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)

Applicant:	South Wind Water & Sewer District Serving: Trailer Terrace Subdivision/Mobile Home Park
Permit Number:	MTX000238
Facility Name:	South Wind Wastewater Treatment Plant
Facility Location:	West ½ of SE ¼ of Section 36, Township 20 North, Range 03 West; Lat. 47.44544° / Long. -111.28888°; Cascade County, Montana
Facility Address:	South Wind Water and Sewer District #65 in Trailer Terrace 5405 Lower River Road Great Falls, Montana 59405
Facility Contact:	Ron Lorenz, District Board President South Wind Water and Sewer District #65 5405 Lower River Road Great Falls, Montana 59405
Receiving Water:	Class III Ground Water
Number of Outfalls:	1
Outfall/Type:	001 – Pressure Dosed Drainfield – Domestic In Nature

This Fact Sheet was completed by Jeffrey Frank Herrick, March 2017.

I. PERMIT STATUS

The following Fact Sheet outlines the basis for issuing a new MGWPCS wastewater discharge permit to South Wind Water and Sewer District for the wastewater treatment and disposal facilities located within the Trailer Terrace subdivision. The subdivision is located around 2 miles south of Great Falls, Montana and east of the Missouri River. 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 proposed wastewater treatment and disposal system described herein.

The South Wind Water & Sewer District represents the Trailer Terrace subdivision. This subdivision is a mobile home park that was originally established to support Malmstrom Air Force Base construction prior to the 1960s. The current South Wind Water & Sewer District was organized to move the subdivision toward an updated and permitted septic disposal system. Refer to Figures 1, 2, and 3 of this Fact Sheet for the location and layout of the Trailer Terrace subdivision. Although the subdivision pre-dates 1962, no records exist depicting the waste handling and disposal before that date. Some 1962 plans do exist for the north phase (Phase 2) of the septic collection system. No plans or other records have been found for the somewhat older southern phase (Phase 1) of the trailer park. Sewage is currently delivered to a lagoon system that consists of 3 cells arranged in series. The old sewage mains and service lines are known to have chronically leaked. These older sewers will be replaced at a later date that is subsequent to completion of the proposed wastewater treatment and disposal system. The lagoon system has no formal outlet and is designed and built to discharge to ground water. There is no record of a county or state permit for the discharge, but both organizations have been attempting to facilitate replacing this lagoon system with a working and modern wastewater treatment and disposal system.

The trailer park's currently operating drinking water system was also originally built prior to or during the early 1960s. This subdivision is provided drinking water by the Trailer Terrace Public Water Supply (PWS) # MT0000025. This PWS has undergone major recent improvements with the installation of newer and deeper supply wells and the installation of new water distribution lines. The wastewater treatment plant and disposal structures will all be new construction and will replace the antiquated 3-cell lagoon system.

A. Application Information

- Payment was made of application fees to DEQ from South Wind Water and Sewer District for the MGWPCS discharge permit. The check was dated 16 August 2016.
- A MGWPCS discharge permit application Forms 1 and GW-1 were received on 09 September 2016. The application proposed the creation of a new wastewater collection, treatment, and disposal system.
- On 22 September 2016 it was determined that the payment of fees was unable to be processed, so a new payment was made on 29 September 2016 which was processed by the State.
- On 06 October 2016 DEQ sent a letter to the District indicating that the application was deficient and outlined the needed information to make it complete.
- On 11 October 2016 DEQ sent a letter indicating that the application fees were received.

- On 24 October DEQ received an updated MGWPCS application that addressed the deficiencies of the first submittal. The same day DEQ sent a letter to the W&S District indicating that the application was complete and DEQ began work toward the development of the discharge permit.
- As of 23 March 2017 no plans or specifications of the proposed wastewater treatment system have been submitted to DEQ.

B. Permit Changes

This is a new MGWPCS permit for a wastewater treatment and disposal system that has not been built or brought on line.

II. FACILITY INFORMATION

A. Facility Location

Trailer Terrace is a mobile home park located approximately 2 miles south of the City of Great Falls, Montana. It is situated along the east side of Lower River Road and straddles 55th Avenue South as it intersects Lower River Road. The address of the northern-subdivision and the proposed wastewater treatment system (WWTS) is at 5405 Lower River Road, Great Falls, Montana 59405. Refer to Figures 1, 2, and 3 at the end of this document for the location of Trailer Terrace, as well as the existing and proposed South Wind wastewater treatment facilities.

B. Facility and Operations

1. Current Facilities

There are no As-Built diagrams available for the current/existing septic collection and treatment system serving the Trailer Terrace subdivision. Sewer *plans* which date to 1962 do exist for the northern, Phase 2, of Trailer Terrace. The plans depict 8-inch concrete sewer lines. Those plans also suggest that the 3-cell lagoon was already present and in-use prior to 1962. No plans exist for the southern, Phase 2, of the subdivision. Orangeburg service pipe, a wound paper pipe used during World War II and for a time after the war, is noted for some of the laterals.

The existing septic disposal system is served with a small sewage lift station adjacent to the fenced lagoon compound. It pumps raw sewage to the primary sewage lagoon cell. That cell outfalls to the other 2 smaller cells in series. There is no surface outlet or discharge from the lagoons. The larger main lagoon appears to have a 541,000 gallon capacity. Both the sewage collection system and the lagoons leak and are known to discharge to ground water. The volume of effluent currently entering the lagoons is not known. Estimates listed below are based on population and were supplied in the 2016 Application or personal communications.

240	Current population of the trailer park.
66 gal/day	Current flow per capita.
~16,000 gal/day	Current average daily flow.
15,000; 19,000; & 24,000 gal/day	Proposed design daily flow.

2. Planned Facilities

The sewer mains and collection laterals are in need of replacement throughout the Trailer Terrace subdivision, as they are known to discharge to ground water. This need is

recognized by the South Wind Water & Sewer District, but will be handled after the construction of the proposed wastewater treatment and disposal facilities.

The proposed wastewater treatment system is a sequencing batch reactor (SBR) plant that is planned to be located as depicted on Figure 3. Note that these are generalized plans for a suitable SBR plant. The unit processes of the SBR and conventional activated sludge systems are the same. SBR plants differ from activated sludge plants as they combine all of the treatment steps and processes into a single tank. Conventional treatment facilities rely on multiple basins. SBR performs equalization, biological treatment, and secondary clarification in a single tank using a timed control sequence. It is intended to control each batch with distinct cycles. These cycles or steps in the process are:

- anoxic fill,
- aerated fill,
- denitrification,
- reaction,
- quiescent settling,
- decant, and
- idle/sludge waste.

The SBR process is intended to control BOD levels and activated sludge age, and to create conditions for tertiary treatment for BOD and total nitrogen removal. A line diagram for the SBR plant is found at the end of this document as Figures 4 and 5. Plans and specifications for the wastewater treatment plant have not been submitted to DEQ for review and approval.

Table 1.

Collection, Treatment, and Disposal System Summary **South Wind W&S District WWTS**
Outfall 001 - Domestic Wastewater/Sewerage **Method of Disposal**: Infiltration to ground water via pressure dosed drainfield. **Disposal Structure**: Subsurface Drainfields (Outfall 001) West 1/2 SE 1/4 of Section 36, Township 20 North, Range 03 East Riverview Addition, Block 002, Lot 004. #65, 5405 Lower River Road, Great Falls, 59405 – this is the Trailer Terrace mobile home park Latitude: 47.44544º; Longitude: -111.28888º Contributing Sources: Private residences in the Trailer Terrace mobile home park Average Daily Design Flow (gpd): 19,000 Daily Maximum Design Flow (gpd): 19,000 (ft^3/day): 2,540 (ft^3/day): 2,540
Current System: Sewer lines carry sewerage to a lift station that in turn sends the influent to three (3) sewage lagoons (arranged in series), with mechanical mixing in the larger lagoon. Sewer lines and the lagoons are extremely old and both are known to discharge to ground water.
Proposed System to be covered by this permit: Sewer lines from both phases of the subdivision will feed sewerage to a lift station, which in turn sends the influent to the waste water treatment plant (WWTP). This proposed plant will utilize a Sequencing Batch Reactor treatment process, followed by UV treatment, and discharge to the subsurface via a pressure dosed drainfield. **Influent Sampling** Location: **INF-001**: Influent sampling is conducted within the surge basin/tank. This tank is after the lift station and before the bar screen enclosure. See Figures 4 and 5. **Effluent Sampling** Location: **EFF-001**: The effluent sampling is located on the line exiting the SBR plant building and post UV treatment. It is just prior to the dose tank / pressure pump station that sends the effluent to the drainfield (which is **Outfall 001**). See Figures 4 and 5. **Disinfection** will be provided by UV treatment prior to effluent being moved out of the SBR building. **Flow Monitoring Equipment**: The make and model of flow meter has not been provided to DEQ. **Flow Monitoring Location**: **FM-001**: Located in the SBR building on the line after UV disinfection and prior to the effluent line exiting the building. See Figures 4 and 5. **Treatment: Level 2 via an SBR** treatment process; **UV disinfection**; followed by discharge to a **pressure dosed drainfield** (Outfall 001). See Figure 3.
Footnotes: Refer to Figures 4 and 5 in the Fact Sheet for the line drawings of the SBR WWTP. These diagrams are not construction plans or specifications for the plant. Plans or Specifications for the SBR WWTP have not been submitted to DEQ, so the above sampling locations are inferred.

C. Effluent Discharge Structures

No discharge structures have been built to date. Effluent out of the WWTP will be sent to Outfall-001 and discharged to ground water through a pressure dosed drainfield. This drainfield will be located within the parcel located northeast of the current lagoons (see Figure 3). Plans and specifications for the discharge structure (the pumps, lines, and laterals of the drainfield) have not been submitted to DEQ for review and approval.

D. Influent & Effluent Monitoring Locations

Plans and specifications for the wastewater treatment plant have not been submitted to DEQ for review and approval. As such, sampling locations for Influent (INF-001) or Effluent (EFF-01) have only been tentatively identified. The tentative location for influent sampling (INF-001) will be from the surge basin/tank. This tank is located after the lift station and before the bar screen enclosure. The tentative location for effluent sampling (EFF-001) is from the effluent line after UV disinfection and before the line exits the SBR building. Please refer to Figures 4 and 5 for the

diagrams of the SBR plant and building as provided in the permit application. Sampling requirements are further discussed in Sections V and VI.

E. Effluent Characteristics

Pursuant to ARM 17.30.1023, DEQ requires the applicant to disclose the quality of the effluent to be discharged such that the potential pollutants can be identified and the proposed discharge can be examined to determine if it will cause pollution of state water, 75-5-605, Montana Code Annotated (MCA). The applicant provided some limited influent and effluent quality data for samples collected in 2006. The samples were collected before the influent was discharged into the lagoons and from a location at the end of the lagoon series. This data is summarized within Appendix I, Table 4. The effluent that currently discharges to the lagoons will, in the future, be treated in the proposed wastewater treatment facility and discharged to the subsurface. That effluent is domestic in nature. If the planned SBR wastewater treatment plant is built and brought on-line, it is anticipated that the resultant effluent discharge will contain on average between 5-10 mg/L Total Nitrogen. These concentrations are based on other similar SBR systems operating in the state.

F. Geology

The thickness of the overburden overlying the bedrock varies considerably across the area, ranging from 5-30 feet thick. Shallow fractured bedrock underlies the overburden beneath the Trailer Terrace subdivision and the surrounding area. The uppermost bedrock is described as Kootenai Sandstone, which overlies the upper portions of the Madison formation. The shallow bedrock is locally blanketed by stream alluvial sand and silty sand in broad areas that flank the Missouri River and Sand Coulee Creek valleys. Further away from the lowlands around each of those streams are eroded and dissected terraces where the bedrock is commonly topped with silty clay or clayey silt. These scattered deposits are probably derived from glacial lakebed deposits dating to when lakes covered this area during major glacial advances. The Trailer Terrace subdivision appears to sit on an area where fine grained lakebed sediments predominate. The subdivision sits on the north facing slope of a terrace, with Sand Coulee Creek located directly north and east of the subdivision. Sand Coulee occupies a broad stream valley with the active channel ~1,700 feet directly north of the subdivision and ~1,800 feet north northwest (down gradient) from the drainfield lot. Refer to Figures 1 and 8. The broad flat stream valley north of the subdivision boundary is filled with sand-rich fluvial deposits. It should be noted that there are sand and gravel pits located both south and north of the trailer park, but soil borings and test pits within the subdivision reported abundant fine materials (silt and clay) in the overburden. The borings and pits were dug as part of geotechnical exploration in support of the installation of new water supply lines and other proposed facilities in the subdivision. Relevant soil borings are included with this Fact Sheet as an Attachment.

Lithologic logs were collected from Montana Bureau of Mines and Geology (MBMG) GWIC well logs for area wells. These and other available well logs are also found in the Attachment at the end of the Fact Sheet. Their approximate mapped locations are depicted on Figure 6. The USDA Natural Resources Conservation Service has conducted fairly detailed surveys of soils in this area and provided maps and descriptions online (they can be found at: http://websoilsurveky.nrcs.usda.gov/app/#). The NRCS survey identifies the soils beneath and directly to the north of the subdivision as 233-Yetull loamy sand. These loamy sands were attributed to alluvial deposition, are somewhat excessively drained, and were mapped to 60 inches (5 feet) deep (this NRCS summary is found in the Attachment to the Fact Sheet). The MBMG mapped the entire area beneath the subdivision and the lot to the north of the

subdivision as Aeolian (wind-blown) sand and silt deposits. Although opinions on the depositional environments are different, the class of sediments for the area is consistent. The author of this Fact Sheet suggests that the sandy sediments north of the subdivision could be either fluvial or windblown sands, whereas the fine-grained sediments beneath the subdivision could easily be glacial windblown silt or lakebed sediments. The sandy soils / sediments in the northern area are confirmed by the presence of at least a couple of sand and gravel pits located in the lot directly north of the subdivision. The sandy nature of the soils north of the subdivision is relevant because this is the area that is intended for a dilution area or mixing zone for the proposed wastewater treatment plant's subsurface outfall/drainfield.

G. Hydrogeologic Characteristics

Ground water beneath this site is present within all of the geologic units described above. Depth to the shallow water table aquifer is generally around 9-11 feet below ground surface (bgs). The shallow alluvial and bedrock aquifer, as well as the deeper water bearing portions of the bedrock aquifer appear to be hydraulically connected. But these units may exhibit differences in general water quality. Older wells in the area tapped the shallow water table aquifer, but over time have given way to significantly deeper wells (greater than 100-150 feet bgs) that tap productive areas within the Kootenai Sandstone. This is because the shallow portion of the aquifer has elevated dissolved minerals and is of only marginal quality. The average specific conductivity of recent water samples from the shallow aquifer averaged ~3,450 µS/cm. As such the shallow unconfined aquifer beneath this site is considered to be Class III ground water.

Although the local shallow sediments appear to be quite variable, the overriding trend is that the near-surface sediments beneath the subdivision appear to be finer grained (clay with admixtures of silt or sand, with occasional sandy strata seen a various depths). To the north, northwest, and northeast of the subdivision and proposed drainfield parcel the soils and other sediments appear to be sand with admixtures of loam. The depth of bedrock beneath the area is quite variable, but seems to range from 5-30 feet bgs.

Ground water has been determined to flow north 20° west with a gradient of 0.021 feet/feet (refer to Figures 2 and 3). The applicant determined this flow direction using the elevation of ground water in 3 monitoring wells in the northern portion of the area. Monitoring well MW-10 (located to the far northwest) and MW-15 (in the area of the proposed drainfield) were 2 of the wells used. MW-15 was also slug tested to help determine the hydraulic conductivity of the shallow aquifer. Unfortunately the well was drilled and constructed in a localized area of fine grained sediments and produced very little water. A survey was conducted of private and public wells that surround the northern portion of the subdivision to come up with a more representative estimate of the sediment present across the area of the mixing zone. These well logs are found in the Attachment at the end of this Fact Sheet. An abbreviated summary of these logs is found in Appendix II, Table 6. The NRCS reported soil survey descriptions; the MBMG mapped Aeolian sands deposits; the sand and gravel pits in the area; and information derived from the area well logs were taken together. Based on these varied sources, an average sediment type is clearly within the range of silty fine sand to moderately-sorted fine-medium sand. Using these texture and sediment types a generalized hydraulic conductivity was developed (Groundwater, Freeze & Cherry, 1979, Table 2.2, page 29). The hydraulic conductivity for the shallow aquifer directly north of the subdivision is estimated to be 20 feet/day.

A summary of the ground water characteristics is provided within Appendix IV, Table 8 which supports the discussion of the mixing zone.

H. Ground Water Monitoring Wells

There were 2 monitoring wells included in the application, both of which were installed into the shallow-most portion of the water table aquifer. MW-10 was installed into borehole BH-10 and is located to the west northwest near Lower River Road. This well is intended to provide ongoing monitoring data for ambient shallow ground water downgradient from the wastewater discharge. MW-15 was drilled and installed into the northwest portion of the parcel dedicated to the proposed drainfield. This well was intended to help the applicant better understand the shallow ground water in the vicinity of the future outfall. This well will be destroyed when the drainfield is installed. Information regarding these monitoring wells have been summarized and listed in Appendix II. Refer to Figure 6 for the location of the above mentioned monitoring wells, as well as other wells used to derive geologic and hydrogeologic information.

I. Ground Water Quality Characteristics

Downgradient well MW-10 was sampled in June 2016 and up-gradient MW-15 was sampled in November 2016. Ground water quality results are summarized in Appendix III. The data suggest that background total nitrate levels are low, at 2.9 and <0.5 mg/L for the respective wells. The TDS values were 1,660 and 3,830 mg/L respectively. Of greater significance was that the specific conductance for the samples with the concentrations being 2,320 and 4,580 µS/cm respectively. The average specific conductance was 3,450 µS/cm. The ARM 17.30.1006 defines Class III ground waters as those ground waters with a natural specific conductance that is greater than 2,500 and less than or equal to 15,000 µS/cm at 25°C. A class III ground water must be maintained so that these waters are at least marginally suitable for the beneficial uses. These uses are detailed in Appendix V.A.

DEQ does not allow the increase of a parameter in effluent discharged to the subsurface to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses listed for Class III ground water. Since DEQ has determined that the receiving ground water is Class III, it is therefore not a high quality water of the state (refer also to Section IX). The applicable water quality standards for Class III ground waters are summarized in Appendix V, Table 9. Note that the non-degradation provisions of 75-5-303 MCA do not apply to Class III ground water.

III. MIXING ZONE

The Montana Water Quality Act (75-5-103, Montana Code Annotated (MCA)) states that a mixing zone is an area of the receiving water, established in a permit, where the water quality standards may be exceeded. The applicant requested the use of a standard mixing zone for this permit cycle. The proposed mixing zone is depicted on Figure 7 and the dimensions of the mixing zone are found in Appendix IV, Table 8. It is a standard mixing zone that is approximately 420 feet wide at the outfall. This width is an estimation that is based on the available width of drainfield laterals within the drainfield lot as measured perpendicular to the ground water flow direction. This width is not based on any specific plans for the drainfield as none have been submitted to DEQ for the drainfield. This mixing zone is oriented with the direction of ground water flow, which is N20°W. This mixing zone extends 500 feet downgradient from the outfall. DEQ will be authorizing a mixing zone within this permit. The mixing zone rationale is further discussed in Appendix IV.

Note that Sand Coulee Creek is approximately 1,800 feet down gradient from the proposed Outfall. Ground water from beneath the subdivision and the Outfall is estimated to flow north northwest toward Sand Coulee Creek and should bend westward to flow mostly subparallel to the stream channel. Sand Coulee Creek drains into the Missouri River just west of Lower River Road. It is estimated that ground water adjacent to the stream discharges either directly into the river or into Sand Coulee just before it enters the river (or both). Note that DEQ conducted water sampling in Sand Coulee Creek in 2009 and noted that there was no flow in the creek near Lower River Road in both June and August 2009. As such, this stream is considered an intermittent stream with only seasonal flow. Of interest is that its confluence with the Missouri River is essentially flooded from the river/stream confluence back to at least where the stream crosses beneath Lower River Road (Refer to Figures 1 and 8). Within this lower reach of the creek, the surface water elevation is strictly governed by the water elevation in the river.

IV. RATIONALE FOR PROPOSED DISCHARGE LIMITATIONS AND CONDITIONS

DEQ has a statutory duty to develop effluent limits and issue permits consistent with the Montana Water Quality Act, §75-5-101, MCA et seq. and rules adopted under that Act. Section IV presents the basis for discharge limitations in accordance with the requirements of ARM 17.30.1006, ARM 17.30.1031, and ARM 17.30.715. The basis for deriving and establishing effluent limitations are further discussed in Appendix V. Based on the information and analyses presented in Sections III and IV, pursuant to ARM 17.30.1031, DEQ proposes the following numerical effluent limitations:

Table 2

Proposed Final Effluent Limit – Outfall 001
South Wind W&S District WWTS

Parameter	Units	Effluent Limitation	Rationale
		Daily Maximum[1,2]	
Nitrogen, Total (as N)	lbs/day	3.0	Human Health Standard

Footnotes:

Beneficial Uses: ARM 17.30.1006(1)(b)(ii)

(1) See definition in Part V of permit.

2) WQBEL. Lbs/day Load Calculation: lbs/day = [(mg/L) x flow(g/d) x (8.34 x 10-6)]

The nondegradation provisions of 75-5-303 MCA do not apply to Class III ground water [ARM 17.30.1006(3)(c)]. The receiving water beneath this facility is Class III ground water.

The above WQBEL was developed based upon drainfield dilution, ambient ground water quality, and the fact that the receiving water is Class III ground water. Refer to the Mixing Zone tables and Effluent Limits explanations found in this document.

V. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

DEQ has a statutory duty to develop effluent limits and issue permits consistent with the Montana Water Quality Act, §75-5-101, MCA et seq. and rules adopted under that Act. ARM 17.30.1031 requires that all issued MGWPCS permits contain monitoring requirements that assure compliance with the developed numeric effluent limitations and therefore water quality standards. Influent and effluent monitoring, as well as ground water monitoring will be required as a condition of this permit. Monitoring requirements and respective rationale is summarized in Appendix VII.

VI. SPECIAL CONDITIONS

In accordance with ARM 17.30.1031 this section contains the basis for special permit conditions that are necessary to assure compliance with the ground water quality standards and the Montana Water Quality Act. The following special condition(s) will be included in the permit.

A. Effluent Limits

Based on the information and analyses presented in Sections III and IV (above), pursuant to ARM 17.30.1031, DEQ has establish numerical effluent limitations for Total Nitrogen in effluent that will be discharged to Outfall 001. Refer to Table 2.

B. Monitoring Well Plans

DEQ is requiring submittal of plans for the drilling and installation of a at least one additional monitoring well. This well is intended to better assess shallow ground water quality downgradient from the mixing zone. The well should be drilled downgradient from the end of the 500 foot long mixing zone and to a depth that allows the well to intersect the upper water table aquifer. DEQ recognizes that the proposed well location will be on property not owned or leased by South Wind Water & Sewer District. The successful installation of this well or other wells in the area will be contingent on the ability to acquire an easement from the property owner for use and access to the well location(s).

C. Monitoring Well Installation

As stated above, DEQ is requiring the drilling and installation of an additional monitoring well. The well should be located directly downgradient from the end of the 500 foot long mixing zone and to a depth that it intersects the upper water table aquifer. It is hoped that this well will be a better representation of downgradient conditions than the existing MW-10. MW-10 is located downgradient, but further away and somewhat lateral to the projected ground water flow direction relative to Outfall 001. It is hoped any new well or wells will provide a better representation of downgradient conditions than the existing MW-10

D. Letter Request to Retire MW-10

If the new well or wells located downgradient from the mixing zone are drilled and installed, and if they successfully represent downgradient conditions in that area, then MW-10 may be deemed unnecessary. If the operator desires to discontinue use of MW-10, they should submit a request to DEQ to allow them to cease using it. Actual abandonment/removal of MW-10 is up to the discretion of the land owner or the Water & Sewer District.

E. Wastewater Treatment Planning & Construction Progress Reporting:

Provide DEQ with a quarterly letter report on the steps taken (the progress made) toward the installation of the monitoring well(s), as well as construction of the wastewater treatment plant and drainfield facilities. The intent of this quarterly reporting is to keep DEQ permitting and engineering staff, and other stakeholders, up to date on progress made and challenges still facing the construction program.

F. Wastewater Treatment Plant and Drainfield As-Built Diagrams:

Provide DEQ with the post-construction as-built schematics for the treatment facilities. These records will allow DEQ to better understand the actual plant layout, the treatment process that is being used on the septic influent, features of the treatment plant, holding tanks and lines,

influent and effluent sample locations, how wastewater is handled and transported through the process, and the layout of the drainfield (or other subsurface discharge structure).

G. Monitoring Well Sampling:

Initiate sampling of the active monitoring wells (inclusive of MW-10 and any new well(s)). These wells should be sampled quarterly. These data will provide for an understanding of the ground water within the downgradient shallow aquifer. Data over time will allow an understanding of any changes that may occur seasonally, year to year, and over time. These data will also provide a reliable measure of any potential impacts to downgradient ground water points of discharge or withdrawal. The laboratory analytic results will be provided to DEQ via NetDMR. Reporting of analytic results will be of daily maximum concentrations and quarterly averages of the concentrations. Sampling and reporting regulations are listed in Appendix VII.

H. Influent and Effluent Sampling & Flow Monitoring:

The influent to the wastewater treatment plant and the effluent discharged from the plant should be sampled as often as needed to characterize the effluent and fine tune the sequencing batch reactor processes for the best results. The laboratory analytic results will be provided to DEQ via NetDMR. Reporting of analytic results will be of daily maximum concentrations and quarterly averages of the concentrations. Flow monitoring will be conducted on effluent that is discharged to the Outfall. Flow data will also be provided to DEQ using NetDMR, reporting daily maximum concentrations and quarterly averages of the discharge flow. Sampling and reporting regulations are listed in Appendix VII.

VII. COMPLIANCE SCHEDULE

A compliance schedule is included to allow a reasonable opportunity for the permittee to attain or maintain compliance with permit requirements. The actions listed in the table below 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. Completion of all actions or deliverables must be reported to DEQ in accordance with Part II.D and Part IV.G of the permit.

Table 3

Compliance Schedule
South Wind Water & Sewer District, Authority for the following is ARM 17.30.1031

Action	Frequency	Scheduled Completion Date of Action(1)	Scheduled Report Due Date.(2)
Effluent Limits: Effluent Limit for Outfall 001 goes into effect with the initial date of this permit	Per the Influent & Effluent Monitoring Requirements, Appendix VII	Effluent Limits in effect until expiration of the permit.	Data reporting is through the DMRs.
Monitoring Well Plans: Submit plans for the location and installation of an additional or replacement monitoring well. If the new well better represents local sediments and shallow ground water, MW-10 can be retired.	Single event	6-months after the effective date of the permit and prior to the WWTS going on-line.	6-months after the effective date of the permit.
Monitoring Well Installation: Drill and install the new monitoring well located N20°W and >500 feet downgradient from Outfall 001.(3)	Single event	Installation of the well completed within 1-year after the effective date of the permit. And prior to the WWTS going on-line.	Letter report detailing the well drilling and installation is due before the end of the 1st quarter of the 2nd year after the effective date of the permit.
Letter Request to Retire MW-10: This request is contingent upon the suitability of the replacement monitoring well to replace MW-10.	Single event	Subsequent to initial water sampling event(s) that demonstrate the usefulness of the new well.	-
WWTS Planning & Construction Progress Reporting: Provide letter report describing the progress made toward final treatment technology design to be constructed. This is a progress report on the steps taken toward that goal.	Quarterly until completion of treatment plant construction	Within one month after plans and specifications for the treatment plant and drainfield are approved by DEQ.	End of each quarter. Report to be submitted before the end of April, July, October, and January for each preceding quarter.
WWTP & Drainfield As-Built Diagrams: Provide report describing the final treatment technology design (the wastewater treatment plant and drainfield) that was approved by DEQ.	Single event	After the WWTS construction is ended.	Within 6-months after the WWTS is completed.
Monitoring Well Sampling: Begin water sampling of all monitoring wells, with ongoing sampling events quarterly thereafter.	Per Ground Water Monitoring Requirements, Appendix VII	First sample event within 1-year of the effective date of the permit and prior to the WWTS going on-line. Subsequent sampling events will be conducted every 3-months thereafter.	Water quality data reporting will be done using DMRs.
Influent and Effluent Sampling & Flow Monitoring: Conduct sampling of Influent entering the WWTS and Effluent exiting the system and discharged to Outfall 001. Also conduct routine flow monitoring.	Per the Effluent Monitoring Requirements, Appendix VII	Ongoing	Influent and Effluent data reporting is through the DMRs.

Footnotes:

1) The actions must be completed on or before the scheduled completion dates.
2) Reports must be received by DEQ on or before the scheduled report due dates. The reports must include all information as required for each applicable action as listed in Section VI.
3) The written report documenting monitoring well installation, must include final location, drilling methods used, borehole lithologic log, well construction details, *elevation of measuring point, and the depth to the top contact of the first ground water bearing zone*. This information must be included for each respective monitoring well.
4) Sampling parameters required for each respective monitoring well and the WWTP samples are as listed within Table 11.
5) Quarterly sampling events required for each monitoring well.

VIII. REASONABLE POTENTIAL ANALYSIS

DEQ has determined that the receiving ground water is Class III and is therefore not a high quality water of the state (Sections II.G.&I. above). Pursuant to ARM 17.30.1006(3), nondegradation provisions do not apply to Class III ground water. DEQ is therefore not required to conduct a significance determination (ARM 17.30.715). The applicable water quality standards for Class III ground water beneath this site are summarized in Table 9 in Appendix V. This permit includes monitoring, reporting, and corrective action requirements to establish, confirm, and maintain compliance with permit limitations. Discharges in compliance with the limitations established in this permit are considered nonsignificant.

DEQ has also determined that the permitted activity is not considered to be a new or increased source resulting in a change of existing water quality occurring on or after April 29, 1993 (ARM 17.30.702). DEQ is therefore not required to perform a significance determination (ARM 17.30.715). The applicable water quality standards for Class III ground water are summarized in Table 9 located in Appendix V. This permit includes monitoring, reporting, and corrective action requirements to establish, confirm, and maintain compliance with the permit limitations.

Because the applicant requested that they be allowed to discharge to ground water (not to surface water), DEQ also performed a reasonable potential analysis to demonstrate whether aquatic life standards may be exceeded at the nearest projected downgradient surface water. The projections used recent site specific information (Appendix VIII). These projections are conservative in nature in that they do not credit potential losses of nitrogen due to chemical transformation or attenuation that may occur within the subsurface (as described above). These projections include all potential cumulative impacts. These cumulative impacts include up-gradient (ambient) sources obtained from on-site water well samples and downgradient with an estimation of downgradient septic systems. DEQ has not identified any additional permitted discharging systems or other ground water sources of nitrates in the vicinity of the facility. The projections indicate that the activity will not result in a reasonable potential to exceed aquatic life standards in downgradient surface water.

The above projections may be reanalyzed at the end of every permit cycle to factor in up-to-date site specific information, including the potential of new sources of nitrates. The projections have been summarized in Appendix VIII.

IX.PUBLIC NOTICE

Legal notice information for water quality discharge permits are listed at the following website: http://deq.mt.gov/Public/notices/wqnotices. Public comments on this proposal are invited any time prior to close of business **on 09 May 2017.** Comments may be directed to:

DEQWPBPublicComments@mt.gov

or at:

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

Any person interested in being placed on the mailing list for information regarding this permit may contact the DEQ Water Protection Bureau at (406) 444-3080 or email DEQWPBPublicComments@mt.gov. All inquiries will need to reference the permit number (**MTX000238**), 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.

FIGURE 1 – Location Map

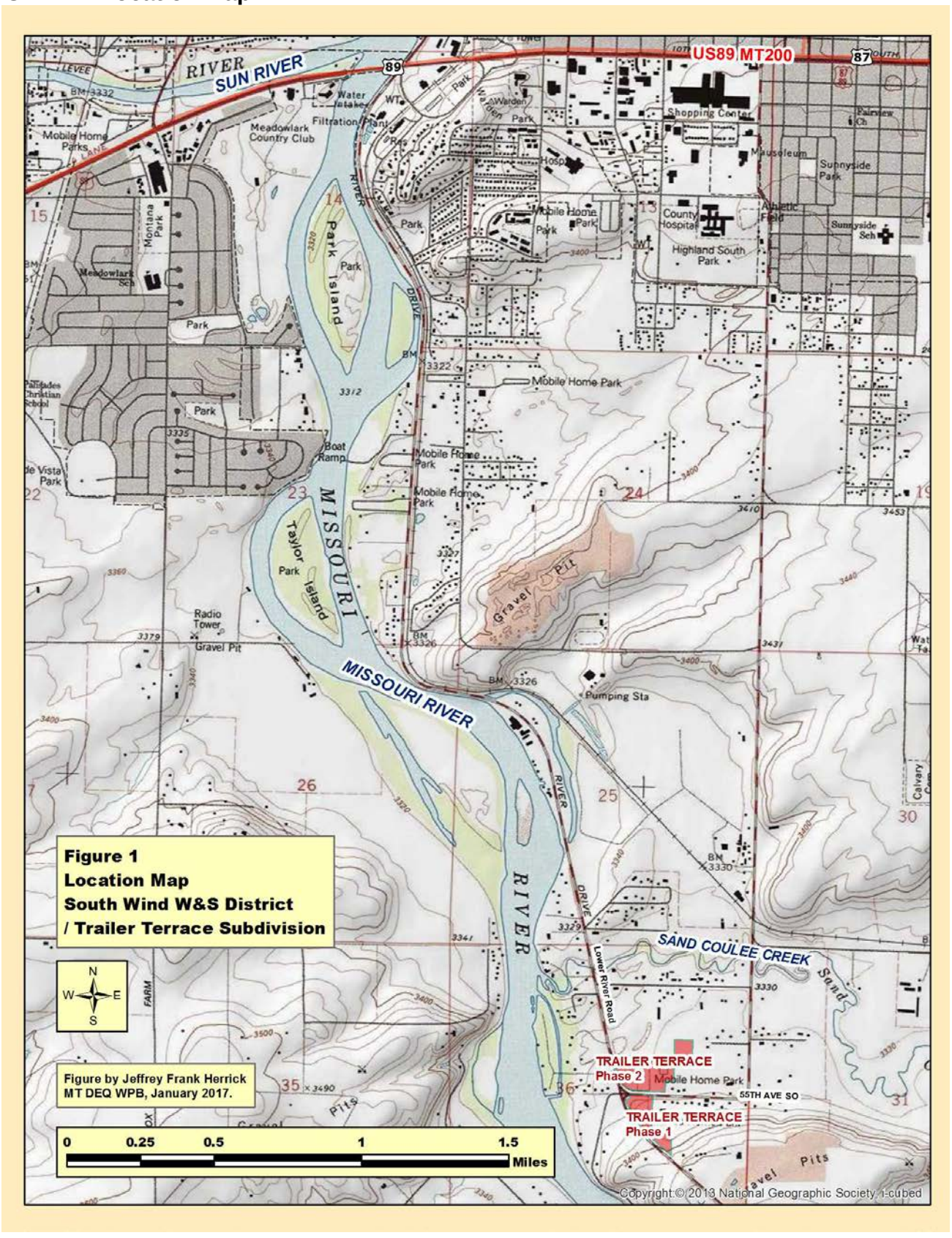

FIGURE 2 – Subdivision Map

FIGURE 3 – Lagoons, Plant, & Drainfield

FIGURE 4 – Wastewater Treatment Plant, Generalized

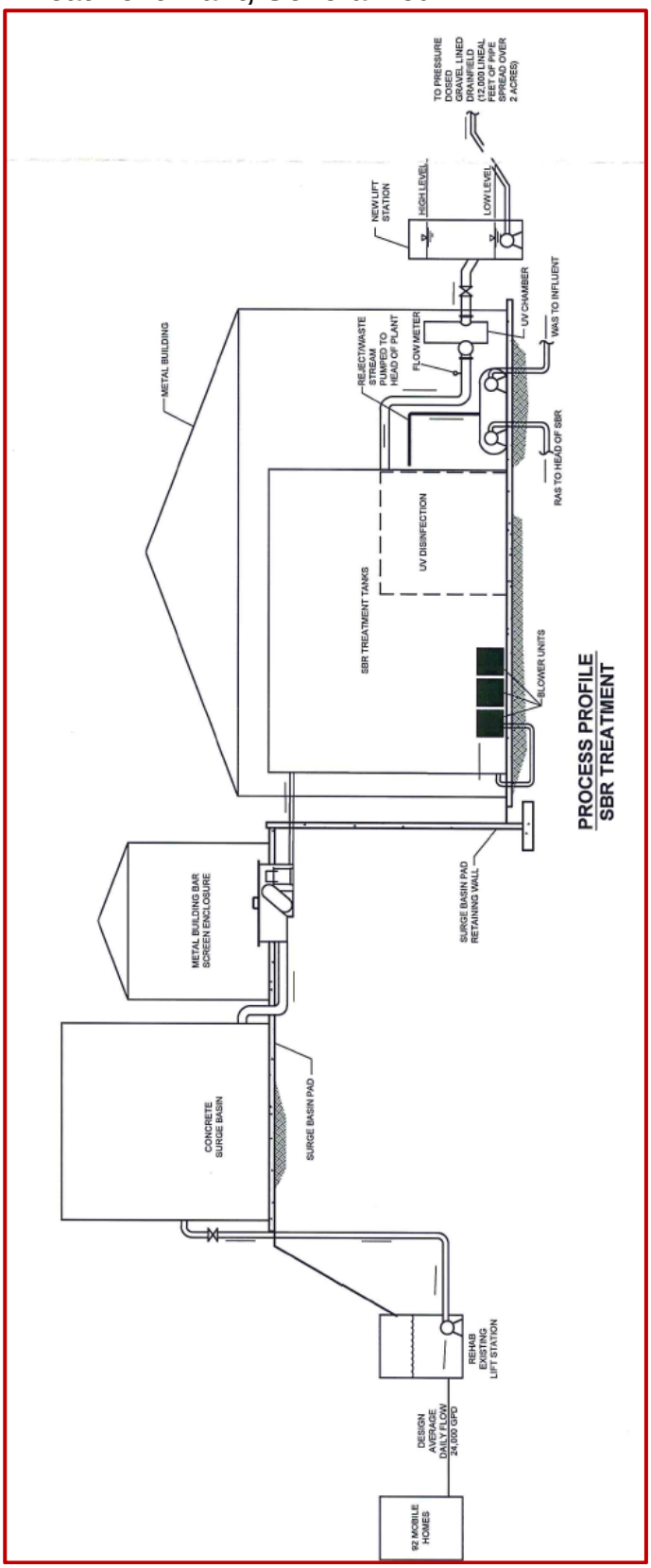

FIGURE 5 – Wastewater Treatment Plant, Tanks

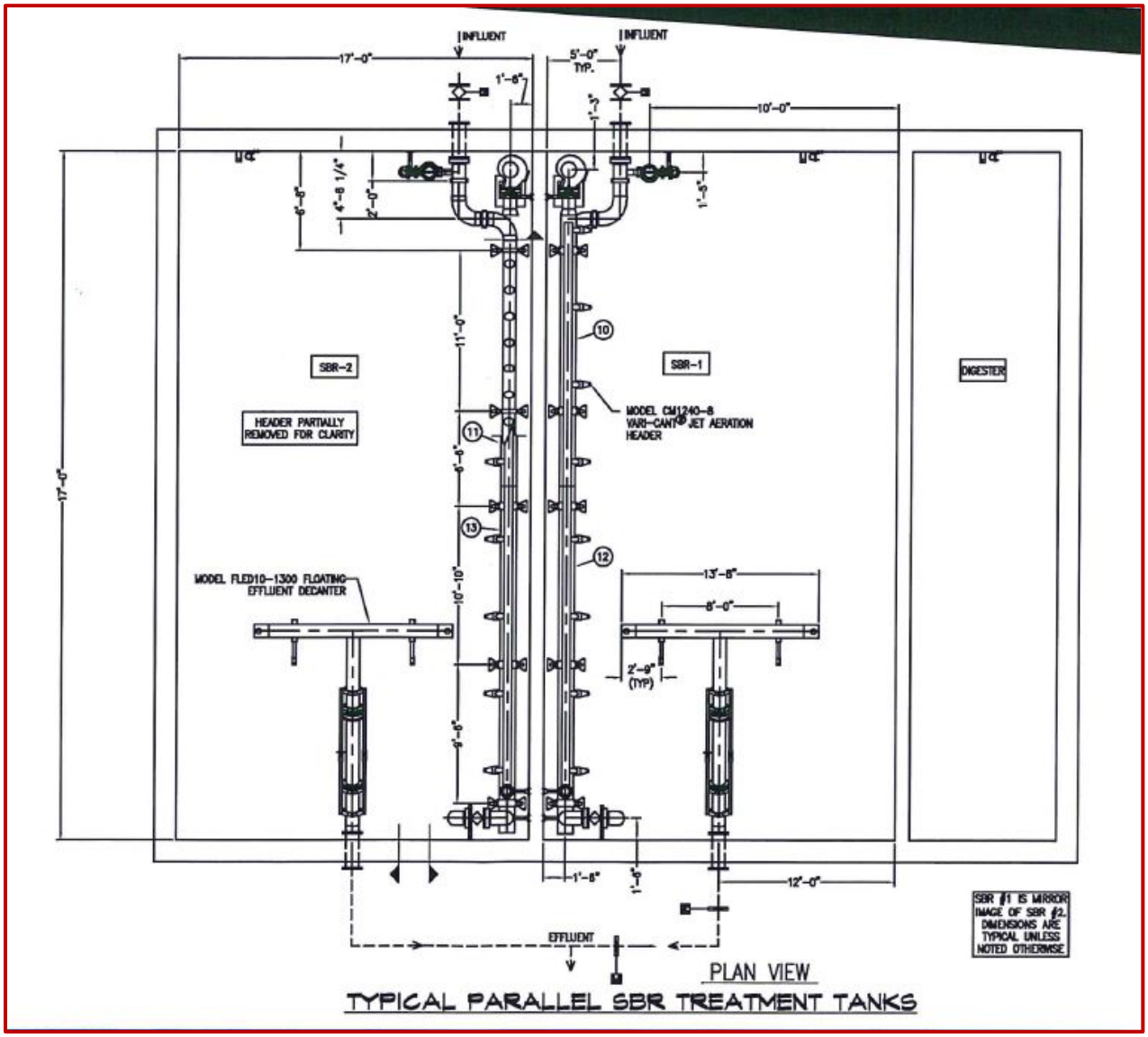

FIGURE 6 – Local Wells

FIGURE 7 – Mixing Zone

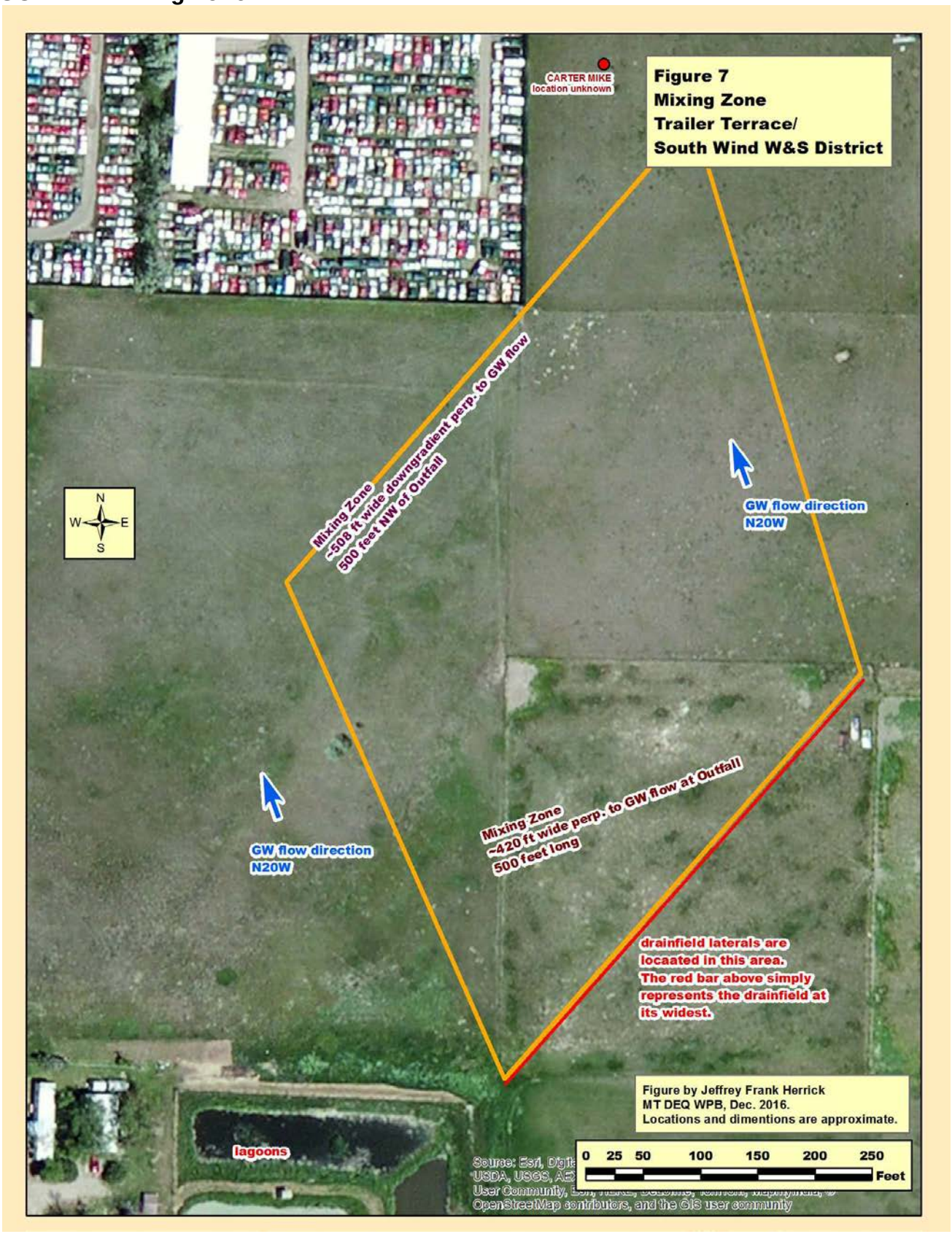

FIGURE 8 – Sand Coulee Creek, Surface Water Sampling Site

APPENDIX I - HISTORIC EFFLUENT QUALITY

Table 4

Historic Influent and Effluent Quality – Existing 3-cell Lagoon System.
South Wind W&S District

Parameter[1]	Location	Units	Reported Value	# of Samples	Source of Data
Biochemical Oxygen Demand (BOD_5)	INF-001	mg/L	210	1	APP
	EFF-001	**mg/L**	**53**	1	APP
Nitrogen, Total (as N)	INF-001	mg/L	50.5	1	APP
	EFF-001	**mg/L**	**35**	1	APP
Phosphorus, Total (as P)	INF-001	mg/L	5.1	1	APP
	EFF-001	**mg/L**	**3.9**	1	APP
Total Suspended Solids (TSS)	INF-001	mg/L	106	1	APP
	EFF-001	**mg/L**	**120**	1	APP
Effluent Flow Estimate, Design Maximum		gal/day	19,000	-	Applicant

Footnotes:

APP = Application Form GW-1 and supplemental materials.

Effluent flow estimated by applicant based on number and type of residences served.

This is historic data. The specific date of this sample unknown, but was represented to be from 2006. The data was provided to DEQ in the permit application.

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

2) (Citation, 2013); Application Form GW-1 Section M.

APPENDIX II – MONITORING WELL SUMMARY

Table 5

Monitoring Well Summary **South Wind W&S District**
Monitoring Well: MW-10 Refer to the well log in the Attachments at the end of the Fact Sheet. Borehole BH-10 and monitoring well MW-10 are the same location. The well was constructed within BH-10. This well is intended to be a ground water sampling point in the shallow aquifer downgradient from the Outfall and mixing zone. Well was drilled and constructed in October 2015. Water Sample collected on 28 July 2016. This well still exists for the purposes of monitoring the shallow ground water. Location: The well is located ~40 feet east of Lower River Road. It is also ~890 feet south of the junction between Franklin Avenue & Lower River Road; and it is ~670 feet north of the junction between Fox Island Lane and Lower River Road. Latitude: 47.44631º Longitude: -111.29455º Representation: Shallow sediment stratigraphy and ambient quality of the shallow unconfined aquifer. This is the receiving ground water, downgradient of Outfall 001.
Monitoring Well: MW-15 Refer to the well log in the Attachments at the end of the Fact Sheet. Well will be abandoned during construction of the septic drainfields. Well was used to determine water quality of the shallow aquifer. It is in the immediate area of the drainfield. Well was drilled and constructed for NCI Engineering by Kristi Hanson Status: Constructed in October 2015. Water Sample collected on 11 November 2016. Location: The well was located in the northwest corner of the parcel dedicated to the proposed drainfields. Latitude: 47.44581º Longitude: -111.28933º Representation: Shallow water table aquifer characterization via water quality analysis. This is the receiving ground water in the vicinity of the Outfall 001.

Table 6

Predominant Shallow Geology
South Wind W&S District.
Taken from Well Logs around the WWTS Outfall, With the estimated K Values.

	From	To	Description	
Site Name: RASMUSSEN LARRY F.				
GWIC Id: 123390	0	20	BROWN SANDY CLAY	Housing area
	20	75	GRAY SILT	**0.3** est. K value
Site Name: DANNELS FRANK V. AND VIOLEET M.	**From**	**To**	**Description**	
GWIC Id: 33386	0	14	LOOSE SAND	east of housing area
	14	20	QUICKSAND	**20** est. K value
	20	97	SILT	
Site Name: HOWARD CAIL	**From**	**To**	**Description**	**Average K Value for shallow sediments in logs for wells surrounding the Mixing Zone.**
GWIC Id: 33382	0	2	TOPSOIL	NE of mixing zone
	2	18	BLOW SAND	**30** est. K value — **20 ft/day**
	18	34	HARD ROCK	
	34	53	SHALE	
Site Name: CARTER MIKE	**From**	**To**	**Description**	vicinity of junk car yard
GWIC Id: 72980	0	70	SAND	**20** est. K value
Site Name: HOUSEMAN KEN	**From**	**To**	**Description**	
GWIC Id: 33379	0	5	TOPSOIL	vicinity of junk car yard
	5	18	SAND ROCK	**10** est. K value
	18	28	LIME ROCK	
	28	32	SHALE ROCK	
	32	37	LIME ROCK	
	37	52	SHALE ROCK	
Site Name: ANNAU THOMAS B.	**From**	**To**	**Description**	W of the development
GWIC Id: 128324	0	3	TOP SAND	**30** est. K value
	3	30	BROWN CLAY	**0.3** est. K value
	30	79	GRAY SILT	
Site Name: TRAILER TERRACE	**From**	**To**	**Description**	S of the development
GWIC Id: 33385	0	22	TOP SOIL AND SANDY CLAY	**1** est. K value
	22	97	GRAY SILT	**0.3** est. K value
Site Name: SMILEY RICHARD	**From**	**To**	**Description**	S of the development
GWIC Id: 33412	0	107	FORMATION CONSISTS OF GRAY SHALE AND LAYERS OF SANDSTONE WATER AT 85 FT	????

MBMG GWIC well logs for the above wells are found attached to this Fact Sheet.
K = hydraulic conductivities with values drawn from text Groundwater by Freeze and Cherry, Range of K Values for Unconsolidated Sediments.

APPENDIX III - GROUND WATER QUALITY MONITORING RESULTS

Table 7

Ground Water Monitoring Results - MW-10 & MW-15
South Wind W&S District

Representation	Parameter	Units	Reported Value MW-10 Sampled 06/20/2016	Reported Value MW-15 Sampled 11/22/2016	Average Value	# of Samples	Source of Data
Ambient Ground Water Quality MW-10 = 800 feet down gradient & MW-15 = in the vicinity of Outfall 001	pH	**s.u.**	**-**	**7.3**	**7.3**	1	Lab
	Chloride (as Cl)	**mg/L**	**178**	**195**	**187**	1	Lab
	Nitrogen, Nitrate + Nitrite (as N)	**mg/L**	**0.12**	**0.04**	**0.08**	1	Lab
	Nitrogen, Total Kjeldahl (as N)	**mg/L**	**2.9**	**<0.5**	**1.5**	1	Lab
	Nitrogen, Total (as N)	**mg/L**	**3.02**	**0.04**	**1.53**	calculated	
	Specific Conductivity (@ 25°C)	**µS/cm**	**2,320**	**4,580**	**3,450**	1	Lab
	Total Dissolved Solids (TDS)	**mg/L**	**1,660**	**3,830**	**2,745**	1	Lab
	Static Water Level (SWL)	**ft-bgs**	**9.6**	**10.0**	**9.8**	1	App

Footnotes:

MW-10 represents ambient ground water downgradient from the mixing zone.
MW-15 represents ambient ground water beneath the Outfall prior to construction of the drainfield.
s.u. = standard units
App = Application Form GW-2 and supplemental materials.
GW Monitoring Date: For MW-10 was 06/20/2016. For MW-15 the sample date was 11/22/2016. Static Water Level measurement for MW-15 was 07/28/2015. Static water levels in the table above do represent the first water seen across this site.
Specific Conductivity average from the above data is = 3,450 µS/cm. As such, this is Class III Ground Water.
bgs = below ground surface
Refer to Section II of the Fact Sheet for the existing or proposed location of the monitoring wells.

APPENDIX IV – MIXING ZONE RATIONALE

The Montana Water Quality Act (75-5-103, Montana Code Annotated (MCA)) states that a mixing zone is an area of the receiving water, established in a permit, where the water quality standards may be exceeded. Mixing zones are subject to the conditions imposed by DEQ and consistent with the rules adopted by the Board of Environmental Review (Board).

The applicant has requested utilizing a standard ground water mixing zone. DEQ determines whether a mixing zone is appropriate pursuant to the requirements and procedures of ARM 17.30.501 et seq. DEQ must conduct a water quality assessment in accordance with ARM 17.30.506 to determine if and what type of mixing zone may be authorized. A person applying to DEQ for a mixing zone must indicate the type of mixing zone requested and supply information of sufficient detail for DEQ to make a determination regarding the authorization of the mixing zone (ARM 17.30.515).

A mixing zone may be denied if it will threaten or impair existing uses (Section III in this Fact Sheet) in accordance with ARM 17.30.505. In making this determination DEQ will consider whether current available data can accurately predict ground water or pollutant movement, or whether there is sufficient unpredictability that might result in adverse impacts due to a particular concentration of a parameter within the mixing zone [ARM 17.30.506 and 517].

For purposes of authorization, DEQ will reference the following rules for water quality assessment of the mixing zone. A mixing zone may be granted for individual parameters in a discharge (ARM 17.30.505). As part of the water quality assessment described above, the concentration of pollutants at the downgradient boundary of the mixing zone must be estimated in accordance with ARM 17.30.517 to determine if the discharge qualifies for a (500 foot) ground water mixing zone. DEQ assessed the South Wind W&S District application information (ARM 17.30.505) and will authorize a mixing zone for the parameters listed within Table 3 as the potential impact to beneficial uses may be minimal (Section II and Section IV).

DEQ will authorize the mixing zone based on the hydrogeologic and mixing zone information as supplied in application and supplemental materials. ARM 17.30.517 states that a specific depth and width are necessary to determine the aquifer cross-section area (A) for a mixing zone. The width of the outfall structures perpendicular to ground water flow direction are reported within Table 8. ARM 17.30.517 states that the depth of a ground water mixing zone extends from the top of the water table beneath the source down to 15 feet below the water table.

The cross sectional area (A) is the area of the ground water flux boundary at the terminus of the mixing zone (ARM 17.30.517). The down gradient boundary mixing zone width is the width of the source (drainfield width perpendicular to ground water flow direction), plus the distance determined by the tangent of 5° (0.0875) times the length of the mixing zone times two (2) (ARM 17.30.517). The calculated widths and respective cross section areas (A) are listed within Table 8.

Based on the dimensions of the standard mixing zones, and the hydrogeologic characteristics (Section II), the volume of ground water (Q_{gw}) available to mix with the effluent (as ft^3/day) is calculated using Darcy's Equation (ARM 17.30.517):

Q_{gw}=KIA

Where:

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

Table 8 lists the volume of ground water available to mix effluent discharged from Outfall 001. Based on the description of the mixing zone above, and analysis presented in Section III, DEQ has determined pursuant to ARM 17.30.505 that a standard mixing zone is still applicable and will be authorized for the individual parameters listed in Table 2 for Outfall 001.
DEQ has made its determination based on site specific conditions listed above and DEQ's assessment of the following:

- General considerations in designation of a mixing zone (ARM 17.30.505);
- Water quality assessment (ARM 17.30.506); and,
- Specific restriction for ground water mixing zones (ARM 17.30.508).

In establishing a mixing zone for the proposed discharge in this permit, DEQ will not allow changes in water quality for any given parameter that may threaten, impair, or interfere with existing beneficial uses of the ground water. Human health based ground water standards will not be exceeded and the mixing zone will not intersect or impact the zone of influence of any existing water supply well. Therefore, pursuant to DEQ procedures (ARM 17.30.515), DEQ will be establishing a mixing zone for this permit cycle.

Table 8

Mixing Zone Information - Outfall 001
South Wind W&S District
Drainfield Lot only, with drainfield measured as 420 ft. wide perpendicular to ground water flow direction
See Figure 7 in the Fact Sheet

Parameter	Units	Value
Mixing Zone Type	-	Standard
Authorized Parameters	-	Total Nitrogen
Ambient Ground Water Concentrations, **Nitrate + Nitrite**	mg/L	2.9
Ambient Ground Water Concentrations, **Total N**	mg/L	**3.02**
Ground Water Flow Direction	bearing	**N20°W**
Length of Mixing Zone	feet	500
Thickness of Mixing Zone	feet	15
Outfall Width, Perpendicular to Ground Water Flow Direction	feet	**420**
Width of Mixing Zone at Down Gradient Boundary	feet	507.5
Cross Sectional Area of Mixing Zone (A)	ft^2	7612.5
Hydraulic Conductivity (K)	feet/day	20.0
Hydraulic Gradient (I)	ft/ft	0.021
Volume of Ground Water Available for Mixing (Q_{gw})	ft^3/day	**3,197**

APPENDIX V - PROPOSED DISCHARGE LIMITATIONS AND CONDITIONS

DEQ has a statutory duty to develop effluent limits and issue permits consistent with the Montana Water Quality Act, §75-5-101, MCA et seq. and rules adopted under that Act. Section IV presents the basis for discharge limitations in accordance with the requirements at ARM 17.30.1006, ARM 17.30.1031, and ARM 17.30.715.

A. Water Use Classification & Applicable Water Quality Standards

The receiving water is Class III ground water and as such, it is not high quality waters of the state (75-5-103, MCA). The quality of Class III ground water must be maintained to protect their beneficial uses. Those beneficial uses are listed below (ARM 17.30.1006). The applicable water quality standards for Class III ground waters are summarized in Table 9 found on the following page.

Persons may not cause a violation of the following specific water quality standards in Class III ground water, pursuant to ARM 17.30.1006, except within a DEQ approved mixing zone as provided in ARM 17.30.1005. The human health standards for ground water are listed in Circular DEQ-7. The receiving water is Class III ground water and is not high quality waters of the state (75-5-103, MCA). The quality of Class III ground water must be maintained so that these waters are suitable for the following beneficial uses with little or no treatment (ARM 17.30.1006):

i. Irrigation of some salt tolerant crops;
ii. Some commercial and industrial purposes;
iii. Drinking water for some livestock and wildlife; and
iv. Drinking, culinary, and food processing purposes where the specific conductance is less than 7,000 µS/cm at 25°C.

Because the receiving ground water is Class III, it is therefore not considered a high quality water of the state (refer also to Section VIII). Note that according to ARM 17.30.1006(3)(c) the nondegradation provisions of 75-5-303 MCA do not apply to Class III ground water. The applicable ground water standards pursuant to ARM 17.30.1006 are summarized in the table below and will be used as the basis for developing effluent limitations in the permit.

Table 9

Applicable Ground Water Quality Standards. **South Wind W&S District WWTS**			
Parameter[(1)]	**Units**	**17.30.1006(3)(b)(ii) Human Health Standards - Ground Water**	**17.30.1006(3)(a) Beneficial Uses - Ground Water**
Nitrogen, Nitrate + Nitrite (as N)	mg/L	10.0	-
Nitrogen, Total (TN)	mg/L	-	10.0

Footnotes:

These standards establish the maximum allowable changes in ground water quality and are the basis for limiting discharges to ground water, ARM 17.30.1005(1); Circular DEQ-7 (2012), Footnote 16.

This list only includes identified parameters of interest.

B. Pollutants and Parameters of Interest (POI)

DEQ has identified pollutants and parameters of interest (POI's) for the proposed discharge. These POIs are based on the Human Health Standard and the need to maintain Beneficial Uses for state ground water. This is a new permit for a proposed wastewater treatment and disposal facility serving a long established subdivision. The proposed and permitted wastewater treatment facility will replace the existing, unpermitted, and failed wastewater lagoon system that is known to be discharging to groundwater. The wastewater effluent discharged from this subdivision is domestic in nature.

DEQ identified pollutants and parameters of interest (POI's) for the proposed discharge based on the following:

- Reported effluent characteristics (Section II,E and Appendix II of this Fact Sheet);
- Water quality standards (Table 9 above);
- Water use classification of the receiving ground water (Appendix III and V); and
- US EPA reference documents (Appendix IX).

Each individual POI is further discussed below.

C. Development of Effluent Limits

ARM 17.30.1006 and 17.30.715 set forth the basis for developing effluent limitations that will protect water quality. The ground water quality standards establish the maximum allowable changes to ground water quality; are the basis for limiting discharges to ground water; and may only be exceeded within a mixing zone authorized by DEQ. The nondegradation provisions of 75-5-303 MCA do not apply to Class III ground water [ARM 17.30.1006(3)(c)].

1. Water Quality Based Effluent Limitations – Nitrogen

Analytic information within the submitted application materials indicate that nitrogen will be present in the proposed wastewater stream (Section II.E. and Appendix I). To protect beneficial uses [ARM 17.30.1006(3)(a)], there shall be no increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses. Therefore, no wastes may be discharged such that the waste either alone or in combination with other

wastes will violate or can reasonably be expected to violate any standard. DEQ will establish the effluent limitations for nitrogen based on the projection that the entire nitrogen load in the wastewater stream may ultimately be converted to nitrate (USEPA, 2002a).

The allowable discharge concentrations will be derived from a mass-balance equation (ARM 17.30.517) which is a simple steady-state model, used to determine the POI concentration after accounting for other sources of pollution in the receiving water and any dilution as provided by a mixing zone. The equation factors in cumulative impacts of existing upgradient discharges and will limit the discharger to the assimilative capacity currently available in the receiving aquifer. Based on an examination of the area (refer to Figures 3 and 6) there do not appear to be any septic systems or other nitrate sources within 500 feet up-gradient of the proposed Outfall location. The mass-balance equation (Equation 1) derived for ground water is as follows:

Equation 1:

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

Where:

Q_{gw}	=	ground water available for mixing. (ft^3/day)
C_{gw}	=	ambient receiving ground water concentration (mg/L TN)
Q_{eff}	=	maximum design capacity of wastewater system (ft^3/day)
C_{eff}	=	allowable effluent pollutant concentration (mg/L TN)
Q_{comb}	=	combined ground water and effluent ($Q_{comb} = Q_{gw} + Q_{eff}$) (ft^3/day)
C_{proj}	=	projected pollutant concentration (after available mixing) (mg/L TN)

The following are some of the values used to come up with a discharge limit.

Drainfield/Outfall width: 420 ft (provided by the applicant)
Downgradient Mixing Zone Width: 508 ft
Hydraulic Conductivity (K): 20 ft/day (per Soil Survey & geol. of well logs)

C_{std}	=	10 mg/L Human Health Standard
Q_{gw}	=	3,197 ft^3/day
C_{gw}	=	3.02 mg/L ambient TN
Q_{eff}	=	2,540 ft^3/day effluent (=19,000 gal/day) the design maximum
C_{eff}	=	allowable discharge conc. mg/L, this is the value that is generally solved for. Note: TN conc. is 50.5 mg/L for influent, 35 mg/L for effluent (to/from the lagoons in 2006).
Q_{comb}	=	5,890 ft^3/day. ($Q_{comb} = Q_{gw} + Q_{eff}$) or (3197 + 2540 = 5737 ft^3/day)
C_{proj}	=	concentration after available mixing, derived using Equation 2 below.

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

Equation 2:

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

Where:
C_{lmt} = effluent limitation concentration (solve for this)
C_{std} = water quality standard concentration
C_{gw} = ambient receiving ground water concentration
D = dilution ratio (Q_{gw} / Q_{eff})

$C_{lmt} = C_{std} + D(C_{std} - C_{gw})$
C_{lmt} =10 mg/L + (3,197 ft^3/day / 2,540 ft^3/day) (10 mg/L – 3.02 mg/L)
C_{lmt} =10 mg/L + (1.259) (6.98 mg/L)
C_{lmt} =10 mg/L + 8.786 mg/L

C_{lmt} =18.79 mg/L Total Nitrogen

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

L_{lmt} lbs/day = (0.00000834) * (18.79) *(19,000 gal/day)
L_{lmt} lbs/day = 2.9774634

L_{lmt} = 3.0 lbs/day Total Nitrogen

In summary, the final effluent limit concentration is 19.2 mg/L and final effluent load limit is 3.0 Lbs/day for Total Nitrogen. Also, please refer to Table 8 in Appendix IV for general Mixing Zone Information and Section V,C,(1) above for an explanation of the development of the Mass Balance Calculation. Refer to Table 2 in Section IV at the beginning of this document for the Load Limit established for Outfall 001.

2. Water Quality Based Effluent Limitations – Phosphorus
ARM 17.30.1006 and 17.30.715 set forth the basis for developing effluent limitations that will protect water quality. The ground water quality standards establish the maximum allowable changes to ground water quality; are the basis for limiting discharges to ground water; and may only be exceeded within a mixing zone authorized by DEQ. The nondegradation provisions of 75-5-303 MCA do not apply to Class III ground water [ARM 17.30.1006(3)(c)]. Appendix VI (on the following pages) discusses the TP breakthrough to surface water analysis. That analysis estimates the breakthrough as >50 years. As such, no discharge limit for phosphorous was established in this permit.

D. Final Effluent Limitations

Based on the information and analyses presented in Sections III and IV and pursuant to 75-5-402, MCA and ARM 17.30.1031, DEQ proposes to establish numerical effluent limitations for Total Nitrogen (as N). No numeric effluent limitation for Total Phosphorous is proposed. The proposed final limitations are the most stringent applicable limitations for each individual parameter as developed above. Effluent limits based on water quality standards are often expressed as a daily maximum concentration. The numeric effluent limitations in this Fact Sheet are expressed as loads since this type of limitation inherently regulates both the volume and the strength of the effluent as prescribed at 75-5-402(3), MCA. Load limits also ensure compliance with the ground water standards at the end of the mixing zone. The proposed final effluent limits are listed on Table 2 in Section IV.

APPENDIX VI – RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

ARM 17.30.1031 requires that all issued MGWPCS permits contain monitoring requirements that assure compliance with the developed numeric effluent limitations and the water quality standards. Influent and effluent monitoring, as well as ground water monitoring will be required as conditions of this permit.

A. Influent and Effluent Monitoring - Compliance

Influent monitoring will be required for this permit to better characterize the influent entering the wastewater treatment facility. This will provide needed information to aid the wastewater plant operators to fine tune the treatment process to best achieve the required effluent limits set forth in this permit.

Final numeric effluent limitations are developed for this permit with specific magnitudes and durations that are based on site-specific conditions. These effluent limits ensure the discharge will not cause or contribute to an exceedance of an applicable water quality standard (see Sections III and IV). Accordingly, the permittee will be required to monitor and report monitoring results at a specified frequency in order to demonstrate compliance with the applicable effluent limitations. Influent and effluent monitoring and reporting requirements are summarized in Table 11 below. All analytical methods must be in accordance with the Code of Federal Regulations, 40 CFR Part 136 for each monitored parameter.

B. Influent and Effluent Monitoring - Sampling Locations

Samples shall be representative of the nature of the monitored inflowing septic waste and the effluent discharge to the outfall (Permit Part II.A.). As discussed in Section II.D, the tentative location for influent sampling will be from the surge basin/tank. This tank is located after the lift station and before the bar screen enclosure. The tentative location for effluent sampling is from the effluent line after UV disinfection and before the line exits the SBR building. Please refer to Figures 4 and 5 for the diagrams of the SBR plant and buildings, which was provided in the permit application. Sampling requirements are further discussed in Section V and in the following Table 10.

C. Effluent Discharge Flow Monitoring

Measurements shall be representative of the volume of the monitored discharge (Permit Part II.A.). The applicant will be required to install, maintain, and report flow measurements using a flow-measuring device capable of measurements that are within 10 percent of the actual flow (Permit Part II.B.). The flow measuring device is located on the effluent line before the effluent leaves the SBR treatment building (Figure 4). This location is identified as measurement location FM-001. The flow measuring device must be installed and in operating condition prior to discharge. Flow monitoring and reporting requirements are summarized in the table below.

Table 10

Monitoring and Reporting Requirements:
Influent Entering the WWTS & Effluent Sent to Outfall 001
South Wind Water and Sewer District WWTP

Parameter/Method	Monitor Location	Units	Sample Type(1)	Minimum Sample Frequency	Reporting Requirements(1)(2)	Report Frequency
Biochemical Oxygen Demand (BOD_5)	**INF-001 & EFF-001**	mg/L	Grab	1/Quarter	Daily Maximum Quarterly Average	Quarterly
Flow Rate, Effluent(3)	**FM-001**	gpd	Contin-uous	Contin-uous	Daily Maximum Quarterly Average	Quarterly
Nitrogen, Nitrite + Nitrate (as N)	**INF-001 & EFF-001**	mg/L	Grab	1/Quarter	Daily Maximum Quarterly Average	Quarterly
Nitrogen, Total Ammonia (as N)	**EFF-001**	mg/L	Grab	1/Quarter	Daily Maximum Quarterly Average	Quarterly
Nitrogen, Total Kjeldahl (TKN)(as N)	**INF-001 & EFF-001**	mg/L	Grab	1/Quarter	Daily Maximum Quarterly Average	Quarterly
Nitrogen, Total (as N)(4)	**INF-001 & EFF-001**	mg/L	Calculate	1/Quarter	Daily Maximum Quarterly Average	Quarterly
		lbs/day(5)	Calculate	1/Quarter	Daily Maximum(6) Quarterly Average(7)	Quarterly
Phosphorus, Total (as P)	**EFF-001**	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly

Footnotes:

INF-001, Influent sampling will be from the surge basin/tank. This tank is located after the lift station and before the bar screen enclosure.

EFF-001: The tentative location for effluent sampling is from the effluent line after UV disinfection and before the line exits the SBR building.

FM-001, The flow measuring device (FM-001) is located on the effluent line before the effluent leaves the SBR treatment building (Figure 4).

If no discharge occurs during the reporting period, "no discharge" shall be recorded on the effluent 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.

See definitions in Part V of the permit.

1) Grab sample will represent concentration for a 24 hour period.
2) Daily Maximum: Report highest measured daily value for the reporting period on Discharge Monitoring Report (DMR) form.
3) Requires recording device or totalizing meter, must record daily effluent volume.
4) Total Nitrogen is the sum of Nitrate + Nitrite and Total Kjeldahl Nitrogen.
5) Load calculation: lbs/day = (mg/L) x flow (gpd) x [8.34×10^{-6}].
6) Daily Maximum Load calculation: lbs/day = the maximum of all calculated individual daily average loads (lbs/day) recorded during the reporting period.
7) Quarterly Average Load calculation: lbs/day = the average of all calculated individual daily average loads (lbs/day) recorded during the reporting period.

D. Ground Water Quality Monitoring

As a special condition (ARM 17.30.1031), ground water monitoring will be established in this permit to provide for long term ambient and downgradient monitoring of the aquifer. Ground water monitoring will be required at all current or other installed or designated monitoring wells. At the time of development of this Fact Sheet, MW-10 is the only monitoring well available. If any monitoring well is installed or designated in the future, it is to be sampled along with MW-10. Ground water monitoring will be used for mixing zone determination, shallow aquifer characterization, and for collection of data that is required for future permit renewal (Part III.A., Duty to Reapply). Ground water monitoring and reporting requirements are summarized in the table below. All analytical methods must be in accordance with the Code of Federal Regulations, 40 CFR Part 136 for each monitored parameter. The existing ground water monitoring well MW-10 shall be maintained and monitored during the term of the upcoming permit cycle. Sampling and reporting requirements shall commence upon the effective date of the permit.

The commencement date for monitoring well sampling and reporting are listed in Section VII. Ground water monitoring and reporting requirements are summarized in the table below.

Table 11

Ground Water Monitoring and Reporting Requirements
MW-10 (and other new or designated monitoring wells)
South Wind Water & Sewer District

Parameter / Method	Monitor Location[1]	Units	Sample Type[2]	Minimum Sampling Frequency	Reporting[2][3][4] Requirements	Reporting Frequency	Rationale
Chloride (as Cl)	MW-10 (include any new monitoring wells as they are added to the project)	mg/L	Grab	1/Quarter	Quarterly Average	Quarterly	Current Permit Requirement & Aquifer Character-ization
Nitrogen, Nitrate + Nitrite (as N)		mg/L	Grab	1/Quarter	Daily Maximum Quarterly Average	Quarterly	
Nitrogen, Total Ammonia (as N)		mg/L	Grab	1/Quarter	Daily Maximum Quarterly Average	Quarterly	
Nitrogen, Total Kjeldahl (TKN)(as N)		mg/L	Grab	1/Quarter	Daily Maximum Quarterly Average	Quarterly	
Specific Conductivity @ 25°C		µS/cm	Grab or Instant-aneous	1/Quarter	Quarterly Average	Quarterly	
Total Dissolved Solids (TDS)		mg/L	Grab or Instant-aneous	1/Quarter	Quarterly Average	Quarterly	
Static Water Level (SWL)[4]		ft-bmp	Instant-aneous	1/Quarter	Quarterly Average	Quarterly	

Footnotes:

ft-bmp = feet below measuring point

At no time shall the permittee mark or state "no discharge" on any monitoring well DMR form.

Each monitor well to be individually sampled and analyzed for each respective parameter listed above.

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.

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) Refer to Figure 6 of the Fact Sheet for the existing or proposed location of the monitoring well.
2) See definitions in Part V of the permit.
3) Daily Maximum: Report highest measured daily value for the reporting period on Discharge Monitoring Report (DMR).
4) Measuring point (point of reference) for SWL measurements shall be from top of casing and measured to within 1/100th of one foot.

APPENDIX VII – RESONABLE POTENTIAL ANALYSIS

The following projections were used by the DEQ permit writer to justify permitting determinations. These templates/tables are highly conservative in nature.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

Significance and Reasonable Potential Analysis Summary
Montana Ground Water Pollution Control System
MTX000238 - Outfall 001
South Wind Water & Sewer District WWTF

Shallow alluvial deposits flanking the south side of Sand Coulee Creek and the Missouri River

Ground Water Dilution Projection (GWDP) - Nondegradation Significance Analysis

Notes:

Dilution projections were performed to provide insight into whether a proposed activity may cause significant changes to the existing water quality of a state water that is not high quality (ARM 17.30.715). On-site information and/or research was used in these projections. The results have been summarized below:

NO	Has DEQ determined the activity to be a new or increased source (ARM 17.30.702)? (DEQ, 2016).	These projections are ultra conservative.
NO	Will the proposed activity result in a discharge to high quality state ground water(ARM 17.30.702)? (DEQ, 2016).	It is Class III GW
YES	Will the discharge structure undergo DEQ engineering review prior to construction and discharge? (DEQ, 2017).	
3.02 mg/L	Actual ambient concentration of nitrates in the receiving ground water aquifer (DEQ 2017).	
1:109,377 flow ratio	Percentage (or Ratio) of the ground water flow rate in comparison to the Missouri River flow rate (downgradient surface water).	3200 ft3/day = 4051 ft3/sec
10 mg/L	Projected concentration of nitrates in the aquifer, at the downgradient edge of the ground water mixing zone.	GWDP(a)
8.75 mg/L	Projected concentration of nitrates in the aquifer, just prior to the downgradient surface water.	GWDP(b)
500 feet	Distance in ground water from the discharge source, in which the concentration of the aquifer is projected to be at or below the significance criteria (10 mg/L).	GWDP(c)

The projections above indicate that the proposed activity will maintain Beneficial Uses.

Surface Water Dilution Projection (SWDP) - Reasonable Potential (RP)

Dilution projections were performed in order to estimate whether the proposed actions will result in a reasonable potential to exceed surface water aquatic standards. On-site information and/or research was used in these projections. The results have been summarized below:

YES	Does the proposed location of the discharge structure meet the Department's Subsurface Wastewater Treatment System setback requirements?	100 feet
NO, it is impaired due to sedimentation	Is the potential receiving surface water listed as impaired (not fully supported for aquatic life) for the parameter of interest?	Reach of the Missouri River down to Sun River Confluence
0.254 mg/L	Projected concentration of nitrates in the surface water, if the treated wastewater was directly injected into the surface water body.	SWDP(a)
0.254 mg/L	Projected concentration of nitrates in the surface water, if the ground water aquifer as a whole (at the downgradient edge of the ground water mixing zone) was directly injected into the surface water body.	SWDP(b)
0.254 mg/L	Projected concentration of nitrates in the surface water, if the ground water aquifer as a whole (just prior to the downgradient surface water body) was directly injected into the surface water body.	SWDP(c)

Note: The concentration of nitrate (N) in surface water was recorded as 0.254 mg/L at the time DEQ conducted surface water sampling.

The projections above do not exceed the surface water aquatic standard (0.0275 mg/L). — DEQ Circular 7, DEQ Circular 12A

In summary, the proposed permitting action will not individually or cumulatively have a significant impact on the human environment, and does not have a reasonable potential to exceed surface water standards. It results in no measurable change in the surface water.

Analyses performed by Jeffrey Frank Herrick March 2017.

Note: The Missouri River is listed by DEQ as impaired and not supporting all beneficial uses. The reach of the river northwest of the outfall is described as not fully supporting aquatic life due to sedimentation and/or siltation.

Table 12

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

Montana Ground Water Pollution Control System
Ground Water Dilution Projection (GWDP)

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 water quality standards.

Site Name:	**South Wind Water & Sewer District / Trailer Terrace Subdivision**
Location:	South of Great Falls
Permit #:	MTX000238 - Outfall 001
Notes:	Design Capacity = 19,000 gal/day; 2540 ft³/day
-	These calculations are for the following parameter of interest: Total Nitrogen
-	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

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

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

Qd =	**2540**	ft³/d	Design capacity - effluent flow rate
Cd =	**19.2**	mg/L	Concentration - effluent (treated wastewater)
	500	ft	Length of ground water dilution zone
	15	ft	Thickness of dilution zone
	420	ft	Outfall width, perpendicular to ground water flow direction
	508	ft	Projected width of downgradient dilution zone
	7620	ft²	Cross sectional area of dilution zone (A)
	20	ft/d	Hydraulic conductivity (K)
	0.021	ft/ft	Hydraulic gradient (I)
Qs(Qgw) =	**3200**	ft³/d	Ground water volume (Qgw)
Cs =	**3.02**	mg/L	Ambient nitrate concentration in ground water
Cr =	**10**	mg/L	Projected concentration - end of the mixing zone
WQ Std. =	**10**	mg/L	Water Quality Standard
	<10	**mg/L**	**Beneficial Uses will be maintained**

GWDP(b) - Ground Water Nitrate Projection just prior to the Downgradient Surface Water.

Qd =	**2540**	ft³/d	Design capacity - effluent flow rate
Cd =	**19.2**	mg/L	Concentration - effluent (treated wastewater)
	1800	ft	Length of ground water dilution zone, the distance to Sand Coulee is between 1800-2400 feet west northwest of the drainfield.
	15	ft	Thickness of dilution zone
	420	ft	Outfall width, perpendicular to ground water flow direction
	735	ft	Projected width of downgradient dilution zone
	11025	ft²	Cross sectional area of dilution zone (A)

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

Montana Ground Water Pollution Control System
Ground Water Dilution Projection (GWDP)

	20	ft/d	Hydraulic conductivity (K)
	0.021	ft/ft	Hydraulic gradient (I)
Qs(Qgw) =	**4631**	ft^3/d	Ground water volume (Qgw)
Cs =	**3.02**	mg/L	Ambient nitrate concentration in ground water
Cr =	**8.75**	mg/L	Projected concentration - just prior to surface water
WQ Std. =	**10**	mg/L	Water Quality Standard
	<10	mg/L	**Beneficial Uses will be maintained**

Projections performed by Jeffrey Frank Herrick on March 2017.

Table 13

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

Montana Ground Water Pollution Control System
Surface Water Dilution Projection (SWDP) - Reasonable Potential (RP)

Estimation of parameter concentrations after instantaneous dilution with the projected downgradient receiving surface water. After dilution, there is no reasonable potential if the projected concentration is below the applicable aquatic standard (DEQ-Circular 7).
-and- After dilution, the concentration is not measureable if the change in the receiving water is below the applicable required reporting value (RRV) (Cr-Cs<0.02 mg/L).

Site Name: **South Wind Water & Sewer District / Trailer Terrace Subdivision**
Location: South of Great Falls, just east of the Missouri River & south of Sand Coulee.
Permit #: MTX000238 - Outfall 001
Notes: Design Capacity = 19,000 gal/day; 2540 ft^3/day

- These calculations are for the following parameter of interest: Total Nitrogen
- Certain calculations may not credit potential ground water dilution.
- These calculations do not credit potential ground water dispersion.
- These calculations do not credit potential losses due to attenuation.
- These calculations do not credit potential losses due to chemical transformation.
- These calculations do not credit potential dilution or losses within the hyporheic zone.
-

Projected Concentration Calculation

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

The activity may not have a Reasonable Potential if Cr < Aquatic Std.
-and- The activity may not be measurable if (Cr-Cs<RRV) Required Reporting Value

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

Montana Ground Water Pollution Control System
Surface Water Dilution Projection (SWDP) - Reasonable Potential (RP)

SWDP(a) - Reasonable Potential of Injecting Treated Wastewater directly into the Downgradient Surface Water

Qd =	**2540**	ft³/d	Wastewater Treatment System design capacity - effluent flow rate
Cd =	**19.2**	mg/L	Concentration - effluent (treated wastewater)
Qs =	**4051**	ft³/s	Flow rate of surface water (14Q5), Missouri R. just south of Sun R. Confluence.
Cs =	**0.254**	mg/L	Concentration in surface water
Cr =	**0.254**	mg/L	Projected concentration after instantaneous dilution in the surface water
Standard =	**0.30**	mg/L	Surface Water Aquatic Standard, DEQ Circular DEQ-12A
RRV	**0.02**	mg/L	RRV for Nitrate
RP?	**<0.30**	mg/L	**The activity is not measureable, there is not a reasonable potential**

SWDP(b) - Reasonable Potential of Injecting the Ground Water Aquifer (located at the Downgradient Edge of the Ground Water Mixing Zone) directly into the Downgradient Surface Water

Qd =	**3200**	ft³/d	Ground Water Volume (Qgw)
Cd =	**10.2**	mg/L	Concentration of Ground water (edge of ground water mixing zone)
Qs =	**4051**	ft³/s	Flow rate of surface water (14Q5), Missouri R. just south of Sun R. Confluence.
Cs =	**0.254**	mg/L	Concentration in surface water
Cr =	**0.254**	mg/L	Projected concentration after instantaneous dilution in surface water
Standard =	**0.30**	mg/L	Surface Water Aquatic Standard, DEQ Circular DEQ-12A
RRV	**0.02**	mg/L	RRV for Nitrate
Measurable?	**No**	mg/L	No measurable change above the criterion
RP?	**<0.30**	mg/L	**The activity is not measureable, there is not a reasonable potential**

SWDP(c) - Reasonable Potential of Injecting the Ground Water Aquifer (located just prior to the Downgradient Surface Water) directly into the Downgradient Surface Water

Qd =	**4631**	ft³/d	Ground Water Volume (Qgw)
Cd =	**8.75**	mg/L	Projected Concentration of Ground water (just prior to surface water body)
Qs =	**4051**	ft³/s	Flow rate of surface water (14Q5)
Cs =	**0.254**	mg/L	Concentration in surface water
Cr =	**0.254**	mg/L	Projected concentration after instantaneous dilution
Standard =	**0.30**	mg/L	Surface Water Aquatic Standard, DEQ Circular DEQ-12A
RRV	**0.02**	mg/L	RRV for Nitrate
Measurable?	**No**	mg/L	No measurable change above the criterion
RP?	**<0.30**	mg/L	**The activity is not measureable, there is not a reasonable potential**

Projections performed by Jeffrey Frank Herrick in March 2017.

APPENDIX VIII - REFERENCES CITED

40 CFR § 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants. 2011.

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.

Department of Environmental Quality, Water Quality Circulars:

- Circular DEQ-2 – Design Standards for Wastewater Facilities.
- Circular DEQ-4 – Montana Standards for On-Site Subsurface Sewage Treatment Systems.
- Circular DEQ-7 – Montana Numeric Water Quality Standards, Required Reporting Values, and Trigger Values.

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Woessner, W., Troy, T., Ball, P. and D.C. DeBorde. 1998. Virus Transport in the Capture Zone of a Well Penetrating a High Hydraulic Conductivity Aquifer Containing a Preferential Flow Zone: Challenges to Natural Disinfection. In Proc. Source Water Protection Int., Dallas, TX. 28–30 Apr. 1998. National Water Research Inst., Fountain Valley, CA.

This Fact Sheet was Prepared By: Jeffrey Frank Herrick, Permit Writer, MT DEQ WPB.

ATTACHMENTS:

Area Well Logs

MONTANA WELL LOG REPORT

NOTICE >> This well has been deepened by GWIC Id 196518. << NOTICE

Site Name: RASMUSSEN LARRY F.
GWIC Id: 123390

Section 1: Well Owner(s)
1) RASMUSSEN, LARRY F (MAIL)
TRAILER TERRACE NO.150
GREAT FALLS MT 59405 [06/20/1988]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	SW¼ SE¼ SW¼ NE¼

County	Geocode
CASCADE	

Latitude	Longitude	Geomethod	Datum
47.4437	-111.291	MAP	NAD27

Ground Surface Altitude	Ground Surface Method	Datum Date

Addition	Block	Lot

Section 3: Proposed Use of Water
PUBLIC WATER SUPPLY (1)

Section 4: Type of Work
Drilling Method: CABLE
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Monday, June 20, 1988

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	213	7

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	95	7				STEEL
17	213	5				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
182	210	5		3/8IN	SAW SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	GALV. SHEET METAL	
0	213	BENTONITE	

Section 7: Well Test Data

Total Depth: 213
Static Water Level: 54
Water Temperature:

Bailer Test *

60 gpm with _ feet of drawdown after 2 hours.
Time of recovery 0.01 hours.
Recovery water level 54 feet.
Pumping water level 67 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
330MDSN - MADISON GROUP OR LIMESTONE

From	To	Description
0	20	BROWN SANDY CLAY
20	75	GRAY SILT
75	95	BROKEN SANDSTONE, GRAVEL, RED AND GRAY SHALE (SOME H2O)
95	133	GRAY GREEN SANDSTONE
133	165	GRAY GREEN SANDSTONE WITH PYRITE
165	175	GRAY GREEN SHALE
175	178	RUSTY BROWN SANDSTONE (WATER)
178	185	BROWN LIMESTONE
185	213	LIGHT BROWN LIMESTONE(WATER 193-210 FT)

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: BYRNE
License No: WWC-318
Date Completed: 6/20/1988

MONTANA WELL LOG REPORT

NOTICE >> This well deepens GWIC Id 123390. **<< NOTICE**

Site Name: RASMUSSEN LARRY
GWIC Id: 196518
DNRC Water Right:

Section 1: Well Owner(s)
1) RASMUSSEN, LARRY (MAIL)
150 TRAILER TERRACE
GREAT FALLS MT 59405 [04/24/2002]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	SW¼ NE¼

County
CASCADE

Geocode

Latitude	Longitude	Geomethod	Datum
47.44494	-111.292839	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: DEEPENED

Section 5: Well Completion Date
Date well completed: Wednesday, April 24, 2002

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	270	5

There are no casing strings assigned to this well.
There are no completion records assigned to this well.
Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 270
Static Water Level: 56
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
20 gpm pump rate with _ feet of drawdown after 1 hours of pumping.
Time of recovery 0.08 hours.
Recovery water level 56 feet.
Pumping water level 66 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
330MDSN - MADISON GROUP OR LIMESTONE

From	To	Description
213	217	HARD BROWN LIME
217	225	LIGHT BROWN RUSTY BROKEN LIME
225	232	HARD BROWN LIME
232	235	WHITE LIME
235	240	GRAY LIME
240	250	WHITE LIME
250	257	HARD BROWN LIME
257	261	LIGHT BROWN RUSTY LIME AND WATER
261	270	LIGHT BROWN LIME

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: BYRNE
License No: WWC-317
Date Completed: 4/24/2002

MONTANA WELL LOG REPORT

Site Name: DANNELS FRANK V. AND VIOLEET M.
GWIC Id: 33386
DNRC Water Right:

Section 1: Well Owner(s)
1) DANNELS, FRANK V AND VIOLEET M (MAIL)
RTE 1 BOX B 53
GREAT FALLS MT 59401 [10/20/1953]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	SE¼ NE¼

County	Geocode
CASCADE	

Latitude	Longitude	Geomethod	Datum
47.44494	-111.287348	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:
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Tuesday, October 20, 1953

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	110	4

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	110	4				CASING

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
110	110	4			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 110
Static Water Level: 20
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
12 gpm pump rate with _ feet of drawdown after _ hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level _ feet.

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

Section 8: Remarks

Section 9: Well Log
Geologic Source
112GFLK - GLACIAL GREAT FALLS LAKE SEDIMENTS

From	To	Description
0	14	LOOSE SAND
14	20	QUICKSAND
20	97	SILT
97	100	QUICKSAND AND GRAVEL
100	109	LOOSE SAND AND GRAVEL
109	110	YELLOW SHALE WATER AT 109 FT

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:	
License No:	-
Date Completed:	10/20/1953

MONTANA WELL LOG REPORT

Site Name: HOWARD CAIL
GWIC Id: 33382
DNRC Water Right: C026709-00

Section 1: Well Owner(s)
1) HOWARD, CAIL (MAIL)
RTE 2 SOUTH BOX 921
GREAT FALLS MT 59405 [08/05/1977]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	SW¼ NE¼ NE¼

County	Geocode
CASCADE	

Latitude	Longitude	Geomethod	Datum
47.447734	-111.288721	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: AIR ROTARY
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Friday, August 05, 1977

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	130	7

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	130	6				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
110	130	0		1/2IN	DRILLED HOLES

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	45	BENTONITE	

Section 7: Well Test Data

Total Depth: 130
Static Water Level: 40
Water Temperature:

Unknown Test Method *

Yield 10 gpm.
Pumping water level 40 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
217KOTN - KOOTENAI FORMATION

From	To	Description
0	2	TOPSOIL
2	18	BLOW SAND
18	34	HARD ROCK
34	53	SHALE
53	66	ROCK
66	100	RED AND PURPLE SHALE
100	110	SANDSTONE
110	125	HARD SAND
125	130	BROKEN SANDSTONE

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: MENDENHALL DRILLING
License No: WWC-199
Date Completed: 8/5/1977

MONTANA WELL LOG REPORT

Site Name: CARTER MIKE
GWIC Id: 72980
DNRC Water Right: C078525-00

Section 1: Well Owner(s)
1) CARTER, MIKE (MAIL)
82 ELK DR
GREAT FALLS MT 59404 [06/04/1991]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	NE¼

County	Geocode
CASCADE	

Latitude	Longitude	Geomethod	Datum
47.446803	-111.290093	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum Date

Addition	Block	Lot
		2

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: Tuesday, June 04, 1991

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	170	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	165	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
165	170	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 170
Static Water Level: 35
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
30 gpm pump rate with _ feet of drawdown after 96 hours of pumping.
Time of recovery 0.5 hours.
Recovery water level 35 feet.
Pumping water level 40 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
112GFLK - GLACIAL GREAT FALLS LAKE SEDIMENTS

From	To	Description
0	70	SAND
70	123	CLAY SILT
123	160	LAYERS SAND SILT CLAY GRAVEL
160	165	ROCK
165	170	SAND GRAVEL

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: POVERTY DRILLING
License No: WWC-302
Date Completed: 6/4/1991

MONTANA WELL LOG REPORT

Site Name: HOUSEMAN KEN
GWIC Id: 33379
DNRC Water Right: C005964-00

Section 1: Well Owner(s)
1) HOUSEMAN, KEN (MAIL)
1000 DURANGO
GREAT FALLS MT 59401 [04/15/1981]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	NE¼

County	Geocode
CASCADE	

Latitude	Longitude	Geomethod	Datum
47.446803	-111.290093	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum Date

Addition	Block	Lot

Section 3: Proposed Use of Water
UNKNOWN (1)

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

Section 5: Well Completion Date
Date well completed: Wednesday, April 15, 1981

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	100	7

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	20	6	.250			STEEL
20	100	6				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
50	100	6		6X1/4IN	PERFORATOR CASING

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	CEMENT	
0	0	PLASTIC	

Section 7: Well Test Data

Total Depth: 100
Static Water Level: 40
Water Temperature:

Air Test *

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

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

Section 8: Remarks

Section 9: Well Log
Geologic Source
217KOTN - KOOTENAI FORMATION

From	To	Description
0	5	TOPSOIL
5	18	SAND ROCK
18	28	LIME ROCK
28	32	SHALE ROCK
32	37	LIME ROCK
37	52	SHALE ROCK
52	57	HARD LIME
57	60	SAND ROCK
60	76	LIME ROCK
76	100	SAND ROCK

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

Name:
Company: SURE WATER DRILLING
License No: WWC-178
Date Completed: 4/15/1981

MONTANA WELL LOG REPORT

Site Name: ANNAU THOMAS B.
GWIC Id: 128324
DNRC Water Right: C081913-00

Section 1: Well Owner(s)
1) ANNAU, THOMAS B. (MAIL)
801 55TH AVE S
GREAT FALLS MT 59405 [03/28/1992]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	SW¼ SW¼ NE¼

County	Geocode
CASCADE	

Latitude	Longitude	Geomethod	Datum
47.444008	-111.294211	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: Saturday, March 28, 1992

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	187	9
187	200	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	187	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
187	200	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	187	CEMENT	

Section 7: Well Test Data

Total Depth: 200
Static Water Level: 29
Water Temperature:

Air Test *

30 gpm with drill stem set at 195 feet for 1 hours.
Time of recovery 0.5 hours.
Recovery water level 29 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
330MDSN - MADISON GROUP OR LIMESTONE

From	To	Description
0	3	TOP SAND
3	30	BROWN CLAY
30	79	GRAY SILT
79	82	BROKEN BROWN SANDSTONE
82	95	GRAY SANDY SHALE
95	162	GRAY&GREEN SANDSTONE W/PYRITE SOME THIN SHALE BEDS
162	168	GRAY-GREEN SANDSTONE
168	171	GRAY SHALE
171	182	GRAY BROWN SANDSTONE
182	184	SWIFT
184	189	HARD LIGHT BROWN LIMESTONE
189	195	BROWN LIMESTONE WATER AT 193-195FT
195	200	HARD WHITE LIGHT BROWN LIMESTONE

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: BYRNE
License No: WWC-318
Date Completed: 3/28/1992

MONTANA WELL LOG REPORT

Site Name: TRAILER TERRACE
GWIC Id: 33385
DNRC Water Right:

Section 1: Well Owner(s)
1) TRAILER, TERRACE (MAIL)
ROUTE 1 SOUTH
GREAT FALLS MT 59405 [03/19/1971]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	SW¼ SE¼ SW¼ NE¼

County	Geocode
CASCADE	

Latitude	Longitude	Geomethod	Datum
47.4434	-111.291	MAP	NAD27

Ground Surface Altitude	Ground Surface Method	Datum Date
3330		

Addition	Block	Lot
		5

Section 3: Proposed Use of Water
PUBLIC WATER SUPPLY (1)

Section 4: Type of Work
Drilling Method: CHURN DRILL
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Friday, March 19, 1971

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	100	7

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	98	7				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
98	100	7			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 100
Static Water Level: 22
Water Temperature:

Bailer Test *

50 gpm with _ feet of drawdown after 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 95 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
217KOTN - KOOTENAI FORMATION

From	To	Description
0	22	TOP SOIL AND SANDY CLAY
22	97	GRAY SILT
97	98	GRAVEL WATER
98	100	BROWN SANDSTONE

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: BYRNE
License No: WWC-135
Date Completed: 3/19/1971

MONTANA WELL LOG REPORT

Site Name: SMILEY RICHARD
GWIC Id: 33412
DNRC Water Right:

Section 1: Well Owner(s)
1) SMILEY, RICHARD (MAIL)
RT 1 SOUTH
GREAT FALLS MT 59405 [08/26/1961]

Section 2: Location

Township	Range	Section	Quarter Sections
20N	03E	36	NE¼ NE¼ NW¼ SE¼

County	Geocode
CASCADE	

Latitude	Longitude	Geomethod	Datum
47.4433	-111.2909	NAV GPS	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date
3340			2/13/2006

Addition	Block	Lot
		5

Section 3: Proposed Use of Water
DOMESTIC (1)
STOCKWATER (2)

Section 4: Type of Work
Drilling Method: CABLE
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Saturday, August 26, 1961

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	107	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	107	5				CASING

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
87	107	5		1/4X3IN	SAW SLOTS

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 107
Static Water Level: 85
Water Temperature:

Bailer Test *

10 gpm with _ feet of drawdown after 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 107 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
THIS LOG WAS MADE OUT BY THOMAS L FRANKLIN SON OF DECEASED DRILLER TO THE BEST OF HIS KNOWLEDGE

Section 9: Well Log
Geologic Source
112SNGR - SAND AND GRAVEL (PLEISTOCENE)

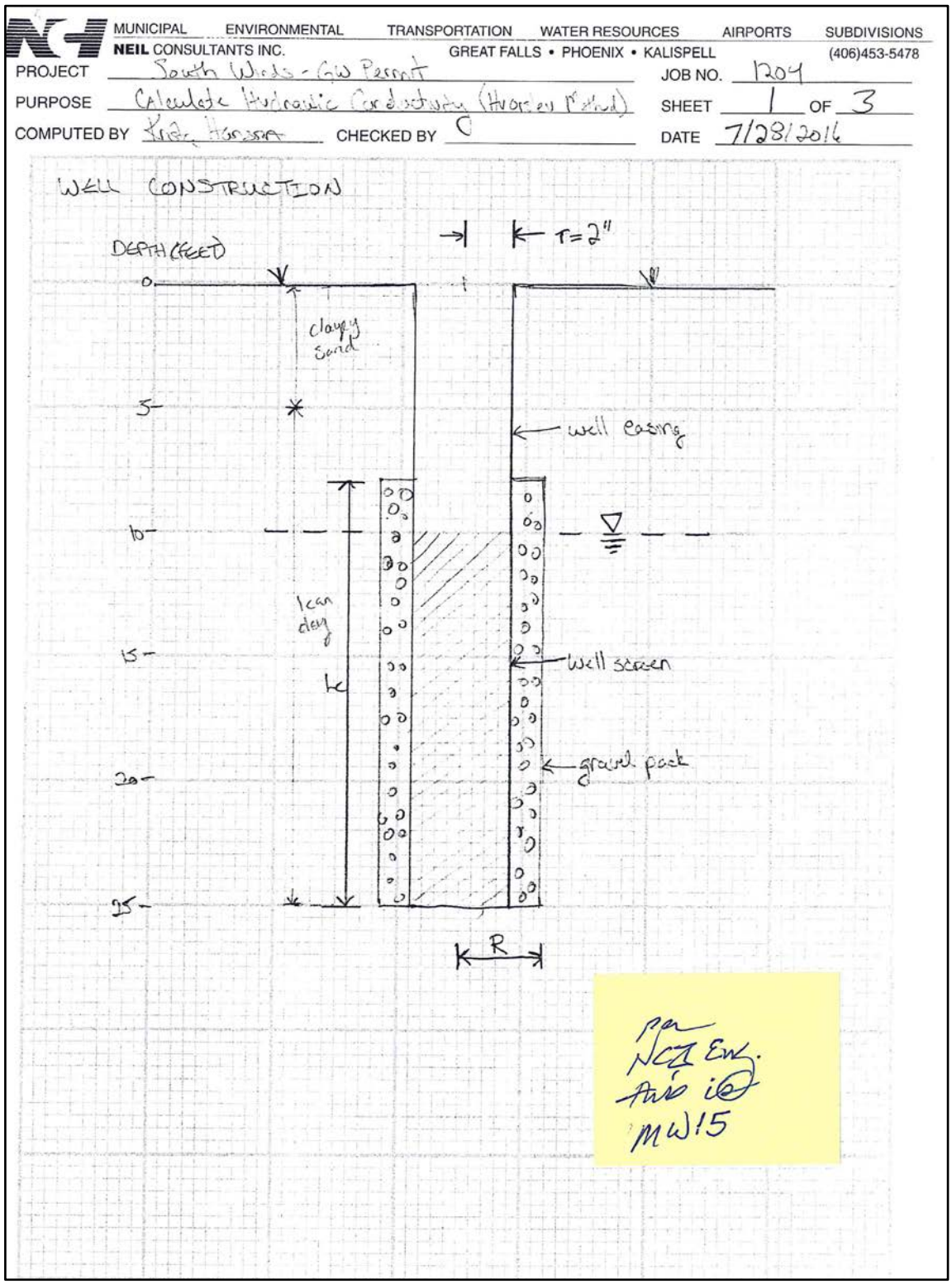
From	To	Description
0	107	FORMATION CONSISTS OF GRAY SHALE AND LAYERS OF SANDSTONE WATER AT 85 FT

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: FRANKLIN
License No: -
Date Completed: 8/26/1961

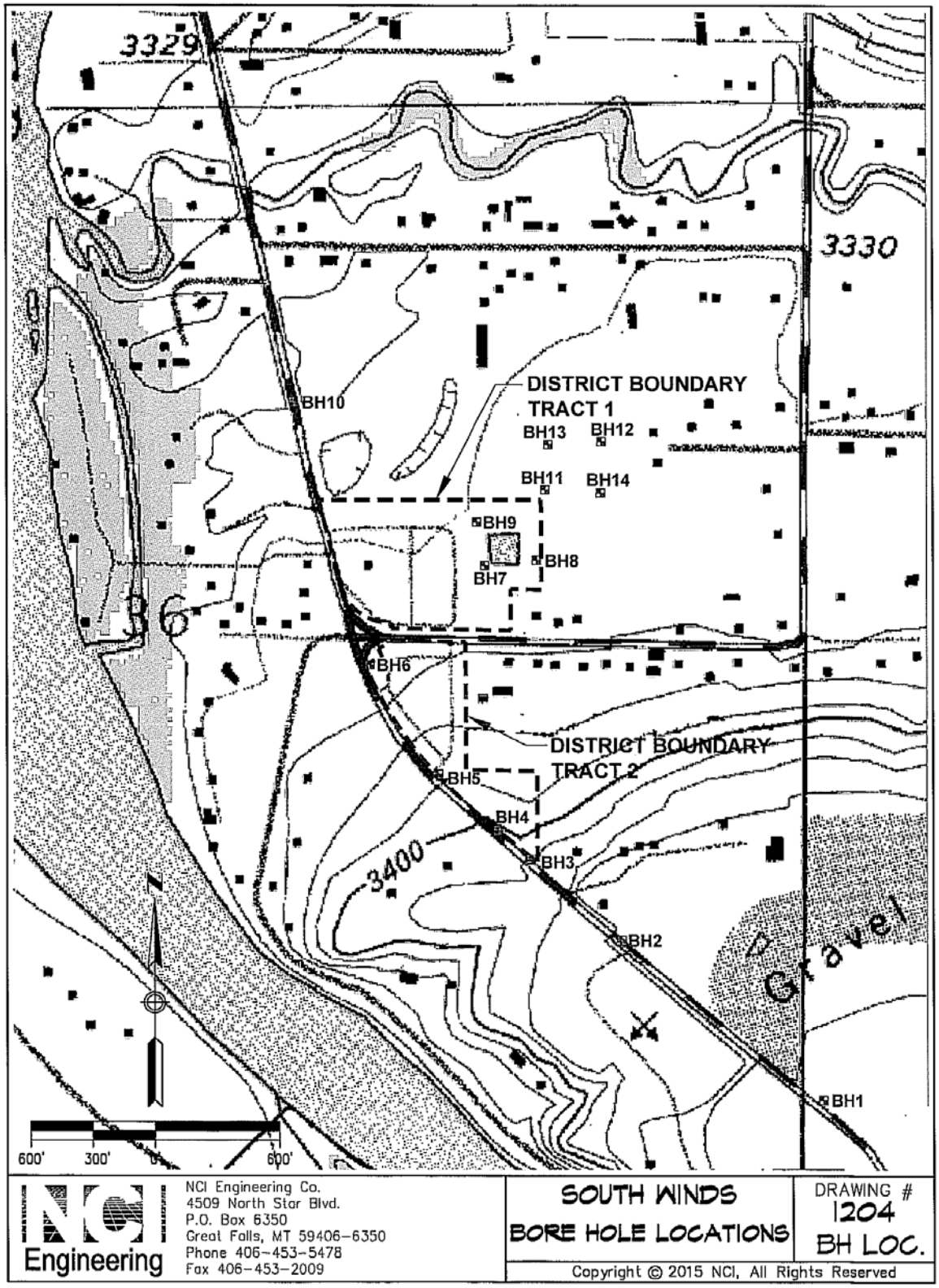
Monitoring Well Logs:
MW-10
MW-10 well log goes here, if it is ever provided by the applicant.

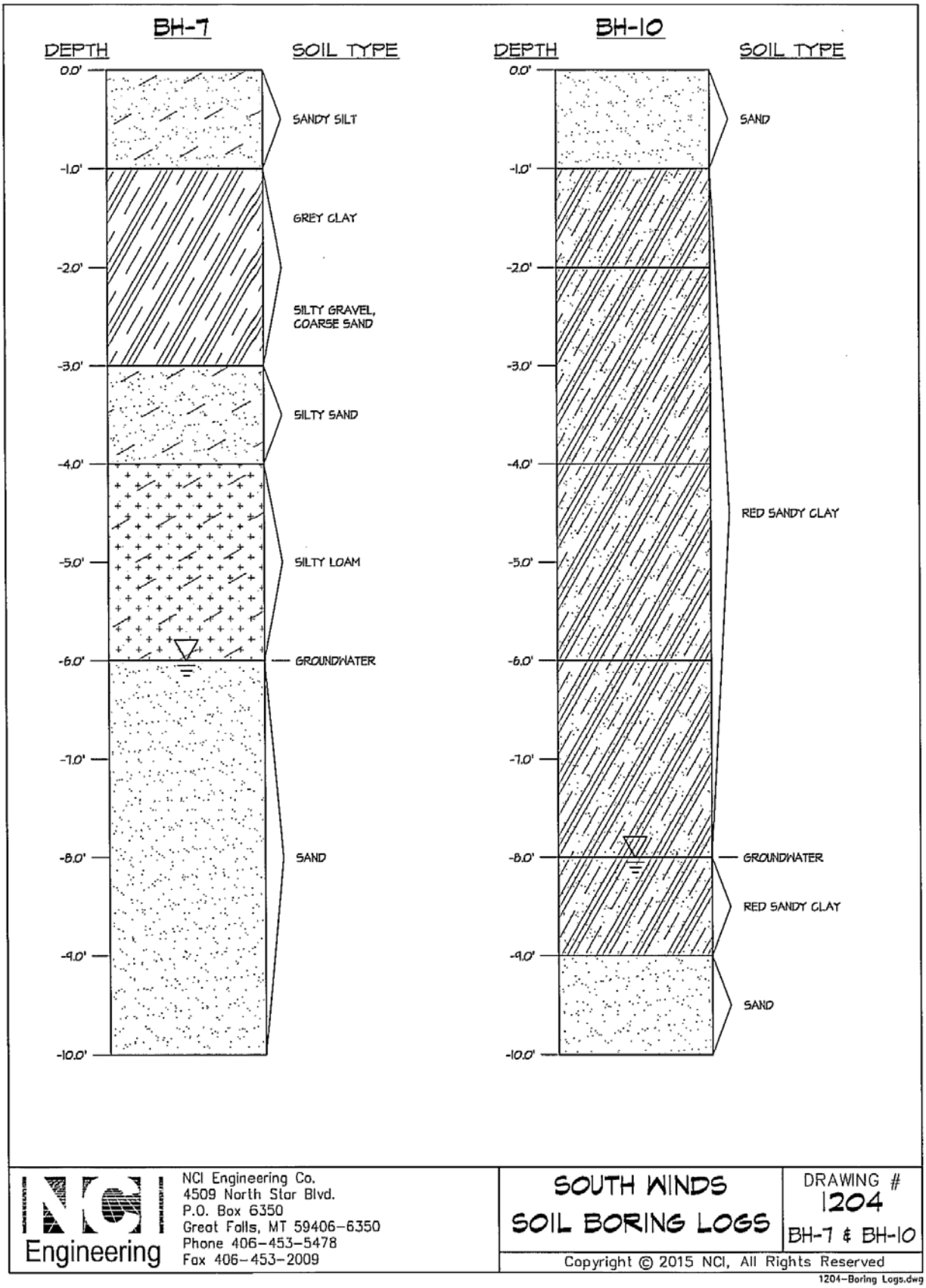
MW-15


MUNICIPAL ENVIRONMENTAL TRANSPORTATION WATER RESOURCES AIRPORTS SUBDIVISIONS
NEIL CONSULTANTS INC.
GREAT FALLS • PHOENIX • KALISPELL
(406)453-5478
PROJECT South Winds - GW Permit
JOB NO. 1204
PURPOSE Calculate Hydraulic Conductivity (Hvorslev Method)
SHEET 1 OF 3
COMPUTED BY Kris Hoosier
CHECKED BY C
DATE 7/28/2016
WELL CONSTRUCTION
DEPTH (FEET)
r=2"
clayey sand
well casing
1can clay
well screen
gravel pack
R
per NCI Env. Aud is @ MW15

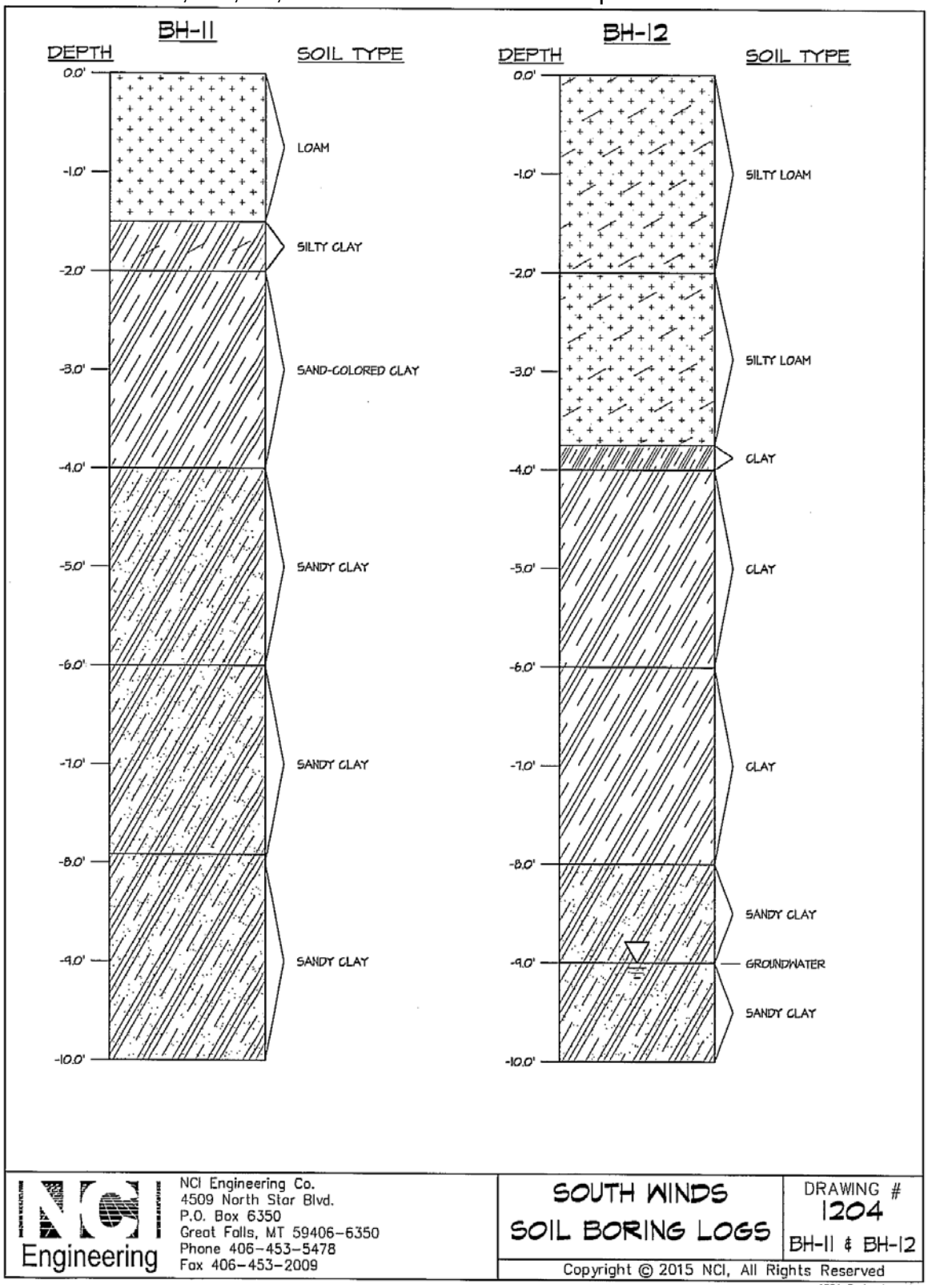
Boring Logs:

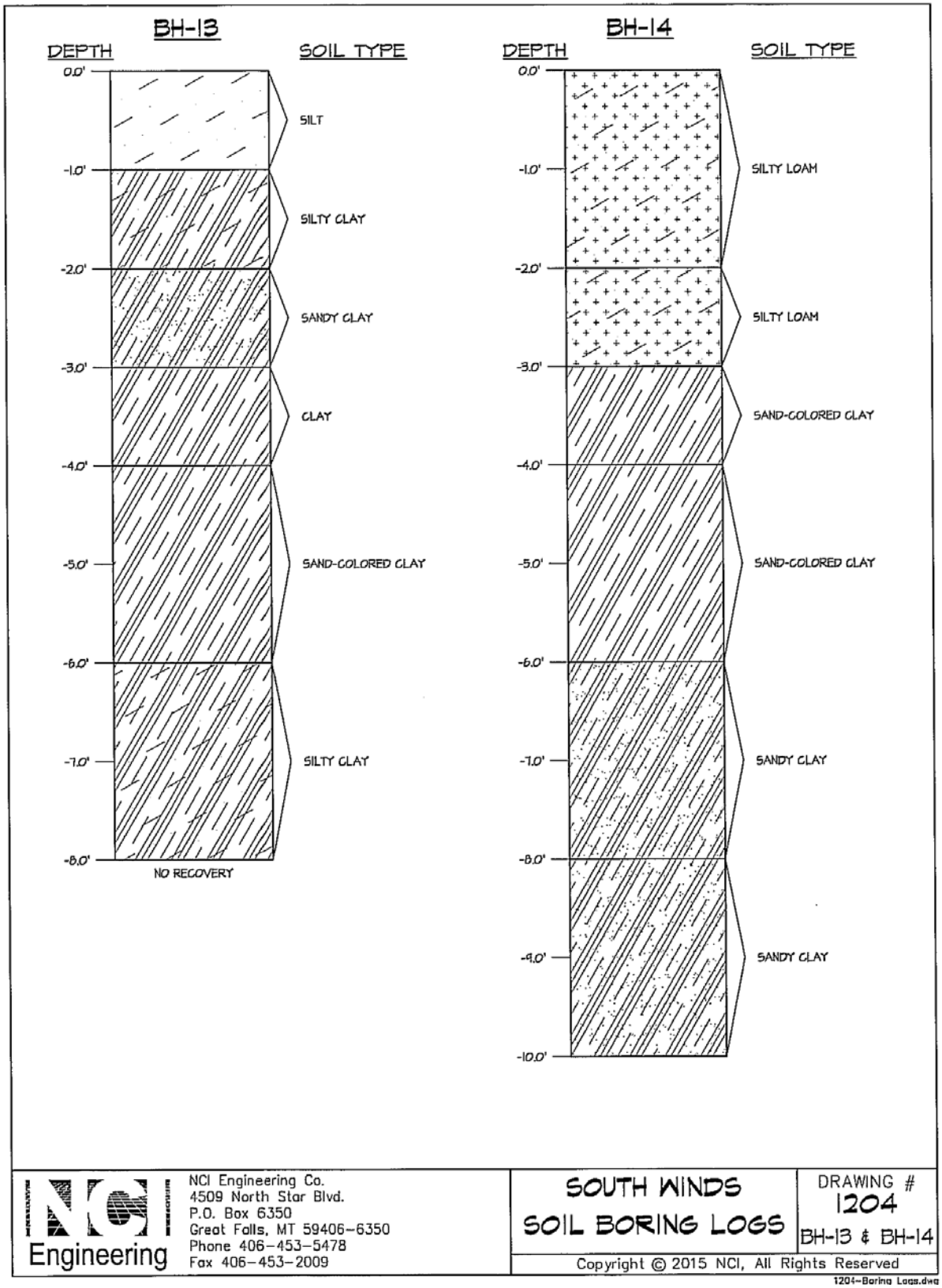
Conducted primarily for water and wastewater line installation and construction in the subdivision.




BH-7
DEPTH
SOIL TYPE
0.0'
-1.0'
-2.0'
-3.0'
-4.0'
-5.0'
-6.0'
-7.0'
-8.0'
-9.0'
-10.0'
SANDY SILT
GREY CLAY
SILTY GRAVEL, COARSE SAND
SILTY SAND
SILTY LOAM
GROUNDWATER
SAND
BH-10
DEPTH
SOIL TYPE
SAND
RED SANDY CLAY
GROUNDWATER
RED SANDY CLAY
SAND
NCI Engineering Co.
4509 North Star Blvd.
P.O. Box 6350
Great Falls, MT 59406-6350
Phone 406-453-5478
Fax 406-453-2009
NCI Engineering
SOUTH WINDS
SOIL BORING LOGS
DRAWING # 1204
BH-7 & BH-10
Copyright © 2015 NCI, All Rights Reserved
1204-Boring Logs.dwg

Boreholes BH-11, -12, 13, & -14 were collected in the parcel intended for the drainfield.





A boring log for BH-15 or well construction log for MW-15 was not provided with the application.

The following text was provided with the boring logs in the submittal.

233-Yetull loamy sand, 4 to 20 percent slopes
The Yetull series consists of deep, well drained soils formed in alluvium and eolian sands. These soils occupy terraces, fans, and foot slopes. Typically the surface layer is grayish brown, calcareous loamy sand about 5 inches thick. The underlying material is grayish brown and light brownish gray, calcareous loamy coarse sand and sand to a depth of 66 inches or more. Permeability is rapid. The available water capacity is low or very low. Reaction is mildly alkaline in the upper 5 inches and moderately alkaline below. These soils are mainly used for range. Small areas are used for woodland. This gently rolling to hilly soil occupies terraces and foot slopes. It has the profile described as typical of the series. Surface runoff is slow or medium. The erosion hazard is severe from wind and moderate from water.

236 Gravel Pits. Original gravel depth in the 12 to 13 foot deep range. Well log for "test well" indicates gravel to 13 foot deep on tank and well house site.

The following is a soil sample collected during the drilling of MW-15.

LABORATORY SERVICES REPORT

Report Number: C4161054.0001
Service Date: 07/26/16
Report Date: 08/08/16

Terracon
1392 13th Ave SW
Great Falls, MT 59404-3155
406-453-5400

Client
NCI Engineering Inc.
Attn: Lyle Meeks
4509 North Star Blvd
PO Box 6350
Great Falls, MT 59406

Project
NCI Engineering Inc - Misc
4509 North Star Blvd
Great Falls, MT 59404

Project Number C4161054

TEST DESCRIPTION

On July 26, 2016, we received a soil sample from the Southwinds # 1204 project. We were instructed to perform a sieve analysis on the sample in accordance with ASTM D1140 and determine the liquid limit, plasticity index in accordance with ASTM D4318 in order to determine the unified soil classification in accordance with ASTM D2487. The test results and USCS classification are presented below.

Southwinds # 1204
Great Falls, Montana
Soil Sample

Screen or Sieve Size	Percent Passing Screen or Sieve Size
3/8	100
No.4	100
No.10	100
No.20	100
No.40	99
No.80	99
No.100	99
No.200	91

Liquid Limit, %	33
Plasticity Index, %	13
USCS Classification:	Lean Clay (CL)

Terracon Rep.: Chapman, RM
Reported To:
Contractor:
Report Distribution:
(1) NCI Engineering Inc., lylemeeks@nciengineering.com

Reviewed By:
R. Michael Chapman
Laboratory Manager SET

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

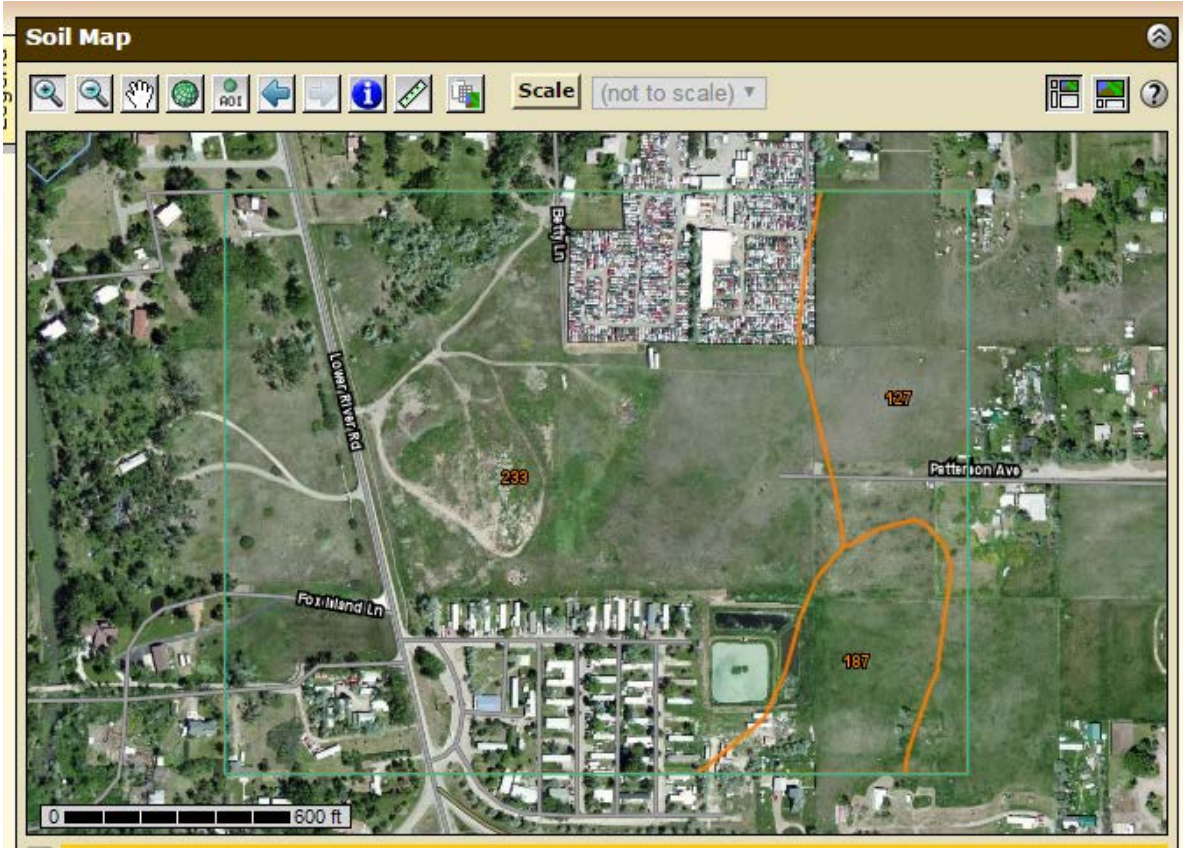
BC-0002 Page 1 of 1 Created 5/30/2008 Revised 3/25/2009

The following is information found on the USDA NRCS online soil survey service called Web Soil Survey.

Natural Resources Conservation Service

Soils

Web Soil Survey
http://websoilsurvey.nrcs.usda.gov/app/#



Report — Map Unit Description
Cascade County Area, Montana

233—Yetull loamy sand, 4 to 20 percent slopes

Map Unit Setting

- *National map unit symbol:* cgs6
- *Elevation:* 3,300 to 3,600 feet
- *Mean annual precipitation:* 12 to 18 inches
- *Mean annual air temperature:* 37 to 45 degrees F

- *Frost-free period:* 105 to 135 days
- *Farmland classification:* Not prime farmland

Map Unit Composition

- *Yetull and similar soils:* 90 percent
- *Minor components:* 10 percent
- *Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Yetull

Setting

- *Landform:* Alluvial fans
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear

Typical profile

- *A - 0 to 5 inches:* loamy sand
- *C - 5 to 60 inches:* sand

Properties and qualities

- *Slope:* 4 to 20 percent
- *Depth to restrictive feature:* More than 80 inches
- *Natural drainage class:* Somewhat excessively drained
- *Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
- *Depth to water table:* More than 80 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Calcium carbonate, maximum in profile:* 5 percent
- *Available water storage in profile:* Low (about 3.7 inches)

Interpretive groups

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 6e
- *Hydrologic Soil Group:* A
- *Ecological site:* Sands (Sa) RRU 46-C 15-19" p.z. (R046XC606MT)
- *Hydric soil rating:* No

Minor Components

Lihen

- *Percent of map unit:* 5 percent
- *Landform:* Alluvial fans
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Ecological site:* Sands (Sa) RRU 46-C 15-19" p.z. (R046XC606MT)
- *Hydric soil rating:* No

Tally

- *Percent of map unit:* 5 percent
- *Landform:* Hills
- *Down-slope shape:* Linear
- *Across-slope shape:* Linear
- *Ecological site:* Draft Sandy (Sy) RRU 46-C 15-19" p.z. (R046XC505MT)
- *Hydric soil rating:* No