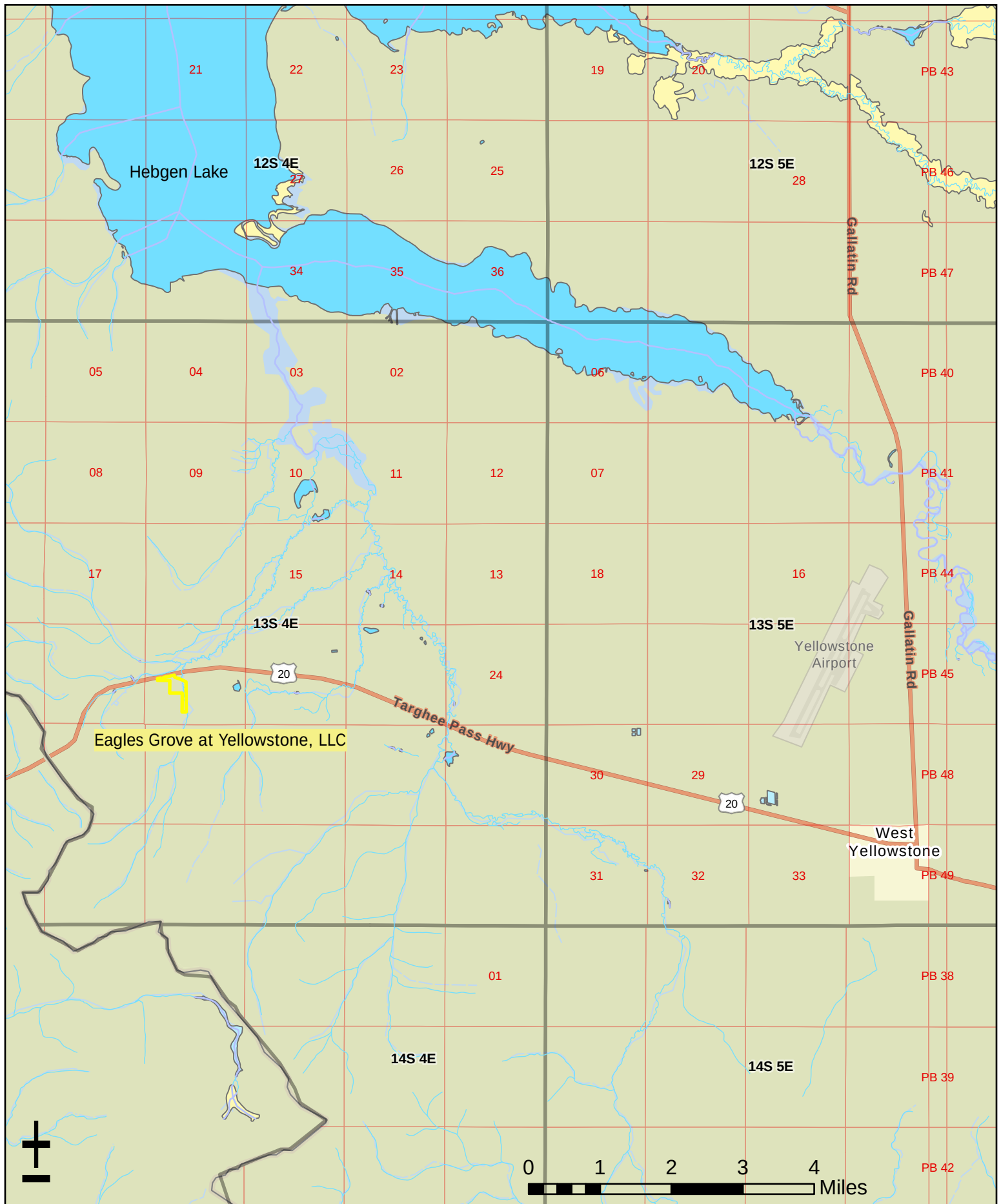




**Morrison
Maierle**

2880 Technology Blvd W
Bozeman, MT 59718
(496) 587-0721

engineers • surveyors • planners • scientists COPYRIGHT © MORRISON-MAIERLE, INC., 2025

DRAWN BY: DMS
CHK'D BY: NPE
APPR. BY: NPE
DATE: 01/2025

LOCATION MAP

West Yellowstone

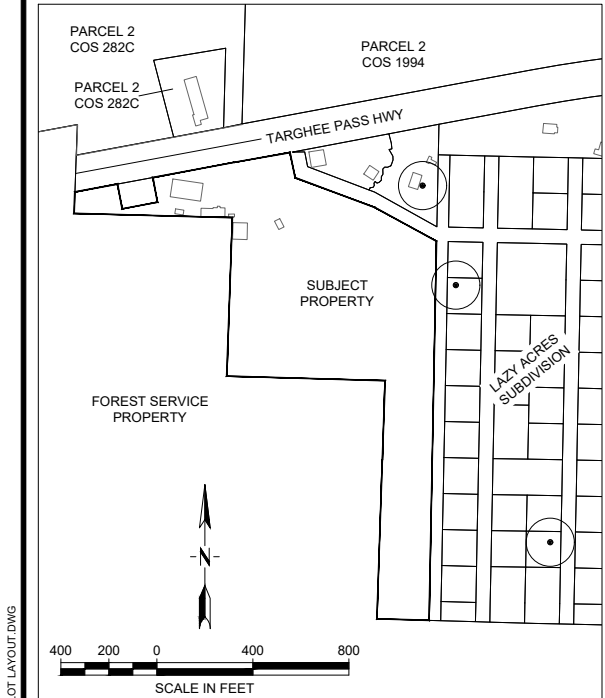
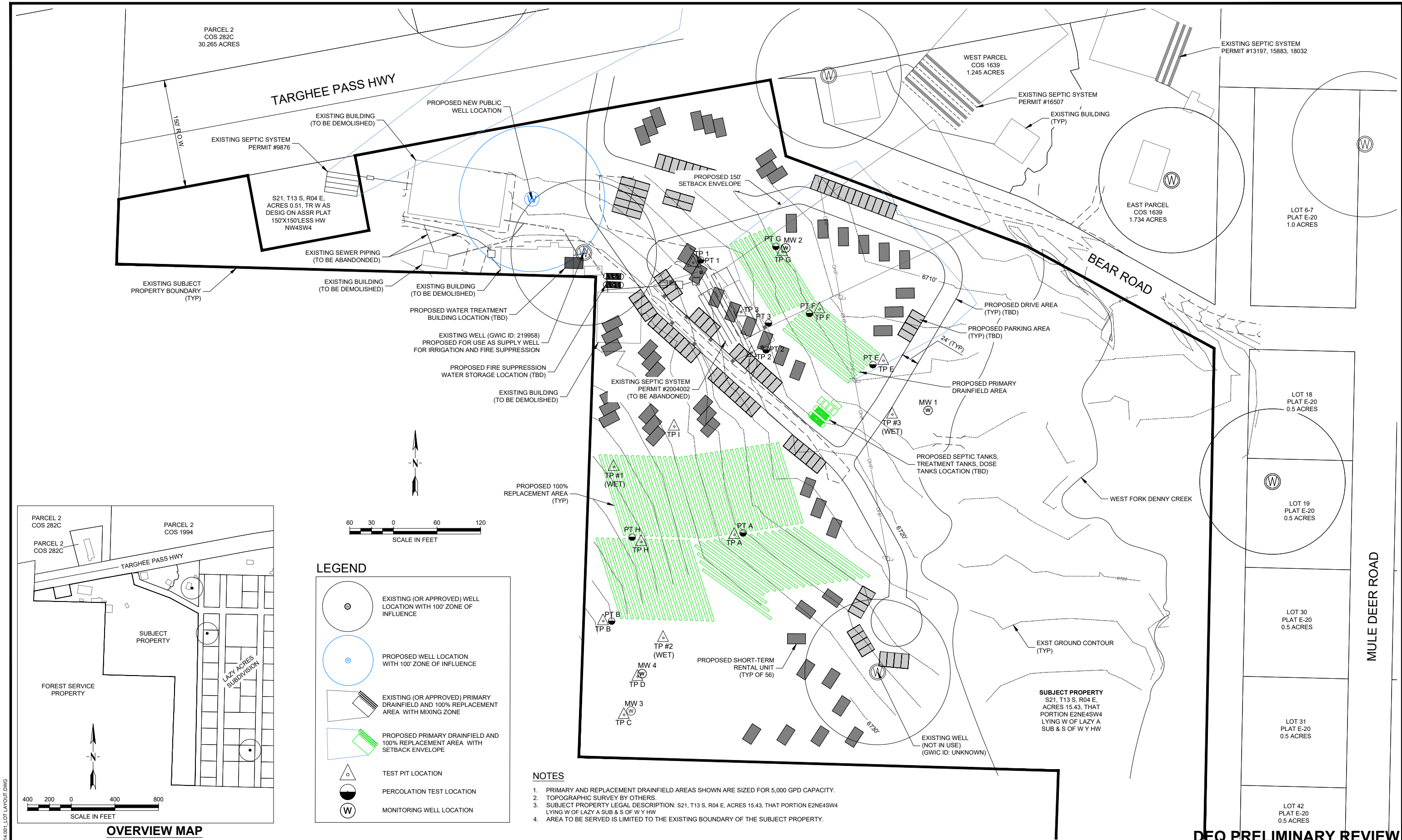
MT

Eagles Grove

PROJECT NO.
10514.001

FIGURE NO.

1



LEGEND

- EXISTING (OR APPROVED) WELL LOCATION WITH 100' ZONE OF INFLUENCE
- PROPOSED WELL LOCATION WITH 100' ZONE OF INFLUENCE
- EXISTING (OR APPROVED) PRIMARY DRAINFIELD AND 100% REPLACEMENT AREA WITH MIXING ZONE
- PROPOSED PRIMARY DRAINFIELD AND 100% REPLACEMENT AREA WITH SETBACK ENVELOPE
- TEST PIT LOCATION
- PERCOLATION TEST LOCATION
- MONITORING WELL LOCATION

- NOTES**
- PRIMARY AND REPLACEMENT DRAINFIELD AREAS SHOWN ARE SIZED FOR 5,000 GPD CAPACITY.
 - TOPOGRAPHIC SURVEY BY OTHERS.
 - SUBJECT PROPERTY LEGAL DESCRIPTION: S21, T13 S, R04 E, ACRES 15.43, THAT PORTION E2NE4SW4 LYING W OF LAZY A SUB & S OF W Y HW
 - AREA TO BE SERVED IS LIMITED TO THE EXISTING BOUNDARY OF THE SUBJECT PROPERTY.

VERIFY SCALE!

THESE PRINTS MAY BE REDUCED. LINE BELOW MEASURES ONE INCH ON ORIGINAL DRAWING.

MODIFY SCALE ACCORDINGLY!

REVISIONS			
NO.	DESCRIPTION	BY	DATE
#	#	#	#
#	#	#	#
#	#	#	#
#	#	#	#

engineers • surveyors • planners • scientists

2880 Technology Blvd West
Bozeman, MT 59718
406.587.0721
www.m-m.net

COPYRIGHT © MORRISON-MAIERLE, 2025

DRAWN BY: MET	EAGLES GROVE	PROJECT NUMBER 10514.001
DSGN BY: MET		
APPR BY: BJH	WEST YELLOWSTONE	SHEET NUMBER 1
DATE: 03/2025		
Q.C. REVIEW BY: #	PRELIMINARY SITE PLAN	DRAWING NUMBER S-1
DATE: #		

DEQ PRELIMINARY REVIEW



United States
Department of
Agriculture

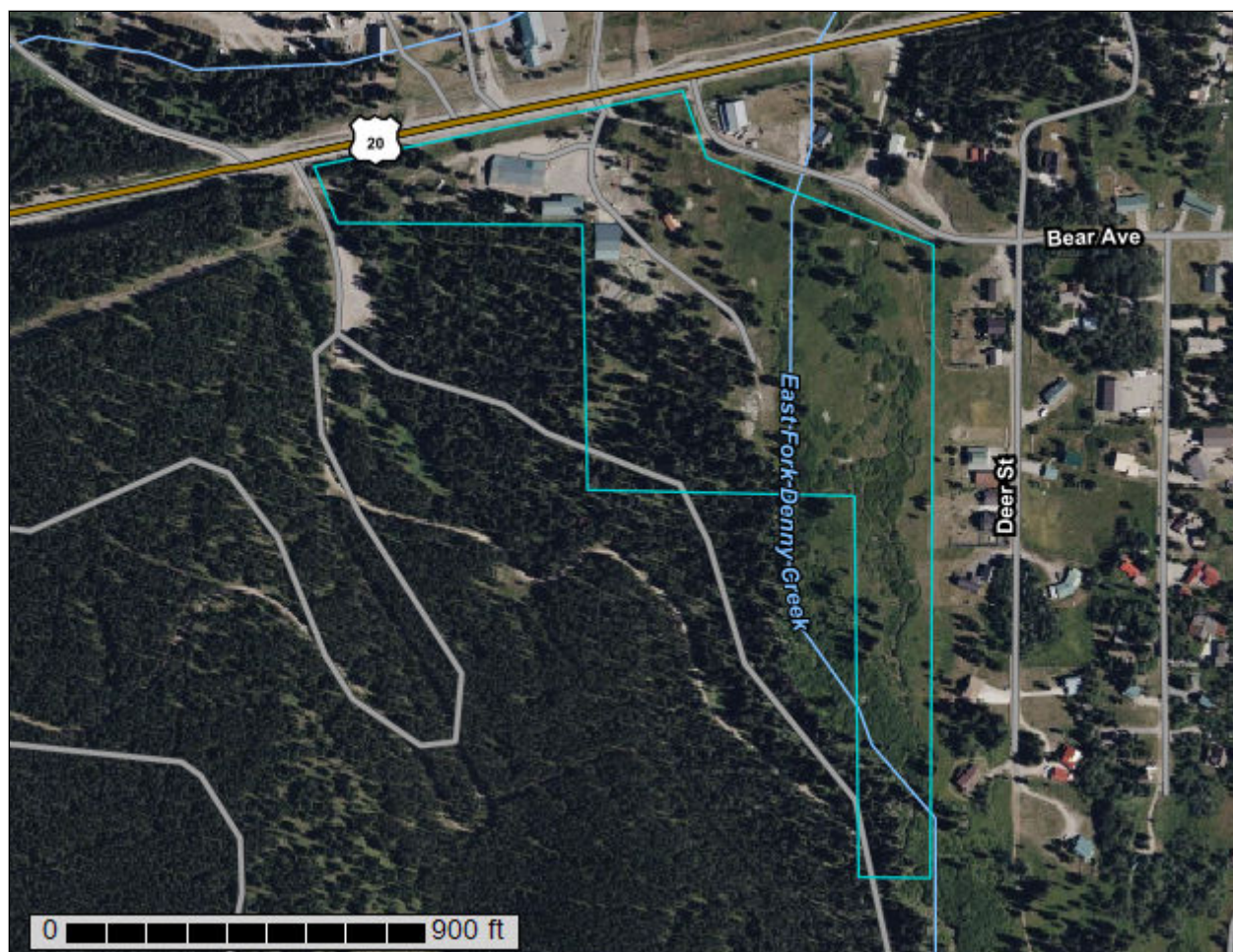
NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Gallatin National Forest Area, Montana

Eagle's Nest



December 3, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface	2
How Soil Surveys Are Made	5
Soil Map	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Gallatin National Forest Area, Montana.....	13
53-3C—Mollic Cryoboralfs, mountain slopes.....	13
66-1A—Cryaquolls and Cryaquents, flood plains.....	14
References	16

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

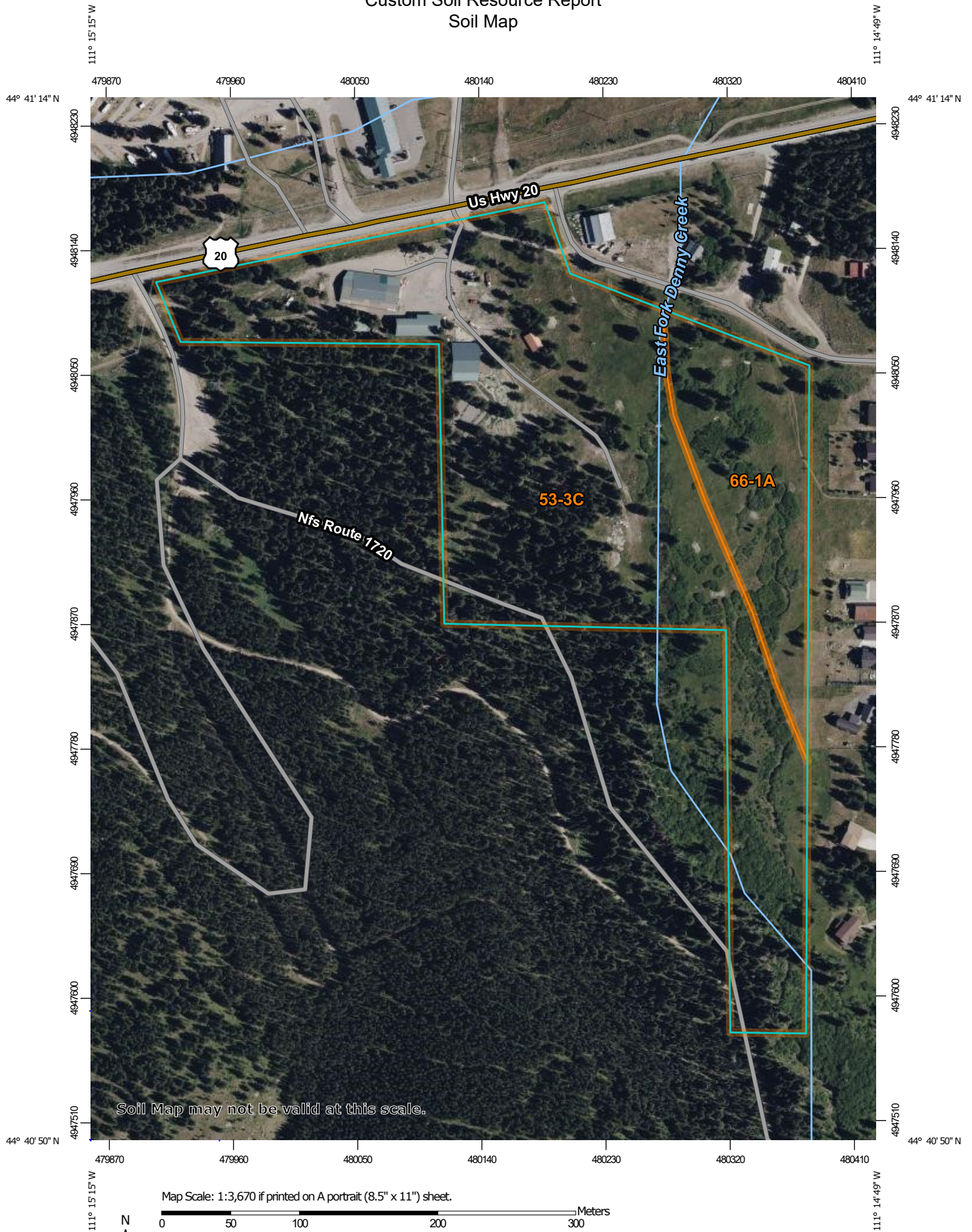
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Gallatin National Forest Area, Montana
Survey Area Data: Version 13, Aug 25, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 22, 2022—Aug 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
53-3C	Mollic Cryoboralfs, mountain slopes	19.3	81.2%
66-1A	Cryaquolls and Cryaquents, flood plains	4.5	18.8%
Totals for Area of Interest		23.8	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Gallatin National Forest Area, Montana

53-3C—Mollic Cryoboralfs, mountain slopes

Map Unit Setting

National map unit symbol: 58kj
Elevation: 6,500 to 7,800 feet
Mean annual precipitation: 20 to 35 inches
Mean annual air temperature: 34 to 37 degrees F
Frost-free period: 50 to 70 days
Farmland classification: Not prime farmland

Map Unit Composition

Mollic cryoboralfs and similar soils: 80 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mollic Cryoboralfs

Setting

Landform: Hills
Parent material: Loamy colluvium derived from basic volcanic breccia

Properties and qualities

Slope: 10 to 45 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: F043BP909MT - Upland Cold Woodland Group
Other vegetative classification: subalpine fir/twinflower (PK660)
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 5 percent
Other vegetative classification: subalpine fir/twinflower (PK660)

66-1A—Cryaquolls and Cryaquents, flood plains

Map Unit Setting

National map unit symbol: 58l5

Elevation: 6,600 to 8,600 feet

Mean annual precipitation: 20 to 50 inches

Mean annual air temperature: 37 to 41 degrees F

Frost-free period: 30 to 60 days

Farmland classification: Not prime farmland

Map Unit Composition

Cryaquolls and similar soils: 51 percent

Cryaquents and similar soils: 49 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cryaquolls

Setting

Landform: Flood plains

Properties and qualities

Slope: 0 to 10 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 0 to 30 inches

Frequency of flooding: Frequent

Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified

Hydrologic Soil Group: B/D

Ecological site: R043BP801MT - Bottomland Group

Other vegetative classification: deschampsia caespitosa/carex spp. h.t. (MS0501)

Hydric soil rating: Yes

Description of Cryaquents

Setting

Landform: Flood plains

Properties and qualities

Slope: 0 to 10 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 12 to 24 inches

Frequency of flooding: Rare

Custom Soil Resource Report

Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6w

Hydrologic Soil Group: B/D

Ecological site: R043BP801MT - Bottomland Group

Other vegetative classification: deschampsia caespitosa/carex spp. h.t. (MS0501)

Hydric soil rating: Yes

References

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

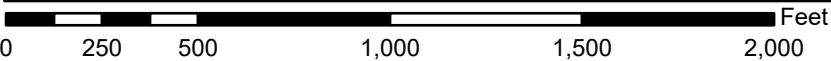
United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

National Flood Hazard Layer FIRMMette



111°15'17"W 44°41'21"N



1:6,000

111°14'40"W 44°40'55"N

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/20/2025 at 4:12 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX E

TEST PITS (PREVIOUS PERMIT #2004002)

Gallatin City-County Health Department -- Environmental Health Services

Confirmation Report: Site Evaluation Notes

Confirmation #: 2004239.01 Purpose: Public System
Legal Description: 1/4 S1/2 1/4 Section 21 T 13 R 4E
Property Owner: Baxter, Gary
Property Address: 1630 Targhee Pass Highway
Subdivision: Lot
Site Evaluator: Odt, David Map Received: ☐

Date of Site Evaluation: 08/30/2004 Time of Site Evaluation: 1:00 PM

Comments: Targhee Fun Center
(If any)

Key in our file - is that for the water supply system. Can Dave pick that up on Monday morning or would somebody bring it with them so he can get a sample and do a pump test. Please call Dave.(TS)

8/26/04 CC & BW to meet with Dave for SE; we will bring the key as GCCHD has custody of the key. (BW)

FIELD NOTES Sanitarian On Site: woodbury/Cox

TH #1

0-12" top soil; loam/silt loam

12-36" loam/silt loam

36-102" sandy clay loam; ~10% gravels

rusty spots in the soil likely due to the type of soil, not true mottling

roots to about 46"

TH#2

0-10" topsoil

30-48" loam/silt loam with about 20-30% gravels and cobbles

48-105" sandy clay

roots to about 46"

TH#3

0-10" topsoil

10-24" silt loam

24-96" sandy clay loam

system that has been installed has 4 laterals ~75' long
will need a D-box, as input to manifold is not centered
will need to determine approx. flows expected from the operation (CC to be working on that issue as she does the plan review for the facility)
A grease trap will be needed inside the facility
Current tank is fiberglass or plastic 1250 gal capacity

Gallatin City-County Health Department -- Environmental Health Services

Confirmation Report: Site Evaluation Notes

Confirmation #: 2004239.01 **Purpose:** Public System

Legal Description: 1/4 S^{1/2} 1/4 Section 21 T 13 R 4E

the well servicing the Fun Center also serves the rental center.

Note: this public system was given state approval without any soils work being submitted, so owners/GCCHD are back tracking to get this system properly sized, etc.

Denny Creek about 300-400 feet to the south. The location of the drainfield is much higher in elevation than the creek and there did not seem to be any indicators of problems from high ground water or flooding.

Client: Targhee Fun Center
Perc Test 1

Budget Septic Design
221 S. 3rd : Bozeman, MT 59715
406-585-2687

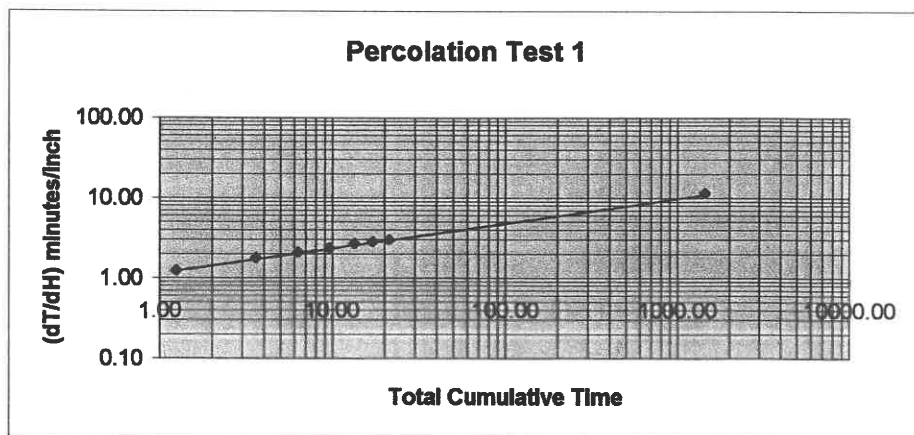
24" deep 8/30/2004

Test # 1	Time Start	Time End	Fill Time	Drop Time	Total Time	Total Drop	dT/dH
1	12:36:40	12:37:55	0:00:30	1.25	1.25	1	1.25
2	12:38:25	12:40:45	0:00:20	2.33	3.58	2	1.79
3	12:41:05	12:43:50	0:00:30	2.75	6.33	3	2.11
4	12:44:20	12:47:35	0:00:25	3.25	9.58	4	2.40
5	12:48:00	12:51:55	0:00:30	3.92	13.50	5	2.70
6	12:52:25	12:56:00	0:00:50	3.58	17.08	6	2.85
7	12:56:50	1:01:05		4.25	21.33	7	3.05

Mathematical computation of expected perc rate at 1440 minutes

Total Time	Log Total Time	dT/dH	Log dT/dH
1.25	0.096910013	1.25	0.09691
3.58	0.553883027	1.79	0.252853
6.33	0.80140371	2.11	0.3242825
9.58	0.981365509	2.40	0.3793055
13.50	1.130226522	2.70	0.4312565
17.08	1.232487866	2.85	0.4543366
21.33	1.328990855	3.05	0.4838928
1440	3.158362492	11.5	1.06089

24" deep 12 minutes/inch forecast at 1440 minutes



Soil Profile Log

Project: Targhee Fun Center
Recorded By: Odt

Location: Sec 21, T13S, R4E
Date: 08/30/04

Hole 1

Horizon	Depth	Thickness	Color	Texture	Structure	Consistence	Roots	Reaction
A	0-9"	9"	Med Bm	Silt Loam	Blocky	V Fri	Many	No
B	9-29"	20"	Light Tan-Bm	Silt Loam	Blocky	V Fri	Some	No
C	29-138"	75"	Med-Dk Bm	Sandy Clay Loam w/10% P-C*	Blocky	V Fri	Few to 46"	No
				Comments: No groundwater, limit layers or redoxomorphic features *P-C denotes rounded pebble- to cobble-sized clasts Hole deepened to 11.5' on 10-14-04; no groundwater observed.				
				Slope: 5% NE Vegetation: Grass Parent Material: Loess, Alluvial Excavator: Baxter				

David Odt, Site Evaluator

Budget Septic Design
220 S. 3rd : Bozeman, MT 59715
406-585-2686

Particle Size Analysis- Test 1
(soil fraction passing a 2.00 mm sieve)

Owner Name: Targhee Fun Center
Project: Public WWTS

Date: 9/28/04

Test Number: 1
Date of Test 09/28/04

Data:

Time	Decimal % Reading**
40 sec (#1)	33.5
40 sec (#2)	33.5
40 sec (#3)	33.5
40 sec (avg)	33.5
2 hr	7.5

(**Grams of Colloid in suspension)

Calculations:

40 sec equation= (40 sec reading*)/50= 70 %silt+clay
2 hr equation= (2 hr reading*)/50= 13 %clay
(*compensated for (NaPO₃)₆ and temperature)

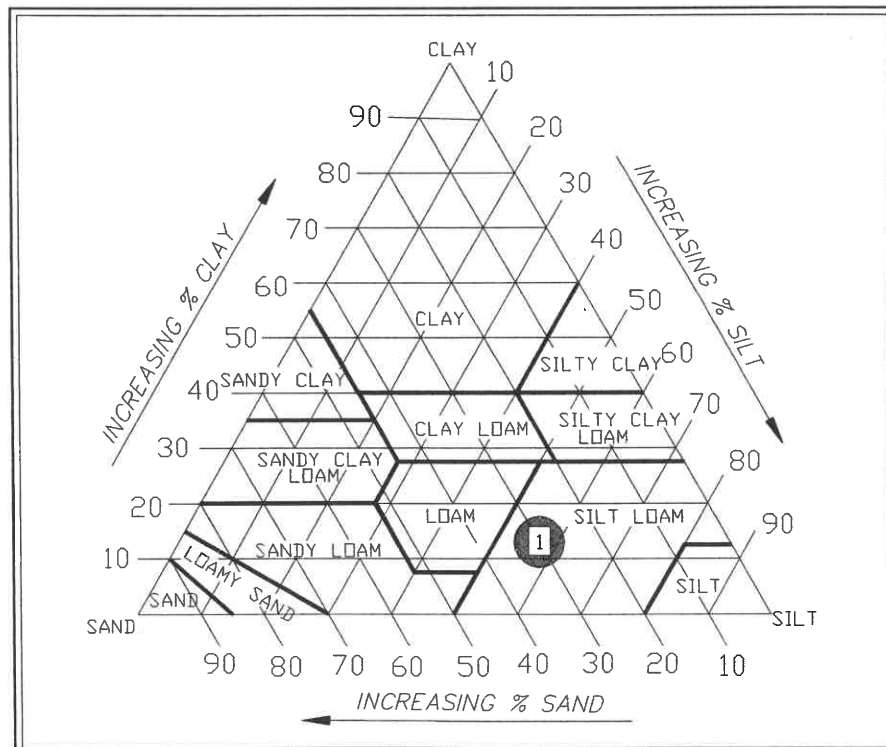
Percentages

% Sand = 30
% Silt = 57
% Clay = 13

The above test was conducted as a variation of the MSU Soils Testing Lab and
MSU Soil Sciences Lab manual methods of the Bouyoucos hydrometer method.

David Odt

Signature of person supervising/conducting tests:



Client: Targhee Fun Center
Perc Test 2

Budget Septic Design
221 S. 3rd : Bozeman, MT 59715
406-585-2687

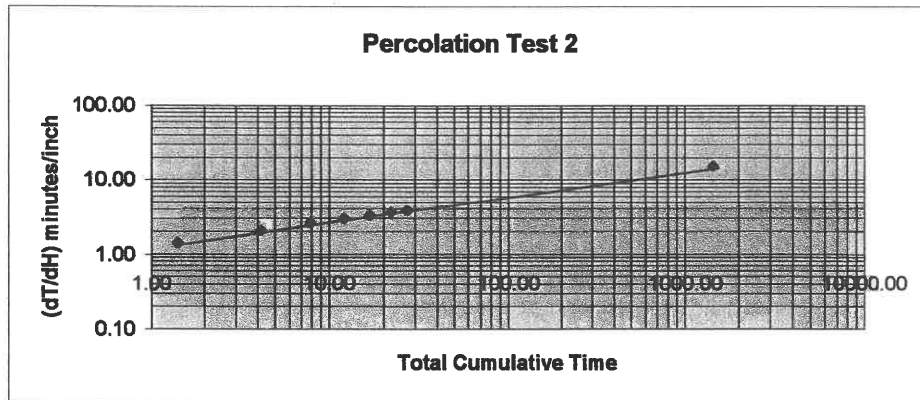
24" deep 8/30/2004

Test # 2	Time Start	Time End	Fill Time	Drop Time	Total Time	Total Drop	dT/dH
1	2:19:35	2:21:00	0:00:30	1.42	1.42	1	1.42
2	2:21:30	2:24:15	0:00:35	2.75	4.17	2	2.08
3	2:24:50	2:28:30	0:00:40	3.67	7.84	3	2.61
4	2:29:10	2:33:35	0:00:35	4.25	12.09	4	3.02
5	2:34:10	2:38:50	0:00:40	4.67	16.76	5	3.35
6	2:39:30	2:44:40	0:00:35	5.17	21.92	6	3.65
7	2:45:15	2:50:30		5.25	27.17	7	3.88

Mathematical computation of expected perc rate at 1440 minutes

Total Time	Log Total Time	dT/dH	Log dT/dH
1.42	0.151267675	1.42	0.15126768
4.17	0.619788758	2.08	0.31875876
7.84	0.894131374	2.61	0.41701012
12.09	1.082306545	3.02	0.48024655
16.76	1.224187631	3.35	0.52521763
21.92	1.340906587	3.65	0.56275534
27.17	1.434142916	3.88	0.58904488
1440	3.158362492	15.4	1.18732

24" deep 15 minutes/inch forecast at 1440 minutes



Soil Profile Log

Project: Targhee Fun Center
Recorded By: Odt

Location: Sec 21, T13S, R4E
Date: 08/30/04

Hole 2

Horizon	Depth	Thickness	Color	Texture	Structure	Consistence	Roots	Reaction
A	0-10"	10"	Med Bm	Silt Loam	Blocky	V Fri	Many	No
B	10-33"	23"	Light Tan-Bm	Silt Loam	Blocky	V Fri	Some	No
C	33-105"	72"	Med-Dk Bm	Sandy Clay/Sandy Clay Loam w/10% P-C*	Blocky	V Fri	Few to 48"	No
Comments: No groundwater, limit layers or redoxomorphic features *P-C denotes rounded pebble- to cobble-sized clasts						Slope: 5% NE Vegetation: Grass Parent Material: Loess, Alluvial Excavator: Baxter		

David Odt, Site Evaluator

Budget Septic Design
220 S. 3rd : Bozeman, MT 59715
406-585-2686

Particle Size Analysis- Test 2
(soil fraction passing a 2.00 mm sieve)

Owner Name: Targhee Fun Center
Project: Public WWTS

Date: 9/28/04

Test Number: 2
Date of Test 09/28/04

Data:

Time	Decimal % Reading**
40 sec (#1)	39.0
40 sec (#2)	39.0
40 sec (#3)	39.0
40 sec (avg)	39.0
2 hr	8.0

(**Grams of Colloid in suspension)

Calculations:

40 sec equation= (40 sec reading*)/50= 76 %silt+clay
2 hr equation= (2 hr reading*)/50= 12 %clay

(*compensated for (NaPO3)6 and temperature)

Percentages

% Sand = 24

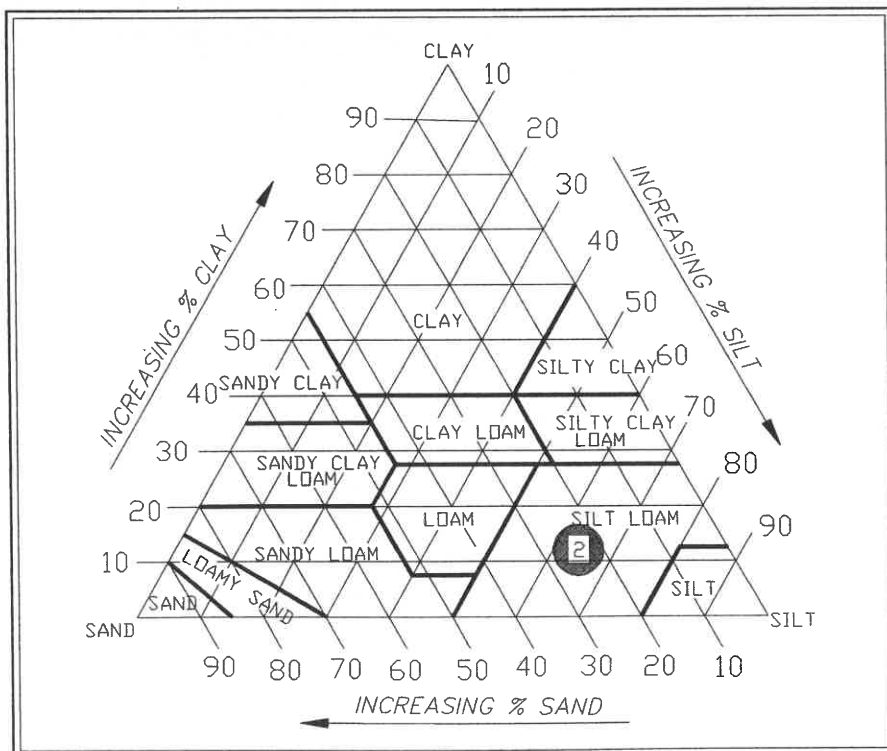
% Silt = 64

% Clay = 12

The above test was conducted as a variation of the MSU Soils Testing Lab and
MSU Soil Sciences Lab manual methods of the Bouyoucos hydrometer method.

David Odt

Signature of person supervising/conducting tests:



Client: Targhee Fun Center
Perc Test 3

Budget Septic Design
221 S. 3rd : Bozeman, MT 59715
406-585-2687

21" deep 8/30/2004

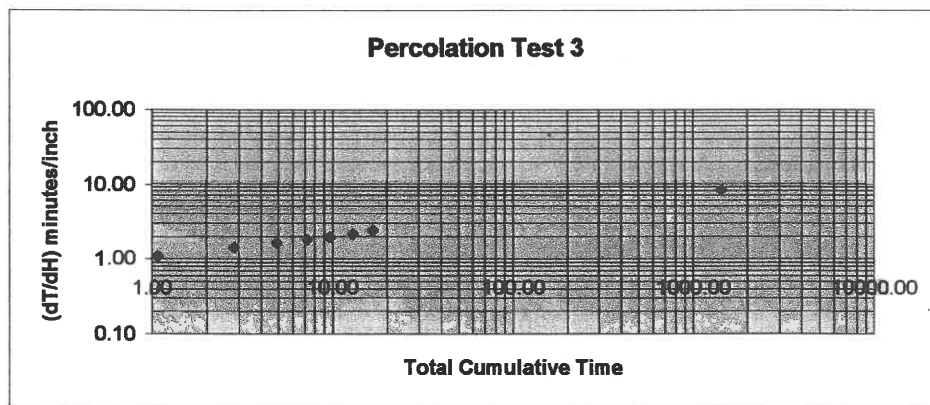
Test # 3	Time Start	Time End	Fill Time	Drop Time	Total Time	Total Drop	dT/dH
1	3:06:40	3:07:45	0:00:30	1.08	1.08	1	1.08
2	3:08:15	3:10:00	0:00:30	1.75	2.83	2	1.42
3	3:10:30	3:12:35	0:00:30	2.08	4.91	3	1.64
4	3:13:05	3:15:25	0:00:45	2.33	7.24	4	1.81
5	3:16:10	3:18:40	0:00:25	2.50	9.74	5	1.95
6	3:19:05	3:22:20	0:01:00	3.25	12.99	6	2.17
7	3:23:20	3:27:05		3.75	16.74	7	2.39

Mathematical computation of expected perc rate at 1440 minutes

Total Time	Log Total Time	dT/dH	Log dT/dH
1.08	0.034762106	1.08	0.03476211
2.83	0.452297671	1.42	0.15126768
4.91	0.691376229	1.64	0.21425497
7.24	0.859938472	1.81	0.25787848
9.74	0.988707561	1.95	0.28973756
12.99	1.11372058	2.17	0.33556933
16.74	1.223841923	2.39	0.37874388
1440	3.158362492	8.1	0.91097

OK TO
8.17

21" deep 8 minutes/inch forecast at 1440 minutes



Soil Profile Log

Project: Targhee Fun Center
Recorded By: Odt

Location: Sec 21, T13S, R4E
Date: 08/30/04

Hole 3

Horizon	Depth	Thickness	Color	Texture	Structure	Consistence	Roots	Reaction
A	0-8"	8"	Med Brn	Silt Loam	Blocky	V Fri	Many	No
B	8-27"	21"	Light Tan-Brn	Silt Loam	Blocky	V Fri	Some	No
C	27-98"	69"	Med-Dk Brn	Sandy Clay/Sandy Clay Loam w/10% P-C*	Blocky	Plastic	Few to 50"	No
Comments: No groundwater, limit layers or redoxomorphic features *P-C denotes rounded pebble- to cobble-sized clasts					Slope: 5% NE Vegetation: Grass Parent Material: Loess, Alluvial Excavator: Baxter			

David Odt, Site Evaluator

Budget Septic Design
220 S. 3rd : Bozeman, MT 59715
406-585-2686

Particle Size Analysis- Test 3
(soil fraction passing a 2.00 mm sieve)

Owner Name: Targhee Fun Center
Project: Public WWTS

Date: 10/18/04

Test Number: 3
Date of Test: 10/18/04

Data:

Time	Decimal % Reading**
40 sec (#1)	38.5
40 sec (#2)	38.5
40 sec (#3)	38.5
40 sec (avg)	38.5
2 hr	7.5

(**Grams of Colloid in suspension)

Calculations:

40 sec equation = $(40 \text{ sec reading})/50 = 75 \text{ \% silt+clay}$
2 hr equation = $(2 \text{ hr reading})/50 = 11 \text{ \% clay}$
(*compensated for $(\text{NaPO}_3)_6$ and temperature)

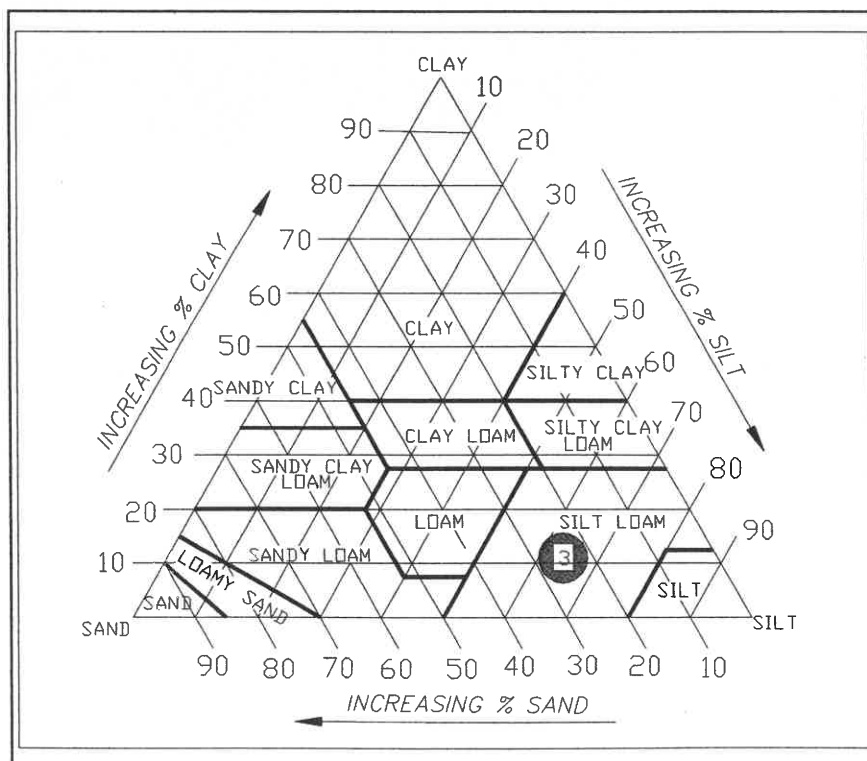
Percentages

% Sand = 25
% Silt = 64
% Clay = 11

The above test was conducted as a variation of the MSU Soils Testing Lab and
MSU Soil Sciences Lab manual methods of the Bouyoucos hydrometer method.



Signature of person supervising/conducting tests:



APPENDIX E

TEST PITS (WET)

Test Pit Characterization: Definitions, Abbreviations & Procedures (Use with Work Sheet for Recording Soil Properties in the Field)

Depth							
measured in inches.							
Color and moist/dry							
use Munsell Color Chart, color name and number.							
Structure							
Grade-Structureless Soils							
m	sg	1	2	3			
massive (no formation of structure type)	single grain (no aggregation, soil is in individual particles that will	weak (units barely observable in place, much material is unaggregated)	moderate (units easily observable in place)	strong (units are distinctly visible in place, nearly the entire mass consists			
Size							
vf	f	m	c	vc			
very fine	fine	medium	coarse	very coarse			
Shape							
gr	pl	pr	abk	sbk			
granular (small, non-porous clusters of soil particles with irregular, rounded surfaces)	platy (clusters of soil particles consisting of thin sheets)	prismatic (pillar-shaped clusters of soil particles, the pillar is longer than wide and has a flat top)	angular blocky (a cube shaped cluster of soil particles with prominent edges)	subangular blocky (a cube shaped cluster of soil particles with rounded edges)			
Gravel							
Indicate the approximate volume percentage of gravel in the soil sample. See Table 2 for terms for rock fragments.							
Consistence							
Dry							
lo	so	sh	h	vh	eh		
loose (noncoherent, such as grains of a sand dune)	soft (easily fails to powder or single grain, with very slight force between thumb and forefinger)	slightly hard (easily fails under slight force between thumb and forefinger)	hard (fails in the hands without difficulty; requires strong force to fail between thumb and forefinger)	very hard (fails in hands with difficulty, but not between thumb and forefinger)	extremely hard (cannot be failed in hands)		
Moist							
lo	vfr	fr	fi	vfi	efi		
loose (noncoherent, such as grains of a sand dune)	soft (easily fails to powder or single grain, with very slight force between thumb and forefinger)	slightly hard (easily fails under slight force between thumb and forefinger)	hard (fails in the hands without difficulty; requires strong force to fail between thumb and forefinger)	very hard (fails in hands with difficulty, but not between thumb and forefinger)	extremely hard (cannot be failed in hands)		
Wet							
so	ss	s	vs	po	ps	p	vp
nonsticky (practically no adherence to thumb and forefinger when pressure released)	slightly sticky (after release of pressure, soil adheres to both thumb and forefinger but comes off one or the other rather cleanly, doesn't appreciably stretch)	sticky (after release of pressure, soil adheres to both thumb and forefinger and tends to stretch somewhat before pulling apart from either digit)	very sticky (after release of pressure, soil adheres strongly to both digits and is markedly stretched when they are separated)	nonplastic (no roll can be formed)	slightly plastic (a roll 4 cm long and 6 mm thick can be formed and, if held on end, will support its own weight. A 4-mm thick roll will not support its own weight. The roll is easily deformed and broken)	plastic (a roll 4 cm long and 4 mm thick can be formed and support its own weight. A 2-mm-thick roll will not support its own weight)	very plastic (a roll 4 cm long and 2 mm thick can be formed and support its own weight. The roll is readily bent into a half or full circle)
Texture							
GS, VCS	LS, CS	MS, SL	FSL, L, SiL	VFS, SCL	CL, SiCL	SC, C, SiC	
Gravelly sand, very coarse sand	Loamy sand, coarse sand	Medium sand, sandy loam	Fine sandy loam, loam, silt loam	Very fine sand, sandy clay loam	Clay loam, silty clay loam	Sandy clay, clay, silty clay loam	
Boundaries							
Sharpness							
a	c	g	d				
abrupt (boundary less than 2 cm thick)	clear (boundary 2 to 5 cm thick)	gradual (boundary 5 to 15 cm thick)	diffuse (boundary more than 15 cm thick)				
Topography							
s	w	i	b				
smooth (the boundary is in a plane with few or no irregularities)	wavy (the boundary has undulations in which depressions are wider than they are deep)	irregular (the boundary has pockets that are deeper than they are wide)	broken (one or both of the horizons or layers separated by the boundary are discontinuous and the boundary is interrupted)				
Notes							
Caliche • Iron staining • Shape of rocks							


Location: TNelsonM01

Test Pit No.: 1

Date: 10/3/22

Time: 11:38

Parent Material: Sandstone, Loamy Colluv ☒ **Vegetation:** native grasses/trees

Application Rate: 0.4


Described by: A, Flammond

Reviewed by:

Depth (in)	In Situ Consistence		Color	Structure			Gravel %	Consistence			Texture	Boundaries		Notes
	Moist	Dry		Grade	Size	Shape		Dry	Moist	Wet		Sharpness	Topography	
0' - 0.8'	☐	☐										c		Topsoil
0.8' - 2.7'	☒	☐	10YR 5/3	1	vf	gr	0		fr	ss	SCL	a	i	1"-2" sandstone rock
2.7' - 6.1'	☒	☐	10YR 4/3	1	f	abk	25		fr	ss	L	a	i	3"-6" sandstone rock
6.1' - 8.8'	☒	☐	10YR 3/3	1	m	abk	50-75		fr	so	LS	a	i	6"-24" sandstone rock
	☐	☐												

Evidence of Ground Water? ☐ Yes ☒ No **Depth:**_____

Limiting Layer Present? ☐ Yes ☒ No **Depth:**_____

Test Pit Characterization: Definitions, Abbreviations & Procedures (Use with Work Sheet for Recording Soil Properties in the Field)

Depth							
measured in inches.							
Color and moist/dry							
use Munsell Color Chart, color name and number.							
Structure							
Grade-Structureless Soils							
m	sg	1	2	3			
massive (no formation of structure type)	single grain (no aggregation, soil is in individual particles that will	weak (units barely observable in place, much material is unaggregated)	moderate (units easily observable in place)	strong (units are distinctly visible in place, nearly the entire mass consists			
Size							
vf	f	m	c	vc			
very fine	fine	medium	coarse	very coarse			
Shape							
gr	pl	pr	abk	sbk			
granular (small, non-porous clusters of soil particles with irregular, rounded surfaces)	platy (clusters of soil particles consisting of thin sheets)	prismatic (pillar-shaped clusters of soil particles, the pillar is longer than wide and has a flat top)	angular blocky (a cube shaped cluster of soil particles with prominent edges)	subangular blocky (a cube shaped cluster of soil particles with rounded edges)			
Gravel							
Indicate the approximate volume percentage of gravel in the soil sample. See Table 2 for terms for rock fragments.							
Consistence							
Dry							
lo	so	sh	h	vh	eh		
loose (noncoherent, such as grains of a sand dune)	soft (easily fails to powder or single grain, with very slight force between thumb and forefinger)	slightly hard (easily fails under slight force between thumb and forefinger)	hard (fails in the hands without difficulty; requires strong force to fail between thumb and forefinger)	very hard (fails in hands with difficulty, but not between thumb and forefinger)	extremely hard (cannot be failed in hands)		
Moist							
lo	vfr	fr	fi	vfi	efi		
loose (noncoherent, such as grains of a sand dune)	soft (easily fails to powder or single grain, with very slight force between thumb and forefinger)	slightly hard (easily fails under slight force between thumb and forefinger)	hard (fails in the hands without difficulty; requires strong force to fail between thumb and forefinger)	very hard (fails in hands with difficulty, but not between thumb and forefinger)	extremely hard (cannot be failed in hands)		
Wet							
so	ss	s	vs	po	ps	p	vp
nonsticky (practically no adherence to thumb and forefinger when pressure released)	slightly sticky (after release of pressure, soil adheres to both thumb and forefinger but comes off one or the other rather cleanly, doesn't appreciably stretch)	sticky (after release of pressure, soil adheres to both thumb and forefinger and tends to stretch somewhat before pulling apart from either digit)	very sticky (after release of pressure, soil adheres strongly to both digits and is markedly stretched when they are separated)	nonplastic (no roll can be formed)	slightly plastic (a roll 4 cm long and 6 mm thick can be formed and, if held on end, will support its own weight. A 4-mm thick roll will not support its own weight. The roll is easily deformed and broken)	plastic (a roll 4 cm long and 4 mm thick can be formed and support its own weight. A 2-mm-thick roll will not support its own weight)	very plastic (a roll 4 cm long and 2 mm thick can be formed and support its own weight. The roll is readily bent into a half or full circle)
Texture							
GS, VCS	LS, CS	MS, SL	FSL, L, SiL	VFS, SCL	CL, SiCL	SC, C, SiC	
Gravelly sand, very coarse sand	Loamy sand, coarse sand	Medium sand, sandy loam	Fine sandy loam, loam, silt loam	Very fine sand, sandy clay loam	Clay loam, silty clay loam	Sandy clay, clay, silty clay loam	
Boundaries							
Sharpness							
a	c	g	d				
abrupt (boundary less than 2 cm thick)	clear (boundary 2 to 5 cm thick)	gradual (boundary 5 to 15 cm thick)	diffuse (boundary more than 15 cm thick)				
Topography							
s	w	i	b				
smooth (the boundary is in a plane with few or no irregularities)	wavy (the boundary has undulations in which depressions are wider than they are deep)	irregular (the boundary has pockets that are deeper than they are wide)	broken (one or both of the horizons or layers separated by the boundary are discontinuous and the boundary is interrupted)				
Notes							
Caliche • Iron staining • Shape of rocks							


Location: TNelsonM01

Test Pit No.: 2

Date: 10/3/22

Time: 12:00

Parent Material: Sandstone, Loamy Colluvium **Vegetation:** native grasses, nearby stream

Application Rate: 0.5


Described by: A, Flammond

Reviewed by:

Depth (in)	In Situ Consistence		Color	Structure			Gravel %	Consistence			Texture	Boundaries		Notes
	Moist	Dry		Grade	Size	Shape		Dry	Moist	Wet		Sharpness	Topography	
0' - 0.3'	☐	☐										a	s	Topsoil
0.3' - 3.9'	☒	☐	7.5YR 3/2	1	f	gr	<10		fr	ss	L	a	w	
3.9' - 7.3'	☒	☐	7.5YR 4/3	2	m	abk	25-50		fi	so	SL	a	i	
7.3' - 9.5'	☒	☐	5YR 4/4	1	vf	gr	10		vfr	so	LS			
	☐	☐												

Evidence of Ground Water? ☐ Yes ☒ No **Depth:**_____

Limiting Layer Present? ☐ Yes ☒ No **Depth:**_____

Test Pit Characterization: Definitions, Abbreviations & Procedures (Use with Work Sheet for Recording Soil Properties in the Field)

Depth							
measured in inches.							
Color and moist/dry							
use Munsell Color Chart, color name and number.							
Structure							
Grade-Structureless Soils							
m	sg	1	2	3			
massive (no formation of structure type)	single grain (no aggregation, soil is in individual particles that will	weak (units barely observable in place, much material is unaggregated)	moderate (units easily observable in place)	strong (units are distinctly visible in place, nearly the entire mass consists			
Size							
vf	f	m	c	vc			
very fine	fine	medium	coarse	very coarse			
Shape							
gr	pl	pr	abk	sbk			
granular (small, non-porous clusters of soil particles with irregular, rounded surfaces)	platy (clusters of soil particles consisting of thin sheets)	prismatic (pillar-shaped clusters of soil particles, the pillar is longer than wide and has a flat top)	angular blocky (a cube shaped cluster of soil particles with prominent edges)	subangular blocky (a cube shaped cluster of soil particles with rounded edges)			
Gravel							
Indicate the approximate volume percentage of gravel in the soil sample. See Table 2 for terms for rock fragments.							
Consistence							
Dry							
lo	so	sh	h	vh	eh		
loose (noncoherent, such as grains of a sand dune)	soft (easily fails to powder or single grain, with very slight force between thumb and forefinger)	slightly hard (easily fails under slight force between thumb and forefinger)	hard (fails in the hands without difficulty; requires strong force to fail between thumb and forefinger)	very hard (fails in hands with difficulty, but not between thumb and forefinger)	extremely hard (cannot be failed in hands)		
Moist							
lo	vfr	fr	fi	vfi	efi		
loose (noncoherent, such as grains of a sand dune)	soft (easily fails to powder or single grain, with very slight force between thumb and forefinger)	slightly hard (easily fails under slight force between thumb and forefinger)	hard (fails in the hands without difficulty; requires strong force to fail between thumb and forefinger)	very hard (fails in hands with difficulty, but not between thumb and forefinger)	extremely hard (cannot be failed in hands)		
Wet							
so	ss	s	vs	po	ps	p	vp
nonsticky (practically no adherence to thumb and forefinger when pressure released)	slightly sticky (after release of pressure, soil adheres to both thumb and forefinger but comes off one or the other rather cleanly, doesn't appreciably stretch)	sticky (after release of pressure, soil adheres to both thumb and forefinger and tends to stretch somewhat before pulling apart from either digit)	very sticky (after release of pressure, soil adheres strongly to both digits and is markedly stretched when they are separated)	nonplastic (no roll can be formed)	slightly plastic (a roll 4 cm long and 6 mm thick can be formed and, if held on end, will support its own weight. A 4-mm thick roll will not support its own weight. The roll is easily deformed and broken)	plastic (a roll 4 cm long and 4 mm thick can be formed and support its own weight. A 2-mm-thick roll will not support its own weight)	very plastic (a roll 4 cm long and 2 mm thick can be formed and support its own weight. The roll is readily bent into a half or full circle)
Texture							
GS, VCS	LS, CS	MS, SL	FSL, L, SiL	VFS, SCL	CL, SiCL	SC, C, SiC	
Gravelly sand, very coarse sand	Loamy sand, coarse sand	Medium sand, sandy loam	Fine sandy loam, loam, silt loam	Very fine sand, sandy clay loam	Clay loam, silty clay loam	Sandy clay, clay, silty clay loam	
Boundaries							
Sharpness							
a	c	g	d				
abrupt (boundary less than 2 cm thick)	clear (boundary 2 to 5 cm thick)	gradual (boundary 5 to 15 cm thick)	diffuse (boundary more than 15 cm thick)				
Topography							
s	w	i	b				
smooth (the boundary is in a plane with few or no irregularities)	wavy (the boundary has undulations in which depressions are wider than they are deep)	irregular (the boundary has pockets that are deeper than they are wide)	broken (one or both of the horizons or layers separated by the boundary are discontinuous and the boundary is interrupted)				
Notes							
Caliche • Iron staining • Shape of rocks							

Location: TNelsonM01

Test Pit No.: 3

Date: 10/3/22

Time: 12:48

Parent Material:
Vegetation: native grasses, nearby stream

Application Rate:


Described by: A, Flammond

Reviewed by:

Test pit is located near surface water and the purpose of this location was to check for signs of high groundwater next to surface water. Soil type and application rate was not assigned.

Depth (in)	In Situ Consistence		Color	Structure			Gravel %	Consistence			Texture	Boundaries		Notes
	Moist	Dry		Grade	Size	Shape		Dry	Moist	Wet		Sharpness	Topography	
0' - 1.5'	☐	☐										g	s	Topsoil
1.5' - 4.7'	☒	☐	10YR 3/2	2	f	gr	<10		fi	s		a	w	
4.7' - 8.5'	☒	☐	10YR 3/3	1	m	gr	25		fr	ss				
	☐	☐												
	☐	☐												

 Evidence of Ground Water? ☐ Yes ☒ No Depth: _____

 Limiting Layer Present? ☐ Yes ☒ No Depth: _____

M:\Tnelson\01\CAD\CIVIL\MC-BM01-TNELSONM01.dwg PLOT DATE 2022-9-30 16:03 USER: aflammond



© 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) D

PRELIMINARY
NOT FOR CONSTRUCTION



Water & Environmental
TECHNOLOGIES
118 East 7th Street
Anaconda, MT 59711
(406) 563-7476
waterenvtech.com

PROPOSED TEST PIT LOCATIONS

PROJECT NAME: TONY NELSON DEVELOPMENT
LOCATION: TARGHEE PASS HWY
FILE NO.: MC-BM01-TNELSONM01.dwg

JOB: TNELSONM01
DATE: 9/30/22
DRAFTER: AF
CHECKED BY:

SHEET

C-1

No.	Description	Date	Drawn By

COPYRIGHT 2022
Water & Environmental Technologies PC hereby reserves all copyright in this document and the ideas and designs incorporated herein as an instrument of professional service which shall not be used in whole or part for any other projects or other use without our express written authorization.

APPENDIX E

TEST PITS (MORRISON-MAIERLE)

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET/BP

DATE: 6/18/2024

TEST PIT#: A

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-4"	Black 10YR 2-1	Topsoil		Yes	No	
B	4"-44"	Dark Yellowish Brown 10YR 4-4	Sandy Loam	Fine Granular	Yes (to 42")	No	2cm ribbons, ~20% angular broken rock fragments
C	44"-74"	Brown 10YR 5-3	Silty Clay	Very Fine Granular	No	No	5cm ribbons, ~20% angular broken rock fragments
D	74"-180"	Dark Yellowish Brown 10YR 4-4	Sandy Loam	Fine Granular	No	No	2cm ribbons, ~20% angular broken rock fragments
							Well graded gravel and cobble in horizons B & C

Seasonal Groundwater present?

Depth:

Est. Depth to Limiting Layer or Bedrock:

Approx. Distance to Neighboring wells:

Approx. Distance to Neighboring Absorption Fields:

Approx. Distance to Nearby Open Water/Stream:

Slope in excess of 4:1 (25%) ?

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET/BP

DATE: 6/18/2024

TEST PIT#: B

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-8"	Black 10YR 2-1	Topsoil		Yes	No	
B	8"-38"	Dark Yellowish Brown 10YR 4-4	Sandy Clay	Very Fine Granular	Yes (to 28")	No	5cm ribbons
C	38"-180"	Dark Yellowish Brown 10YR 3-4	Sandy Clay	Very Fine Granular	No	No	5cm ribbons
							well graded large angular rock at >70"

Seasonal Groundwater present?

Depth:

Est. Depth to Limiting Layer or Bedrock:

Approx. Distance to Neighboring wells:

Approx. Distance to Neighboring Absorption Fields:

Approx. Distance to Nearby Open Water/Stream:

Slope in excess of 4:1 (25%) ?

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET/BP

DATE: 6/18/2024

TEST PIT#: C

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-8"	Black 10YR 2-1	Topsoil		Yes	No	
B	8"-72"	Dark Yellowish Brown 10YR 3-4	Sandy Clay	Very Fine Granular	Yes (to 48")	No	5cm ribbons, well graded large angular rock
C	72"-180"	Redish Brown 5YR 3-4	Sandy Clay	Very Fine Granular	No	No	5cm ribbons, well graded large angular rock

Seasonal Groundwater present?

Yes

Depth:

120"

Est. Depth to Limiting Layer or Bedrock:

120"

Approx. Distance to Neighboring wells:

~640'

Approx. Distance to Neighboring Absorption Fields:

~930'

Approx. Distance to Nearby Open Water/Stream:

~450'

Slope in excess of 4:1 (25%) ?

No

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET/BP

DATE: 6/18/2024

TEST PIT#: D

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-8"	Black 10YR 2-1	Topsoil		Yes	No	
B	8"-72"	Dark Yellowish Brown 10YR 3-6	Sandy Clay	Very Fine Granular	Yes (to 48")	No	5cm ribbons, well graded large angular rock
C	72"-186"	Yellowish Red 5YR 4-6	Sandy Loam	Very Fine Granular	No	No	5cm ribbons, well graded large angular rock

Seasonal Groundwater present?

Depth:

Est. Depth to Limiting Layer or Bedrock:

Approx. Distance to Neighboring wells:

Approx. Distance to Neighboring Absorption Fields:

Approx. Distance to Nearby Open Water/Stream:

Slope in excess of 4:1 (25%) ?

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET

DATE: 7/10/2024

TEST PIT#: E

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-10"	Black 10YR 2-1	Topsoil	Fine Granular	Yes	No	
B	10"-30"	Very Dark Grayish Brown 10YR 3-2	Sandy Clay Loam	Fine Granular	Yes	No	<5cm ribbons
C	30"-60"	Very Dark Brown 10YR 2-2	Sandy Clay Loam	Fine Granular	Yes	No	<5cm ribbons, <15% small gravel
D	60"-180"	Dark Yellowish Brown 10YR 3-6	Sandy Clay	Fine Granular	Yes (to 70")	No	<30% fine gravelly

Seasonal Groundwater present?

No

Est. Depth to Limiting Layer or Bedrock:

Depth: >180"

Approx. Distance to Neighboring wells:

>180"

Approx. Distance to Neighboring Absorption Fields:

~440'

Approx. Distance to Nearby Open Water/Stream:

~340'

Slope in excess of 4:1 (25%) ?

No

~135'

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET

DATE: 7/10/2024

TEST PIT#: F

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-4"	Black 10YR 2-1	Topsoil	Fine Granular	Yes	No	
B	4"-20"	Dark Yellowish Brown 10YR 4-4	Silty Clay Loam	Fine Granular	Yes	No	5cm ribbons
C	20"-48"	Dark Yellowish Brown 10YR 4-4	Sandy Loam	Fine Granular	Yes	No	2cm ribbons
D	48"-180"	Dark Yellowish Brown 10YR 3-6	Sandy Clay	Fine Granular	Yes (to 70")	No	5cm ribbons

Seasonal Groundwater present?

Depth:

Est. Depth to Limiting Layer or Bedrock:

Approx. Distance to Neighboring wells:

Approx. Distance to Neighboring Absorption Fields:

Approx. Distance to Nearby Open Water/Stream:

Slope in excess of 4:1 (25%) ?

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET

DATE: 7/10/2024

TEST PIT#: G

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-4"	Black 10YR 2-1	Topsoil	Fine Granular	Yes	No	
B	4"-35"	Dark Yellowish Brown 10YR 4-4	Silty Clay Loam	Fine Granular	Yes	No	<5cm ribbons, <15% small gravel
C	35"-180"	Dark Yellowish Brown 10YR 3-6	Sandy Clay Loam	Fine Granular	Yes (to 60")	No	<5cm ribbons, <15% small gravel
							~30% fractured angular rock at >8'

Seasonal Groundwater present?

Depth:

Est. Depth to Limiting Layer or Bedrock:

Approx. Distance to Neighboring wells:

Approx. Distance to Neighboring Absorption Fields:

Approx. Distance to Nearby Open Water/Stream:

Slope in excess of 4:1 (25%) ?

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET

DATE: 7/10/2024

TEST PIT#: H

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-4"	Black 10YR 2-1	Topsoil	Fine Granular	Yes	No	
B	4"-22"	Dark Yellowish Brown 10YR 3-4	Sandy Clay	Fine Granular	Yes	No	>5cm ribbons
C	22"-57"	Dark Yellowish Brown 10YR 3-6	Sandy Clay	Fine Granular	Yes (to 50")	No	>5cm ribbons
D	57"-180"	Dark Brown 10YR 3-3	Sandy Clay	Fine Granular	No	No	>5cm ribbons
							~30% fractured angular rock at >54"

Seasonal Groundwater present?

Est. Depth to Limiting Layer or Bedrock:

Depth:

Approx. Distance to Neighboring wells:

Approx. Distance to Neighboring Absorption Fields:

Approx. Distance to Nearby Open Water/Stream:

Slope in excess of 4:1 (25%) ?

SOIL PROFILE LOG

BACKHOE TEST PIT



JOB #: 10514.001

PROJECT: Eagles Grove

LOCATION: West Yellowstone

EVAL. BY: MET

DATE: 7/10/2024

TEST PIT#: I

HORIZON	DEPTH	COLOR	TEXTURE	STRUCTURE	ROOTS	MOTTLING	NOTES
A	0"-13"		Sand (fill)	Granular	Yes	No	Sand w/ gravel (possible import fill)
B	13"-24"	Very Dark Brown 10YR 2-2	Silty Clay Loam	Fine Granular	Yes	No	<5cm ribbons
C	24"-180"	Dark Yellowish Brown 10YR 4-4	Sandy Clay	Fine Granular	Yes (to 48")	No	>5cm ribbons, <15% small gravel

Seasonal Groundwater present?

Depth:

Est. Depth to Limiting Layer or Bedrock:

Approx. Distance to Neighboring wells:

Approx. Distance to Neighboring Absorption Fields:

Approx. Distance to Nearby Open Water/Stream:

Slope in excess of 4:1 (25%) ?

**MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM**

Owner Name TONY NELSON

Project Name FAWER BROVE (1630 TARIHER PASS Hwy)

Lot of Tract Number _____ Test Number A

Diameter of Test Hole 8" Depth of Test Hole 24"

Date and Time Soak Period Began 7/15/24 at 10:45am Ended 7/16/24 at 8:30am

Date Test Began 7/16/24

Distance of the reference point above the bottom of the hole 7"

Test Results

Start Time of Day	End Time of Day	Time Interval (minutes)	Initial Distance Below Reference Point	Final Distance Below Reference Point	Drop in Water Level (inches)	Percolation Rate (mpi)
8:30am	8:45am	15	0 in.	4 in.	4 in.	
8:45am	9:00am	15	0 in.	3.25 in.	3.25 in.	
9:00am	9:15am	15	0 in.	2.75 in.	2.75 in.	
9:15am	9:30am	15	0 in.	2.75 in.	2.75 in.	
9:30am	9:45am	15	0 in.	2.75 in.	2.75 in.	5.45 mpi

I certify that this percolation test was done by a qualified site evaluator in accordance with DEQ-4 Section 1.2.68 and Appendix A.

Brian Peck  7/17/2024
Name (printed) Signature Date

Morrison-Maierle, Inc.
Company

**MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM**

Owner Name Torrey Nelson

Project Name TABLES GROVE (1630 TARBULEE PASS Hwy)

Lot of Tract Number _____ Test Number B

Diameter of Test Hole 8" Depth of Test Hole 24"

Date and Time Soak Period Began 7/15/24 at 10:45am Ended 7/16/24 at 8:30am

Date Test Began 7/16/24

Distance of the reference point above the bottom of the hole 7"

Test Results

Start Time of Day	End Time of Day	Time Interval (minutes)	Initial Distance Below Reference Point	Final Distance Below Reference Point	Drop in Water Level (inches)	Percolation Rate (mpi)
8:30am	8:45am	15	0 in.	.75 in.	.75 in.	
8:45am	9:00am	15	0 in.	0.5 in.	0.5 in.	
9:00am	9:15am	15	0 in.	.25 in.	.25 in.	
9:15am	9:30am	15	0 in.	.25 in.	.25 in.	
9:30am	9:45am	15	0 in.	.25 in.	.25 in.	60 mpi

I certify that this percolation test was done by a qualified site evaluator in accordance with DEQ-4 Section 1.2.68 and Appendix A.

Brian Peck  7/17/2024
Name (printed) Signature Date

Morrison-Maierle, Inc.
Company

**MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM**

Owner Name Tony Nelson
Project Name EAGLES GROVE (11630 TARDUZZ PASS Hwy)
Lot of Tract Number _____ Test Number H
Diameter of Test Hole 8" Depth of Test Hole 24"
Date and Time Soak Period Began 7/15/24 at 10:45am Ended 7/16/24 at 8:30am
Date Test Began 7/16/24
Distance of the reference point above the bottom of the hole 7"

Test Results

Start Time of Day	End Time of Day	Time Interval (minutes)	Initial Distance Below Reference Point	Final Distance Below Reference Point	Drop in Water Level (inches)	Percolation Rate (mpi)
8:30am	8:45am	15	0 in.	1.5 in.	1.5 in.	
8:45am	9:00am	15	0 in.	1.5 in.	1.5 in.	
9:00am	9:15am	15	0 in.	1.5 in.	1.5 in.	
9:15am	9:30am	15	0 in.	1.5 in.	1.5 in.	
9:30am	9:45am	15	0 in.	1.5 in.	1.5 in.	10 mpi

I certify that this percolation test was done by a qualified site evaluator in accordance with DEQ-4 Section 1.2.68 and Appendix A.

Brian Peck  7/17/2024
Name (printed) Signature Date

Morrison-Maierle, Inc.
Company

**MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM**

Owner Name Tony Nelson
Project Name FABLES GROVE (1630 TARKER PASS Hwy)
Lot of Tract Number _____ Test Number E
Diameter of Test Hole 8" Depth of Test Hole 24"
Date and Time Soak Period Began 7/15/24 at 10:45am Ended 7/16/24 at 8:30am
Date Test Began 7/16/24
Distance of the reference point above the bottom of the hole 6"

Test Results

Start Time of Day	End Time of Day	Time Interval (minutes)	Initial Distance Below Reference Point	Final Distance Below Reference Point	Drop in Water Level (inches)	Percolation Rate (mpi)
8:30am	8:45am	15	0 in.	4 in.	4 in.	
8:45am	9:00am	15	0 in.	4 in.	4 in.	
9:00am	9:15am	15	0 in.	3 in.	3 in.	
9:15am	9:30am	15	0 in.	3.25 in.	3.25 in.	
9:30am	9:45am	15	0 in.	2.5 in.	2.5 in.	
9:45am	10:00am	15	0 in.	2.25 in.	2.25 in.	6.67 mpi

I certify that this percolation test was done by a qualified site evaluator in accordance with DEQ-4 Section 1.2.68 and Appendix A.

Brian Peck  7/17/2024
Name (printed) Signature Date

Morrison-Maierle, Inc.
Company

**MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM**

Owner Name Tony Nelson

Project Name Expos Grove (11030 Tarbuck Pass Hwy)

Lot of Tract Number _____ Test Number F

Diameter of Test Hole 8" Depth of Test Hole 24"

Date and Time Soak Period Began 7/15/24 at 10:45am Ended 7/16/24 at 8:30am

Date Test Began 7/16/24

Distance of the reference point above the bottom of the hole 6"

Test Results

Start Time of Day	End Time of Day	Time Interval (minutes)	Initial Distance Below Reference Point	Final Distance Below Reference Point	Drop in Water Level (inches)	Percolation Rate (mpi)
8:30am	8:45am	15	0 in.	2.5 in.	2.5 in.	
8:45am	9:00am	15	0 in.	3 in.	3 in.	
9:00am	9:15am	15	0 in.	3 in.	3 in.	
9:15am	9:30am	15	0 in.	2.25 in.	2.25 in.	
9:30am	9:45am	15	0 in.	2 in.	2 in.	7.5 mpi

I certify that this percolation test was done by a qualified site evaluator in accordance with DEQ-4 Section 1.2.68 and Appendix A.

Brian Peck  7/17/2024
Name (printed) Signature Date

Morrison-Maierle, Inc.
Company

**MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM**

Owner Name Tony Nelson

Project Name Ember's Grove (1630 Tarbush Pass Hwy)

Lot of Tract Number _____ Test Number G

Diameter of Test Hole 8" Depth of Test Hole 24"

Date and Time Soak Period Began 7/15/24 at 10:45am Ended 7/16/24 at 8:30am

Date Test Began 7/16/24

Distance of the reference point above the bottom of the hole 6"

Test Results

Start Time of Day	End Time of Day	Time Interval (minutes)	Initial Distance Below Reference Point	Final Distance Below Reference Point	Drop in Water Level (inches)	Percolation Rate (mpi)
8:30am	8:45am	15	0 in.	1.5 in.	1.5 in.	
8:45am	9:00am	15	0 in.	1.5 in.	1.5 in.	
9:00am	9:15am	15	0 in.	1 in.	1 in.	
9:15am	9:30am	15	0 in.	1 in.	1 in.	
9:30am	9:45am	15	0 in.	1 in.	1 in.	15 mpi

I certify that this percolation test was done by a qualified site evaluator in accordance with DEQ-4 Section 1.2.68 and Appendix A.

Brian Peck  7/17/2024
Name (printed) Signature Date

Morrison-Maierle, Inc.
Company



Corporate Office
32 Discovery Drive
Bozeman, MT 59718
Ph: (406) 582-0221
Fax: (406) 582-5770

North Dakota Office
299 Prairie Drive
PO Box 1251
Stanley, ND 58784
Ph: (701) 628-0221

November 11, 2016

Chris Boe
Ground Water Discharge Permitting Program
Montana DEQ/Water Protection Bureau

Ph: 406-444-6752

e-mail: CBoe@mt.gov

RE: Lionshead RV Park Groundwater Monitoring
300 Circle Right Rd., West Yellowstone, MT 59758
Located In Sec. 21, T13S, R04E, P.M.M. Gallatin County, Montana

Dear Mr. Boe,

This letter is written as a follow-up summary of the groundwater monitoring that was requested by MDEQ, for the Lionshead RV Park outside of West Yellowstone, MT.

As requested by MDEQ, the plan was to install three (3) monitor wells in the area of the proposed future replacement wastewater system area, so that we can evaluate seasonal groundwater flow direction and gradient in the area. The upper soils generally consisting of gravel and cobbles, as evidenced from our test pits conducted in 2015 (8 ft – 10 ft deep). There was no water to the depth of the existing test pits, nor in any of the corresponding 10 ft deep monitor wells in 2015. We had anticipated groundwater could be about 15 ft deep, within the gravel stratum. Our plan was to drill 6-inch steel casing, and perforate the well casing, extending past the first aquifer by 15 ft, or so, with a total depth of each monitor anticipated to be approximately 30 ft deep.

Following is a summary of the three (3) monitor well locations used to triangulate, so that we can show groundwater gradient and direction in the immediate vicinity of the proposed replacement absorption area.

- MW #1A: located in the northeast portion of the future replacement area, just west of the existing shop
- MW #2: located upgradient of the proposed wastewater system, north of the existing store, east of the bathhouse.
- MW #3A: located northeast of the Super 8 Motel, on the Lionshead property, SW of the existing structure.

We have coordinated with Red Tiger Drilling, and the owner contracted with the well driller to drill three (3) monitor wells at Lionshead RV Park.

As part of the monitor well drilling program for MW's #1A, #2, and #3A, we encountered "no water" in the cobbles and gravel stratum, which typically extended about 10 - 12 ft deep, and "no water" in the intermixed silts/sands to about 23 ft deep, at which point a confining shale layer was encountered. Since "no water" was encountered to that depth, the well driller was instructed to drive steel casing through the confining shale layer, in search of first water. Once extended into the shale, the driller was able to maintain the formation and drill open hole throughout the remainder of the hole. The first water was encountered below the confining shale, and the depth was extended an additional 10-20 ft further past first water. First water for MW's #1A, #2, and #3A was generally encountered at 33 ft, and 47 ft (with traces of water at 26 ft), and 25 ft, correspondingly. A 4-inch perforated pipe was installed in the open hole portion, to maintain access for monitoring purposes.

Based on what was encountered in MW's #1A, #2, and #3A, the upper formation was sealed off and would not be able to measure any perched water tables above the shale. Therefore, the owner agreed to drill two (2) additional shallow wells, which terminated 1-2 ft above the shale later, and were perforated from about the 10 ft down to its total depth of about 22 ft.

- MW #1B: shallow well located located in the immediate proximity of MW #1A
- MW #3B: shallow well located in immediate proximity of MW #3A.

Groundwater was monitored on a weekly basis, starting May 26 - November 6, 2016. The results were verified on May 26th and June 26th, by Allied Engineering, and remained consistent throughout the entire monitoring season. In general, following is the typical depths to static water level.

MW #1A = First Water at 33 ft, Static Water Level approximately 22 ft bgs

MW #1B = "No Water" to depth of approximately 21 ft bgs

MW #2 = First Water at 47 ft (traces at 26 ft), Static Water Level approximately 30 ft bgs

MW #3A = First Water at 25 ft, Static Water Level approximately 23 ft bgs

MW #3B = "No Water" to depth of approximately 22 ft bgs

We used MW's #1A, #2, and #3A to triangulate groundwater flow direction, which is generally east-north-east. Denny Creek, located north of the proposed wastewater replacement area, is typically about 3-5 ft deep to the creek bottom, and groundwater levels were consistently 20+ ft deep, from below the confining shale layer, thus wastewater effluent from the proposed absorption area would have no physical means of entering the Denny Creek surface water, based on elevations.

The facility is shut down for the winter, as the West Yellowstone area has some very extreme winter conditions. Groundwater Monitoring during the winter would be very difficult regarding feasibility and access, which is way monitoring wells were drilled in the spring. Also, since the groundwater results are consistent throughout the past 6 months, and well below the depth of the nearest surface water, we would request acceptance of the groundwater monitoring, such that the owner can proceed with wastewater system options for the site. We would appreciate your concurrence to terminate the groundwater monitoring, and get started on design and submittal of a new replacement wastewater system.

The owner will be requesting a new license for operation in 2017, which will be consistent with previous years. We understand this would be granted based on the reviewing agencies request to conduct groundwater monitoring, so we know the groundwater conditions prior to wastewater system design and submittal.

The owner has been anxious for Allied to get started on design. Upon your concurrence of the groundwater monitoring, we can proceed with concept design and anticipated submittal dates for your use.

Please call if you have any comments or questions. Thank you.

Sincerely,

Allied Engineering Services, Inc.

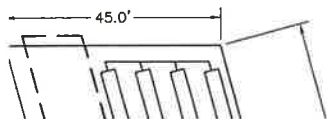
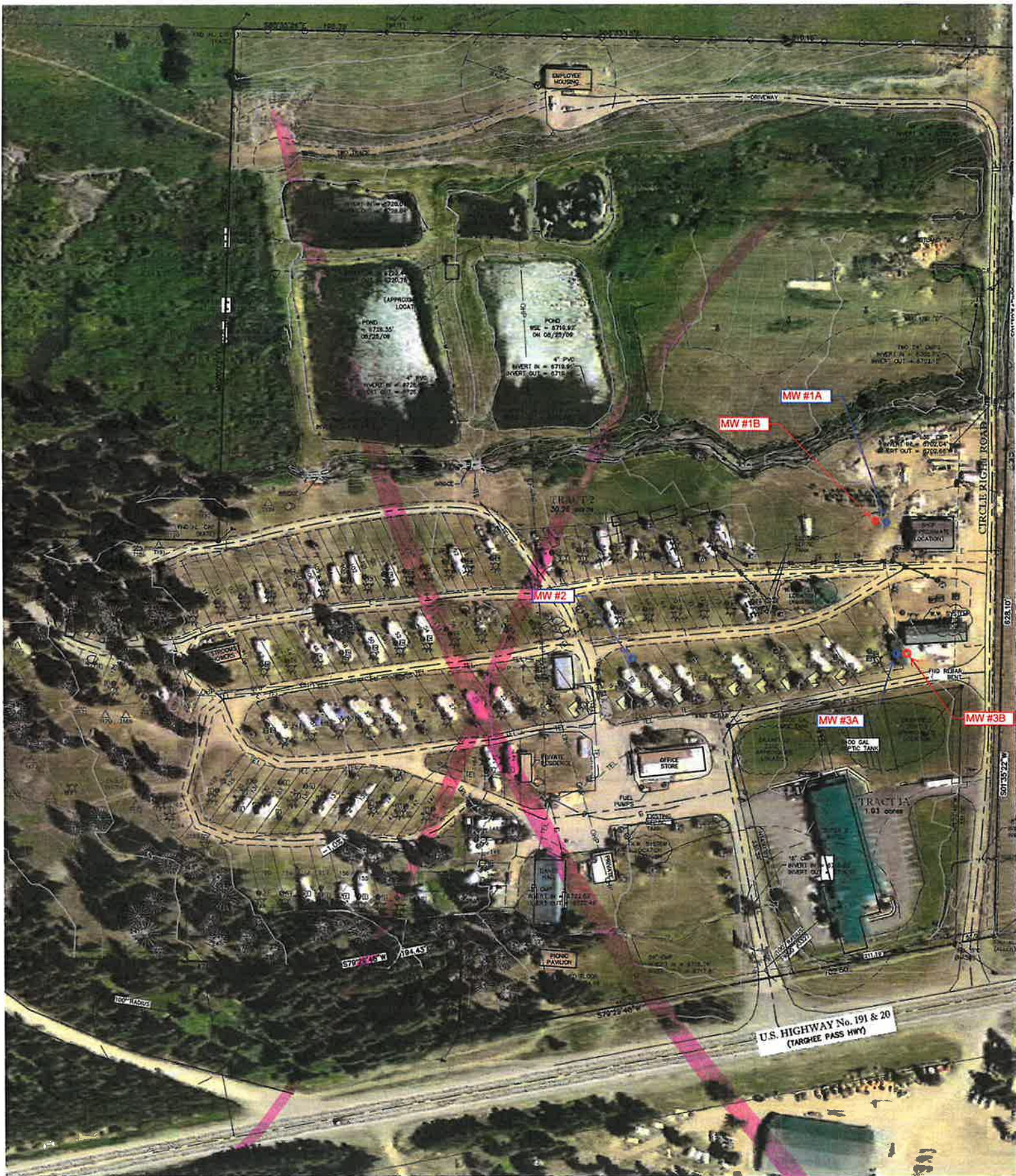


Digitally signed by
Mark Fasting
Date: 2016.11.11
15:43:32 -07'00'

Mark Fasting, PE
Civil Engineer

enc: Groundwater Monitoring Well Locations (3 exhibits)
Monitor Well Logs – via Red Tiger Drilling (5 total)
Groundwater Monitoring Results (tabulation and graph)
Groundwater Gradient and Direction (2 exhibits)

cc: Rachel Clark (MDEQ – Public Water and Subdivisions Bureau) e-mail: rclark@mt.gov
Joe Meek (MDEQ – Groundwater Discharge Permit Supervisor) e-mail: jmeek@mt.gov
Denise Moldroski (GCCHD) e-mail: Denise.Moldroski@gallatin.mt.gov
Marvin Linde (owner) e-mail: firstkoa@aol.com



This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report was completed online by the driller. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

1) YELLOWSTONE RENTAL PROPERTIES LLC (MAIL)
3305 TARGHEE PASS HWY 20
WET YELLOWSTONE MT 59758
2) YELLOWSTONE RENTAL PROPERTIES LLC (WELL)
SAME
N/A N/A N/A

Township	Range	Section	Quarter Sections
13S	04E	21	SE¼ SW¼ NW¼
County		Geocode	
GALLATIN			
Latitude	Longitude	Geomethod	Datum
44.688331	-111.251317	NAV-GPS	NAD83
Addition	Block	Lot	

From	To	Description	Cont. Fed?
0	0	CASING SEAL	Y

5 gpm with drill stem set at 55 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 25 feet.

Date Certified: 6/30/2016

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report was completed online by the driller. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Section 7: Well Test Data

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

Air Test *

0 gpm with drill stem set at 22 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 22.5 feet.

Township	Range	Section	Quarter Sections
13S	04E	21	SE¼ SW¼ NW¼
County		Geocode	
GALLATIN			
Latitude	Longitude	Geomethod	Datum
44.688344	-111.251381	NAV-GPS	NAD83
Addition	Block	Lot	

* 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
MONITOR WELL 1B (NO WATER)

Section 9: Well Log

[illegible]

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: TROY HAUSER
Company: RED TIGER DRILLING
Address: PO BOX 659
City: MANHATTAN MT 59741
License No: MWC-365
Date Certified: 6/30/2016

Borehole dimensions

From	To	Diameter
0	22.5	7.3

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	22.5	6.6	0.250		WELDED	A53B STEEL

From	To	Diameter	# of Openings	Size of Openings	Description
10	19.4	6.6	90	1/4" X 1"	HOLTE PERFORATOR SLOTS

From	To	Description	Cont. Fed?
0	0	CASING SEAL Y	

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report was completed online by the driller. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: YELLOWSTONE RENTAL PROPERTIES LLC Section 7: Well Test Data
GWIC Id: 287946

Section 1: Well Owner(s)

1) YELLOWSTONE RENTAL PROPERTIES LLC (MAIL)
3305 TARGHEE PASS HWY 20
WEST YELLOWSTONE MT 59758
2) YELLOWSTONE RENTAL PROPERTIES LLC (WELL)
SAME
N/A N/A N/A

Section 2: Location

Township	Range	Section	Quarter Sections
13S	04E	21	SW¼ SW¼ NW¼
County		Geocode	
GALLATIN			
Latitude	Longitude	Geomethod	Datum
44.687814	-111.252581	NAV-GPS	NAD83
Addition	Block	Lot	

Section 3: Proposed Use of Water

MONITORING (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Wednesday, May 25, 2016

Section 6: Well Construction Details

Meta Data Fields

1. Was borehole completed as a well? YES
2. Was well abandoned?

Borehole dimensions

From	To	Diameter
0	34	7.3
34	56	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
1.5	34	6.6	0.250		WELDED	A53B STEEL
16	23	4		220.0	SPLINE	PVC-SCHED 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
23	56	4	45	1/4" X 6"	SAW SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	CASING SEAL Y	

Total Depth: 56

Static Water Level: 32

Water Temperature:

Air Test *

13 gpm with drill stem set at 55 feet for 1 hours.

Time of recovery 1 hours.

Recovery water level 32 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

MONITOR WELL 2

Section 9: Well Log

From	To	Description
0	1	TOP SOIL
1	8	BROWN STREAKED SHALE & CLAY W/ STREAKS OF MEDIUM GRAVELS
8	11	FINE SAND, MEDIUM SHARP GRAVELS & QUARTZ
11	21	GRAY SILTSAND W/ GRAY CLAY AND GRAY SHALE STREAKS
21	22	GRAY SHALE
22	23	GRAY SILTSAND W/ GRAY SHALE STREAKS
23	25	FRACTURED GRAY & BROWN SHALE STREAKS
25	27	GRAY SILTSAND W/ GRAY SHALE STREAKS & 3 GPM WATER @ 26'
27	36	BROWN & GRAY STREAKED SHALE W/ CLAY STRINGERS
36	47	GRAY FINE SAND W/ GRAY CLAYSTONE & 10 GPM WATER @ 47'
47	56	BROWN SILTSAND W/ GRAY & BROWN STREAKED CLAY STRINGERS

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: TROY HAUSER

Company: RED TIGER DRILLING

Address: PO BOX 659

City: MANHATTAN MT 59741

License No: MVC-365

Date Certified: 6/30/2016

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report was completed online by the driller. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Date Certified: 6/30/2016

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report was completed online by the driller. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

0 gpm with drill stem set at 22 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 23.3 feet.

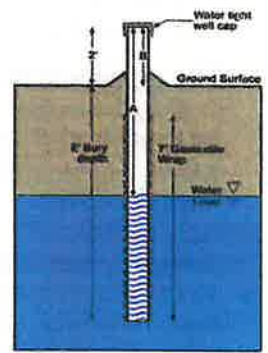
Date Certified: 6/30/2016

Groundwater Monitoring Results: MW 1A

Project: Lionshead RV Park
 Project Number: 15-042
 Location: See well location map
 Date Installed: 5/24/2016
 Installed By: Red Tiger Drilling



GROUND WATER OBSERVATION WELL DESIGN



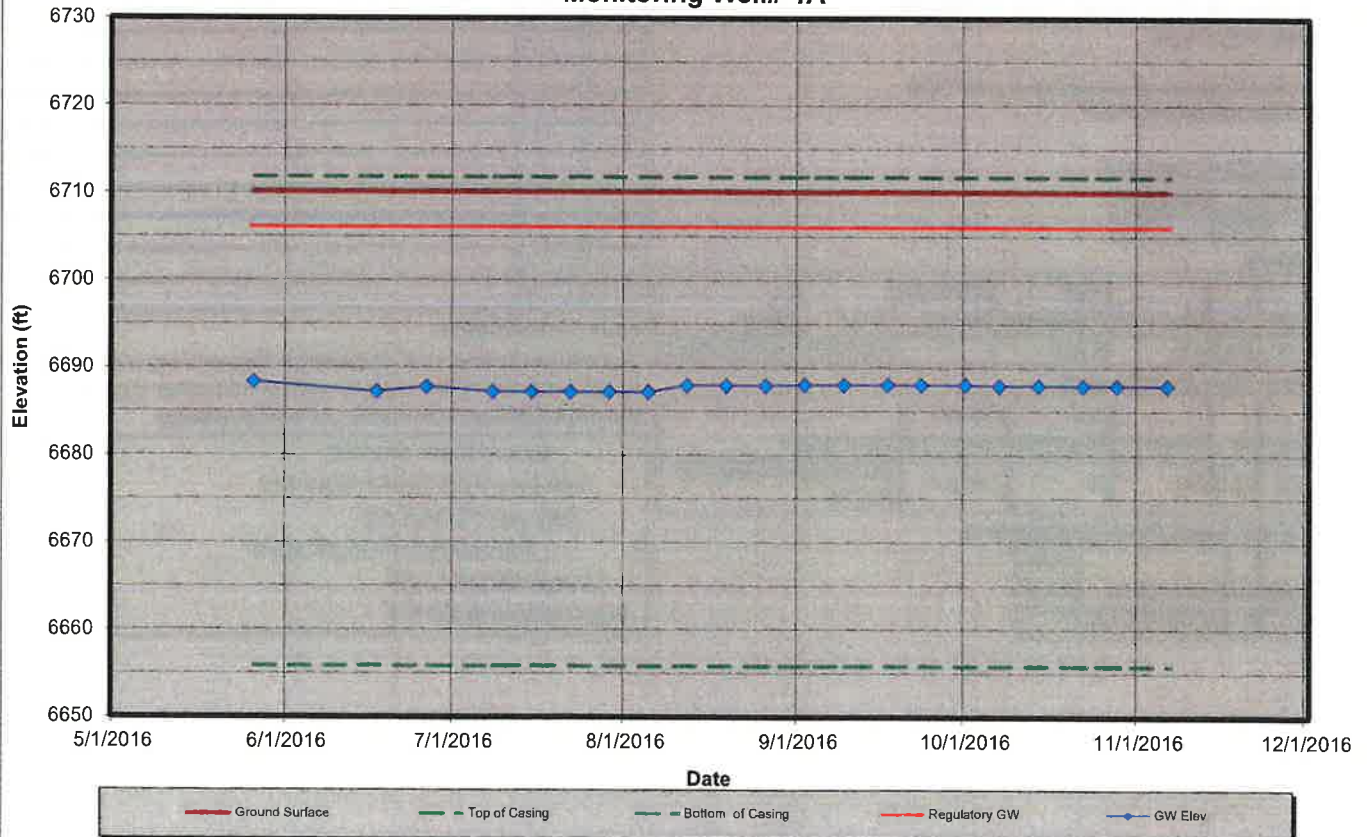
NOTES:

If the well is dry, graph shows the groundwater at bottom of the well casing.
 Figure of "Groundwater Observation Well Design" provided for illustrative purposes only.
 Actual dimensions may vary depending on site specific installation.

Checked by: _____

Date	Time	Total Well Casing Length (ft)	Well Casing Height B (feet)	Well Casing Bury Depth (feet)	Measure from T.O.C. to GW A (feet)	Depth to GW A - B (feet)	Depth to GW A - B (inches)	Ground Surface Elev. (feet)	Top of Casing Elev. (feet)	Bottom of Casing Elev. (feet)	Regulatory GW Elev. (4' bgs) (feet)	GW Elev. (feet)	Measured by
05/26/16	12:00 PM	56.00	1.69	54.31	23.45	21.76	261.1	6710.16	6711.85	6655.85	6706.16	6688.40	KT
06/17/16	4:30 PM	56.00	1.69	54.31	24.58	22.89	274.7	6710.16	6711.85	6655.85	6706.16	6687.27	AM
06/26/16	12:00 PM	56.00	1.69	54.31	24.01	22.32	267.8	6710.16	6711.85	6655.85	6706.16	6687.84	MF
07/08/16	12:00 PM	56.00	1.69	54.31	24.58	22.89	274.7	6710.16	6711.85	6655.85	6706.16	6687.27	MJ
07/15/16	12:00 PM	56.00	1.69	54.31	24.58	22.89	274.7	6710.16	6711.85	6655.85	6706.16	6687.27	MJ
07/22/16	12:00 PM	56.00	1.69	54.31	24.58	22.89	274.7	6710.16	6711.85	6655.85	6706.16	6687.27	MJ
07/29/16	12:00 PM	56.00	1.69	54.31	24.58	22.89	274.7	6710.16	6711.85	6655.85	6706.16	6687.27	MJ
08/05/16	12:00 PM	56.00	1.69	54.31	24.58	22.89	274.7	6710.16	6711.85	6655.85	6706.16	6687.27	MJ
08/12/16	12:00 PM	56.00	1.69	54.31	23.83	22.14	265.7	6710.16	6711.85	6655.85	6706.16	6688.02	MJ
08/19/16	12:00 PM	56.00	1.69	54.31	23.83	22.14	265.7	6710.16	6711.85	6655.85	6706.16	6688.02	MJ
08/26/16	12:00 PM	56.00	1.69	54.31	23.83	22.14	265.7	6710.16	6711.85	6655.85	6706.16	6688.02	MJ
09/02/16	12:00 PM	56.00	1.69	54.31	23.75	22.06	264.7	6710.16	6711.85	6655.85	6706.16	6688.10	MJ
09/09/16	12:00 PM	56.00	1.69	54.31	23.75	22.06	264.7	6710.16	6711.85	6655.85	6706.16	6688.10	MJ
09/17/16	12:00 PM	56.00	1.69	54.31	23.75	22.06	264.7	6710.16	6711.85	6655.85	6706.16	6688.10	MJ
09/23/16	12:00 PM	56.00	1.69	54.31	23.75	22.06	264.7	6710.16	6711.85	6655.85	6706.16	6688.10	MJ
10/01/16	12:00 PM	56.00	1.69	54.31	23.75	22.06	264.7	6710.16	6711.85	6655.85	6706.16	6688.10	MJ
10/07/16	12:00 PM	56.00	1.69	54.31	23.83	22.14	265.7	6710.16	6711.85	6655.85	6706.16	6688.02	MJ
10/14/16	12:00 PM	56.00	1.69	54.31	23.83	22.14	265.7	6710.16	6711.85	6655.85	6706.16	6688.02	MJ
10/22/16	12:00 PM	56.00	1.69	54.31	23.83	22.14	265.7	6710.16	6711.85	6655.85	6706.16	6688.02	MJ
10/28/16	12:00 PM	56.00	1.69	54.31	23.83	22.14	265.7	6710.16	6711.85	6655.85	6706.16	6688.02	MJ
11/06/16	12:00 PM	56.00	1.69	54.31	23.83	22.14	265.7	6710.16	6711.85	6655.85	6706.16	6688.02	MJ

Lionshead RV Park Project: 15-042 Monitoring Well# 1A

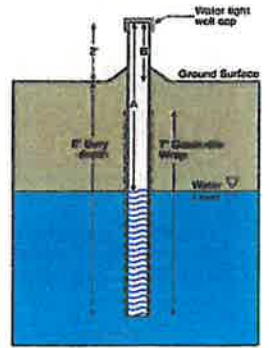


Groundwater Monitoring Results: MW 1B

Project: Lionshead RV Park
Project Number: 15-042
Location: See well location map
Date Installed: 5/24/2016
Installed By: Red Tiger Drilling



GROUND WATER OBSERVATION WELL DESIGN



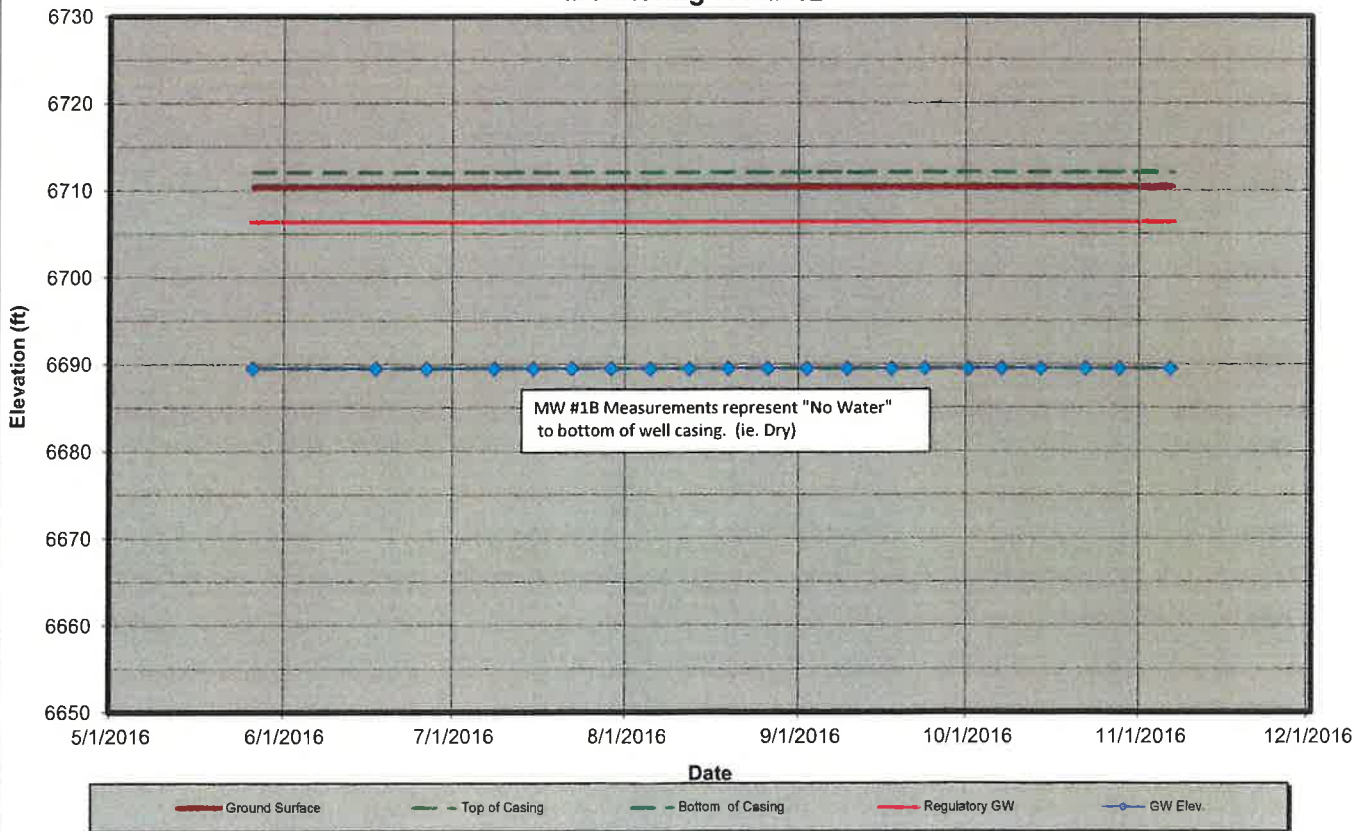
NOTES:

If the well is dry, graph shows the groundwater at bottom of the well casing.
 Figure of "Groundwater Observation Well Design" provided for illustrative purposes only.
 Actual dimensions may vary depending on site specific installation.
 MW #1B "dry", and terminated above shale layer. Measurement shown at bottom of dry well casing

Checked by: _____

Date	Time	Total Well Casing Length (ft)	Well Casing Height B (feet)	Well Casing Bury Depth (feet)	Measure from T.O.C. to GW A (feet)	Depth to GW A - B (feet)	Depth to GW A - B (inches)	Ground Surface Elev. (feet)	Top of Casing Elev. (feet)	Bottom of Casing Elev. (feet)	Regulatory GW Elev. (4' bgs) (feet)	GW Elev. (feet)	Measured by
05/26/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	KT
06/17/16	4:30 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	AM
06/26/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MF
07/08/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
07/15/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
07/22/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
07/29/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
08/05/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
08/12/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
08/19/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
08/26/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
09/02/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
09/09/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
09/17/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
09/23/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
10/01/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
10/07/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
10/14/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
10/22/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
10/28/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ
11/06/16	12:00 PM	22.50	1.63	20.87	Dry	20.87	250.4	6710.46	6712.09	6689.59	6706.46	6689.59	MJ

Lionshead RV Park Project: 15-042 Monitoring Well# 1B

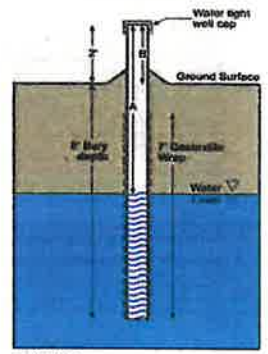


Groundwater Monitoring Results: MW 2

Project: Lionshead RV Park
 Project Number: 15-042
 Location: See well location map
 Date Installed: 5/24/2016
 Installed By: Red Tiger Drilling



GROUND WATER OBSERVATION WELL DESIGN



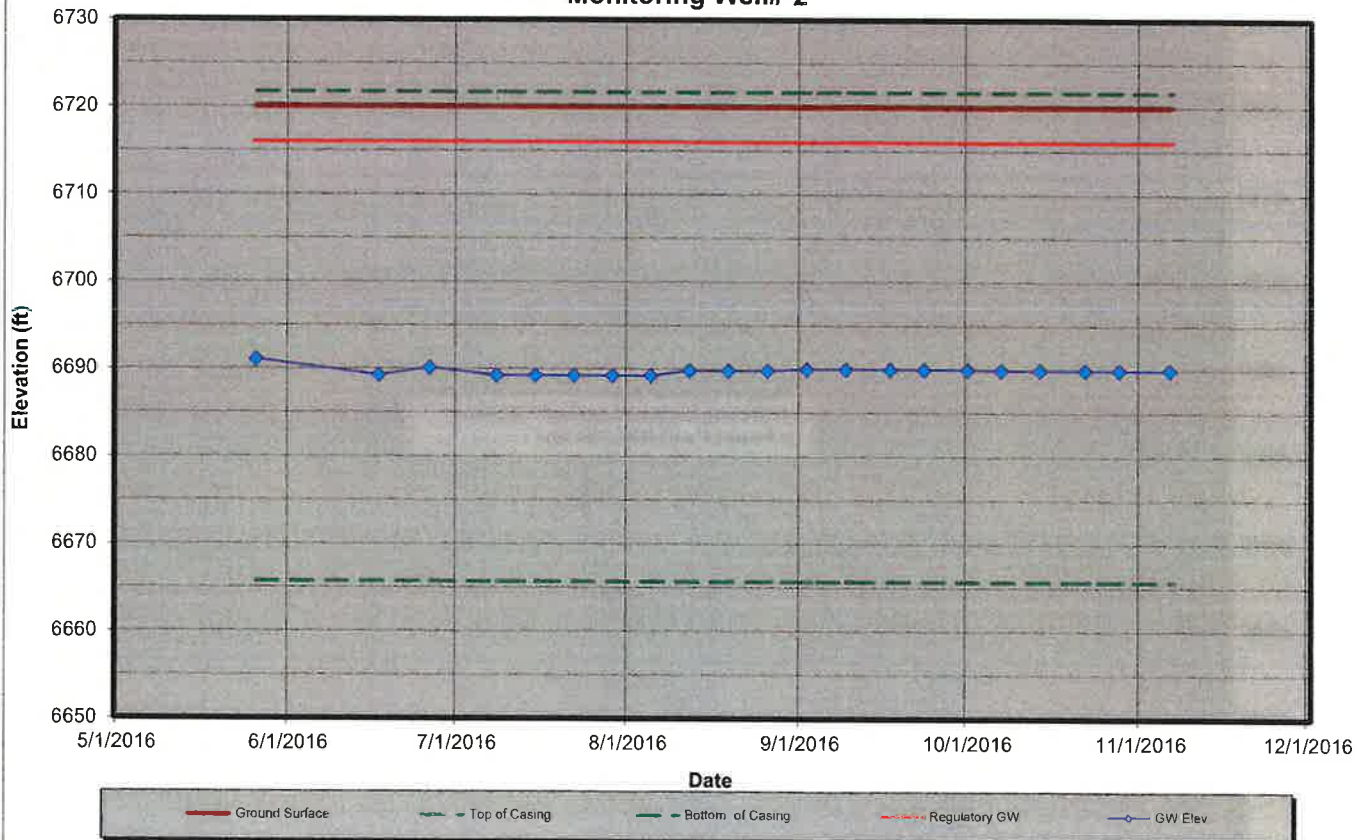
NOTES:

If the well is dry, graph shows the groundwater at bottom of the well casing.
 Figure of "Groundwater Observation Well Design" provided for illustrative purposes only.
 Actual dimensions may vary depending on site specific installation.

Checked by: _____

Date	Time	Total Well Casing Length (ft)	Well Casing Height B (feet)	Well Casing Bury Depth (feet)	Measure from T.O.C. to GW A (feet)	Depth to GW A - B (feet)	Depth to GW A - B (inches)	Ground Surface Elev. (feet)	Top of Casing Elev. (feet)	Bottom of Casing Elev. (feet)	Regulatory GW Elev. (4' bgs) (feet)	GW Elev. (feet)	Measured by
05/26/16	12:00 PM	56.00	1.66	54.34	30.60	28.94	347.3	6720.07	6721.73	6665.73	6716.07	6691.13	KT
06/17/16	4:30 PM	56.00	1.66	54.34	32.42	30.76	369.1	6720.07	6721.73	6665.73	6716.07	6689.31	AM
06/28/16	12:00 PM	56.00	1.66	54.34	31.56	29.90	358.8	6720.07	6721.73	6665.73	6716.07	6690.17	MF
07/08/16	12:00 PM	56.00	1.66	54.34	32.42	30.76	369.1	6720.07	6721.73	6665.73	6716.07	6689.31	MJ
07/15/16	12:00 PM	56.00	1.66	54.34	32.42	30.76	369.1	6720.07	6721.73	6665.73	6716.07	6689.31	MJ
07/22/16	12:00 PM	56.00	1.66	54.34	32.42	30.76	369.1	6720.07	6721.73	6665.73	6716.07	6689.31	MJ
07/29/16	12:00 PM	56.00	1.66	54.34	32.42	30.76	369.1	6720.07	6721.73	6665.73	6716.07	6689.31	MJ
08/05/16	12:00 PM	56.00	1.66	54.34	32.42	30.76	369.1	6720.07	6721.73	6665.73	6716.07	6689.31	MJ
08/12/16	12:00 PM	56.00	1.66	54.34	31.83	30.17	362.0	6720.07	6721.73	6665.73	6716.07	6689.90	MJ
08/19/16	12:00 PM	56.00	1.66	54.34	31.83	30.17	362.0	6720.07	6721.73	6665.73	6716.07	6689.90	MJ
08/26/16	12:00 PM	56.00	1.66	54.34	31.83	30.17	362.0	6720.07	6721.73	6665.73	6716.07	6689.90	MJ
09/02/16	12:00 PM	56.00	1.66	54.34	31.67	30.01	360.1	6720.07	6721.73	6665.73	6716.07	6690.06	MJ
09/09/16	12:00 PM	56.00	1.66	54.34	31.67	30.01	360.1	6720.07	6721.73	6665.73	6716.07	6690.06	MJ
09/17/16	12:00 PM	56.00	1.66	54.34	31.67	30.01	360.1	6720.07	6721.73	6665.73	6716.07	6690.06	MJ
09/23/16	12:00 PM	56.00	1.66	54.34	31.67	30.01	360.1	6720.07	6721.73	6665.73	6716.07	6690.06	MJ
10/01/16	12:00 PM	56.00	1.66	54.34	31.67	30.01	360.1	6720.07	6721.73	6665.73	6716.07	6690.06	MJ
10/07/16	12:00 PM	56.00	1.66	54.34	31.75	30.09	361.1	6720.07	6721.73	6665.73	6716.07	6689.98	MJ
10/14/16	12:00 PM	56.00	1.66	54.34	31.75	30.09	361.1	6720.07	6721.73	6665.73	6716.07	6689.98	MJ
10/22/16	12:00 PM	56.00	1.66	54.34	31.75	30.09	361.1	6720.07	6721.73	6665.73	6716.07	6689.98	MJ
10/28/16	12:00 PM	56.00	1.66	54.34	31.75	30.09	361.1	6720.07	6721.73	6665.73	6716.07	6689.98	MJ
11/06/16	12:00 PM	56.00	1.66	54.34	31.75	30.09	361.1	6720.07	6721.73	6665.73	6716.07	6689.98	MJ

Lionshead RV Park Project: 15-042 Monitoring Well# 2

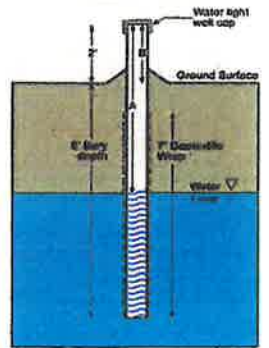


Groundwater Monitoring Results: MW 3A

Project: Lionshead RV Park
Project Number: 15-042
Location: See well location map
Date Installed: 5/24/2016
Installed By: Red Tiger Drilling



GROUND WATER OBSERVATION WELL DESIGN



Scale: None

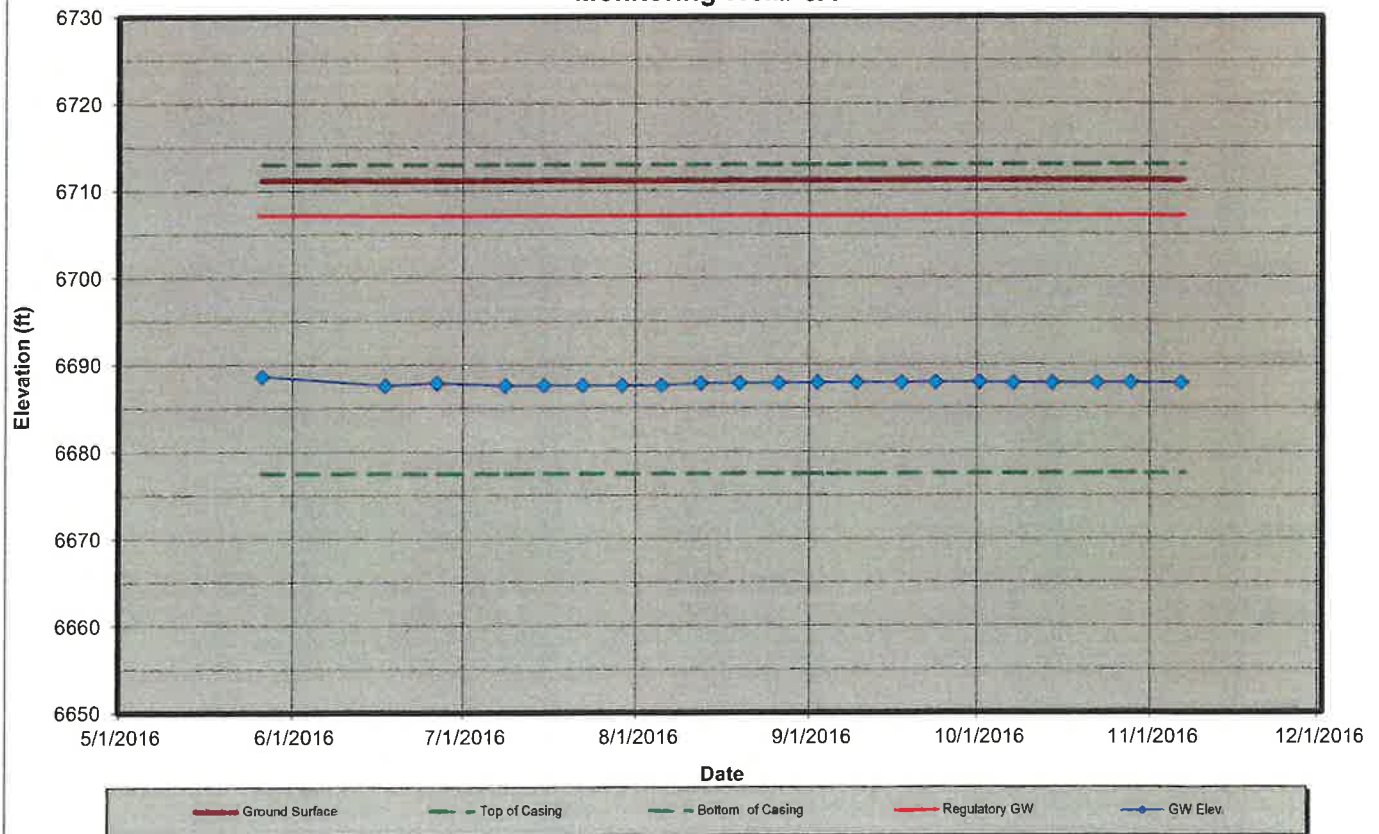
NOTES:

If the well is dry, graph shows the groundwater at bottom of the well casing.
 Figure of "Groundwater Observation Well Design" provided for illustrative purposes only.
 Actual dimensions may vary depending on site specific installation.

Checked by: _____

Date	Time	Total Well Casing Length (ft)	Well Casing Height B (feet)	Well Casing Bury Depth (feet)	Measure from T.O.C. to GW A (feet)	Depth to GW A - B (feet)	Depth to GW A - B (inches)	Ground Surface Elev. (feet)	Top of Casing Elev. (feet)	Bottom of Casing Elev. (feet)	Regulatory GW Elev. (4' bgs) (feet)	GW Elev. (feet)	Measured by
05/26/16	12:00 PM	35.50	1.82	33.68	24.30	22.48	269.8	6711.22	6713.04	6677.54	6707.22	6688.74	KT
06/17/16	4:30 PM	35.50	1.82	33.68	25.33	23.51	282.1	6711.22	6713.04	6677.54	6707.22	6687.71	AM
06/26/16	12:00 PM	35.50	1.82	33.68	25.05	23.23	278.8	6711.22	6713.04	6677.54	6707.22	6687.99	MF
07/08/16	12:00 PM	35.50	1.82	33.68	25.33	23.51	282.1	6711.22	6713.04	6677.54	6707.22	6687.71	MJ
07/15/16	12:00 PM	35.50	1.82	33.68	25.33	23.51	282.2	6711.22	6713.04	6677.54	6707.22	6687.71	MJ
07/22/16	12:00 PM	35.50	1.82	33.68	25.33	23.51	282.2	6711.22	6713.04	6677.54	6707.22	6687.71	MJ
07/29/16	12:00 PM	35.50	1.82	33.68	25.33	23.51	282.1	6711.22	6713.04	6677.54	6707.22	6687.71	MJ
08/05/16	12:00 PM	35.50	1.82	33.68	25.33	23.51	282.1	6711.22	6713.04	6677.54	6707.22	6687.71	MJ
08/12/16	12:00 PM	35.50	1.82	33.68	25.08	23.26	279.1	6711.22	6713.04	6677.54	6707.22	6687.96	MJ
08/19/16	12:00 PM	35.50	1.82	33.68	25.08	23.26	279.1	6711.22	6713.04	6677.54	6707.22	6687.96	MJ
08/26/16	12:00 PM	35.50	1.82	33.68	25.08	23.26	279.1	6711.22	6713.04	6677.54	6707.22	6687.96	MJ
09/02/16	12:00 PM	35.50	1.82	33.68	25.00	23.18	278.2	6711.22	6713.04	6677.54	6707.22	6688.04	MJ
09/09/16	12:00 PM	35.50	1.82	33.68	25.00	23.18	278.2	6711.22	6713.04	6677.54	6707.22	6688.04	MJ
09/17/16	12:00 PM	35.50	1.82	33.68	25.00	23.18	278.2	6711.22	6713.04	6677.54	6707.22	6688.04	MJ
09/23/16	12:00 PM	35.50	1.82	33.68	25.00	23.18	278.2	6711.22	6713.04	6677.54	6707.22	6688.04	MJ
10/01/16	12:00 PM	35.50	1.82	33.68	25.00	23.18	278.2	6711.22	6713.04	6677.54	6707.22	6688.04	MJ
10/07/16	12:00 PM	35.50	1.82	33.68	25.08	23.26	279.1	6711.22	6713.04	6677.54	6707.22	6687.96	MJ
10/14/16	12:00 PM	35.50	1.82	33.68	25.08	23.26	279.1	6711.22	6713.04	6677.54	6707.22	6687.96	MJ
10/22/16	12:00 PM	35.50	1.82	33.68	25.08	23.26	279.1	6711.22	6713.04	6677.54	6707.22	6687.96	MJ
10/28/16	12:00 PM	35.50	1.82	33.68	25.08	23.26	279.1	6711.22	6713.04	6677.54	6707.22	6687.96	MJ
11/06/16	12:00 PM	35.50	1.82	33.68	25.08	23.26	279.1	6711.22	6713.04	6677.54	6707.22	6687.96	MJ

Lionshead RV Park Project: 15-042 Monitoring Well# 3A

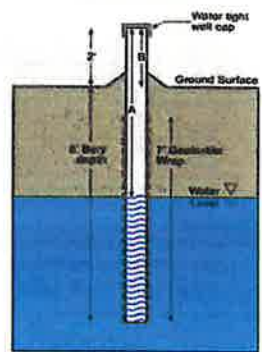


Groundwater Monitoring Results: MW 3B

Project:	Lionshead RV Park
Project Number:	15-042
Location:	See well location map
Date Installed:	5/24/2016
Installed By:	Red Tiger Drilling



GROUND WATER OBSERVATION WELL DESIGN



Scale: None

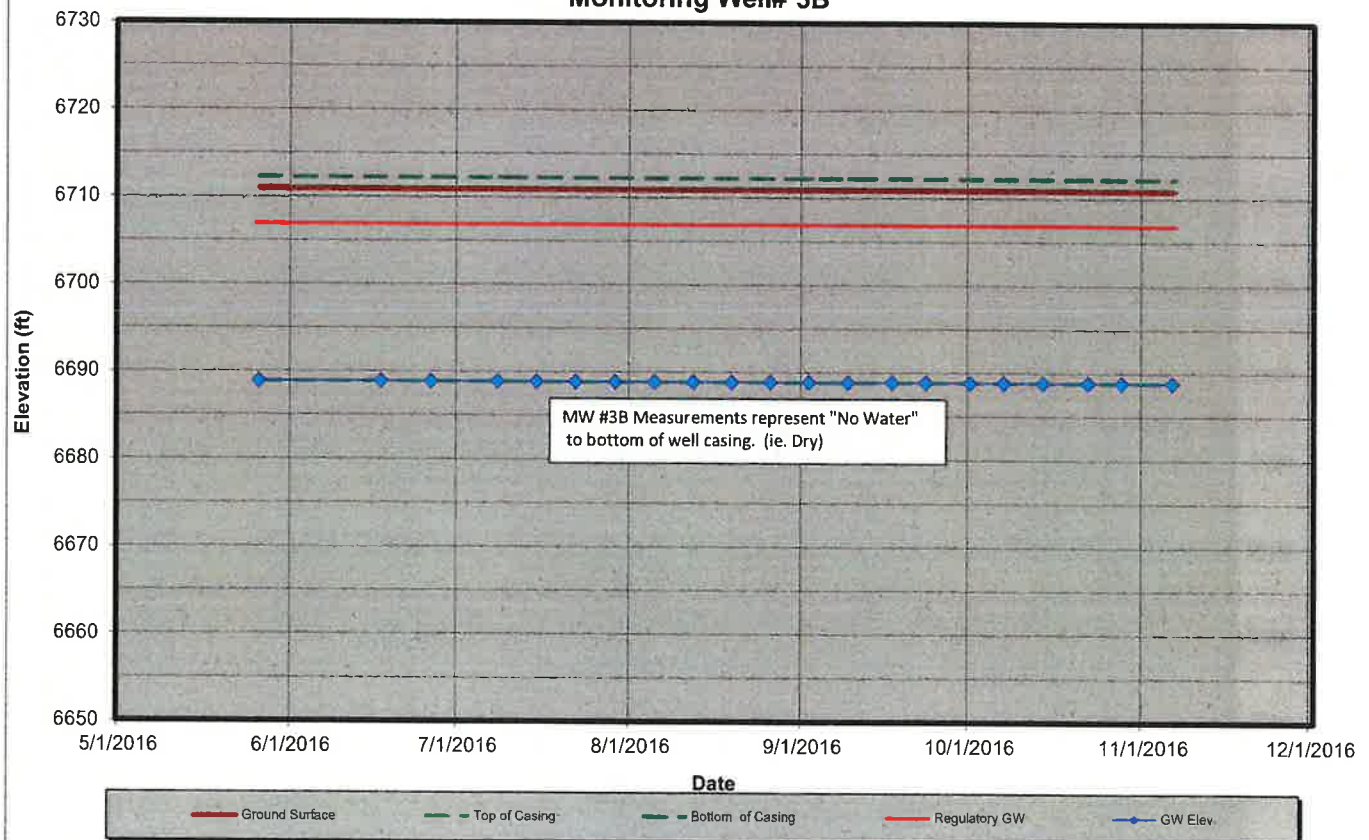
NOTES:

If the well is dry, graph shows the groundwater at bottom of the well casing.
Figure of "Groundwater Observation Well Design" provided for illustrative purposes only.
Actual dimensions may vary depending on site specific installation.
MW #3B "dry", and terminated above shale layer. Measurement shown at bottom of dry well casing

Checked by: _____

Date	Time	Total Well Casing Length (ft)	Well Casing Height B (feet)	Well Casing Bury Depth (feet)	Measure from T.O.C. to GW A (feet)	Depth to GW A - B (feet)	Depth to GW A - B (inches)	Ground Surface Elev. (feet)	Top of Casing Elev. (feet)	Bottom of Casing Elev. (feet)	Regulatory GW Elev. (4' bgs) (feet)	GW Elev. (feet)	Measured by
05/26/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	KT
06/17/16	4:30 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	AM
06/26/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MF
07/08/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
07/15/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
07/22/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
07/29/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
08/05/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
08/12/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
08/19/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
08/26/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
09/02/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
09/09/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
09/17/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
09/23/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
10/01/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
10/07/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
10/14/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
10/22/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
10/28/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ
11/06/16	12:00 PM	23.30	1.29	22.01	Dry	22.01	264.1	6710.95	6712.24	6688.94	6706.95	6688.94	MJ

Lionshead RV Park Project: 15-042 Monitoring Well# 3B



Groundwater Monitoring Results: All

Project:	Lionshead RV Park
Project Number:	15-042
Location:	See well location map
Date Installed:	5/24/2016
Installed By:	Red Tiger Drilling

NOTES:

If the well is dry, graph shows the groundwater at bottom of the well casing.

Figure of "Groundwater Observation Well Design" provided for illustrative purposes only.

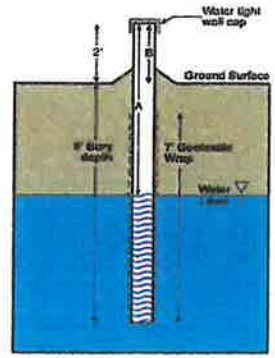
Actual dimensions may vary depending on site specific installation.

MW #1B and #3B were "dry", and terminated above shale layer. Measurement shown at bottom of dry well casing

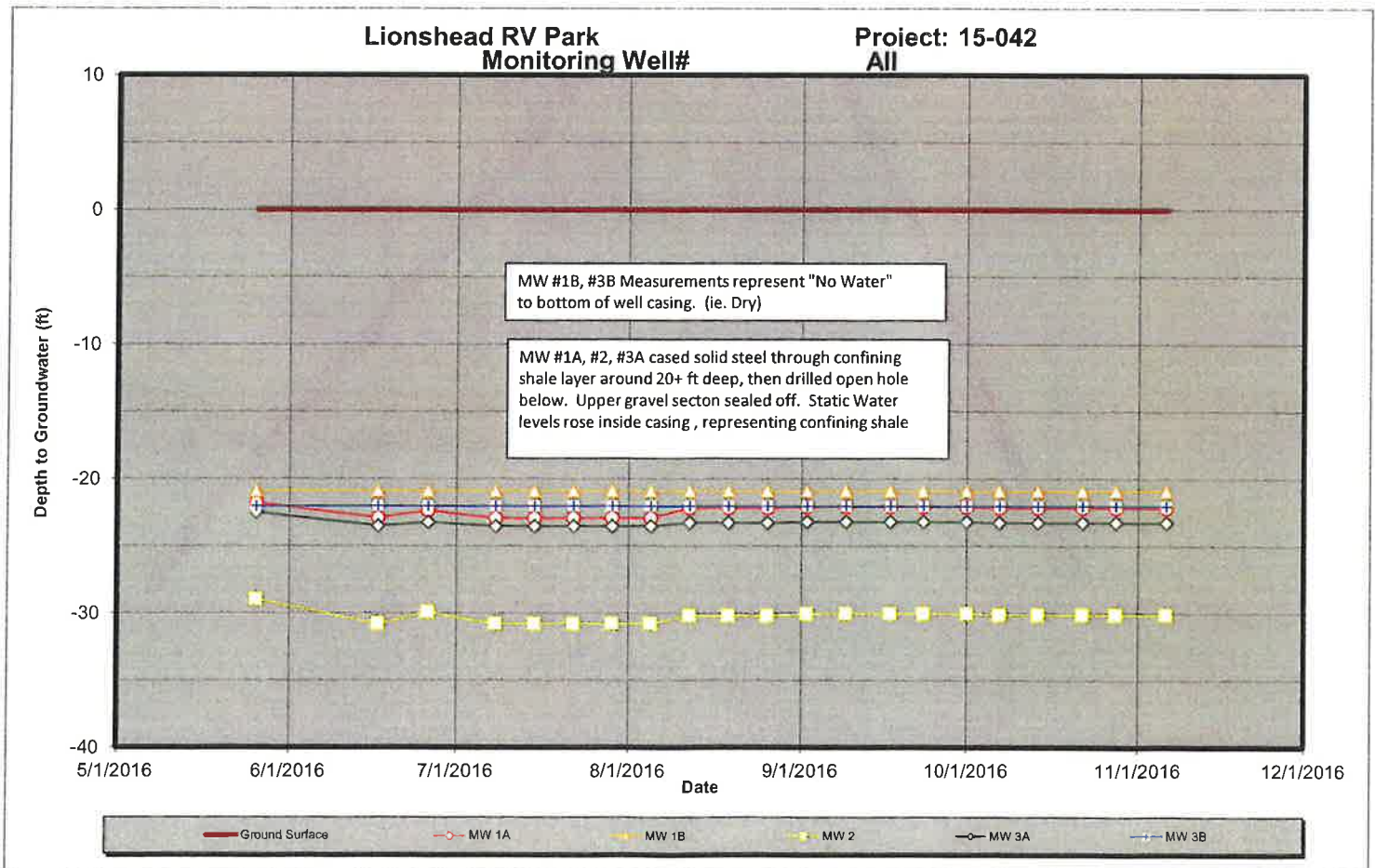
Checked by: _____



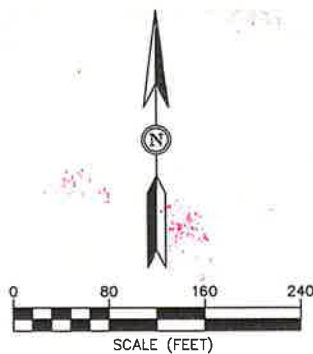
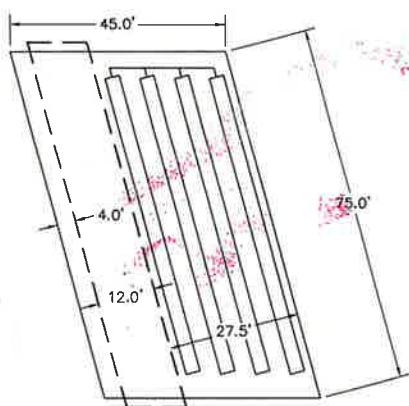
GROUND WATER OBSERVATION WELL DESIGN



Date	Time	Ground Surface Elev. (feet)	MW 1A Depth to GW A - B (feet)	MW 1B Depth to GW A - B (feet)	MW 2 Depth to GW A - B (feet)	MW 3A Depth to GW A - B (feet)	MW 3B Depth to GW A - B (feet)
05/26/16	12:00 PM	0	-21.76	-20.87	-28.94	-22.48	-22.01
06/17/16	4:30 PM	0	-22.89	-20.87	-30.76	-23.51	-22.01
06/26/16	12:00 PM	0	-22.32	-20.87	-29.90	-23.23	-22.01
07/08/16	12:00 PM	0	-22.89	-20.87	-30.76	-23.51	-22.01
07/15/16	12:00 PM	0	-22.89	-20.87	-30.76	-23.51	-22.01
07/22/16	12:00 PM	0	-22.89	-20.87	-30.76	-23.51	-22.01
07/29/16	12:00 PM	0	-22.89	-20.87	-30.76	-23.51	-22.01
08/05/16	12:00 PM	0	-22.89	-20.87	-30.76	-23.51	-22.01
08/12/16	12:00 PM	0	-22.14	-20.87	-30.17	-23.26	-22.01
08/19/16	12:00 PM	0	-22.14	-20.87	-30.17	-23.26	-22.01
08/26/16	12:00 PM	0	-22.14	-20.87	-30.17	-23.26	-22.01
09/02/16	12:00 PM	0	-22.06	-20.87	-30.01	-23.18	-22.01
09/09/16	12:00 PM	0	-22.06	-20.87	-30.01	-23.18	-22.01
09/17/16	12:00 PM	0	-22.06	-20.87	-30.01	-23.18	-22.01
09/23/16	12:00 PM	0	-22.06	-20.87	-30.01	-23.18	-22.01
10/01/16	12:00 PM	0	-22.06	-20.87	-30.01	-23.18	-22.01
10/07/16	12:00 PM	0	-22.14	-20.87	-30.09	-23.26	-22.01
10/14/16	12:00 PM	0	-22.14	-20.87	-30.09	-23.26	-22.01
10/22/16	12:00 PM	0	-22.14	-20.87	-30.09	-23.26	-22.01
10/28/16	12:00 PM	0	-22.14	-20.87	-30.09	-23.26	-22.01
11/06/16	12:00 PM	0	-22.14	-20.87	-30.09	-23.26	-22.01



LIONSHEAD RV PARK
BEING TRACT 2 OF CERTIFICATE OF SURVEY No. 282C
LOCATED IN A PORTION OF THE NORTHWEST ONE-QUARTER AND THE SOUTHWEST ONE-QUARTER OF SECTION 21,
TOWNSHIP 13 SOUTH, RANGE 4 EAST, PRINCIPAL MERIDIAN MONTANA, GALLATIN COUNTY, MONTANA



1
1 of 1
DETAIL (PLAN VIEW)
TYPICAL RV SPACE LAYOUT
1" = 20'

VICINITY MAP
NOT TO SCALE

LIONSHEAD RV PARK
OVERALL EXISTING CONDITIONS
GALLATIN COUNTY, MONTANA

32 DISCOVERY DRIVE
BOZEMAN, MT 59718
PHONE (406) 582-0221
FAX (406) 582-5770
www.alliedengineering.com

Civil Engineering
Geotechnical Engineering
Land Surveying



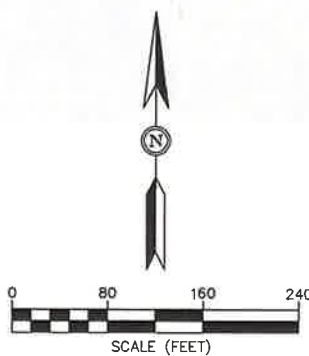
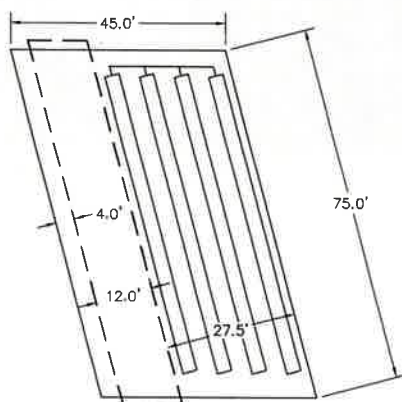
PROJECT #: 15-042
DATE: 09/24/2015
PROJECT ENGINEER: MAF
DRAWN BY: JDS
REVIEWED BY: MAF

FIGURE
1 of 1

C:\Users\jds\Documents\15-042 Lionshead RV Park & Super 8 Motel\15-042 Lionshead RV Park.dwg Sep 24, 2015 1:25pm

LIONSHEAD RV PARK

BEING TRACT 2 OF CERTIFICATE OF SURVEY No. 282C
LOCATED IN A PORTION OF THE NORTHWEST ONE-QUARTER AND THE SOUTHWEST ONE-QUARTER OF SECTION 21,
TOWNSHIP 13 SOUTH, RANGE 4 EAST, PRINCIPAL MERIDIAN MONTANA, GALLATIN COUNTY, MONTANA



1
1 of 1
DETAIL (PLAN VIEW)
TYPICAL RV SPACE LAYOUT
1" = 20'

LIONSHEAD RV PARK
OVERALL EXISTING CONDITIONS
GALLATIN COUNTY, MONTANA

32 DISCOVERY DRIVE
BOZEMAN, MT 59718
PHONE (406) 582-0221
FAX (406) 582-5770
www.alliedengineering.com

Civil Engineering
Geotechnical Engineering
Land Surveying



PROJECT #: 15-042
DATE: 09/24/2015
LIONSHEAD RV
PROJECT ENGINEER: MAF
DRAWN BY: JDS
REVIEWED BY: MAF

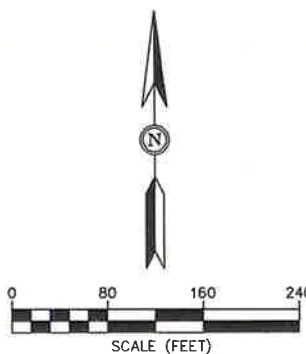
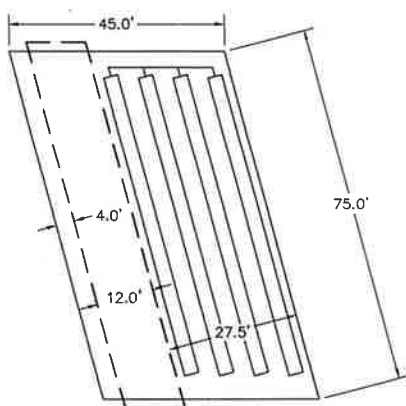
FIGURE
1 of 1

C:\Users\m\Design\2015\15-042 Lionshead RV Park & Super 8 Motel\23 CSD-Master\WFS Site Plan-201-000.dwg Sep 24, 2015 1:24pm

LIONSHEAD RV PARK

BEING TRACT 2 OF CERTIFICATE OF SURVEY No. 282C

LOCATED IN A PORTION OF THE NORTHWEST ONE-QUARTER AND THE SOUTHWEST ONE-QUARTER OF SECTION 21,
TOWNSHIP 13 SOUTH, RANGE 4 EAST, PRINCIPAL MERIDIAN MONTANA, GALLATIN COUNTY, MONTANA



1
1 of 1
DETAIL (PLAN VIEW)
TYPICAL RV SPACE LAYOUT
1" = 20'

VICINITY MAP
NOT TO SCALE

LIONSHEAD RV PARK
OVERALL EXISTING CONDITIONS
GALLATIN COUNTY, MONTANA

32 DISCOVERY DRIVE
BOZEMAN, MT 59718
PHONE (406) 582-0221
FAX (406) 582-5770
www.alliedengineering.com

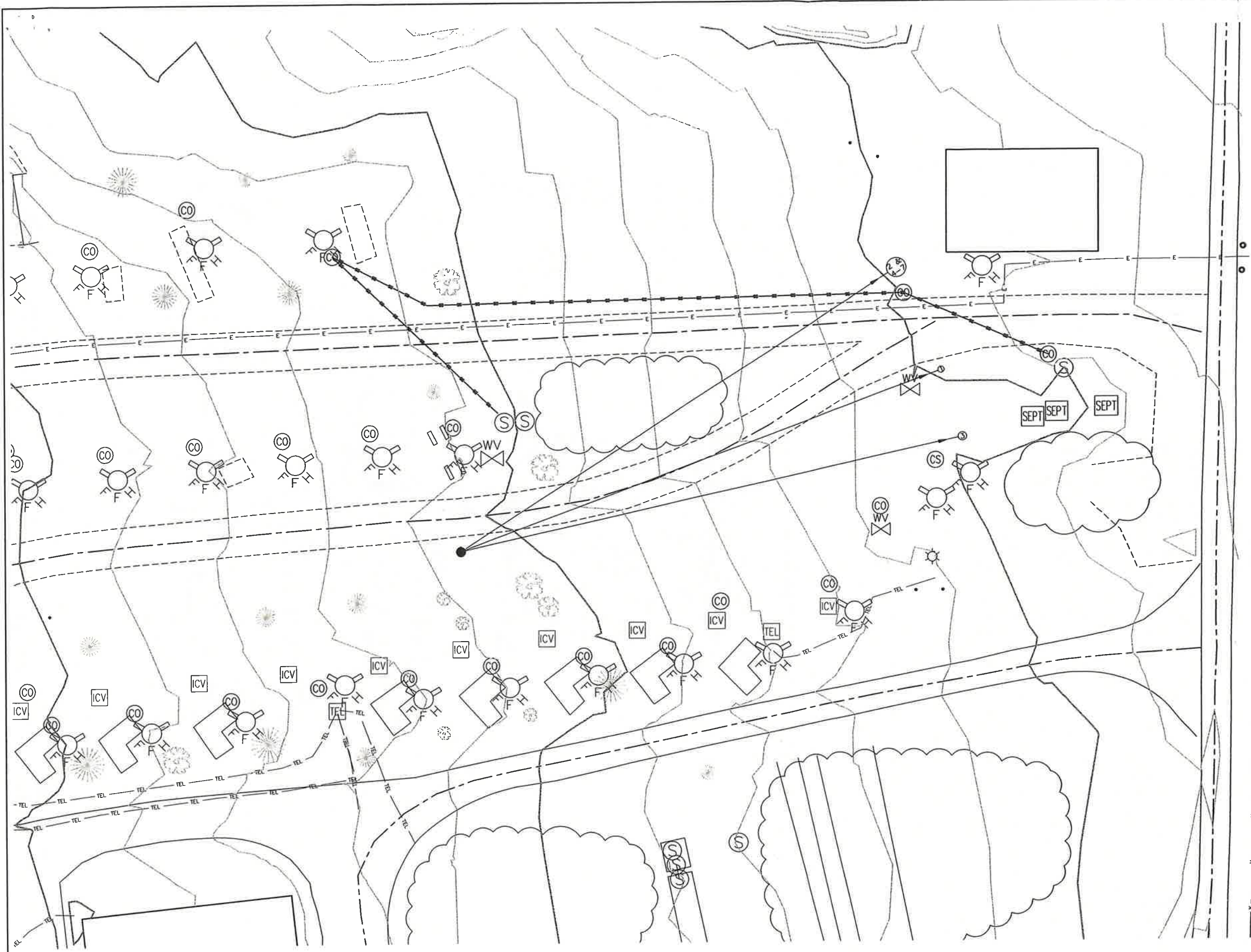
Civil Engineering
Geotechnical Engineering
Land Surveying



PROJECT #: 15-042
DATE: 09/24/2015
LIONSHEAD RV
PROJECT ENGINEER: MAF
DRAWN BY: JDS
REVIEWED BY: MAF

FIGURE
1 of 1

C:\Users\jds\Documents\2015\15-042 Lionshead RV Park & Super 8 Motel\23 CSD-Master\WMS Site Plan_09-09-2015.dwg Spt 24, 2015 - 1:35pm



GROUNDWATER GRADIENT TABLE			
INDEX No.	DATE	GRADIENT	DIRECTION
1	5/26/2016	0.0073 FT/FT	NORTH 69°33'25" EAST
2	6/17/2016	0.0054 FT/FT	NORTH 57°11'26" EAST
3	6/26/2016	0.0064 FT/FT	NORTH 77°23'16" EAST
4	7/6/2016	0.0054 FT/FT	NORTH 57°11'26" EAST
5	7/15/2016	0.0054 FT/FT	NORTH 57°11'26" EAST
6	7/22/2016	0.0054 FT/FT	NORTH 57°11'26" EAST
7	7/29/2016	0.0054 FT/FT	NORTH 57°11'26" EAST



NO.	REVISIONS	DRAWN BY	DATE

SCALE (FEET)

PROJECT ENGINEER: MAF DRAWN BY: JDS

DESIGNED BY: JDS REVIEWED BY: MAF

LIONSHEAD RV PARK
GROUNDWATER GRADIENT EXHIBIT
GALLATIN COUNTY, MONTANA

32 DISCOVERY DRIVE
BOZEMAN, MT 59718
PHONE (406) 582-0221
FAX (406) 582-5770
www.alliedengineering.com

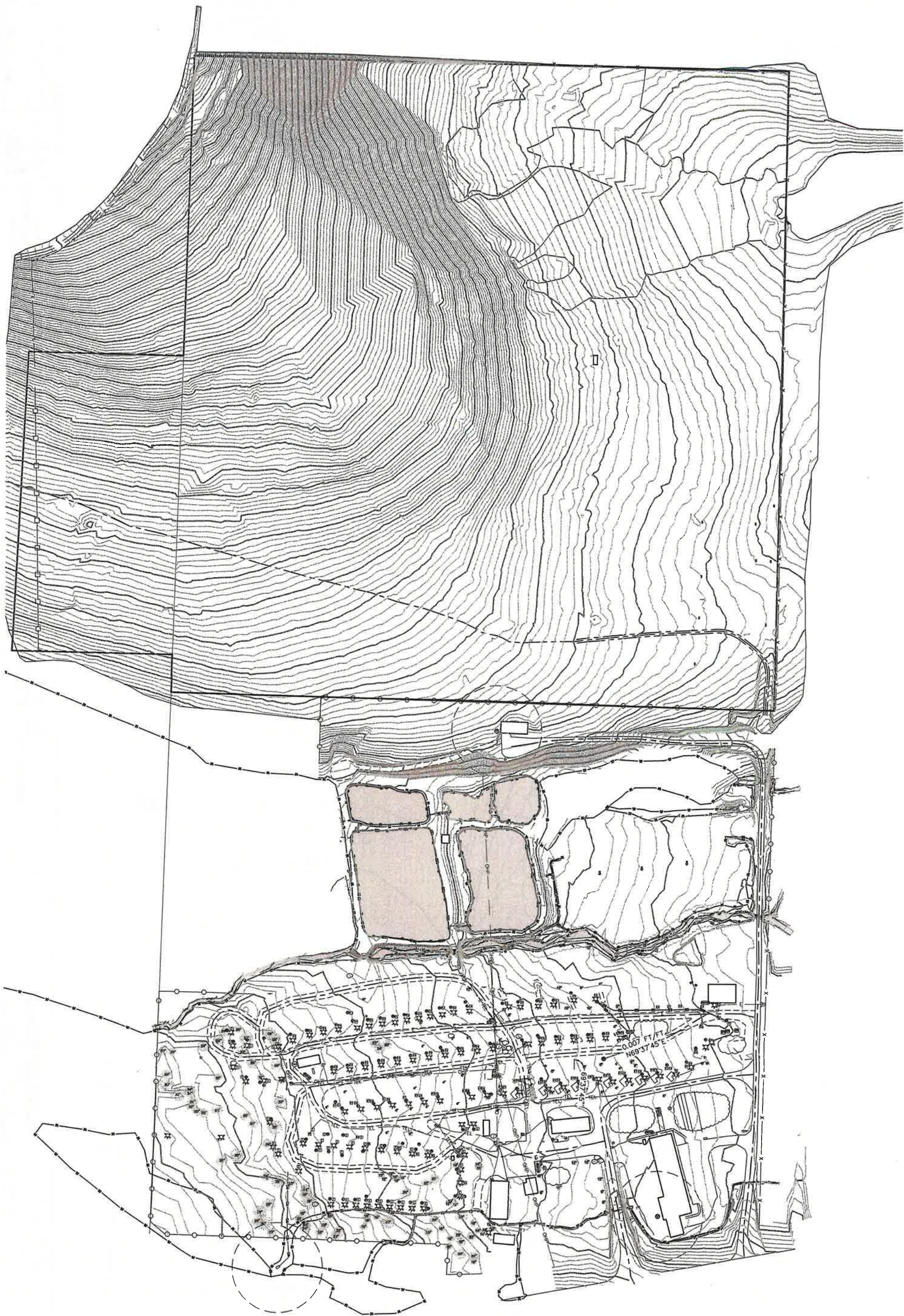
Civil Engineering
Geotechnical Engineering
Land Surveying

PROJECT #: 15-042
DATE: 08/03/2016

SHEET
1 of 1

LIONSHEAD RV PARK
GW GRADIENT EXHIBIT

H:\2015\15-042 Lionshead RV Park & Super 8 Motel\GIS Data Production\GW Gradient Exhibit.dwg



LIONSHEAD RV PARK
GROUNDWATER GRADIENT EXHIBIT
GALLATIN COUNTY, MONTANA

32 DISCOVERY DRIVE
BOZEMAN, MT 59718
PHONE (406) 582-0221
FAX (406) 582-5770
www.alliedengineering.com

Civil Engineering
Geotechnical Engineering
Land Surveying



PROJECT #: 15-042
DATE: 08/02/2016
PROJECT ENGINEER: MAF
DRAWN BY: JDS
REVIEWED BY: MAF

FIGURE
1 of 1

Eagles Grove

Conductivity Calculations

Razak and Huntley Equation

Notes:

Well logs used are for wells near the project location and include complete test data with pumping levels.

See attached well map for well locations.

Conductivity Calculation:

Well Site Information			
	Coffin	Baxter	Helppie
GWIC ID	106752	106758	106745
Q(gpm)	15	30	9
Pumping Level (ft)	61.5	97	125
Static Level (ft)	51.5	92	90
Aquifer thickness	10	20	16
K (ft/day)	149.6	189.3	28.7
Avg K (ft/day)	122.5	Razack and Huntley Equation (Fetter, 1994)	

Other Options

[Return to menu](#)
[Plot this site in State Library Digital Atlas](#)
[Plot this site in Google Maps](#)
[View scanned well log \(7/3/2006 10:12:43 AM\)](#)

Section 7: Well Test Data

Total Depth: 71.5
Static Water Level: 51.5
Water Temperature:

15 gpm with feet of drawdown after 1.5 hours.
Time of recovery hours.
Recovery water level feet.
Pumping water level 61.5 feet.

Section 8: Remarks

GALLATIN					
Latitude		Longitude		Geomethod	Datum
44.6863		-111.2477		UNKNOWN	NAD27
Ground Surface Altitude		Ground Surface Method		Datum	Date
6710					
Addition	Block			Lot	

Section 9: Well Log

Geologic Source

211UDFD - UPPER CRETACEOUS UNDIFFERENTIATED

[illegible]

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.

Casing						
From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1	71.5	6				STEEL

From	To	Diameter	# of Openings	Size of Openings	Description
71.5	71.5	6			OPEN BOTTOM

There are no annular space records assigned to this well.

Company:

Date Completed: 5/14/1968

Other Options

[Go to GWIC website](#)
[Plot this site in State Library Digital Atlas](#)
[Plot this site in Google Maps](#)
[View hydrograph for this site](#)
[View field visits for this site](#)
 View scanned well log (7/6/2006 8:18:35 AM)

Section 7: Well Test Data

Total Depth: 125
Static Water Level: 92
Water Temperature:

Bailer Test *

30 gpm with feet of drawdown after 2 hours.
Time of recovery hours.
Recovery water level feet.
Pumping water level 97 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.*

Township	Range	Section	Quarter Sections	
13S	04E	21	NW¼ NW¼ SW¼ SE¼	
County		Geocode		
GALLATIN				
Latitude	Longitude	Geomethod	Datum	
44.6825	-111.2447	UNKNOWN	NAD27	
Ground Surface	Altitude	Ground Surface	Method	Datum
6747				
Measuring Point	Altitude	MP Method	Datum	Date Applies
6748.1				7/10/1996 1:20:00 PM
Addition			Block	Lot
LAZY ACRES				

Section 8: Remarks

WELL SERVICES THREE HOMES.

Section 9: Well Log

DOMESTIC (1)

Geologic Source

211UFD - UPPER CRETACEOUS UNDIFFERENTIATED

[illegible]

Drilling Method: CABLE
Status: NEW WELL

Driller Certification

Date well completed: Wednesday, November 2, 1983

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.

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	125	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	31.8	6				STEEL
-2	120	5				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
100	120	5			SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	33	MUD	

Other Options

[Go to GWIC website](#)
[Plot this site in State Library Digital Atlas](#)
[Plot this site in Google Maps](#)
[View field visits for this site](#)
 View scanned well log (7/3/2006 9:25:14 AM)

Section 7: Well Test Data

Total Depth: 137
Static Water Level: 90
Water Temperature:

Bailer Test *

9 gpm with feet of drawdown after 1 hours.
Time of recovery hours.
Recovery water level feet.
Pumping water level 125 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
211UDED - UPPER CRETACEOUS UNDIFFERENTIATED

[illegible]

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.

Date well completed: Monday, July 11, 1960

Name: CARL F. HOLLENSTEINER
Company:
License No: WWC-9
Date Completed: 7/11/1960

From	To	Diameter
0	137	6

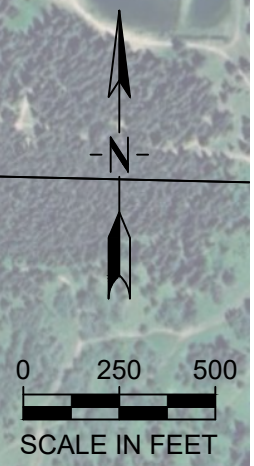
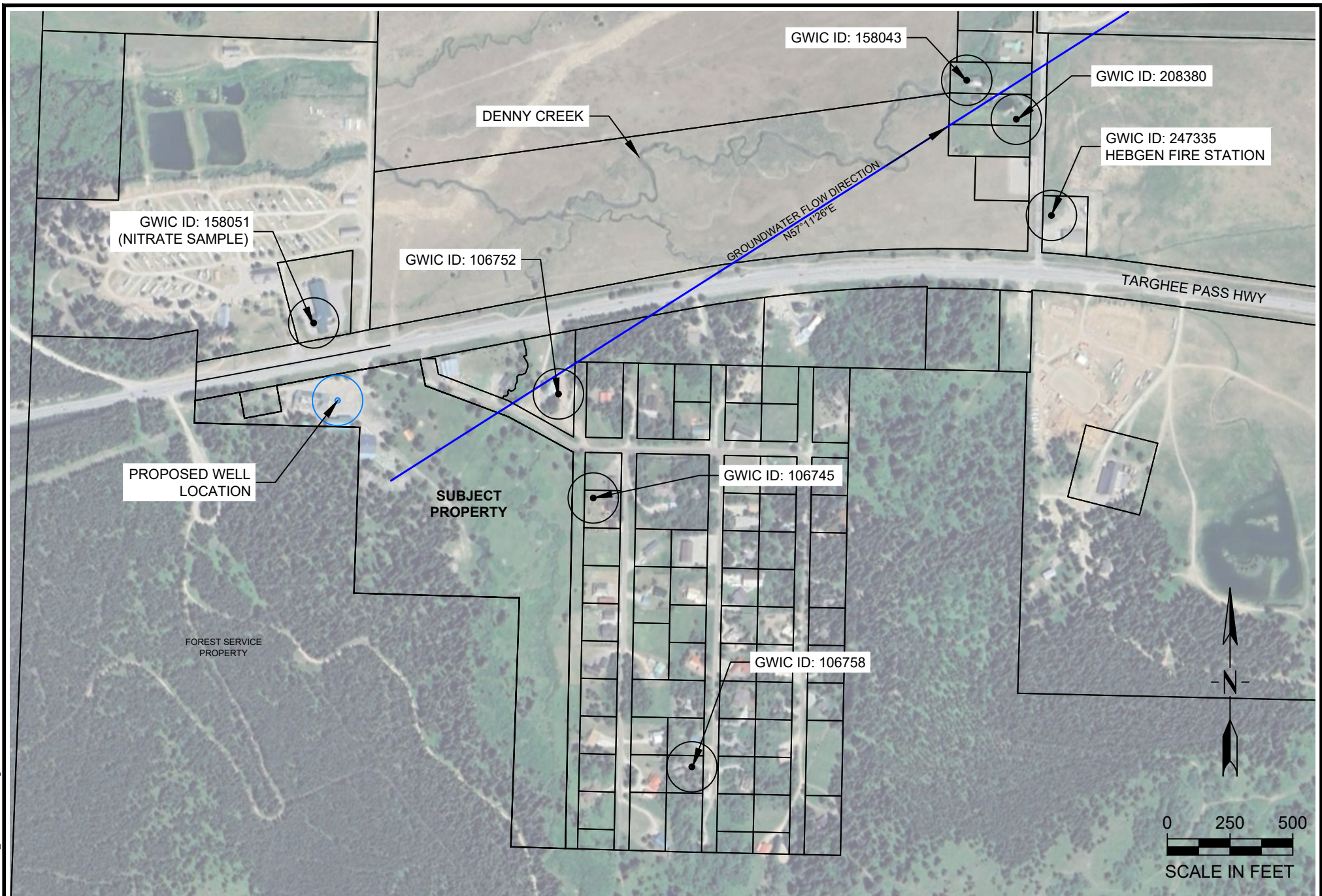
Casing						
From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	121.56					STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
121	137	6			OPEN HOLE

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.



N:\10514\001\ACAD\Exhibits\10514_001_LOT_LAYOUT.dwg



Inorganic Chemicals Sample Report

Water System:	MT0003327	MOUNTAIN VISTA HOTEL	Sample Collected:	09/10/2024	9.00 AM
Facility Source/Plant :	TP001	TREATMENT PLANT	Lab Received:	09/10/2024	
Sampling Pt:	EP502	EP FOR WELL 1 TP			
Address:	HOTEL VISTA				
Sample Type:	ROUTINE	For Compliance:	Yes		
Lab Sample No:	H24090324-001A	Laboratory:	19	ENERGY LABORATORIES INC HELENA	
State Sample No:					

RESULT	Analyte	Method	Analysis Start and End Dates	State Notified On	PWS Notified On
1038	NITRATE-NITRITE	353.2	09/23/2024 5.08 PM	09/26/2024	
Detection:	0.32 MG/L				

MONTANA WELL LOG REPORT**Other Options**

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

[Go to GWIC website](#)
[Plot this site in State Library Digital Atlas](#)
[Plot this site in Google Maps](#)
[View field visits for this site](#)
[View water quality for this site](#)

Site Name: LIONSHEAD SUPER 8
GWIC Id: 158051

Section 7: Well Test Data

Total Depth:
 Static Water Level:
 Water Temperature:

Unknown Test Method *

Yield _ gpm.
 Pumping water level _ 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

UNABLE TO REMOVE WELL COVER. SAMPLE FROM TAP LOCATED NEAR THE SW CORNER OF THE SUPER 8.

Section 9: Well Log**Geologic Source**

100UDFD - CENOZOIC UNDIFFERENTIATED

Lithology Data

There are no lithologic details assigned to this well.

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:

Section 1: Well Owner(s)

1) YELLOWSTONE RENTAL PROPERTIES, LLC. (MAIL)
 P.O. BOX 348
 WEST YELLOWSTONE MT 59758 [09/30/2021]
 2) T & J ENTERPRISES (MAIL)
 1345 TARGHEE PASS
 WEST YELLOWSTONE MT 59758 [10/04/1996]

Section 2: Location

Township	Range	Section	Quarter Sections	Geocode
14S	04E	21	SE¼ SE¼ SW¼ NW¼	
County				
GALLATIN				
Latitude	Longitude	Geomethod	Datum	
44.6869	-111.2505	UNKNOWN	NAD27	
Ground Surface Altitude	Ground Surface Method	Datum	Date	
6700				
Measuring Point Altitude	MP Method	Datum	Date Applies	
6700			10/4/1996	
Addition	Block	Lot		

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method:
 Status: NEW WELL

Section 5: Well Completion Date

Date well completed: N/A

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.
 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.

Water Sample for Background N

APPENDIX K

WELL LOGS AT 1/2 MILE

Other Options

[Go to GWIC website](#)
[Plot this site in State Library Digital Atlas](#)
[Plot this site in Google Maps](#)
[View field visits for this site](#)

Section 7: Well Test Data

Total Depth: 72.5
Static Water Level: 48
Water Temperature:

Bailer Test *

30 gpm with feet of drawdown after hours.
Time of recovery hours.
Recovery water level feet.
Pumping water level 63 feet.

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

Section 8: Remarks

WELL WAS DRILLED PRIOR TO 1950S. WELL IS CURRENTLY UNUSED AND DISCONNECTED. OWNERS ANTICIPATE USE IN NEXT COUPLE OF YEARS. WELL CAP INACCESSIBLE. WELL INFORMATION FROM MARY CAVALIER. PHONE CALL ON 3 APRIL 1997.

Section 9: Well Log

Geologic Source

100UDFD - CENOZOIC UNDIFFERENTIATED

[illegible]

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: 5/18/1972

Name:
Company:
License No: -
Date Completed: 5/18/1972

Other Options

[Go to GWIC website](#)
[Plot this site in State Library Digital Atlas](#)
[Plot this site in Google Maps](#)
[View scanned well log \(7/3/2006 10:11:25 AM\)](#)

Section 7: Well Test Data

Air Test *

** 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

Township	Range	Section	Quarter Sections			
13S	04E	21	NE¼	NE¼	SW¼	NE¼
County			Geocode			
GALLATIN						
Latitude		Longitude		Geomethod		Datum
44.6895		-111.24		NAV-GPS		NAD27
Ground Surface Altitude		Ground Surface Method		Datum	Date	

Lot

DOMESTIC (1)

Drilling Method: ROTARY
Status: NEW WELL

Date well completed: Monday, October 6, 2003

Borehole dimensions

From	To	Diameter
0	116	6

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	58.5	6	0.250		WELDED	STEEL
56	116	4.5		220.00	THREADED	PVC

From	To	Diameter	# of Openings	Size of Openings	Description
96	116	4.5	30	1/8 X 4 IN	SAW SLOTS

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Geologic Source

[illegible]

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: POTTS DRILLING INC
License No: WWC-512
Date Completed: 10/6/2003

MONTANA WELL LOG REPORT**Other Options**

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

[Go to GWIC website](#)
[Plot this site in State Library Digital Atlas](#)
[Plot this site in Google Maps](#)
[View hydrograph for this site](#)
[View field visits for this site](#)
[View water quality for this site](#)
[View scanned field visit document \(9/29/2023 10:52:25 AM\)](#)

Site Name: HEBGEN BASIN FIRE STATION 3**GWIC Id: 247335****DNRC Water Right: 30046212****Section 1: Well Owner(s)**

1) LINDE RENTAL PROPERTIES LLC [HEBGEN BASIN FIRE DISTRICT]
 (MAIL)
 PO BOX 1508
 WEST YELLOWSTONE MT 59758 [12/10/2009]
 2) LINDE RENTAL PROPERTIES LLC (MAIL)
 P.O. BOX 1488
 WEST YELLOWSTONE MT 59758 [09/30/2008]
 3) LINDE RENTAL PROPERTIES LLC (WELL)
 10 DENNY CREEK RD.
 WEST YELLOWSTONE MT 59758 [09/30/2008]

Section 2: Location

Township	Range	Section	Quarter Sections	Geocode
13S	04E	21	NW¼ SW¼ SE¼ NE¼	
County				
GALLATIN				
Latitude	Longitude	Geomethod	Datum	
44.68814	-111.23986	NAV-GPS	NAD83	
Ground Surface Altitude	Ground Surface Method	Datum	Date	
6654	MAP		7/13/2010	
Measuring Point Altitude	MP Method	Datum	Date Applies	
6655.3			7/13/2010 1:10:00 PM	
Addition	Block	Lot		

Section 3: Proposed Use of Water

DOMESTIC (1)
 FIRE PROTECTION (2)
 IRRIGATION (3)

Section 4: Type of Work

Drilling Method: ROTARY
 Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Tuesday, September 30, 2008

Section 6: Well Construction Details**Borehole dimensions**

From	To	Diameter
0	140	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.8	77.3	6	0.25		WELDED	A53B STEEL
60	120	4.5		200.0	SPLINE	PVC-SCHED 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
120	140	4.5		.025	FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	30	BENTONITE GRANULES	Y

Section 7: Well Test Data

Total Depth: 140
 Static Water Level: 56.5
 Water Temperature: 4.44 °C

Air Test *

50 gpm with drill stem set at 135 feet for 1 hours.
 Time of recovery 0.5 hours.
 Recovery water level 56.5 feet.
 Pumping water level feet.

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

Section 8: Remarks

WELL IS FOR VOLUNTEER FIRE DEPT. STATION.

Section 9: Well Log**Geologic Source**

121VLCC - VOLCANIC ROCKS (PLIOCENE)

From	To	Description
0	22	SAND & GRAVEL, DIRTY
22	26	CLAY
26	42	MEDIUM TO COARSE SAND, MIXED SILTS
42	45	SANDSTONE, GRAY, SOFT
45	96	VOLCANIC ROCK, PURPLE TO GRAY, FRACTURE RUBBLE 62-65
96	97	CLAY, GRAY
97	122	VOLCANIC ROCK, PURPLE
122	127	SANDSTONE, BROWN, SOFT
127	138	VOLCANIC ROCK, PURPLE, SOFT
138	140	CLAY, BLACK

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: DAVE POTTS
Company: POTTS DRILLING INC.
License No: WWC-512
Date Completed: 9/30/2008

APPENDIX K

GROUNDWATER MONITORING DATA (MORRISON-MAIERLE)

Eagles Grove

Goundwater Monitoring at East Fork of Denny Creek

Monitoring Well #1

MMI # 10514.001

Notes:

Monitoring well was installed by MMI on 6/18/2024 ~15 feet from creek.
GW measurements take from north side of top of casing.
Ground elevation based on topo survey by others. (MMI to update following 2025 topo survey)
All units are feet.

Elevations:

Bottom of Creek = 6712.24
Creek Water Surface = 6713.36
EG at MW = 6714.81
Top of MW casing = 6716.55
Bottom of MW = 6699.81

Distances:

Total Depth of MW = 15.00
Bottom of Creek to Bottom of MW = 12.43
Top of Casing to Ground = 1.74

Field Data (input)		Ground Surface to Groundwater	Creek Bottom to Groundwater
DATE	MW #1	MW #1	MW #1
6/18/2024	Dry	>15	>12.43
6/23/2024	Dry	>15	>12.43
7/10/2024	Dry	>15	>12.43

Eagles Grove
Goundwater Monitoring
MMI # 10514.001

Notes:
Monitoring wells were installed by MMI on 6/18/2024.
GW measurements take from north side of top of casing.
All units are feet.

Field Data (input)
(top of casing to groundwater)

DATE	MW #1	MW #2
6/18/2024	Dry	Dry
6/23/2024	Dry	Dry
7/10/2024	Dry	Dry

Ground Surface to
Groundwater

DATE	MW #1	MW #2
6/18/2024	>15	>15
6/23/2024	>15	>15
7/10/2024	>15	>15

APPENDIX K

SURFACE WATER CONNECTIVITY INFORMATION (FROM PREVIOUS PERMITTING #2004002)

Surface Water Nondegradation Studies

Page 1 of 2

EQ# 03-2050

Targhee Fun Center

December 17, 2004

Surface Water Nondegradation Studies

SUMMARY

Since the mixing zone for the Targhee Fun Center was shortened due to down-gradient surface water, DEQ has requested that surface water nondegradation studies be prepared to address potential impacts of nitrate-nitrogen. The surface water downgradient from the Targhee Fun Center drainfield is the east fork of Denny Creek. A test hole was excavated about 14 feet from the creek to investigate depth to groundwater and soil composition. Data indicates the creek is a "losing" stream and is underlain by silty clay-rich soils. Therefore surface nondegradation calculations are not required.

METHODS

A low area 14 feet from the creek (and in the direction of the proposed drainfield) was chosen for a test site to evaluate the soil and sub-soil characteristics and depth to groundwater. The hole was dug with shovel, pry bar, post hole digger and gas-powered auger. The soil characteristics were observed. A surface water elevation was measured. Elevations were measured for the ground surface and total depth of the test hole in relation to surface water, using a tape and clinometer.

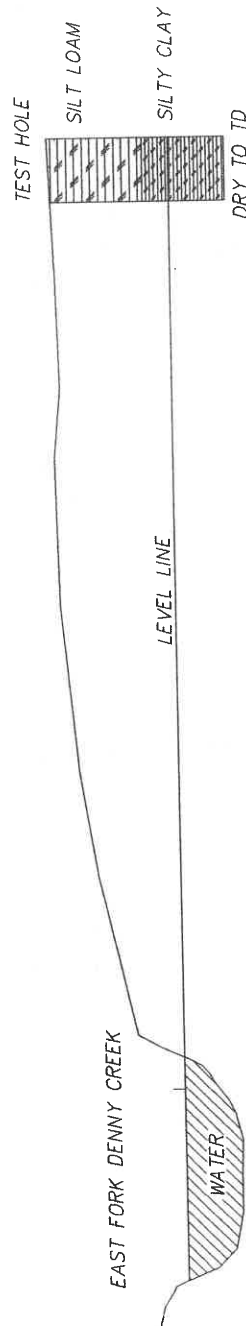
RESULTS

The test hole was excavated entirely in fine-textured soils consisting of silt loam topsoil and silty clay subsoil. No groundwater was encountered to the bottom of the test hole, which is 0.87 feet in elevation below the creek surface.

CONCLUSIONS

Data indicates the creek is "perched" atop fine-textured soils, and the creek is not gaining water from subsurface input in the downgradient vicinity of the proposed drainfield. Since the creek is perched and is a "losing" creek, impact from the proposed drainfield to downgradient surface water is nonsignificant.

CROSS SECTION
 (LOOKING SOUTH)



SCALE: 1" = 3'

NOTE:

A TEST HOLE ADJACENT TO CREEK INDICATES THE SOIL AND SUB-SOIL IS SILT LOAM AND SILTY CLAY. NO GROUNDWATER WAS NOTED TO THE BOTTOM OF THE HOLE, WHICH IS 0.87 FEET LOWER IN ELEVATION THAN THE WATER SURFACE IN THE CREEK. THIS INDICATES THE CREEK IS "PERCHED" ATOP IMPERVIOUS SOILS, AND SURFACE WATER IS NOT FEEDING INTO THE CREEK. THEREFORE IMPACTS OF THE PROPOSED DRAINFIELD TO SURFACE WATER ARE NONSIGNIFICANT.

SURFACE WATER NONDEGRADATION
 TARGHEE FUN CENTER
 1630 TARGHEE PASS HIGHWAY
 GALLATIN COUNTY, MONTANA

	BUDGET SEPTIC DESIGN DAVID ODT, SITE EVALUATOR
	221 S. 3RD AVE. BOZEMAN, MT. 585-2687 PROJECT: SURFACE WATER NONDEG DATE: 12-17-2004

APPENDIX K

SURFACE WATER CONNECTIVITY INFORMATION (FROM HEBGEN BASIN FIRE STATION MONITORING WELL)

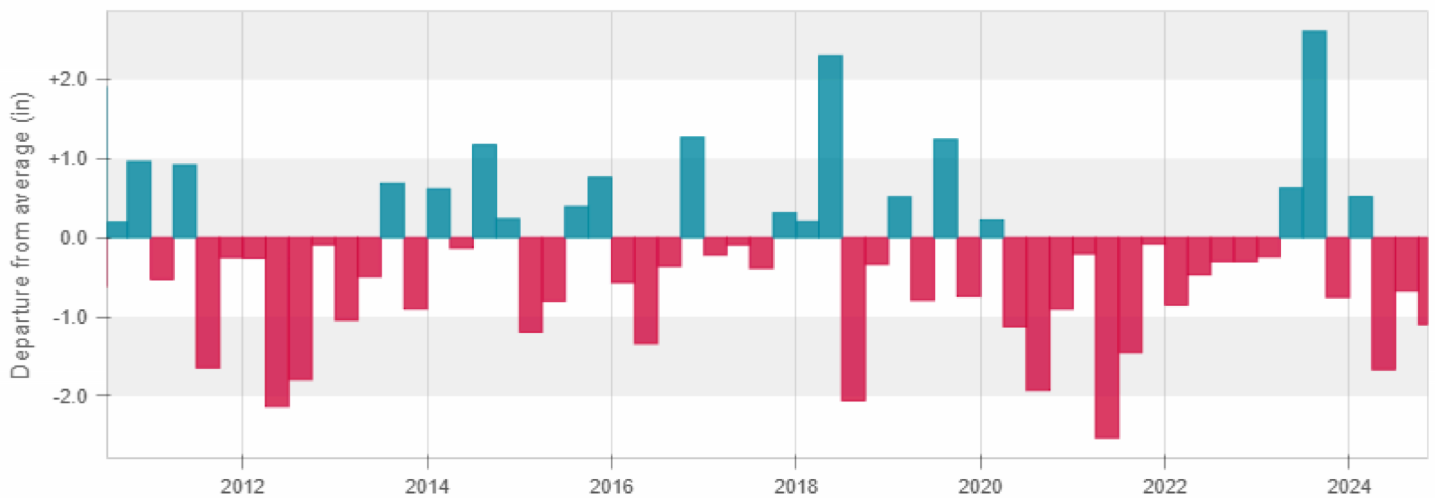


3/20/2025

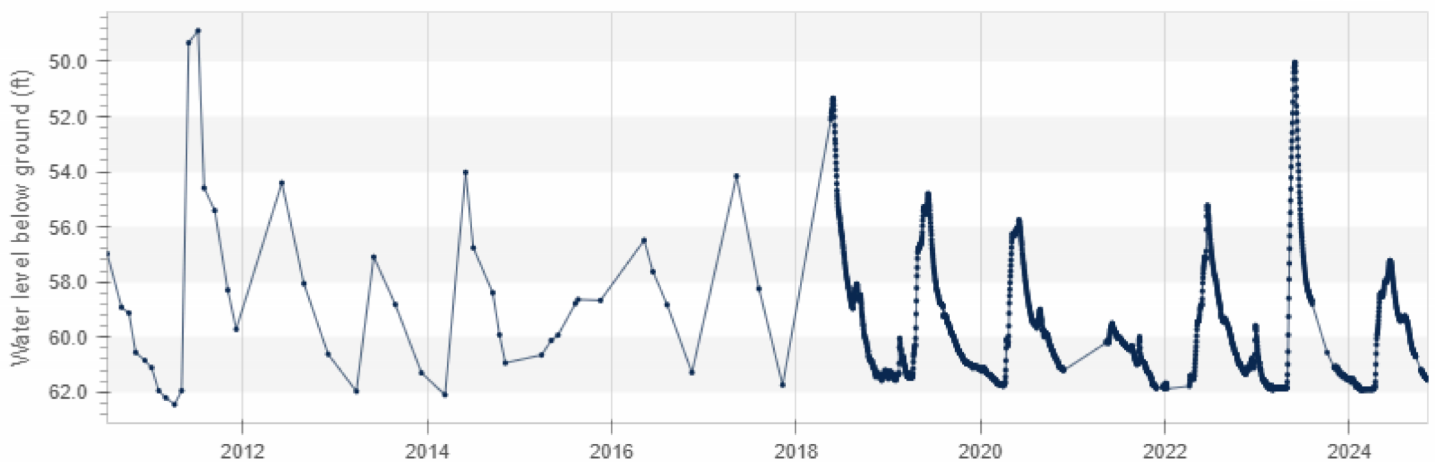
Ground Water Information Center

Hydrograph and Precipitation Display

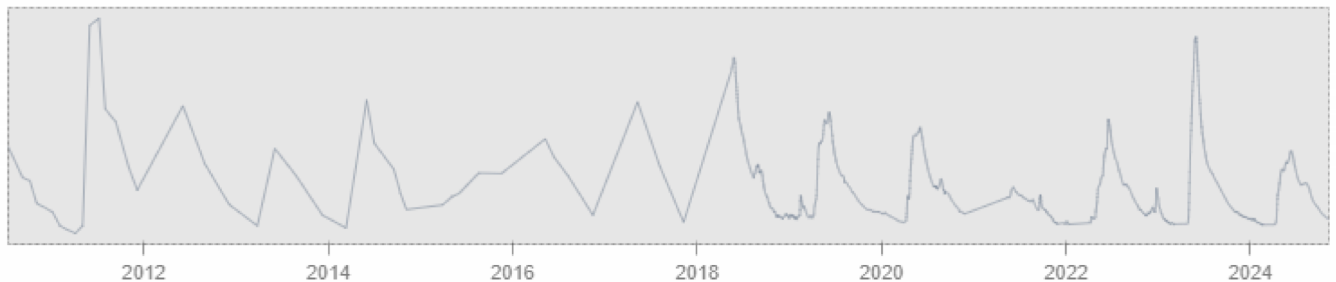
Quarterly Precipitation Departure for Southwest Climate Division



Daily Average Water Level (GWIC ID 247335)



Drag the left or right edge to change the range



GWIC ID 247335

Aquifer

121VLCC — VOLCANIC ROCKS (PLIOCENE)



3/20/2025

Legal Description	13S04E21ADCB
Latitude	44.68814
Longitude	-111.23986
Geomethod	NAV-GPS
Datum	NAD83

Total Depth 140 feet

Water Level Range 47 to 64 feet below ground

Measurements 36674

Period of Record

7/13/2010 1:10:00 PM - 11/7/2024 12:37:00 PM

Data reported are water levels in feet below ground surface. Water levels in wells used for water supply may reflect intervals of pumping.

Disclaimer

The preceding materials represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date [3/20/2025 8:44:17 AM] of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user at the time and date of the retrieval. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. There may be wells in the request area that are not recorded at the Information Center. Water level data downloaded from GWIC are not filtered and will contain all measurements.

© Ground Water Information Center Online 1998-2025
Staff | Privacy Statement

Facebook

YouTube

Calendar

Office Location

Publication Sales



3/20/2025

FAX 406.496.4451



101 Grand Avenue
Billings, MT 59101-6011 USA

©2024 Copyright. All rights reserved.

APPENDIX K

SURFACE WATER CONNECTIVITY INFORMATION (TEST PIT AT DENNY CREEK)(BY WET)

Test Pit Characterization: Definitions, Abbreviations & Procedures (Use with Work Sheet for Recording Soil Properties in the Field)

Depth							
measured in inches.							
Color and moist/dry							
use Munsell Color Chart, color name and number.							
Structure							
Grade-Structureless Soils							
m	sg	1	2	3			
massive (no formation of structure type)	single grain (no aggregation, soil is in individual particles that will	weak (units barely observable in place, much material is unaggregated)	moderate (units easily observable in place)	strong (units are distinctly visible in place, nearly the entire mass consists			
Size							
vf	f	m	c	vc			
very fine	fine	medium	coarse	very coarse			
Shape							
gr	pl	pr	abk	sbk			
granular (small, non-porous clusters of soil particles with irregular, rounded surfaces)	platy (clusters of soil particles consisting of thin sheets)	prismatic (pillar-shaped clusters of soil particles, the pillar is longer than wide and has a flat top)	angular blocky (a cube shaped cluster of soil particles with prominent edges)	subangular blocky (a cube shaped cluster of soil particles with rounded edges)			
Gravel							
Indicate the approximate volume percentage of gravel in the soil sample. See Table 2 for terms for rock fragments.							
Consistence							
Dry							
lo	so	sh	h	vh	eh		
loose (noncoherent, such as grains of a sand dune)	soft (easily fails to powder or single grain, with very slight force between thumb and forefinger)	slightly hard (easily fails under slight force between thumb and forefinger)	hard (fails in the hands without difficulty; requires strong force to fail between thumb and forefinger)	very hard (fails in hands with difficulty, but not between thumb and forefinger)	extremely hard (cannot be failed in hands)		
Moist							
lo	vfr	fr	fi	vfi	efi		
loose (noncoherent, such as grains of a sand dune)	soft (easily fails to powder or single grain, with very slight force between thumb and forefinger)	slightly hard (easily fails under slight force between thumb and forefinger)	hard (fails in the hands without difficulty; requires strong force to fail between thumb and forefinger)	very hard (fails in hands with difficulty, but not between thumb and forefinger)	extremely hard (cannot be failed in hands)		
Wet							
so	ss	s	vs	po	ps	p	vp
nonsticky (practically no adherence to thumb and forefinger when pressure released)	slightly sticky (after release of pressure, soil adheres to both thumb and forefinger but comes off one or the other rather cleanly, doesn't appreciably stretch)	sticky (after release of pressure, soil adheres to both thumb and forefinger and tends to stretch somewhat before pulling apart from either digit)	very sticky (after release of pressure, soil adheres strongly to both digits and is markedly stretched when they are separated)	nonplastic (no roll can be formed)	slightly plastic (a roll 4 cm long and 6 mm thick can be formed and, if held on end, will support its own weight. A 4-mm thick roll will not support its own weight. The roll is easily deformed and broken)	plastic (a roll 4 cm long and 4 mm thick can be formed and support its own weight. A 2-mm-thick roll will not support its own weight)	very plastic (a roll 4 cm long and 2 mm thick can be formed and support its own weight. The roll is readily bent into a half or full circle)
Texture							
GS, VCS	LS, CS	MS, SL	FSL, L, SiL	VFS, SCL	CL, SiCL	SC, C, SiC	
Gravelly sand, very coarse sand	Loamy sand, coarse sand	Medium sand, sandy loam	Fine sandy loam, loam, silt loam	Very fine sand, sandy clay loam	Clay loam, silty clay loam	Sandy clay, clay, silty clay loam	
Boundaries							
Sharpness							
a	c	g	d				
abrupt (boundary less than 2 cm thick)	clear (boundary 2 to 5 cm thick)	gradual (boundary 5 to 15 cm thick)	diffuse (boundary more than 15 cm thick)				
Topography							
s	w	i	b				
smooth (the boundary is in a plane with few or no irregularities)	wavy (the boundary has undulations in which depressions are wider than they are deep)	irregular (the boundary has pockets that are deeper than they are wide)	broken (one or both of the horizons or layers separated by the boundary are discontinuous and the boundary is interrupted)				
Notes							
Caliche • Iron staining • Shape of rocks							

Location: TNelsonM01

Test Pit No.: 3

Date: 10/3/22

Time: 12:48

Parent Material:
Vegetation: native grasses, nearby stream

Application Rate:


Described by: A, Flammond

Reviewed by:

Test pit is located near surface water and the purpose of this location was to check for signs of high groundwater next to surface water. Soil type and application rate was not assigned.

Depth (in)	In Situ Consistence		Color	Structure			Gravel %	Consistence			Texture	Boundaries		Notes
	Moist	Dry		Grade	Size	Shape		Dry	Moist	Wet		Sharpness	Topography	
0' - 1.5'	☐	☐										g	s	Topsoil
1.5' - 4.7'	☒	☐	10YR 3/2	2	f	gr	<10		fi	s		a	w	
4.7' - 8.5'	☒	☐	10YR 3/3	1	m	gr	25		fr	ss				
	☐	☐												
	☐	☐												

 Evidence of Ground Water? ☐ Yes ☒ No Depth: _____

 Limiting Layer Present? ☐ Yes ☒ No Depth: _____

M:\Tnelson\01\CAD\CIVIL\MC-BM01-TNELSONM01.dwg PLOT DATE 2022-9-30 16:03 USER: aflammond



© 2022 Microsoft Corporation © 2022 Maxar ©CNES (2022) D

PRELIMINARY
NOT FOR CONSTRUCTION

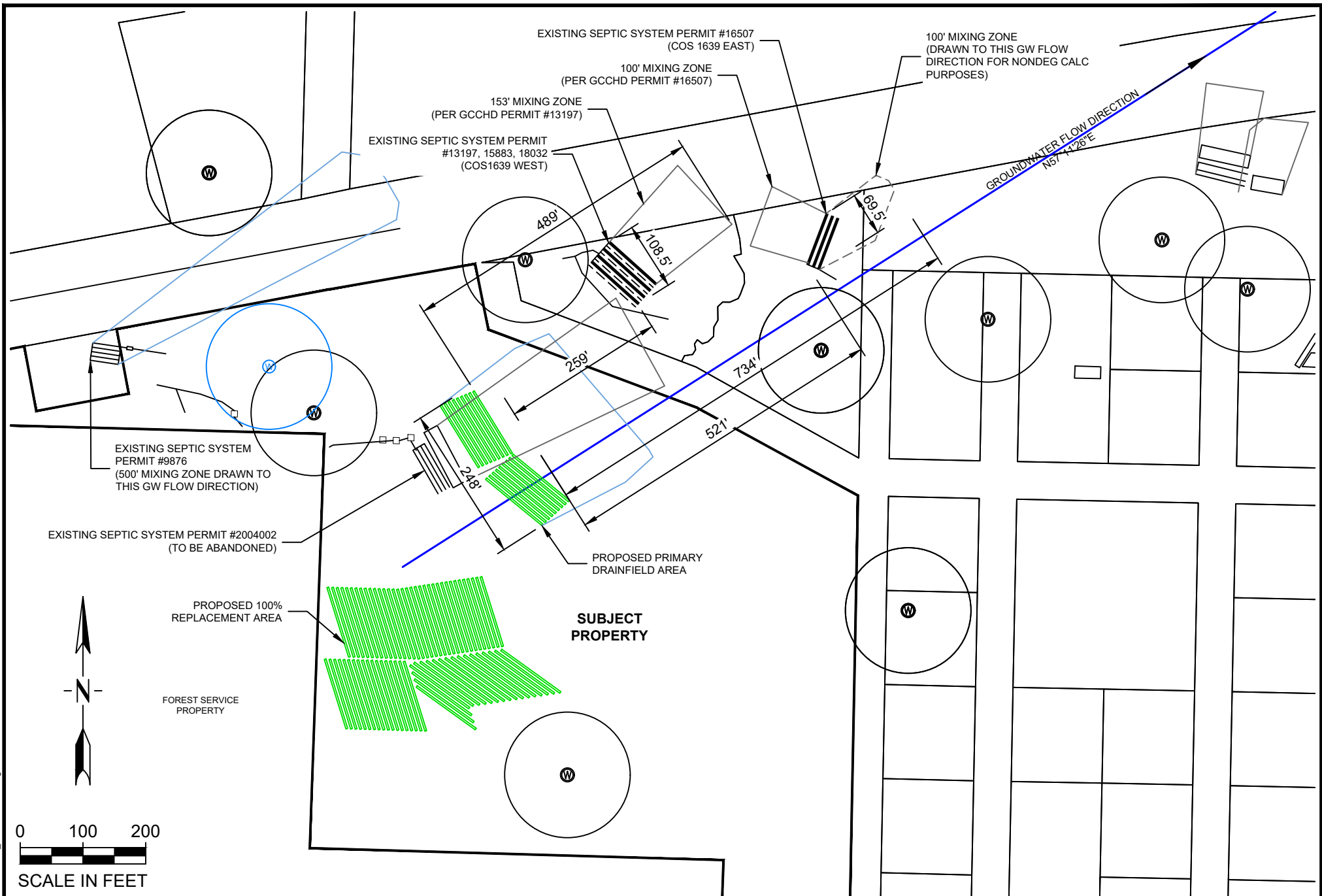
PROPOSED TEST PIT LOCATIONS

JOB: TNELSONM01
DATE: 9/30/22
DRAFTER: AF
CHECKED BY:



No.	Description	Date	Drawn By

COPYRIGHT 2022
The copyright in this document and the ideas and designs incorporated herein as an instrument of professional service which shall not be used in whole or part for any other projects or other use without the express written authorization.



 engineers ■ surveyors ■ planners ■ scientists Plotted by mason tuttle on Mar/26/2025	 2880 Technology Blvd West Bozeman, MT 59718  406.587.0721  www.m-m.net COPYRIGHT © MORRISON-MAIERLE, 2025	DRAWN BY: <u>MET</u> DSGN. BY: _____ APPR. BY: _____ DATE: <u>03/2025</u>	EAGLE'S GROVE		PROJECT NO. 10514.001	
			WEST YELLOWSTONE		MONTANA	FIGURE NUMBER ND
			NONDEGRADATION EXHIBIT			

N:\10514\1001\ACAD\Exhibits\10514.001_LOT_LAYOUT.dwg

Plotted by mason tuttle on Mar/26/2025

Appendix E

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

NITRATE SENSITIVITY ANALYSIS

SITE NAME:	Eagles Grove
-------------------	--------------

COUNTY:		Gallatin
----------------	--	----------

NOTES:	Cumulative Effects with COS 1639 East (GCCHD Permit #16507)
---------------	---

BY:	MET
-----	-----

DATE:	03/24/25
--------------	----------

Nitrate at end of mixing zone(s) with no cumulative effects

[illegible]

Nitrate at end of mixing zones with cumulative effects

[illegible]

REV. 03/20005

NOTES:

[illegible]

Appendix E

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

NITRATE SENSITIVITY ANALYSIS

SITE NAME: Eagles Grove
COUNTY: Gallatin
NOTES: Cumulative Effects with COS 1639 West (GCCHD Permits #13197, #15883, #18032)

BY: MET
DATE: 03/24/25

Nitrate at end of mixing zone(s) with no cumulative effects

Variable	(K)	(I)	(D)	(L)	(Y)	(Ng)	(Nr)	(Ne)	(#I)	(QI)	(P)	(V)	(W)	(Am)	(As)	(Qg)	(Qr)	(Qe)	Nt
	Hydr.	Hydr.	Mix	Down	Drain-	Back-	Nitrate	Effluent	# of	Effluent			Down-	Mix	Mix. zone	Ground			
	cond.	grad.	zone	grad.	field	ground	in	Nitrate	single	per	Annual	Percent	grad.	zone	surface	water	Recharge	Effluent	Resulting
LOT #	(ft/day)	(ft/ft)	(feet)	(feet)	(feet)	(mg/l)	(mg/l)	(mg/l)	homes	(ft3/day)	(in/yr)	recharge	(feet)	area	area	flow	flow	flow	nitrate (N)
														(ft ²)	(ft ²)	(ft3/day)	(ft3/day)	(ft3/day)	(mg/l)
Eagles	122.5	0.0054	15.0	150	248	0.32	1.0	7.5	25.0	26.70	21.56	0.2	274.25	4113.75	41137.50	2721.25	40.50	667.50	1.73
COS 1639 West	122.5	0.0054	15.0	153	108.5	0.32	1.0	50.0	2.05	26.70	21.56	0.2	135.28	2029.13	20697.08	1342.27	20.38	54.74	2.25
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	

Nitrate at end of mixing zones with cumulative effects

LOT #																			
Eagles	122.5	0.0054	15.0	489	248	0.32	1.0	7.5	25.0	26.70	21.6	0.2	333.58	5003.63	163118.18	3309.90	160.59	667.50	1.50
COS 1639 West	122.5	0.0054	15.0	153	108.5	1.50	1.0	50.0	2.05	26.70	0.0	0.0	135.28	2029.13	20697.08	1342.27	0.00	54.74	3.40
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	
											0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	

REV. 03/20005

NOTES:

[illegible]

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

CUMULATIVE PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME: Eagles Grove
COUNTY: Gallatin

NOTES: Cumulative Effects with COS 1639 West (GCCHD Permits #13197, #15883, #18032)

CONSTANTS
Phosphorous Load (lbs/yr) 6.44
Conversion Factor 1,000,000

VARIABLES										EQUATIONS			SOLUTION	
Tract	Perpendicular Width of Drainfield (ft) Lg	Drainfield Long Axis (ft) L	Drainfield Short Axis (ft) W	Depth to Limiting Layer (ft) B	Distance to Surface Water/ Downgradient Drainfield (ft) D	Mixing Depth (ft) T	Soil Weight (lbs) Sw	Soil Phosphorous Adsorption Capacity (ppm) Pa	# of Homes on Drainfield #I	Total Phosphorous Load (lbs/yr) Pt	Soil Weight under Drainfield (lbs) W1	Soil Weight from Drainfield to Surface Water (lbs) W2	Total Phosphorous Adsorption by Soils (lbs) P	Breakthrough Time (years) BT
Eagles Grove	248.0	232.0	59.0	12.0	259.0	1.0	100	200	25.0	161.00	16425600	7010159	4687.15	29.1
COS 1639 West	108.5	100.0	45.0	7.0	400.0	1.0	100	200	2.05	13.20	3150000	5740000	1778.00	134.7
Required to pass														70.89

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

CUMULATIVE PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME: Eagles Grove

COUNTY: Gallatin

NOTES: Cumulative Effects with COS 1639 East (GCCHD Permit #16507)

CONSTANTS

Phosphorous Load (lbs/yr) 6.44
Conversion Factor 1,000,000

VARIABLES

EQUATIONS

SOLUTION

Tract	Perpendicular Width of Drainfield (ft) Lg	Drainfield Long Axis (ft) L	Drainfield Short Axis (ft) W	Depth to Limiting Layer (ft) B	Distance to Surface Water/ Downgradient Drainfield (ft) D	Mixing Depth (ft) T	Soil Weight (lbs) Sw	Soil Phosphorous Adsorption Capacity (ppm) Pa	# of Homes on Drainfield #I	Total Phosphorous Load (lbs/yr) Pt	Soil Weight under Drainfield (lbs) W1	Soil Weight from Drainfield to Surface Water (lbs) W2	Total Phosphorous Adsorption by Soils (lbs) P	Breakthrough Time (years) BT	
Eagles Grove	248.0	232.0	59.0	12.0	521.0	1.0	100	200	25.0	161.00	16425600	15295909	6344.30	39.4	
COS 1639 East	69.5	85.0	21.0	6.0	400.0	1.0	100	200	2.15	13.85	1071000	4180000	1050.20	75.8	ok
Required to pass														60.59	