATORIES

www.energylab.com

Chain of Custody (COC) & Analytical Request Record

Lab Workorder #: B22111573

Project Information

Laboratory Use

Client:	Water and Environmental Technologies	*Quote:*	N/A	*Critical Hold Time:*	30 Hours
Project:	Lakeside Water and Sewer District	*BO#:*	168767	*# of Samples:*	1
Purchase Order:		*EE#:*	45786	*Matrix:*	Aqueous
Contact/Phone:	Nathan Small (406)309-6091/M:(626)993-0638	*Turn-Around Time:*	Standard		

Comments:

Contact ELI prior to RUSH sample submittal for charges, availability & scheduling. Samples submitted may be subcontracted to other laboratories to complete the test(s) requested; this will be clearly noted on the analytical report.

Analysis Requested

	Sample Identification	Collection Date/Time	# of Containers	Matrix	RUSH TAT	Conductivity (A2510 B)	Anions by Ion Chromatography (E300.0)	pH (A4500-H B)	Solids, Total Dissolved (A2540 C)	Nitrogen, Nitrate + Nitrite (E353.2)	Nitrogen, Total Kjeldahl (E351.2)	Nitrogen, Total (TKN +NO3+NO2) (Calculation)	Carbon, Total Organic (A5310 C)	Bacteria, Private Water Supply (A9223 B)					
	Hold Time (Days)					28	28	Fld	7	28	28	N/A	28	1.25					
1			4	W		X	X	X	X	X	X	X	X	X					
2	LCWSD MW#5	11/17/22 14:22	3	W		X	X	X	X	X	X	X	X						
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			

Custody Record MUST be signed

Lab provided preservatives were used ☐Yes ☐No

Sampler Name (if different than Relinquished by): Nathan Small

Sampler Phone: 406-309-6091

Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
Nathan Small	11/17/22 1630	Nathan Small			
Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	Signature
			Lynda LeBrowse	11/18/22 09:15	Lynda LeBrowse

Date Printed: 11/09/2022 EE: BL - 45786 COC: Page 1 of 1

ANALYTICAL REPORT

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904-1900
Phone: 406-755-2131 Fax: 406-257-5359 www.melab.us

Water & Environmental Tech
Water & Environmental Technologies
102 Cooperative Way, Ste 100
Kalispell, MT 59901

PWS ID:
Project: 48.1167, -114.2276

Client Sample ID: 48.1167, -114.2276 **Lab ID:** 2302242-01
Matrix: DRINKING WATER **Collected:** 03/15/2023 14:02 **Received:** 03/15/2023 15:05

Coliform	Result	Units	RL	MCL	Method	Prepared	Analyzed	Analyst
Coliform Bacteria	**Present**	P/A			SM9223B	03/16/2023 10:45	03/18/2023 9:00	BSB
Coliform, Escherichia - P/A	**Absent**	P/A			SM9223B	03/16/2023 10:45	03/18/2023 9:00	BSB

MCL = Maximum Contaminant Limit ND = Not Detected
RL = Reporting Limit

MEL REVIEW: _____

ANALYTICAL REPORT

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904-1900
Phone: 406-755-2131 Fax: 406-257-5359 www.melab.us

Water & Environmental Tech
Water & Environmental Technologies
102 Cooperative Way, Ste 100
Kalispell, MT 59901

PWS ID:
Project: 48.1167, -114.2276

Montana Environmental Laboratory LLC
1170 N. Meridian Rd., P.O. Box 8900, Kalispell, MT 59904
Phone: 406-755-2131 Fax: 406-257-5359 www.melab.us

2242

Total Coliform Bacteria - Chain of Custody

Samples must arrive at the lab within 18 hours of collection.
SEE BACK OF FORM FOR SAMPLING INSTRUCTIONS
Keep sample cool, not frozen. It is important to sample correctly.

PAYMENT MUST ACCOMPANY SAMPLE

Total Coliform Bacteria and E. coli test: $32
For **RUSH** (next morning results) add $16: _____
Extra copies of report, emails, faxes ($1 each): _____
If using a prepaid postage mailer tube, add $9: _____

Total enclosed:$ _____

Customer Name: Water & Environmental Technologies, Nathan Small
Mailing Address: 102 Cooperative Way Suite 100
City, State, Zip: Kalispell MT 59901 Phone #: 406-309-6085

Physical address of Sample Site	Sample Site (kitchen sink, hydrant, etc.)	Sample Date	Sample Time
48.1167, -114.2276	Monitoring Well	3/15/23	1402

One copy of the report is included in the price of the test. How would you like to receive this report?

☐ Mail to:
☐ Email to: nsmall@waterenvtech.com
☐ Fax to:
Extra copies ($1 each) to:

I hereby acknowledge that this sample was collected at the above location, date and time.

Sampler signature: Nathan Small **Date/Time:** 3/15/23

This form MUST be signed — **Signature of person delivering sample:** Nathan Small **Date/Time:** 3/15/23

LAB USE ONLY

Received by lab date/time: JB 3-15-23 15:05 M DB UPS Shipping charge: $

Paid by:

Amount: $ CC CASH CHK # Invoice EMAIL AM

ANALYTICAL SUMMARY REPORT

March 28, 2023

Water and Environmental Technologies
480 E Park St Ste 200
Butte, MT 59701-1923

Work Order: B23031196

Project Name: 1539-22 LCWSD

Energy Laboratories Inc Billings MT received the following 1 sample for Water and Environmental Technologies on 3/16/2023 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B23031196-001	MW-5	03/15/23 14:04	03/16/23	Aqueous	Carbon, Total Organic Nitrogen, Nitrate + Nitrite Nitrogen, Total Kjeldahl Nitrogen, Total (TKN+NO3+NO2) pH Preparation for TDS A2540 C TKN preparation E351.2 Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

CLIENT: Water and Environmental Technologies
Project: 1539-22 LCWSD
Work Order: B23031196

Report Date: 03/28/23

CASE NARRATIVE

Tests associated with analyst identified as ELI-CA were subcontracted to Energy Laboratories, PO Box 247, Casper, WY, EPA Number WY00002.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies
Project: 1539-22 LCWSD
Lab ID: B23031196-001
Client Sample ID: MW-5

Report Date: 03/28/23
Collection Date: 03/15/23 14:04
DateReceived: 03/16/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.5	s.u.	H	0.1		A4500-H B	03/16/23 16:56 / fap
pH Measurement Temp	15.4	°C		1.0		A4500-H B	03/16/23 16:56 / fap
Solids, Total Dissolved TDS @ 180 C	334	mg/L		20		A2540 C	03/17/23 13:42 / pjw
AGGREGATE ORGANICS							
Organic Carbon, Total (TOC)	3.5	mg/L		0.5		A5310 C	03/24/23 15:45 / eli-ca
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.15	mg/L		0.01		E353.2	03/21/23 15:54 / krt
Nitrogen, Kjeldahl, Total as N	ND	mg/L		0.5		E351.2	03/22/23 16:52 / jaw
Nitrogen, Total	ND	mg/L		0.5		Calculation	03/24/23 08:07 / rs4

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Casper, WY Branch

Client: Water and Environmental Technologies **Work Order:** B23031196 **Report Date:** 03/27/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5310 C									Analytical Run: TOC4-C_230324A	
Lab ID: CCV-11940		Continuing Calibration Verification Standard							03/24/23 13:46	
Organic Carbon, Total (TOC)		5.31	mg/L	0.50	106	90	110			
Method: A5310 C									Batch: R293074	
Lab ID: MBLK		Method Blank				Run: TOC4-C_230324A			03/24/23 13:11	
Organic Carbon, Total (TOC)		ND	mg/L	0.1						
Lab ID: LCS-11923		Laboratory Control Sample				Run: TOC4-C_230324A			03/24/23 13:31	
Organic Carbon, Total (TOC)		5.13	mg/L	0.50	103	90	111			
Lab ID: C23030598-001AMS		Sample Matrix Spike				Run: TOC4-C_230324A			03/24/23 14:53	
Organic Carbon, Total (TOC)		6.69	mg/L	0.50	102	90	111			
Lab ID: C23030598-001AMSD		Sample Matrix Spike Duplicate				Run: TOC4-C_230324A			03/24/23 15:08	
Organic Carbon, Total (TOC)		6.64	mg/L	0.50	101	90	111	0.8	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23031196 **Report Date:** 03/28/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: 176850
Lab ID: MB-176850		Method Blank				Run: BAL #30_230317E				03/17/23 13:37
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	20						
Lab ID: LCS-176850		Laboratory Control Sample				Run: BAL #30_230317E				03/17/23 13:38
Solids, Total Dissolved TDS @ 180 C		1010	mg/L	25	101	90	110			
Lab ID: B23031161-012A DUP		Sample Duplicate				Run: BAL #30_230317E				03/17/23 13:38
Solids, Total Dissolved TDS @ 180 C		117	mg/L	25				2.2	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23031196 **Report Date:** 03/28/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B										Analytical Run: PHSC _101-B_230316A
Lab ID: pH 8	2	Initial Calibration Verification Standard								03/16/23 09:11
pH		8.0	s.u.	0.1	100	98	102			
pH Measurement Temp		20.2	°C	1.0						
Lab ID: CCV - pH 7	2	Continuing Calibration Verification Standard								03/16/23 16:40
pH		7.0	s.u.	0.1	101	98	102			
pH Measurement Temp		19.2	°C	1.0		0	0			
Method: A4500-H B										Batch: R399018
Lab ID: B23031189-003ADUP	2	Sample Duplicate				Run: PHSC _101-B_230316A				03/16/23 16:51
pH		7.0	s.u.	0.1				0.7	3	
pH Measurement Temp		15.4	°C	1.0						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23031196 **Report Date:** 03/28/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E351.2										Analytical Run: FIA204-B_230322B
Lab ID: ICV-176770	Initial Calibration Verification Standard									03/22/23 15:15
Nitrogen, Kjeldahl, Total as N		10.3	mg/L	0.50	103	90	110			
Lab ID: CCV-176770	Continuing Calibration Verification Standard									03/22/23 16:46
Nitrogen, Kjeldahl, Total as N		9.97	mg/L	0.50	100	90	110			
Method: E351.2										Batch: 176920
Lab ID: MB-176920	Method Blank					Run: FIA204-B_230322B				03/22/23 16:23
Nitrogen, Kjeldahl, Total as N		ND	mg/L	0.4						
Lab ID: LCS-176920	Laboratory Control Sample					Run: FIA204-B_230322B				03/22/23 16:25
Nitrogen, Kjeldahl, Total as N		9.84	mg/L	0.50	98	90	110			
Lab ID: B23031224-002AMS	Sample Matrix Spike					Run: FIA204-B_230322B				03/22/23 16:59
Nitrogen, Kjeldahl, Total as N		11.5	mg/L	0.50	101	90	110			
Lab ID: B23031224-002AMSD	Sample Matrix Spike Duplicate					Run: FIA204-B_230322B				03/22/23 17:01
Nitrogen, Kjeldahl, Total as N		11.5	mg/L	0.50	101	90	110	0.0	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23031196 **Report Date:** 03/28/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2										Analytical Run: FIA203-B_230321A
Lab ID: ICV		Initial Calibration Verification Standard								03/21/23 13:25
Nitrogen, Nitrate+Nitrite as N		0.573	mg/L	0.010	101	90	110			
Lab ID: CCV		Continuing Calibration Verification Standard								03/21/23 15:43
Nitrogen, Nitrate+Nitrite as N		0.992	mg/L	0.010	99	90	110			
Lab ID: ICV		Initial Calibration Verification Standard								03/21/23 18:29
Nitrogen, Nitrate+Nitrite as N		0.589	mg/L	0.010	104	90	110			
Method: E353.2										Batch: R399259
Lab ID: MBLK		Method Blank				Run: FIA203-B_230321A				03/21/23 13:26
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.008						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA203-B_230321A				03/21/23 13:28
Nitrogen, Nitrate+Nitrite as N		0.994	mg/L	0.010	99	90	110			
Lab ID: FILTERLFB		Laboratory Fortified Blank				Run: FIA203-B_230321A				03/21/23 13:29
Nitrogen, Nitrate+Nitrite as N		1.03	mg/L	0.010	103	90	110			
Lab ID: B23031189-001EMS		Sample Matrix Spike				Run: FIA203-B_230321A				03/21/23 15:46
Nitrogen, Nitrate+Nitrite as N		1.56	mg/L	0.010	103	90	110			
Lab ID: B23031189-001EMSD		Sample Matrix Spike Duplicate				Run: FIA203-B_230321A				03/21/23 15:47
Nitrogen, Nitrate+Nitrite as N		1.57	mg/L	0.010	104	90	110	0.8	10	
Lab ID: B23031219-001CMS		Sample Matrix Spike				Run: FIA203-B_230321A				03/21/23 16:02
Nitrogen, Nitrate+Nitrite as N		0.970	mg/L	0.010	97	90	110			
Lab ID: B23031219-001CMSD		Sample Matrix Spike Duplicate				Run: FIA203-B_230321A				03/21/23 16:03
Nitrogen, Nitrate+Nitrite as N		1.01	mg/L	0.010	101	90	110	3.9	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

Work Order Receipt Checklist

Water and Environmental Technologies B23031196

Login completed by:	Lyndsi E. LeProwse	Date Received:	3/16/2023
Reviewed by:	tedwards	Received by:	lrs
Reviewed Date:	3/20/2023	Carrier name:	Return-FedEx Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	2.3°C On Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Page _____ of _____

Account Information (Billing information)

Company/Name	Water & Environmental Technologies
Contact	Lisa Johnson
Phone	406-756-2550
Mailing Address	102 Cooperative Way
City, State, Zip	Kalispell MT 59901
Email	ljohnson@waterenvtech.com
Receive Invoice	☐Hard Copy ☐Email
Receive Report	☐Hard Copy ☐Email
Purchase Order	
Quote	
Bottle Order	

Report Information (if different than Account Information)

Company/Name	
Contact	Nathan Small
Phone	406-309-6091
Mailing Address	
City, State, Zip	
Email	nsmall@waterenvtech.com
Receive Report	☐Hard Copy ☑Email
Special Report/Formats:	☐ LEVEL IV ☐ NELAC ☐ EDD/EDT (contact laboratory) ☐ Other_____

Comments

Project Information

Project Name, PWSID, Permit, etc.	1531-22 LCWSD
Sampler Name	N. Small
Sampler Phone	626-993-0638
Sample Origin State	MT
EPA/State Compliance	☐ Yes ☐ No

URANIUM MINING CLIENTS MUST indicate sample type.
☐ NOT Source or Byproduct Material
☐ Source/Processed Ore (Ground or Refined) **CALL BEFORE SENDING
☐ 11e.(2) Byproduct Material (Can ONLY be Submitted to ELI Casper Location)

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

	Sample Identification (Name, Location, Interval, etc.)	Collection Date	Collection Time	Number of Containers	Matrix (See Codes Above)	Analysis Requested: A4500HB	A2540C	E351.2 E353.2	A5310C	See Attached	RUSH TAT	ELI LAB ID (Laboratory Use Only)
1	MW-5	3/15/23	1404	4	W	X	X	X	X			B23031466
2												
3												
4												
5												
6												
7												
8												
9												
10												

Custody Record MUST be signed	Relinquished by (print) Nathan Small	Date/Time 3/15/23 1600	Signature Nathan Small	Received by (print)	Date/Time	Signature	
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print) Len Sharboo	Date/Time 3/16/23 08:55	Signature	

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check_____	Amount $	Receipt Number (cash/check only)

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-10/18 v.3

ANALYTICAL SUMMARY REPORT

May 11, 2023

Water and Environmental Technologies
480 E Park St Ste 200
Butte, MT 59701-1923

Work Order: B23050152

Project Name: Lakeside Water and Sewer District

Energy Laboratories Inc Billings MT received the following 1 sample for Water and Environmental Technologies on 5/2/2023 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B23050152-001	MW-5	05/01/23 13:05	05/02/23	Aqueous	Bacteria, Private Water Supply Conductivity Carbon, Total Organic Anions by Ion Chromatography Nitrogen, Nitrate + Nitrite Nitrogen, Total Kjeldahl Nitrogen, Total (TKN+NO3+NO2) pH Preparation for TDS A2540 C TKN preparation E351.2 Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

CLIENT: Water and Environmental Technologies
Project: Lakeside Water and Sewer District
Work Order: B23050152

Report Date: 05/11/23

CASE NARRATIVE

Tests associated with analyst identified as ELI-CA were subcontracted to Energy Laboratories, PO Box 247, Casper, WY, EPA Number WY00002.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies
Project: Lakeside Water and Sewer District
Client Sample ID: MW-5
Sampled By: Nathan Small
Lab ID: B23050152-001D

Report Date: 05/11/23
Collection Date: 05/01/23 13:05
Received Date: 05/02/23 10:20
Matrix: Aqueous

Analyses	Result	Units	Safe/Unsafe	Qualifier	Method	Analysis Date / By
MICROBIOLOGICAL						
Coliform, Total	Absent	per 100ml	SAFE		A9223 B	05/02/23 14:06 / spb
Coliform, E-Coli	Absent	per 100ml			A9223 B	05/02/23 14:06 / spb

Comments: The notation "SAFE" indicates that the water was bacteriologically SAFE when sampled.
The notation "UNSAFE" indicates that the water was bacteriologically UNSAFE when sampled.

Qualifiers:

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies
Project: Lakeside Water and Sewer District
Lab ID: B23050152-001
Client Sample ID: MW-5

Report Date: 05/11/23
Collection Date: 05/01/23 13:05
DateReceived: 05/02/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.4	s.u.	H	0.1		A4500-H B	05/02/23 13:53 / nrb
pH Measurement Temp	11.5	°C		1.0		A4500-H B	05/02/23 13:53 / nrb
Conductivity @ 25 C	589	umhos/cm		5		A2510 B	05/02/23 13:53 / nrb
Solids, Total Dissolved TDS @ 180 C	338	mg/L		20		A2540 C	05/02/23 15:39 / idg
INORGANICS							
Chloride	8	mg/L		1		E300.0	05/03/23 00:52 / caa
Sulfate	8	mg/L		1		E300.0	05/03/23 00:52 / caa
AGGREGATE ORGANICS							
Organic Carbon, Total (TOC)	3.6	mg/L		0.5		A5310 C	05/04/23 19:26 / eli-ca
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.15	mg/L		0.01		E353.2	05/03/23 14:30 / krt
Nitrogen, Kjeldahl, Total as N	ND	mg/L		0.5		E351.2	05/05/23 10:03 / jaw
Nitrogen, Total	ND	mg/L		0.5		Calculation	05/08/23 10:42 / bap

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Casper, WY Branch

Client: Water and Environmental Technologies **Work Order:** B23050152 **Report Date:** 05/09/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5310 C									Analytical Run: TOC3-C_230504A	
Lab ID: CCV-11940		Continuing Calibration Verification Standard							05/04/23 17:44	
Organic Carbon, Total (TOC)		5.40	mg/L	0.50	108	90	110			
Method: A5310 C									Batch: R294293	
Lab ID: MBLK		Method Blank				Run: TOC3-C_230504A			05/04/23 17:09	
Organic Carbon, Total (TOC)		ND	mg/L	0.1						
Lab ID: LCS-11923		Laboratory Control Sample				Run: TOC3-C_230504A			05/04/23 17:29	
Organic Carbon, Total (TOC)		5.27	mg/L	0.50	105	90	111			
Lab ID: C23050116-001AMS		Sample Matrix Spike				Run: TOC3-C_230504A			05/04/23 18:17	
Organic Carbon, Total (TOC)		10.4	mg/L	0.50	98	90	111			
Lab ID: C23050116-001AMSD		Sample Matrix Spike Duplicate				Run: TOC3-C_230504A			05/04/23 18:33	
Organic Carbon, Total (TOC)		10.5	mg/L	0.50	101	90	111	1.3	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23050152 **Report Date:** 05/11/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **A2510 B**										Batch: R401317
Lab ID: **SC 2nd 1413**	Laboratory Control Sample					Run: PHSC _101-B_230502A				05/02/23 08:42
Conductivity @ 25 C		1410	umhos/cm	5.0	100	90	110			
Lab ID: **MBLK**	Method Blank					Run: PHSC _101-B_230502A				05/02/23 08:49
Conductivity @ 25 C		ND	umhos/cm	5						
Lab ID: **B23050080-001ADUP**	Sample Duplicate					Run: PHSC _101-B_230502A				05/02/23 09:07
Conductivity @ 25 C		408	umhos/cm	5.0				7.1	10	
Lab ID: **B23050168-001ADUP**	Sample Duplicate					Run: PHSC _101-B_230502A				05/02/23 15:07
Conductivity @ 25 C		339	umhos/cm	5.0				3.8	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23050152 **Report Date:** 05/11/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: 178312
Lab ID: MB-178312		Method Blank				Run: BAL #30_230502F				05/02/23 15:36
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	20						
Lab ID: LCS-178312		Laboratory Control Sample				Run: BAL #30_230502F				05/02/23 15:36
Solids, Total Dissolved TDS @ 180 C		1020	mg/L	25	102	90	110			
Lab ID: B23041936-001A DUP		Sample Duplicate				Run: BAL #30_230502F				05/02/23 15:36
Solids, Total Dissolved TDS @ 180 C		15900	mg/L	500				2.5	10	H
Method: A2540 C										Batch: 178312
Lab ID: B23050170-001A DUP		Sample Duplicate				Run: BAL #30_230508D				05/08/23 14:38
Solids, Total Dissolved TDS @ 180 C		665	mg/L	25				1.4	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

H - Analysis performed past the method holding time

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23050152 **Report Date:** 05/11/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B									Analytical Run: PHSC _101-B_230502A	
Lab ID: pH 8	2	Initial Calibration Verification Standard							05/02/23 08:27	
pH		8.0	s.u.	0.1	100	98	102			
pH Measurement Temp		20.5	°C	1.0						
Method: A4500-H B									Batch: R401317	
Lab ID: B23050080-001ADUP	2	Sample Duplicate				Run: PHSC _101-B_230502A			05/02/23 09:07	
pH		6.3	s.u.	0.1				2.7	3	H
pH Measurement Temp		13.3	°C	1.0						
Lab ID: B23050168-001ADUP	2	Sample Duplicate				Run: PHSC _101-B_230502A			05/02/23 15:07	
pH		8.3	s.u.	0.1				2.1	3	H
pH Measurement Temp		11.0	°C	1.0						

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

H - Analysis performed past the method holding time

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23050152 **Report Date:** 05/11/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E300.0**									Analytical Run: IC METROHM 2_230501A	
Lab ID: **ICV**	2	Initial Calibration Verification Standard							05/01/23 11:44	
Chloride		25.1	mg/L	1.0	100	90	110			
Sulfate		101	mg/L	1.0	101	90	110			
Lab ID: **CCV**	2	Continuing Calibration Verification Standard							05/03/23 00:35	
Chloride		25.1	mg/L	1.0	100	90	110			
Sulfate		101	mg/L	1.0	101	90	110			
Method: **E300.0**									Batch: R401318	
Lab ID: **ICB**	2	Method Blank				Run: IC METROHM 2_230501A			05/01/23 12:00	
Chloride		ND	mg/L	0.1						
Sulfate		ND	mg/L	0.5						
Lab ID: **LFB**	2	Laboratory Fortified Blank				Run: IC METROHM 2_230501A			05/01/23 12:17	
Chloride		23.9	mg/L	1.0	95	90	110			
Sulfate		96.9	mg/L	1.1	97	90	110			
Lab ID: **B23050152-001AMS**	2	Sample Matrix Spike				Run: IC METROHM 2_230501A			05/03/23 01:08	
Chloride		34.1	mg/L	1.0	105	90	110			
Sulfate		114	mg/L	1.1	106	90	110			
Lab ID: **B23050152-001AMSD**	2	Sample Matrix Spike Duplicate				Run: IC METROHM 2_230501A			05/03/23 01:25	
Chloride		34.3	mg/L	1.0	106	90	110	0.6	20	
Sulfate		115	mg/L	1.1	107	90	110	0.7	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23050152 **Report Date:** 05/11/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E351.2**										Analytical Run: FIA204-B_230505A
Lab ID: **ICV-178056**	Initial Calibration Verification Standard									05/05/23 09:57
Nitrogen, Kjeldahl, Total as N		10.6	mg/L	0.50	106	90	110			
Method: **E351.2**										Batch: 178372
Lab ID: **MB-178372**	Method Blank					Run: FIA204-B_230505A				05/05/23 10:00
Nitrogen, Kjeldahl, Total as N		ND	mg/L	0.4						
Lab ID: **LCS-178372**	Laboratory Control Sample					Run: FIA204-B_230505A				05/05/23 10:01
Nitrogen, Kjeldahl, Total as N		10.1	mg/L	0.50	101	90	110			
Lab ID: **B23050152-001BMS**	Sample Matrix Spike					Run: FIA204-B_230505A				05/05/23 10:05
Nitrogen, Kjeldahl, Total as N		10.6	mg/L	0.50	106	90	110			
Lab ID: **B23050152-001BMSD**	Sample Matrix Spike Duplicate					Run: FIA204-B_230505A				05/05/23 10:06
Nitrogen, Kjeldahl, Total as N		10.9	mg/L	0.50	109	90	110	2.8	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Water and Environmental Technologies **Work Order:** B23050152 **Report Date:** 05/11/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: **E353.2**										Analytical Run: FIA203-B_230503B
Lab ID: **ICV**		Initial Calibration Verification Standard								05/03/23 12:45
Nitrogen, Nitrate+Nitrite as N		0.562	mg/L	0.010	99	90	110			
Lab ID: **CCV**		Continuing Calibration Verification Standard								05/03/23 14:21
Nitrogen, Nitrate+Nitrite as N		0.985	mg/L	0.010	98	90	110			
Method: **E353.2**										Batch: R401439
Lab ID: **MBLK**		Method Blank				Run: FIA203-B_230503B				05/03/23 12:46
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.008						
Lab ID: **LFB**		Laboratory Fortified Blank				Run: FIA203-B_230503B				05/03/23 12:48
Nitrogen, Nitrate+Nitrite as N		1.05	mg/L	0.010	105	90	110			
Lab ID: **FILTERLFB**		Laboratory Fortified Blank				Run: FIA203-B_230503B				05/03/23 12:49
Nitrogen, Nitrate+Nitrite as N		1.06	mg/L	0.010	106	90	110			
Lab ID: **B23050125-001BMS**		Sample Matrix Spike				Run: FIA203-B_230503B				05/03/23 14:25
Nitrogen, Nitrate+Nitrite as N		5.21	mg/L	0.020	102	90	110			
Lab ID: **B23050125-001BMSD**		Sample Matrix Spike Duplicate				Run: FIA203-B_230503B				05/03/23 14:26
Nitrogen, Nitrate+Nitrite as N		5.29	mg/L	0.020	106	90	110	1.5	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

Work Order Receipt Checklist

Water and Environmental Technologies B23050152

Login completed by: Tyler J. Gasser
Date Received: 5/2/2023
Reviewed by: nhill
Received by: tjg
Reviewed Date: 5/3/2023
Carrier name: Return-FedEx Ground

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	2.9°C On Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES

www.energylab.com

Chain of Custody (COC) & Analytical Request Record

Lab Workorder #: B23050152

Project Information

Laboratory Use

Client:	Water and Environmental Technologies	*Quote:* N/A	*Critical Hold Time:* 30 Hours
Project:	Lakeside Water and Sewer District	*BO#:* 173151	*# of Samples:* 1
Purchase Order:		*EE#:* 49878	*Matrix:* Aqueous
Contact/Phone:	Nathan Small (406)309-6091/M:(626)993-0638	*Turn-Around Time:* Standard	

Comments:

Contact ELI prior to RUSH sample submittal for charges, availability & scheduling. Samples submitted may be subcontracted to other laboratories to complete the test(s) requested; this will be clearly noted on the analytical report.

Analysis Requested

	Sample Identification	Collection Date/Time	# of Containers	Matrix	RUSH TAT	Conductivity (A2510 B)	Anions by Ion Chromatography (E300.0)	pH (A4500-H B)	Solids, Total Dissolved (A2540 C)	Nitrogen, Nitrate + Nitrite (E353.2)	Nitrogen, Total Kjeldahl (E351.2)	Nitrogen, Total (TKN +NO3+NO2) (Calculation)	Carbon, Total Organic (A5310 C)	Bacteria, Private Water Supply (A9223 B)					
	Hold Time (Days)					28	28	Fld	7	28	28	N/A	28	1.25					
1	MW-5	5/1/23 1305	4	W		X	X	X	X	X	X	X	X	X					
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			

Custody Record MUST be signed

Lab provided preservatives were used ☐Yes ☐No

Sampler Name (if different than Relinquished by):

Sampler Phone: 406-309-6091

Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
Nathan Small	5/1/23 1505				
Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	Signature
			Tyler Grasser	5/2/23 1020	

ANALYTICAL SUMMARY REPORT

November 08, 2023

Water and Environmental Technologies
480 E Park St Ste 200
Butte, MT 59701-1923

Work Order: H23100915

Project Name: B&P

Energy Laboratories Inc Helena MT received the following 1 sample for Water and Environmental Technologies on 10/25/2023 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H23100915-001	WET-10-23-23-1	10/23/23 13:30	10/25/23	Aqueous	Conductivity Carbon, Total Organic Anions by Ion Chromatography Nitrogen, Nitrate + Nitrite Nitrogen, Total Kjeldahl Nitrogen, Total (TKN+NO3+NO2) pH E365.1 Digestion, Total P TKN Prep Phosphorus, Total Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:

CLIENT: Water and Environmental Technologies
Project: B&P
Work Order: H23100915

Report Date: 11/08/23

CASE NARRATIVE

Tests associated with analyst identified as ELI-CA were subcontracted to Energy Laboratories, 2393 Salt Creek Hwy., Casper, WY, EPA Number WY00002.

LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies
Project: B&P
Lab ID: H23100915-001
Client Sample ID: WET-10-23-23-1

Report Date: 11/08/23
Collection Date: 10/23/23 13:30
DateReceived: 10/25/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.4	s.u.	H	0.1		A4500-H B	10/25/23 15:17 / eek
pH Measurement Temp	18.2	°C				A4500-H B	10/25/23 15:17 / eek
Conductivity @ 25 C	1190	umhos/cm		5		A2510 B	10/26/23 10:41 / dpw
Solids, Total Dissolved TDS @ 180 C	690	mg/L		20		A2540 C	10/25/23 13:50 / dpw
INORGANICS							
Chloride	179	mg/L		1		E300.0	10/31/23 00:01 / SRW
Sulfate	2	mg/L		1		E300.0	10/31/23 00:01 / SRW
AGGREGATE ORGANICS							
Organic Carbon, Total (TOC)	15.6	mg/L		0.5		A5310 C	11/01/23 21:38 / eli-ca
NUTRIENTS							
Nitrogen, Kjeldahl, Total as N	2.8	mg/L		0.50		E351.2	11/03/23 14:01 / JAR
Nitrogen, Nitrate+Nitrite as N	0.02	mg/L		0.01		E353.2	11/01/23 16:40 / JAR
Nitrogen, Total	2.8	mg/L		0.50		Calculation	11/07/23 08:07 / tkj
Phosphorus, Total as P	0.26	mg/L		0.01		E365.1	11/02/23 17:26 / JAR

Report Definitions:
RL - Analyte Reporting Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies **Work Order:** H23100915 **Report Date:** 11/08/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2510 B									Analytical Run: PHSC_101-H_231026A	
Lab ID: SC 150		Initial Calibration Verification Standard							10/26/23 08:46	
Conductivity @ 25 C		150	umhos/cm	5.0	100	90	110			
Lab ID: SC 20000		Initial Calibration Verification Standard							10/26/23 08:48	
Conductivity @ 25 C		19300	umhos/cm	5.0	97	90	110			
Lab ID: SC 5000		Initial Calibration Verification Standard							10/26/23 08:50	
Conductivity @ 25 C		4890	umhos/cm	5.0	98	90	110			
Method: A2510 B									Batch: R189493	
Lab ID: SC 1000		Laboratory Control Sample				Run: PHSC_101-H_231026A			10/26/23 08:52	
Conductivity @ 25 C		988	umhos/cm	5.0	99	90	110			
Lab ID: MBLK		Method Blank				Run: PHSC_101-H_231026A			10/26/23 10:27	
Conductivity @ 25 C		ND	umhos/cm	5						
Lab ID: H23100915-001ADUP		Sample Duplicate				Run: PHSC_101-H_231026A			10/26/23 10:43	
Conductivity @ 25 C		1190	umhos/cm	5.0				0.5	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies **Work Order:** H23100915 **Report Date:** 11/08/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: TDS231025A
Lab ID: MB-1_231025	Method Blank					Run: ACCU-124 (14410200)_23102				10/25/23 13:44
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	6						
Lab ID: LCS-2_231025	Laboratory Control Sample					Run: ACCU-124 (14410200)_23102				10/25/23 13:44
Solids, Total Dissolved TDS @ 180 C		1970	mg/L	50	98	90	110			
Lab ID: H23100876-001B DUP	Sample Duplicate					Run: ACCU-124 (14410200)_23102				10/25/23 13:45
Solids, Total Dissolved TDS @ 180 C		267	mg/L	25				2.7	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies **Work Order:** H23100915 **Report Date:** 11/08/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B									Analytical Run: PHSC_101-H_231025A	
Lab ID: pH 7	2	Initial Calibration Verification Standard							10/25/23 08:33	
pH		7.0	s.u.	0.1	100	98	102			
pH Measurement Temp		19.4	°C			0	0			
Lab ID: CCV - pH 7	2	Continuing Calibration Verification Standard							10/25/23 11:21	
pH		7.0	s.u.	0.1	100	98	102			
pH Measurement Temp		18.5	°C			0	0			
Method: A4500-H B									Batch: R189427	
Lab ID: H23100898-001ADUP	2	Sample Duplicate				Run: PHSC_101-H_231025A			10/25/23 15:15	
pH		7.9	s.u.	0.1				0.1	3	H
pH Measurement Temp		17.7	°C							

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

H - Analysis performed past the method holding time

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies **Work Order:** H23100915 **Report Date:** 11/08/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5310 C									Analytical Run: SUB-C300601	
Lab ID: CCV-11940		Continuing Calibration Verification Standard							11/01/23 19:35	
Organic Carbon, Total (TOC)		5.03	mg/L	0.50	101	90	110			
Method: A5310 C									Batch: C_R300601	
Lab ID: MBLK		Method Blank				Run: SUB-C300601			11/01/23 15:03	
Organic Carbon, Total (TOC)		ND	mg/L	0.1						
Lab ID: LCS		Laboratory Control Sample				Run: SUB-C300601			11/01/23 15:24	
Organic Carbon, Total (TOC)		5.07	mg/L	0.50	101	90	111			
Lab ID: C23101048-003HMS		Sample Matrix Spike				Run: SUB-C300601			11/01/23 20:27	
Organic Carbon, Total (TOC)		14.5	mg/L	0.50	99	90	111			
Lab ID: C23101048-003HMSD		Sample Matrix Spike Duplicate				Run: SUB-C300601			11/01/23 20:45	
Organic Carbon, Total (TOC)		14.5	mg/L	0.50	99	90	111	0.1	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies **Work Order:** H23100915 **Report Date:** 11/08/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Analytical Run: IC METROHM_231030A	
Lab ID: ICV	2	Initial Calibration Verification Standard							10/30/23 12:45	
Chloride		108	mg/L	1.0	108	90	110			
Sulfate		424	mg/L	1.0	106	90	110			
Lab ID: CCV	2	Continuing Calibration Verification Standard							10/30/23 23:04	
Chloride		49.7	mg/L	1.0	99	90	110			
Sulfate		201	mg/L	1.0	100	90	110			
Method: E300.0									Batch: R189623	
Lab ID: ICB	2	Method Blank				Run: IC METROHM_231030A			10/30/23 11:47	
Chloride		ND	mg/L	0.02						
Sulfate		ND	mg/L	0.03						
Lab ID: LFB	2	Laboratory Fortified Blank				Run: IC METROHM_231030A			10/30/23 12:59	
Chloride		25.0	mg/L	1.0	100	90	110			
Sulfate		105	mg/L	1.0	105	90	110			
Lab ID: H23100948-006BMS	2	Sample Matrix Spike				Run: IC METROHM_231030A			10/31/23 01:56	
Chloride		34.2	mg/L	1.0	106	90	110			
Sulfate		142	mg/L	1.0	104	90	110			
Lab ID: H23100948-006BMSD	2	Sample Matrix Spike Duplicate				Run: IC METROHM_231030A			10/31/23 02:10	
Chloride		34.2	mg/L	1.0	106	90	110	0.1	20	
Sulfate		143	mg/L	1.0	106	90	110	0.9	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies **Work Order:** H23100915 **Report Date:** 11/08/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E351.2									Analytical Run: SEAL AA500_231103A	
Lab ID: ICV		Initial Calibration Verification Standard							11/03/23 13:40	
Nitrogen, Kjeldahl, Total as N		9.97	mg/L	0.50	100	90	110			
Method: E351.2									Batch: 69122	
Lab ID: MB-69122		Method Blank				Run: SEAL AA500_231103A			11/03/23 13:43	
Nitrogen, Kjeldahl, Total as N		ND	mg/L	0.1						
Lab ID: LCS-69122		Laboratory Control Sample				Run: SEAL AA500_231103A			11/03/23 13:46	
Nitrogen, Kjeldahl, Total as N		9.31	mg/L	0.50	93	90	110			
Lab ID: H23100915-001Bms		Sample Matrix Spike				Run: SEAL AA500_231103A			11/03/23 14:02	
Nitrogen, Kjeldahl, Total as N		12.3	mg/L	0.50	95	90	110			
Lab ID: H23100915-001Bmsd		Sample Matrix Spike Duplicate				Run: SEAL AA500_231103A			11/03/23 14:04	
Nitrogen, Kjeldahl, Total as N		12.3	mg/L	0.50	95	90	110	0.2	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies **Work Order:** H23100915 **Report Date:** 11/08/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2									Analytical Run: SEAL AA500_231101A	
Lab ID: ICV		Initial Calibration Verification Standard							11/01/23 16:16	
Nitrogen, Nitrate+Nitrite as N		0.978	mg/L	0.010	98	90	110			
Lab ID: CCV		Continuing Calibration Verification Standard							11/01/23 16:31	
Nitrogen, Nitrate+Nitrite as N		1.02	mg/L	0.010	102	90	110			
Method: E353.2									Batch: R189685	
Lab ID: ICB		Method Blank				Run: SEAL AA500_231101A			11/01/23 16:14	
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.01						
Lab ID: LFB		Laboratory Fortified Blank				Run: SEAL AA500_231101A			11/01/23 16:17	
Nitrogen, Nitrate+Nitrite as N		1.04	mg/L	0.011	104	90	110			
Lab ID: H23100915-001BMS		Sample Matrix Spike				Run: SEAL AA500_231101A			11/01/23 16:41	
Nitrogen, Nitrate+Nitrite as N		1.04	mg/L	0.011	102	90	110			
Lab ID: H23100915-001BMSD		Sample Matrix Spike Duplicate				Run: SEAL AA500_231101A			11/01/23 16:42	
Nitrogen, Nitrate+Nitrite as N		1.04	mg/L	0.011	102	90	110	0	10	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Water and Environmental Technologies **Work Order:** H23100915 **Report Date:** 11/08/23

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E365.1									Analytical Run: SEAL AA500_231102A	
Lab ID: ICV		Initial Calibration Verification Standard							11/02/23 16:29	
Phosphorus, Total as P		0.246	mg/L	0.010	99	90	110			
Lab ID: CCV		Continuing Calibration Verification Standard							11/02/23 17:18	
Phosphorus, Total as P		0.0991	mg/L	0.010	99	90	110			
Method: E365.1									Batch: 69125	
Lab ID: MB-69125		Method Blank				Run: SEAL AA500_231102A			11/02/23 16:33	
Phosphorus, Total as P		ND	mg/L	0.001						
Lab ID: LCS-69125		Laboratory Control Sample				Run: SEAL AA500_231102A			11/02/23 17:01	
Phosphorus, Total as P		0.416	mg/L	0.010	104	90	110			
Lab ID: H23100876-009Ems		Sample Matrix Spike				Run: SEAL AA500_231102A			11/02/23 17:22	
Phosphorus, Total as P		0.216	mg/L	0.010	108	90	110			
Lab ID: H23100876-009Emsd		Sample Matrix Spike Duplicate				Run: SEAL AA500_231102A			11/02/23 17:23	
Phosphorus, Total as P		0.214	mg/L	0.010	107	90	110	0.6	20	

Qualifiers:

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

Work Order Receipt Checklist

Water and Environmental Technologies H23100915

Login completed by:	Rebecca A. Tooke	Date Received:	10/25/2023
Reviewed by:	tjones	Received by:	rrs
Reviewed Date:	10/27/2023	Carrier name:	US Mail

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☐	No ☑	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	14.6°C Melted Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	Not Applicable ☐

Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

The reference date for Radon analysis is the sample collection date. The reference date for all other Radiochemical analyses is the analysis date. Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

For methods that require zero headspace or require preservation check at the time of analysis due to potential interference, the pH is verified at analysis. Nonconforming sample pH is documented as part of the analysis and included in the sample analysis comments.

Contact and Corrective Action Comments:

Sample for E-Coli Bacteria was received past the EPA 8 hour holding time and past 24 hour holding time allowed by MT DEQ. Emailed Brad about past hold bacteria/ecoli and over temperature status. 10/25/23 rt
Per email we are to continue with analysis over temp. Christina acknowledged ecoli will need to be resampled. 10/25/23 rt

ENERGY LABORATORIES
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name	WET
Contact	Accounting
Phone	4067825220
Mailing Address	480 E Park St
City, State, Zip	Butte, MT 59701
Email	accounting@waterenvtech.com
Receive Invoice ☐Hard Copy ☐Email	Receive Report ☐Hard Copy ☒Email
Purchase Order	Quote / Bottle Order

Report Information *(if different than Account Information)*

Company/Name	WET
Contact	Brad Bennett
Phone	4067825220
Mailing Address	102 Cooperative Way, Ste 100
City, State, Zip	Kalispell, MT 59901
Email	bbennett@waterenvtech.com
Receive Report ☐Hard Copy ☑Email	
Special Report/Formats: ☐ LEVEL IV ☐ NELAC ☑EDD/EDT *(contact laboratory)* ☐ Other	

Comments

please also cc eggensperger@waterenvtech.com

Project Information

Project Name, PWSID, Permit, etc.	B&P
Sampler Name: christina eggensperger	Sampler Phone: 4065319486
Sample Origin State: MT	EPA/State Compliance ☐ Yes ☐ No

MINING CLIENTS, please indicate sample type.
*If ore has been processed or refined, call before sending.
☐ Byproduct 11 (e)2 material ☐ Unprocessed ore (NOT ground or refined)*

Matrix Codes
A - Air
W - Water
S - Soils/Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

	Sample Identification (Name, Location, Interval, etc.)	Collection Date	Collection Time	Number of Containers	Matrix (See Codes Above)	Analysis Requested: BacT/Ecoli	TKN, Total N, Nitrate+Nitrite	Conductivity	TOC	pH	TDS	Chloride	Sulfate	Total Phosphorous	See Attached	RUSH TAT	ELI LAB ID (Laboratory Use Only)
1	WET-10-23-23-1	10-23-23	1330	4	W	x	x	x	x	x	^	x	x	x			H23100915
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	christina eggensperger	10-23-23 1420				
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print) R SPONHOLZ	Date/Time 102525 1145	Signature

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals Y N C B	Intact Y N	Receipt Temp °C	Temp Blank Y N	On Ice Y N	Payment Type CC Cash Check	Amount $	Receipt Number *(cash/check only)*
US MAIL	Y	Y N C B	Y N	14.6 °C	Y N	Y N			

MELTED

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.
This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

ELI-COC-12/16 v.1

Attachment E

GWIC Well Logs within ¼-mile

MONTANA WELL 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 (7/20/2009 1:12:51 PM)

Site Name: HISLOP ANDREW C
GWIC Id: 80932
DNRC Water Right: 65001

Section 1: Well Owner(s)

1) HISLOP, ANDREW C. (MAIL)
470 WILY DYKE RD
KALISPELL MT 59901 [12/12/1986]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	11	SE¼ SE¼ NE¼

County / **Geocode**

FLATHEAD

Latitude	Longitude	Geomethod	Datum
48.118174	-114.225721	TRS-SEC	NAD83

Ground Surface Altitude **Ground Surface Method** **Datum** **Date**

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: FORWARD ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, December 12, 1986

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	452	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	PUDDLED CLAY	

Section 7: Well Test Data

Total Depth: 454
Static Water Level: 10
Water Temperature:

Air Test *

80 gpm with drill stem set at _ feet for 2 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 440 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

112ALVM - ALLUVIUM (PLEISTOCENE)

From	To	Description
0	2	BLACK TOP SOIL
2	28	TAN SAND
28	134	GRAY SAND
134	215	GRAY CLAY
215	287	TAN CLAY
287	325	GREEN CLAY
325	387	TAN CLAY
387	420	TAN CLAY- SMALL GRAVEL- SAND
420	446	SAND- SMALL GRAVELS
446	454	TAN CLAY- GRAVELS

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: LOWE-BUSH
License No: WWC-476
Date Completed: 12/12/1986

MONTANA WELL 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 hydrograph for this site
View field visits for this site
View scanned well log (7/20/2009 1:18:13 PM)

Site Name: HUNTSMAN DALE
GWIC Id: 80936

Section 1: Well Owner(s)

1) HUNTSMAN, DALE (MAIL)
347 WILEY DIKE RD
KALISPELL MT 59901 [05/14/1996]
2) HUNTSMAN, DALE (MAIL)
BOX 2378
KALISPELL MT 59901 [03/30/1983]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	11	SW¼ NE¼ NW¼ SE¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.1161	-114.2305	MAP	NAD27

Ground Surface Altitude	Ground Surface Method	Datum	Date
2904	LIDAR	NAVD88	8/12/2015

Measuring Point Altitude	MP Method	Datum	Date Applies
2905.7	LIDAR	NAVD88	5/14/1996 2:24:00 PM

Addition	Block	Lot
		4

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: FORWARD ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Wednesday, March 30, 1983

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	280	6				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
280	280	6			OPEN BOTTOM *

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	25	CLAY- SLURRY	

Section 7: Well Test Data

Total Depth: 280
Static Water Level: 10
Water Temperature:

Air Test *

30 gpm with drill stem set at _ feet for 3 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 280 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

6 STEEL CASING WITH SUBMERSIBLE PUMP AND BOLT ON CAP- USE HAMMER TO REMOVE CAP. SAMPLING PT -HYDRANT JUST NORTH OF WELL AND AT SW CORNER OF TRAILER HOUSE.

Section 9: Well Log

Geologic Source

112ALVM - ALLUVIUM (PLEISTOCENE)

From	To	Description
0	1	TOPSOIL
1	10	CLAY
10	100	CLAY AND SILT
100	150	SILT AND WATER
150	250	SAND AND WATER
250	270	SAND- GRAVEL AND WATER
270	280	GRAVEL AND WATER

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: STINGER WELL DRILLING
License No: WWC-325
Date Completed: 3/30/1983

MONTANA WELL 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 (7/20/2009 3:02:47 PM)

Site Name: LAKESIDE COUNTY SEWER DISTRICT
GWIC Id: 80952
DNRC Water Right: 67752

Section 1: Well Owner(s)

1) LAKESIDE COUNTY SEWER DISTRICT (MAIL)
BOX 532
LAKESIDE MT 59922 [06/25/1987]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	14	NE¼ NE¼

County: FLATHEAD
Geocode:

Latitude	Longitude	Geomethod	Datum
48.108258	-114.227314	TRS-SEC	NAD83

Ground Surface Altitude: **Ground Surface Method**: **Datum**: **Date**:

Addition: **Block**: **Lot**:

Section 3: Proposed Use of Water

INDUSTRIAL (1)

Section 4: Type of Work

Drilling Method: FORWARD ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, June 25, 1987

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	25	6				
14	25	5				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
25	35	5			5X9/16 SCREEN

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	CEMENT	

Section 7: Well Test Data

Total Depth: 75
Static Water Level: 10
Water Temperature:

Unknown Test Method *

Yield 30 gpm.
Pumping water level 25 feet.
Time of recovery _ hours.
Recovery 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

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	9	BROWN CLAY AND SILT
9	25	BROWN CLAY- SILT AND WATER
25	35	SAND AND WATER
35	75	BROWN CLAY- SILT AND WOOD CHIPS

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: BILLMAYER DRILLING
License No: WWC-335
Date Completed: 6/25/1987

MONTANA WELL 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 hydrograph for this site
View field visits for this site
View scanned well log (7/20/2009 1:13:01 PM)

Site Name: FLANAGAN DARRIS R
GWIC Id: 120651
DNRC Water Right: 75397

Section 1: Well Owner(s)

1) FLANAGAN, DARRIS R. (MAIL)
480 WILEY DIKE RD
KALISPELL MT 59901 [05/21/1990]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	11	SW¼ SE¼ SE¼ NE¼

County	Geocode
FLATHEAD	

Latitude	Longitude	Geomethod	Datum
48.1177	-114.225	MAP	NAD27

Ground Surface Altitude	Ground Surface Method	Datum	Date
2912	LIDAR	NAVD88	8/12/2015

Measuring Point Altitude	MP Method	Datum	Date Applies
2913.95	LIDAR	NAVD88	6/4/1996 6:10:00 PM

Addition	Block	Lot
		A

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: CABLE
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Monday, May 21, 1990

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	41	6				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
41	46	5			.020 COOK SCRNS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	18	BENTONITE	

Section 7: Well Test Data

Total Depth: 46
Static Water Level: 17
Water Temperature:

Bailer Test *

25 gpm with _ feet of drawdown after 1 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

6 STEEL CASING WITH BOLT-ON CAP. HAS A JET PUMP IN THE PUMP HOUSE NEXT TO WELL HEAD. SAMPLING PT -FAUCET ON NW CORNER OF HOUSE.

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	3	TOPSOIL
3	35	BROWN SAND
35	46	COARSE SAND

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: MONTANA
License No: WWC-488
Date Completed: 5/21/1990

MONTANA WELL 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 (7/20/2009 2:44:16 PM)

Site Name: RHOADES JACOB
GWIC Id: 194578

Section 1: Well Owner(s)

1) RHOADES, JACOB (MAIL)
446 N SOMERS ROAD
SOMERS MT 59932 [12/17/2001]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	13	NW¼ NW¼ NW¼

County

FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.109107	-114.223288	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot
	8	

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Monday, December 17, 2001

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	440	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	438	6	0.250			STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
438	440	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	

Section 7: Well Test Data

Total Depth: 438
Static Water Level: 15
Water Temperature:

Air Test *

50 gpm with drill stem set at 120 feet for 1 hours.
Time of recovery 0.16 hours.
Recovery water level 18 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

Unassigned

From	To	Description
0	1	TOPSOIL
1	21	BROWN SAND SILT
21	68	GRAY SAND
68	297	GRAY CLAY
297	440	SAND GRAVEL WATER

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: SUDAN DRILLING
License No: WWC-450
Date Completed: 12/17/2001

MONTANA WELL 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 (7/20/2009 1:21:53 PM)

Site Name: HALLSTROM LEIF
GWIC Id: 195240

Section 1: Well Owner(s)

1) HALLSTROM, LEIF (MAIL)
2231 TEAL DRIVE
KALISPELL MT 59901 [03/14/2002]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	12	NW¼ SW¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.11539	-114.221894	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date
2907	LIDAR	NAVD88	8/12/2015

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, March 14, 2002

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	292	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	290	6	0.250			STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
290	292	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	

Section 7: Well Test Data

Total Depth: 292
Static Water Level: 16
Water Temperature:

Air Test *

60 gpm with drill stem set at 283 feet for 1 hours.
Time of recovery 2 hours.
Recovery water level 16 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
Unassigned

From	To	Description
0	2	TOPSOIL
2	34	TAN SILTY CLAY SAND
34	55	SAND WATER
55	84	TAN CLAY
84	245	GRAY SILTY CLAY
245	265	REDDISH CLAY
265	275	GRAY CLAY
275	288	GRAVEL SAND WATER
288	292	GRAVEL WATER

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: GLAZIER DRILLING
License No: WWC-113
Date Completed: 3/14/2002

MONTANA WELL 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 (7/20/2009 1:17:18 PM)

Site Name: BASNETT JEFF AND CINDY
GWIC Id: 195910

Section 1: Well Owner(s)

1) BASNETT, JEFF AND CINDY (MAIL)
345 CEDAR MILL
KALISPELL MT 59901 [05/03/2002]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	11	NE¼ NW¼ SE¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.116357	-114.231147	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date
2902	LIDAR	NAVD88	8/12/2015

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, May 3, 2002

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	300	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	297	6	0.250			STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
297	300	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	

Section 7: Well Test Data

Total Depth: 297
Static Water Level: 11
Water Temperature:

Air Test *

50 gpm with drill stem set at 290 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 11 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
Unassigned

From	To	Description
0	1	TOPSOIL
1	13	CLAY GRAVEL
13	38	CLAY SAND WATER
38	142	GRAY CLAY
142	217	BROWN CLAY
217	225	CLAY GRAVEL WATER
225	300	SAND GRAVEL WATER

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: SUDAN DRILLING
License No: WWC-450
Date Completed: 5/3/2002

MONTANA WELL 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 (7/20/2009 1:22:03 PM)

Site Name: RHOADES BEN AND KAREN
GWIC Id: 200036

Section 1: Well Owner(s)

1) RHOADES, BEN AND KAREN (MAIL)
521 WILEY DIKE
KALISPELL MT 59904 [11/08/2002]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	12	NW¼ NW¼ SW¼

County FLATHEAD **Geocode**

Latitude	Longitude	Geomethod	Datum
48.116306	-114.22327	TRS-SEC	NAD83

Ground Surface Altitude **Ground Surface Method** **Datum** **Date**

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, November 8, 2002

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	460	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	458	6	0.250			STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
458	460	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	CONT FED BENTONITE	

Section 7: Well Test Data

Total Depth: 458
Static Water Level: 11
Water Temperature:

Air Test *

35 gpm with drill stem set at 450 feet for 1 hours.
Time of recovery 0.75 hours.
Recovery water level 11 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
Unassigned

From	To	Description
0	10	SAND AND SILT
10	22	BROWN CLAY
22	38	SAND AND SILT
38	388	BROWN SILTY CLAY
388	425	MEDIUM GRAVEL AND SAND
425	442	COARSE SAND AND SILT AND GRAVEL
442	460	MEDIUM GRAVEL AND SAND AND WATER

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: SUDAN DRILLING
License No: WWC-450
Date Completed: 11/8/2002

MONTANA WELL 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 (7/20/2009 1:22:15 PM)

Site Name: FARRIER JOHN AND CHRISTINA
GWIC Id: 204340

Section 1: Well Owner(s)

1) FARRIER, JOHN AND CHRISTINA (MAIL)
531 WILEY DIKE RD
KALISPELL MT 59901 [05/30/2003]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	12	SW¼ NW¼ SW¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.114475	-114.22327	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date
2907	LIDAR	NAVD88	8/12/2015

Addition	Block	Lot
	3AB	

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, May 30, 2003

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	300	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	298	6	0.250			STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
298	300	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	CONT FED BENTONITE	

Section 7: Well Test Data

Total Depth: 298
Static Water Level: 19
Water Temperature:

Air Test *

80 gpm with drill stem set at 160 feet for 1 hours.
Time of recovery 0.5 hours.
Recovery water level 19 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
Unassigned

From	To	Description
0	182	SILT SAND
182	215	STICKY GRAY CLAY
215	283	STICKY BROWN CLAY
283	300	MEDIUM GRAVEL SAND WATER

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: SUDAN DRILLING
License No: WWC-450
Date Completed: 5/30/2003

MONTANA WELL 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

Site Name: ROBBINS, ROBERT OR DOROTHY
GWIC Id: 221367

Section 1: Well Owner(s)

1) ROBBINS, ROBERT OR DOROTHY (MAIL)
410 WILEY DIKE ROAD
KALISPELL MT 59901 [08/15/2005]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	11	SE¼ NE¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.119082	-114.227077	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date
2914	LIDAR	NAVD88	8/12/2015

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Monday, August 15, 2005

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	18	10
18	510	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	510.1	6	0.250		WELDED	A53B STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	18	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 510
Static Water Level: 12
Water Temperature:

Air Test *

80 gpm with drill stem set at 60 feet for 2 hours.
Time of recovery 0.5 hours.
Recovery water level 12 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
Unassigned

From	To	Description
0	1	TOPSOIL.
1	231	GRAY SILTY, SANDY CLAY MATRIX WITH SEEPS OF STINKY WATER.
231	365	TAN TO BROWN SILTY, SANDY CLAY MATRIX.
365	475	SMALL GRAVEL IN SILTY SAND MATRIX - SOME SILTY, SANDY WATER.
475	495	SMALL RED GRAVEL IN BROWN SILTY SAND MATRIX - SOME SILTY, SANDY WATER.
495	502	LARGER GRAVEL WITH LESS SILT AND SAND - SOME WATER.
502	510	CLEAN COARSE SAND AND GRAVEL - WATER. 80 GPM TOTAL WATER.

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: LIBERTY DRILLING & PUMP CO
License No: WWC-458
Date Completed: 8/15/2005

MONTANA WELL 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 (5/9/2006 2:57:07 PM)

Site Name: MASSIE WALLEY
GWIC Id: 223830

Section 1: Well Owner(s)

1) MASSIE, WALLY (MAIL)
764 PARKWAY DRIVE
KALISPELL MT 59901 [12/02/2005]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	13	SW¼ NW¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.104645	-114.22193	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date
2912	LIDAR	NAVD88	8/12/2015

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, December 2, 2005

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	420	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	418	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
418	420	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 420
Static Water Level: 17
Water Temperature:

Air Test *

60 gpm with drill stem set at 180 feet for 2 hours.
Time of recovery 1 hours.
Recovery water level 17 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
Unassigned

From	To	Description
0	1	TOPSOIL
1	30	TAN SANDY CLAY
30	78	GRAY SATURATED SILTY SAND
78	82	GRAY CLAY GRAVEL
82	195	GRAY CLAY
195	321	TAN CLAY
321	365	GRAY CLAY GRAVEL
365	410	GRAVEL FINE SAND GRAY SILT TAN SILT WATER
410	420	GRAVEL SAND TAN SILT WATER

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: GLAZIER DRILLING
License No: WWC-113
Date Completed: 12/2/2005

MONTANA WELL 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 (11/14/2006 7:50:02 PM)

Site Name: OSLER MIKE
GWIC Id: 230990

Section 1: Well Owner(s)

1) OSLER, MIKE (MAIL)
241 MAIN ST.
KALISPELL MT 59901 [08/25/2006]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	11	SE¼ NE¼

County: FLATHEAD
Geocode:

Latitude	Longitude	Geomethod	Datum
48.119082	-114.227077	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date
2914	LIDAR	NAVD88	8/12/2015

Addition: **Block**: **Lot**:

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, August 25, 2006

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	521	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	519	6	0.25		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
519	521	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 519
Static Water Level: 11
Water Temperature:

Air Test *

80 gpm with drill stem set at 502 feet for 1.5 hours.
Time of recovery 1 hours.
Recovery water level 11 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
Unassigned

From	To	Description
0	2	TOPSOIL
2	17	TAN SAND AND SMALL AMOUNT OF CLAY
17	23	TAN SAND
23	176	GRAY SILTY SAND AND BURNT WOOD CHIPS
176	350	GRAY STICKY CLAY
350	450	TAN SANDY SILTY CLAY
450	475	HEAVING TAN SILTY SAND AND SCATTERED GRAVEL, WATER
475	502	SEMI-CONSOLIDATED GRAVEL, SAND, SILTY WATER, CLEANING UP PRETTY GOOD, BUT ONLY 35 GPM
502	521	COARSE TAN SAND, GRAVEL, TAN SILT, AND WATER

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: JEFF GLAZIER
Company: GLAZIER DRILLING
License No: WWD-113
Date Completed: 8/25/2006

MONTANA WELL 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 (2/24/2014 9:39:29 AM)

Site Name: PERIMAN, LAWRENCE AND MARGORIE
GWIC Id: 276841

Section 1: Well Owner(s)

1) PERIMAN, LAWRENCE AND MARGORIE (MAIL)
355 CEDAR MILL ROAD
KALISPELL MT 59901 [04/09/2013]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	11	NW¼ SE¼ NW¼ SE¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.1141	-114.2314	NAV-GPS	WGS84

Ground Surface Altitude	Ground Surface Method	Datum	Date
2907	LIDAR	NAVD88	8/12/2015

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: CABLE TOOL
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Tuesday, April 9, 2013

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	50	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	22	6	0.25		WELDED	STEEL
9	22	4		40.00		PVC
42	50	4		40.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
22	42	4		0.020	SCREEN-CONTINUOUS-PVC

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 50
Static Water Level: 17.83
Water Temperature:

Pump Test *

Depth pump set for test 40 feet.
17 gpm pump rate with 1.67 feet of drawdown after 8 hours of pumping.
Time of recovery 0.02 hours.
Recovery water level 17.83 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
Unassigned

From	To	Description
0	2	BROWN SOIL
2	19	BROWN SANDS AND SILTY CLAY
19	42	GRAY SANDS AND H2O
42	50	GRAY SILT AND FINE GRAY SANDS

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: PAUL A. ERICKSON
Company: ERICKSON DRILLING & PUMP CO
License No: WWC-478
Date Completed: 4/9/2013

MONTANA WELL 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

Site Name: KOISTINEN, DARWIN AND ERIKA
GWIC Id: 277090

Section 1: Well Owner(s)

1) KOISTINEN, DARWIN AND ERIKA (MAIL)
P.O. BOX 3306
KALISPELL MT. 59903 [03/27/2014]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	13	SW¼ NW¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.1046448138	-114.2219299135	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date
2912	LIDAR	NAVD88	8/12/2015

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)
IRRIGATION (2)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, March 27, 2014

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	420	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	418	6	0.25		WELDED	A53B STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
413	417	6	25	1/8X5	TORCH OR PLASMA CUTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	30	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 420
Static Water Level: 86
Water Temperature:

Air Test *

60 gpm with drill stem set at 400 feet for 2 hours.
Time of recovery 0.33 hours.
Recovery water level 86 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
Unassigned

From	To	Description
0	2	SOIL AND SAND
2	59	SILTY SAND
59	215	SANDY GRAY CLAY
215	291	TAN SILTY CLAY
291	354	TAN CLAY AND GRAVEL
354	396	SANDY GRAVEL AND WATER
396	420	CLEANER GRAVEL AND WATER 60 GPM

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: BRAD FORMAN
Company: ALLWEST DRILLING INC
License No: WWC-571
Date Completed: 3/27/2014

MONTANA WELL 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

Site Name: CAMAS CREEK CONTRACTING
GWIC Id: 299874

Section 1: Well Owner(s)

1) CAMAS CREEK CONTRACTING (MAIL)
310 KINSHELLA RD
KALISPELL MT 59901 [11/17/2018]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	11	NW¼ SE¼

County

FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.116856	-114.231411	NAV-GPS	NAD83

Ground Surface Altitude **Ground Surface Method** **Datum** **Date**

Addition **Block** **Lot**

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: DUAL ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Tuesday, June 19, 2018

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	290	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	290	6	0.25		WELDED	A53B STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
-2	290	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	290	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 290
Static Water Level: 15
Water Temperature:

Air Test *

35 gpm with drill stem set at 1 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 15 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

WELL DRILLED BY MARTY WILSON

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	15	TAN SANDY SOIL
15	120	GREY WET SAND
120	140	GRAY SILTY CLAY
140	235	TAN SILTY CLAY
235	265	CLAY SOME GRAVEL
265	280	CEMENTED GRAVELS
280	290	CEMENTED GRAVELS WITH WATER

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: MARTIN WILSON
Company: COLDWATER DRILLING AND PUMPS
License No: WWC-624
Date Completed: 6/19/2018

MONTANA WELL 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

Site Name: BAKER, ALLAN
GWIC Id: 317435

Section 1: Well Owner(s)

1) BAKER, ALLAN (MAIL)
277 MY WAY
KALISPELL MT 59901 [10/19/2021]

Section 2: Location

Township	Range	Section	Quarter Sections
27N	21W	12	SW¼ SW¼

County
FLATHEAD

Geocode

Latitude	Longitude	Geomethod	Datum
48.110378	-114.222181	NAV-GPS	WGS84

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: DUAL ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Tuesday, October 19, 2021

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	30	10.8
30	420	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	420	6.6	0.25		WELDED	A53B STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
402	412	6	4 ROWS	1/8 X 1	HOLTE PERFORATOR SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	30	BENTONITE CHIPS	

Section 7: Well Test Data

Total Depth: 420
Static Water Level: 20
Water Temperature:

Air Test *

100 gpm with drill stem set at 120 feet for 4 hours.
Time of recovery 1 hours.
Recovery water level 20 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
Unassigned

From	To	Description
0	60	BROWN SANDY CLAY
60	220	WET BROWN CLAY
220	290	GRAY STICKY CLAY
290	340	GRAY CLAY AND SOME GRAVEL
340	400	SAND GRAVEL WATER SANDY
400	415	SAND GRAVEL WATER CLEAN 400'
415	420	CEMENTED GRAVEL WATER SHUT OFF

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: MARTIN WILSON
Company: COLDWATER DRILLING AND PUMPS
License No: WWC-624
Date Completed: 10/19/2021

Attachment F

Monthly Groundwater Contour Maps

NOTES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	GWE CONTOURS	1/25/23	KK	CE
2	GW FLOW DIRECTION	4/21/23	KK	CE
3	MAP EDITS	7/5/23	EK	CE
4				
5				

GROUNDWATER POTENTIOMETRIC SURFACE MAP 9-14-22

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 3

JOB#: 1539-22

DATE:7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental Technologies

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NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	GWE CONTOURS	2/1/23	KK	CE
2	CONTOUR EDITS, FLOW DIRECTION	4/21/23	KK	CE
3				
4				
5				

NOTES

GROUNDWATER POTENTIOMETRIC SURFACE MAP 10-20-22

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 6

JOB#: 1539-22

DATE: 7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental TECHNOLOGIES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	GWE CONTOURS	2/1/23	KK	CE
2	ADD FLOW DIRECTION	4/21/23	KK	CE
3				
4				
5				

NOTES

GROUNDWATER POTENTIOMETRIC SURFACE MAP 11-18-22

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 8

JOB#: 1539-22

DATE:7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental TECHNOLOGIES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	1/25/23	KK	CE
2	ADD CONTOURS	4/7/23	KK	CE
3	CONTOUR EDITS, GW FLOW EDIT	4/21/23	KK	CE
4				
5				

NOTES: MW-1 stick-up was destroyed, and has been re-surveyed and replaced by MW-1R

GROUNDWATER POTENTIOMETRIC SURFACE MAP 12-15-22

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 10

JOB#: 1539-22

DATE:7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental TECHNOLOGIES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	1/25/23	KK	CE
2	GWE CONTOURS	2/1/23	KK	CE
3	GW FLOW DIRECTION	4/21/23	KK	CE
4				
5				

NOTES: MW-1 stick-up was destroyed, and has been re-surveyed and replaced by MW-1R

GROUNDWATER POTENTIOMETRIC SURFACE MAP 1-17-23

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 12

JOB#: 1539-22

DATE:7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental TECHNOLOGIES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	3/31/23	KK	CE
2	ADDED CONTOURS	4/7/23	KK	CE
3				
4				
5				

NOTES: MW-1 stick-up was destroyed in December 22, and has been re-surveyed and replaced by MW-1R

GROUNDWATER POTENTIOMETRIC SURFACE MAP 2-14-23

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 13

JOB#: 1539-22

DATE:7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental TECHNOLOGIES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	3/31/23	KK	CE
2	ADDED CONTOURS	4/7/23	KK	CE
3				
4				
5				

NOTES: MW-1 stick-up was destroyed in December 22, and has been re-surveyed and replaced by MW-1R

GROUNDWATER POTENTIOMETRIC SURFACE MAP 3-16-23

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 14

JOB#: 1539-22

DATE:7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental TECHNOLOGIES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	6/12/23	KK	CE
2	GW FLOW DIRECTION	6/20/23	EK	CE
3				
4				
5				

NOTES: MW-1 stick-up was destroyed in December 22, and has been re-surveyed and replaced by MW-1R

GROUNDWATER POTENTIOMETRIC SURFACE MAP 4-18-23

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 16

JOB#: 1539-22

DATE:7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental TECHNOLOGIES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION	6/12/23	KK	CE
2	CONTOURS	6/23/23	KK	CE
3				
4				
5				

NOTES: MW-1 stick-up was destroyed in December 22, and has been re-surveyed and replaced by MW-1R

GROUNDWATER POTENTIOMETRIC SURFACE MAP 5-9-23

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 19

JOB#: 1539-22

DATE:7/5/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental TECHNOLOGIES

N
W E
S

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION & CONTOUR PLACEMENT	7/20/23	EK	CE
2	CONTOURS	2/12/24	KK	CE
3				
4				
5				

NOTES: MW-1 stick-up was destroyed in December 22, and has been re-surveyed and replaced by MW-1R

GROUNDWATER POTENTIOMETRIC SURFACE MAP 6-6-23

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE

JOB#: 1539-22

DATE:2/12/2024

Path: C:\Users\kkresan\Working\1539-22\1539-22.aprx, Author: kkresan

Water & Environmental TECHNOLOGIES

NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1	MAP CREATION & CONTOUR PLACEMENT	7/20/23	EK	CE
2				
3				
4				
5				

NOTES: MW-1 stick-up was destroyed in December 22, and has been re-surveyed and replaced by MW-1R

GROUNDWATER POTENTIOMETRIC SURFACE MAP 7-11-23

LAKESIDE COUNTY WATER & SEWER DISTRICT, FLATHEAD COUNTY, MT

FIGURE 25

JOB#: 1539-22

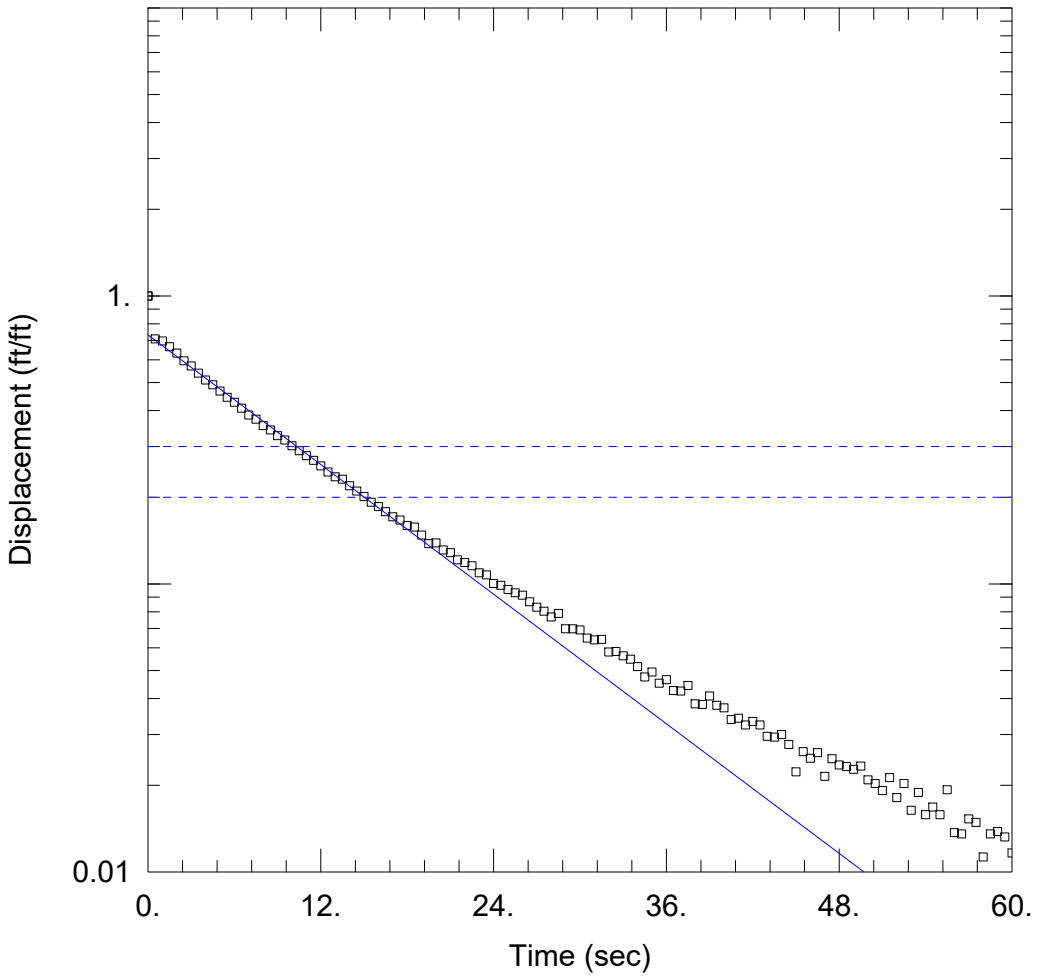
DATE: 7/20/2023

Path: M:\0 Kalispell\1539-22 LCWSD GW Discharge Permit\GIS\1539-22\1539-22.aprx, Author: ekamp

Water & Environmental
TECHNOLOGIES

Attachment G

AQTESOLV© Slug Test Solutions



WELL TEST ANALYSIS

Data Set: K:\...\MW-1 TSlug Test 1.aqt
Date: 04/10/23 Time: 09:13:04

AQUIFER DATA

Saturated Thickness: 14.23 ft Anisotropy Ratio (Kz/Kr): 1.

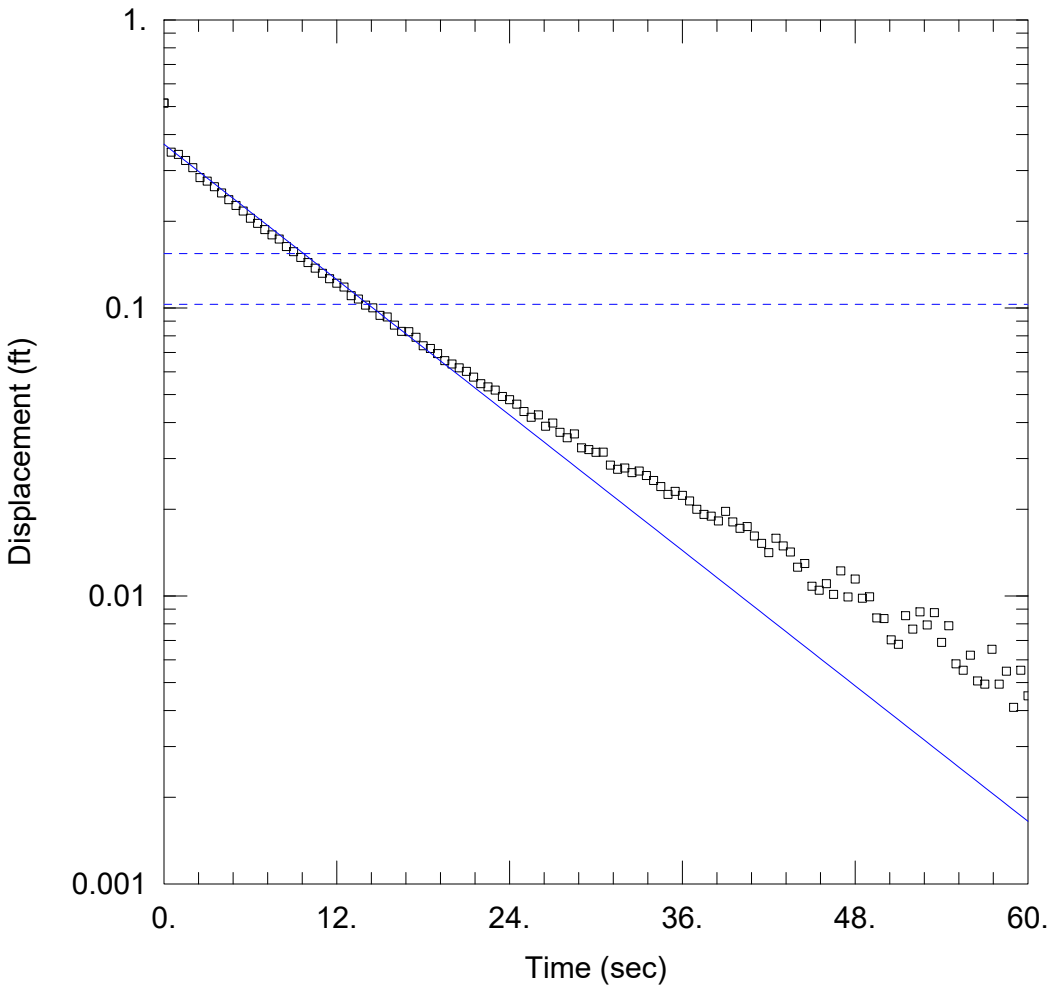
WELL DATA (MW-1)

Initial Displacement: 0.4993 ft
Total Well Penetration Depth: 13.57 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 14.23 ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 6.706 ft/day y0 = 0.3656 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-1 TSlug Test 2.aqt
Date: 04/10/23 Time: 09:13:19

AQUIFER DATA

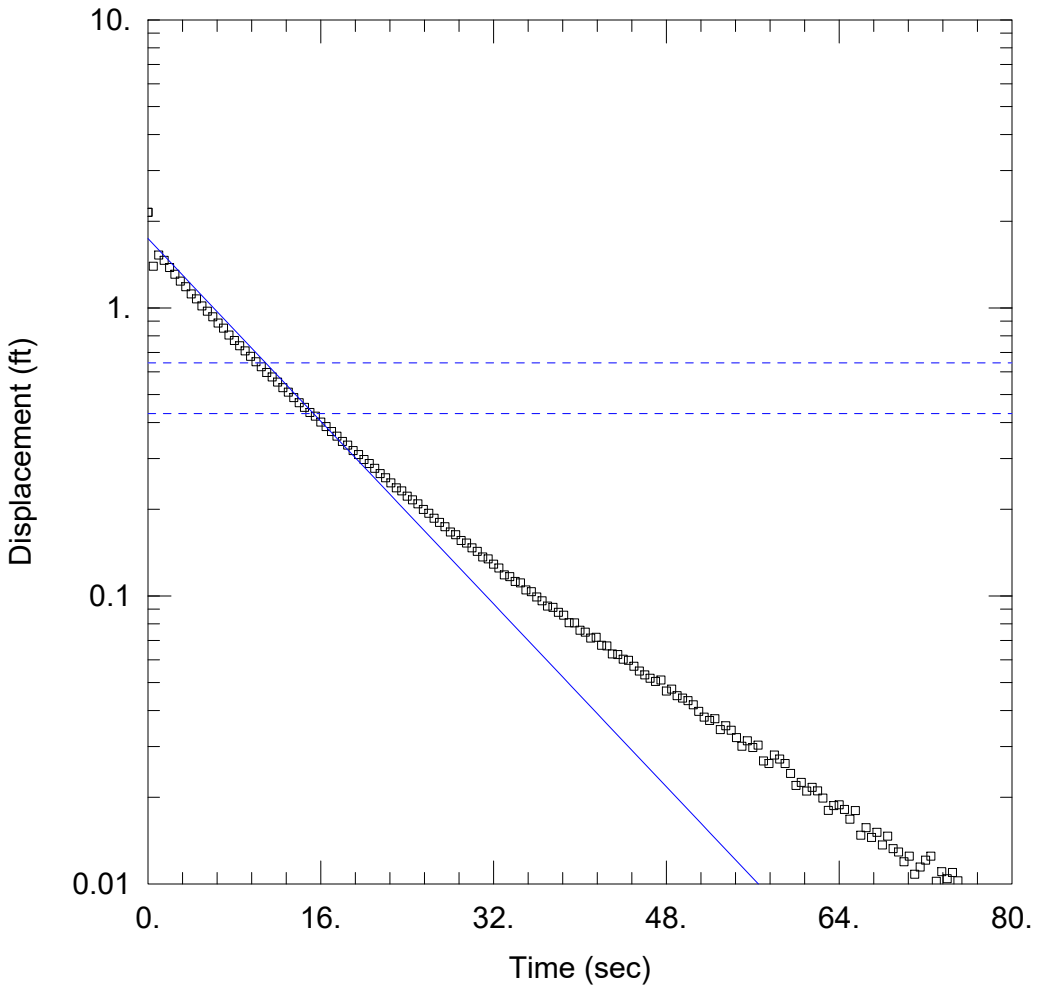
Saturated Thickness: 14.23 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-1)

Initial Displacement: 0.5147 ft
Total Well Penetration Depth: 13.57 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 14.23 ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 7.005 ft/day
y0 = 0.3702 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-1 TSlug Test 3.aqt
Date: 04/10/23 Time: 09:14:29

AQUIFER DATA

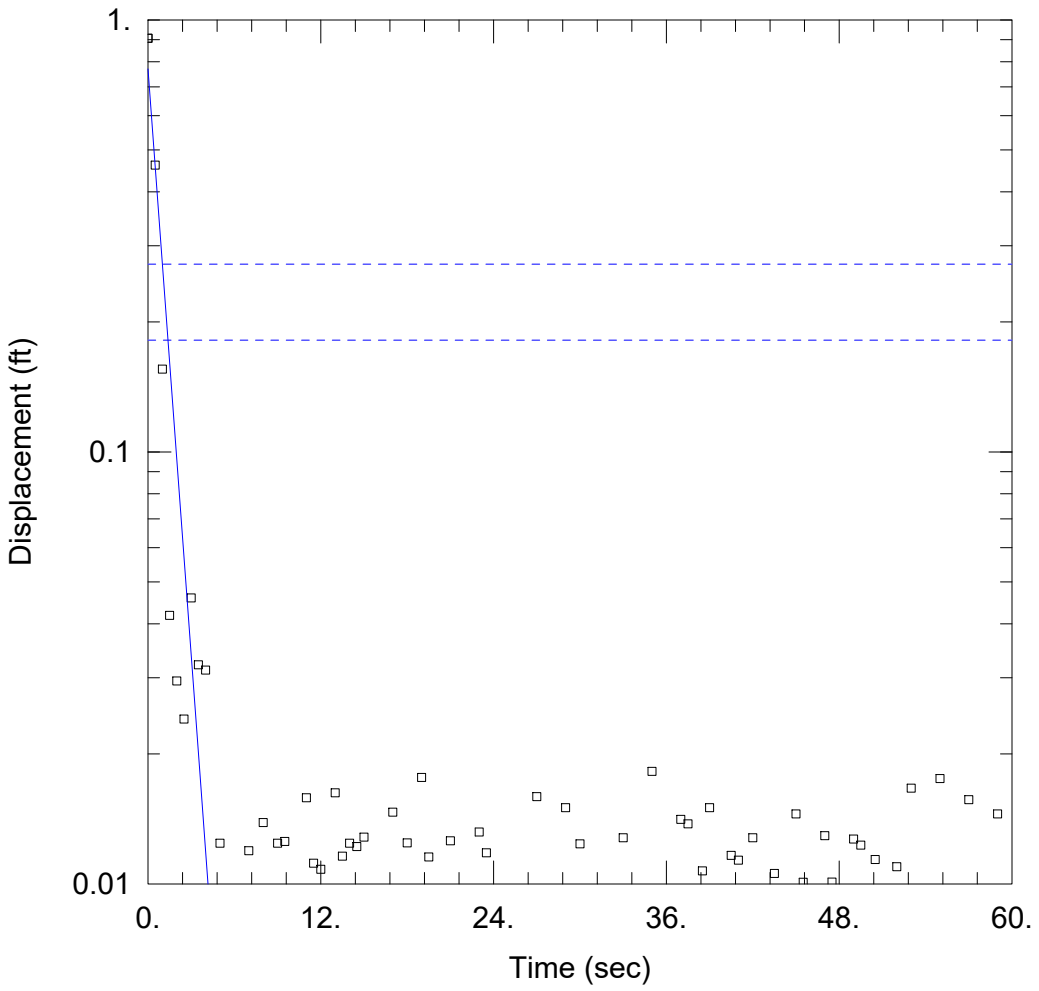
Saturated Thickness: 14.27 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-1)

Initial Displacement: 2.148 ft
Total Well Penetration Depth: 14.27 ft
Casing Radius: 0.083 ft
Static Water Column Height: 14.27 ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 7.602 ft/day
y0 = 1.741 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-2 Slug Test 1.aqt
Date: 04/10/23 Time: 09:14:08

AQUIFER DATA

Saturated Thickness: 12.79 ft Anisotropy Ratio (Kz/Kr): 1.

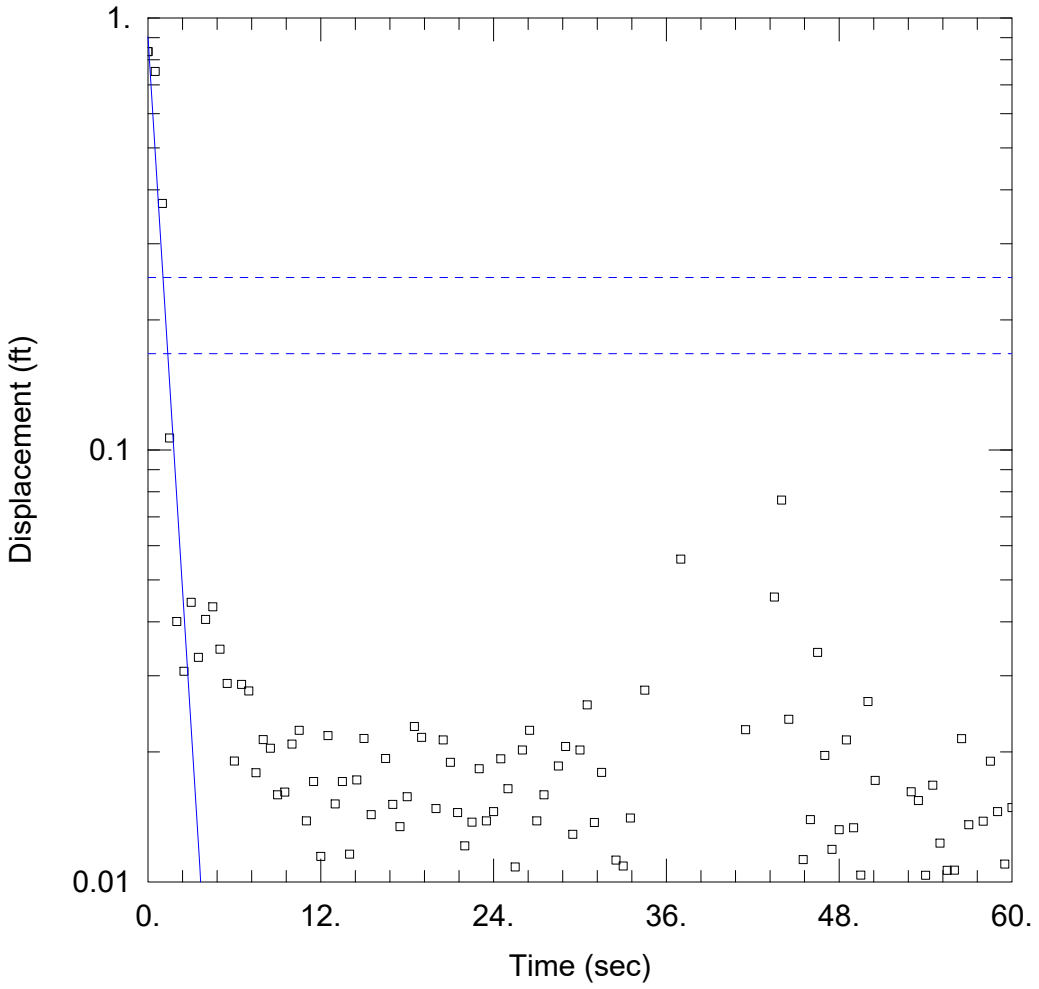
WELL DATA (MW-2)

Initial Displacement: 0.9069 ft
Total Well Penetration Depth: 13.17 ft
Casing Radius: 0.167 ft
Static Water Column Height: 12.79 ft
Screen Length: 10. ft
Well Radius: 0.167 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 415.7 ft/day y0 = 0.7701 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-2 Slug Test 2.aqt
Date: 04/10/23 Time: 09:14:46

AQUIFER DATA

Saturated Thickness: 12.79 ft Anisotropy Ratio (Kz/Kr): 1.

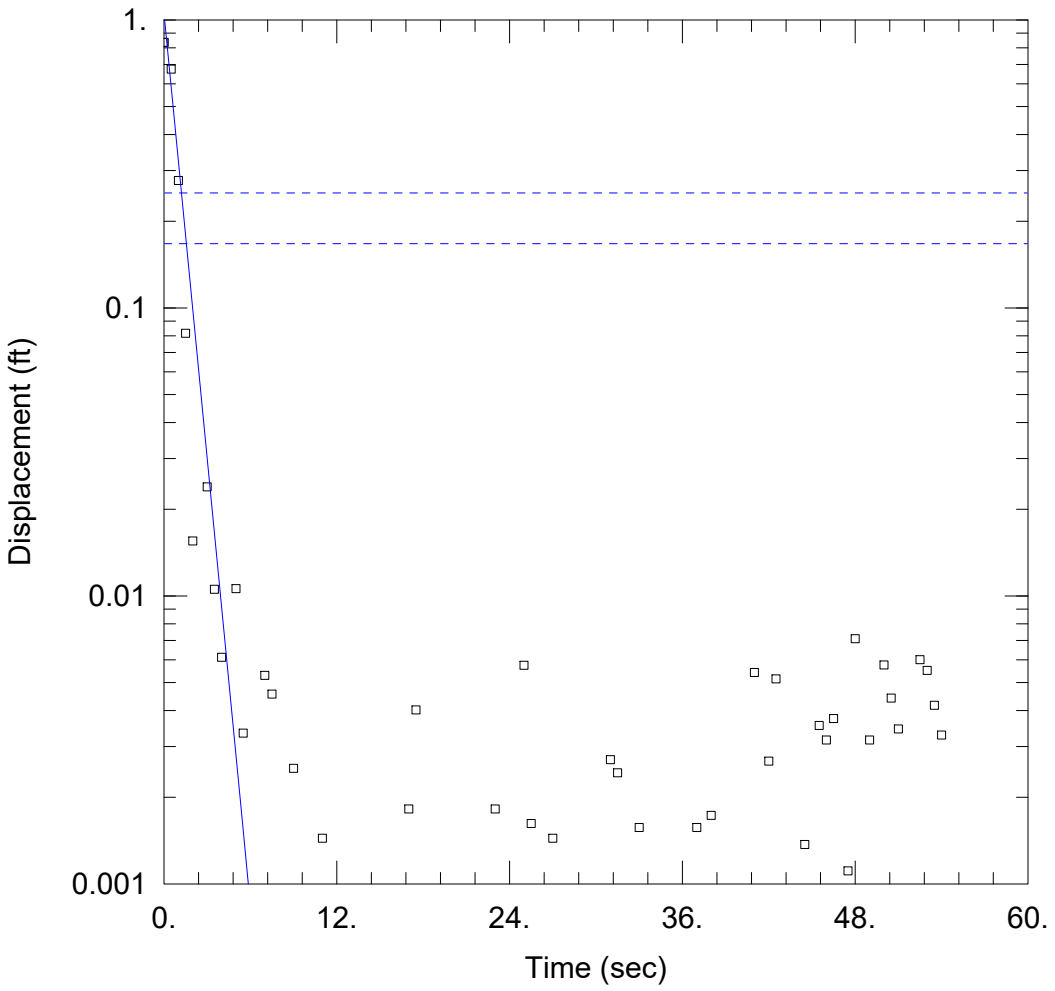
WELL DATA (MW-2)

Initial Displacement: 0.8354 ft
Total Well Penetration Depth: 13.17 ft
Casing Radius: 0.167 ft
Static Water Column Height: 12.79 ft
Screen Length: 10. ft
Well Radius: 0.167 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 490.5 ft/day y0 = 0.9035 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-2 Slug Test 3.aqt
Date: 04/10/23 Time: 09:14:58

AQUIFER DATA

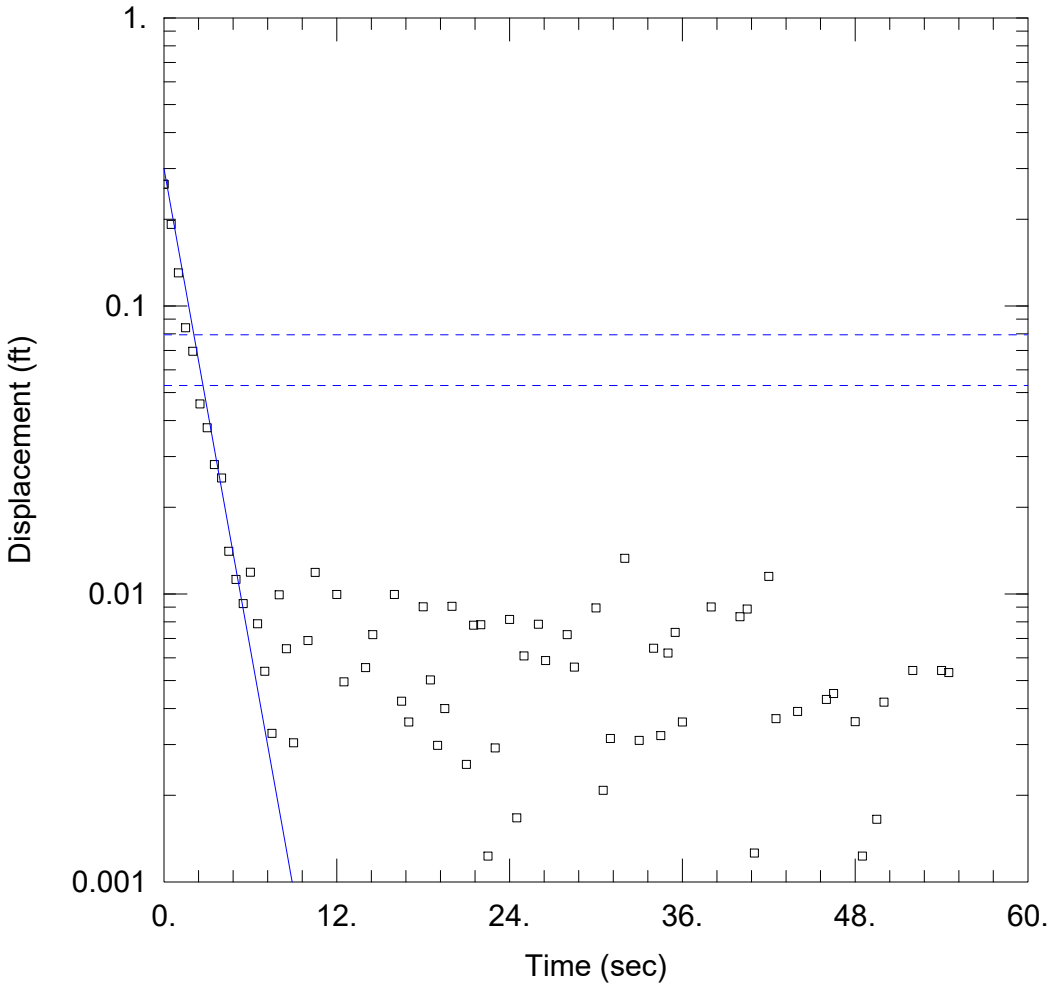
Saturated Thickness: 15.61 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-2)

Initial Displacement: 0.836 ft
Total Well Penetration Depth: 14.01 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.61 ft
Screen Length: 14. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 270.9 ft/day
y0 = 1.061 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-3 Slug Test 1.aqt
Date: 04/10/23 Time: 09:15:24

AQUIFER DATA

Saturated Thickness: 15.55 ft Anisotropy Ratio (Kz/Kr): 1.

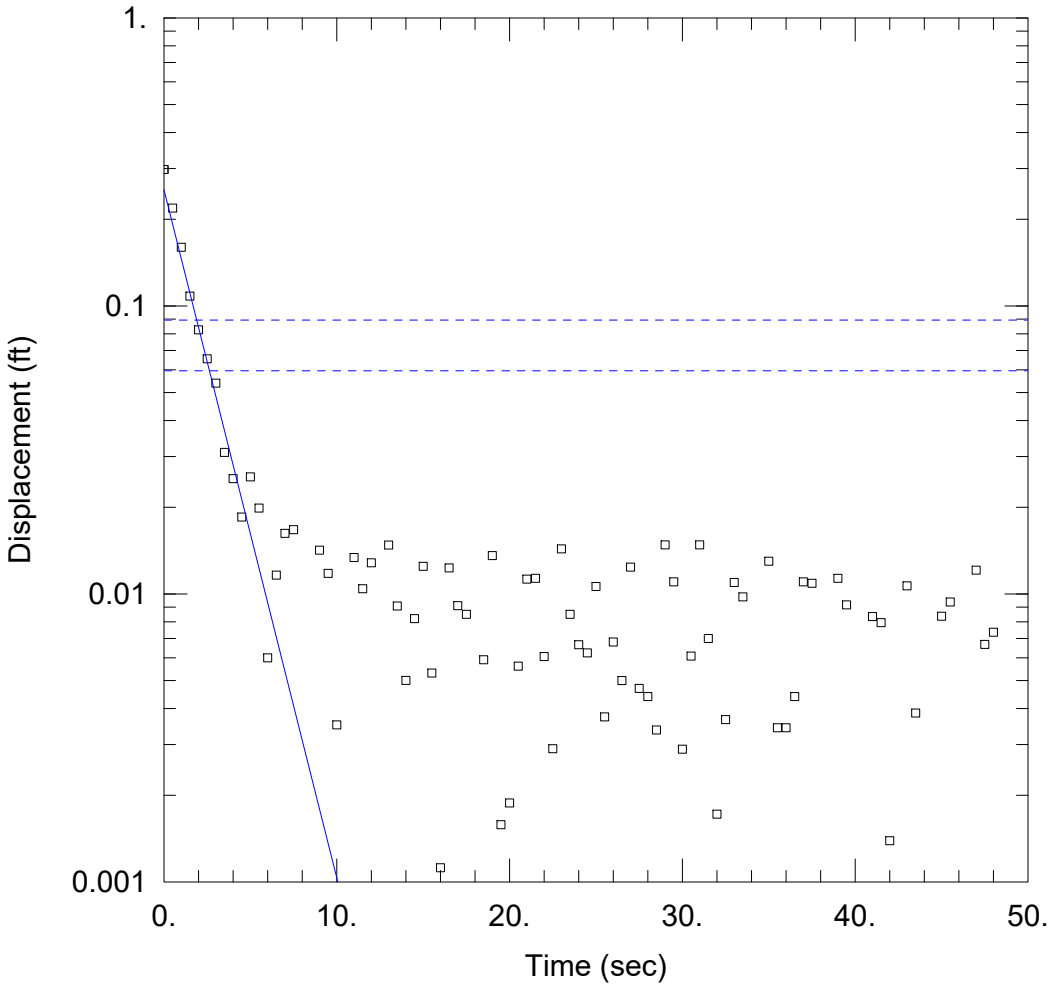
WELL DATA (MW-3)

Initial Displacement: 0.2646 ft
Total Well Penetration Depth: 14.76 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.55 ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 49.92 ft/day y0 = 0.2998 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-3 Slug Test 2.aqt
Date: 04/10/23 Time: 09:15:38

AQUIFER DATA

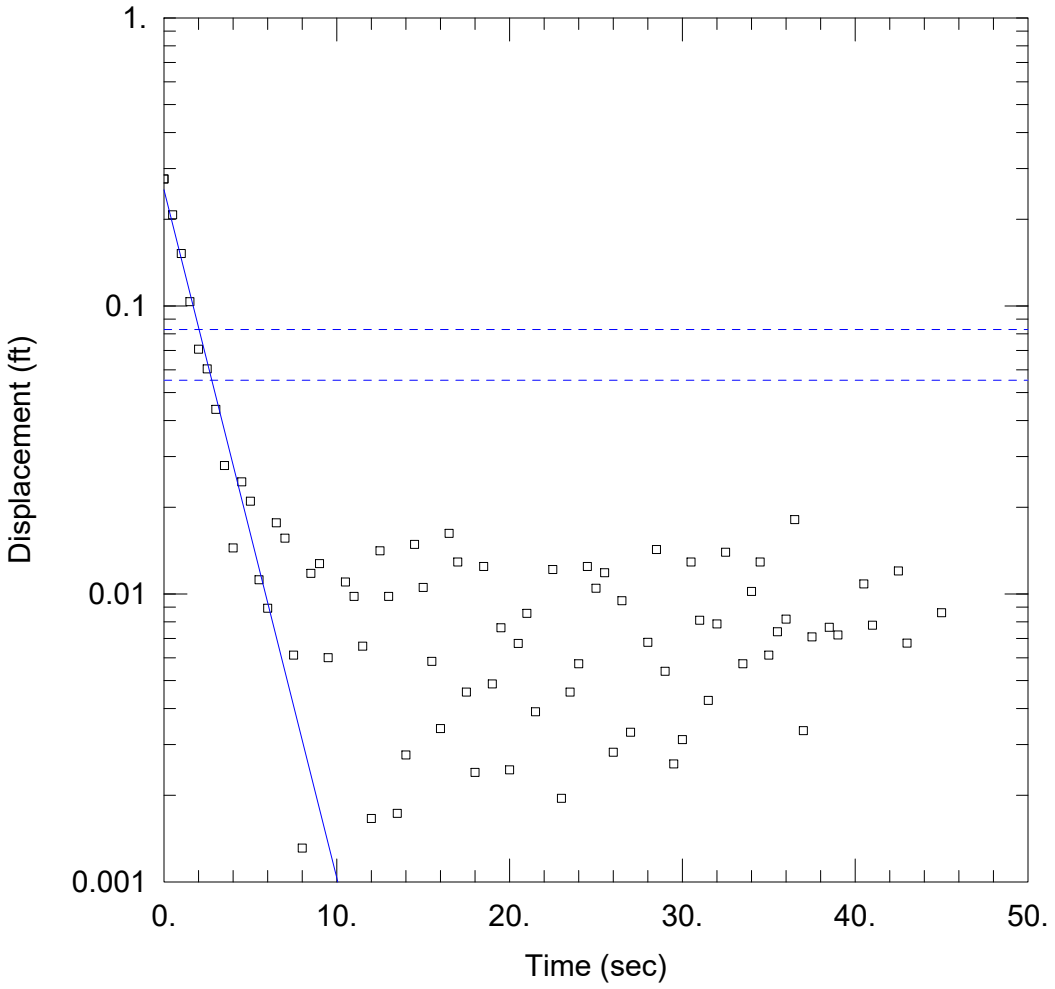
Saturated Thickness: 15.55 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-3)

Initial Displacement: 0.2975 ft
Total Well Penetration Depth: 14.76 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.55 ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 42.86 ft/day
y0 = 0.2528 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-3 Slug Test 3.aqt
Date: 04/10/23 Time: 09:13:39

AQUIFER DATA

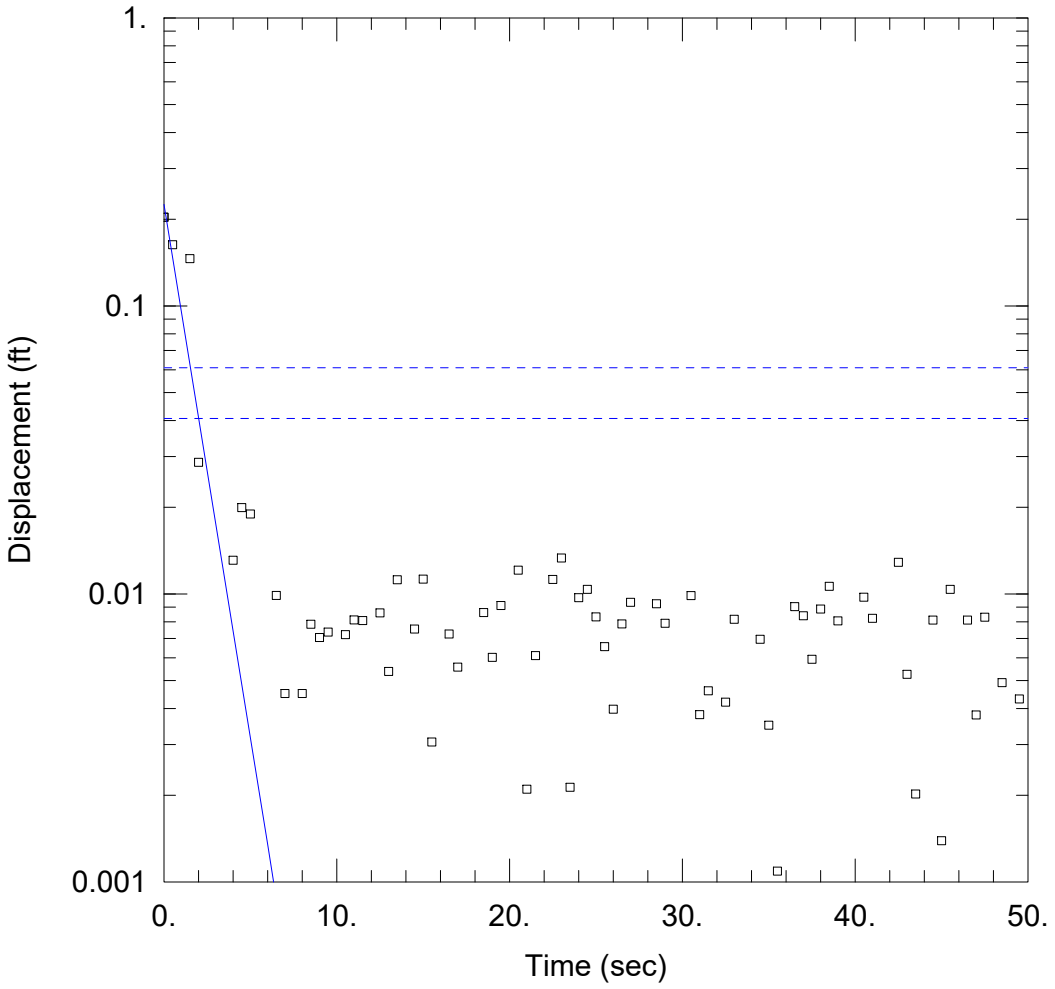
Saturated Thickness: 15.55 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-3)

Initial Displacement: 0.2761 ft
Total Well Penetration Depth: 14.76 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.55 ft
Screen Length: 10. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 42.86 ft/day
y0 = 0.2528 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-4 Slug Test 1.aqt
Date: 04/10/23 Time: 09:15:51

AQUIFER DATA

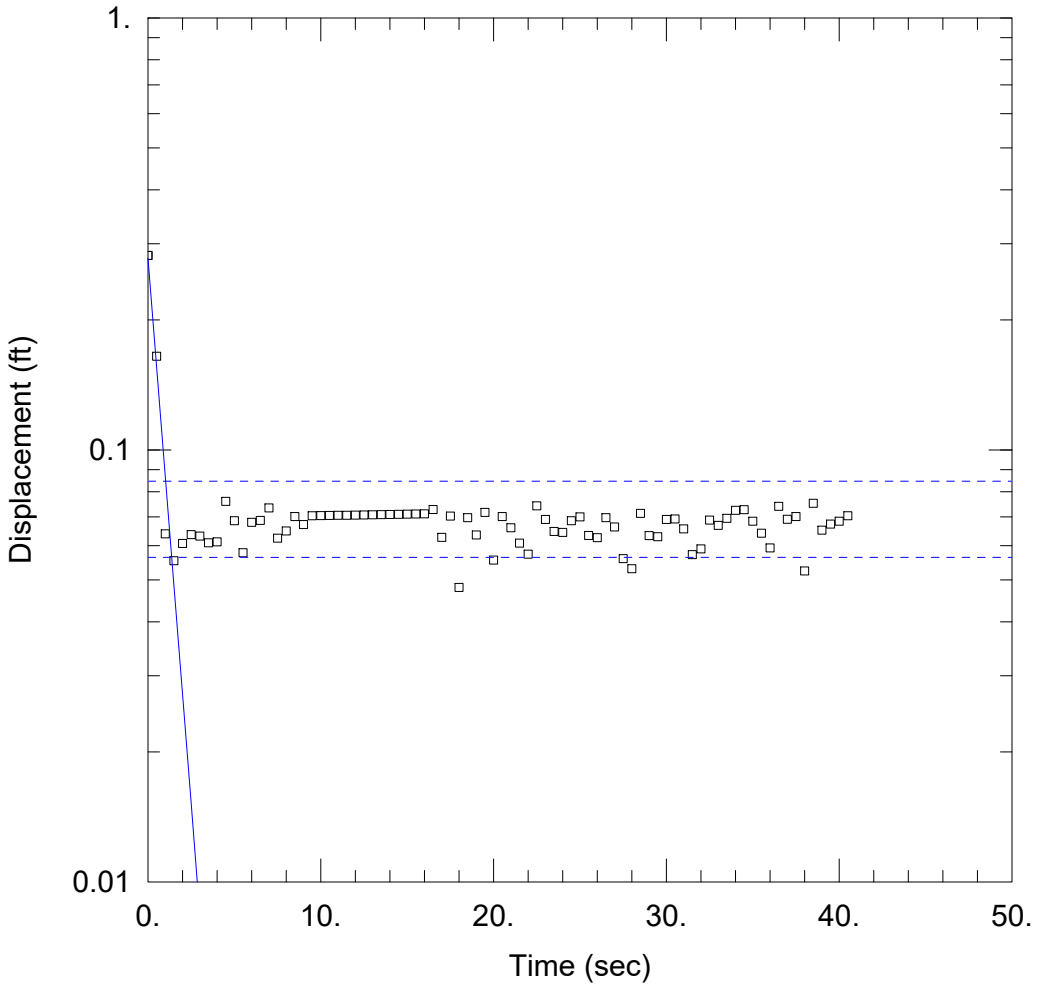
Saturated Thickness: 19.53 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-4)

Initial Displacement: 0.2032 ft
Total Well Penetration Depth: 22.49 ft
Casing Radius: 0.083 ft
Static Water Column Height: 19.53 ft
Screen Length: 20. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 41.85 ft/day
y0 = 0.2252 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-4 Slug Test 2.aqt
Date: 04/10/23 Time: 09:16:24

AQUIFER DATA

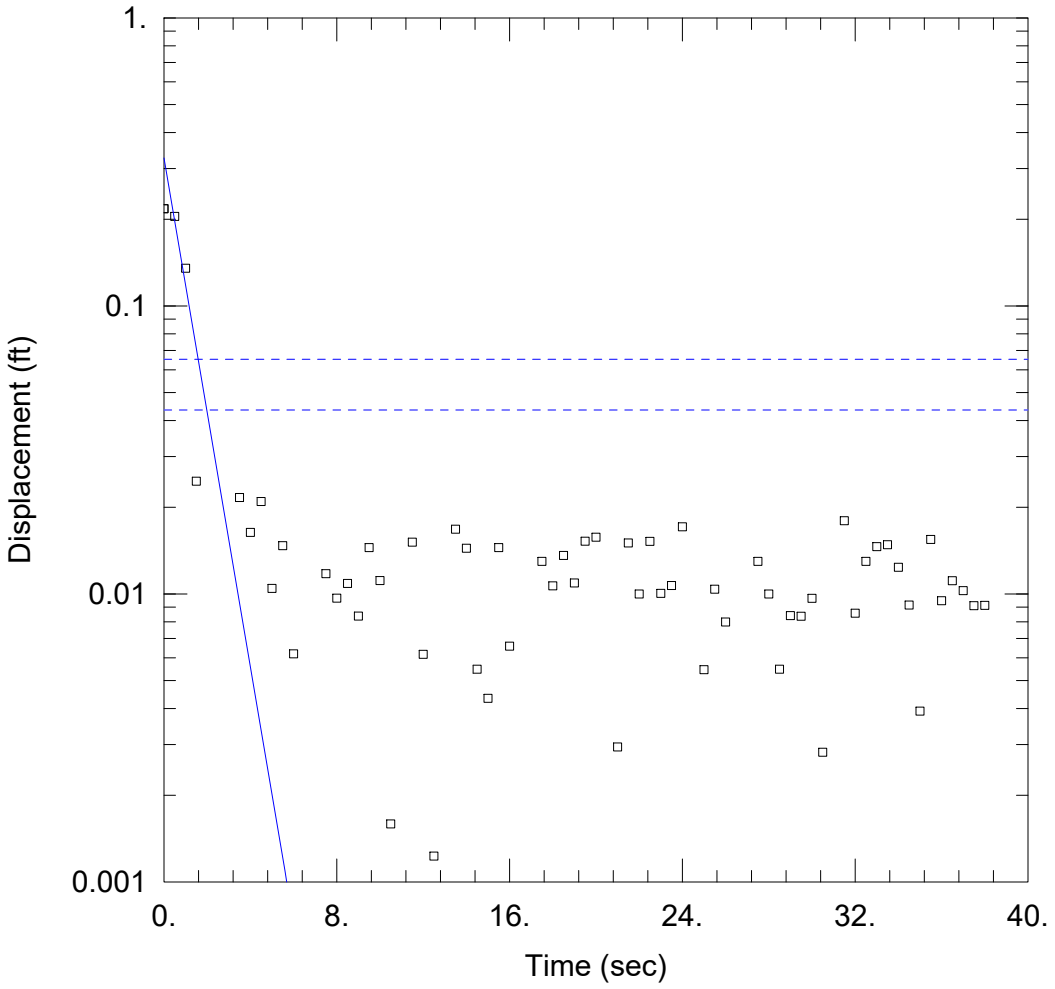
Saturated Thickness: 19.53 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-4)

Initial Displacement: 0.2821 ft
Total Well Penetration Depth: 22.49 ft
Casing Radius: 0.083 ft
Static Water Column Height: 19.53 ft
Screen Length: 20. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 57.01 ft/day
y0 = 0.2776 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-4 Slug Test 3.aqt
Date: 04/10/23 Time: 09:16:32

AQUIFER DATA

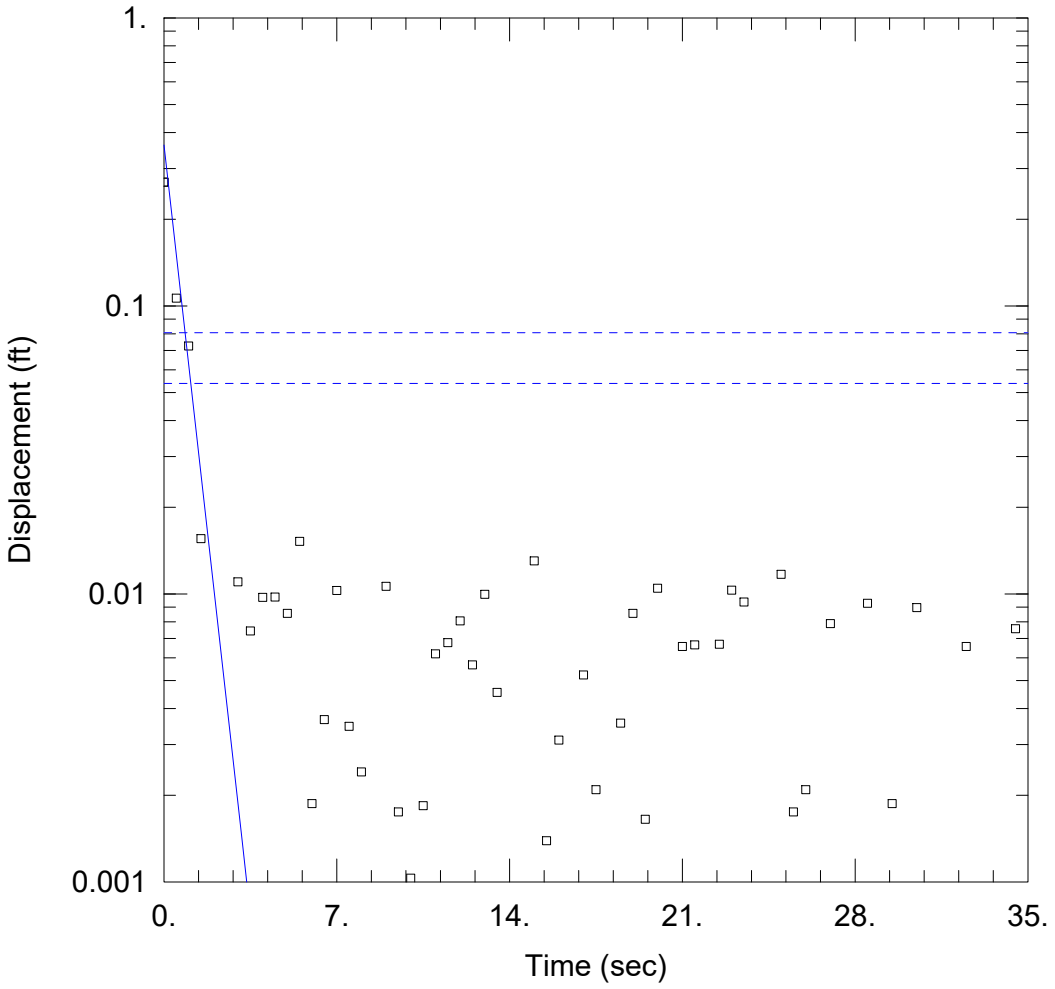
Saturated Thickness: 19.53 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-4)

Initial Displacement: 0.2175 ft
Total Well Penetration Depth: 22.49 ft
Casing Radius: 0.083 ft
Static Water Column Height: 19.53 ft
Screen Length: 20. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 49.93 ft/day
y0 = 0.3265 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-5 Slug Test 1.aqt
Date: 04/10/23 Time: 09:16:46

AQUIFER DATA

Saturated Thickness: 13.23 ft Anisotropy Ratio (Kz/Kr): 1.

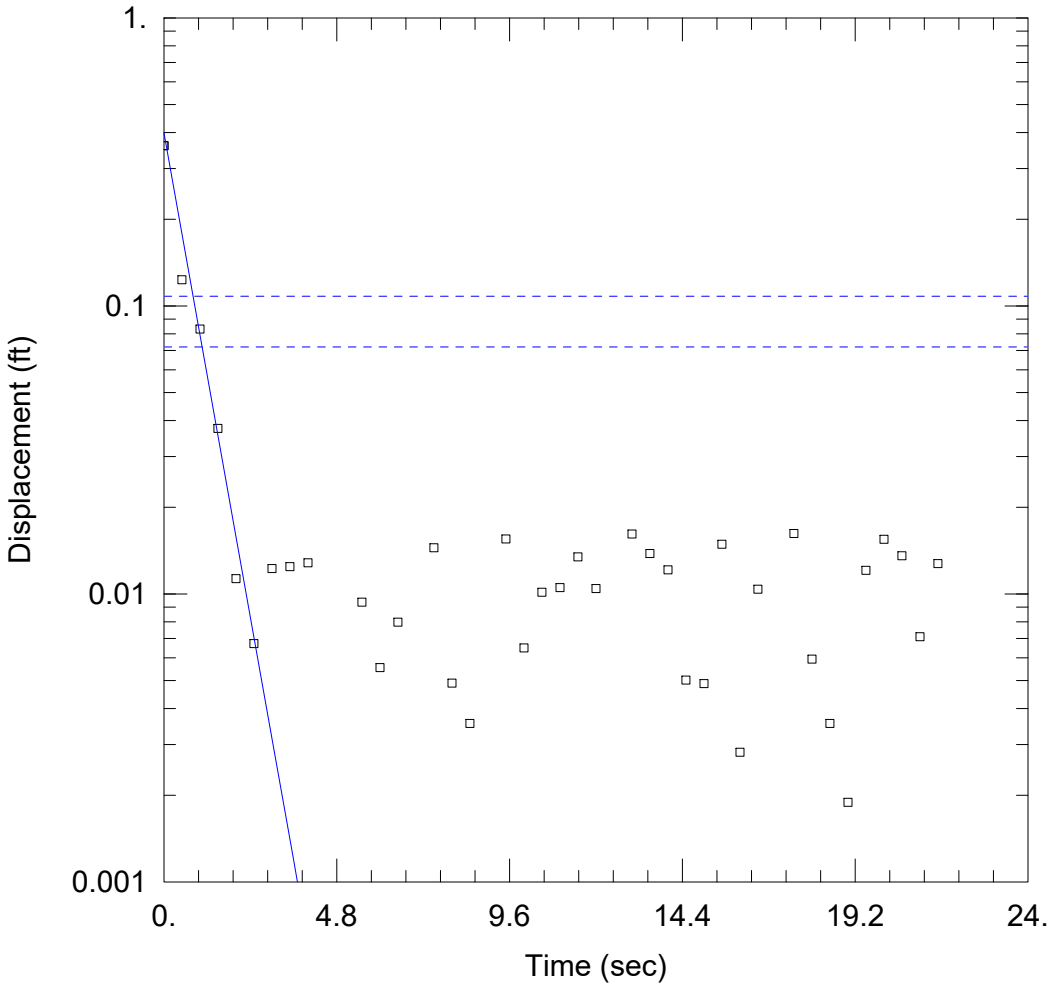
WELL DATA (MW-5)

Initial Displacement: 0.2689 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.23 ft
Screen Length: 20. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 121.4 ft/day y0 = 0.3621 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-5 Slug Test 2.aqt
Date: 04/10/23 Time: 09:16:57

AQUIFER DATA

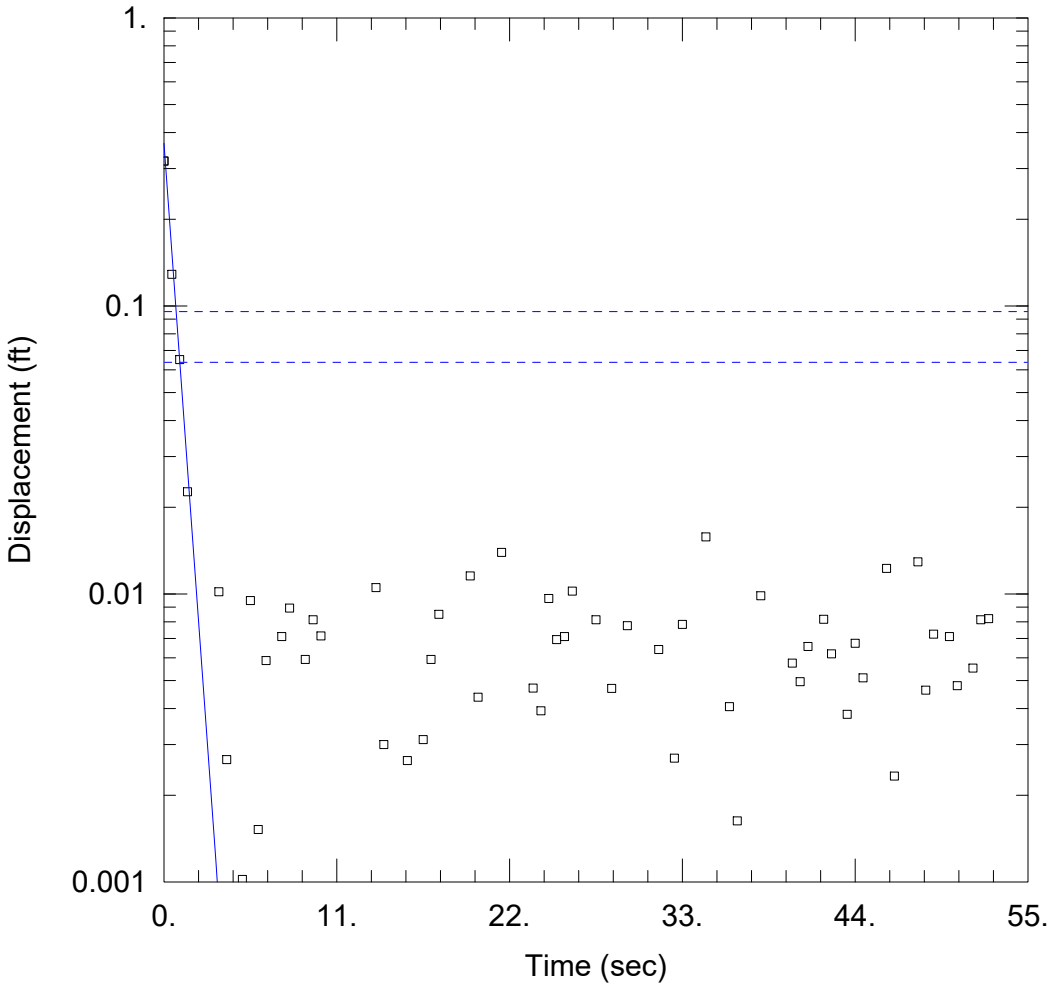
Saturated Thickness: 13.23 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-5)

Initial Displacement: 0.3602 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.23 ft
Screen Length: 20. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 111.6 ft/day
y0 = 0.3981 ft



WELL TEST ANALYSIS

Data Set: K:\...\MW-5 Slug Test 3.aqt
Date: 04/10/23 Time: 09:17:12

AQUIFER DATA

Saturated Thickness: 13.23 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-5)

Initial Displacement: 0.3185 ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.083 ft
Static Water Column Height: 13.23 ft
Screen Length: 20. ft
Well Radius: 0.33 ft
Gravel Pack Porosity: 0.

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 120. ft/day
y0 = 0.3664 ft

Attachment H

Montana DEQ Pathogen Model Spreadsheet

Appendix U
Pathegen Transport Model

Input Parameters		**units**			**converted**	
K	hydraulic conductivity	ft/day	122.4			from non-deg analysis
i	groundwater gradient	ft/ft	0.003			triangulated or published data
b	aquifer saturated thickness	ft	14.7			from drinking water well log
d	depth to groundwater	feet	4	cm	121.92	depth of soil test pit less trench depth
dw	distance to drinking water well	ft	305			from lot layout - drainfield to well isolation zone
Q	drinking water well pumping rate	gpd	3000	ft3/day	401.0159	estimated demand- well use + irrigation. Assume 1 living unit uses 250 gpd + irrigaion
p	annual precipitation	in/year	15.17	cm/year	38.5318	local rainfall from NOAA (https://www.ncdc.noaa.gov/cdo-web/datatools/normals)
e	effluent application rate	gpd/sf	1.01	cm/year	1501.87	from test pits
	soil type		loamy sand			from test pits
n	effective soil porosity	%	0.27			** see soil properties sheet below
	volumetric soil moisture content	mL/cm3	0.1			** see soil properties sheet below
	virulo soil type					from test pits
	soil depth	m				depth from bottom of infiltrative surface to either limiting layer or bottom of the test pit
	virulo virus					must run all virus to see the worst case for the soil type
	number of runs					minimum of 5 runs/ worst case virus
	highest # of exceedances					highest value
	log equivalent		#NUM!			

Results w/o Virulo:		
Horizontal travel time	3.913534	logs
Vertical travel time - Wyoming	0.115556	logs
Total	**4.02909**	**logs**

Results with Virulo:		
Horizontal travel time	3.913534	logs
Vertical travel time - virulo	#NUM!	
Total	**#NUM!**	**logs**

Time of Travel Calculation

User supplies K, b, I, Q, n, and X (distance estimate) to calculate travel time and other parameters.

Input Values				TOT and Capture Zone Results		
K=	122.4	ft/day				
b=	14.7	ft		Tx	195.68	Days
I=	0.003	ft/ft		Tx (years)	0.54	Years
Q=	401.02	ft3/day		Null Point	-11.82	ft
n=	0.27	%		Boundary	37.15	ft
X=	305.00	ft		Flow Veloc	1.56	ft/day

logs of inactivation:
3.913534

from EPA Ground Water Rule Source Assessment Guidance Manual, Appendix C
viruses are typically 0.02 log10 removal/day

Distance Traveled			Time of Travel			
feet	miles		days	months	years	
100	**0.02**		**64.2**	**2.1**	**0.18**	**Control Zone**
200	0.04		128.3	4.3	0.35	
300	0.06		192.5	6.4	0.53	
400	0.08		256.6	8.6	0.70	
500	0.09		320.8	10.7	0.88	
1,000	**0.19**		**641.6**	**21.4**	**1.76**	**Confined Aquifer Inventory Region**
2,640	0.50		1693.7	56.5	4.64	
5,280	**1**		**3387.5**	**112.9**	**9.28**	**General Inventory Region**
7,920	2		5081.2	169.4	13.92	
10,560	2		6774.9	225.8	18.56	
15,840	3		10162.4	338.7	27.84	
21,120	4		13549.8	451.7	37.12	
26,400	5		16937.3	564.6	46.40	
52,800	10		33874.5	1129.2	92.81	

Attachment I

MOUNDSOLV© Modeling Summary Report
Primary Analysis

MOUNDSOLV
Groundwater Mounding Analysis
For A Sloping Water-Table Aquifer
Zlotnik et al. (2017) Solution

Solution Method

Zlotnik et al. (2017) transient solution for a rectangular source (linearization method 2)

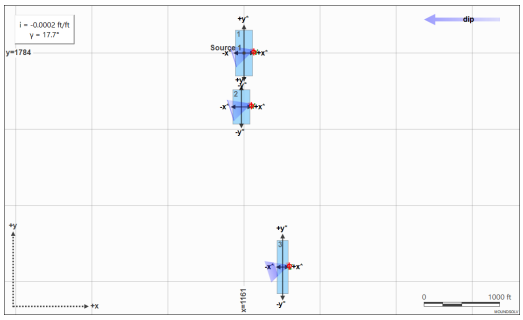
Site Description

Aquifer Data

Property	Value
Horizontal hydraulic conductivity, K (ft/d)	122.4
Specific yield, Sy	0.27
Initial saturated thickness, h_0 (ft)	14.7
Maximum allowable water-table rise, σ (ft)	0
Dip, i (ft/ft)	-0.0002
Slope rotation from x axis, γ (°)	17.7

Recharge Sources

Property	Source 1	Source 2	Source 3
X coordinate at center, X (ft)	1161	1127	1669
Y coordinate at center, Y (ft)	1784	1077	-1025
Dimension along x* axis, L (ft)	225	225	145
Dimension along y* axis, W (ft)	600	450	700
Rotation from slope direction, ϕ (°)	-17.7	-17.7	-17.7
Recharge rate, Q (ft³/d)	10694	8021	8021
Infiltration rate, q (ft/d)	0.07921481481	0.07921975309	0.07902463054

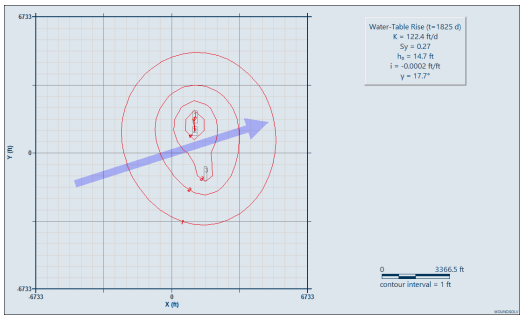


Map of recharge source.

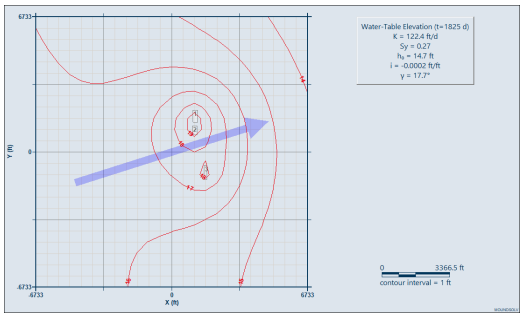
Monitoring Points

Elapsed Time, t = 1825 d

Name	x (ft)	y (ft)	s (ft)	h (ft)	z (ft)
Source 1	1161	1784	4.981	19.68	0



Contour plot of water-table rise.



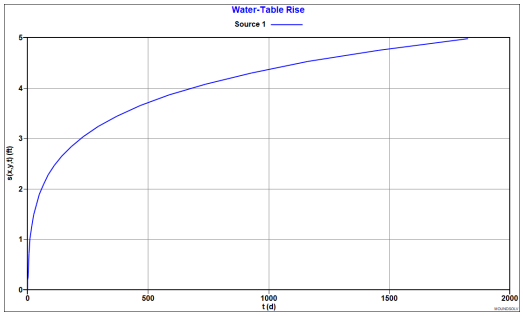
Contour plot of water-table elevation.

Time Series Data

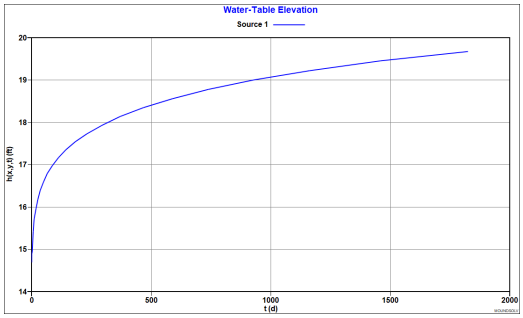
Time	Source 1	
(d)	s (ft)	h (ft)
0	0	14.7
0.002327	0.0006828	14.7
0.005236	0.001536	14.7
0.008873	0.002603	14.7

0.01342	0.003937	14.7
0.0191	0.005604	14.71
0.0262	0.007688	14.71
0.03508	0.01029	14.71
0.04618	0.01355	14.71
0.06005	0.01762	14.72
0.07739	0.0227	14.72
0.09906	0.02906	14.73
0.1262	0.03697	14.74
0.16	0.04681	14.75
0.2024	0.05895	14.76
0.2553	0.07382	14.77
0.3214	0.09187	14.79
0.4041	0.1135	14.81
0.5075	0.1393	14.84
0.6366	0.1697	14.87
0.7981	0.205	14.91
1	0.2458	14.95
5.245	0.7268	15.43
10.55	1.023	15.72
17.18	1.268	15.97
25.48	1.49	16.19
35.84	1.698	16.4
48.79	1.897	16.6
64.99	2.09	16.79
85.23	2.28	16.98
110.5	2.467	17.17
142.2	2.655	17.36
181.7	2.846	17.55
231.1	3.04	17.74
292.9	3.239	17.94
370.1	3.443	18.14
466.6	3.652	18.35
587.3	3.865	18.57
738.1	4.083	18.78

926.6	4.304	19
1162	4.528	19.23
1457	4.754	19.45
1825	4.981	19.68



Time-series plot of water-table rise.



Time-series plot of water-table elevation.

Profile Data

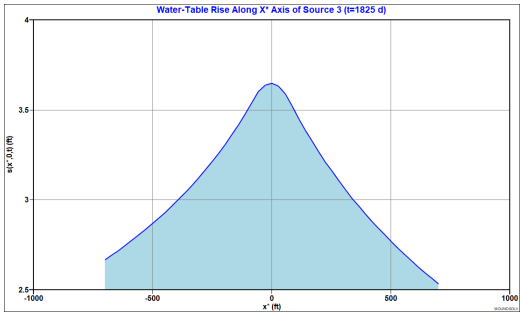
Profile Along X Axis for Source 3 at Elapsed Time, t = 1825 d*

x* (ft)	s (ft)	h (ft)	z (ft)
-700	2.667	17.57	0.2074
-672	2.693	17.6	0.2021
-644	2.72	17.62	0.1967
-616	2.747	17.64	0.1914
-588	2.776	17.66	0.186
-560	2.805	17.69	0.1807
-532	2.835	17.71	0.1754
-504	2.866	17.74	0.17
-476	2.898	17.76	0.1647
-448	2.932	17.79	0.1594

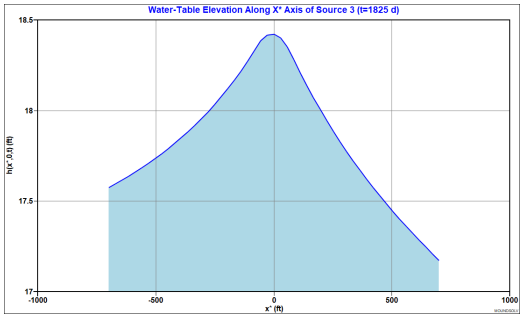
-420	2.966	17.82	0.154
-392	3.003	17.85	0.1487
-364	3.04	17.88	0.1434
-336	3.08	17.92	0.138
-308	3.121	17.95	0.1327
-280	3.165	17.99	0.1274
-252	3.211	18.03	0.122
-224	3.259	18.08	0.1167
-196	3.309	18.12	0.1114
-168	3.363	18.17	0.106
-140	3.419	18.22	0.1007
-112	3.478	18.27	0.09535
-84	3.541	18.33	0.09002
-56	3.601	18.39	0.08469
-28	3.638	18.42	0.07935
0	3.648	18.42	0.07402
28	3.632	18.4	0.06868
56	3.59	18.35	0.06335
84	3.524	18.28	0.05801
112	3.456	18.21	0.05268
140	3.391	18.14	0.04734
168	3.329	18.07	0.04201
196	3.27	18.01	0.03667
224	3.213	17.94	0.03134
252	3.16	17.89	0.026
280	3.108	17.83	0.02067
308	3.059	17.77	0.01533
336	3.012	17.72	0.009997
364	2.967	17.67	0.004662
392	2.924	17.62	-0.0006733
420	2.882	17.58	-0.006008
448	2.842	17.53	-0.01134
476	2.804	17.49	-0.01668
504	2.766	17.44	-0.02201
532	2.73	17.4	-0.02735

560	2.695	17.36	-0.03268
588	2.661	17.32	-0.03802
616	2.628	17.28	-0.04335
644	2.596	17.25	-0.04869
672	2.564	17.21	-0.05402
700	2.534	17.17	-0.05936

The axes of Source 3 (x, y*) are rotated 0° from the axes of mapping coordinate system (x, y)*



Profile of water-table rise along x axis of Source 3.*



Profile of water-table elevation along x axis of Source 3.*

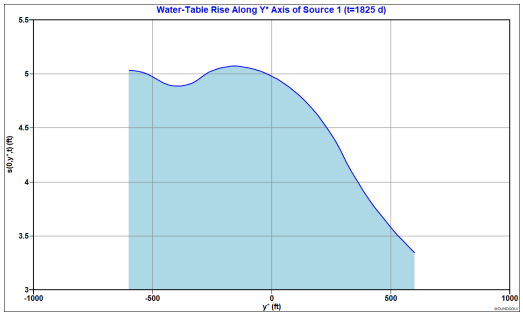
Profile Along Y Axis for Source 1 at Elapsed Time, t = 1825 d*

y* (ft)	s (ft)	h (ft)	z (ft)
-600	5.034	19.77	0.03648
-576	5.031	19.77	0.03502
-552	5.022	19.76	0.03357
-528	5.006	19.74	0.03211
-504	4.981	19.71	0.03065
-480	4.948	19.68	0.02919
-456	4.917	19.65	0.02773
-432	4.897	19.62	0.02627

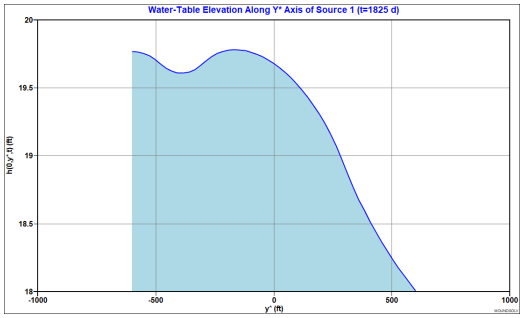
-408	4.888	19.61	0.02481
-384	4.887	19.61	0.02335
-360	4.897	19.62	0.02189
-336	4.916	19.64	0.02043
-312	4.946	19.66	0.01897
-288	4.984	19.7	0.01751
-264	5.016	19.73	0.01605
-240	5.04	19.75	0.01459
-216	5.057	19.77	0.01313
-192	5.067	19.78	0.01167
-168	5.072	19.78	0.01022
-144	5.072	19.78	0.008756
-120	5.067	19.77	0.007297
-96	5.058	19.76	0.005837
-72	5.045	19.75	0.004378
-48	5.028	19.73	0.002919
-24	5.006	19.71	0.001459
0	4.981	19.68	0
24	4.952	19.65	-0.001459
48	4.918	19.62	-0.002919
72	4.881	19.58	-0.004378
96	4.839	19.53	-0.005837
120	4.792	19.48	-0.007297
144	4.741	19.43	-0.008756
168	4.684	19.37	-0.01022
192	4.621	19.31	-0.01167
216	4.551	19.24	-0.01313
240	4.474	19.16	-0.01459
264	4.389	19.07	-0.01605
288	4.293	18.98	-0.01751
312	4.189	18.87	-0.01897
336	4.091	18.77	-0.02043
360	4.001	18.68	-0.02189
384	3.917	18.59	-0.02335
408	3.839	18.51	-0.02481

432	3.766	18.44	-0.02627
456	3.697	18.37	-0.02773
480	3.631	18.3	-0.02919
504	3.568	18.24	-0.03065
528	3.508	18.18	-0.03211
552	3.451	18.12	-0.03357
576	3.396	18.06	-0.03502
600	3.343	18.01	-0.03648

The axes of Source 1 (x, y*) are rotated 0° from the axes of mapping coordinate system (x, y)*



Profile of water-table rise along y axis of Source 1.*



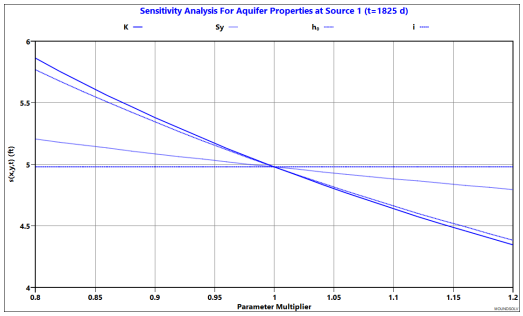
Profile of water-table elevation along y axis of Source 1.*

Sensitivity Data

Source 1, x=1161 ft, y=1784 ft

Parameter	Water-Table Rise (ft)			
Multiplier	**K**	**Sy**	**h_o**	**i**
0.8	5.864	5.208	5.771	4.981
0.82	5.76	5.183	5.681	4.981
0.84	5.66	5.158	5.593	4.981
0.86	5.564	5.134	5.508	4.981
0.88	5.472	5.111	5.426	4.981

0.9	5.382	5.088	5.346	4.981
0.92	5.296	5.066	5.269	4.981
0.94	5.214	5.044	5.194	4.981
0.96	5.133	5.023	5.121	4.981
0.98	5.056	5.002	5.05	4.981
1	4.981	4.981	4.981	4.981
1.02	4.909	4.961	4.914	4.981
1.04	4.839	4.941	4.849	4.981
1.06	4.771	4.922	4.785	4.981
1.08	4.705	4.903	4.724	4.981
1.1	4.641	4.885	4.664	4.981
1.12	4.579	4.866	4.605	4.981
1.14	4.519	4.849	4.548	4.981
1.16	4.46	4.831	4.493	4.981
1.18	4.404	4.814	4.438	4.982
1.2	4.348	4.797	4.386	4.982



Sensitivity plot for water-table rise.

Notation

h is water-table elevation above datum[1]
h_o is aquifer saturated thickness prior to mounding
i is dip of aquifer
K is horizontal hydraulic conductivity
L is dimension of recharge source parallel to *x** axis
q is infiltration rate (= *Q* / *L*·*W*)
Q is recharge rate
s is water-table rise above static water table
Sy is specific yield
t is time since start of recharge
t_o is time when recharge stops
W is dimension of recharge source parallel to *y** axis

x, y are mapping Cartesian coordinate axes
x^*, y^* are recharge source Cartesian coordinate axes
z is elevation above datum[1]
γ is angle between x axis and dip direction
ϕ is angle between dip direction and x^* axis of recharge source
σ is maximum acceptable water-table rise

[1]*Elevation datum is the base of aquifer beneath the center of primary recharge source*

Attachment J

MOUNDSOLV© Modeling Summary Report
Alternate Analysis

MOUNDSOLV
Groundwater Mounding Analysis
For A Sloping Water-Table Aquifer
Zlotnik et al. (2017) Solution

Solution Method

Zlotnik et al. (2017) transient solution for a rectangular source (linearization method 2)

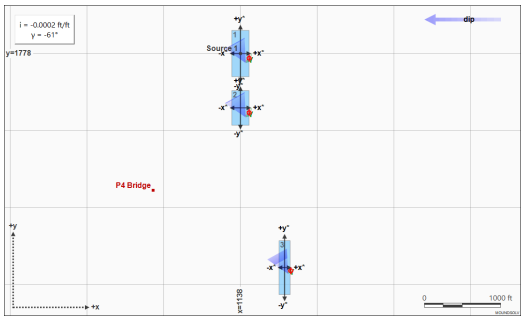
Site Description

Aquifer Data

Property	Value
Horizontal hydraulic conductivity, K (ft/d)	122.4
Specific yield, Sy	0.27
Initial saturated thickness, h_0 (ft)	14.7
Maximum allowable water-table rise, σ (ft)	0
Dip, i (ft/ft)	-0.0002
Slope rotation from x axis, γ (°)	-61

Recharge Sources

Property	Source 1	Source 2	Source 3
X coordinate at center, X (ft)	1138	1138	1714
Y coordinate at center, Y (ft)	1778	1071	-1005
Dimension along x* axis, L (ft)	225	225	145
Dimension along y* axis, W (ft)	600	450	700
Rotation from slope direction, ϕ (°)	61	61	61
Recharge rate, Q (ft³/d)	10694	8021	8021
Infiltration rate, q (ft/d)	0.07921481481	0.07921975309	0.07902463054

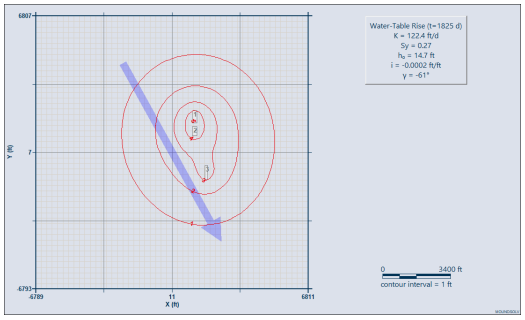


Map of recharge source.

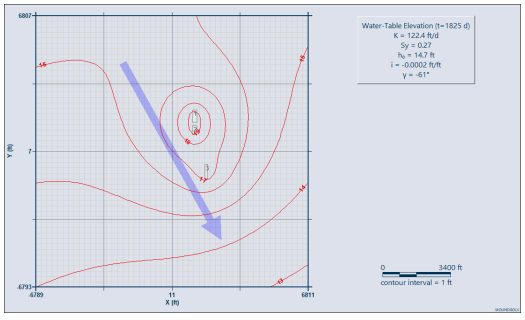
Monitoring Points

Elapsed Time, t = 1825 d

Name	x (ft)	y (ft)	s (ft)	h (ft)	z (ft)
Source 1	1138	1778	4.967	19.67	0
P4 Bridge	0	0	2.45	16.95	-0.2007



Contour plot of water-table rise.



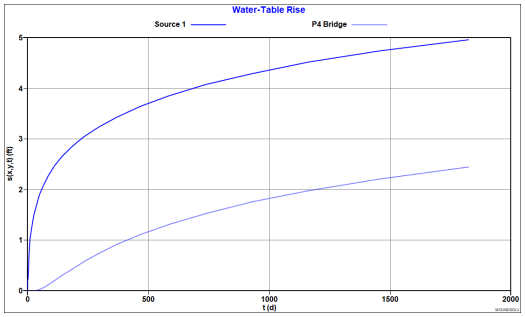
Contour plot of water-table elevation.

Time Series Data

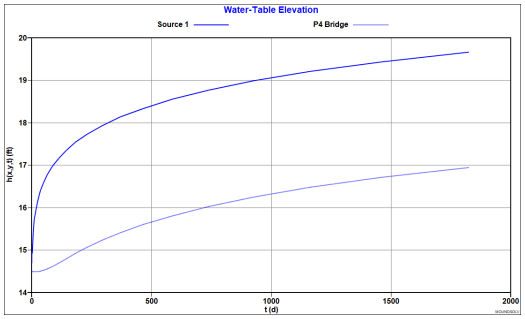
Time	Source 1		P4 Bridge	
(d)	s (ft)	h (ft)	s (ft)	h (ft)
0	0	14.7	0	14.5
0.002327	0.0006828	14.7	0	14.5
0.005236	0.001536	14.7	0	14.5

0.008873	0.002603	14.7	0	14.5
0.01342	0.003937	14.7	0	14.5
0.0191	0.005604	14.71	0	14.5
0.0262	0.007688	14.71	0	14.5
0.03508	0.01029	14.71	0	14.5
0.04618	0.01355	14.71	0	14.5
0.06005	0.01762	14.72	0	14.5
0.07739	0.0227	14.72	0	14.5
0.09906	0.02906	14.73	0	14.5
0.1262	0.03697	14.74	0	14.5
0.16	0.04681	14.75	0	14.5
0.2024	0.05895	14.76	0	14.5
0.2553	0.07382	14.77	0	14.5
0.3214	0.09187	14.79	0	14.5
0.4041	0.1135	14.81	0	14.5
0.5075	0.1393	14.84	0	14.5
0.6366	0.1697	14.87	0	14.5
0.7981	0.205	14.91	0	14.5
1	0.2458	14.95	0	14.5
5.245	0.7268	15.43	3.564E-9	14.5
10.55	1.023	15.72	1.159E-5	14.5
17.18	1.268	15.97	0.000374	14.5
25.48	1.49	16.19	0.002826	14.5
35.84	1.698	16.4	0.0111	14.51
48.79	1.897	16.6	0.0303	14.53
64.99	2.089	16.79	0.06565	14.56
85.23	2.278	16.98	0.1213	14.62
110.5	2.465	17.17	0.1998	14.7
142.2	2.653	17.35	0.3017	14.8
181.7	2.843	17.54	0.4265	14.93
231.1	3.037	17.74	0.5723	15.07
292.9	3.235	17.94	0.7368	15.24
370.1	3.438	18.14	0.9176	15.42
466.6	3.646	18.35	1.112	15.61
587.3	3.859	18.56	1.318	15.82

738.1	4.075	18.77	1.532	16.03
926.6	4.295	18.99	1.755	16.25
1162	4.517	19.22	1.982	16.48
1457	4.741	19.44	2.214	16.71
1825	4.967	19.67	2.45	16.95



Time-series plot of water-table rise.



Time-series plot of water-table elevation.

Profile Data

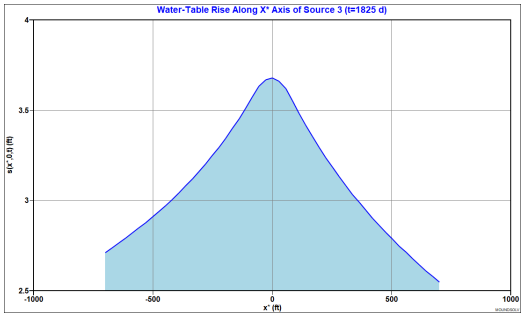
Profile Along X Axis for Source 3 at Elapsed Time, t = 1825 d*

x* (ft)	s (ft)	h (ft)	z (ft)
-700	2.713	16.94	-0.4748
-672	2.738	16.96	-0.4775
-644	2.765	16.98	-0.4802
-616	2.792	17.01	-0.4829
-588	2.819	17.03	-0.4856
-560	2.848	17.06	-0.4884
-532	2.878	17.09	-0.4911
-504	2.908	17.11	-0.4938
-476	2.94	17.14	-0.4965

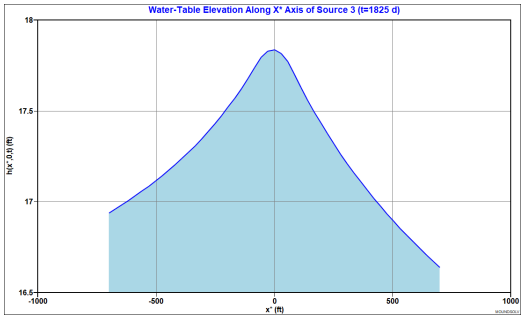
-448	2.973	17.17	-0.4992
-420	3.007	17.21	-0.5019
-392	3.043	17.24	-0.5047
-364	3.08	17.27	-0.5074
-336	3.119	17.31	-0.5101
-308	3.16	17.35	-0.5128
-280	3.203	17.39	-0.5155
-252	3.248	17.43	-0.5182
-224	3.295	17.47	-0.5209
-196	3.345	17.52	-0.5237
-168	3.398	17.57	-0.5264
-140	3.453	17.62	-0.5291
-112	3.512	17.68	-0.5318
-84	3.574	17.74	-0.5345
-56	3.634	17.8	-0.5372
-28	3.67	17.83	-0.5399
0	3.679	17.84	-0.5427
28	3.663	17.82	-0.5454
56	3.62	17.77	-0.5481
84	3.553	17.7	-0.5508
112	3.484	17.63	-0.5535
140	3.418	17.56	-0.5562
168	3.356	17.5	-0.559
196	3.296	17.43	-0.5617
224	3.239	17.37	-0.5644
252	3.185	17.32	-0.5671
280	3.133	17.26	-0.5698
308	3.083	17.21	-0.5725
336	3.035	17.16	-0.5752
364	2.99	17.11	-0.578
392	2.946	17.07	-0.5807
420	2.904	17.02	-0.5834
448	2.863	16.98	-0.5861
476	2.824	16.93	-0.5888
504	2.786	16.89	-0.5915

532	2.749	16.85	-0.5942
560	2.713	16.82	-0.597
588	2.678	16.78	-0.5997
616	2.645	16.74	-0.6024
644	2.612	16.71	-0.6051
672	2.58	16.67	-0.6078
700	2.549	16.64	-0.6105

The axes of Source 3 (x, y*) are rotated 0° from the axes of mapping coordinate system (x, y)*



Profile of water-table rise along x axis of Source 3.*



Profile of water-table elevation along x axis of Source 3.*

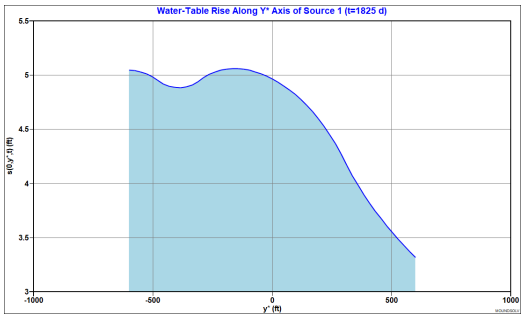
Profile Along Y Axis for Source 1 at Elapsed Time, t = 1825 d*

y* (ft)	s (ft)	h (ft)	z (ft)
-600	5.048	19.64	-0.105
-576	5.044	19.64	-0.1008
-552	5.033	19.64	-0.09656
-528	5.015	19.62	-0.09236
-504	4.989	19.6	-0.08816
-480	4.954	19.57	-0.08396
-456	4.921	19.54	-0.07977

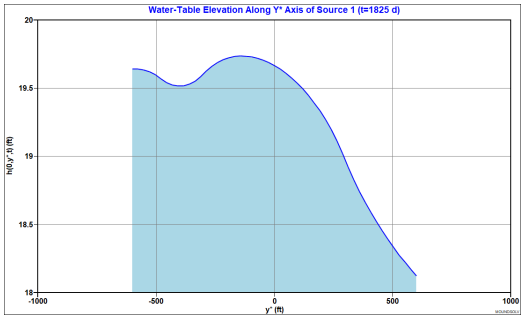
-432	4.899	19.52	-0.07557
-408	4.888	19.52	-0.07137
-384	4.886	19.52	-0.06717
-360	4.894	19.53	-0.06297
-336	4.913	19.55	-0.05877
-312	4.941	19.59	-0.05458
-288	4.979	19.63	-0.05038
-264	5.01	19.66	-0.04618
-240	5.033	19.69	-0.04198
-216	5.049	19.71	-0.03778
-192	5.059	19.73	-0.03359
-168	5.063	19.73	-0.02939
-144	5.062	19.74	-0.02519
-120	5.057	19.74	-0.02099
-96	5.047	19.73	-0.01679
-72	5.033	19.72	-0.01259
-48	5.015	19.71	-0.008396
-24	4.993	19.69	-0.004198
0	4.967	19.67	0
24	4.937	19.64	0.004198
48	4.903	19.61	0.008396
72	4.865	19.58	0.01259
96	4.823	19.54	0.01679
120	4.776	19.5	0.02099
144	4.723	19.45	0.02519
168	4.666	19.4	0.02939
192	4.602	19.34	0.03359
216	4.532	19.27	0.03778
240	4.455	19.2	0.04198
264	4.369	19.12	0.04618
288	4.273	19.02	0.05038
312	4.168	18.92	0.05458
336	4.07	18.83	0.05877
360	3.98	18.74	0.06297
384	3.895	18.66	0.06717

408	3.817	18.59	0.07137
432	3.743	18.52	0.07557
456	3.674	18.45	0.07977
480	3.607	18.39	0.08396
504	3.545	18.33	0.08816
528	3.484	18.28	0.09236
552	3.427	18.22	0.09656
576	3.372	18.17	0.1008
600	3.318	18.12	0.105

The axes of Source 1 (x, y*) are rotated 0° from the axes of mapping coordinate system (x, y)*



Profile of water-table rise along y axis of Source 1.*



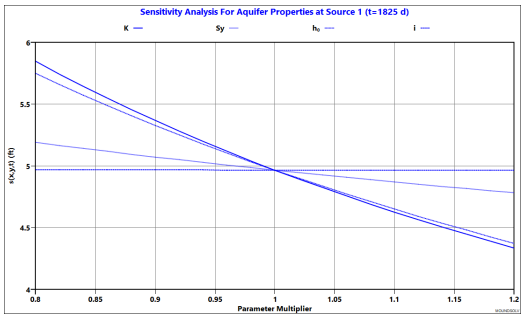
Profile of water-table elevation along y axis of Source 1.*

Sensitivity Data

Source 1, x=1138 ft, y=1778 ft

Parameter	**Water-Table Rise (ft)**			
Multiplier	**K**	**Sy**	**h_0**	**i**
0.8	5.849	5.193	5.751	4.97
0.82	5.745	5.168	5.662	4.97
0.84	5.645	5.143	5.575	4.97
0.86	5.549	5.119	5.491	4.969

0.88	5.457	5.096	5.409	4.969
0.9	5.368	5.073	5.33	4.969
0.92	5.282	5.051	5.253	4.968
0.94	5.199	5.03	5.179	4.968
0.96	5.119	5.008	5.106	4.968
0.98	5.042	4.988	5.036	4.968
1	4.967	4.967	4.967	4.967
1.02	4.895	4.947	4.901	4.967
1.04	4.825	4.928	4.836	4.967
1.06	4.757	4.909	4.773	4.966
1.08	4.691	4.89	4.712	4.966
1.1	4.628	4.871	4.652	4.966
1.12	4.566	4.853	4.594	4.965
1.14	4.506	4.836	4.537	4.965
1.16	4.447	4.818	4.482	4.965
1.18	4.391	4.801	4.428	4.965
1.2	4.336	4.784	4.375	4.964



Sensitivity plot for water-table rise.

Notation

h is water-table elevation above datum[1]
h_0 is aquifer saturated thickness prior to mounding
i is dip of aquifer
K is horizontal hydraulic conductivity
L is dimension of recharge source parallel to *x** axis
q is infiltration rate (= *Q* / *L*·*W*)
Q is recharge rate
s is water-table rise above static water table
Sy is specific yield
t is time since start of recharge

t_0 is time when recharge stops
W is dimension of recharge source parallel to y^* axis
x, y are mapping Cartesian coordinate axes
x^*, y^* are recharge source Cartesian coordinate axes
z is elevation above datum[1]
γ is angle between x axis and dip direction
ϕ is angle between dip direction and x^* axis of recharge source
σ is maximum acceptable water-table rise

[1]*Elevation datum is the base of aquifer beneath the center of primary recharge source*

Attachment K

Phosphorous Breakthrough Analyses

Appendix J

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME: LCWSD RIB
COUNTY: Flathead
LOT #:
NOTES: RI Basin Area Two - Phosphorous Breakthrough to Pond 4

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	450.0	ft
L	Length of Primary Drainfield's Long Axis	450.0	ft
W	Width of Primary Drainfield's Short Axis	112.5	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4.0	ft
D	Distance from Drainfield to Surface Water	1160.0	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils, 1.0 ft for fine soils)**	1.0	ft
~~No~~			
Sw	Soil Weight (usually constant)	100.0	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200.0	ppm
#I	Volume of Contributing Discharge	30,000.0	gpd
	Phosphorous Concentration in Discharge	2.00	mg/L
CONSTANTS			
PI	Phosphorous Load (1/2-RI Basin Area 2)	183.00	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
Pt	Total Phosphorous Load = (PI)(#I)	183.00	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	20250000.0	lbs
Da	Dispersion Angle	5.0	degrees
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	63974000.0	lbs
P	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	16844.8	lbs
SOLUTION			
BT	**Breakthrough Time to Surface Water = P / Pt**	92.0	years

BY: B. Bennett
DATE: February 13, 2024

NOTES: ** Depth to limiting layer is typically based on depth to a limiting layer (such as clay, bedrock or water) in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*
*** Material type is usually based on test pit. A soil that can be described as loam (e.g. gravelly loam, sandy loam, etc.) or finer according to the USDA soil texture classification system is considered a "fine" soil.*

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MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME: LCWSD RIB
COUNTY: Flathead
LOT #:
NOTES: RI Basin Area One - Phosphorous Breakthrough to Wiley Slough

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	225.0	ft
L	Length of Primary Drainfield's Long Axis	300.0	ft
W	Width of Primary Drainfield's Short Axis	225.0	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4.0	ft
D	Distance from Drainfield to Surface Water	1335.0	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils, 1.0 ft for fine soils)**	1.0	ft
~~Nc~~			
Sw	Soil Weight (usually constant)	100.0	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200.0	ppm
#I	Volume of Contributing Discharge	40,000.0	gpd
	Phosphorous Concentration in Discharge	2.00	mg/L
CONSTANTS			
Pl	Phosphorous Load (1/2-RI Basin Area 2)	244.00	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
Pt	Total Phosphorous Load = (Pl)(#I)	244.00	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	27000000.0	lbs
Da	Dispersion Angle	12.5	degrees
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.21875)(D)(D)] (T)(Sw)	69023671.9	lbs
P	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	19204.7	lbs
SOLUTION			
BT	**Breakthrough Time to Surface Water = P / Pt**	78.7	years

BY: B. Bennett
DATE: February 13, 2024

NOTES: ** Depth to limiting layer is typically based on depth to a limiting layer (such as clay, bedrock or water) in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*
*** Material type is usually based on test pit. A soil that can be described as loam (e.g. gravelly loam, sandy loam, etc.) or finer according to the USDA soil texture classification system is considered a "fine" soil.*

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MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME: LCWSD RIB
COUNTY: Flathead
LOT #:
NOTES: RI Basin Area Three - Phosphorous Breakthrough to Pond 7

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	700.0	ft
L	Length of Primary Drainfield's Long Axis	700.0	ft
W	Width of Primary Drainfield's Short Axis	145.0	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4.0	ft
D	Distance from Drainfield to Surface Water	2540.0	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils, 1.0 ft for fine soils)**	1.0	ft
~~Nc~~			
Sw	Soil Weight (usually constant)	100.0	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200.0	ppm
#I	Volume of Contributing Discharge	30,000.0	gpd
	Phosphorous Concentration in Discharge	2.00	mg/L
CONSTANTS			
Pl	Phosphorous Load (1/2-RI Basin Area 2)	183.00	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
Pt	Total Phosphorous Load = (Pl)(#I)	183.00	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	40600000.0	lbs
Da	Dispersion Angle	5.0	degrees
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	234251500.0	lbs
P	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	54970.3	lbs
SOLUTION			
BT	**Breakthrough Time to Surface Water = P / Pt**	300.4	years

BY: B. Bennett
DATE: February 13, 2024

NOTES: ** Depth to limiting layer is typically based on depth to a limiting layer (such as clay, bedrock or water) in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*
*** Material type is usually based on test pit. A soil that can be described as loam (e.g. gravelly loam, sandy loam, etc.) or finer according to the USDA soil texture classification system is considered a "fine" soil.*

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